Supplement 1[1]
S3-Leitlinie der Deutschen Gesellschaft für Ernährungsmedizin (DGEM) Klinische Ernährung und Hydrierung im Alter
Evidenztabellen

I. Grundprinzipien klinischer Ernährung im Alter

I.1 Richtwerte für die Energie- und Nährstoffversorgung

Empfehlung 1

Der Richtwert für die Energiezufuhr älterer Personen beträgt 30 kcal pro kg Körpergewicht und Tag; dieser Wert sollte individuell je nach Ernährungsstatus, körperlicher Aktivität, Gesundheitszustand und Toleranz angepasst werden.

Empfehlungsgrad B

Alix E, Berrut G, Bore M et al. Energy requirements in hospitalized elderly people. J Am Geriatr Soc 2007; 55: 1085-1089. doi:10.1111/j.1532-5415.2007.01236.x [19]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Cohort study 2+	**Countries:** France **Centers:** General Hospital, Le Mans; University Hospital, Angers; St Nicolas Hospital, Angers **Setting:** acute or rehabilitation care unit **Funding Sources:** Chiesi SA **Dropout rates:** 0% **Study limitations:** a phase of hypermetabolism during the first 5 to 7 days after	**Total no. Patients:** 90 **Inclusion criteria:** men and women aged 65 and older and hospitalized in an acute or rehabilitation care unit **Exclusion criteria:** low MMSE score (<19)	n/a

[1] Ein Großteil der Evidenztabellen wurde aus früheren Leitlinien übernommen. Daher wurde die Literatur mit unterschiedlichen Methoden bewertet. Für die entsprechende Methodik in den Original-Leitlinien wird auf Volkert et al. 2013 (https://doi.org/10.1055/s-0033-1343169) und Volkert et al. 2019 (https://doi.org/10.1016/j.clnu.2018.05.024) verwiesen

	admission may have been missed		
Notes	**Author's Conclusion:** The mean REE of the geriatric patients studied was 18.8 kcal/kg per day, whereas energy intake was just sufficient to cover minimal requirements. Thus, hospitalized elderly patients are likely to benefit from higher calorie intake.		
Outcome measures/results	Patients' energy intake and resting EE (REE) were measured over a 3-day period. Blood samples were taken to determine C-reactive protein (CRP), creatinine, and albumin concentrations and to check renal function.		Energy intake was higher than REE by a factor of 1.29, but it was lower than the energy requirement. Energy intake, adjusted for differences in body weight, was independent of sex, highest in those who were malnourished (defined as a body mass index (BMI) <21), and lowest in patients who scored poorly on the Mini-Mental State Examination. Energy intake and REE were independent of plasma CRP, creatinine, and albumin concentrations, as well as the initial diagnosis. REE was similar in men and women, at 18.8 kcal/kg per day. REE was 21.4 kcal/kg per day in patients with a BMI of 21 or less and 18.4 kcal/kg per day in those with a BMI greater than 21 kg/m2. The Harris-Benedict equation accurately predicted mean REE.

Gaillard C, Alix E, Salle A et al. Energy requirements in frail elderly people: a review of the literature. Clin Nutr 2007; 26: 16-24. doi:10.1016/j.clnu.2006.08.003 [20]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Review 1-	**Countries:** France **Centers:** Angers, Le Mans **Setting:** n/a **Funding Sources:** n/a **Dropout rates:** n/a **Study limitations:** n/a	**Total no. Patients:** 2450 **Inclusion criteria:** (1) studies in which subjects had a minimal mean age of 60 yr. or more with all being at least 55 yr. of age, (2) those in which indirect calorimetry was performed while subjects were at rest and while fasting. **Exclusion criteria:** Studies that included patients on specific diets, mechanically ventilated, cancer or burns patients or patients with thyroid problems, Studies that did not mention the mean body weight of the studied group	n/a

Notes	**Author's Conclusion:** REE, which can be used in conjunction with PAL to calculate energy requirements, is approximately 20 kcal/kg/d in sick elderly people. This figure is not increased when compared to their healthy elderly counterparts. REE appears no longer affected by gender over the age of 60 yr. and minimal energy requirements can be set between 20x1.36 and 20x1.51, i.e. between 27 and 30 kcal/kg/d in sick elderly people. Requirements are higher in underweight people (34–38 kcal/kg/d). Further studies are needed in very elderly and sick people, taking their specific pathology into consideration.	
Outcome measures/results	• REE using indirect calorimetry • Body composition using dual energy X-ray absorptiometry, DLW, BIA, underwater weighing or body density • Total energy expenditure (TEE) and Energy Intake (EI) using DLW technique • Dietary records	(1) REE, when adjusted for differences in both body weight and fat-free mass (FFM), is similar in healthy and in sick elderly people being 20 and 28 kcal/kg of FFM per day, respectively, (2) their nutritional status influences their energy requirements given that weight-adjusted REE increases in line with a decrease in BMI, (3) total energy expenditure is lower in sick elderly people given that their physical activity level, i.e. the ratio of total energy expenditure to REE, is reduced during disease averaging at 1.36, (4) energy intake (EI) being only 1.23_REE is insufficient to cover energy requirements in sick elderly patients, whereas the EI of healthy elderly people appears sufficient to cover requirements, and finally, (5) gender ceases to be a determinant of REE in people aged 60 yr. or over, with the Harris & Benedict equation capable of accurately predicting mean REE in this population, whether healthy or sick.

Gaillard C, Alix E, Salle A et al. A practical approach to estimate resting energy expenditure in frail elderly people. J Nutr Health Aging 2008; 12: 277-280 [21]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Retrospective cohort study 2++	**Countries:** France **Centers:** Pôle de médicine interne et maladies métaboliques, Angers; Service de Gériatrie, Le Mans **Setting:** University hospital of Angers **Funding Sources:** Chiesi SA **Dropout rates:** n/a **Study limitations:** n/a	**Total no. Patients:** 187 **Inclusion criteria:** men and women above 55 yrs. of age and hospitalized in a short-stay or rehabilitation care units **Exclusion criteria:** n/a	n/a
Notes	**Author's Conclusion:** A simple formula using a factor multiplying body weight, i.e. 22 kcal/kg/d in under-weight and 19kcal/kg/d in normal weight sick elderly was accurate to predicting REE and bias was not influenced by the level of REE. This model included half of the group in the range of ±10% of the difference between predicted REE and measured REE, but the confidence interval of the bias was ±400kcal/d. Conversely, the Harris and Benedict and WHO formulae did accurately predict REE.		

Outcome measures/results	• Height and weight, BMI • REE measured by indirect calorimetry	The present study shows that the Fredrix et al. equation gave an accurate prediction of REE without significant bias along the whole range of REE. It also shows that under-weight sick elderly patients (BMI≤ 21 kg/m²) had a greater weight-adjusted REE than their normal weight counterparts.

Empfehlung 2

Die Proteinzufuhr älterer Personen sollte mindestens 1 g Protein pro kg Körpergewicht und Tag betragen und individuell je nach Ernährungsstatus, körperlicher Aktivität, Gesundheitszustand und Toleranz angepasst werden.

Empfehlungsgrad B

Bauer J, Biolo G, Cederholm T et al. Evidence-based recommendations for optimal dietary protein intake in older people: a position paper from the PROT-AGE Study Group. J Am Med Dir Assoc 2013; 14: 542-559. doi:10.1016/j.jamda.2013.05.021 [29]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Position paper 1+	**Countries:** n/a **Centers:** n/a **Setting:** n/a **Funding Sources:** Nestlé Nutrition **Dropout rates:** n/a **Study limitations:** n/a	**Total no. Patients:** n/a **Inclusion criteria:** n/a **Exclusion criteria:** n/a	n/a
Notes	**Author's Conclusion:** Guidelines for dietary protein intake have traditionally advised similar intake for all adults, regardless of age or sex: 0.8 grams of protein per kilogram of body weight each day (g/kg BW/d). The one-size-fits-all protein recommendation does not consider age-related changes in metabolism, immunity, hormone levels, or progressing frailty.		
Relevant recommendations/statements	• To maintain physical function, older people need more dietary protein than do younger people; older people should consume an average daily intake at least in the range of 1.0 to 1.2 g/kg BW/d. • The amount of additional dietary protein or supplemental protein needed depends on the disease, its severity, the patient's nutritional status prior to disease, as well as the disease impact on the patient's nutritional status. • Most older adults who have an acute or chronic disease need even more dietary protein (i.e., 1.2–1.5 g/kg BW/d); people with severe illness or injury or with marked malnutrition may need as much as 2.0 g/kg BW/d. • Older people with severe kidney disease who are not on dialysis (i.e., estimated GFR < 30 mL/min/1.73m²) are an exception to the high-protein rule; these individuals need to limit protein intake.		

	• Protein quality, timing of intake, and amino acid supplementation may be considered so as to achieve the greatest benefits from protein intake, but further studies are needed to make explicit recommendations. • In combination with increased protein intake, exercise is recommended at individualized levels that are safe and tolerated.

Deutz NE, Bauer JM, Barazzoni R et al. Protein intake and exercise for optimal muscle function with aging: recommendations from the ESPEN Expert Group. Clin Nutr 2014; 33: 929-936. doi:10.1016/j.clnu.2014.04.007 [30]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Recommendations 2++	**Countries:** n/a **Centers:** n/a **Setting:** n/a **Funding Sources** n/a **Dropout rates:** n/a **Study limitations:** n/a	**Total no. Patients:** n/a **Inclusion criteria:** n/a **Exclusion criteria:** n/a	n/a
Notes	**Author's Conclusion:** In order to help prevent or delay adverse consequences, we encourage increased intake of dietary protein for older adults (>65 years) compared to younger adults, and continued participation in routine exercise or physical activities. At the same time, it is important for older people to balance total energy intake with total body energy demands a rationale for consuming protein as a higher proportion of daily energy intake.		
Relevant recommendations/statements	• for healthy older people, the diet should provide at least 1.0-1.2 g protein/kg body weight/day, • for older people who are malnourished or at risk of malnutrition because they have acute or chronic illness, the diet should provide 1.2-1.5 g protein/kg body weight/day, with even higher intake for individuals • with severe illness or injury, • daily physical activity or exercise (resistance training, aerobic exercise) • should be undertaken by all older people, for as long as possible.		

Richter M, Baerlocher K, Bauer JM et al. Revised Reference Values for the Intake of Protein. Ann Nutr Metab 2019; 74: 242-250. doi:10.1159/000499374 [31]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic review 1+ AMSTAR2: Low quality	**Countries:** Germany, Switzerland, Austria **Centers:** n/a **Setting:** n/a	**Total no. patients**: n/a **Inclusion criteria:** Literature on protein and amino acid requirements published between	Analysis of protein intake recommendations for various age groups based on nitrogen balance studies and other methodologies

	Funding Sources: Fresenius, Nestlé, Nutricia Danone, Novartis, Pfizer, Bayer, Alpro Foundation **Dropout rates:** n/a **Study limitations:** there is controversy around the protein requirements assessed using the indicator amino acid oxidation (IAAO) method; limited data on specific protein requirements for different age groups; potential conflict of interest due to the financial ties of some authors to the food and pharmaceutical industries Risk of Bias Low Inconsistency n/a Indirectness Low Imprecision Moderate Publication Bias n/a	2000 and 2017; focus on controlled human nitrogen balance studies. **Exclusion criteria:** Studies that did not meet the methodological standards for nitrogen balance studies; non-human studies	
Notes	**Author's Conclusion:** The revised reference values for protein intake largely align with previously published values, except for adults over 65 years, where a higher estimated value is recommended. This adjustment reflects new evidence suggesting older adults may benefit from a higher protein intake to maintain muscle mass and function.		
Outcome measures/results	Updated reference values for protein intake across different age groups.		Infants: 2.5 for infants at the age of 0 to under1 month, 1.8 for infants at the age of 1 to under 2 months, and 1.4 for infants at the age of 2 to under 4 months g/kg body weight per day Children/Adolescents: 0.82 g/kg body weight per day at the age of 1 to under 4 years to 0.70 g/kg body weight per day [male] and 0.68 g/kg body weight [female] in adolescence Adults <65 years: Protein intake remains at 0.8 g/kg body weight/day. Adults >65 years: Recommended intake increased to 1.0 g/kg body weight/day based on recent evidence.

		Pregnant/Lactating Women: 2nd trimester 0.9, 3rd trimester 1.0, Lactating women 1.2 g/kg body weight per day

Rizzoli R, Stevenson JC, Bauer JM et al. The role of dietary protein and vitamin D in maintaining musculoskeletal health in postmenopausal women: a consensus statement from the European Society for Clinical and Economic Aspects of Osteoporosis and Osteoarthritis (ESCEO). Maturitas 2014; 79: 122-132. doi:10.1016/j.maturitas.2014.07.005 [32]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Consensus statement 2+	**Countries:** n/a **Centers:** n/a **Setting:** n/a **Funding Sources:** Danone S.A. **Dropout rates:** n/a **Study limitations:**	**Total no. Patients:** n/a **Inclusion criteria:** n/a **Exclusion criteria:** n/a	n/a
Notes	**Author's Conclusion:** The European Society for Clinical and Economic Aspects of Osteoporosis and Osteoarthritis (ESCEO) recommends optimal dietary protein intake of 1.0–1.2 g/kg body weight/d with at least 20–25 g of high-quality protein at each main meal, with adequate vitamin D intake at 800 IU/d to maintain serum 25-hydroxyvitamin D levels >50 nmol/L as well as calcium intake of 1000 mg/d, alongside regular physical activity/exercise 3–5times/week combined with protein intake in close proximity to exercise, in postmenopausal women for prevention of age-related deterioration of musculoskeletal health.		
Relevant recommendations/statements	• Food intake and physical activity are key anabolic stimuli for muscle protein synthesis. Exercise can enhance muscle protein synthesis irrespective of age. • The ingestion of protein and amino acids stimulates muscle protein synthesis; however, the anabolic sensitivity of skeletal muscle tissue to protein intake is reduced with ageing, leading to the concept of anabolic resistance. • Different protein sources may vary in their capacity to stimulate the rate of postprandial muscle protein synthesis. Leucine is a key anabolic amino acid that exerts a dose response effect on muscle protein synthesis, and is demonstrated to increase rates of postprandial muscle protein synthesis in elderly men. • Dietary proteins have a direct effect on key regulatory proteins and growth factors involved in muscle and bone growth. For example, aromatic amino acids (prevalent in dairy protein) lead to increased IGF-I resulting in greater muscle mass and strength. • Low dietary intake of protein (below the recommended daily allowance level of 0.8 g/kg/BW/d) in elderly women is associated with a reduction in plasma IGF-I levels and skeletal muscle fiber atrophy. The least muscle loss was seen in the elderly (aged 70–79 years) consuming protein at 1.1 g/kg/BW/d or 18% of total energy intake. • The distribution of protein intake over the day may be important, and it is proposed that 20–25 g of dietary protein per meal is required to allow an appropriate stimulation of post-prandial muscle protein synthesis over a 24-h period.		

	• Dietary protein may positively impact bone health by increasing calcium absorption, suppressing parathyroid hormone, and increasing production of IGF-I, a potent bone anabolism stimulator. • A positive association between protein intake and BMD, bone mineral content, and a reduction in bone resorption markers has been demonstrated in a meta-analysis. • There is no evidence to support the theory that high protein intake (of animal origin) leads to increased bone resorption, bone loss and osteoporosis.

Deutsche Gesellschaft für Ernährung, Österreichische Gesellschaft für Ernährung (Hrsg.): Protein. In: Referenzwerte für die Nährstoffzufuhr. Bonn, 2. Auflage, 3. aktualisierte Ausgabe (2017) [33]	
Referenzwerte für die Nährstoffzufuhr **Relevant recommendations/ statements**	• Der Proteinbedarf für Personen ab 65 Jahren wird auf 1,0 g/kg Körpergewicht pro Tag geschätzt. • Diese Empfehlung berücksichtigt die abnehmende Muskelmasse, die häufig mit steigendem Alter auftritt, sowie den Bedarf, Risiken wie Sarkopenie, verminderter Mobilität, erhöhter Sturzgefahr und längeren Krankenhausaufenthalten entgegenzuwirken. • Eine Proteinzufuhr im Bereich von 1,2 bis 1,5 g/kg Körpergewicht pro Tag wurde in Studien als sicher bewertet und kann in bestimmten Fällen sinnvoll sein, insbesondere bei gesundheitlichen Herausforderungen. • Die Anpassung der Proteinzufuhr ist individuell vorzunehmen, abhängig von Faktoren wie körperlicher Aktivität, Gesundheitszustand, Ernährungsstatus und Toleranz. • Eine regelmäßige und gleichmäßige Proteinaufnahme über den Tag verteilt unterstützt die Proteinsynthese und den Erhalt der Muskelmasse und ist daher besonders wichtig.

Empfehlung 3

Die Gesamtflüssigkeitszufuhr älterer Personen sollte ausgehend von 30 mL pro kg Körpergewicht und Tag an die individuellen Flüssigkeitsverluste und die klinische Situation angepasst werden.

Empfehlungsgrad B

EFSA Panel on Dietetic Products Nutrition and Allergies (NDA). Scientific Opinion on Dietary Reference Values for Water. EFSA Journal 2010; 8: 48 [38]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Scientific Opinion 2+	**Countries:** n/a **Centers:** n/a **Setting:** n/a **Funding Sources:**	**Total no. Patients:** n/a **Inclusion criteria:** n/a **Exclusion criteria:** n/a	n/a

	Dropout rates: n/a **Study limitations:** n/a		
Notes	**Author's Conclusion:** The Panel concludes that available data for adults permit the definition of adequate intakes and that these adequate intakes should be based both on observed intakes and on considerations of achievable or desirable urine osmolarity. Adequate total water intakes for females would have to be 2.0 L/day and for males 2.5 L/day. The Panel defines the same adequate intakes for the elderly as for adults, because both renal concentrating capacity and thirst are decreasing with age. **Note:** Research suggests that ~80% of fluid intake is from drinks, ~20% from foods and metabolism, hence drinks recommendations are 80% of total water intakes.		
Relevant recommendations/statements	Several studies show that elderly persons have lower total water intakes than younger adults, and that particularly women are at risk of too low intake. This has adverse effects on mental status and activities of daily life. Adequate intakes of water for the elderly, therefore, should not be based solely on observed intakes, but should take into account the decreases in renal concentrating capacity with age and the decrease in thirst sensitivity. The Panel has decided to follow the decision of the Institute of Medicine (United States) to set, therefore, the adequate total intake of water for elderly at the same level as for younger adults.		

Deutsche Gesellschaft für Ernährung, Österreichische Gesellschaft für Ernährung (Hrsg.): Wasser. In: Referenzwerte für die Nährstoffzufuhr. Bonn, 2. Auflage, 1. Ausgabe (2015) [39]	
Referenzwerte für die Nährstoffzufuhr **Relevant recommendations/ statements**	• Die empfohlene Gesamtflüssigkeitszufuhr bei älteren Erwachsenen beträgt mehr als 250 ml/MJ (ca. 1,1 ml/kcal) und orientiert sich an der Energiezufuhr sowie den individuellen Bedingungen. Dies entspricht etwa 30 ml pro Kilogramm Körpergewicht pro Tag, abhängig von den klimatischen Bedingungen und der körperlichen Aktivität • Ältere Menschen haben oft ein vermindertes Durstempfinden, was das Risiko eines Flüssigkeitsdefizits erhöht. Eine bewusste Flüssigkeitszufuhr sollte daher auch dann erfolgen, wenn kein ausgeprägtes Durstgefühl besteht • Ein erhöhter Flüssigkeitsbedarf besteht bei Hitze, trockener Luft, hohem Energieumsatz, reichlicher Proteinzufuhr sowie bei pathologischen Zuständen wie Fieber, Erbrechen oder Durchfall. Unter solchen Bedingungen sollten Flüssigkeitsverluste gezielt durch die Zufuhr von Wasser oder geeigneten Getränken ausgeglichen werden

<u>Empfehlung 4</u>

Ältere Personen sollten täglich angemessene Mengen an Ballaststoffen zu sich nehmen; auch bei enteraler Ernährung sollten ballaststoffhaltige Produkte verwendet werden.

Empfehlungsgrad B

European Food Safety Authority (EFSA). Scientific opinion on dietary reference values for carbohydrates and dietary fibre. EFSA Journal 2010; 8: 1462 [40]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Scientific Opinion 2+	**Countries:** n/a **Centers:** n/a **Setting:** n/a **Funding Sources:** **Dropout rates:** n/a **Study limitations:** n/a	**Total no. Patients:** n/a **Inclusion criteria:** n/a **Exclusion criteria:** n/a	n/a
Relevant recommendations/statements	The EFSA Panel recommends a dietary fibre intake of 25 g/day as adequate for normal laxation in adults. Additionally, there is evidence suggesting health benefits from consuming diets rich in fibre-containing foods at intakes above 25 g per day, including a reduced risk of coronary heart disease and type 2 diabetes, as well as improved weight maintenance. For elderly individuals, the report notes that constipation is more prevalent in this population and negatively affects quality of life. Dietary fibre plays a crucial role in bowel function, and increased fibre intake is associated with greater stool weight and improved laxation. While no separate recommendation is made for the elderly, the general 25 g/day recommendation applies, with potential benefits from higher intakes.		

Tay VXP, Noor NAM, Tan LB. Effects of fibre-supplemented enteral feeds on bowel function of non-critically ill tube-fed adults: a meta-analysis of randomised controlled trials. Br J Nutr 2023; 130: 2076-2087 [41]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Meta-Analysis 1+ AMSTAR2: moderate quality	**Countries:** n/a **Centers:** n/a **Setting:** in-patient **Funding Sources:** none **Dropout rates:** n/a **Study limitations:** High risk of selection bias due to unclear allocation concealment and randomization processes; potential conflicts of interest, as some studies included additional	**Total no. studies**: 13 **Inclusion criteria:** Adults (aged 18 years and above) on exclusive enteral tube feeding.; RCTs that evaluated the effects of fibre-supplemented (FS) enteral feeds on diarrhoea incidence and stool frequency **Exclusion criteria:** Non-human studies; studies involving critically ill patients or those not on exclusive enteral tube feeding;	**Intervention**: Fibre-supplemented (FS) enteral feeds. **Control**: Non-fibre-supplemented (NFS) enteral feeds.

	substances (e.g., arginine and probiotics) that could influence results; small sample sizes and short study durations, leading to underpowered studies; significant heterogeneity between studies in terms of population, assessment tools for diarrhoea, and definitions used. Risk of Bias Moderate Inconsistency Moderate Indirectness Low Imprecision Low Publication Bias n/a	studies that did not report on diarrhoea or other secondary outcomes as the study outcome; interventions specifically used to treat existing diarrhoea conditions	
Notes	**Author's Conclusion:** FS feeds can reduce the incidence of diarrhoea in non-critically ill adults on exclusive enteral tube feeding. However, the effects on stool frequency remain debatable, and the results should be interpreted with caution due to considerable heterogeneity and potential biases.		
Outcome measures/results	**Primary Outcomes**: Incidence of diarrhoea. **Secondary Outcomes**: Stool frequency, type of fibre used, and incidence of other gastrointestinal symptoms.		**Diarrhoea Incidence**: FS feeds significantly reduced the incidence of diarrhoea compared to NFS feeds (OR 0.44; 95% CI 0.20, 0.95; P = 0.04) **Stool Frequency**: No significant differences were found in stool frequency between FS and NFS feeds (SMD 0.32; 95% CI -0.53, 1.16; P = 0.47)

Deutsche Gesellschaft für Ernährung, Österreichische Gesellschaft für Ernährung (Hrsg.): Ballaststoffe (Nahrungsfasern). In: Referenzwerte für die Nährstoffzufuhr. Bonn, 2. Auflage, 7. aktualisierte Ausgabe (2021) [42]	
Referenzwerte für die Nährstoffzufuhr **Relevant recommendations/ statements**	• Der Richtwert für die Ballaststoffzufuhr bei Erwachsenen liegt bei mindestens 30 g pro Tag, unabhängig vom Geschlecht. Dieser Wert basiert auf Studien, die den primärpräventiven Nutzen einer ballaststoffreichen Ernährung für Erkrankungen wie koronare Herzkrankheiten, Diabetes mellitus Typ 2, Krebserkrankungen und allgemeine Mortalitätsrisiken belegen • Ballaststoffe erhöhen die Stuhlmasse, verbessern die Konsistenz und steigern die Häufigkeit der Darmentleerung. • Präbiotische Eigenschaften bestimmter Ballaststoffe wie Inulin unterstützen eine gesunde Darmmikrobiota, indem sie das Wachstum nützlicher Mikroorganismen fördern

Empfehlung 7

Einrichtungen, die ältere Personen medizinisch und/oder pflegerisch versorgen, sollten ein Ernährungsversorgungskonzept haben, in dem Standardabläufe für die Ernährungs- und Flüssigkeitsversorgung festgelegt sowie Verantwortlichkeiten und Kommunikationswege klar geregelt sind.

Empfehlungsgrad B

Babineau J, Villalon L, Laporte M, et al. Outcomes of screening and nutritional intervention among older adults in healthcare facilities. Can J Diet Pract Res. 2008;69:91-6. [49]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Pre-Post-Study 2+	**Countries:** Canada **Centers:** Campbellton Regional Hospital (CRH) and Moncton Hospital (MH), New Brunswick **Setting:** in-patient **Funding Sources:** Canadian Foundation for Dietetic Research **Dropout rates:** 0% **Study limitations**: small sample size; no control group due to ethical concerns about withholding nutritional treatment; inter-rater reliability among dietitians was not measured; difficulty in isolating the benefits of nutritional intervention from other medical interventions.	**Total no. patients**: 62 **Inclusion criteria:** Patients aged 65 years or older; admitted to the geriatric and rehabilitation wards of CRH or MH; identified as at high risk for PEM using the screening tools **Exclusion criteria:** n/a	Nutritional screening followed by a comprehensive nutritional assessment and individualized care plan, including weekly monitoring of dietary intake, weight, and biochemical indices.
Notes	**Author's Conclusion:** Early identification of at-risk older adults through nutritional screening and the subsequent development of a nutritional care plan led to significant improvements in nutritional intake, biochemical indices, and health-related quality of life (HRQOL). The study underscores the importance of screening and timely intervention in preventing and treating malnutrition in older adults.		
Outcome measures/results	primary Outcomes: Changes in energy and protein intake, serum albumin, prealbumin, transferrin, and hematocrit levels.		Energy intake (+171.79 kcal, p=0.0001), protein intake (+5.48g, p=0.01), serum albumin (+1.08 g/L, p=0.001), prealbumin (+0.02 g/L, p=0.003), transferrin (+0.06

	secondary Outcomes: Changes in HRQOL dimensions (measured by Short-Form 36).	g/L, p=0.024), hematocrit (+1%, p=0.026); HRQOL improvements: Significant improvements in all but one dimension (Role - emotional).

Biernacki C, Ward L, Barratt J. Improving the nutritional status of people with dementia. Br J Nurs 2001; 10: 1104-1114 [50]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Case series 3	**Countries:** UK **Centers:** single-center **Setting:** long-stay ward for care and treatment of women suffering with dementia **Funding Sources :** n/a **Dropout rates:** n/a **Study limitations:** n/a	**Total no. patients:** n=20 **Inclusion criteria:** female, late stage dementia, severe mental and physical health problems (dysphagia, dehydration) **Exclusion criteria:** n/a	Specific and appropriate assessment: - Swallow assessment & according adjustment of diet consistency Expansion of intervention options: - Increase of diet consistency options from two (normal or puréed) to four (normal, fork-mashable, soft, and smooth dysphagic) - Introduction of oral nutritional supplements - Introduction of snacks (chocolate, crisps, biscuits or cakes) for in-between meals - Prolonging self-feeding by offering finger-food for all meals - Offering the option od percutaneous endo scopic gastrostomy (PEG) feeding Increase in skilled care by nurses and ongoing monitoring by multidisciplinary team: - Encouragement of eating any (unhealthy) food rather than no food - train nurses in the assessment of swallowing train unqualified staff in the nutritional needs and care of people with dementia was also commenced
Notes	**Author's Conclusion:** Through skilled coordination of multidisciplinary working where individuals are motivated to investigate and apply research and new technology, it has been shown that people suffering dementia can achieve and maintain healthy nutritional status. The benefits for patients are not only physical but also a greater sense of wellbeing and enjoyment of food.		
Outcome measures/results	Primary outcome: BMI of patients Secondary outcome: staff skills		- BMI of patients: increase - Staff: increase of confidence and skill in assessment, care planning, care delivery and evaluation of patients' nutritional requirements; decrease of frustration and trepidation

Hoekstra JC, Goosen JH, de Wolf GS et al. Effectiveness of multidisciplinary nutritional care on nutritional intake, nutritional status and quality of life in patients with hip fractures: a controlled prospective cohort study. Clin Nutr 2011; 30: 455-461. doi:10.1016/j.clnu.2011.01.011 [51]										
Grade of evidence	**Study design**	**Intervention**		**Setting**	**Patients**			**Results**		
		Description	**Duration**		**n**	**Age [y.]**	**characteristics**	**Intake**	**Weight effect**	**Other**
IIa	controlled prospective cohort study	comprehensive, individualized Nutritional care	3 months	Clinic and at home after the hospital stay	115 (IG 57, CG 58)	> 65	Femoral neck fracture with subsequent surgical treatment	Energy intake ↑, protein intake ↑	Less weight loss	Quality of life ↑

Rypkema G, Adang E, Dicke H et al. Cost-effectiveness of an interdisciplinary intervention in geriatric inpatients to prevent malnutrition. J Nutr Health Aging 2004; 8: 122-127 [52]										
Grade of evidence	**Study design**	**Intervention**		**Setting**	**Patients**			**Results**		
		Description	**Duration**		**n**	**Age [y.]**	**characteristics**	**Intake**	**Weight effect**	**Other**
IIa	prospective control study	interdisciplinary teamwork	n/a	geriatric wards	298 (IG 140, CG 158)	> 60	Stay longer than two days	n/a	Weight gain	Infections in hospital ↓

II. Interventionen zur Erfassung, Prävention und Therapie von Mangelernährung

II.1 Generell, unabhängig von bestimmten Krankheiten

II.1.3 Unterstützende Maßnahmen

II.1.3.1. Hilfe bei den Mahlzeiten

Empfehlung 13

Älteren Personen mit Mangelernährung oder Risiko für Mangelernährung und eingeschränkter Selbständigkeit beim Essen und Trinken soll die individuell benötige Unterstützung beim Essen und Trinken angeboten werden, um eine angemessene Nahrungsaufnahme [A] und die Selbständigkeit [B] zu fördern.

Empfehlungsgrad A/B

Abbott RA, Whear R, Thompson-Coon J et al. Effectiveness of mealtime interventions on nutritional outcomes for the elderly living in residential care: a systematic review and meta-analysis. Ageing Res Rev 2013; 12: 967-981. doi:10.1016/j.arr.2013.06.002 [68]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic review 1++	**Countries:** United States, Sweden, Holland, Canada, UK, Finland, France, Taiwan **Centers:** n/a **Setting:** n/a **Funding Sources:** National Institute for Health Research through Peninsula CLAHRC **Dropout rates:** 99.39% (total 6028 → full text 95 → 37 included)	**Total no. Studies:** n=37 **Inclusion criteria:** (cluster) RCTs, non-RCTs, Studies with before and after designs, time-series studies, case-control studies, intervention in residential, nursing homes/care homes, Residents aged 65 years +, interventions had to be provided directly or indirectly, Nutrition education/training specific to mealtime care, report at least one nutritional outcome	Mealtime interventions → 5 categories 1) changes to food service (for ex.: presentation, color-contrast, portions, finger food) 2) food improvement (for ex.: adding sauce, flavor) 3) dining environment alteration (including: food service, staff assistance sometimes components of improving dining environment with the aim of making the dining room **more ´home-like´ =** decoration, self-service, ambience) 4) staff training (for ex.: feeding skills) 5) feeding assistance (for ex.: reinforcement, correct positioning)

	Study limitations: inadequate reporting in over a half of the articles → Data quality, Meta-analyses limited, limited number of RCTs, categories may not fully accounted for all components of interventions/big variation in interventions	**Exclusion criteria:** case studies, not enough information for replication or quality appraisal, studies in hospital or palliative care setting, individual´s home within the community, studies that included residents with specific eating difficulties (dysphagia), Interventions with oral nutritional supplementation or assessed fortification of food with protein or energy	
Notes	• **S**earch strategy: developed by specialist, combination of MeSH terms and free text terms • Bias: risk of bias assessed using a checklist (randomization RCT, blinded, reporting of compliance, outcomes, power calculation, validity, reliability) → none of the studies met all criteria • Used random-effects model for meta-analyses (weightings:size, heterogeneity) • Studies involved: published between 1981 and 2012 • Overall quality of the included studies was low (due to range of designs, measurements, etc.) **Author's Conclusion:** The need to improve the nutrition of the elderly living in residential long term care is well recognized. This review found some evidence that simple intervention around various aspects of mealtime practices and the mealtime environment can result in favorable nutritional outcomes.		
Outcome measures/results	• Nutritional outcome: direct→ **food intake** (energy, macronutrient, percentage);**body weight/weight status** MNA, BMI, body composition, biochemical indices, functional status • Mealtime intervention: aim to improve mealtime routine, experience, environment • Intervention directly/indirectly: assistance, encouragement, stimulating environment, increased access to food, more choice/appealing foods • Other nutritional outcomes: Diet satisfaction, time spent eating, fluid intake	• Food improvement: low/inconsistent effects • Food services: Most of the interventions showed positive effects on caloric intake (increased) → real food snacks; except for reducing portion size to increase appetite. This was the only one residents consumed less food. Biochemical indices were inconsistent between the studies that measured them • Dining environment: mixed findings, individual significance (Nijs et al.). Low/no effects on body weight/consumption, biochemical indices; MNA in some intervention group improved vs. control • Staff training: low or mixed effect • Feeding assistance: one to one feeding assistance improves consumption	

Brunner S, Mayer H, Qin H et al. Interventions to optimise nutrition in older people in hospitals and long-term care: Umbrella review. Scand J Caring Sci 2022; 36: 579-598. doi:10.1111/scs.13015 [69]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1++ AMSTAR2: High quality	**Countries:** Asia, Australia, Europe and North America **Centers:** n/a **Setting:** hospitals and long-term care **Funding Sources:** City Hospital Waid and Triemli, Zurich (working hours). Stiftung Alta Vita (funding of editing) **Dropout rates:** n/a **Study limitations:** Only interventions that were already synthesized were included; no special attention to food literacy; restricted to studies published in English and German; Risk of Bias Moderate Inconsistency n/a Indirectness Low Imprecision Low Publication Bias n/a	**Total no. studies**: 13 **Inclusion criteria:** Geriatric patients or people aged 65 years or older with physical, social or cognitive functional ability; treatment of the risk for protein-/ energy malnutrition, comparison to no intervention or 'standard care'; outcomes: nutritional status, nutrient intake, body mass index, functional status, appetite, quality of life, patient satisfaction, in combination with laboratory findings; published within the last 10 years (2010–2020); acute care, long-term care institution, rehabilitation; systematic reviews, narrative review, meta-analysis, meta-synthesis, other types of review; abstract in english, full text in english or german **Exclusion criteria:** Children, young adults; terminally ill, palliative patients; studies with interventions in micronutrients or molecular level only, tube feeding, parenteral nutrition, validation of screening tools; studies with outcome measures in laboratory signs only, prevalence of malnutrition as main outcome; studies Homecare, ambulatory care, intensive care	n/a

		units, palliative care, hospicereview of low quality (no flow chart of study selection, without explicit inclusion, exclusion criteria)	
Notes	**Author's Conclusion:** Several studies synthesised that optimising nutrition in older people in hospitals and long-term care is achievable. Interventions were effective if—on a meta-level—staff training was addressed as part of a multi-component measure to reach an interprofessional food promoting culture.		
Outcome measures/results	- descriptions of interventions that influenced nutritional status or food intake - weight gain, Body Mass Index, behaviour during food intake, functional status, appetite, quality of life or patient satisfaction in combination with laboratory findings or muscle mass		An interprofessional food promoting culture, including staff training as part of a multi-component measure, has shown to be a successful element in implementing activities of Nutrition Management.

Edwards D, Carrier J, Hopkinson J. Mealtime assistance for older adults in hospital settings and rehabilitation units from the perspective of patients, families and healthcare professionals: a mixed methods systematic review. JBI Database System Rev Implement Rep 2016; 14: 261-357. doi:10.11124/jbisrir-2016-003100 [70]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1+ AMSTAR II: high quality	**Countries:** n/a **Centers:** n/a **Setting:** hospitals and rehabilitation units **Funding Sources:** **Dropout rates:** **Study limitations:** quality of the included studies; variety of interventions and outcome measures; mainly female patients; only westernized countries; patients who are too ill to consent are mostly those at the greatest risk of undernutrition	**Total no. studies**: 19 **Inclusion criteria:** studies that included older adults (65 years and over) from any ethnic background in hospital settings, including rehabilitation units, with any diagnosis; studies focusing on family members; volunteers, healthcare professionals **Exclusion criteria:** Patients under 65 years of age; Patients on artificial feeding; Patients residing in other healthcare settings such as nursing homes or long-term care facilities	- interventions for mealtime assistance, observed mealtime assistance, or discussed experiences of mealtime assistance with patients, families and healthcare professionals

	Risk of Bias Moderate Inconsistency Moderate Indirectness Low Imprecision Low Publication Bias n/a		
Notes	**Author's Conclusion:** No firm conclusions can be drawn with respect to the most effective initiatives. Initiatives with merit include those that encourage social interaction, either through the use of a dining room, or employed staff or volunteers, relatives or visitors supporting the older patient during mealtimes. Volunteers value training and support and clarification of their roles and responsibilities.		
Outcome measures/results	- first objective: improved nutritional intake/status (energy & protein intake, nutritional status), length of stay, postoperative complications, mortality rates - second objective: description of the mealtime assistance from the perspective of the patient, healthcare professional, carer or family members		- Mealtimes should be viewed as high priority, healthcare staff should limit other activities during mealtimes and allow older patients to eat uninterrupted, providing support where required. - Nursing staff, employed mealtime assistants, volunteers or relatives/visitors can help prepare the older patient for meals; this includes opening packages and cutting up food as well as physically feeding patients. - Social interaction at mealtimes for older patients is effective in increasing food, energy and protein intake, and should be encouraged. - Communication between all members of the multi-disciplinary team, staff and volunteers is essential.

Edwards D, Carrier J, Hopkinson J. Assistance at mealtimes in hospital settings and rehabilitation units for patients (>65years) from the perspective of patients, families and healthcare professionals: A mixed methods systematic review. Int J Nurs Stud 2017; 69: 100-118. doi:10.1016/j.ijnurstu.2017.01.013 [71]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic review 1+ AMSTAR 2: critically low quality	**Countries:** USA; Australia; UK; Canada **Centers**: n/a **Setting:** hospital settings including rehabilitation units **Funding Sources:** n/a **Dropout rates:** n/a **Study limitations:** n/a Risk of Bias Moderate Inconsistency Moderate Indirectness High Impreciseness Moderate	**Total no. Studies: 19** **Inclusion criteria:** >65 years, English, including or focusing on carers, family members, volunteers and healthcare professionals perspectives **Exclusion criteria:** <65 years of age, artificial feeding such as patients obtaining their nutrition exclusively by enteral or parenteral means and patients residing in other healthcare	qualitative, quantitative and mixed methods studies; interventions for mealtime assistance, observed mealtime assistance or discussed experiences of mealtime assistance with staff, patients, relatives, volunteers or stakeholders

	Publication Bias Moderate	settings such	
Notes	Three aggregated mixed methods syntheses were developed: 1) Mealtimes should be viewed as high priority. 2a) Nursing staff, employed mealtime assistants, volunteers or relatives/visitors can help with mealtime assistance. 2b) Social interaction at mealtimes should be encouraged. 3) Communication is essential. **Author's Conclusion:** A number of initiatives were identified which can be used to support older patients (>65 years) at mealtimes in hospital settings and rehabilitation units. However, no firm conclusions can be drawn in respect to the most effective initiatives. Initiatives with merit include those that encourage social interaction. Any initiative that involves supporting the older patient (>65 years) at mealtimes is beneficial. A potential way forward would be for nurses to focus on the training and support of volunteers and relatives to deliver mealtime assistance, whilst being available at mealtimes to support patients with complex nutritional needs.		
Outcome measures/results	the effectiveness of the varying types of mealtime assistance provided in both hospital settings and rehabilitation units and the views of patients, health care professionals, family members and volunteers on mealtime assistance for patients Protein intake (g), Energy intake (KJ), % meeting nutritional requirements Experiences of volunteers, nurses and patients in relation to feeding assistance, Tasks completed by the volunteer Time spent with each patient Addressing barriers to consumption, Interruptions Infection rates (number of antibiotics prescribed) Functional status (GS (kgf)) Nutritional status, Mortality; LOS; albumin Feasibility of delivering mealtime assistance	TSE1 Lunch time and daily energy intake, breakfast, lunch time and daily protein intake can be increased in patients (>65 years) in hospital settings when trained volunteers are present to provide support TSE2 Daily energy intake, nutritional status, mortality four months post discharge can be increased in patients (>65 years) in hospital settings when employed assistants are present to provide support TSE3 Lunch time energy intake can be increased in patients (>65 years) in hospital settings when they eat their meals in a supervised dining room as opposed to on the ward TSE4 Eating in a communal dining room in hospital settings is associated with better protein intake for patients (>65 years)	

Herke M, Fink A, Langer G et al. Environmental and behavioural modifications for improving food and fluid intake in people with dementia. Cochrane Database Syst Rev 2018; 7: CD011542-CD011542. doi:10.1002/14651858.CD011542.pub2 [72]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic review 1+	**Countries:** n/a **Centers**: n/a	**Total no. Studies:** 9 1502 randomised participants **Inclusion criteria:**	• Environmental modifications ◦ Change of routine (physical surroundings, social context and timing) ◦ Change of context (which persons are present)

AMSTAR2: High quality	**Setting:** home care, residential care and nursing home care **Funding Sources:** n/a **Dropout rates:** n/a **Study limitations:** duration of observation is short, Dementia diagnostic criteria not clear. Risk of Bias Moderate Inconsistency Moderate Indirectness Low Impreciseness High Publication Bias n/a	people with dementia RCT 's behavioural or environmental modifications as interventions, or to modify the mealtime behaviour of people with dem. or their caregivers or both, with the intention of improving food and fluid intake. **Exclusion criteria:** • Parenteral, Tube nutrition. • Mod.food swallowing disord. • Drugs • Modifications that are not directly aimed at nutrition and mealtimes, but instead at, for example, oral hygiene, general motor skills or general knowledge of the condition • outcomes relevant only to other stakeholders (e.g. relatives orhealth professionals) and • biomarkers	◦ Change of ambience (properties of the light, sound, smell or temperature of dining environment; home-like environment by means of furniture and decoration or having tableware in high-contrast colours) ◦ Others (Complementary food items during or in between mealtimes) • Behavioural modifications ◦ Education or training of people with dementia (knowledge people with dementia have about nutrition, their skills in self-feeding and their attitude and habits concerning mealtimes) ◦ Education or training of caregivers (aimed at those providing assistance to people with dementia during mealtimes, similar objectives. ◦ Others **Three kinds of comparator interventions** • Usual care or optimised usual care • Any other intervention included in this review. • Any non-specific intervention.
Notes	Methodological quality of studies was assessed using criteria based on those of the Cochrane 'Risk of bias' tool • Due to high heterogeneity results most were not pooled but are reported narratively **Author's Conclusion:** The review covers a wide range of possible interventions. Due to the quantity and quality of the evidence currently available, we cannot identify any specific environmental or behavioral modifications for improving food and fluid intake in people with dementia. We believe further studies of the behavioural and environmental strategies included in this review, and others, are warranted.		
Outcome measures/results	1. measures of fluid food, protein and caloric intake, nutritional status (BMI, MNA, body weight follow up) 2. mealtime behaviour, cognitive and functional outcomes (ADL) and quality of life 3. Global change in symptoms and performance (measured by validated global scales), 4. compliance with intervention, entry to institutional care or any other reported participant-relevant outcome. 5. Psychological or behavioural events, such as depression or agitation.		One study implemented environmental as well as behavioural modifications by providing additional food items between meals and personal encouragement to consume them, control group no intervention. Differences between groups were very small and the quality of the evidence from this study was very low, so we are very uncertain of any effect of this intervention. 8 studies implemented behavioural modifications. 3 studies provided nutritional education and nutrition promotion programmes. Control groups did not receive these programmes.

	6. Adverse effects, such as aspiration-related pneumonia or death.	After 12 months, the intervention behavioural modification and nutrition promotion programmes group showed slightly higher protein intake per day (mean difference (MD) 0.11 g/kg, 95%, 1 study; low-quality evidence), but there was no clear evidence of a difference in nutritional status assessed with body mass index (BMI) (MD -0.26 kg/m² favouring control, 95% CI -0.70 to 0.19; n = 734, 2 studies; moderate-quality evidence), body weight (MD -1.60 kg favouring control, 95% CI -3.47 to 0.27; n = 656, 1 study; moderate-quality evidence), or score on Mini Nutritional Assessment (MNA) (MD -0.10 favouring control, 95%CI -0.67 to 0.47; n = 656, 1 study; lowquality evidence). After six months, the intervention group in one study had slightly lower BMI (MD -1.79 kg/m² favouring control, 95% CI -1.28 to -2.30; n = 52, 1 study; moderate-quality evidence) and body weight (MD -8.11 kg favouring control, 95% CI -2.06 to -12.56; n = 52, 1 study; moderate-quality evidence). This type of intervention may have a small positive effect on food intake, but little or no effect, or a negative effect, on nutritional status. Two studies compared self-feeding skills training programmes. In one study, the control group received no training and in the other study the control group received a different self-feeding skills training programme. the quality of the evidence was very low and we are very uncertain whether these interventions have any effect. One study investigated general training of nurses to impart knowledge on how to feed people with dementia and improve attitudes towards people with dementia. Again, the quality of the evidence was very low so that we cannot be certain of any effect. Two studies investigated vocal or tactile positive feedback provided by caregivers while feeding participants. After three weeks, the intervention group showed an increase in calories consumed per meal (MD 200 kcal, 95% CI 119.81 to 280.19; n = 42, 1 study; low-quality evidence) and protein consumed per meal (MD 15g, 95% CI 7.74 to 22.26; n = 42, 1 study; low-quality evidence). This intervention may increase the intake of food and liquids slightly; nutritional status was not assessed.

Hollingsworth EK, Long EA, Simmons SF. Comparison Between Quality of Care Provided by Trained Feeding Assistants and Certified Nursing Assistants During Between-Meal Supplementation in Long-Term Care Settings. J Appl Gerontol 2018; 37: 1391-1410. doi:10.1177/0733464816669806 [73]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Observational study 2+ NOS: 8/9	**Countries: USA** **Centers:** Vanderbilt University Medical Center, Nashville **Setting:** five Long-Term Care facilities in one region **Funding Sources:** National Institute of Aging (NIA) R01 grant **Dropout rates:** 1,5 % **Study limitations:** Nurse stuffing levels below nat. average Targeted on a subset of residents (long stay) Risk of Bias Moderate Inconsistency n/a Indirectness Low Impreciseness High Publication Bias n/a	**Total no. Patients: 128** **Inclusion criteria:** residents to be long-stay and at nutritional risk, as defined by a physician or dietitian order for caloric supplementation **Exclusion criteria:** an order for hospice services, enteral or parenteral feeding, or a history of aspiration, medically complicated swallowing issues	compare the quality of feeding assistance provided by trained non-nursing staff with care provided by certified nursing assistants (CNAs) Research staff provided an 8-hr training course that met federal and state requirements to non-nursing staff in five community longterm care facilities. Trained staff were assigned to between-meal supplement and/or snack delivery for 24 weeks **Control Group** usual care
Notes	**Research Questions** 1: How do trained staff compare to indigenous CNAs on the quality of between-meal feeding assistance care processes based on standardized observations? 2: What are the perceptions of trained staff related to their feeding assistant care role and their competency in this role based on structured interviews? 3: What are the perceptions of CNAs and upper level management staff related to the impact and competency of non-nursing staff to provide feeding assistance care based on structured interviews? **Author's Conclusion:** between-meal and mealtime care tasks are typically provided by CNAs, who are often understaffed and also have a high turnover rate. training non-nursing staff provides a practical way to improve feeding assistance care quality within the constraints of existing staffing resources		
Outcome measures/results	Using standardized observations, research staff measured feeding assistance care processes between meals across all study weeks. Trained staff, nurse aides, and upper level staff interviewed at 24 weeks: staff perceptions of program impact		Trained staff performed significantly better than CNAs for 12 of 13 care process measures. Residents also consumed significantly more calories per snack offer from trained staff (M = 130 ± 126 [SD] kcal) compared with CNAs (M = 77 ± 94 [SD] kcal). The majority of staff reported a positive impact of the training program

<table>
<tr><th colspan="4">Howson FFA, Sayer AA, Roberts HC. The impact of trained volunteer mealtime assistants on dietary intake and satisfaction with mealtime care in adult hospital inpatients: A systematic review. The Journal of nutrition, health and aging 2017; 21: 1038-1049. doi:10.1007/s12603-016-0847-2 [74]</th></tr>
<tr><th>Study Type/
Evidence Level</th><th>Study details/limitations</th><th>Patient characteristics</th><th>Interventions</th></tr>
<tr><td>Systematic Review
1-

AMSTAR2: moderate quality</td><td>Countries: n/a
Centers: n/a
Setting: in-patient
Funding Sources: the National Institute for Health Research (NIHR) Collaboration for Leadership in Applied Health Research and Care (CLAHRC) Wessex
Dropout rates: n/a
Study limitations: moderate quality of the majority of the studies; none were of high quality; variability in methods and outcomes across studies; lack of standardization in reporting dietary intake and satisfaction outcomes; absence of adverse events reporting in most studies
Risk of Bias Moderate
Inconsistency Moderate
Indirectness Low
Imprecision Moderate
Publication Bias n/a</td><td>Total no. patients: 14
Inclusion criteria: Adult hospital inpatients; including those in rehabilitation units; Provision of additional mealtime assistance by trained volunteers; Any nutritional outcomes, satisfaction with mealtime care
Exclusion criteria: Long-term care facilities</td><td>Intervention: Trained volunteer mealtime assistants providing assistance with meal preparation, feeding, and encouragement during mealtimes.
Control: Presence or absence of volunteers, with some studies using historical or parallel control groups</td></tr>
<tr><td>Notes</td><td colspan="3">Author’s Conclusion:
There is evidence from small studies and improvement projects that trained volunteer mealtime assistants are safe and improve satisfaction with mealtime care in hospital inpatients, although evidence for an effect on dietary intake was less consistent.</td></tr>
<tr><td>Outcome measures/results</td><td colspan="2">Primary Outcome: Dietary intake (protein and energy intake).
Secondary Outcomes: Satisfaction with mealtime care, nutritional status, and volunteer activity.</td><td>Significant increases in protein intake (ranging from 2g to 10.7g) and energy intake (ranging from 44kcal to 618kcal) in some studies.</td></tr>
</table>

		Positive feedback from patients, staff, and volunteers regarding satisfaction with mealtime care. No adverse events reported in three studies; other studies did not discuss adverse events.

Howson FFA, Robinson SM, Lin SX et al. Can trained volunteers improve the mealtime care of older hospital patients? An implementation study in one English hospital. BMJ open 2018; 8: e022285-e022285. doi:10.1136/bmjopen-2018-022285 [75]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Mixed methods prospective quasi-experimental study	**Countries:** England **Centers:** University Hospital Southampton NHS FT, Southampton, UK **Setting**: in-patient **Funding Sources:** Funded by the National Institute for Health Research (NIHR) Collaboration for Leadership in Applied Health Research and Care (CLAHRC) Wessex and supported by the Faculty of Medicine and the Faculty of Health Sciences at the University of Southampton **Dropout rates:** n/a **Study limitations:** conducted in a single hospital, limiting generalizability; no ethnic diversity among patients; volunteer activity was self-reported, potentially underestimating the extent of assistance; did not	**Total no. patients**: 1721 **Inclusion criteria:** patients aged 70 years or older admitted to one of the 9 participating wards; volunteers aged 17–77 trained to provide mealtime assistance **Exclusion criteria:** Departments such as oncology or stroke units	Volunteers provided mealtime assistance, including feeding patients, preparing food, and encouraging eating

	measure the impact on dietary intake or nutritional status		
Notes	**Author's Conclusion:** Trained volunteers can deliver high-quality mealtime care, including safely feeding patients, across various hospital departments. The programme was cost-effective, releasing valuable nursing time for clinical tasks**.**		
Outcome measures/results	**Primary Outcome**: Number of volunteers recruited and trained, and the amount of mealtime assistance provided. **Secondary Outcomes**: Barriers and enablers of the volunteer programme, cost analysis, patient and staff satisfaction.		65 volunteers provided 846 sessions of mealtime assistance, helping 1721 patients. Cost savings equivalent to £17,200 (Band 3) and up to £32,400 (Band 5) nursing time. Positive feedback from patients and staff; no adverse events reported.

Latif J, Dabbous M, Weekes CE et al. The effectiveness of trained volunteer delivered interventions in adults at risk of malnutrition: A systematic review and meta-analysis. Clin Nutr 2021; 40: 710-727. doi:10.1016/j.clnu.2020.06.008 [76]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review & Meta-Analysis 1- AMSTAR2: Moderate quality	**Countries:** n/a **Centers:** n/a **Setting:** n/a **Funding Sources:** none **Dropout rates:** n/a **Study limitations:** High risk of bias in many studies due to non-blinding and small sample sizes; low quality of evidence across the studies due to variability in study designs, methods of data collection, and lack of control groups in some studies; inconsistency in the reported outcomes and lack of standardization in the interventions; no assessment of publication bias; no grey literature	**Total no. studies**: 17 **Inclusion criteria:** Adults aged 18 years or older at risk of malnutrition; studies involving volunteer-delivered nutritional interventions, including mealtime assistance, social support, and nutritional education. **Exclusion criteria:** Studies based in economically less developed countries; studies not focused on nutritional interventions or those that did not report relevant outcomes for volunteer interventions; tudies on obesity/overweight, animals, children, adolescents and artificial nutrition	Intervention: Various volunteer-delivered interventions, including mealtime assistance, social support, and nutritional education, tailored to address malnutrition risk. Control: Controls varied by study, including usual care, no intervention, or social support provided by non-volunteers.

	was explored; authors were not contacted for missing data Risk of Bias Moderate Inconsistency Low Indirectness Low Imprecision Low Publication Bias n/a		
Notes	**Author's Conclusion:** The review suggests that trained volunteer interventions may improve certain outcomes such as nutritional intake and patient satisfaction, but the evidence is generally of low quality. There is a need for adequately powered studies to confirm these findings and to better define the role of volunteers in preventing malnutrition.		
Outcome measures/results	Primary Outcomes: Nutritional intake (e.g., energy intake), functional outcomes (e.g., physical performance, fear of falling). Secondary Outcomes: Quality of life, patient and staff satisfaction, adherence and retention, cost-effectiveness, patient safety.	Primary Outcomes: Meta-analysis showed a significant improvement in lunchtime energy intake with volunteer assistance (MD: 378.15 Kcal, p=0.04) but no significant effect on total daily energy intake. Secondary Outcomes: Improvements in patient satisfaction, with volunteers being valued by both patients and staff. Some studies reported increased physical performance and reduced fear of falling with volunteer interventions.	

Li L, Zhao Y, Wang Y et al. Overview of systematic reviews: Effectiveness of non-pharmacological interventions for eating difficulties in people with dementia. J Adv Nurs 2020; 76: 2830-2848. doi:10.1111/jan.14492 [77]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic review 1+ AMSTAR2: Moderate quality	**Countries**: 11 Europe, 3 North America, 2 Australia, 2 China**.** **Centers**: n/a **Setting:** n/a **Funding Sources:** Beijing Municipal Science & Technology Commission Peking University Langtai nursing research fund **Dropout rates:** **Study limitations:** Risk of Bias Moderate	**Total no. Studies: 18** **Inclusion criteria:** systematic reviews or meta-analyses based on PWD RCT, dementia multiple research designs, **Exclusion criteria**: reviews without available full text, redundant publications, research proposal stage, parenteral nutrition	12 Rev. <u>environmental modifications:</u> lighting and contrast (7/12), home-like environment (4/12), fish aquarium in dining area (6/12), music played during mealtimes (10/12), seated in the same location (1/12), and shared mealtime with others (3/12). 8 Rev. <u>change of food provision and service</u>, including additional food between meals (3/8), finger foods (1/8), menu changes (2/8), bulk food service (3/8), self-service style (3/8), and family style food service (4/8). 7 Rev. <u>education/training,</u> including education and nutrition promotion programme for PWD (2/7), spaced retrieval activities training for PWD (5/7), Montessori-based activities training for PWD (6/7), caregiver education (5/7), feeding skills training programme for caregivers (4/7). 4 Rev. <u>Feeding assistance, 8 rev. ONS</u>

	Inconsistency Moderate Indirectness Low Impreciseness High Publication Bias n/a		4 Rev. Mixed interventions and other interventions: vocal or tactile positive feedback (2/4) and exercise (3/4).
Notes	Assessment of quality of studies using AMSTAR 2 and GRADE system. 13 systematic reviews included were rated of critically low overall confidence and only included one middle-quality study. Of 18 reviews included, 14 (78%) lacked a list of excluded studies and justifications for the exclusion. Risk of bias of the included studies was not considered when interpreting/discussing the results of the system reviews in 13 (72%) reviews. Also, in 12 (67%) reviews, there were no report whether the research methods of reviews were determined before implementation and whether there was any inconsistency with the protocols. **Author's Conclusion:** Some evidence showed that environmental modifications, education/ training, and Oral nutrition supplements (ONS) were beneficial to improving eating difficulties. But the current evidence failed to support the effectiveness of other interventions. The overall confidence of systematic reviews is relatively low. High-quality studies are needed to further validate the effectiveness of non-pharmacological interventions for eating difficulties in PWD.		
Outcome measures/results	-food/drink intake (amount of food eaten or fluid drank) energy intake in calorie, protein intake, etc. -nutritional status (body weight, BMI, MNA) -eating behaviours (Edinburgh Feeding Evaluation in dementia, Eating Behavior Scale, Level of Eating Independence Scale) -incidence of agitation/aggression, time/frequency of self-feeding, and time/frequency of assistance, communication, and participation during mealtimes.	environmental modifications could be beneficial to increase food and drink intake. 2 reviews suggested that improving dining room lighting and visual contrast had a positive effect on decrease of agitation behaviours. 2 reviews indicating appropriate lighting and contrast was shown to promote communication. 1 review reported that home-like environment was associated with an increase in interaction among PWD and active eating participation compared with general care facility environment. education/training: 3 reviews reported spaced retrieval activities training could improve food and drink intake. Over half of reviews indicated it brought a positive effect on nutritional status, while consistent conclusions whether it worked for eating behaviours were not drawn. Montessori-based activities training: No conclusive evidence on improved food and drink intake, nutritional status, as well as eating behaviours. Regarding caregiver education, 4 reviews: beneficial to increase intake of food and drink, 3 reviews : beneficial to gain weight, but no significant effect to BMI. 2 reviews : feeding skill training programme for caregivers could improve the ability of PWD to eat independently, there was still insufficient evidence for increasing food intake. education and nutrition promotion programme for PWD could have brought a slight increase in food intake per day, but no statistical differences were found in body weight, BMI, or MNA score. 1 review reported a positive effect on weight and MNA score, but level of evidence was not high.

Liu W, Cheon J, Thomas SA. Interventions on mealtime difficulties in older adults with dementia: A systematic review. Int J Nurs Stud. 2014;51:14–27. [78]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1+	**Countries:** United States **Centers:** n/a **Setting: unlimited setting** **Funding Sources:** n/a **Dropout rates:** n/a **Study limitations:** heterogeneous in patient population, intervention protocols, time points of data collection, and measures of certain outcomes; language bias; publication bias	**Total no. patients**: 2082 **Inclusion criteria:** aged 65 years and above; with dementia of any type and any stage; any intervention on mealtime difficulties, in which the study analyzes its effect on the outcome of interest; published intervention studies in English **Exclusion criteria:** interventions or outcomes only for caregivers or provides; review; not human; data collection before 2000	– Intervention with nutritional supplements; training/education programs; environment/routine modification; feeding assistance and mixed interventions – Any comparator or none at all
Notes	**Author's Conclusion:** Mealtime difficulties in older adults with dementia still exist, and various types of effective interventions should be implemented to alleviate eating or feeding difficulties and reduce adverse outcomes. By evaluating studies of almost the last decade, this systematic review provides updated evidence for clinical practice and points out priorities for nursing research		
Outcome measures/results	Outcome: eating or feeding behaviors; any subsequent nutritional outcomes		– ''Nutritional supplements'' showed moderate evidence to increase food intake, body weight and BMI. – ''Training/education programs'' demonstrated moderate evidence to increase eating time and decrease feeding difficulty. Both ''training/education programs'' and ''feeding assistance'' were insufficient to increase food intake. – ''Environment/ routine modification'' indicated low evidence to increase food intake, and insufficient to decrease agitation. – Evidence was sparse on nutritional status, eating ability, behavior disturbance, behavioral and cognitive function, or level of dependence.

Liu W, Galik E, Boltz M et al. Optimizing Eating Performance for Older Adults With Dementia Living in Long-term Care: A Systematic Review. Worldviews Evid Based Nurs 2015; 12: 228-235. doi:10.1111/wvn.12100 [79]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1-	**Countries:** United States **Centers:** n/a	**Total no. patients**: 530	Intervention: training programs for residents or nursing assistants at intra- or interpersonal levels; mealtime assistance from nursing caregivers at interpersonal

	Setting: long-term care (LTC) **Funding Sources:** n/a **Dropout rates:** n/a **Study limitations:** language bias; publication bias, widely varied quality of individual studies; small number of identified studies; missed potential eligible studies	**Inclusion criteria:** intervention studies focused on optimizing eating performance and evaluated change of self-feeding or eating performance in older adults (≥ 65 years) with dementia **Exclusion criteria:** enteral or parenteral nutrition; not in long-term care setting; the outcome were nutritional intake, anthropometric and biochemical parameters, behavioral disturbances or other adverse events	level; environment modification at environmental levell, and multicomponent interventions at both personal and environmental levels
Notes	**Author's Conclusion:** Effective interventions should be based on multilevel, multi- component individualized care approaches to achieve optimal eating performance among LTC residents with dementia. By evaluating studies within the last three decades, this review provides preliminary support for using training programs and mealtime assistance to optimize eating performance in this population		
Outcome measures/results	Outcome: eating independence; self-feeding ability; feeding difficulty; mealtime communication		Training programs targeting older adults showed good evidence in decreasing feeding difficulty Mealtime assistance offered by nursing staff showed good evidence in improving eating performance, while future work using strong designs is needed to accumulate evidence Environmental modifications are worthwhile to improve eating performance while reliable evidence is needed with strong RCT designs, valid outcome measures and minimum confounding bias

Palese A, Bressan V, Kasa T et al. Interventions maintaining eating Independence in nursing home residents: a multicentre qualitative study. BMC Geriatr 2018; 18: 292-292. doi:10.1186/s12877-018-0985-y [80]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Qualitative study/focus group 3	**Countries:** Italy **Centers:** multicenter **Setting:** nursing homes **Funding Sources:** n/a **Dropout rates: n**/a	**Total no. patients**: 54 **Inclusion criteria:** residents with moderate to severe functional dependence; at need of assistance in eating; those who were involved	Intervention by ritualizing the mealtime experience by creating a controlled stimulated environment; structuring effective interactions to ensure a pleasant mealtime experience and individualizing eating assistance

	Study limitations: only regarding the interventions performed in the dining room; not evaluated data saturation; considered only effective interventions Risk of Bias Moderate Inconsistency n/a Indirectness Low Impreciseness High Publication Bias n/a	on a daily basis in assisting residents at mealtime; those with at least of 6 months of nursing home experience; those who were willing to participate in the study **Exclusion criteria:** n/a	
Notes	**Author's Conclusion:** Several interventions that emerged as effective, according to the experience of participants, have never been documented before; while others are in contrast to the evidence documented. This suggests the need for further studies in the field; as no conclusions regarding the best interventions have been established to date		
Outcome measures/results	n/a		Ritualizing the mealtime experience by creating a controlled stimulated environment: starting the mealtime ritual; promoting the desire to eat; creating and maintaining a peaceful environment

Simmons SF, Hollingsworth EK, Long EA et al. Training Nonnursing Staff to Assist with Nutritional Care Delivery in Nursing Homes: A Cost-Effectiveness Analysis. J Am Geriatr Soc 2017; 65: 313-322. doi:10.1111/jgs.14488 [81]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+ ROB2: Some concerns	**Countries:** USA **Centers:** five community NHs, four of which were for profit, Total and nurse aide staffing in the participating NHs were below national averages **Setting:** nursing home **Funding Sources:** National Institute of Aging (NIA) Grant **Dropout rates:** 15 % **Study limitations:**	**Total no. Patients: 122** **Inclusion criteria:** Long-stay NH residents with an order for caloric supplementation **Exclusion criteria**: Aspiration Episodes	trained staff for between-meal assistance after baseline assessments. to - provide supplements or snacks twice per day (morning and afternoon), Five weekdays per week for 24 consecutive weeks. -offer a variety of food, beverage supplement -options in conjunction with assistance (e.g., opening containers, verbal cueing, physical help) to promote consumption. The facility kitchen provided all items. **Control Group:** routine care as nurse aide staff usually provided

	differences between groups at baseline Costs in terms of food, fluid, and supplement items given and staff time per episode of care not 8 hours required for training of staff Risk of Bias Moderate Inconsistency n/a Indirectness Low Impreciseness High Publication Bias n/a		
Notes	**Research Questions:** 1 How many and what type(s) of NH staff will be willing to complete the required 8-hour training curriculum related to nutritional care? 2 What is the effect of trained staff on the frequency of supplement and snack delivery between meals for residents with an order for caloric supplementation? 3 What is the effect of trained staff on residents' between-meal and total caloric intake? 4 What is the cost-effectiveness of training nonnursing staff to provide nutritional care based on staff time per episode of care and residents' caloric intake? **Author's Conclusion:** It is cost effective to train nonnursing staff to provide caloric supplementation, and this practice has a positive effect on residents' between-meal intake.		
Outcome measures/results	Documented at baseline and monthly throughout the 24-week intervention: staff time (minutes and seconds) to provide supplements or snacks between meals and provide assistance to promote consumption, resident refusal rates, and cost of snacks and supplements (according to facility costs) 13-item skills assessment to monitor intervention implementation by trained staff.	Fifty staff (mean 10 per site) completed training. The intervention had a significant effect on between-meal caloric intake ($F = 56.29$, $P < .001$), consuming, on average, 163.33 (95% CI = 120.19–206.47) calories per person per day more than control group. The intervention costs were $1.27 per person per day higher than usual care ($P < .001$). The incremental cost-effectiveness ratio for the intervention was 134 kcal per dollar. This Cost was due to the higher frequency and number of snacks and the associated staff time to provide assistance.	

Tassone EC, Tovey JA, Paciepnik JE et al. Should we implement mealtime assistance in the hospital setting? A systematic literature review with meta-analyses. J Clin Nurs 2015; 24: 2710-2721. doi:10.1111/jocn.12913 [82]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1+	**Countries:** USA, Australia, UK **Centers:** n/a **Setting:** hospital **Funding Sources:** no grants received for this research **Dropout rates:** n/a **Study limitations:** heterogeneity of the studies included (designs, sample size, duration of intervention, data collection);absence of blinding in the included studies; observation +sampling bias possible; language bias (only English studies included)	**Total no. Studies:** n=5 **Inclusion criteria:** hospitalized patients ≥65 years, mealtime assistance by nurses/volunteers or trained staff, standard/usual care vs multiple interventions with mealtime assistance; Publications only in English **Exclusion criteria:** dysphagia**,** critically/terminally ill; studies in age-care nursing home facilities, mental health facilities, outpatient centers; Studies targeting nutritional status through enteral/parenteral nutrition, nutritional supplements (also vitamins/minerals), medication aiding in appetite stimulation; systematic reviews, conference abstracts, theses, non-peer reviewed articles, non-human research	Specific feeding/mealtime assistance strategies carried out by volunteers, nursing staff or trained paid personal Compared to Standard/usual care practices
Notes	• Studies were examined for quality and risk of bias (by Academy of Nutrition and Dietetics Quality Checklist); Outcome data were combined narratively and by meta-analyses; no criteria for study design (PICOs format was used to develop the criteria for study inclusion) • Study designs: RCT, Case series, cross-over (2x), quasi-experimental • none of the included papers were rated below level III-2, indicating that the level of evidence for mealtime assistance was generally of good quality • Food intake: recorded by visual estimation (if not possible to weighed remaining food on the plate → observational bias possible) **Author's Conclusion:** The evidence identified suggests that mealtime assistance provided to hospitalized older patients (≥65 years) leads to a statistically significant increase in energy and protein intake. For many patients, this increase in both energy and protein intake will be clinically significant, reducing the gap between requirements and actual intake.		

Outcome measures/results	• Key outcome: Nutritional status including energy and protein intake, anthropometric measures: body mass index, triceps skinfold, mid-arm-(+ -muscle) circumference	Overall, mealtime assistance significantly improved daily energy intake, with a mean difference of 486.4 kJ (95% CI: 11.15, 961.66 kJ), p = 0.04. The mean difference in daily protein intake of 5.86 g (95% CI: 1.09, 10.63 g), p = 0.02, was also statistically significant. Mealtime assistance was generally not associated with significant differences in anthropometric variables, although a trend towards increased body weight was reported → no decreases in anthropometrical or nutritional outcomes were associated with mealtime assistance in any of the included studies

II.1.3.2. Essumgebung

Empfehlung 15

In Einrichtungen, die ältere Personen medizinisch und/oder pflegerisch versorgen, soll die Umgebung bei den Mahlzeiten angenehm gestaltet werden, um die Nahrungsaufnahme älterer Personen mit Mangelernährung oder Risiko für Mangelernährung zu unterstützen.

Empfehlungsgrad A

Abbott RA, Whear R, Thompson-Coon J et al. Effectiveness of mealtime interventions on nutritional outcomes for the elderly living in residential care: a systematic review and meta-analysis. Ageing Res Rev 2013; 12: 967-981. doi:10.1016/j.arr.2013.06.002 [68]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic review 1++	**Countries:** United States, Sweden, Holland, Canada, UK, Finland, France, Taiwan **Centers:** n/a **Setting:** n/a **Funding Sources:** National Institute for Health Research through Peninsula CLAHRC **Dropout rates:** 99.39% (total 6028 → full text 95 → 37 included)	**Total no. Studies:** n=37 **Inclusion criteria:** (cluster) RCTs, non-RCTs, Studies with before and after designs, time-series studies, case-control studies, intervention in residential, nursing homes/care homes, Residents aged 65 years +, interventions had to be provided directly or indirectly, Nutrition education/training specific to mealtime care, report at least one nutritional outcome	Mealtime interventions → 5 categories 1) changes to food service (for ex.: presentation, color-contrast, portions, finger food) 2) food improvement (for ex.: adding sauce, flavor) 3) dining environment alteration (including: food service, staff assistance sometimes components of improving dining environment with the aim of making the dining room **more ´home-like´ =** decoration, self-service, ambience) 4) staff training (for ex.: feeding skills) 5) feeding assistance (for ex.: reinforcement, correct positioning)

	Study limitations: inadequate reporting in over a half of the articles → Data quality, Meta-analyses limited, limited number of RCTs, categories may not fully accounted for all components of interventions/big variation in interventions	**Exclusion criteria:** case studies, not enough information for replication or quality appraisal, studies in hospital or palliative care setting, individual´s home within the community, studies that included residents with specific eating difficulties (dysphagia), Interventions with oral nutritional supplementation or assessed fortification of food with protein or energy	
Notes	• **S**earch strategy: developed by specialist, combination of MeSH terms and free text terms • Bias: risk of bias assessed using a checklist (randomization RCT, blinded, reporting of compliance, outcomes, power calculation, validity, reliability) → none of the studies met all criteria • Used random-effects model for meta-analyses (weightings:size, heterogeneity) • Studies involved: published between 1981 and 2012 • Overall quality of the included studies was low (due to range of designs, measurements, etc.) **Author's Conclusion:** The need to improve the nutrition of the elderly living in residential long term care is well recognized. This review found some evidence that simple intervention around various aspects of mealtime practices and the mealtime environment can result in favorable nutritional outcomes.		
Outcome measures/results	• Nutritional outcome: direct→ **food intake** (energy, macronutrient, percentage);**body weight/weight status** MNA, BMI, body composition, biochemical indices, functional status • Mealtime intervention: aim to improve mealtime routine, experience, environment • Intervention directly/indirectly: assistance, encouragement, stimulating environment, increased access to food, more choice/appealing foods • Other nutritional outcomes: Diet satisfaction, time spent eating, fluid intake	• Food improvement: low/inconsistent effects • Food services: Most of the interventions showed positive effects on caloric intake (increased) → real food snacks; except for reducing portion size to increase appetite. This was the only one residents consumed less food. Biochemical indices were inconsistent between the studies that measured them • Dining environment: mixed findings, individual significance (Nijs et al.). Low/no effects on body weight/consumption, biochemical indices; MNA in some intervention group improved vs. control • Staff training: low or mixed effect • Feeding assistance: one to one feeding assistance improves consumption	

Borders JC, Blanke S, Johnson S et al. Efficacy of Mealtime Interventions for Malnutrition and Oral Intake in Persons With Dementia: A Systematic Review. Alzheimer Dis Assoc Disord 2020; 34: 366-379. doi:10.1097/wad.0000000000000387 [90]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic review 1- AMSTAR2: Critically low quality	**Countries:** United States **Centers:** n/a **Setting:** n/a **Funding Sources:** National Institute of Aging **Dropout rates:** n/a **Study limitations:** articles only in English; heterogeneity in study outcomes; improvements in study outcomes were based solely on statistical significance Risk of Bias Low Inconsistency Low Indirectness Moderate Impreciseness Low Publication Bias Low	**Total no. patients**: **Inclusion criteria:** full text articles that reported on mealtime interventions and its effect on at least 1 nutritional outcome on person with dementia; the outcome(s) were objective measures of nutritional status and/or oral intake **Exclusion criteria:** dissertations; grey literature; studies with a focus on end-of-life care; qualitative methods/analyses; geriatric populations without dementia; enteral interventions; non-English articles	Mealtime intervention (feeding interventions; environmental modifications; oral supplementation; education of patient, family and staff; and other pharmacologic/Ecopsychological interventions) Any comparator
Notes	**Author's Conclusion:** Findings clarify the state of existing evidence regarding various interventional strategies for improving malnutrition in persons with dementia. While some approaches are promising, adequately powered and rigorously designed multi-dimensional intervention trials are needed to inform clinical decision-making in real-world contexts.		
Outcome measures/results	Outcome: oral intake or nutritional status; knowledge and behaviors of nursing assistants; feeding ability; functional level of residents		Moderate evidence to suggest the efficacy of oral supplementation, and preliminary evidence to suggest that feeding interventions, education, and environmental modifications may confer improvements

Brunner S, Mayer H, Qin H et al. Interventions to optimise nutrition in older people in hospitals and long-term care: Umbrella review. Scand J Caring Sci 2022; 36: 579-598. doi:10.1111/scs.13015 [69]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1++	**Countries:** Asia, Australia, Europe and North America	**Total no. studies**: 13	n/a

AMSTAR2: High quality	**Centers:** n/a **Setting:** hospitals and long-term care **Funding Sources:** City Hospital Waid and Triemli, Zurich (working hours). Stiftung Alta Vita (funding of editing) **Dropout rates:** n/a **Study limitations:** Only interventions that were already synthesized were included; no special attention to food literacy; restricted to studies published in English and German; Risk of Bias Moderate Inconsistency n/a Indirectness Low Imprecision Low Publication Bias n/a	**Inclusion criteria:** Geriatric patients or people aged 65 years or older with physical, social or cognitive functional ability; treatment of the risk for protein-/ energy malnutrition, comparison to no intervention or 'standard care'; outcomes: nutritional status, nutrient intake, body mass index, functional status, appetite, quality of life, patient satisfaction, in combination with laboratory findings; published within the last 10 years (2010–2020); acute care, long-term care institution, rehabilitation; systematic reviews, narrative review, meta-analysis, meta-synthesis, other types of review; abstract in english, full text in english or german **Exclusion criteria:** Children, young adults; terminally ill, palliative patients; studies with interventions in micronutrients or molecular level only, tube feeding, parenteral nutrition, validation of screening tools; studies with outcome measures in laboratory signs only, prevalence of malnutrition as main outcome; studies Homecare, ambulatory care, intensive care units, palliative care, hospicereview of low quality (no flow chart of study selection, without explicit inclusion, exclusion criteria)	

Notes	**Author's Conclusion:** Several studies synthesised that optimising nutrition in older people in hospitals and long-term care is achievable. Interventions were effective if—on a meta-level—staff training was addressed as part of a multi-component measure to reach an interprofessional food promoting culture.	
Outcome measures/results	- descriptions of interventions that influenced nutritional status or food intake - weight gain, Body Mass Index, behaviour during food intake, functional status, appetite, quality of life or patient satisfaction in combination with laboratory findings or muscle mass	An interprofessional food promoting culture, including staff training as part of a multi-component measure, has shown to be a successful element in implementing activities of Nutrition Management.

Li L, Zhao Y, Wang Y et al. Overview of systematic reviews: Effectiveness of non-pharmacological interventions for eating difficulties in people with dementia. J Adv Nurs 2020; 76: 2830-2848. doi:10.1111/jan.14492 [77]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic review 1+ AMSTAR2: Moderate quality	**Countries**: 11 Europe, 3 North America, 2 Australia, 2 China**.** **Centers**: n/a **Setting:** n/a **Funding Sources:** Beijing Municipal Science & Technology Commission Peking University Langtai nursing research fund **Dropout rates:** **Study limitations:** Risk of Bias Moderate Inconsistency Moderate Indirectness Low Impreciseness High Publication Bias n/a	**Total no. Studies: 18** **Inclusion criteria:** systematic reviews or meta-analyses based on PWD RCT, dementia multiple research designs, **Exclusion criteria**: reviews without available full text, redundant publications, research proposal stage, parenteral nutrition	12 Rev. <u>environmental modifications:</u> lighting and contrast (7/12), home-like environment (4/12), fish aquarium in dining area (6/12), music played during mealtimes (10/12), seated in the same location (1/12), and shared mealtime with others (3/12). 8 Rev. <u>change of food provision and service</u>, including additional food between meals (3/8), finger foods (1/8), menu changes (2/8), bulk food service (3/8), self-service style (3/8), and family style food service (4/8). 7 Rev. <u>education/training,</u> including education and nutrition promotion programme for PWD (2/7), spaced retrieval activities training for PWD (5/7), Montessori-based activities training for PWD (6/7), caregiver education (5/7), feeding skills training programme for caregivers (4/7). 4 Rev. <u>Feeding assistance, 8 rev. ONS</u> <u>4 Rev. Mixed interventions</u> and <u>other interventions</u>: vocal or tactile positive feedback (2/4) and exercise (3/4).
Notes	Assessment of quality of studies using AMSTAR 2 and GRADE system. 13 systematic reviews included were rated of critically low overall confidence and only included one middle-quality study. Of 18 reviews included, 14 (78%) lacked a list of excluded studies and justifications for the exclusion. Risk of bias of the included studies was not considered when interpreting/discussing the results of the system reviews in 13 (72%) reviews. Also, in 12 (67%) reviews, there were no report whether the research methods of reviews were determined before implementation and whether there was any inconsistency with the protocols.		

	Author's Conclusion: Some evidence showed that environmental modifications, education/ training, and Oral nutrition supplements (ONS) were beneficial to improving eating difficulties. But the current evidence failed to support the effectiveness of other interventions. The overall confidence of systematic reviews is relatively low. High-quality studies are needed to further validate the effectiveness of non-pharmacological interventions for eating difficulties in PWD.	
Outcome measures/results	-food/drink intake (amount of food eaten or fluid drank) energy intake in calorie, protein intake, etc. -nutritional status (body weight, BMI, MNA) -eating behaviours (Edinburgh Feeding Evaluation in dementia, Eating Behavior Scale, Level of Eating Independence Scale) -incidence of agitation/aggression, time/frequency of self-feeding, and time/frequency of assistance, communication, and participation during mealtimes.	<u>environmental modifications</u> could be beneficial to increase food and drink intake. 2 reviews suggested that improving dining room lighting and visual contrast had a positive effect on decrease of agitation behaviours. 2 reviews indicating appropriate lighting and contrast was shown to promote communication. 1 review reported that home-like environment was associated with an increase in interaction among PWD and active eating participation compared with general care facility environment. <u>education/training</u>: 3 reviews reported spaced retrieval activities training could improve food and drink intake. Over half of reviews indicated it brought a positive effect on nutritional status, while consistent conclusions whether it worked for eating behaviours were not drawn. Montessori-based activities training: No conclusive evidence on improved food and drink intake, nutritional status, as well as eating behaviours. Regarding caregiver education, 4 reviews: beneficial to increase intake of food and drink, 3 reviews : beneficial to gain weight, but no significant effect to BMI. 2 reviews : feeding skill training programme for caregivers could improve the ability of PWD to eat independently, there was still insufficient evidence for increasing food intake. <u>education and nutrition promotion programme</u> for PWD could have brought a slight increase in food intake per day, but no statistical differences were found in body weight, BMI, or MNA score. 1 review reported a positive effect on weight and MNA score, but level of evidence was not high.

Navarro DA, Shapiro Y, Birk R, et al. Orange napkins increase food intake and satisfaction with hospital food service: A randomized intervention. Nutrition. 2019;67-68S:100008. doi: 10.1016/j.nutx.2020.100008. [91]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+ ROB2: Some concerns	**Countries:** Israel **Centers:** Internal Medicine Department E, Edith Wolfson Medical Center, Holon, Israel	**Total no. patients**: 131 **Inclusion criteria:** newly admitted to the department consuming their first hospital lunch; capable of responding to study questionnaires	Intervention (n=66): lunch tray with an orange napkin Control group (n=65): lunch tray with a white napkin

	Setting: hospital **Funding Sources:** n/a **Dropout rates:** 0% **Study limitations:** experiment only at the lunch meal; only among patients hospitalized in an internal medicine department; potential confounders Risk of Bias: Moderate Inconsistency: n/a Indirectness: Low Impreciseness: Moderate Publication Bias: n/a	**Exclusion criteria:** not present for lunch meal	
Notes	**Author's Conclusion:** The addition of an orange napkin to the meal tray of patients hospitalized in internal medicine departments can increase dietary intake and improve satisfaction with hospital food services. At about 5 cents per piece, the orange napkin is a low-cost, easily implemented strategy to address malnutrition risk in hospitalized adults.		
Outcome measures/results	Outcome: food intake; satisfaction with food service		Patients in the orange napkin group (n = 66) consumed 17.6% more hospital-provided food than those in the white napkin (control) group (n = 65), driven by the significantly greater proportion of the carbo- hydrate side dishes and the vegetable dishes consumed. Patients in the orange napkin group also reported significantly greater satisfaction with the hospital's food service.

Palese A, Bressan V, Kasa T et al. Interventions maintaining eating Independence in nursing home residents: a multicentre qualitative study. BMC Geriatr 2018; 18: 292-292. doi:10.1186/s12877-018-0985-y [80]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Qualitative study/focus group 3	**Countries:** Italy **Centers:** multicenter **Setting:** nursing homes **Funding Sources:** n/a **Dropout rates: n**/a **Study limitations:** only regarding the interventions	**Total no. patients**: 54 **Inclusion criteria:** residents with moderate to severe functional dependence; at need of assistance in eating; those who were involved on a daily basis in assisting residents at mealtime; those with	Intervention by ritualizing the mealtime experience by creating a controlled stimulated environment; structuring effective interactions to ensure a pleasant mealtime experience and individualizing eating assistance

	performed in the dining room; not evaluated data saturation; considered only effective interventions Risk of Bias Moderate Inconsistency n/a Indirectness Low Impreciseness High Publication Bias n/a	at least of 6 months of nursing home experience; those who were willing to participate in the study **Exclusion criteria:** n/a	
Notes	**Author's Conclusion:** Several interventions that emerged as effective, according to the experience of participants, have never been documented before; while others are in contrast to the evidence documented. This suggests the need for further studies in the field; as no conclusions regarding the best interventions have been established to date		
Outcome measures/results	n/a		Ritualizing the mealtime experience by creating a controlled stimulated environment: starting the mealtime ritual; promoting the desire to eat; creating and maintaining a peaceful environment

II.1.3.3. Gesellschaft beim Essen

Empfehlung 16

Ältere Personen mit Mangelernährung oder Risiko für Mangelernährung sollten ermutigt werden, ihre Mahlzeiten in Gesellschaft einzunehmen, um die Nahrungsaufnahme zu unterstützen.

Empfehlungsgrad B

Abdelhamid A, Bunn D, Copley M et al. Effectiveness of interventions to directly support food and drink intake in people with dementia: systematic review and meta-analysis. BMC Geriatr 2016; 16: 26 [94]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic review and meta-analysis 1++	**Countries:** Europe, North America, Brazil, Taiwan, New Zealand **Centers:** n/a **Setting:** most institution or hospital setting, 4 day	**Total no. Studies:** n=43 **Inclusion criteria:** RCT and non-RCT: ≥3 adults with any type/stage of dementia or mild cognitive impairment or MMSE score plus one standard deviation ≤26, ≥5 days, interventions: aimed	Direct intervention: - Oral supplements - Food/drink modification - Swallowing problems management - Eating assistance - Social support

	centers/community, 1 unclear setting **Funding Sources :**National Institute for Health research, Collaboration for Leadership in Applied Health Research&Care, National Insitute of Health Research Fellowship programme **Dropout rates:** n/a **Study limitations:** some studies might have been missed due to poor indexing and abstracts omitting to identify participants as having dementia or cognitive impairment; transferability interventions for people with swallowing problems without dementia to people with dementia; lack of data in the studies (for ex. Nutritional status); interventions might be stage- or problem-specific; no definite evidence on effectiveness of one or more interventions	modify food and/or drink, provide food- or drink-based supplements, assist with eating/drinking/manage swallowing problems, and see "outcomes" **Exclusion criteria:** n/a	
Notes	• Data and quality characteristics were extracted independently by two reviewers/Methodological quality was assessed using Cochrane risk of bias tool: study was at low risk of bias when it was at low risk of both selection bias and detection bias • Studies were grouped by type of intervention, study design → many studies underpowered → unable to suggest statistically significant benefits or harms **Author's Conclusion:** We found no definitive evidence on effectiveness, or lack of effectiveness, of specific interventions but studies were small and short term. People with cognitive impairment and their carers have to tackle eating problems despite this lack of evidence, so promising interventions are listed. The need remains for high quality trials tailored for people with cognitive impairment assessing robust outcomes.		
Outcome measures/results	• At least one of these outcomes: Nutrition or hydration status→quantity, quality or adequacy of food or fluid		• ONS intervention: some no effect on weight >12 weeks, some RCTs→ [MD] 0.72 kg, 95 % CI −1.02-2.45, 382 participants) but with high heterogeneity

	intake, ability to eat independently, swallow without aspirating, enjoyment of food or meaningful activity • Quality of life, functional, cognitive status, views or attitudes, cost effectiveness, resource use, mortality, health outcomes	(I2 89 %); some had an effect on weight: RCTs 3-12 weeks →2.02 kg, 95 % CI 1.53-2.50, 344 participants, I2 0 %; effects on other anthropometric measures were mixed; MNA improved; Quality of life, functional, cognitive status, mortality→ no effect • Food and drink modification: no significant/mixed effect; but finger food seems to be positive for improving energy intake/weight (+2.06 kg vs +0.32 kg, $p < 0.05$), no effect on MNA, cognition, mortality • Eating and drinking assistance: energy intake, cost effectiveness → no significant on weight, mixed effects on energy intake • Social support: low effects on weight and BMI (weight: 1.3% vs. -0.6%, p=0.005; BMI: 0.4 % vs. -0.2 %, p = 0.003). Energy intake (0.7 vs.-0.3 MJ/day, p = 0.084), functional and cognitive status did not alter; Family-style meals showed improvements for example on satisfaction/enjoyment, weight, autonomy • Swallowing problems: reformed foods/thickened fluids vs standard → some found improvements, some not

Borders JC, Blanke S, Johnson S et al. Efficacy of Mealtime Interventions for Malnutrition and Oral Intake in Persons With Dementia: A Systematic Review. Alzheimer Dis Assoc Disord 2020; 34: 366-379. doi:10.1097/wad.0000000000000387 [90]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic review 1- AMSTAR2: Critically low quality	**Countries:** United States **Centers:** n/a **Setting:** n/a **Funding Sources:** National Institute of Aging **Dropout rates:** n/a **Study limitations:** articles only in English; heterogeneity in study outcomes; improvements in study outcomes were based solely on statistical significance Risk of Bias Low	**Total no. patients**: **Inclusion criteria:** full text articles that reported on mealtime interventions and its effect on at least 1 nutritional outcome on person with dementia; the outcome(s) were objective measures of nutritional status and/or oral intake **Exclusion criteria:** dissertations; grey literature; studies with a focus on end-of-life care; qualitative methods/analyses; geriatric populations without dementia;	Mealtime intervention (feeding interventions; environmental modifications; oral supplementation; education of patient, family and staff; and other pharmacologic/Ecopsychological interventions) Any comparator

	Inconsistency Low Indirectness Moderate Impreciseness Low Publication Bias Low	enteral interventions; non-English articles	
Notes	**Author's Conclusion:** Findings clarify the state of existing evidence regarding various interventional strategies for improving malnutrition in persons with dementia. While some approaches are promising, adequately powered and rigorously designed multi-dimensional intervention trials are needed to inform clinical decision-making in real-world contexts.		
Outcome measures/results	Outcome: oral intake or nutritional status; knowledge and behaviors of nursing assistants; feeding ability; functional level of residents		Moderate evidence to suggest the efficacy of oral supplementation, and preliminary evidence to suggest that feeding interventions, education, and environmental modifications may confer improvements

Bunn DK, Abdelhamid A, Copley M et al. Effectiveness of interventions to indirectly support food and drink intake in people with dementia: Eating and Drinking Well IN dementiA (EDWINA) systematic review. BMC Geriatr 2016; 16: 89 [95]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1++	**Countries:** North America, Europe, Asia, New Zealand, South America **Centers:** n/a **Setting:** any setting(most institutional settings) **Funding Sources:** This article summarizes independent research funded in part by the National Institute for Health Research, Collaboration for Leadership in Applied Health Research & Care, East of England, and in part by the National Institute of Health Research Fellowship programme	**Total no. Studies:** n=51 **Inclusion criteria:** RCT,CCTs→≥3 adults diagnosed any stage/type of dementia or mild cognitive impairment or MMSE score+standard deviation ≤26, ≥consecutive days; included interventions: see "interventions"; Included studies only with outcomes: see "outcomes" **Exclusion criteria: c**ase reports	Studies were grouped by type of Intervention 1. Dining environment and food service (any alteration (for ex. Noise, sensory adjustments, furniture,..) of the physical environment in which food/drink was taken) 2. Education/training of people with dementia or their care givers 3. behavioral intervention: alter behavior such as verbal prompting 4. exercise (any exercise component) 5. multicomponent intervention (>3 interventions, including at least 1 listed here) then grouped by study design

	Dropout rates: n/a **Study limitations:** high risk of bias (small number of patients included in the studies+ low validity), effective interventions may be underpowered, shortage of potentially useful interventions/research, inability to pool outcome data (no meta-analysis possible → interventions too different)		
Notes	• Meta-analysis (statistical pooling) was not appropriate so data were tabulated and synthesized narratively; Methodological quality was assessed using Cochrane risk of bias tool; assessed also: funding bias, validity of dementia diagnosis, outcome measures and baseline comparability between groups • Intervention duration differed from 5 days to 1 year **Author's Conclusion:** We found no definitive evidence on effectiveness, or lack of effectiveness, of specific interventions but studies were small and short term. A variety of promising indirect interventions need to be tested in large, high-quality RCTs, and may be approaches that people with dementia and their formal or informal care-givers would wish to try.		
Outcome measures/results	• Primary outcomes: - Nutrition or hydration status - Meaningful activity or enjoyment of food/drink - Quality of life • Secondary outcomes - Quantity, quality, adequacy of food/fluid intake • Other outcomes of interest: - Functional or cognitive status - Views, attitudes - Cost effectiveness - Resource use - Mortality, health outcomes		• No clearly effective or clearly ineffective interventions - Mixed results: some examples: Charras et al. shared mealtimes → weight increased (+5.64 kg, $p>0.024$), improved autonomy, longer meals; no effect on weight/BMI (Desai et al.) by comparing bulk service vs. pre-plated but increased intake of energy, protein, carbohydrate; education: (Riviere et al.)improved weight (1.4 kg, $p<0.05$) compared to usual care/(Hanson et al.) significant decrease in %weight loss compared to control; behavioral intervention → longer mealtimes (Van Ort et al.); exercise interventions no improve in nutritional status in any study • Promising interventions included: - eating meals with care-givers - family style meals - soothing mealtime music - constantly accessible snacks and longer mealtimes - education and support for formal and informal care-givers

		- spaced retrieval and Montessori activities - facilitated breakfast clubs (Santo Pietro et al., 1998, CCT) multisensory exercise and multicomponent interventions

Edwards D, Carrier J, Hopkinson J. Mealtime assistance for older adults in hospital settings and rehabilitation units from the perspective of patients, families and healthcare professionals: a mixed methods systematic review. JBI Database System Rev Implement Rep 2016; 14: 261-357. doi:10.11124/jbisrir-2016-003100 [70]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1+ AMSTAR II: high quality	**Countries:** n/a **Centers:** n/a **Setting:** hospitals and rehabilitation units **Funding Sources:** **Dropout rates:** **Study limitations:** quality of the included studies; variety of interventions and outcome measures; mainly female patients; only westernized countries; patients who are too ill to consent are mostly those at the greatest risk of undernutrition Risk of Bias Moderate Inconsistency Moderate Indirectness Low Imprecision Low Publication Bias n/a	**Total no. studies**: 19 **Inclusion criteria:** studies that included older adults (65 years and over) from any ethnic background in hospital settings, including rehabilitation units, with any diagnosis; studies focusing on family members; volunteers, healthcare professionals **Exclusion criteria:** Patients under 65 years of age; Patients on artificial feeding; Patients residing in other healthcare settings such as nursing homes or long-term care facilities	- interventions for mealtime assistance, observed mealtime assistance, or discussed experiences of mealtime assistance with patients, families and healthcare professionals
Notes	**Author's Conclusion:** No firm conclusions can be drawn with respect to the most effective initiatives. Initiatives with merit include those that encourage social interaction, either through the use of a dining room, or employed staff or volunteers, relatives or visitors supporting the older patient during mealtimes. Volunteers value training and support and clarification of their roles and responsibilities.		
Outcome measures/results	- first objective: improved nutritional intake/status (energy & protein intake, nutritional status), length of stay, postoperative complications, mortality rates		- Mealtimes should be viewed as high priority, healthcare staff should limit other activities during mealtimes and allow older patients to eat uninterrupted, providing support where required.

	- second objective: description of the mealtime assistance from the perspective of the patient, healthcare professional, carer or family members	- Nursing staff, employed mealtime assistants, volunteers or relatives/visitors can help prepare the older patient for meals; this includes opening packages and cutting up food as well as physically feeding patients. - Social interaction at mealtimes for older patients is effective in increasing food, energy and protein intake, and should be encouraged. - Communication between all members of the multi-disciplinary team, staff and volunteers is essential.

Edwards D, Carrier J, Hopkinson J. Assistance at mealtimes in hospital settings and rehabilitation units for patients (>65years) from the perspective of patients, families and healthcare professionals: A mixed methods systematic review. Int J Nurs Stud 2017; 69: 100-118. doi:10.1016/j.ijnurstu.2017.01.013 [71]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic review 1+ AMSTAR 2: critically low quality	**Countries:** USA; Australia; UK; Canada **Centers**: n/a **Setting:** hospital settings including rehabilitation units **Funding Sources:** n/a **Dropout rates:** n/a **Study limitations:** n/a Risk of Bias Moderate Inconsistency Moderate Indirectness High Impreciseness Moderate Publication Bias Moderate	**Total no. Studies: 19** **Inclusion criteria:** >65 years, English, including or focusing on carers, family members, volunteers and healthcare professionals perspectives **Exclusion criteria:** <65 years of age, artificial feeding such as patients obtaining their nutrition exclusively by enteral or parenteral means and patients residing in other healthcare settings such	qualitative, quantitative and mixed methods studies; interventions for mealtime assistance, observed mealtime assistance or discussed experiences of mealtime assistance with staff, patients, relatives, volunteers or stakeholders
Notes	Three aggregated mixed methods syntheses were developed: 1) Mealtimes should be viewed as high priority. 2a) Nursing staff, employed mealtime assistants, volunteers or relatives/visitors can help with mealtime assistance. 2b) Social interaction at mealtimes should be encouraged. 3) Communication is essential. **Author's Conclusion:** A number of initiatives were identified which can be used to support older patients (>65 years) at mealtimes in hospital settings and rehabilitation units. However, no firm conclusions can be drawn in respect to the most effective initiatives. Initiatives with merit include those that encourage social interaction. Any initiative that involves supporting the older patient (>65 years) at mealtimes is beneficial. A potential way forward would be for nurses to focus on the training and support of volunteers and relatives to deliver mealtime assistance, whilst being available at mealtimes to support patients with complex nutritional needs.		
Outcome	the effectiveness of the varying types of mealtime assistance		TSE1 Lunch time and daily energy intake, breakfast, lunch time and daily protein

measures/results	provided in both hospital settings and rehabilitation units and the views of patients, health care professionals, family members and volunteers on mealtime assistance for patients Protein intake (g), Energy intake (KJ), % meeting nutritional requirements Experiences of volunteers, nurses and patients in relation to feeding assistance, Tasks completed by the volunteer Time spent with each patient Addressing barriers to consumption, Interruptions Infection rates (number of antibiotics prescribed) Functional status (GS (kgf)) Nutritional status, Mortality; LOS; albumin Feasibility of delivering mealtime assistance	intake can be increased in patients (>65 years) in hospital settings when trained volunteers are present to provide support TSE2 Daily energy intake, nutritional status, mortality four months post discharge can be increased in patients (>65 years) in hospital settings when employed assistants are present to provide support TSE3 Lunch time energy intake can be increased in patients (>65 years) in hospital settings when they eat their meals in a supervised dining room as opposed to on the ward TSE4 Eating in a communal dining room in hospital settings is associated with better protein intake for patients (>65 years)

Fetherstonhaugh D, Haesler E, Bauer M. Promoting mealtime function in people with dementia: A systematic review of studies undertaken in residential aged care. Int J Nurs Stud 2019; 96: 99-118. doi:10.1016/j.ijnurstu.2019.04.005 [96]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1- AMSTAR2: High quality	**Countries:** n/a **Centers:** n/a **Setting:** residential age care **Funding Sources:** Australian Centre for Evidence Based Aged Care **Dropout rates:** n/a **Study limitations:** limited to studies published in the past 17 years in the English language; limited to studies involving people with dementia who were living in aged care facilities; possible outcome reporting bias, since valid and reliable outcome measurement was lacking in many studies; only	**Total no. studies**: 20 **Inclusion criteria:** interventions designed to improve the mealtime function of older people with dementia; individuals aged over 65 years with dementia (excluding delirium) who were living in any type of residential aged care setting; any quantitative outcome measure to evaluate improved function in mealtime activities, including measures of food intake, eating skills, behavioural and psychological symptoms of dementia, or nutritional status **Exclusion criteria:** no report of relevant outcome measures, non-	n/a

	few studies reported that interrater reliability was established when using subjective assessment tools, and blinding of data collectors was addressed poorly in almost all the studies; study design mostly of low quality Risk of Bias Low Inconsistency n/a Indirectness Low Imprecision n/a Publication Bias n/a	research papers and systematic reviews	
Notes	**Author's Conclusion:** There is insufficient evidence to highly recommend any specific intervention to improve mealtime functional ability in people with dementia.		
Outcome measures/results	measures of nutritional status communication and behavioural and psychological symptoms of dementia		- Low quality evidence suggested that playing music and introducing fish to the dining room may improve the food intake of people with dementia by a small amount. - Montessori and spaced retrieval programs also demonstrated some positive impact on eating skills and nutritional intake. - Animal-assisted therapy also demonstrated small statistically significant improvements in weight and body mass index.

Li L, Zhao Y, Wang Y et al. Overview of systematic reviews: Effectiveness of non-pharmacological interventions for eating difficulties in people with dementia. J Adv Nurs 2020; 76: 2830-2848. doi:10.1111/jan.14492 [77]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic review 1+ AMSTAR2: Moderate quality	**Countries**: 11 Europe, 3 North America, 2 Australia, 2 China**.** **Centers**: n/a **Setting:** n/a **Funding Sources:** Beijing	**Total no. Studies: 18** **Inclusion criteria:** systematic reviews or meta-analyses based on PWD RCT, dementia multiple research designs,	12 Rev. <u>environmental modifications:</u> lighting and contrast (7/12), home-like environment (4/12), fish aquarium in dining area (6/12), music played during mealtimes (10/12), seated in the same location (1/12), and shared mealtime with others (3/12). 8 Rev. <u>change of food provision and service</u>, including additional food between meals (3/8), finger foods (1/8), menu changes (2/8), bulk food service (3/8), self-service style (3/8), and family style food service (4/8).

	Municipal Science & Technology Commission Peking University Langtai nursing research fund **Dropout rates:** **Study limitations:** Risk of Bias Moderate Inconsistency Moderate Indirectness Low Impreciseness High Publication Bias n/a	**Exclusion criteria**: reviews without available full text, redundant publications, research proposal stage, parenteral nutrition	7 Rev. education/training, including education and nutrition promotion programme for PWD (2/7), spaced retrieval activities training for PWD (5/7), Montessori-based activities training for PWD (6/7), caregiver education (5/7), feeding skills training programme for caregivers (4/7). 4 Rev. Feeding assistance, 8 rev. ONS 4 Rev. Mixed interventions and other interventions: vocal or tactile positive feedback (2/4) and exercise (3/4).
Notes	Assessment of quality of studies using AMSTAR 2 and GRADE system. 13 systematic reviews included were rated of critically low overall confidence and only included one middle-quality study. Of 18 reviews included, 14 (78%) lacked a list of excluded studies and justifications for the exclusion. Risk of bias of the included studies was not considered when interpreting/discussing the results of the system reviews in 13 (72%) reviews. Also, in 12 (67%) reviews, there were no report whether the research methods of reviews were determined before implementation and whether there was any inconsistency with the protocols. **Author's Conclusion:** Some evidence showed that environmental modifications, education/ training, and Oral nutrition supplements (ONS) were beneficial to improving eating difficulties. But the current evidence failed to support the effectiveness of other interventions. The overall confidence of systematic reviews is relatively low. High-quality studies are needed to further validate the effectiveness of non-pharmacological interventions for eating difficulties in PWD.		
Outcome measures/results	-food/drink intake (amount of food eaten or fluid drank) energy intake in calorie, protein intake, etc. -nutritional status (body weight, BMI, MNA) -eating behaviours (Edinburgh Feeding Evaluation in dementia, Eating Behavior Scale, Level of Eating Independence Scale) -incidence of agitation/aggression, time/frequency of self-feeding, and time/frequency of assistance, communication, and participation during mealtimes.		environmental modifications could be beneficial to increase food and drink intake. 2 reviews suggested that improving dining room lighting and visual contrast had a positive effect on decrease of agitation behaviours. 2 reviews indicating appropriate lighting and contrast was shown to promote communication. 1 review reported that home-like environment was associated with an increase in interaction among PWD and active eating participation compared with general care facility environment. education/training: 3 reviews reported spaced retrieval activities training could improve food and drink intake. Over half of reviews indicated it brought a positive effect on nutritional status, while consistent conclusions whether it worked for eating behaviours were not drawn. Montessori-based activities training: No conclusive evidence on improved food and drink intake, nutritional status, as well as eating behaviours. Regarding caregiver education, 4 reviews: beneficial to increase intake of food and drink, 3 reviews : beneficial to gain weight, but no significant effect to BMI. 2 reviews

		: feeding skill training programme for caregivers could improve the ability of PWD to eat independently, there was still insufficient evidence for increasing food intake. education and nutrition promotion programme for PWD could have brought a slight increase in food intake per day, but no statistical differences were found in body weight, BMI, or MNA score. 1 review reported a positive effect on weight and MNA score, but level of evidence was not high.

Palese A, Bressan V, Kasa T et al. Interventions maintaining eating Independence in nursing home residents: a multicentre qualitative study. BMC Geriatr 2018; 18: 292-292. doi:10.1186/s12877-018-0985-y [80]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Qualitative study/focus group 3	**Countries:** Italy **Centers:** multicenter **Setting:** nursing homes **Funding Sources:** n/a **Dropout rates: n**/a **Study limitations:** only regarding the interventions performed in the dining room; not evaluated data saturation; considered only effective interventions Risk of Bias Moderate Inconsistency n/a Indirectness Low Impreciseness High Publication Bias n/a	**Total no. patients**: 54 **Inclusion criteria:** residents with moderate to severe functional dependence; at need of assistance in eating; those who were involved on a daily basis in assisting residents at mealtime; those with at least of 6 months of nursing home experience; those who were willing to participate in the study **Exclusion criteria:** n/a	Intervention by ritualizing the mealtime experience by creating a controlled stimulated environment; structuring effective interactions to ensure a pleasant mealtime experience and individualizing eating assistance
Notes	**Author's Conclusion:** Several interventions that emerged as effective, according to the experience of participants, have never been documented before; while others are in contrast to the evidence documented. This suggests the need for further studies in the field; as no conclusions regarding the best interventions have been established to date		
Outcome measures/results	n/a		Ritualizing the mealtime experience by creating a controlled stimulated environment: starting the mealtime ritual; promoting the desire to eat; creating and maintaining a peaceful environment

II.1.3.4 Gelieferte Mahlzeiten

Empfehlung 17

Ältere Personen im Privathaushalt können durch nach Hause gelieferte Mahlzeiten unterstützt werden. Für ältere Personen mit Mangelernährung oder Risiko für Mangelernährung sollten diese Mahlzeiten energiedicht und proteinreich sein und durch Zwischen-Mahlzeiten ergänzt werden, um eine angemessene Energie- und Nährstoffaufnahme zu fördern.

Empfehlungsgrad B

Arjuna T, Miller M, Ueno T et al. Food Services Using Energy- and Protein-Fortified Meals to Assist Vulnerable Community-Residing Older Adults Meet Their Dietary Requirements and Maintain Good Health and Quality of Life: Findings from a Pilot Study. Geriatrics (Basel, Switzerland) 2018; 3: 60. doi:10.3390/geriatrics3030060 [101]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1- ROB2: High risk of bias	**Countries:** Australia **Centers:** Meals-on-Wheels South Australia Inc **Setting:** community-living **Funding Sources:** Nestlé Australia; National Health and Medical Research Council of Australia; Commerce International Merchant Bankers Berhad Regional Scholarship; Royal Adelaide Hospital Mary Overton and Florey Fellowships **Dropout rates:** 30% **Study limitations:** recruitment only from the Adelaide region of Australia; small final sample size; high dropout rate in the first weeks has caused some bias Risk of Bias High Inconsistency n/a	**Total no. patients**: 41 **Inclusion criteria:** 70 years and above; in need of nutritional support; Mini Nutritional Assessment (MNA) score > 17 ≤ 23.5 and/or BMI < 24.0 kg/m^2; reduced appetite or unintentional weight loss; unable to shop or prepare food **Exclusion criteria:** clinical diagnosis of dementia or significant depression; severely malnourished	- Intervention group received either a standard (STD) or a protein- and energy enriched (HEHP) hot lunchtime meal for at least 3 days/week in 12 weeks • with STD food-service meals (n=16): typical 3-course hot lunchtime meal (soup, a main dish, and a dessert; contained 2.3 MJ and 30g protein per meal and 33% of estimated daily energy and protein requirements • with HEHP food-service meals (n=14): recipes remained largely the same as for the STD main course; contained 2.3 MJ and 30 g protein per meal and 66% of estimated daily energy and protein requirements - Control group (n=11): receiving no food-service meals

	Indirectness Low Impreciseness High Publication Bias n/a		
Notes	**Author's Conclusion:** The findings indicate that provision of HEHP-fortified food-service meals can increase energy and protein intake and improve the nutritional status of nutritionally at-risk older people.		
Outcome measures/results	Primary outcome: energy and protein intakes; nutritional status Secondary outcome: physical capacity; general and psychological wellbeing; quality of life; number and duration of stay; level of satisfaction with meals; general service provided by the meal service		- HEHP subjects increased their mean daily energy intake from 6151 ± 376 kJ to 8228 ± 642 kJ (p = 0.002 for effect of time) and protein intake from 67 ± 4 g to 86 ± 8 g (p = 0.014 for effect of time) - The MNA score was increased significantly in HEHP by 4.0 ± 1.1 points (p = 0.001), but not in the STD and control groups (2.8 ± 2.1 points and 1.8 ± 1.1 points, p > 0.05) - No difference was found for other clinical outcomes between the groups

Borkent JW, Beelen J, Linschooten JO et al. The ConsuMEER study: a randomised trial towards the effectiveness of protein-rich ready-made meals and protein-rich dairy products in increasing protein intake of community-dwelling older adults after switching from self-prepared meals towards ready-made meals. J Nutr Sci 2019; 8: e30-e30. doi:10.1017/jns.2019.27 [102]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1++ ROB2: Some concerns	**Countries:** the Netherlands **Centers:** n/a **Setting:** community-dwelling **Funding Sources:** Centre of Expertise Food; Sligro Food Group; FrieslandCampina **Dropout rates:** 12% **Study limitations:** short duration of the intervention; only one supplier for the ready-made meals; Effect of the intervention on physical parameters was not measured; missing true control group as both	**Total no. patients**: 100 **Inclusion criteria:** aged 65 years or over; living at home; being able to eat independently; having a microwave to heat meals; being able to understand, read and speak Dutch **Exclusion criteria:** protein restriction diet; vegetarian diet; allergies or intolerances prohibiting the use of dairy products; only using texture-modified foods or a liquid diet; diagnosed with renal insufficiency suffering from a terminal illness; Mini Mental State Examination (MMSE) score < 24 (exception: within couples, one	- Intervention group: choose from thirty-two home-delivered ready-made protein-rich hot meals and protein-rich dairy products; the protein-rich meals contained at least 20% energy from protein and on average 30.5 g of protein - Control group: choose between thirty home-delivered standard (not classifying as protein-rich) ready-made hot meals and drinks (low-protein desserts or fruit juices); the protein content of these standard meals was on average 21.3g per meal

	groups received an intervention Risk of Bias Moderate Inconsistency n/a Indirectness Low Impreciseness Moderate Publication Bias n/a	participant with a score below 24 was allowed if the partner scored at least 24 points and helped with the food diary)	
Notes	**Author's Conclusion:** Switching from a regular diet to ready-made meals carries the risk of a decreasing protein intake if meals are not selected for high protein content. Protein-rich ready-made meals and protein-rich dairy products could prevent older adults from a decrease in protein intake but the combination of products provided in the present trial was not effective in increasing protein intake towards 1.2 g protein/kg body weight (BW) per d		
Outcome measures/results	Primary outcome: achieving a total protein intake of at least 1.2g protein/kg BW per day Secondary outcome: daily protein intake (g); Protein intake at breakfast, lunch and dinner (g); achieving an intake of ≥ 25g protein at every meal moment		- The total protein intake of participants in the intervention group was higher than that of the control group (mean difference: 13.6 g) - Protein intake decreased in the control group compared with baseline, both at dinner and total protein per day ($p < 0.05$) - Neither the intervention nor the control group reached the average daily protein goal of 1.2 g protein/kg BW per day - At breakfast and lunch, differences in protein intake between groups remained small (<2 g protein difference) but were significant at lunch (mean difference: 2.0 g). A significantly higher intake of protein (g) was seen at dinner for the intervention group compared with the control group (mean difference: 9.6 g)

Kretser AJ, Voss T, Kerr WW et al. Effects of two models of nutritional intervention on homebound older adults at nutritional risk. J Am Diet Assoc 2003; 103: 329-336. doi:10.1053/jada.2003.50052 [103]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Intervention study/ controlled trial 1-	**Countries:** n/a **Centers:** n/a **Setting:** Meals-on-Wheels → home of the participants **Funding Sources:** National Meals on Wheels	**Total no. Patients:** n= 203 (age-range= 60-90 years) **Inclusion criteria:** comprehensive home care assessment tool and MNA through same assessor→ Eligibility	2 Intervention Groups: 1)traditional MOW-Model (Meals-on-Wheels): 5 hot meals per week → 33% of DRI for those over 50 years (Daily Reference Intake) (n= 101) 2) restorative, comprehensive New MOW-program: 3 meals and 2 snacks per day, 7 days a week → 100% DRI for those over 50 years (n=102); daily phone call from older adult volunteers to provide a measure of safety and socialization

	Foundation, Millenium Healthcare Solutions, Mecklenberg Country Department of Social Services **Dropout rates:** 23.64% **Study limitations:** n/a	**Exclusion criteria:** MNA>22.5, self-report of terminal illness, medical conditions that precluded meals being adequate, significant food allergies, previous participation in home-delivered senior nutrition meals	Meal delivery: weekly
Notes	• 6 months prospective comparative study; 15 months period • Randomized: unserviced rural outlying area = new MOW model; few participants refused multiple meal model → were placed in traditional MOW; participants were not denied participation in either model if he/she could not contribute. • Assessments were conducted in the home of the participants • Recruitment: potential participants were drawn from current waiting lists, referrals made by hospital discharge planners, local advertisement; then followed by telephone screening • During each reassessment: New MOW participants → food satisfaction survey with specific questions to the food they consumed on that day or the day before. Additional questions: assistance in meal preparation, difficulty in opening meals, and suggestions for improving meals. **Author's Conclusion:** Applicants for home meal delivery have varying nutrition needs. By addressing nutritional risk, interventions can be targeted to meet these needs. A new, restorative, comprehensive meal program improved nutritional status and decreased nutritional risk and can possibly impact independence and functionality. Our research indicates that a higher quality of life and the potential for delaying the loss of independence is within reach of the MOW program.	
Outcome measures/results	• MNA: evaluate nutritional risk, status: baseline, after 3 and 6 months • Evaluation of limitations in actions of daily living: through standardized functional impairment scales, ADL , IADL (scoring system → summary scores for all tasks: ADL range=0-6; IADL range= 0-7; change in functional status: ADL/IADL follow up – baseline)	• New MOW group: ▪ significant weight gain baseline to 3 months (2.78 lb. vs -1.46 lb., p=.0120) and 3 to 6 months (4.3 lb. vs -1.72 lb., p=0.0004) compared to traditional • MNA: ▪ MNA improved faster in the New MOW group at 3 months (Improvement New MOW: at risk 86%, malnourished 96%) ▪ no significant difference in mean MNA between MOW groups ▪ 2/3 of participants moved from "at-risk" to "well-nourished" at 6 months in both models ▪ MNA significant lower in women than in men • Greatest improvement in nutritional risk: first 3 months of treatment in both groups • Functional change: more related to BMI, age than to intervention; malnourished participants of the New MOW with increase in BMI had less decline in functional status (especially at 6 months; IADL, p=0.0494)

		• Malnourished participants in both groups took longer to affect positive change (between 3 to 6 months) vs participants "at risk"→ weight gain occurred earlier (within first 3 months, p=0.003) • Drop-outs: Higher mortality rate among traditional MOW (n=9 vs n=3), loss of independence higher in traditional group, withdrawal of consent

Silver HJ, Dietrich MS, Castellanos VH. Increased energy density of the home-delivered lunch meal improves 24-hour nutrient intakes in older adults. J Am Diet Assoc 2008; 108: 2084-2089. doi:10.1016/j.jada.2008.09.005 [104]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1++	***Countries:*** Florida, USA ***Centers:*** n/a ***Setting:*** Regularly served home-delivered meal menu ***Funding Sources:*** Retirement Research Foundation, Chicago, IL ***Dropout rates:*** 13.47% ***Study limitations:*** short duration, findings discern whether greater preference for enhanced meal was directly related to fat content or energy density, kosher food items, recipe manipulations with items from local grocery stores	**Total no. Patients:** n=52 **Inclusion criteria:** subjects providing home delivered kosher lunch meals from Kramer Senior Services Agency, West Palm Beach, FL, ≥60 years **Exclusion criteria:** chewing, swallowing dysfunction, need for feeding assistance, eating disorder, depression, impaired functional status, dementia, BMI≥30 followed a medically restricted diet, liquid nutrition supplements, meal skipping, took orexigenic acids, smoked, alcoholic beverage daily >1	Regularly served home-delivered meal menu Crossover: 1)regular meal 2)enhanced meal →Type of food, portion size and appearance of the lunch was held constant →both: 225 g portion of Salisbury steak, 150 g portion of mashed potato (enhanced by adding eggs, nondairy kosher creamer for water) dish, 120 g portion of broccoli casserole (enhanced by adding almonds, mayonnaise), 24 g dinner roll 7 months period Regular or enhanced version during alternate test weeks; Test days separated by a 6-day washout period
Notes	• Recruitment: Screening by telephone; interest in participation: home visit by registered dietitian trained in subject recruitment, 24-hour diet recall methodology, anthropometry (height measurement through knee height, weight without shoes, heavy clothes) • Subjects were counseled to maintain their habitual lifestyle and physical activities during the study. • Subjects were compensated for participation with three $5 Publix gift certificates • Regular lunch meal: 1/3 of Recommended Dietary Allowance for energy (1,1 kcal/g)/ enhanced versions energy density was twice of the regular (2,2 kcal/g)+10g more protein; stable cook-chill food preparation system • Pre-experiment pilot test with 9 adults: confirming study methods		

	• Subjects were instructed how to warm the lunch meal, how to consume it in the same manner with usual home-delivered meal, how to place leftovers **Author's Conclusion:** Altering the energy density of regularly served menu items is an effective strategy to improve dietary intakes of free-living older adults.	
Outcome measures/results	• Interview: demographic data, usual dietary behavior, weight history • Telephone interviews, home visits during first week; second week: Test meals prepared • 24-hour diet recall for ad libitum food and beverage consumption (12:00 AM Monday to 12:00 AM Tuesday; standardized script) • Leftovers were weighed • Labels were showed to dietitians: portion size, ingredients	• High acceptance of test meals • Enhanced meal: ▪ Increased lunch energy intake by 86% (358.6±17,4 kcal; p<0.001) ▪ increased 24-hour energy intake by 453 kcal (from 1423.1±62.2 regular meal to 1876±78.3 kcal enhanced meal, p<0.001) ▪ consumption increased within the enhanced meal: potato dish: regular 83% vs enhanced 93%; Broccoli casserole: regular 64% vs enhanced 99% (p<0.001) ▪ key nutrients significantly more on enhanced meal day: protein, n-3 fatty acids, vitamin D/E/riboflavin/B6, niacin, calcium, magnesium, copper, selenium • not statistically different between meals : ▪ consumption of Salisbury steak and dinner roll ▪ grams of food consumed ▪ energy intakes during breakfast, dinner on regular and test meal days

Ziylan C, Haveman-Nies A, Kremer S et al. Protein-Enriched Bread and Readymade Meals Increase Community-Dwelling Older Adults' Protein Intake in a Double-Blind Randomized Controlled Trial. J Am Med Dir Assoc 2017; 18: 145-151. doi:10.1016/j.jamda.2016.08.018 [105]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1++ ROB2: Some concerns	**Countries:** the Netherlands **Centers:** senior residential center in the eastern Netherlands **Setting:** senior residential center **Funding Sources:** Wageningen University & Research; the Dutch Ministry of Economic	**Total no. patients**: 42 **Inclusion criteria:** aged 65 years or older; able to choose and eat their food by themselves; like whole-wheat bread and at least 5 of the 8 offered meals; no allergy/intolerance for milk, lactose, soy, or gluten; not following a diet that disallowed the use of normal bread or meals; not	- Intervention group (n=22) received 5 protein-enriched readymade meals and plentiful protein-enriched bread during 2 weeks - Control group (n=20) received 5 regular meals and plentiful regular bread during 2 weeks

	Affairs; the graduate school Advanced studies in Food Technology, Agrobiotechnology, Nutrition, and Health Sciences **Dropout rates:** 0% **Study limitations:** short intervention period; study population were health and independent older adults, whereas the protein-enriched products are more intended for frail, dependent older adults Risk of Bias Moderate Inconsistency n/a Indirectness Low Impreciseness Moderate Publication Bias n/a	suffering from renal insufficiency or other medical conditions that limit intake of protein-enriched foods; not suffering from a terminal illness; had a Mini Mental State Examination Score $\geq$ 24 **Exclusion criteria:** decrease renal function; admission to nursing home	
Notes	**Author's Conclusion:** This study showed that community-dwelling older adults' protein intake can be increased to recommended levels with highly acceptable and applicable protein-enriched products that fit into the normal eating pattern		
Outcome measures/results	Primary outcome: daily nutritional intake; daily protein intake, acceptability of protein-enriched products		- Mean intake of food products (g) and energy (kJ) did not differ significantly between the control and the intervention groups - Total daily protein intake in the intervention group was 14.6 g higher than in the control group (87.7 vs 73.1 g/d, p=0.004). Protein intake was significantly higher in the intervention group than in the control group (1.25 vs 0.99 g/kg/d, p=0.003) - The enriched products were equally liked, scoring 7.7 of 10.0 - The in-depth interviews with participants indicated high acceptability of the enriched products

II.1.3.5 Ernährungsinformation / -schulung

Empfehlung 18

Älteren Personen mit Mangelernährung oder Risiko für Mangelernährung sollten im Rahmen eines umfassenden Interventionskonzepts Ernährungsinformationen angeboten werden, um das Bewusstsein für und das Wissen über Ernährungsprobleme zu verbessern und dadurch eine adäquate Ernährung zu fördern.

Empfehlungsgrad B

Brunner S, Mayer H, Qin H et al. Interventions to optimise nutrition in older people in hospitals and long-term care: Umbrella review. Scand J Caring Sci 2022; 36: 579-598. doi:10.1111/scs.13015 [69]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1++ AMSTAR2: High quality	**Countries:** Asia, Australia, Europe and North America **Centers:** n/a **Setting:** hospitals and long-term care **Funding Sources:** City Hospital Waid and Triemli, Zurich (working hours). Stiftung Alta Vita (funding of editing) **Dropout rates:** n/a **Study limitations:** Only interventions that were already synthesized were included; no special attention to food literacy; restricted to studies published in English and German; Risk of Bias Moderate Inconsistency n/a Indirectness Low Imprecision Low	**Total no. studies**: 13 **Inclusion criteria:** Geriatric patients or people aged 65 years or older with physical, social or cognitive functional ability; treatment of the risk for protein-/ energy malnutrition, comparison to no intervention or 'standard care'; outcomes: nutritional status, nutrient intake, body mass index, functional status, appetite, quality of life, patient satisfaction, in combination with laboratory findings; published within the last 10 years (2010–2020); acute care, long-term care institution, rehabilitation; systematic reviews, narrative review, meta-analysis, meta-synthesis, other types of review; abstract in english, full text in english or german **Exclusion criteria:** Children, young adults; terminally ill, palliative	n/a

	Publication Bias n/a	patients; studies with interventions in micronutrients or molecular level only, tube feeding, parenteral nutrition, validation of screening tools; studies with outcome measures in laboratory signs only, prevalence of malnutrition as main outcome; studies Homecare, ambulatory care, intensive care units, palliative care, hospicereview of low quality (no flow chart of study selection, without explicit inclusion, exclusion criteria)	
Notes	**Author's Conclusion:** Several studies synthesised that optimising nutrition in older people in hospitals and long-term care is achievable. Interventions were effective if—on a meta-level—staff training was addressed as part of a multi-component measure to reach an interprofessional food promoting culture.		
Outcome measures/results	- descriptions of interventions that influenced nutritional status or food intake - weight gain, Body Mass Index, behaviour during food intake, functional status, appetite, quality of life or patient satisfaction in combination with laboratory findings or muscle mass		An interprofessional food promoting culture, including staff training as part of a multi-component measure, has shown to be a successful element in implementing activities of Nutrition Management.

Bunn DK, Abdelhamid A, Copley M et al. Effectiveness of interventions to indirectly support food and drink intake in people with dementia: Eating and Drinking Well IN dementiA (EDWINA) systematic review. BMC Geriatr 2016; 16: 89 [95]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1++	**Countries:** North America, Europe, Asia, New Zealand, South America **Centers:** n/a **Setting:** any setting(most institutional settings)	**Total no. Studies:** n=51 **Inclusion criteria:** RCT,CCTs→≥3 adults diagnosed any stage/type of dementia or mild cognitive impairment or MMSE score+standard deviation ≤26, ≥consecutive days; included	Studies were grouped by type of Intervention 6. Dining environment and food service (any alteration (for ex. Noise, sensory adjustments, furniture,..) of the physical environment in which food/drink was taken) 7. Education/training of people with dementia or their care givers 8. behavioral intervention: alter behavior such as verbal prompting 9. exercise (any exercise component)

	Funding Sources: This article summarizes independent research funded in part by the National Institute for Health Research, Collaboration for Leadership in Applied Health Research & Care, East of England, and in part by the National Institute of Health Research Fellowship programme **Dropout rates:** n/a **Study limitations:** high risk of bias (small number of patients included in the studies+ low validity), effective interventions may be underpowered, shortage of potentially useful interventions/research, inability to pool outcome data (no meta-analysis possible → interventions too different)	interventions: see "interventions"; Included studies only with outcomes: see "outcomes" **Exclusion criteria: c**ase reports	10. multicomponent intervention (>3 interventions, including at least 1 listed here) then grouped by study design
Notes	• Meta-analysis (statistical pooling) was not appropriate so data were tabulated and synthesized narratively; Methodological quality was assessed using Cochrane risk of bias tool; assessed also: funding bias, validity of dementia diagnosis, outcome measures and baseline comparability between groups • Intervention duration differed from 5 days to 1 year **Author's Conclusion:** We found no definitive evidence on effectiveness, or lack of effectiveness, of specific interventions but studies were small and short term. A variety of promising indirect interventions need to be tested in large, high-quality RCTs, and may be approaches that people with dementia and their formal or informal care-givers would wish to try.		
Outcome measures/results	• Primary outcomes: - Nutrition or hydration status		• No clearly effective or clearly ineffective interventions

	- Meaningful activity or enjoyment of food/drink - Quality of life • Secondary outcomes - Quantity, quality, adequacy of food/fluid intake • Other outcomes of interest: - Functional or cognitive status - Views, attitudes - Cost effectiveness - Resource use - Mortality, health outcomes	- Mixed results: some examples: Charras et al. shared mealtimes → weight increased (+5.64 kg, p>0.024), improved autonomy, longer meals; no effect on weight/BMI (Desai et al.) by comparing bulk service vs. pre-plated but increased intake of energy, protein, carbohydrate; education: (Riviere et al.)improved weight (1.4 kg, p<0.05) compared to usual care/(Hanson et al.) significant decrease in %weight loss compared to control; behavioral intervention → longer mealtimes (Van Ort et al.); exercise interventions no improve in nutritional status in any study • Promising interventions included: - eating meals with care-givers - family style meals - soothing mealtime music - constantly accessible snacks and longer mealtimes - education and support for formal and informal care-givers - spaced retrieval and Montessori activities - facilitated breakfast clubs (Santo Pietro et al., 1998, CCT) multisensory exercise and multicomponent interventions

Fernández-Barrés S, García-Barco M, Basora J et al. The efficacy of a nutrition education intervention to prevent risk of malnutrition for dependent elderly patients receiving Home Care: A randomized controlled trial. Int J Nurs Stud 2017; 70: 131-141. doi:10.1016/j.ijnurstu.2017.02.020 [112]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1- ROB2: High risk of bias	**Countries:** Spain **Centers:** multicenter **Setting:** primary care center **Funding Sources:** Instituto de Salud Carlos III, Evaluación de Tecnologías Sanitarias, Ministerio de Sanidad y Consumo, Madrid, Spain, and the Generalitat de Catalunya, Agència d'Informació, Avaluació i Qualitat en Salut, Barcelona, Spain	**Total no. patients**: 173 **Inclusion criteria:** participation in the Home Care Program- Atenció Domiciliària; aged 65 years and above; Mini Nutritional Assessment score (MNA) 17-23.5 points; have difficulties to perform Activities of Daily Living, be caregiver-dependent and must have a caregiver **Exclusion criteria:** enteral feeding; severe dysphagia; any serious illness that progresses to	Intervention group (n=101): the nurses conducted initial educational intervention sessions for caregivers and then monitored at home every month for 6 months Control group (n=72): did not receive nutrition intervention

	Dropout rates: 35.8% **Study limitations:** same nurse in the smaller centers, overestimated the intake by using the food frequency questionnaire; high dropout level Risk of Bias: High Inconsistency: n/a Indirectness: Low Impreciseness: Moderate Publication Bias: n/a	malnutrition; consumption of vitamin and/or dietary supplements	
Notes	**Author's Conclusion:** From this study, we can conclude that an educational intervention for caregivers may reduce the risk of malnutrition among older dependent patients and improve their dietary habits and nutritional intake. However, further research is needed to include a nutrition education intervention as a standard part of care in a home-care program for community-dwelling dependent older patients, to prevent malnutrition.		
Outcome measures/results	Primary outcome: nutritional status Secondary outcome: anthropometric measurements; food consumption; biochemical markers; degree of dependency; cognitive function; mood		Differences were found between the groups for Mini Nutritional Assessment test score change (repeated measures ANOVA, F = 10.1; P < 0.001), the intervention improved the Mini Nutritional Assessment test score of the participants in the intervention group. The egg consumption (F=4.1; P=0.018), protein intake (F=3.0; P=0.050), polyunsaturated fatty acid intake (F = 5.3; P = 0.006), folate (F = 3.3; P = 0.041) and vitamin E (F = 6.4; P = 0.002) showed significant group x time interactions.

Herke M, Fink A, Langer G et al. Environmental and behavioural modifications for improving food and fluid intake in people with dementia. Cochrane Database Syst Rev 2018; 7: CD011542-CD011542. doi:10.1002/14651858.CD011542.pub2 [72]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic review 1+ AMSTAR2: High quality	**Countries:** n/a **Centers**: n/a **Setting:** home care, residential care and nursing home care **Funding Sources:** n/a **Dropout rates:** n/a	**Total no. Studies:** 9 1502 randomised participants **Inclusion criteria:** people with dementia RCT 's behavioural or environmental modifications as interventions, or to modify the mealtime behaviour of	• Environmental modifications ◦ Change of routine (physical surroundings, social context and timing) ◦ Change of context (which persons are present) ◦ Change of ambience (properties of the light, sound, smell or temperature of dining environment; home-like environment by means of furniture and decoration or having tableware in high-contrast colours) ◦ Others (Complementary food items during or in between mealtimes)

	Study limitations: duration of observation is short, Dementia diagnostic criteria not clear. Risk of Bias Moderate Inconsistency Moderate Indirectness Low Impreciseness High Publication Bias n/a	people with dem. or their caregivers or both, with the intention of improving food and fluid intake. **Exclusion criteria:** • Parenteral, Tube nutrition. • Mod.food swallowing disord. • Drugs • Modifications that are not directly aimed at nutrition and mealtimes, but instead at, for example, oral hygiene, general motor skills or general knowledge of the condition • outcomes relevant only to other stakeholders (e.g. relatives orhealth professionals) and • biomarkers	• Behavioural modifications ◦ Education or training of people with dementia (knowledge people with dementia have about nutrition, their skills in self-feeding and their attitude and habits concerning mealtimes) ◦ Education or training of caregivers (aimed at those providing assistance to people with dementia during mealtimes, similar objectives. ◦ Others **Three kinds of comparator interventions** • Usual care or optimised usual care • Any other intervention included in this review. • Any non-specific intervention.
Notes	Methodological quality of studies was assessed using criteria based on those of the Cochrane 'Risk of bias' tool • Due to high heterogeneity results most were not pooled but are reported narratively **Author's Conclusion:** The review covers a wide range of possible interventions. Due to the quantity and quality of the evidence currently available, we cannot identify any specific environmental or behavioral modifications for improving food and fluid intake in people with dementia. We believe further studies of the behavioural and environmental strategies included in this review, and others, are warranted.		
Outcome measures/results	1. measures of fluid food, protein and caloric intake, nutritional status (BMI, MNA, body weight follow up) 2. mealtime behaviour, cognitive and functional outcomes (ADL) and quality of life 3. Global change in symptoms and performance (measured by validated global scales), 4. compliance with intervention, entry to institutional care or any other reported participant-relevant outcome. 5. Psychological or behavioural events, such as depression or agitation. 6. Adverse effects, such as aspiration-related pneumonia or death.	One study implemented environmental as well as behavioural modifications by providing additional food items between meals and personal encouragement to consume them, control group no intervention. Differences between groups were very small and the quality of the evidence from this study was very low, so we are very uncertain of any effect of this intervention. 8 studies implemented behavioural modifications. 3 studies provided nutritional education and nutrition promotion programmes. Control groups did not receive these programmes. After 12 months, the intervention behavioural modification and nutrition promotion programmes group showed slightly higher protein intake per day (mean difference (MD) 0.11 g/kg, 95%, 1 study; low-quality evidence), but there was no clear evidence of a difference in nutritional status assessed with body mass index (BMI) (MD -0.26 kg/m² favouring control, 95% CI -0.70 to 0.19; n = 734, 2 studies; moderate-quality	

		evidence), body weight (MD -1.60 kg favouring control, 95% CI -3.47 to 0.27; n = 656, 1 study; moderate-quality evidence), or score on Mini Nutritional Assessment (MNA) (MD -0.10 favouring control, 95%CI -0.67 to 0.47; n = 656, 1 study; lowquality evidence). After six months, the intervention group in one study had slightly lower BMI (MD -1.79 kg/m² favouring control, 95% CI -1.28 to -2.30; n = 52, 1 study; moderate-quality evidence) and body weight (MD -8.11 kg favouring control, 95% CI -2.06 to -12.56; n = 52, 1 study; moderate-quality evidence). This type of intervention may have a small positive effect on food intake, but little or no effect, or a negative effect, on nutritional status. Two studies compared self-feeding skills training programmes. In one study, the control group received no training and in the other study the control group received a different self-feeding skills training programme. the quality of the evidence was very low and we are very uncertain whether these interventions have any effect. One study investigated general training of nurses to impart knowledge on how to feed people with dementia and improve attitudes towards people with dementia. Again, the quality of the evidence was very low so that we cannot be certain of any effect. Two studies investigated vocal or tactile positive feedback provided by caregivers while feeding participants. After three weeks, the intervention group showed an increase in calories consumed per meal (MD 200 kcal, 95% CI 119.81 to 280.19; n = 42, 1 study; low-quality evidence) and protein consumed per meal (MD 15g, 95% CI 7.74 to 22.26; n = 42, 1 study; low-quality evidence). This intervention may increase the intake of food and liquids slightly; nutritional status was not assessed.

Li L, Zhao Y, Wang Y et al. Overview of systematic reviews: Effectiveness of non-pharmacological interventions for eating difficulties in people with dementia. J Adv Nurs 2020; 76: 2830-2848. doi:10.1111/jan.14492 [77]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic review 1+	**Countries**: 11 Europe, 3 North America, 2 Australia, 2 China**.** **Centers**: n/a	**Total no. Studies: 18** **Inclusion criteria:** systematic reviews or meta-analyses based on PWD	12 Rev. <u>environmental modifications:</u> lighting and contrast (7/12), home-like environment (4/12), fish aquarium in dining area (6/12), music played during mealtimes (10/12), seated in the same location (1/12), and shared mealtime with others (3/12).

AMSTAR2: Moderate quality	**Setting:** n/a **Funding Sources:** Beijing Municipal Science & Technology Commission Peking University Langtai nursing research fund **Dropout rates:** **Study limitations:** Risk of Bias Moderate Inconsistency Moderate Indirectness Low Impreciseness High Publication Bias n/a	RCT, dementia multiple research designs, **Exclusion criteria**: reviews without available full text, redundant publications, research proposal stage, parenteral nutrition	8 Rev. change of food provision and service, including additional food between meals (3/8), finger foods (1/8), menu changes (2/8), bulk food service (3/8), self-service style (3/8), and family style food service (4/8). 7 Rev. education/training, including education and nutrition promotion programme for PWD (2/7), spaced retrieval activities training for PWD (5/7), Montessori-based activities training for PWD (6/7), caregiver education (5/7), feeding skills training programme for caregivers (4/7). 4 Rev. Feeding assistance, 8 rev. ONS 4 Rev. Mixed interventions and other interventions: vocal or tactile positive feedback (2/4) and exercise (3/4).
Notes	Assessment of quality of studies using AMSTAR 2 and GRADE system. 13 systematic reviews included were rated of critically low overall confidence and only included one middle-quality study. Of 18 reviews included, 14 (78%) lacked a list of excluded studies and justifications for the exclusion. Risk of bias of the included studies was not considered when interpreting/discussing the results of the system reviews in 13 (72%) reviews. Also, in 12 (67%) reviews, there were no report whether the research methods of reviews were determined before implementation and whether there was any inconsistency with the protocols. **Author's Conclusion:** Some evidence showed that environmental modifications, education/ training, and Oral nutrition supplements (ONS) were beneficial to improving eating difficulties. But the current evidence failed to support the effectiveness of other interventions. The overall confidence of systematic reviews is relatively low. High-quality studies are needed to further validate the effectiveness of non-pharmacological interventions for eating difficulties in PWD.		
Outcome measures/results	-food/drink intake (amount of food eaten or fluid drank) energy intake in calorie, protein intake, etc. -nutritional status (body weight, BMI, MNA) -eating behaviours (Edinburgh Feeding Evaluation in dementia, Eating Behavior Scale, Level of Eating Independence Scale) -incidence of agitation/aggression, time/frequency of self-feeding, and time/frequency of assistance, communication, and participation during mealtimes.		environmental modifications could be beneficial to increase food and drink intake. 2 reviews suggested that improving dining room lighting and visual contrast had a positive effect on decrease of agitation behaviours. 2 reviews indicating appropriate lighting and contrast was shown to promote communication. 1 review reported that home-like environment was associated with an increase in interaction among PWD and active eating participation compared with general care facility environment. education/training: 3 reviews reported spaced retrieval activities training could improve food and drink intake. Over half of reviews indicated it brought a positive effect on nutritional status, while consistent conclusions whether it worked for eating behaviours were not drawn. Montessori-based activities training: No conclusive evidence on improved food and drink intake, nutritional status, as well as eating behaviours.

		Regarding caregiver education, 4 reviews: beneficial to increase intake of food and drink, 3 reviews : beneficial to gain weight, but no significant effect to BMI. 2 reviews: feeding skill training programme for caregivers could improve the ability of PWD to eat independently, there was still insufficient evidence for increasing food intake. education and nutrition promotion programme for PWD could have brought a slight increase in food intake per day, but no statistical differences were found in body weight, BMI, or MNA score. 1 review reported a positive effect on weight and MNA score, but level of evidence was not high.

Neves FJ, Tomita LY, Liu ASLW et al. Educational interventions on nutrition among older adults: A systematic review and meta-analysis of randomized clinical trials. Maturitas 2020; 136: 13-21. doi:10.1016/j.maturitas.2020.03.003 [113]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1++ AMSTAR2: Low quality	**Countries:** Brazil **Centers:** n/a **Setting:** community living **Funding Sources:** Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brazil **Dropout rates:** n/a **Study limitations:** small number of clinical trials with no appropriate blinding method; heterogeneous intervention strategies, follow-up periods and dietary assessment methods; studies with different health conditions Risk of Bias: High Inconsistency: Moderate Indirectness: Moderate Impreciseness: Low	**Total no. patients**: 3893 **Inclusion criteria:** aged 60 years and above; clinical trial; present original data; contain estimates of dietary intake of food, food groups or nutrient intake post-intervention; conducted in human; contain effect estimates between baseline and post-intervention with their corresponding estimates of precision **Exclusion criteria:** no RCT design; not include the exposure of interest; not conducted among older adults	– Intervention as individual nutritional educational sessions or group sessions – Control groups received home-based exercise programs, exercise and fall prevention techniques, minimal information about healthy food habit, diet advice and physical training, dietary counselling only or no activities or information

	Publication Bias: Low		
Notes	**Author's Conclusion:** Our results suggest that nutritional interventions were effective in increasing vegetable, fruit and fiber intake. However, these results should be analyzed carefully, due to the small number of studies included in the meta-analysis.		
Outcome measures/results	Outcome: intake of fruits and vegetables, fiber, meat, fish, cereal, dairy, nuts, energy, fat, protein, carbohydrate and micronutrient; blood levels, weight loss; food behavior; alcohol consumption; body composition; cardiovascular risk factors		The present systematic review provided evidence that nutrition interventions based on vegetable, fruit and fiber were effective. Results of pooling eleven studies were as follows: standardized mean differences SMD = 0.25 (95 % CI = 0.15 – 0.34; I^2 = 0,0%) for vegetable, SMD = 0.18 (95 % CI = 0.08 – 0.27; I^2 = 0,0%) for fruit and SMD = 0.27 (95 % CI = 0.18 – 0.36; I^2 = 58,3%) for fiber intake.

Rea J, Walters K, Avgerinou C. How effective is nutrition education aiming to prevent or treat malnutrition in community-dwelling older adults? A systematic review. Eur Geriatr Med 2019; 10: 339-358. doi:10.1007/s41999-019-00172-6 [114]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1+ AMSTAR2: Critically low quality	**Countries:** United Kingdom **Centers: n/a** **Setting:** community-dwelling **Funding Sources:** National Institute for Health Research (NIHR); NIHR in-practice Fellowship; NIHR Clinical Lectureship **Dropout rates:** n/a **Study limitations:** most of the studies were hampered by poor methodology, low sample size and high rates of loss to follow-up; lack of consensus around definition of malnutrition across different studies; low or insufficiently reported adherence to the interventions tested; lack of evidence of effectiveness in	**Total no. patients**: 772 **Inclusion criteria:** RCTs and quasi-experimental studies; aged 50 years and above; living in the community setting; interventions targeted to address malnutrition and/or involuntary weight loss, at the individual and/or their caregiver; interventions delivered by primary health care workers, trained researchers or dieticians; and interventions that included a nutritional education component; studies comparing the intervention group to baseline care, usual care or a comparator nutritional intervention **Exclusion criteria:** people with terminal cancer or end-stage organ failure; use of enteral or parenteral nutrition; studies without a comparator group; included	interventions targeted to address malnutrition and/or involuntary weight loss, at the individual and/or their caregiver; delivered by primary health care workers, trained researchers or dieticians; and interventions that included a nutritional education component

	hard health outcomes; short period of intervention and/or follow-up; did not search grey literature Risk of Bias: High Inconsistency: Moderate Indirectness: Moderate Impreciseness: High Publication Bias: High	nutritional supplements; not targeting malnutrition; composite and multifactorial interventions; delivery of food/meals; unavailable full-text	
Notes	**Author's Conclusion:** Although nutritional education interventions in community- dwelling older adults may have the potential to improve outcomes such as nutritional risk and risk of readmission to hospital, the strength of currently available evidence is poor, with significant methodological limitations, and it does not allow for specific recommendations to be made. It is evident from this review that we need further high-quality randomized controlled trials to test the clinical and cost- effectiveness of community-based nutritional education for older adults living in the community, with sufficient follow- up to determine longer term outcomes.		
Outcome measures/results	Primary outcome: any relevant nutritional, dietary, behavioral or clinical outcome, expected to be related to; physical performance Secondary outcome: cognition; mood; quality of life		We found some evidence (in five out of eight studies) that nutrition education may improve nutrition-related outcomes. Nutrition education involving caregivers was found to reduce nutritional risk in one study, and nutritional counselling following discharge from hospital was found to reduce the risk of readmission in another study

Young K, Bunn F, Trivedi D et al. Nutritional education for community dwelling older people: a systematic review of randomised controlled trials. Int J Nurs Stud 2011; 48: 751-780. doi:10.1016/j.ijnurstu.2011.03.007 [115]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1+	**Countries:** United States, United Kingdom, Australia,	**Total no. Studies:** n=23 (separate RCTs) Publications included n=35	Classification of interventions: 1) Nutritional education only (n=5)

	Canada, Spain, Norway, Finland **Centers:** n/a **Setting:** community dwelling older people **Funding Sources:** supported by a grant from Hertnet, The Hertfordshire Primary Care Research Network, UK **Dropout rates:** n/a **Study limitations:** high heterogenity, high risk of bias, methodological issues that could have bearing on the validity of the results, studies with complex interventions: difficult to isolate effectiveness of the nutritional aspect, complexity of measurements of dietary related outcomes,	**Inclusion criteria:** RCTs evaluating nutritional education or advice for people aged ≥65 years, living in their own homes, any type of nutritional intervention that contained dietary advice and education, and/or provision of information, studies limited to English languagepublications only **Exclusion criteria:** RCTs with participants living in residental or sheltered housing where food is provided, interventions relating to parenteral/enteral feeds, medications, prescription of sip/supplementary feeds	2) Complex interventions: including serveral interactive components (n=18) → individualized holistic care, healthy lifestyle advice, exercise advice, screening ➔ Interventions were all delivered by out-patient, hospital outreach or community staff
Notes	• Assessment of risk of bias on 6 domains → many studies were at moderate or high risk of bias; methodological quality of studies was assessed using criteria based on those of the Cochrane Collaboration; Additional use of NICE (National Institute of Health and Clinical Excellence)criteria • Due to high heterogeneity results were not pooled but are reported narratively • From 23 studies all but one of the interventions were delivered by health care professionals; 10 delivered by nurses • Review was intended to inform nursing practice: review was interested in interventions that either were or had the potential to be, delivered by nurses • Studies varied in the format of intensities, strategies, populations(healthy, frails elderly, specific diseases) an aims **Author's Conclusion:** This review indicates that nutritional education or advice can positively affect physical function and diet, whilst complex interventions with nutritional education as a component, can reduce depression in people over 65 years who live at home. However, more research is needed to determine whether outcomes are influenced by types of intervention, morbidity, and socioeconomic circumstance of participants.		
Outcome measures/results	Measurements of: • Physical function • Emotional well being/mental health • Quality of life • Service use		• Nutritional education or advice can be used positively influence diet and improve physical function • Some biochemical markers can be positively affected by nutritional education (raising albumin, reducing sodium excretion); mixed results in influencing inflammatory biomarkers in patients with OA

	• Nutritional indices • Anthropometric measures: BMI, grip strength, biochemical indicators • Mortality	• Several studies indicated that complex interventions with nutritional education as a component, also reduce depression • Impact on weight change was inconclusive • No evidence of improvements in anxiety, quality of life, service use, costs of care or mortality, or that length of the intervention has an impact on effectiveness • Dietary fiber: none of the studies which measured dietary fiber found any evidence of effect • Mixed effects in cardiovascular studies on dietary fat intake; together the studies provide some evidence to suggest that nutritional educations can lead to change in fat intake • Energy intake: significant intervention effects (decrease in cardiovascular patients/increase in patients with chronic kidney disease) • General dietary improvements: intervention group reported more improvements to their diet than the control (n=2) • Interventions significantly decreased BMI (n=2) vs. no significant intervention effect (n=5) • Limited success in lowering cholesterol by nutritional education

Empfehlung 19

Brunner S, Mayer H, Qin H et al. Interventions to optimise nutrition in older people in hospitals and long-term care: Umbrella review. Scand J Caring Sci 2022; 36: 579-598. doi:10.1111/scs.13015 [69]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1++ AMSTAR2: High quality	**Countries:** Asia, Australia, Europe and North America **Centers:** n/a **Setting:** hospitals and long-term care **Funding Sources:** City Hospital Waid and Triemli, Zurich (working hours). Stiftung Alta Vita (funding of editing) **Dropout rates:** n/a	**Total no. studies**: 13 **Inclusion criteria:** Geriatric patients or people aged 65 years or older with physical, social or cognitive functional ability; treatment of the risk for protein-/ energy malnutrition, comparison to no intervention or 'standard care'; outcomes: nutritional status, nutrient intake, body mass index, functional status, appetite, quality	n/a

	Study limitations: Only interventions that were already synthesized were included; no special attention to food literacy; restricted to studies published in English and German; Risk of Bias Moderate Inconsistency n/a Indirectness Low Imprecision Low Publication Bias n/a	of life, patient satisfaction, in combination with laboratory findings; published within the last 10 years (2010–2020); acute care, long-term care institution, rehabilitation; systematic reviews, narrative review, meta-analysis, meta-synthesis, other types of review; abstract in english, full text in english or german **Exclusion criteria:** Children, young adults; terminally ill, palliative patients; studies with interventions in micronutrients or molecular level only, tube feeding, parenteral nutrition, validation of screening tools; studies with outcome measures in laboratory signs only, prevalence of malnutrition as main outcome; studies Homecare, ambulatory care, intensive care units, palliative care, hospicereview of low quality (no flow chart of study selection, without explicit inclusion, exclusion criteria)	
Notes	**Author's Conclusion:** Several studies synthesised that optimising nutrition in older people in hospitals and long-term care is achievable. Interventions were effective if—on a meta-level—staff training was addressed as part of a multi-component measure to reach an interprofessional food promoting culture.		
Outcome measures/results	- descriptions of interventions that influenced nutritional status or food intake - weight gain, Body Mass Index, behaviour during food intake, functional status, appetite, quality of life or patient satisfaction in combination with laboratory findings or muscle mass		An interprofessional food promoting culture, including staff training as part of a multi-component measure, has shown to be a successful element in implementing activities of Nutrition Management.

Edwards D, Carrier J, Hopkinson J. Mealtime assistance for older adults in hospital settings and rehabilitation units from the perspective of patients, families and healthcare professionals: a mixed methods systematic review. JBI Database System Rev Implement Rep 2016; 14: 261-357. doi:10.11124/jbisrir-2016-003100 [70]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1+ AMSTAR II: high quality	**Countries:** n/a **Centers:** n/a **Setting:** hospitals and rehabilitation units **Funding Sources:** **Dropout rates:** **Study limitations:** quality of the included studies; variety of interventions and outcome measures; mainly female patients; only westernized countries; patients who are too ill to consent are mostly those at the greatest risk of undernutrition Risk of Bias Moderate Inconsistency Moderate Indirectness Low Imprecision Low Publication Bias n/a	**Total no. studies**: 19 **Inclusion criteria:** studies that included older adults (65 years and over) from any ethnic background in hospital settings, including rehabilitation units, with any diagnosis; studies focusing on family members; volunteers, healthcare professionals **Exclusion criteria:** Patients under 65 years of age; Patients on artificial feeding; Patients residing in other healthcare settings such as nursing homes or long-term care facilities	- interventions for mealtime assistance, observed mealtime assistance, or discussed experiences of mealtime assistance with patients, families and healthcare professionals
Notes	**Author's Conclusion:** No firm conclusions can be drawn with respect to the most effective initiatives. Initiatives with merit include those that encourage social interaction, either through the use of a dining room, or employed staff or volunteers, relatives or visitors supporting the older patient during mealtimes. Volunteers value training and support and clarification of their roles and responsibilities.		
Outcome measures/results	- first objective: improved nutritional intake/status (energy & protein intake, nutritional status), length of stay, postoperative complications, mortality rates - second objective: description of the mealtime assistance from the perspective of the patient, healthcare professional, carer or family members		- Mealtimes should be viewed as high priority, healthcare staff should limit other activities during mealtimes and allow older patients to eat uninterrupted, providing support where required. - Nursing staff, employed mealtime assistants, volunteers or relatives/visitors can help prepare the older patient for meals; this includes opening packages and cutting up food as well as physically feeding patients. - Social interaction at mealtimes for older patients is effective in increasing food, energy and protein intake, and should be encouraged.

		- Communication between all members of the multi-disciplinary team, staff and volunteers is essential.

Edwards D, Carrier J, Hopkinson J. Assistance at mealtimes in hospital settings and rehabilitation units for patients (>65years) from the perspective of patients, families and healthcare professionals: A mixed methods systematic review. Int J Nurs Stud 2017; 69: 100-118. doi:10.1016/j.ijnurstu.2017.01.013 [71]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic review 1+ AMSTAR 2: critically low quality	**Countries:** USA; Australia; UK; Canada **Centers**: n/a **Setting:** hospital settings including rehabilitation units **Funding Sources:** n/a **Dropout rates:** n/a **Study limitations:** n/a Risk of Bias Moderate Inconsistency Moderate Indirectness High Impreciseness Moderate Publication Bias Moderate	**Total no. Studies: 19** **Inclusion criteria:** >65 years, English, including or focusing on carers, family members, volunteers and healthcare professionals perspectives **Exclusion criteria:** <65 years of age, artificial feeding such as patients obtaining their nutrition exclusively by enteral or parenteral means and patients residing in other healthcare settings such	qualitative, quantitative and mixed methods studies; interventions for mealtime assistance, observed mealtime assistance or discussed experiences of mealtime assistance with staff, patients, relatives, volunteers or stakeholders
Notes	Three aggregated mixed methods syntheses were developed: 1) Mealtimes should be viewed as high priority. 2a) Nursing staff, employed mealtime assistants, volunteers or relatives/visitors can help with mealtime assistance. 2b) Social interaction at mealtimes should be encouraged. 3) Communication		

	is essential. **Author's Conclusion:** A number of initiatives were identified which can be used to support older patients (>65 years) at mealtimes in hospital settings and rehabilitation units. However, no firm conclusions can be drawn in respect to the most effective initiatives. Initiatives with merit include those that encourage social interaction. Any initiative that involves supporting the older patient (>65 years) at mealtimes is beneficial. A potential way forward would be for nurses to focus on the training and support of volunteers and relatives to deliver mealtime assistance, whilst being available at mealtimes to support patients with complex nutritional needs.	
Outcome measures/results	the effectiveness of the varying types of mealtime assistance provided in both hospital settings and rehabilitation units and the views of patients, health care professionals, family members and volunteers on mealtime assistance for patients Protein intake (g), Energy intake (KJ), % meeting nutritional requirements Experiences of volunteers, nurses and patients in relation to feeding assistance, Tasks completed by the volunteer Time spent with each patient Addressing barriers to consumption, Interruptions Infection rates (number of antibiotics prescribed) Functional status (GS (kgf)) Nutritional status, Mortality; LOS; albumin Feasibility of delivering mealtime assistance	TSE1 Lunch time and daily energy intake, breakfast, lunch time and daily protein intake can be increased in patients (>65 years) in hospital settings when trained volunteers are present to provide support TSE2 Daily energy intake, nutritional status, mortality four months post discharge can be increased in patients (>65 years) in hospital settings when employed assistants are present to provide support TSE3 Lunch time energy intake can be increased in patients (>65 years) in hospital settings when they eat their meals in a supervised dining room as opposed to on the ward TSE4 Eating in a communal dining room in hospital settings is associated with better protein intake for patients (>65 years)

Fernández-Barrés S, García-Barco M, Basora J et al. The efficacy of a nutrition education intervention to prevent risk of malnutrition for dependent elderly patients receiving Home Care: A randomized controlled trial. Int J Nurs Stud 2017; 70: 131-141. doi:10.1016/j.ijnurstu.2017.02.020 [112]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1- ROB2: High risk of bias	**Countries:** Spain **Centers:** multicenter **Setting:** primary care center **Funding Sources:** Instituto de Salud Carlos III, Evaluación de Tecnologías Sanitarias, Ministerio de Sanidad y Consumo, Madrid, Spain, and the Generalitat de Catalunya, Agència d'Informació, Avaluació i	**Total no. patients**: 173 **Inclusion criteria:** participation in the Home Care Program- Atenció Domiciliària; aged 65 years and above; Mini Nutritional Assessment score (MNA) 17-23.5 points; have difficulties to perform Activities of Daily Living, be caregiver-dependent and must have a caregiver	Intervention group (n=101): the nurses conducted initial educational intervention sessions for caregivers and then monitored at home every month for 6 months Control group (n=72): did not receive nutrition intervention

	Qualitat en Salut, Barcelona, Spain **Dropout rates:** 35.8% **Study limitations:** same nurse in the smaller centers, overestimated the intake by using the food frequency questionnaire; high dropout level Risk of Bias: High Inconsistency: n/a Indirectness: Low Impreciseness: Moderate Publication Bias: n/a	**Exclusion criteria:** enteral feeding; severe dysphagia; any serious illness that progresses to malnutrition; consumption of vitamin and/or dietary supplements	
Notes	**Author's Conclusion:** From this study, we can conclude that an educational intervention for caregivers may reduce the risk of malnutrition among older dependent patients and improve their dietary habits and nutritional intake. However, further research is needed to include a nutrition education intervention as a standard part of care in a home-care program for community-dwelling dependent older patients, to prevent malnutrition.		
Outcome measures/results	Primary outcome: nutritional status Secondary outcome: anthropometric measurements; food consumption; biochemical markers; degree of dependency; cognitive function; mood		Differences were found between the groups for Mini Nutritional Assessment test score change (repeated measures ANOVA, F = 10.1; P < 0.001), the intervention improved the Mini Nutritional Assessment test score of the participants in the intervention group. The egg consumption (F=4.1; P=0.018), protein intake (F=3.0; P=0.050), polyunsaturated fatty acid intake (F = 5.3; P = 0.006), folate (F = 3.3; P = 0.041) and vitamin E (F = 6.4; P = 0.002) showed significant group x time interactions.

Li L, Zhao Y, Wang Y et al. Overview of systematic reviews: Effectiveness of non-pharmacological interventions for eating difficulties in people with dementia. J Adv Nurs 2020; 76: 2830-2848. doi:10.1111/jan.14492 [77]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic review 1+ AMSTAR2: Moderate quality	**Countries**: 11 Europe, 3 North America, 2 Australia, 2 China**.** **Centers**: n/a **Setting:** n/a **Funding Sources:** Beijing	**Total no. Studies: 18** **Inclusion criteria:** systematic reviews or meta-analyses based on PWD RCT, dementia multiple research designs,	12 Rev. <u>environmental modifications:</u> lighting and contrast (7/12), home-like environment (4/12), fish aquarium in dining area (6/12), music played during mealtimes (10/12), seated in the same location (1/12), and shared mealtime with others (3/12).

	Municipal Science & Technology Commission Peking University Langtai nursing research fund **Dropout rates:** **Study limitations:** Risk of Bias Moderate Inconsistency Moderate Indirectness Low Impreciseness High Publication Bias n/a	**Exclusion criteria**: reviews without available full text, redundant publications, research proposal stage, parenteral nutrition	8 Rev. change of food provision and service, including additional food between meals (3/8), finger foods (1/8), menu changes (2/8), bulk food service (3/8), self-service style (3/8), and family style food service (4/8). 7 Rev. education/training, including education and nutrition promotion programme for PWD (2/7), spaced retrieval activities training for PWD (5/7), Montessori-based activities training for PWD (6/7), caregiver education (5/7), feeding skills training programme for caregivers (4/7). 4 Rev. Feeding assistance, 8 rev. ONS 4 Rev. Mixed interventions and other interventions: vocal or tactile positive feedback (2/4) and exercise (3/4).
Notes	Assessment of quality of studies using AMSTAR 2 and GRADE system. 13 systematic reviews included were rated of critically low overall confidence and only included one middle-quality study. Of 18 reviews included, 14 (78%) lacked a list of excluded studies and justifications for the exclusion. Risk of bias of the included studies was not considered when interpreting/discussing the results of the system reviews in 13 (72%) reviews. Also, in 12 (67%) reviews, there were no report whether the research methods of reviews were determined before implementation and whether there was any inconsistency with the protocols. **Author's Conclusion:** Some evidence showed that environmental modifications, education/ training, and Oral nutrition supplements (ONS) were beneficial to improving eating difficulties. But the current evidence failed to support the effectiveness of other interventions. The overall confidence of systematic reviews is relatively low. High-quality studies are needed to further validate the effectiveness of non-pharmacological interventions for eating difficulties in PWD.		
Outcome measures/results	-food/drink intake (amount of food eaten or fluid drank) energy intake in calorie, protein intake, etc. -nutritional status (body weight, BMI, MNA) -eating behaviours (Edinburgh Feeding Evaluation in dementia, Eating Behavior Scale, Level of Eating Independence Scale) -incidence of agitation/aggression, time/frequency of self-feeding, and time/frequency of assistance, communication, and participation during mealtimes.		environmental modifications could be beneficial to increase food and drink intake. 2 reviews suggested that improving dining room lighting and visual contrast had a positive effect on decrease of agitation behaviours. 2 reviews indicating appropriate lighting and contrast was shown to promote communication. 1 review reported that home-like environment was associated with an increase in interaction among PWD and active eating participation compared with general care facility environment. education/training: 3 reviews reported spaced retrieval activities training could improve food and drink intake. Over half of reviews indicated it brought a positive effect on nutritional status, while consistent conclusions whether it worked for eating behaviours were not drawn. Montessori-based activities training: No conclusive evidence on improved food and drink intake, nutritional status, as well as eating behaviours. Regarding caregiver education, 4 reviews: beneficial to increase intake of food and drink, 3 reviews : beneficial to gain weight, but no significant effect to BMI. 2 reviews

		: feeding skill training programme for caregivers could improve the ability of PWD to eat independently, there was still insufficient evidence for increasing food intake. education and nutrition promotion programme for PWD could have brought a slight increase in food intake per day, but no statistical differences were found in body weight, BMI, or MNA score. 1 review reported a positive effect on weight and MNA score, but level of evidence was not high.

Marshall S, Agarwal E, Young A et al. Role of domiciliary and family carers in individualised nutrition support for older adults living in the community. Maturitas 2017; 98: 20-29. doi:10.1016/j.maturitas.2017.01.004 [120]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1- AMSTAR2: Critically low quality	**Countries:** n/a **Centers:** n/a **Setting:** home care of community-dwelling adults **Funding Sources:** none **Dropout rates:** n/a **Study limitations:** none stated Risk of Bias: High Inconsistency: Moderate Indirectness: Moderate Impreciseness: High Publication Bias: High	**Total no. Studies**: 16 **Inclusion criteria:** none stated **Exclusion criteria:** none stated	n/a
Notes	**Author's Conclusion:** Domiciliary and family carers are well-placed to conduct weight monitoring and nutrition screening of older adults, sourcing and preparing of meals, offering assistance with feeding, and acting as a conduit between their older care-recipient and formal nutrition support staff such as dietitians. Emerging evidence demonstrates that expanding the knowledge and role of domiciliary and family carers in the nutritional management of community-dwelling older adults may improve health-related outcomes in the care-recipient. However, further interventional and translational research is required to before community care organisations may extend the scope of practice for domiciliary carers, and to demonstrate the efficacy of family carers in older adults in the general community as opposed to high-risk groups only.		
Outcome measures/results	- Nutritional and functional status - Intervention satisfaction - Nutritional knowledge and mental health of family carers	- Moderate evidence supports the role of domiciliary carers in implementing nutrition screening and referral pathways, and emerging evidence suggests they may have a role in malnutrition interventions when supported by health professionals.	

		- Moderate evidence also supports the engagement of family carers as part of the nutrition care team for older adults with malnutrition. - Interventions such as group education, skill-development workshops and telehealth demonstrate promise and have significantly improved outcomes in older adults with dementia.

Mawardi F, Lestari AS, Kusnanto H et al. Malnutrition in older adults: how interprofessional teams see it? A systematic review of the qualitative research. Fam Pract 2020; 38: 43-48. doi:10.1093/fampra/cmaa091 [121]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1- AMSTAR II: Low quality	**Countries:** Indonesia **Centers:** n/a **Setting:** community settings; nursing homes **Funding Sources:** n/a **Dropout rates:** n/a **Study limitations:** limited number of studies Risk of Bias Low Inconsistency Moderate Indirectness High Impreciseness N/A Publication Bias N/A	**Total no. patients**: 109 **Inclusion criteria:** qualitative studies using data collection; analysis; explored the views or perceptions of health care providers regarding malnutrition in elderly; English language; published from 2016 to 2020 **Exclusion criteria:** quantitative design; conference abstracts; commentaries; reviews	Semi-structured interview
Notes	**Author's Conclusion:** Nutritional knowledge and skills, management of malnutrition and the need for multidisciplinary teams are the main themes of this systematic review. Some solution and recommendations for management of malnutrition in older adult such as supportive interventions include environmental changes, nutritional counselling, food modification, ONS and pharmacotherapy if needed, routine screening and interprofessional approach		
Outcome measures/results	Outcome: views and perceptions of health care providers	The results showed that there are three main themes that reflect their malnutrition experiences: (i) knowledge and skills about malnutrition, (ii) management of malnutrition and (iii) the need for collaborative teams.	

II.1.3.6 Bewegungsmaßnahmen

Empfehlung 21

Ältere Personen mit Mangelernährung oder Risiko für Mangelernährung sollten auch während Phasen körperlichen Trainings mit ausreichenden Mengen an Energie und Protein versorgt werden, um den erhöhten Bedarf zu decken und dadurch das Körpergewicht und die Muskelmasse zu erhalten oder zu steigern.

Empfehlungsgrad B

<table>
<tr><th colspan="4">Lammes E, Rydwik E, Akner G. Effects of nutritional intervention and physical training on energy intake, resting metabolic rate and body composition in frail elderly. a randomised, controlled pilot study. J Nutr Health Aging 2012; 16: 162-167 [131]</th></tr>
<tr><th>Study Type/ Evidence Level</th><th>Study details/limitations</th><th>Patient characteristics</th><th>Interventions</th></tr>
<tr><td>Open, randomized, controlled pilot treatment study
1-</td><td>Countries: Sweden
Centers: Elderly research centre in Solna (suburb of Stockholm)
Setting: Community-based research center
Funding Sources:
Äldreforskning Nord Väst (local research centre for the elderly)
Dropout rates: baseline: 3.13% (n=3); after 3 months follow-up: 17.71%
After 9 months follow-up: 33.34%
Study limitations: large clinical heterogeneity→ no standard power calculation possible, therefore: Pilot-study; no consensus regarding definition of frailty</td><td>Total no. Patients: n=96
Inclusion criteria: community-dwelling frail elderly people, >75 years, unintentional weight loss of ≥5% during the last year and/or BMI <20 kg/m², low physical activity level (≤grade 3 in Mattiasson-Nilo classification of physical activity)
Exclusion criteria: age under 75, BMI > 30 kg/m², nonwalkers, recent cardiac problems requiring hospital care, hip fracture or surgery during the last 6 months, current cancer treatment, stroke within the last 2 years; <7 points of MMSE, institutionalized residents</td><td>4 treatment arms
1) Nutrition (n=25): Individual nutritional advice and group sessions on nutrition for the elderly; general physical training advice
2) Training (n=23): Physical training 2x 45 minutes per week for 3 months; general dietary advice
3) Combined nutritional und physical intervention (n=25): Individualized dietary counseling and group session education; specific physical training
4) Control group (n=23): General advice regarding diet and physical training

➔ Nutritional intervention: individual dietary counseling on the baseline food record data focusing on food choices and meal patterns; Energy needs: 1.4 x RMR (N/C Group); 1.5 x RMR (NT/T group)</td></tr>
<tr><td>Notes</td><td colspan="3">• Recruitment: questionnaires, advertisements in local newspapers, referrals from primary care and home service administration
• N=437 were interested and who met inclusion criteria were contacted by telephone for screening
• Randomization in open manner (study personal, statistician); no blinding</td></tr>
</table>

	• Assessments: baseline, 3 months (F1), 9Months (F2) **Author's Conclusion:** Individual nutrition counselling and physical exercise had no effect on energy intake, RmR or fat free mass in community-dwelling frail elderly people aged 75 and older. Interventions in frail elderly people should be targeted according to the needs of the individual patients. The issues of randomization, targeting and responders in are problematized and discussed.	
Outcome measures/results	• Energy intake (4-day food diary); home visit (nutritionist went through the record verifying details of food and amounts consumed); questions about: appetite, cooking, buying groceries, meal patterns) • MNA • Resting metabolic rate (indirect calorimetry; fasting) • Body composition: anthropometry (weight, height, skinfolds (4); body density + FM from sum of 4 skinfolds; FFM (Body weight- FM); Body composition (DXA) • Physical performance: pADL with Functional Independence Measure (FIM), iADL • Physical training: 60 minutes organized sessions 2x/week for 12 weeks (endurance, muscle strength, balance) → physiotherapist, trained instructor	• At baseline: 4 groups were comparable; except there were significantly more men in the training group compared to control group • Median MNA score just above "risk for malnutrition"; Majority was practically independent (pADL); large variation in iADL between individuals • Analysis within treatment groups: changes from baseline to F1 and F2 were very small • Training group: significant increase in RMR at 3 months; otherwise no differences between 4 groups • Correlation of 0.75 between FFM and RMR for all groups combined at each of the 3 assessments; Correlation energy intake for FFM and RMR varied between 0.27 and 0.49, with the lowest at F2; no correlation at an individual level for all 3 assessments • Mean energy intake: no differences at baseline between groups • Participants with low energy intake who increased it during the study ("responders"): statistically significantly lower BMI (21 vs. 24) and lower fat percentage (23 vs. 30) at baseline than "non-responders" • "non-responders": statistically significant decrease in body fat percentage at F1 and in Body weight, BMI, FFM at 9 months (F2)

Miller MD, Crotty M, Whitehead C et al. Nutritional supplementation and resistance training in nutritionally at risk older adults following lower limb fracture: a randomized controlled trial. Clin Rehabil 2006; 20: 311-323. doi:10.1191/0269215506cr942oa [134]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1++	**Countries:** Australia **Centers:** Flinders University Department of Rehabilitation and Aged Care, Repatriation General Hospital **Setting:** Teaching hospital **Funding Sources:** NHMRC Public Health Postgraduate	**Total no. Patients:** 100 **Inclusion criteria:** All participants were recruited from the orthopedic wards of the Flinders Medical Centre, Adelaide, South Australia. Patients aged ≥70 years consecutively admitted to Flinders Medical Centre	Commenced seven days after injury. Consisted of daily multinutrient energy-dense oral supplement (6.3 kJ/mL) individually prescribed for six weeks (n =25), tri-weekly resistance training for 12 weeks (n = 25), combined treatment (n = 24) or attention control plus usual care and general nutrition and exercise advice (n = 26).

	Research Scholarship, Flinders University-Industry Collaborative Research Grant and Nutricia Australia Pty Ltd **Dropout rates:** 7% **Study limitations:** -relatively small sample size - The study interventions were not implemented until day 7 post injury and there may have been significant declines or complications prior to commencing the interventions that impacted on the effectiveness of treatment. - There are possibly other unknown non-medical variables that may have impacted on outcomes of all participants.	with a fall-related lower limb fracture between September 2000 and October 2002 were screened for inclusion in the study. **Exclusion criteria:** Patients were excluded who (1) did not reside within southern Adelaide, (2) were unable to comprehend instructions relating to positioning of the upper arm for eligibility assessment, (3) were unable to fully weight bear on the side of the injury for more than seven days post admission, (4) were not independently mobile prefracture, (5) were medically unstable > seven days post admission, (6) were suffering from cancer, chronic renal failure, unstable angina or unstable diabetes or (7) were not classified as malnourished, (> 25th percentile for mid-arm circumference of a large representative sample of older Australians - 27.0 cm and 26.3 cm for males and females respectively).	
Notes	**Author's Conclusion:** Frail, undernourished older adults with a fall-related lower limb fracture experience clinically significant weight loss that is unable to be reversed with oral nutritional supplements. Those receiving a program of resistance training without concurrent nutrition support are at increased risk of weight loss compared with those who receive a combined nutrition and resistance training intervention. In this high-risk patient group it is possible to prevent further decline in nutritional status using oral nutritional supplements if strategies are implemented to ensure prescription is adequate to meet energy requirements and levels of adherence are high.		
Outcome measures/results	Weight change, quadriceps strength, gait speed, quality of life and health care utilization at completion of the 12-week intervention.		At 12 weeks, all groups lost weight: nutrition -6.2% (-8.4, - 4.0); resistance training - 6.3% (-8.3, -4.3); nutrition and resistance training -4.7% (-7.4, - 2.0); attention control - 5.2% (-9.0, - 1.5). Those receiving resistance training alone lost more weight than those receiving the combined treatment (P=0.029). Significant weight loss was

		prevented if supplement was consumed for at least 35 days. Groups were no different at 12 weeks for any other outcome.

Rydwik E, Lammes E, Frändin K et al. Effects of a physical and nutritional intervention program for frail elderly people over age 75. A randomized controlled pilot treatment trial. Aging Clin Exp Res 2008; 20: 159-170 [133]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+	**Countries:** Sweden **Centers:** n/a **Setting:** outpatient **Funding Sources:** **Dropout rates:** 33% **Study limitations:** small sample size and large heterogeneity regarding both physical performance and nutritional measurements; fairly high dropout rate; test leaders were not blinded to randomization	**Total no. patients**: 96 **Inclusion criteria:** unintentional weight loss >/=5% and/or body mass index (BMI) </=20 kg/m2; low physical activity level (</=grade 3 on a six-graded scale of physical activity **Exclusion criteria:** age under 75, BMI >30 kg/m2, non-walkers, people with recent cardiac problems requiring hospital care, recent hip fracture or surgery during the last six months, present cancer treatment, stroke within the last two years, less than 7 points of a total 9-point score on the short form of the Mini Mental State Examination; institutionalization.	12 weeks of: i) a physical training program (aerobic, muscle strength, balance) ii) a nutritional intervention program (individually targeted advice and group sessions) iii) a combination of these interventions iv) a control group assessement at: 0 months, 3 months, 9 months
Notes	**Author's Conclusion:** This study shows the positive effect on lower-extremity muscle strength directly after the intervention. Balance training most probably needs to be more individualized in order to be effective for frail elderly people.		
Outcome measures/results	physical performance (muscle strength, balance, mobility and activities of daily living) nutritional aspects (energy intake, body weight and fat-free mass)		Between-group analyses showed that there was a significant improvement regarding leg press, dips and step tests: i) leg press for the T+N and T groups compared with the N group at 1st follow-up, with mean differences of 11.4 kg [CI 95% 0.8 ; 21.9] and 14.3 kg [4.4 ; 24.1] respectively (p<0.01)

		ii) ii) dips for the T+N and T groups compared with the C group at 1st follow-up, with mean differences of 2.9 kg [0.2 ; 5.5] and 3 kg [0.4 ; 5.5] respectively (p<0.01) iii) iii) step test for the T group compared with the T+N group with a mean difference of 4.3 [0.2 ; 8.5] (p<0.05) There were no significant between-group differences between baseline and 2nd follow-up. Significant positive within group differences were mainly observed for muscle strength measurements in the T and T+N groups There were no significant differences for FIM and IAM within groups There were no significant differences between groups, but there was a significant but small decrease in FFM within the T group between baseline and 2nd follow-up

Rydwik E, Frändin K, Akner G. Effects of a physical training and nutritional intervention program in frail elderly people regarding habitual physical activity level and activities of daily living—a randomized controlled pilot study. Arch Gerontol Geriatr 2010; 51: 283-289 [132]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+	**Countries:** Sweden **Centers:** n/a **Setting:** outpatient **Funding Sources:** n/a **Dropout rates**: 33% **Study limitations:** small sample size, high heterogeneity regarding instrumental ADL; high drop-out rate; test leaders were not blinded to randomization	**Total no. patients**: 96 **Inclusion criteria:** unintentional weight loss >5% during the last 12 months and/or body mass index (BMI) <20 kg/ m2 and; low physical activity level (</=grade 3 in a six-graded scale of physical activity **Exclusion criteria:** age under 75, BMI >30 kg/m2; non-walkers; people with recent cardiac problems requiring hospital care; recent hip fracture or surgery during the last six months; present cancer treatment; stroke within the last two years and less than 7 points of a total 9 point score on the short form of the Mini Mental State Examination	4 groups: Training (n = 23): Specific physical training + general diet advice Training/nutrition (n = 25): Specific physical training + -specific individualized diet counseling and group-session training Nutrition (n = 25): Specific individualized diet counseling and group-session training + general physical training advice Control (n = 23): General physical training advice and general diet advice 12-week intervention program, six months of home-based exercises for the training groups, Follow-ups: 3 months, 9 months, 24 months

Notes	**Author's Conclusion:** The present study indicates that physical training increased the habitual physical activity level in frail elderly people and that this increase remained. over time for six months. Increase in physical activity and degree of home-based exercises were moderately related to improvements in ADL. The nutrition intervention did not add any extra benefit.	
Outcome measures/results	Primary: physical activity level, walking habits Secondary: ADL (activities of daily living)	increase of the habitual physical activity level and walking duration at 1st and 2nd follow-up for the two training groups compared to the other groups The nutrition intervention did not show any significant results. No significant effects on ADLwere shown however, there were moderate correlations between increases in physical activity level and ADL as well as between the amounts of home-based exercises and ADL for the two training groups

II.1.4 Ernährungsberatung

II.1.4.1 Indikation

Empfehlung 22

Älteren Personen mit Mangelernährung oder Risiko für Mangelernährung und/oder ihren Bezugspersonen sollte eine individuelle Ernährungsberatung angeboten werden, um eine angemessene Nahrungsaufnahme zu unterstützen und den Ernährungszustand zu verbessern oder aufrechtzuerhalten.

Evidenzgrad B

Baldwin C, de van der Schueren MA, Kruizenga HM, et al. Dietary advice with or without oral nutritional supplements for disease-related malnutrition in adults. Cochrane Database Syst Rev. 2021;12:CD002008. doi: 10.1002/14651858.CD002008.pub5.2019 Mar 22. [144]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1++ AMSTAR 2: high quality	**Countries:** United Kingdom **Centers:** multicenter **Setting:** hospital; residential care; community-living **Funding Sources:** National Institute for Health Research; London Regional Health Authority **Dropout rates:** n/a **Study limitations:** limited number of studies	**Total no. patients**: 10284 **Inclusion criteria:** all RCTs and quasi-RCTs; Adults over 16 years of age with disease-related malnutrition or described as at nutritional risk by the study investigator or judged to be at nutritional risk by the review authors due to their clinical condition or clinical treatment or both, additional feeding was	- 24 studies (n=3523) compared dietary advice (DA) with no DA - 12 studies (n=852) compared DA with ONS - 22 studies (n=1286) compared DA, no ONS with DA plus ONS - 31 studies (n=3308) compared DA plus ONS, if required with no DA and no ONS - 13 studies (n=1315) compared DA plus ONS with no DA and no ONS

	Risk of Bias Low Inconsistency Moderate Indirectness Moderate Imprecision High Publication Bias Moderate	received by 10% or fewer of included participants **Exclusion criteria:** pregnant women or people with eating disorders and in conditions of food insufficiency; studies of oral nutritional supplements (ONS) with novel ingredients	
Notes	**Author's Conclusion:** We found no evidence of an effect of any intervention on mortality. There may be weight gain with DA and with DA plus ONS in the short term, but the benefits of DA when compared with ONS are uncertain. The size and direction of effect and the length of intervention and follow-up required for benefits to emerge were inconsistent for all other outcomes. There were too few data for many outcomes to allow meaningful conclusions		
Outcome measures/results	Primary outcome: mortality; morbidity; measures of nutritional status and body composition Secondary outcome: nutritional intake before and after the intervention; measures of clinical function; quality of life; cost		- In all included studies, there may be little or no effect on mortality after three months or at later time points - They did report some positive changes in energy intake (measured in calories), protein intake, weight, muscle bulk and quality of life. - There were some reductions in complications and the length of time spent in hospital. However, there is no clear evidence about which treatment is the most helpful or the time it takes to achieve any benefit

Munk T, Tolstrup U, Beck AM et al. Individualised dietary counselling for nutritionally at-risk older patients following discharge from acute hospital to home: a systematic review and meta-analysis. J Hum Nutr Diet 2016; 29: 196-208. doi:10.1111/jhn.12307 [145]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review and meta-analysis 1++	**Countries:** n/a **Centers:** n/a **Setting:** n/a **Funding Sources:** n/a **Dropout rates:** n/a **Study limitations:** small number of included studies, high risk of bias in the single studies, lack of statistical power in the single studies	**Total no. Studies:** n=4 **Inclusion criteria:** studies on patients > 60 years and assessed to be at nutritional risk, studies evaluating individualized dietary counselling after an acute hospital stay, RCT **Exclusion criteria:** patients suffering from chronic medical conditions requiring further hospital stays,	Different forms of individualized dietary counselling

		artificial nutritional support, no individual counselling, multifactorial interventions	
Notes	**Author's Conclusion:** We found moderate-quality evidence that individualized dietary counselling provided by a registered dietitian improved weight, energy and protein intake in older nutritionally at-risk patients, although without clearly improving physical function. No effect was found on mortality. Because of a lack of data on hospital readmissions and quality of life, meta-analyses of these outcomes were not possible. Given the prevalence of undernutrition in older patients, the valid evaluation of the effect of nutritional interventions on clinically relevant outcomes is a prerequisite. Therefore, consensus regarding which instruments to use to measure outcomes and the identification of minimal clinically relevant changes is needed.		
Outcome measures/results	Primary outcome: physical function Secondary outcomes: different parameters of nutritional status		There was no significant effect of the intervention on hand grip strength; weight increased significantly in intervention patients; the mini nutritional assessment (MNA) improved for dietary assessment and subjective assessment in intervention patients; there was no influence on mortality; no difference was detected regarding quality of life

Schuetz P, Fehr R, Baechli V et al. Individualised nutritional support in medical inpatients at nutritional risk: a randomised clinical trial. Lancet 2019; 393: 2312-2321. doi:10.1016/s0140-6736(18)32776-4 [146]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+ ROB 2: low risk of bias	**Countries:** Switzerland **Centers:** University Clinic in Aarau, the University Hospital in Bern, the Cantonal hospitals in Lucerne, Solothurn, St Gallen, Muensterlingen, and	**Total no. Patients:** 2088 **Inclusion criteria:** at least 18 years at nutritional risk of 3 or greater expected to stay in hospital for more than 4 days if they were willing to provide informed consent within 48 h of hospital admission for any reason	Patients were randomly assigned (1:1) to receive either individualized nutritional support (intervention group) or standard hospital food (control group). In the intervention group, nutritional support was initiated as soon as possible after randomization and within 48 h after hospital admission. Patients received individualized nutritional support (figure 1) to reach protein and caloric goals, according to a previously published consensus protocol19 that follows 2018 inter-national guidelines.7 Briefly, individualized nutritional goals were defined for each patient on hospital admission by a trained registered dietitian. Caloric requirements

	Baselland, and the hospital in Lachen **Setting:** n/a **Funding Sources:** The Swiss National Science Foundation and the Research Council of the Kantonsspital Aarau, Switzerland **Dropout rates:** 2.9% **Study limitations:** Trial was pragmatic, and masking of participants and personnel was deemed to be impractical, thus observer Risk of Bias Moderate Inconsistency N/A Indirectness Low Imprecision Low Publication Bias N/A	**Exclusion criteria:** patients who were initially admitted to intensive care units or surgical units; unable to ingest oral nutrition; already receiving nutritional support on admission; with a terminal condition; admitted to hospital because of anorexia nervosa, acute pancreatitis, acute liver failure, cystic fibrosis, or stem- cell transplantation; after gastric bypass surgery; with contraindications for nutritional support	were predicted using the weight adjusted Harris-Benedict equation.20 Daily protein intake was set at 1·2–1·5 g/kg of bodyweight to adjust for increased protein breakdown during acute disease,21 with lower targets for patients with acute renal failure (0·8 g/kg of bodyweight). To reach these goals, an individual nutritional plan was developed by a trained registered dietitian for each patient. Patients in the control group received standard hospital food according to their ability and desire to eat, with no nutritional consultation and no recommendation for additional nutritional support.
Notes	**Author's Conclusion:** Understanding the optimal use of nutritional support is complex because timing, route of delivery, and the amount and type of nutrients might all affect clinical outcomes. In our trial, we asked the basic question of whether nutritional support during the hospital stay improves outcomes in medical patients at nutritional risk, compared with standard hospital food. This trial showed that early use of individualized nutritional support to reach protein and caloric goals in medical inpatients at nutritional risk is effective in increasing energy and protein intakes, and in lowering the risk of adverse outcomes and mortality within 30 days. Our findings strongly support the concept of systematically screening medical inpatients on admission to hospital for nutritional risk, irrespective of any underlying conditions, followed by a nutritional assessment and introduction of individualized nutritional support in at-risk patients.		
Outcome measures/results	adverse clinical outcome within 30 days		"In the intervention group, individualized nutritional support goals were defined by specialist dietitians and nutritional support was initiated no later than 48 h after admission. By day 30, 73 [7%] patients had died in the intervention group compared with 100 [10%] patients in the control group (adjusted OR 0·65 [0·47–0·91], p=0·011)"

Wong A, Huang Y, Sowa PM et al. Effectiveness of dietary counseling with or without nutrition supplementation in hospitalized patients who are malnourished or at risk of malnutrition: A systematic review and meta-analysis. JPEN J Parenter Enteral Nutr 2022; 46: 1502-1521. doi:10.1002/jpen.2395 [147]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic review 1++ AMSTAR 2: high quality	**Countries:** Australia **Centers:** multicenter **Setting:** hospital **Funding Sources:** n/a **Dropout rates:** n/a **Study limitations:** only 12.5% of publications were assessed as low risk of bias; inconsistency; inadequately reported information on the type, content, and frequency of the dietary counseling provided, along with details of the experience of clinicians Risk of Bias Low Inconsistency Moderate Indirectness Low Imprecision High Publication Bias Moderate	**Total no. patients**: 4359 **Inclusion criteria:** adult over 18 years; malnourished; at risk of malnutrition and receiving dietary counseling during hospitalization; only RCTs; published or accepted with an online early view **Exclusion criteria:** only provide ONS; dietary supplements, or intravenous and/or parenteral and/or enteral nutrition without any dietary counseling; purpose of education to instruct patients to consume ONS and multimodal studies that used physical therapy or exercises; critical illness, immunological and oncological diseases, end-stage organ failure, palliative care, and elective surgery admissions	3 different dietary counseling interventions: dietary counseling with compulsory ONS; dietary counseling with ONS if appropriate; dietary counseling only Control group: no dietary counseling or only minimal dietary counseling (except 1 study); 6 studies received ONS before or during the study
Notes	**Author's Conclusion:** This systematic review and meta-analysis found evidence that dietary counseling with or without ONS probably does not reduce mortality from inpatient to 30 days, results in a slight reduction in mortality up to 6 months and in 6-month readmissions, and reduces complications but may not reduce LOS when compared with standard care. However, the effect remains very uncertain for QoL		
Outcome measures/results	Outcome: clinical outcome (hospital length of stay, complications, mortality rates, frequency of hospital admissions); quality of life; changes in nutrition status, anthropometric measurements and physical indicators		Compared with standard care, dietary counseling with or without ONS probably does not reduce inpatient rates of 30-day mortality (RR=1.24; 0.60–2.55; I2=45%; P=0.56; moderate certainty), slightly reduces 6-month mortality (RR = 0.83; 0.69–1.00; I2 = 16%; P = 0.06; high certainty), reduces complications (RR = 0.85; 0.73–0.98; I2 = 0%; P = 0.03; high certainty), and may slightly reduce readmission (RR=0.83; 0.66–1.03; I2=55%; P=0.10; low certainty) but may not reduce length of stay (mean difference: −0.75 days; −1.66- 0.17; I2 = 70%; P = 0.11; low certainty). Intervention may result in slight improvements in nutrition status/intake and weight/body mass index (low certainty)

II.1.5 Modifikation der Nahrung

Empfehlung 24

Mahlzeiten und Zwischenmahlzeiten für ältere Personen mit Mangelernährung oder Risiko für Mangelernährung sollten den individuellen Erfordernissen entsprechend modifiziert werden, um eine bedarfsgerechte Aufnahme an Energie und Nährstoffen zu ermöglichen.

Empfehlungsgrad B

Barton AD, Beigg CL, Macdonald IA et al. A recipe for improving food intakes in elderly hospitalized patients. Clin Nutr 2000; 19: 451-454. doi:10.1054/clnu.2000.0149 [149]										
Grade of evidence	**Study design**	**Intervention**		**Setting**	**Patients**			**Results**		
		Description	**Duration**		**n**	**Age [y.]**	**characteristics**	**Intake**	**Weight effect**	**Other**
Ib	RCT	Smaller, enriched meals	56 days	Reha-bilitation	35	~70	n/a	Food intake ↑	n/a	Food waste ↓

Cassens D, Johnson E, Keelan S. Enhancing Taste, Texture, Appearance, and Presentation of Pureed Food Improved Resident Quality of Life and Weight Status. Nutr Rev 2009; 54: S51-S54. doi:10.1111/j.1753-4887.1996.tb03790.x [150]										
Grade of evidence	**Study design**	**Intervention**		**Setting**	**Patients**			**Results**		
		Description	**Duration**		**n**	**Age [y.]**	**characteristics**	**Intake**	**Weight effect**	**Other**
IIb	Controlled, not randomised	Optimization of pureed food in terms of taste, consistency, etc.	16 days	Nursing home	18 (4 drop-outs)	n/a	n/a	Food intake + 15 %	Less/reduced weight loss	Appetite ↑

Gall MJ, Grimble GK, Reeve NJ et al. Effect of providing fortified meals and between-meal snacks on energy and protein intake of hospital patients. Clin Nutr 1998; 17: 259-264. doi:10.1016/s0261-5614(98)80317-8 [151]										
Grade of evidence	**Study design**	**Intervention**		**Setting**	**Patients**			**Results**		
		Description	**Duration**		**n**	**Age [y.]**	**characteristics**	**Intake**	**Weight effect**	**Other**
IIa	Controlled, not randomised	Smaller meals enriched with protein and energy	32 days	hospital	62 (inter-vention group) 82 (control group)	n/a	n/a	Energy intake ↑, protein intake ↑	Weight gain	n/a

Heelan M, Prieto J, Roberts H et al. The use of finger foods in care settings: an integrative review. J Hum Nutr Diet 2019; 33: 187-197. doi:10.1111/jhn.12725 [152]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1+ AMSTAR 2: moderate quality	**Countries:** n/a **Centers:** n/a **Setting:** n/a **Funding Sources:** clinical doctoral research fellowship funded through an educational grant by Medirest, a division of Compass Group UK and Ireland **Dropout rates:** n/a **Study limitations:** Small sample sizes across studies; poorly reported study designs; no high-quality trials were included; no control groups in most studies; lack of blinding and potential researcher bias Risk of Bias Moderate	**Total no. studies**: 6 **Inclusion criteria:** Adults aged 18 years or older; studies involving the use of finger foods in institutional settings like long-term care centers, assisted living residences, residential homes, nursing homes, and acute hospital wards; empirical research only **Exclusion criteria:** Non-empirical studies; studies not involving finger foods or not conducted in institutional settings.	Introduction of finger food menus designed to increase feeding independence, improve nutrition, and enhance well-being

	Inconsistency Moderate Indirectness Moderate Imprecision High Publication Bias Moderate		
Notes	**Author's Conclusion:** The use of finger foods may positively influence nutritional intake and independence in long-term care settings, particularly for adults with cognitive impairments. However, the evidence is limited due to the low quality of the studies, small sample sizes, and lack of robust research designs. High-quality trials are needed to confirm these findings.		
Outcome measures/results	Primary Outcomes: Nutritional intake (e.g., food intake, weight maintenance or gain). Secondary Outcomes: Well-being, independence in feeding, and cost-effectiveness.	**Primary Outcomes**: Some studies showed increased food intake and weight gain with finger foods, although results varied. One study reported that 83% of participants maintained or gained weight, while another found a significant increase in food consumption. **Secondary Outcomes**: Improvements in well-being and feeding independence were reported, with participants showing increased independence and positive responses to finger foods.	

Lorefält B, Wissing U, Unosson M. Smaller but energy and protein-enriched meals improve energy and nutrient intakes in elderly patients. J Nutr Health Aging 2005; 9: 243-247 [153]

Grade of evidence	Study design	Intervention		Setting	Patients			Results		
		Description	Duration		n	Age [y.]	characteristics	Intake	Weight effect	Other
III	Obser-vational study	Smaller meals enriched with protein and energy	3 days	Reha-bilitaion	10	77-87	Geriatric patients	Supply of energy, KH, protein, fat, vitamins, minerals ↑	too short duration	n/a

Taylor KA, Barr SI. Provision of Small, Frequent Meals Does Not Improve Energy Intake of Elderly Residents with Dysphagia Who Live in an Extended-Care Facility. J Am Diet Assoc 2006; 106: 1115-1118. doi:10.1016/j.jada.2006.04.014 [154]										
Grade of evidence	**Study design**	**Intervention**		**Setting**	**Patients**			**Results**		
		Description	**Duration**		**n**	**Age [y.]**	**characteristics**	**Intake**	**Weight effect**	**Other**
IIa	Randomised cross-over trial	small, more frequent meals	2 x 4 days	Nursing home	31	85(±6,5)	Dysphagia, BMI ~20.4	Food intake =, liquid supply ↑	n/a	n/a

Young KWH, Greenwood CE, van Reekum R et al. A Randomized, Crossover Trial of High-Carbohydrate Foods in Nursing Home Residents With Alzheimer's Disease: Associations Among Intervention Response, Body Mass Index, and Behavioral and Cognitive Function. J Gerontol A Biol Sci Med Sci 2005; 60: 1039-1045. doi:10.1093/gerona/60.8.1039 [155]										
Grade of evidence	**Study design**	**Intervention**		**Setting**	**Patients**			**Results**		
		Description	**Duration**		**n**	**Age [y.]**	**characteristics**	**Intake**	**Weight effect**	**Other**
IIb	Randomised cross-over trial	Carbohydrate-rich meals in the evening or at lunchtime	4 phases à 21 days	Nursing home	32	n/a	advanced Alzheimer's disease	Amount of food ↑, carbo-hydrate intake ↑	Hardly any change in weight (too short a duration)	Memory ↓

<u>Empfehlung 25</u>

Älteren Personen mit Mangelernährung oder Risiko für Mangelernährung sollen zusätzliche Zwischenmahlzeiten angeboten werden, um die Nahrungsaufnahme zu unterstützen.

Empfehlungsgrad B

Heelan M, Prieto J, Roberts H et al. The use of finger foods in care settings: an integrative review. J Hum Nutr Diet 2019; 33: 187-197. doi:10.1111/jhn.12725 [152]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1+ AMSTAR 2: moderate quality	**Countries:** n/a **Centers:** n/a **Setting:** n/a **Funding Sources:** clinical doctoral research fellowship funded through an educational grant by Medirest, a division of Compass Group UK and Ireland **Dropout rates:** n/a **Study limitations:** Small sample sizes across studies; poorly reported study designs; no high-quality trials were included; no control groups in most studies; lack of blinding and potential researcher bias Risk of Bias Moderate Inconsistency Moderate Indirectness Moderate Imprecision High Publication Bias Moderate	**Total no. studies**: 6 **Inclusion criteria:** Adults aged 18 years or older; studies involving the use of finger foods in institutional settings like long-term care centers, assisted living residences, residential homes, nursing homes, and acute hospital wards; empirical research only **Exclusion criteria:** Non-empirical studies; studies not involving finger foods or not conducted in institutional settings.	Introduction of finger food menus designed to increase feeding independence, improve nutrition, and enhance well-being
Notes	**Author's Conclusion:** The use of finger foods may positively influence nutritional intake and independence in long-term care settings, particularly for adults with cognitive impairments. However, the evidence is limited due to the low quality of the studies, small sample sizes, and lack of robust research designs. High-quality trials are needed to confirm these findings.		
Outcome measures/results	Primary Outcomes: Nutritional intake (e.g., food intake, weight maintenance or gain). Secondary Outcomes: Well-being, independence in feeding, and cost-effectiveness.		**Primary Outcomes**: Some studies showed increased food intake and weight gain with finger foods, although results varied. One study reported that 83% of participants maintained or gained weight, while another found a significant increase in food consumption.

		Secondary Outcomes: Improvements in well-being and feeding independence were reported, with participants showing increased independence and positive responses to finger foods.

Kenkmann A, Price GM, Bolton J et al. Health, wellbeing and nutritional status of older people living in UK care homes: an exploratory evaluation of changes in food and drink provision. BMC Geriatr 2010; 10: 28 [156]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1-	**Countries:** UK **Centers:** University of East Anglia, Norwich, UK **Setting:** care homes **Funding Sources:** **Dropout rates:** 20% **Study limitations: high heterogeneity of residents** of different homes; during the 2 years nutrition screening, finger foods and a campaign to reduce dehydration were introduced nation wide; the system of food and drink provision was already of high quality in many respects at baseline; the number of participating nursing homes was limited by the County Council's rolling programme of improvements; finding the data in various (differing) sets of care notes maintained by the homes was difficult and differing	**Total no. patients**: 105 **Inclusion criteria:** n/a **Exclusion criteria:** n/a	- health, wellbeing and nutritional status were measured - an intervention comprising improved dining atmosphere, greater food choice, extended restaurant hours, and readily available snacks and drinks machines was implemented in three care homes. - Three control homes maintained their previous system. - Outcomes were assessed in the year before and the year after the changes.

	levels of details were recorded; the knowledge of the upcoming changes might have altered some residences decisions to participate in the study (as the response rate was lower in those in control homes) and may have altered responses to the questionnaires		
Notes	**Author's Conclusion:** This intervention to improve food and drink provision was well received by residents, but effects on health indicators (despite the relative reduction in falls rate) were inconclusive, partly due to problems with routine data collection and loss to follow up.		
Outcome measures/results	- Primary outcomes: falls - Secondary outcomes: Satisfaction with meals, body weight, dehydration, cognitive functioning, depression, haemoglobin and cholesterol levels		- the rate of falls (falls per person per month) relative to being in a control home was reduced by 24% (rate ratio 0.76, 95% CI 0.57 to 1.02, p = 0.06) - Compared to controls participants in intervention homes gained 0.63 kg (95% CI -1.2 to +2.4 kg, p = 0.49) - The risk of being dehydrated in an intervention home compared to a control home was 0.36 (95% CI 0.06 to 2.04, p = 0.25) - There was no significant effect of the food and drink intervention on level of depression (p = 0.42) - Adjusting for age and effect of home pair, the food and drink intervention has no statistically significant impact on residents' haemoglobin and cholesterol levels - While the mean change of residents' perception of their own enjoyment of food and drink in intervention homes (+0.28, sd 0.43) was slightly greater than that in control homes (+0.09, sd 0.63), this difference was not statistically significant (p = 0.237) - No other outcomes suggested a statistically significant effect of the intervention compared with control once adjustment was made for age and cluster

Mills SR, Wilcox CR, Ibrahim K et al. Can fortified foods and snacks increase the energy and protein intake of hospitalized older patients? A systematic review. Journal of human nutrition and dietetics : the official journal of the British Dietetic Association 2018; 31: 379-389. doi:10.1111/jhn.12529 [157]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1++ AMSTAR 2: moderate quality	**Countries:** United Kingdom **Centers:** multicenter **Setting:** acute hospitals or rehabilitation units **Funding Sources:** National Institute for Health Research Collaboration for Leadership in Applied Health Research and Care Wessex at University Hospital Southampton **Dropout rates:** n/a **Study limitations:** lack of standardized terminology, keywords and MeSH terms; heterogeneity of the study populations, interventions, comparators, outcome assessment; introduction of novelty by changing the menu; publication bias Risk of Bias Moderate Inconsistency Moderate Indirectness Low Imprecision High Publication Bias Moderate	**Total no. patients**: 546 **Inclusion criteria:** use of energy and protein dense meals or snacks to increase the energy and/or protein intake of inpatients with a mean age over 60 years in acute hospitals or rehabilitation units **Exclusion criteria:** studies involving fortification with micronutrients only or the addition of flavor enhancers	- 8 studies compared a diet enrichment intervention with usual nutritional care (standard hospital menu), or the same products in a non-enriched format. 6 of these studies assessed either energy- or protein-based fortification and supplementation alone; and two assessed a menu enriched with both energy and protein - 2 studies used oral nutritional supplements as a comparator
Notes	**Author's Conclusion:** Compared with usual nutritional care, we suggest that combined energy- and protein-based fortification of main meals, as well as supplementation with snacks, could be employed as an effective and feasible intervention to improve dietary intake amongst older inpatients.		
Outcome measures/results	Primary outcome: energy and protein intake Secondary outcome: acceptability of fortified food; cost effectiveness		- Compared with usual nutritional care, six studies using either energy- or protein-based fortification and supplementation significantly increased intake of energy (250–450 kcal/day) or protein (12–16 g/day)

		- Two studies enriched menus with both energy and protein, and significantly increased both energy (698 kcal/day and 21 kJ/kg) and protein (16 g/kg and 0.2 g/kg) intake compared to usual care - Oral nutritional supplement was similar to supplementation in one study but superior to fortification in another. - Four studies reported good acceptability of enriched products and two studies that found they were cost-effective

Morilla-Herrera JC, Martin-Santos FJ, Caro-Bautista J et al. Effectiveness of Food-Based Fortification in Older People. A Systematic Review and Meta-Analysis. J Nutr Health Aging 2016; 20: 178-184. doi:10.1007/s12603-015-0591-z [158]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review and Meta-Analysis 1+	**Countries:** n/a **Centers:** n/a **Setting:** Hospitals, Community-dwelling, Institutions **Funding Sources:** Andalusian Council of Health **Dropout rates:** n/a **Study limitations:** poor methodological quality of the included studies, heterogeneity of the studies	**Total no. Studies:** n=7 **Inclusion criteria:** RCT, quasi-experimental, interrupted time series including a longitudinal analysis with at least 2 observations before and after intervention, elderly patients who are institutionalized, hospitalized, community-dwelling, age ≥65 **Exclusion criteria:** patients in clinical care, recovering from cancer treatment, Studies used oral nutritional supplementation, unpublished studies	Studies had to compare: 1)food-based fortifications with macronutrients Versus 2)alternatives
Notes	• PICO question: In older people, the use of food-based fortification with macronutrients against other alternatives, which effects produces on any nutritional parameter, such as weight gain, protein or calories intake, or non-nutritional outcomes such as food consumption, functional status or quality of life. • Independent peer review was implemented; studies were evaluated with regard to: random sequence generation, allocation concealment, blinding, personnel and outcome assessment, basal homogeneity of groups, precision of results, presence of co-interventions, incomplete data reporting-intention to treat analysis		

	Author's Conclusion: Food-based fortification yielded positive results in the total amount of ingested calories and protein. Despite the limited evidence, due to their simplicity, low cost, and positive results in protein and calories intake, simple dietary interventions based on the food-based fortification or densification with protein or energy of the standard diet could be considered in patients at risk of malnutrition.	
Outcome measures/results	• Comparison of the interventions for assessing their effectiveness on any nutritional parameter (weight gain, protein/calorie intake, anthropometric changes, biochemical markers, changes in nutritional status) or non-nutritional outcomes (food consumption, functional status, QoL)	• Food-based fortification within the studies: ▪ Enrichment: effective to achieve caloric increases (enriched breakfast, enriched foods and snacks) ▪ Densification: caloric increase in all of the studies, mixed results: protein increase vs no effect • Meta-analysis: ▪ Mean difference in favor of the enrichment group resulted in 200.22 Kcal/day [132.97, 267.48] p<0.00001.high heterogeneity (I2= 85%) ▪ Protein intake→differences: 7.01 g/day (1.42, 12.60), p<0.00001, although as previously, high heterogeneity (I2=98%); after sensitivity analysis: protein intake in favor of the experimental group (4.35 mg/day, 95% CI: 0.82 to 7.88) ▪ No meta-analysis: nutritional/functional status, QoL

Odlund Olin A, Koochek A, Cederholm T et al. Minimal effect on energy intake by additional evening meal for frail elderly service flat residents--a pilot study. J Nutr Health Aging 2008; 12: 295-301. doi:10.1007/bf02982658 [159]										
Grade of evidence	**Study design**	**Intervention**		**Setting**	**Patients**			**Results**		
		Description	**Duration**		**n**	**Age [y.]**	**characteristics**	**Intake**	**Weight effect**	**Other**
IIb	Controlled pilot trial	Additional evening meal	6 months	Assisted living	49 (23 intervention group, 26 control group)	79-90	frail, malnutrition or risk of malnutrition	Protein intake ↑ Energy intake =	No changes	Quality of life =

Simmons SF, Zhuo X, Keeler E. Cost-effectiveness of nutrition interventions in nursing home residents: a pilot intervention. J Nutr Health Aging 2010; 14: 367-372. doi:10.1007/s12603-010-0082-1 [160]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+ ROB2: Low risk of bias	**Countries:** United States **Centers:** multicenter **Setting:** nursing home **Funding Sources:** National Alzheimer's Association; National Institute of Aging, UCLA Claude D. Pepper Older Americans Independence Center **Dropout rates:** 3% **Study limitations:** small sample sizes; low recruitment rates; short intervention period; not independent weight data measurement; hidden cost Risk of Bias Low Inconsistency N/A Indirectness Low Imprecision Moderate Publication Bias N/A	**Total no. patients**: 63 **Inclusion criteria:** long-stay; free of feeding tube; have an existing physician or dietitian order for nutrition supplementation **Exclusion criteria:** receiving hospice care	- Control group: usual care - Supplement group: trained research staff provided supplements consistent with each participant's order in available flavors twice daily between meals, five days per week, for six weeks - Between-meal snacks group: trained research staff provided a variety of foods and fluids consistent with diet specifications in participants' medical records twice daily between meals, five days per week, for six weeks
Notes	**Author's Conclusion:** Offering residents a choice among a variety of foods and fluids twice per day may be a more effective nutrition intervention than oral liquid nutrition supplementation		
Outcome measures/results	total daily caloric intake, required staff time, residents' refusal rates, cost of snacks and supplements		Both interventions increased between meal caloric intake significantly relative to the control group and required more staff time than usual nursing home care. The snack intervention was slightly less expensive and more effective than the supplement intervention

Simmons SF, Keeler E, An R et al. Cost-Effectiveness of Nutrition Intervention in Long-Term Care. J Am Geriatr Soc 2015; 63: 2308-2316. doi:10.1111/jgs.13709 [161]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1- ROB2: Low risk of bias	**Countries:** United States **Centers:** multicenter **Setting:** nursing home **Funding Sources:** Agency for Healthcare Research and Quality; National Center for Research Resources; National center for Advancing Translational Science **Dropout rates:** 27% **Study limitations:** not designed to detect the cost-effectiveness of nutrition intervention on total long-term costs or other outcomes associated with poor caloric intake Risk of Bias Low Inconsistency N/A Indirectness Low Imprecision Moderate Publication Bias N/A	**Total no. patients**: 154 **Inclusion criteria:** long stay, capable of oral intake **Exclusion criteria:** Medicare, receiving end-of-life care	- Control group (n=49): usual care - Oral nutritional supplement (ONS) intervention group (n=52): offering a variety of available flavors, including liquid and solid supplement options with each participant's diet orders twice per day (morning and afternoon), 5 weekdays per week for 24 weeks - Snack intervention group (n=53): offering a variety of foods (yogurts, pudding…) and beverages (assorted juices, liquid supplements) with each participant's diet orders twice per day (morning and afternoon), 5 weekdays per week for 24 weeks
Notes	**Author's Conclusion:** Oral liquid nutrition supplements and snack offers were efficacious in promoting caloric intake when coupled with assistance to promote consumption and a variety of options, but neither intervention resulted in significant weight gain		
Outcome measures/results	total calorie intake, body weight, staff time		- Total calorie intake: ONS intervention group took in an average of 265 calories more per day and snack intervention group took in an average of 303 calories more per day than the control group - Body weight: neither intervention had a significant effect, despite positive trends - Staff time required to provide each intervention averaged 11 and 14 minutes per person per offer for ONS and snack, and 3 minutes for usual care

Sossen L, Bonham M, Porter J. Can fortified, nutrient-dense and enriched foods and drink-based nutrition interventions increase energy and protein intake in residential aged care residents? A systematic review with meta-analyses. Int J Nurs Stud 2021; 124: 104088. doi:10.1016/j.ijnurstu.2021.104088 [162]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic review with meta-analyses 1+ AMSTAR 2: High quality	**Countries:** Australia **Centers:** multicenter **Setting:** nursing homes **Funding Sources:** none **Dropout rates:** n/a **Study limitations:** limitations of the pre-existing evidence; absence of blinding and intervention fidelity Risk of Bias Low Inconsistency High Indirectness Low Imprecision High Publication Bias Low	**Total no. patients**: 891 **Inclusion criteria:** adults living in residential aged care home, long term care, residential facility or nursing home **Exclusion criteria:** where the intervention was delivered in the community; rehabilitation and/or acute care hospital	- Intervention: provision of additional foods, drinks, or ingredients that fortify the usual diet (including protein powders, extra cheese, extra chocolate, additional food items…) - Comparator: commercial oral nutritional supplement (ONS), or no change to the menu (standard menu or usual care)
Notes	**Author's Conclusion:** fortified menus may significantly increase energy and protein intakes		
Outcome measures/results	Primary outcome: total energy intake; and total protein intake Secondary outcome: weight change; nutritional status; acceptability; cost-effectiveness, and cost-benefit	- The group receiving the fortified diet had a significantly higher energy intake (Hedges' g = 0.69 (CI 0.36–1.03), $p < 0.0001$) and protein intake (Hedges' g = 0.46 (CI 0.17–0.74), p = 0.003) compared with the groups receiving the standard menu +/- ONS - The meta-analysis revealed I^2 values of 77% for energy ($p < 0.0001$) and 60% for protein (p = 0.003), indicating considerable statistical heterogeneity across included studies - Benefits to weight and nutritional status of residents were recorded in some studies - Cost-effectiveness and cost-benefit of menu fortification/supplementation were variable	

Trabal J, Farran-Codina A. Effects of dietary enrichment with conventional foods on energy and protein intake in older adults: a systematic review. Nutr Rev 2015; 73: 624-633. doi:10.1093/nutrit/nuv023 [163]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review	**Countries:** n/a	**Total no. Studies:** n=9	Intervention:

1+	**Centers:** n/a **Setting:** community setting, Hospital, long-term care facilities **Funding Sources:** no external funding **Dropout rates:** n/a **Study limitations:** Heterogeneity: different designs, presentation of the result, lack of important outcome measures and wide variability in duration of the intervention between the studies, small number of included studies, 5 studies high risk of bias→ limits validity of the results	**Inclusion criteria:** experimental, quasi-experimental, observational time series designs, participants age >65 years of any nutritional status, dietary-enrichment interventions with conventional foods and powered modules with aim to increase energy/protein density without significantly increasing final volume of the meals, community setting, Hospital, long-term care facilities **Exclusion criteria:** case series, case studies, published in other language than English, Spanish, Catalan, interventions with enriched dishes a la carte, use of nutritional supplements, vitamin/mineral supplements, homemade supplements, studies only evaluating micronutrient enrichment, abstracts from conference communications	1)standard diet versus 2)dietary-enrichment interventions with conventional foods and powered modules →interventions: energy + protein enrichment (5 studies); enrichment of meals with energy dense food (4 studies); snacks included in 3 studies; powered modules along with conventional food (4 Studies)
Notes	• PICOS criteria; Risk of bias and study quality were assessed using the Academy of Nutrition and Dietetics' Quality Criteria Checklists for Primary Research • Nutritional status: not restricted to any specific method; Studies had to report on at least one measure of assessment aside from body weight; nutritional status of the individuals was not specified in most studies • Higher energy densities ranged from 198 kcal/day to 966 kcal/day; protein enrichment 22 g/day (1 study); duration of intervention varied from 2 days to 15 weeks • 4 studies were nonrandomized **Author's Conclusion:** The results suggest that dietary enrichment can improve energy intake in older adults. While dietary enrichment seems to increase protein intake, there is not enough evidence of sufficient quality to confirm this observation or to determine whether dietary enrichment improves other outcomes assessed in this population. Additional large clinical trials with long-term interventions are needed to establish the effects of dietary enrichment in older people at risk of malnutrition.		
Outcome measures/results	• Main outcome: Changes in energy intake		• Energy intake:

	• Other Outcomes: nutrient intake(protein intake), nutritional status, body weight, functional status, episodes of infection	▪ Significant changes in total daily energy intake due to the enriched intervention (7 studies; 2 no sig. changes) For example: most effective intervention - breakfast + lunch enrichment (18% increase; Castellanos et al.); crossover study 24 % (Silver et al.), 35% with snacks/50% without snacks (only enrichment in lunch and dinner) (Odlund Olin et al.) increase in energy intake between periods ($p<0.001$); Gall et al.: BMI<20 greatest increase in energy intake (32%) • Protein intake: ▪ Significant changes (3 studies from 8 which reported protein intake) only due to energy enrichment! No specific protein enrichment in these studies For example: 16%difference (Smoliner et al.), 10% increase (Silver et al.) • Nutritional status: MNA no differences between groups (Smoliner et al.), no between-group differences in BMI after intervention • Body weight: only 1 of 4 studies observed a significant increase in body weight of 3.4% (Odlund Olin et al.) • Functional status: no differences between groups (2 of 3 studies) • Episodes of infection: no significant changes (1 of 1 study)

Turic A, Gordon KL, D CRAIG L et al. Nutrition supplementation enables elderly residents of long-term-care facilities to meet or exceed RDAs without displacing energy or nutrient intakes from meals. J Am Diet Assoc 1998; 98: 1457-1459 [164]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1-	**Countries:** USA **Centers:** n/a **Setting:** long term care facilities (LTC) **Funding Sources:** Ross Products Division, Abbott Laboratories, Columbus, Ohia **Dropout rates:** 14%	**Total no. patients**: 68 **Inclusion criteria:** at least 60 years old, noallergies, not receiving nutrition by tube or vein, at risk for poor nutrition status due to previous weight loss and current weight under 90% of ideal **Exclusion criteria:** none stated	- Control group: LTC nutrition + 3 snacks at 10am, 2pm, before bed - Intervention group: LTC nutrition + 8 oz of medical nutrition supplement 3 times per day

	Study limitations: none stated		
Notes	**Author's Conclusion:** Our study demonstrated that the consumption of a medical nutrition supplement as a between meal snack permitted LTC residents to meet or exceed the RDA for energy and nutrients whereas consumption of snacks typically given in the LTC facilities did not**.**		
Outcome measures/results	- Daily intakes of energy and nutrients		- The supplement group had significantly higher intakes than the snack group for energy and all nutrients (p<.001; p=.022 for vitamin C - only the residents in the supplement group met or exceeded the RDA for vitamin D, niacin, folate,vitamin B6, calcium, magnesium, zinc - The energy intake from meals alone did not decrease

Wong A, Burford S, Wyles C et al. Evaluation of strategies to improve nutrition in people with dementia in an assessment unit. J Nutr Health Aging 2008; 12: 309-312			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1-	**Countries:** New Zealand **Centers:** n/a **Setting:** assessment unit **Funding Sources:** none **Dropout rates:** n/a **Study limitations: t**he sample is likely to be biased towards the acutely ill and physically unwell patient with dementia; the staff were aware of the study and it is possible that there was a Hawthorne effect with a heightened awareness of the staff to nutritional issues.	**Total no. patients**: n/a **Inclusion criteria:** n/a **Exclusion criteria:** n/a	Phase 1: Observation. Phase 2: Encouraging dietary, 'Grazing'. Phase 3: Using volunteers to feed patients. Phase 4: Improving dining room ambience by playing soothing music
Notes	**Author's Conclusion:** Simple, inexpensive and easy to implement strategies can improve nutrition in hospital inpatients with dementia.		
Outcome measures/results	- Body Mass Index (BMI) - mid arm circumference - mini nutrition index		- BMI fell in the Observation phase 0.6+0.68 kg/m2 (p<0.001), but increased in each of the Intervention phases. Phase2 0.3+0.86 kg/m2 (p<0.04), Phase 3 0.37+0.4 kg/m2 (p<0.04), Phase 4 0.39+0.7 kg/m2 (p<0.007).

	- caloric intake by plate waste measurement	- Caloric intake increased in the intervention phases. - Mid arm circumference was not measured in phase 1 but increased 0.04+0.065cm in phase 2, 0.14+0.24cm in phase 3 and 0.09+0.44 in phase 4. These increases were not statistically significant. - Playing soothing music (phase 4) resulted in an overall increase of 129.2+91.4 kcal/day compared with phase 2 (grazing), the benefit was noticed at lunchtime and at dinner but music at breakfast time resulted in a decrease in overall intake.

Empfehlung 26

Älteren Personen mit Mangelernährung oder Risiko für Mangelernährung sollen angereicherte Lebensmittel und Mahlzeiten angeboten werden, um die Energie- und Proteinaufnahme zu steigern [A] und den Ernährungszustand zu verbessern [B].

Empfehlungsgrad A/B

Mills SR, Wilcox CR, Ibrahim K et al. Can fortified foods and snacks increase the energy and protein intake of hospitalized older patients? A systematic review. Journal of human nutrition and dietetics : the official journal of the British Dietetic Association 2018; 31: 379-389. doi:10.1111/jhn.12529 [157]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1++ AMSTAR 2: moderate quality	**Countries:** United Kingdom **Centers:** multicenter **Setting:** acute hospitals or rehabilitation units **Funding Sources:** National Institute for Health Research Collaboration for Leadership in Applied Health Research and Care Wessex at University Hospital Southampton **Dropout rates:** n/a **Study limitations:** lack of standardized terminology, keywords and MeSH terms; heterogeneity of the study	**Total no. patients**: 546 **Inclusion criteria:** use of energy and protein dense meals or snacks to increase the energy and/or protein intake of inpatients with a mean age over 60 years in acute hospitals or rehabilitation units **Exclusion criteria:** studies involving fortification with micronutrients only or the addition of flavor enhancers	- 8 studies compared a diet enrichment intervention with usual nutritional care (standard hospital menu), or the same products in a non-enriched format. 6 of these studies assessed either energy- or protein-based fortification and supplementation alone; and two assessed a menu enriched with both energy and protein - 2 studies used oral nutritional supplements as a comparator

	populations, interventions, comparators, outcome assessment; introduction of novelty by changing the menu; publication bias Risk of Bias Moderate Inconsistency Moderate Indirectness Low Imprecision High Publication Bias Moderate		
Notes	**Author's Conclusion:** Compared with usual nutritional care, we suggest that combined energy- and protein-based fortification of main meals, as well as supplementation with snacks, could be employed as an effective and feasible intervention to improve dietary intake amongst older inpatients.		
Outcome measures/results	Primary outcome: energy and protein intake Secondary outcome: acceptability of fortified food; cost effectiveness		- Compared with usual nutritional care, six studies using either energy- or protein-based fortification and supplementation significantly increased intake of energy (250–450 kcal/day) or protein (12–16 g/day) - Two studies enriched menus with both energy and protein, and significantly increased both energy (698 kcal/day and 21 kJ/kg) and protein (16 g/kg and 0.2 g/kg) intake compared to usual care - Oral nutritional supplement was similar to supplementation in one study but superior to fortification in another. - Four studies reported good acceptability of enriched products and two studies that found they were cost-effective

Morilla-Herrera JC, Martin-Santos FJ, Caro-Bautista J et al. Effectiveness of Food-Based Fortification in Older People. A Systematic Review and Meta-Analysis. J Nutr Health Aging 2016; 20: 178-184. doi:10.1007/s12603-015-0591-z [158]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review and Meta-Analysis	**Countries:** n/a **Centers:** n/a	**Total no. Studies:** n=7	Studies had to compare: 1)food-based fortifications with macronutrients

1+	**Setting:** Hospitals, Community-dwelling, Institutions **Funding Sources:** Andalusian Council of Health **Dropout rates:** n/a **Study limitations:** poor methodological quality of the included studies, heterogeneity of the studies	**Inclusion criteria:** RCT, quasi-experimental, interrupted time series including a longitudinal analysis with at least 2 observations before and after intervention, elderly patients who are institutionalized, hospitalized, community-dwelling, age ≥65 **Exclusion criteria:** patients in clinical care, recovering from cancer treatment, Studies used oral nutritional supplementation, unpublished studies	Versus 2)alternatives
Notes	• PICO question: In older people, the use of food-based fortification with macronutrients against other alternatives, which effects produces on any nutritional parameter, such as weight gain, protein or calories intake, or non-nutritional outcomes such as food consumption, functional status or quality of life. • Independent peer review was implemented; studies were evaluated with regard to: random sequence generation, allocation concealment, blinding, personnel and outcome assessment, basal homogeneity of groups, precision of results, presence of co-interventions, incomplete data reporting-intention to treat analysis **Author's Conclusion:** Food-based fortification yielded positive results in the total amount of ingested calories and protein. Despite the limited evidence, due to their simplicity, low cost, and positive results in protein and calories intake, simple dietary interventions based on the food-based fortification or densification with protein or energy of the standard diet could be considered in patients at risk of malnutrition.		
Outcome measures/results	• Comparison of the interventions for assessing their effectiveness on any nutritional parameter (weight gain, protein/calorie intake, anthropometric changes, biochemical markers, changes in nutritional status) or non-nutritional outcomes (food consumption, functional status, QoL)	• Food-based fortification within the studies: ▪ Enrichment: effective to achieve caloric increases (enriched breakfast, enriched foods and snacks) ▪ Densification: caloric increase in all of the studies, mixed results: protein increase vs no effect • Meta-analysis: ▪ Mean difference in favor of the enrichment group resulted in 200.22 Kcal/day [132.97, 267.48] p<0.00001.high heterogeneity (I2= 85%) ▪ Protein intake→differences: 7.01 g/day (1.42, 12.60), p<0.00001, although as previously, high heterogeneity (I2=98%); after sensitivity analysis: protein intake in favor of the experimental group (4.35 mg/day, 95% CI: 0.82 to 7.88) ▪ No meta-analysis: nutritional/functional status, QoL	

Sossen L, Bonham M, Porter J. Can fortified, nutrient-dense and enriched foods and drink-based nutrition interventions increase energy and protein intake in residential aged care residents? A systematic review with meta-analyses. Int J Nurs Stud 2021; 124: 104088. doi:10.1016/j.ijnurstu.2021.104088 [162]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic review with meta-analyses 1+ AMSTAR 2: High quality	**Countries:** Australia **Centers:** multicenter **Setting:** nursing homes **Funding Sources:** none **Dropout rates:** n/a **Study limitations:** limitations of the pre-existing evidence; absence of blinding and intervention fidelity Risk of Bias Low Inconsistency High Indirectness Low Imprecision High Publication Bias Low	**Total no. patients**: 891 **Inclusion criteria:** adults living in residential aged care home, long term care, residential facility or nursing home **Exclusion criteria:** where the intervention was delivered in the community; rehabilitation and/or acute care hospital	- Intervention: provision of additional foods, drinks, or ingredients that fortify the usual diet (including protein powders, extra cheese, extra chocolate, additional food items…) - Comparator: commercial oral nutritional supplement (ONS), or no change to the menu (standard menu or usual care)
Notes	**Author's Conclusion:** fortified menus may significantly increase energy and protein intakes		
Outcome measures/results	Primary outcome: total energy intake; and total protein intake Secondary outcome: weight change; nutritional status; acceptability; cost-effectiveness, and cost-benefit	- The group receiving the fortified diet had a significantly higher energy intake (Hedges' g = 0.69 (CI 0.36–1.03), $p < 0.0001$) and protein intake (Hedges' g = 0.46 (CI 0.17–0.74), p = 0.003) compared with the groups receiving the standard menu +/- ONS - The meta-analysis revealed I^2 values of 77% for energy ($p < 0.0001$) and 60% for protein (p = 0.003), indicating considerable statistical heterogeneity across included studies - Benefits to weight and nutritional status of residents were recorded in some studies - Cost-effectiveness and cost-benefit of menu fortification/supplementation were variable	

Trabal J, Farran-Codina A. Effects of dietary enrichment with conventional foods on energy and protein intake in older adults: a systematic review. Nutr Rev 2015; 73: 624-633. doi:10.1093/nutrit/nuv023 [163]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review	**Countries:** n/a	**Total no. Studies:** n=9	Intervention:

1+	**Centers:** n/a **Setting:** community setting, Hospital, long-term care facilities **Funding Sources:** no external funding **Dropout rates:** n/a **Study limitations:** Heterogeneity: different designs, presentation of the result, lack of important outcome measures and wide variability in duration of the intervention between the studies, small number of included studies, 5 studies high risk of bias→ limits validity of the results	**Inclusion criteria:** experimental, quasi-experimental, observational time series designs, participants age >65 years of any nutritional status, dietary-enrichment interventions with conventional foods and powered modules with aim to increase energy/protein density without significantly increasing final volume of the meals, community setting, Hospital, long-term care facilities **Exclusion criteria:** case series, case studies, published in other language than English, Spanish, Catalan, interventions with enriched dishes a la carte, use of nutritional supplements, vitamin/mineral supplements, homemade supplements, studies only evaluating micronutrient enrichment, abstracts from conference communications	1)standard diet versus 2)dietary-enrichment interventions with conventional foods and powered modules →interventions: energy + protein enrichment (5 studies); enrichment of meals with energy dense food (4 studies); snacks included in 3 studies; powered modules along with conventional food (4 Studies)
Notes	• PICOS criteria; Risk of bias and study quality were assessed using the Academy of Nutrition and Dietetics' Quality Criteria Checklists for Primary Research • Nutritional status: not restricted to any specific method; Studies had to report on at least one measure of assessment aside from body weight; nutritional status of the individuals was not specified in most studies • Higher energy densities ranged from 198 kcal/day to 966 kcal/day; protein enrichment 22 g/day (1 study); duration of intervention varied from 2 days to 15 weeks • 4 studies were nonrandomized **Author's Conclusion:** The results suggest that dietary enrichment can improve energy intake in older adults. While dietary enrichment seems to increase protein intake, there is not enough evidence of sufficient quality to confirm this observation or to determine whether dietary enrichment improves other outcomes assessed in this population. Additional large clinical trials with long-term interventions are needed to establish the effects of dietary enrichment in older people at risk of malnutrition.		
Outcome measures/results	• Main outcome: Changes in energy intake		• Energy intake:

	• Other Outcomes: nutrient intake(protein intake), nutritional status, body weight, functional status, episodes of infection	▪ Significant changes in total daily energy intake due to the enriched intervention (7 studies; 2 no sig. changes) For example: most effective intervention - breakfast + lunch enrichment (18% increase; Castellanos et al.); crossover study 24 % (Silver et al.), 35% with snacks/50% without snacks (only enrichment in lunch and dinner) (Odlund Olin et al.) increase in energy intake between periods ($p<0.001$); Gall et al.: BMI<20 greatest increase in energy intake (32%) • Protein intake: ▪ Significant changes (3 studies from 8 which reported protein intake) only due to energy enrichment! No specific protein enrichment in these studies For example: 16%difference (Smoliner et al.), 10% increase (Silver et al.) • Nutritional status: MNA no differences between groups (Smoliner et al.), no between-group differences in BMI after intervention • Body weight: only 1 of 4 studies observed a significant increase in body weight of 3.4% (Odlund Olin et al.) • Functional status: no differences between groups (2 of 3 studies) • Episodes of infection: no significant changes (1 of 1 study)

<u>Empfehlung 27</u>

Älteren Personen mit Mangelernährung oder Risiko für Mangelernährung und Kauproblemen oder oropharyngealer Dysphagie kann eine geschmacklich und optisch ansprechende und ggf. angereicherte texturmodifzierte Kost angeboten werden, um eine sichere und angemessene Nahrungsaufnahme zu unterstützen.

Empfehlungsgrad 0

Hansen T, Beck AM, Kjaersgaard A et al. Second update of a systematic review and evidence-based recommendations on texture modified foods and thickened liquids for adults (above 17 years) with oropharyngeal dysphagia. Clinical Nutrition ESPEN 2022; 49: 551-555. doi:10.1016/j.clnesp.2022.03.039 [167]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**

Systematic review 1+ AMSTAR 2: moderate quality	**Countries:** Denmark **Centers:** n/a **Setting**: n/a **Funding Sources:** none **Dropout rates:** **Study limitations**: small number of high-quality trials available; high risk of bias in one of the new studies included; no new studies on texture-modified diets (TMD) were identified; the review had to rely on existing studies, with potential biases in recruitment and outcome reporting. Risk of Bias Moderate Inconsistency Low Indirectness Low Imprecision Low Publication Bias n/a	**Total no. studies**: 3 **Inclusion criteria:** adults above 17 years with oropharyngeal dysphagia (OD); randomized controlled trials (RCTs) focusing on the effectiveness of thickened liquids (TL) and texture-modified diets (TMD). **Exclusion criteria:** Studies without control groups; studies focusing on different types of interventions, like free water protocols.	Use of thickened liquids (TL) or texture-modified diets (TMD) compared to no modification/usual care.
Notes	**Author's Conclusion:** There is no convincing evidence that thickened liquids or texture-modified diets prevent death or pneumonia, nor do they improve quality of life, nutritional status, or oral intake in individuals with OD. Clinicians should use TL only after careful consideration, and no recommendation could be made for TMD due to lack of new evidence.		
Outcome measures/results	Primary Outcomes: Mortality, incidence of pneumonia. Secondary Outcomes: Quality of life, aspiration risk, dehydration, weight loss, patient preferences, and adherence to intervention.		Primary Outcomes: No significant effect on mortality (RR 0.91 for nectar TL, RR 0.92 for honey TL) or pneumonia (RR 0.81 for nectar TL, RR 1.58 for honey TL). Secondary Outcomes: Mixed results with some evidence of increased dehydration and weight loss in groups receiving TL, and decreased patient preferences.

Painter V, Le Couteur DG, Waite LM. Texture-modified food and fluids in dementia and residential aged care facilities. Clin Interv Aging 2017; 12: 1193-1203. doi:10.2147/CIA.S140581 [169]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic review 1- AMSTAR 2: low quality	**Countries:** Australia **Centers:** Concord Repatriation General Hospital, Concord, NSW, Australia; University of Sydney, NSW, Australia. **Setting:** Residential aged care facilities. **Funding Sources:** none **Dropout rates**: n/a **Study limitations:** Small sample sizes and short follow-up periods in most studies.; heterogeneity of studies in design and methodology; lack of high-quality evidence and methodological bias in many studies; no studies exclusively focused on dementia patients; limited data on clinically relevant outcomes like malnutrition, dehydration, and quality of life Risk of Bias High Inconsistency High Indirectness Low Imprecision Low Publication Bias n/a	**Total no. studies**: 22 **Inclusion criteria:** Clinical studies published in English where texture-modified food (TMF) was used as an intervention; studies examining at least one clinically relevant outcome in relation to TMF **Exclusion criteria:** Studies focusing entirely on stroke patients or those with non-progressive neurological conditions; duplicates, literature reviews, case studies, and commentaries.	**Intervention**: Texture-modified food and fluids (TMF) aimed at managing dysphagia in dementia and aged care settings. **Control**: Various, depending on the study, including normal diet, different types of TMF, or no direct comparison in some cases.

Notes	**Author's Conclusion:** The evidence for the use of TMF in people living with dementia and in residential aged care facilities is limited, with no significant impact on clinical outcomes like aspiration pneumonia, malnutrition, or hydration. There is an urgent need for more robust research to guide clinical practice.	
Outcome measures/results	**Primary Outcomes**: Aspiration prevention, nutrition, hydration, and adherence to TMF. **Secondary Outcomes**: Clinical outcomes such as pneumonia, malnutrition, hospital admissions, and mortality	Aspiration: TMF reduced aspiration seen on videofluoroscopy but not clinical aspiration and pneumonia; Nutrition: TMF was associated with lower daily energy and fluid intake; Hydration: TMF did not maintain daily fluid requirements in many cases; Adherence: Non-adherence ranged from 10% to 52% in different settings

Ott A, Senger M, Lötzbeyer T et al. Effects of a texture-modified, enriched and reshaped diet on dietary intake and body weight of nursing home residents with chewing and/or swallowing problems: An enable study. Clin Nutr 2018; 37: S55-S56. doi:10.1016/j.clnu.2018.06.1241 [170]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Pre-Post study 2+ NHLBI Pre-Post checklist: good quality	**Countries:** Germany **Centers:** n/a **Setting:** Nursing homes **Funding Sources:** Supported by the Federal Ministry of Education and Research **Dropout rates:** n/a **Study limitations:** Small sample size, no control group, lack of blinding for nursing personnel, and variation in timing/conditions of body weight measurements Risk of Bias: Moderate Inconsistency: N/A Indirectness: Moderate Impreciseness: High Publication Bias: N/A	**Total no. patients**: 16 **Inclusion criteria:** Chewing and/or swallowing problems, regularly receiving texture-modified diet, not tube-fed, not acutely ill or in terminal phase, able to perceive meals visually **Exclusion criteria:** Acute illness, terminal phase of life	Intervention involved a texture-modified, enriched, and reshaped diet; no control group was included
Notes	**Author's Conclusion:** The diet showed promise for managing nutritional needs in nursing home residents with chewing/swallowing problems. Future studies are needed to confirm these results in larger samples		
Outcome measures/results	Primary outcome—dietary intake and body weight;	• Energy intake increased from 1237 kcal to 1597 kcal after the new diet was introduced.	

	Secondary outcomes—acceptance of diet, nutritional status changes	• Protein intake increased from 42 g to 62 g. • Body weight initially decreased but increased by +1.1 kg during the intervention phase

Wu XS, Miles A, Braakhuis A. Nutritional Intake and Meal Composition of Patients Consuming Texture Modified Diets and Thickened Fluids: A Systematic Review and Meta-Analysis. Healthcare (Basel) 2020; 8: 579. doi:10.3390/healthcare8040579 [171]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1++ AMSTAR 2: low quality	**Countries:** New Zealand **Centers:** University of Auckland **Setting:** hospitals, long-term care facilities, and community settings **Funding Sources:** n/a **Dropout rates:** n/a **Study limitations:** Limited by heterogeneity in study designs, lack of standardization of TMDs/TFs, inconsistent measurement of meal textures and nutrient content, publication bias indicated by funnel plot asymmetry Risk of Bias: High Inconsistency: Low Indirectness: Moderate Impreciseness: High Publication Bias: Low	**Total no. patients**: 2245 **Inclusion criteria:** Studies included adults aged 18+ consuming TMDs or TFs in hospital, aged-care, or community settings; clear fluid diets were excluded **Exclusion criteria:** Case studies, reviews, expert opinions, conference papers, uncompleted clinical trials, and studies not published in English.	The intervention involved various TMDs (texture-modified diets) and thickened fluids; comparisons were made against regular diets and unmodified TMDs
Notes	**Author's Conclusion:** The study suggests that TMDs and TFs may compromise nutrition intake, but improvements can be achieved through nutrient enrichment and consistent shaping/moulding of foods		

Outcome measures/results	Primary outcomes included nutritional intake (energy, protein, calcium). Secondary outcomes focused on meal compliance and adequacy of dietary intake.	• Energy intake from TMDs was significantly lower than regular diets (−237.9 kcal/day). • Calcium intake was lower for TMD consumers (−63.1 mg/day). • Protein intake did not show a significant difference compared to regular diets. • Enhanced TMDs (shaped/moulded) showed increased energy (+273.8 kcal/day) and protein intake (+12.4 g/day)

Empfehlung 29

Älteren Personen mit Mangelernährung oder Risiko für Mangelernährung sollen orale bilanzierte Diäten (Trinknahrung) angeboten werden, um die Energie- und Nährstoffaufnahme zu steigern und das Körpergewicht zu steigern bzw. zu erhalten.

Empfehlungsgrad A

Baldwin C, Kimber KL, Gibbs M et al. Supportive interventions for enhancing dietary intake in malnourished or nutritionally at-risk adults. Cochrane Database Syst Rev 2016. 12:CD009840 [186]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1++	**Countries:** UK **Centers:** Diabetes & Nutritional Sciences Division, School of Medicine, King's College London **Setting:** n/a **Funding Sources:** British Dietetic Association **Dropout rates:** n/a **Study limitations:** The overall quality of evidence ranged between moderate to very low, mainly because for most of the outcomes there was only a small number of studies and participants to achieve reliable information,	**Total no. Studies:** 41 **Inclusion criteria:** Randomized controlled trials of supportive interventions given with the aim of enhancing dietary intake in nutritionally vulnerable adults compared with usual care **Exclusion criteria:** n/a	There were five different interventions ('supportive interventions'): changes to the organization of nutritional care (13 studies, 3456 people), changes to the feeding environment (5 studies, 351 people), modification of the meal profile or pattern (12 studies, 649 people), additional supplementation of meals (10 studies, 6022 people) and home meal delivery systems (1 study, 203 people)

	or because risk of bias made results uncertain.		
Notes	**Author's Conclusion:** There is evidence of moderate to very low quality to suggest that supportive interventions to improve nutritional care results in minimal weight gain. Most of the evidence for the lower risk of all-cause mortality for supportive interventions comes from hospital-based trials and more research is needed to confirm this effect. There is very low-quality evidence regarding adverse effects; therefore whilst some of these interventions are advocated at a national level clinicians should recognize the lack of clear evidence to support their role. This review highlights the importance of assessing patient-important outcomes in future research.		
Outcome measures/results	• **Primary Outcomes:** nutritional intake, health-related quality of life and patient satisfaction, morbidity/ complications • **Secondary Outcomes:** nutritional status, clinical function, hospitalization and institutionalization, adverse effects, death from any cause, economic costs		Forty-one trials (10,681 participants) met the inclusion criteria. Trials were grouped according to similar interventions (changes to organization of nutritional care (N = 13; 3456 participants), changes to the feeding environment (N = 5; 351 participants), modification of meal profile or pattern (N = 12; 649 participants), additional supplementation of meals (N = 10; 6022 participants) and home meal delivery systems (N = 1; 203 participants). Follow-up ranged from 'duration of hospital stay' to 12 months. The overall quality of evidence was moderate to very low, with the majority of trials judged to be at an unclear risk of bias in several risk of bias domains. The risk ratio (RR) for all-cause mortality was 0.78 (95% confidence interval (CI) 0.66 to 0.92); P = 0.004; 12 trials; 6683 participants; moderate-quality evidence. This translates into 26 (95%CI 9 to 41) fewer cases of death per 1000 participants in favor of supportive interventions. The RR for number of participants with any medical complication ranged from 1.42 in favor of control compared with 0.59 in favor of supportive interventions (very low-quality evidence). Only five trials (4451 participants) investigated health-related quality of life showing no substantial differences between intervention and comparator groups. Information on patient satisfaction was unreliable. The effects of supportive interventions versus comparators on hospitalization showed a mean difference (MD) of -0.5 days (95% CI -2.6 to 1.6); P = 0.65; 5 trials; 667 participants; very low-quality evidence. Only three of 41 included trials (4108 participants; very low-quality evidence) reported on adverse events, describing intolerance to the supplement (diarrhea, vomiting; 5/34 participants) and discontinuation of oral nutritional supplements because of refusal or dislike of taste (567/ 2017 participants). Meta-analysis across 17 trials with adequate data on weight change revealed an overall improvement in weight in favor of supportive interventions versus control: MD 0.6 kg (95% CI 0.21 to 1.02); 2024 participants; moderate-quality evidence. A total of 27 trials investigated nutritional intake with a majority of trials not finding marked differences in energy intake between intervention and comparator groups. Only three trials (1152 participants)

		reported some data on economic costs but did not use accepted health economic methods (very low-quality evidence).

Beck AM, Holst M, Rasmussen HH. Oral nutritional support of older (65 years+) medical and surgical patients after discharge from hospital: systematic review and meta-analysis of randomized controlled trials. Clin Rehabil 2013; 27: 19-27. doi:10.1177/0269215512445396 [187]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review and Meta-Analysis 1-	**Countries:** Europe, United States, China, Australia **Centers:** n/a **Setting:** discharge from hospital → rehabilitation care, patients own homes **Funding Sources:** no specific grant from any founding agency in the public, commercial or not-for-profit sectors **Dropout rates:** n/a **Study limitations:** poor quality with regard to blinding, limited number of studies, length of the included studies was relatively short, start intervention at discharge might be too late, high number of re-admission, low level of compliance, patients with single or multiple conditions might make a difference, only English studies included, lack of adequately performed RCTs	**Total no. Studies:** n=6 **Inclusion criteria:** RCTs, minimum duration of intervention 1 week, surgical/medical patients, age ≥65 years, patients being discharged from hospital, dietary supplements **Exclusion criteria:** other language than English, publicized studies older than 5 years, lack of recovery and rehabilitation measures, start of intervention before discharge/unclear start of intervention, additional vitamin D and calcium only	Interventions: 1) standard care (for comparison) 2) Industrial oral nutritional supplements (iONS); home-made milk based supplements, fortification of normal food sources and dietary advice

Notes	• aim: improving the intake of protein and energy(normal oral route) • also observed: Confounding factors (compliance, adverse effects); results were double-checked with trials identified in the Cochrane reviews, Methodological quality was assessed as described in the Cochrane Handbook 1997 (No study passed all the methodological criteria, highest score:17); only one reviewer • Often outcome measurements were not in sufficient detail or format, to be included in a meta-analysis • Except for one study, the participants in the included trials underwent screening and were classified as actually being malnourished or at nutritional risk. **Author's Conclusion:** Although the evidence is limited, we suggest that oral nutritional support may be considered for older malnourished medical and surgical patients after discharge from hospital.	
Outcome measures/results	• Primary Outcomes: Re-admission and mortality • Secondary outcomes: energy and protein intake, Survival, Nutritional and functional status, Quality of life (QoL), morbidity	• all trials: positive effect on nutritional intake (energy) and/or nutritional status (weight) • compliance with nutritional intervention varied between 38% to 67% (compliance reported in only 3 studies); 2 studies side effects of the nutritional intervention were reported (gastrointestinal disturbances) • positive effect on functional outcomes (2 studies) • prevalence of re-admission: 56% in both intervention and control group • no significant effect on mortality (odds ratio 0.80 (95% confidence interval (CI) 0.46 to 1.39)) or re-admissions (odds ratio 1.07 (95% CI 0.71 to 1.61)) • no statistically significant heterogeneity was found

Cawood AL, Elia M, Stratton RJ. Systematic review and meta-analysis of the effects of high protein oral nutritional supplements. Ageing research reviews. 2012;11:278-96. [188]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review and Meta-Analysis 1+	**Countries:** n/a **Centers:** n/a **Setting:** n/a **Funding Sources:** AC, RS employed by Nutricia, Advanced Medical Nutrition **Dropout rates:** n/a **Study limitations:** heterogeneity of the studies (duration, setting,..)	**Total no. Studies:** n=36 **Inclusion criteria:** Studies available as full papers, English language, only RCTs, subjects of any nutritional status, no restrictions on sample size/duration/year of publication/type of comparator/setting, using multi-nutrient high protein ONS of any consistency with at least 20% of energy provided from protein using	Intervention could provide some or the entire daily requirement for energy + could be nutritional complete or incomplete 1) high protein ONS (>20% energy from protein) 2) comparator arm = control or standard ONS

		or comparing with dietary counseling and/or standard diet/ONS, subjects ≥18 years **Exclusion criteria:** animal studies, developing world, pregnancy/lactation, sport studies, dietary counselling only, parental nutrition only, enteral tube feeding, ONS with <2 macronutrients, no macronutrients, <20% energy from protein, language other than English, abstract only, conference proceedings	
Notes	• Studies had intervention and follow up periods ranging from as little as 2 weeks to a maximum of 1 year. The total number of patients studied in a single trial ranged from o 672 patients. High protein ONS had differing energy densities (0.75–3.85 kcal/ml) and the percentage energy from protein ranged from 20–54%. • Populations studied: hip fractures, pressure ulcers, COPD, cancer, gastro-intestinal disease, range of clinical and acute illness • Heterogeneous group → sub group analysis (setting); Confounder noted in statistical analysis **Author's Conclusion:** There are clinical, nutritional and functional benefits resulting from high protein ONS use and the available evidence suggests little suppression of normal food intake, with the ONS being mostly additive to food intake. The systematic review and meta-analysis provides evidence that high protein supplements produce clinical benefits, with economic implications.		
Outcome measures/results	• clinical, health care use: complications, mortality, length of stay, readmission to hospital • functional: strength, QoL, activities of daily living (ADL), mobility • nutritional: intake, weight, appetite, body composition	• positive effects of the (high protein) ONS: ▪ reduced complications (odds ratio (OR) 0.68 (95%CI 0.55–0.83), p < 0.001, 10 RCT, n = 1830) → average of 19% absolute reduction in complications ▪ reduced readmission to hospital (OR 0.59 (95%CI 0.41–0.84), p = 0.004, 2 RCT, n = 546); ONS reduced overall readmission by 30% ▪ improved grip strength (1.76 kg (95%CI 0.36–3.17), p < 0.014, 4 RCT, n = 219) ▪ increased intake of protein and energy (p<0.001) ▪ improvements in weight (p<0.001); Meta-analysis (12RCT) high protein ONS significantly increased weight compared to control (1.7 kg (95% CI 0.8–2.7) p < 0.001, n = 1224, random effects model); duration has an great impact (increasing length → higher improvements through ONS) • inadequate information to compare standard ONS with high protein ONS • none of 15 RCTs reported significant differences in mortality between groups; Meta-analysis showed the same	

		• length of stay: mixed effects (4 of 9 studies showed effects in favor of ONS group); meta-analysis (7 studies)high protein ONS reduced length of stay not sig. (ca. 10% reduction) • ADL mixed results: 5 studies no significant effect, 2 studies improvements in ADL in ONS group; Quality of life: Improvements, some significant in the ONS group; mobility: no sig. difference between groups • Body composition: 6 of 10 studies significant improvements with ONS

Correa-Pérez A, Abraha I, Cherubini A et al. Efficacy of non-pharmacological interventions to treat malnutrition in older persons: A systematic review and meta-analysis. The SENATOR project ONTOP series and MaNuEL knowledge hub project. Ageing Res Rev 2019; 49: 27-48. doi:10.1016/j.arr.2018.10.011 [189]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1+ AMSTAR 2: Critically low quality	**Countries:** France; Germany; the Netherlands; Spain; Italy; United Kingdom; Ireland **Centers:** n/a **Setting:** hospital; nursing homes; community-dwelling older people **Funding Sources:** European Union's H2020 Research; Innovation Program; European Union Seventh Framework Program **Dropout rates:** n/a **Study limitations:** recently published studies might not have been included; large heterogeneity of the included trials; different physiopathology of malnutrition and its progression depending on setting	**Total no. patients**: 2091 **Inclusion criteria:** systematic reviews or meta-analyses; any non-pharmacological intervention to treat malnutrition; aged 65 years and above; risk of malnutrition or malnutrition using following measurements: Mini Nutritional Assessment; Subjective Global Assessment; Malnutrition Universal Screening Tool; Nutritional Risk Screening; Body Mass Index; unintentional weight loss > 5% over the last 3 months or > 10% indefinite of time **Exclusion criteria:** guidelines that did not include a systematic review; observational studies or before-after studies with historical controls; conference proceedings or program abstracts; malnutrition or risk of malnutrition assessed by other measures; patients admitted	Main comparator: usual care Intervention: oral nutritional supplementation (ONS)

	Risk of Bias Moderate Inconsistency Moderate Indirectness High Impreciseness Moderate Publication Bias Low	to intensive care, palliative care, oncology patients, HIV-infected patients; oral nutritional supplements using only individual specific vitamins or other micronutrients	
Notes	**Author's Conclusion:** this overview of studies included in systematic re- views has showed there is little evidence on which non-pharmacological interventions can be used to effectively treat malnutrition in older people. There is a clear need for well-designed RCTs that follow standard criteria for reporting non-pharmacological interventions on relevant outcomes for the treatment of malnutrition in older people		
Outcome measures/results	Outcome: nutritional status; morbidity; functional status; mortality; quality of life		No beneficial effects of ONS treatment, after performing two meta-analyses in body weight changes (six studies), mean difference: 0.59 (95%CI -0.08, 1.96) kg, and in body mass index changes (two studies), mean difference: 0.31 (95%CI -0.17, 0.79) kg/m^2 were found. Neither in MNA scores, muscle strength, activities of daily living, timed Up&Go, quality of life and mortality. Results of other intervention studies (dietary counselling and ONS, ONS combined with exercise, nutrition delivery systems) were inconsistent

Li M, Zhao S, Wu S et al. Effectiveness of Oral Nutritional Supplements on Older People with Anorexia: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. Nutrients 2021; 13: 835. doi:10.3390/nu13030835 [190]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1++ AMSTAR 2: Critically low quality	**Countries:** China **Centers:** n/a **Setting:** n/a **Funding Sources:** special funding for the construction of innovative provinces in Hunan; the long-term care service system for the elderly; China Oceanwide Holding Group Project Fund **Dropout rates:** n/a **Study limitations:** n/a Risk of Bias Moderate Inconsistency Moderate	**Total no. patients**: 1204 **Inclusion criteria:** aged 60 years and above in any setting; with any health conditions; original research paper; RCT or non-randomized studies of the effects of interventions; all studies using ONS regardless of type or dosage **Exclusion criteria:** case report; intervention study; opinion letter; review; systematic review; meta-analysis; Participants with enteral tube feeding or appetite-affecting	Intervention group: treatment that used oral nutritional supplements (ONS) of any kind for at least two days regardless of the state Control group: regular diets with or without placebo

	Indirectness High Impreciseness Moderate Publication Bias Low	disorder; no intervention to treat anorexia of aging	
Notes	**Author's Conclusion:** findings related to pressure sores and diarrhea should be interpreted with caution due to a lack of data; more studies are needed to investigate the impact of ONS in combination with other interventions on anorexia of aging and the overall health of older adults.		
Outcome measures/results	Primary outcome: appetite Secondary outcome: intake; body weight; body mass index; diarrhea; pressure sores; quality of life; total health care cost indices		– ONS had a positive effect on the overall appetite, MD = 0.18, 95% CI (0.03, 0.33), p = 0.02, and consumption, MD = 1.43, 95% CI (0.01, 2.86), p = 0.05; but not significant in terms of other aspects of appetite: hunger, p = 0.73; fullness, p = 0.60; desire to eat, p = 0.80; preoccupation, p = 0.15. – It showed an increase in the overall energy intake, SMD = 0.46, 95% CI (0.29, 0.63), p < 0.001, in protein intake, SMD = 0.59, 95% CI (0.16, 1.02), p = 0.007, and in fat intake, MD = 3.47, 95% CI (1.98, 4.97), p < 0.001, while no positive effect was found on carbohydrates intake, p = 0.06. Significance differences were also found in the body weight, SMD = 0.53, 95% CI (0.41, 0.65), p < 0.001, and body mass index (BMI), MD = 0.53, 95% CI (0.12, 0.95), p = 0.01. Moreover, subgroup analyses were conducted according to the nutrient density with no positive results showed except for the low-density ONS on overall energy intake

Milne AC, Potter J, Vivanti A et al. Protein and energy supplementation in elderly people at risk from malnutrition. Cochrane Database Syst Rev 2009. doi:10.1002/14651858.CD003288.pub3: Cd003288. doi:10.1002/14651858.CD003288.pub3 [191]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1++	**Countries:** Europe, USA, Canada, Australia, Hong Kong **Centers:** n/a **Setting:** variety of settings, most participants (71%, 26 studies) were hospitalized in-patients with acute conditions; others: long-stay/care of elderly, care wards, nursing homes, at home in the community **Funding Sources:** n/a **Dropout rates:** n/a	**Total no. Studies:** n=62 **Inclusion criteria:** RCTs, quasi-randomized CTs, oral protein and energy supplementation, minimum duration ≥2 weeks, age ≥ 65 years, mixed groups of patients (some recovering from cancer, some under clinical care, interventions: normal oral route **Exclusion criteria:** groups recovering from cancer treatment or clinical care, dietary advice alone, specially designed immunomodulatory	Interventions with the aim of improving the intake of protein/Energy: 1) Interventions: ▪ Commercial sip feeds ▪ Milk based supplements ▪ Via the fortification of normal food sources 2) Usual practice (no supplement, alternative supplement with different amount of calories or protein, placebo (low energy drink)

	Study limitations: poor quality of the included trials(blinding, not without placebo), bias: analysis of outcomes on "intention-to-treat bias", often not reported: reasons for losses to follow-up, selective reporting	supplements, supplements with specific amino acids, protein-only supplementation	
Notes	• Duration varied from minimum 10 days to 18 months; minimum duration of intervention 1 week; number of participants varied from 10 to 4023 • Most included trials had poor quality; articles retrieved if there was some doubt about eligibility; all differences in data extraction/methodological quality were resolved by discussion with a third reviewer • Short term outcomes: up to 3 months; medium term outcomes: 3 to 6 months; long term outcomes: over 6 months • Subgroup analysis/investigations of heterogeneity: baseline nutritional status, health status, mean age, amount of kilocalories in supplement, duration of intervention (less than 35 days; 35 days or more); sensitivity Analyses **Author's Conclusion:** Supplementation produces a small but consistent weight gain in older people. Mortality may be reduced in older people who are undernourished. There may also be a beneficial effect on complications which needs to be confirmed. However, this updated review found no evidence of improvement in functional benefit or reduction in length of hospital stay with supplements. Additional data from large-scale multi-center trials are still required. Patients should have a variety of options for increasing intake.		
Outcome measures/results	• Primary Outcomes: ▪ All-cause mortality ▪ Morbidity, number complications ▪ Functional status (cognitive, muscle, mobility, ADL) • Secondary Outcomes ▪ QoL (validated scale) ▪ Length of hospital stay (hospital patients only) ▪ Number of primary care contacts (non-hospital participants only) ▪ Adverse effects of nutritional supplementation ▪ Level of care/support required ▪ Number of hospital/care (re)admissions ▪ Nutritional status (change anthropometry) ▪ Percentage change dietary intake ▪ Compliance with intervention ▪ Economic outcomes	• Nutritional status: ▪ Weight mean difference (WMD) for percentage weight change: benefit of supplementation 2.2% (95% CI 1.8 to2.5; 42 trails) ▪ AMC: benefit of supplementation of 1.2% ▪ Intake: different results or not clear in the studies • Mortality: No significant reduction in mortality between groups (RR 0.92, CI 0.81 to 1.04; 42 trails); Mortality results significant: limited to trails in which participants (N=2461) were defined as undernourished (RR 0.79, 95% CI 0.64 to 0.97); post-hoc subgroup analyses for mortality: statistically significant within patients with geriatric conditions most in hospital (n=2701, RR 0.78; 95%CI 0.62 to 0.98); no benefit within hip fracture. • Risk of complications was reduced (RR 0.86, 95% CI 0.75 to 0.99; 24 trails); risk of developing pressure ulcer in control group increased vs. intervention group (n=672, RR 0.57, 95%CI 1.03 to 2.38) • Functional benefit from supplementations (few trails); no evidence of improvement in cognitive function between groups

		• QoL: some studies reported improvements in the intervention group vs control group • length of hospital stay: no benefit from supplementation • Adverse effects: nausea or diarrhea, vomiting, fatigue, loss of appetite → gastro-intestinal discomfort → often lead to drop-out • Compliance: varied in the studies; often reported "taste-problems" • No reduction in health care costs with supplementation

Stratton RJ, Hebuterne X, Elia M. A systematic review and meta-analysis of the impact of oral nutritional supplements on hospital readmissions. Ageing Res Rev 2013; 12: 884-897. doi:10.1016/j.arr.2013.07.002 [192]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review and Meta-analysis 1+	**Countries:** n/a **Centers:** n/a **Setting:** n/a **Funding Sources:** first author is employed by Nutricia Ltd. **Dropout rates:** n/a **Study limitations:** Most studies involved recruitment of patients who had been hospitalised, mainly for acute illness, often with pre-existing chronic conditions; all participants were above 65 years old;	**Total no. studies**: 9 **Inclusion criteria:** adults with a mean age ≥18 years; in the community; all studies using ONS; randomised controlled trials; outcomes: hospital admissions, including readmissions **Exclusion criteria:** animal studies; developing world; pregnancy and lactation; individuals in sports studies; studies in healthy adults; individuals in metabolic studies; dietary counselling only; enteral tube feeding; supplements containing only one macronutrient; micronutrient-only supplements; ONS vs. ONS studies; ONS with elemental formulations; all non-RCT study designs	n/a
Notes	**Author's Conclusion:** This systematic review shows that ONS significantly reduce hospital (re)admissions, particularly in older patient groups, with economic implications for health care.		

Outcome measures/results	- Hospital admissions, including readmissions	- Meta-analysis of 6 RCT (N = 852) with data on the proportion of patients (re)admitted to hospital showed significant reductions with ONS vs. routine care (OR 0.59, 95% CI 0.43–0.80, P = 0.001)

Thomson KH, Rice S, Arisa O et al. Effectiveness and cost-effectiveness of oral nutritional supplements in frail older people who are malnourished or at risk of malnutrition: a systematic review and meta-analysis. Lancet Healthy Longev 2022; 3: e654-e666. doi:10.1016/s2666-7568(22)00171-4 [193]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1++ AMSTAR 2: Critically low quality	**Countries:** United Kingdom **Centers:** n/a **Setting:** n/a **Funding Sources:** UK National Institute of Health and Care Research; Health Technology Assessment **Dropout rates:** n/a **Study limitations:** small evidence; only studies in English Risk of Bias Moderate Inconsistency Moderate Indirectness High Impreciseness Moderate Publication Bias Low	**Total no. patients**: 822 **Inclusion criteria:** aged 65 years and above in any settings; able to swallow, malnourished or at risk of malnutrition, and considered to be frail; parallel-arm, cross-over; cluster-RCTs; prospective, comparative non-RCTs; English language **Exclusion criteria:** ONS was not assessed as an individual trial arm	Intervention: comprised any form of prescribable oral nutritional supplements (ONS), with or without dietary advice or counselling Any comparator
Notes	**Author's Conclusion:** we found little evidence of ONS reducing malnutrition or its associated adverse outcomes in older people who are frail. High-quality, non-industry-funded, adequately powered studies reporting on short-term and long-term health outcomes, determinants, and participant characteristics are needed.		
Outcome measures/results	Outcome: associated with malnutrition; functional status; change in frailty status; quality of life; mortality; morbidity; adverse events; barriers and facilitators to the use of ONS; treatment persistence; adherence; acceptance; the role of carers in delivering the intervention; cost-effectiveness	Meta-analysis indicated ONS might have a slightly positive effect on energy (kcal) intake (standardized mean difference 1·02 [95% CI 0·15 to 1·88]; I2=87%; four studies), protein intake (standardized mean difference 1·67 [–0·03 to 3·37; I2=97%; four studies), and mobility (mean difference 0·03 [0·02 to 0·04]; I2=0%; four studies), compared with standard care. The evidence was of very low certainty	

Empfehlung 30

Auch nach der Entlassung aus dem Krankenhaus sollten älteren Personen mit Mangelernährung oder Risiko für Mangelernährung orale bilanzierte Diäten (Trinknahrung) angeboten werden, um die Nahrungsaufnahme und den Ernährungszustand zu verbessern und das Risiko für funktionellen Abbau und Mortalität zu reduzieren.

Empfehlungsgrad B

Beck AM, Holst M, Rasmussen HH. Oral nutritional support of older (65 years+) medical and surgical patients after discharge from hospital: systematic review and meta-analysis of randomized controlled trials. Clin Rehabil 2013; 27: 19-27. doi:10.1177/0269215512445396 [187]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review and Meta-Analysis 1-	**Countries:** Europe, United States, China, Australia **Centers:** n/a **Setting:** discharge from hospital → rehabilitation care, patients own homes **Funding Sources:** no specific grant from any founding agency in the public, commercial or not-for-profit sectors **Dropout rates:** n/a **Study limitations:** poor quality with regard to blinding, limited number of studies, length of the included studies was relatively short, start intervention at discharge might be too late, high number of re-admission, low level of compliance, patients with single or multiple conditions might make a	**Total no. Studies:** n=6 **Inclusion criteria:** RCTs, minimum duration of intervention 1 week, surgical/medical patients, age ≥65 years, patients being discharged from hospital, dietary supplements **Exclusion criteria:** other language than English, publicized studies older than 5 years, lack of recovery and rehabilitation measures, start of intervention before discharge/unclear start of intervention, additional vitamin D and calcium only	Interventions: 1) standard care (for comparison) 2) Industrial oral nutritional supplements (iONS); home-made milk based supplements, fortification of normal food sources and dietary advice

	difference, only English studies included, lack of adequately performed RCTs		
Notes	• aim: improving the intake of protein and energy(normal oral route) • also observed: Confounding factors (compliance, adverse effects); results were double-checked with trials identified in the Cochrane reviews, Methodological quality was assessed as described in the Cochrane Handbook 1997 (No study passed all the methodological criteria, highest score:17); only one reviewer • Often outcome measurements were not in sufficient detail or format, to be included in a meta-analysis • Except for one study, the participants in the included trials underwent screening and were classified as actually being malnourished or at nutritional risk. **Author's Conclusion:** Although the evidence is limited, we suggest that oral nutritional support may be considered for older malnourished medical and surgical patients after discharge from hospital.		
Outcome measures/results	• Primary Outcomes: Re-admission and mortality • Secondary outcomes: energy and protein intake, Survival, Nutritional and functional status, Quality of life (QoL), morbidity		• all trials: positive effect on nutritional intake (energy) and/or nutritional status (weight) • compliance with nutritional intervention varied between 38% to 67% (compliance reported in only 3 studies); 2 studies side effects of the nutritional intervention were reported (gastrointestinal disturbances) • positive effect on functional outcomes (2 studies) • prevalence of re-admission: 56% in both intervention and control group • no significant effect on mortality (odds ratio 0.80 (95% confidence interval (CI) 0.46 to 1.39)) or re-admissions (odds ratio 1.07 (95% CI 0.71 to 1.61)) • no statistically significant heterogeneity was found

Deutz NE, Matheson EM, Matarese LE et al. Readmission and mortality in malnourished, older, hospitalized adults treated with a specialized oral nutritional supplement: a randomized clinical trial. Clin Nutr 2016; 35: 18-26 [194]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Multicenter, randomized, placebo-controlled, double-blind trial 1++	**Countries:** USA **Centers:** n/a **Setting:** n/a **Funding Sources:** Abbott Nutrition **Dropout rates:** 4.9 % **Study limitations:** Limited generalizability; patients	**Total no. patients:** n = 652 **Inclusion criteria:** aged ≥ 65 years with a recent hospital admission (within 72 h) with a primary diagnosis of congestive heart failure, acute myocardial infarction, pneumonia, or chronic obstructive pulmonary disease. Patients were	Evaluation of a high-protein oral nutritional supplement (HP-HMB) containing beta-hydroxybeta- methylbutyrate on post discharge outcomes of non-elective readmission and mortality in malnourished, hospitalized older adults. Standard-of-care plus HP-HMB (n = 328) or a placebo supplement (n = 324), 2 servings/day.

	represent a selected hospitalized population. Risk of Bias Moderate Inconsistency n/a Indirectness High Impreciseness Moderate Publication Bias n/a	required to have a Subjective Global Assessment (SGA) class of B (moderate or suspected malnutrition) or C (severe malnutrition) **Exclusion criteria:** diabetes mellitus (type 1 or 2) due to product composition not intended for patients with diabetes mellitus; current active or treated cancer, and impaired renal or liver function	
Notes	**Author's Conclusion:** Although no effects were observed for the primary composite endpoint, compared with placebo HP-HMB decreased mortality and improved indices of nutritional status during the 90-day observation period.		
Outcome measures/results	**primary outcome measure:** 90-day post discharge incidence of death or non-elective readmission **secondary outcome measure:** 30- and 60-day post discharge incidence of death or readmission, length of stay (LOS), SGA class, body weight, and activities of daily living (ADL)	The primary composite endpoint was similar between HP-HMB (26.8%) and placebo (31.1%). No between-group differences were observed for 90-day readmission rate, but 90-day mortality was significantly lower with HP-HMB relative to placebo (4.8% vs. 9.7%; relative risk 0.49, 95% confidence interval [CI], 0.27 to 0.90; p = 0.018). The number-needed-to-treat to prevent 1 death was 20.3 (95% CI: 10.9, 121.4). Compared with placebo, HP-HMB resulted in improved odds of better nutritional status (SGA class, OR, 2.04, 95% CI: 1.28, 3.25, p = 0.009) at day 90, and an increase in body weight at day 30 (p = 0.035). LOS and ADL were similar between treatments.	

Loman BR, Luo M, Baggs GE et al. Specialized High-Protein Oral Nutrition Supplement Improves Home Nutrient Intake of Malnourished Older Adults Without Decreasing Usual Food Intake. JPEN J Parenter Enteral Nutr 2019; 43: 794-802. doi:10.1002/jpen.1467 [195]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Cohort study 2- NOS 9/9	**Countries:** USA **Centers:** n/a **Setting:** n/a **Funding Sources: t**his study was funded by Abbott Nutrition **Dropout rates:** n/a **Study limitations:** sample size	**Total no. Patients:** 30 **Inclusion criteria**: from NOURISH study: patients hospitalized with CHF, AMI, pneumonia or COPD; functionally independent at the study admission, malnourished patients with a Subjective Global Assessment (SGA) class of B (moderate or suspected	- data for this analysis were derived from the NOURISH (Nutrition effect On Unplanned Readmissions and Survival in Hospitalized patients) study cohort - 14 S-ONS and 16 placebo - patients who were randomized to the S-ONS group (n=14) received standard of care and a specialized, nutrient-dense, high-protein, ready-to-drink supplement 2 servings per day during hospitalization and up to 90 days after discharge - patients in the placebo group (n=16) received standard of care and a ready-to-drink liquid

	Risk of Bias Moderate Inconsistency n/a Indirectness High Impreciseness Moderate Publication Bias n/a	malnutrition) or C (severe malnutrition) **Exclusion criteria:** specialized High-Protein Oral Nutrition Supplement Improves Home Nutrient Intake of Malnourished Older Adults Without Decreasing Usual Food Intake	
Notes	**Author's Conclusion:** S-ONS intake increases oral nutrient intake to help meet most nutrient requirements without decreasing nutrient intake from food in malnourished clinical populations		
Outcome measures/results	Primary outcome: nutrient intake from food alone, nutrient intake from food and ONSs Secondary outcome: Relationship Between Patient Supplement Consumption and Number of DRIs Met		Three months of S-ONS consumption increases intake of numerous nutrients without decreasing nutrient intake from food in older malnourished adults post discharge.

McMurdo ME, Price RJ, Shields M et al. Should oral nutritional supplementation be given to undernourished older people upon hospital discharge? A controlled trial. J Am Geriatr Soc 2009; 57: 2239-2245 [196]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+	**Countries:** Scotland, UK **Centers:** Tayside (Ninewells Hospital, Medicine for the Elderly wards at Royal Victoria Hospital, Dundee) and Glasgow (Glasgow Royal Infirmary Ligthburn Hospital and Stobhill Hospital) **Setting:** Community-based study **Funding Sources:** Health Services Research Committee, Chief Scientist Office, Department of Health, Scotland; Fresenius Kabi Ltd. Donated ONS and	**Total no. Patients:** n=253 **Inclusion criteria:** community-dwelling, ≥70 years, admitted to hospital with an acute illness, BMI<24 kg/m², mid-arm muscle circumference below 10th centile or weight loss of 5% or more during the hospital stay **Exclusion criteria:** Barthel score>18, chronic liver disease, renal failure (serum creatinine >3.39 mg/dL), residence in a care home, cognitive impairment precluding informed consent, dysphagia, metastatic carcinoma or other terminal illness, acute inflammatory arthritis, stroke	1) Oral nutritional supplementation (600 kcal/d); IG; n=126 2) Control supplement (200 kcal/d); CG; n=127 →16 weeks

	the control group supplement at no cost **Dropout rates:** 24.51% (n=62) **Study limitations:** both groups received additional calories, poor adherence	affecting both hands, major surgery within preceding month	
Notes	• Mean age: 82 years • Blinded: both preparations were packaged in identical 200 mL plain white rectangular cartons and labeled using one of two randomization codes **Author's Conclusion:** Oral nutritional supplementation of undernourished older people upon hospital discharge did not reduce disability, despite improving handgrip strength and modestly increasing objectively measured physical activity levels. Lack of an effect of the nutritional supplement used in this study may have been due to low adherence, suggesting that different approaches to nutritional supplementation need to be tested in this population.		
Outcome measures/results	• Primary outcome: 20-point activity of daily living Barthel Index • Secondary outcomes: ▪ handgrip strength (muscle function) ▪ sit-to-stand test ▪ Euroquol (health-related Quality of Life) ▪ Body weight, BMI ▪ Physical activity ▪ Dietary intake: 3-day dietary record at baseline and during second half of the study ➔ Measurements at baseline (after discharge from hospital and before supplement was commenced) and 8 and 16 weeks ➔ Accelerometry-measured physical activity levels at baseline and 16 weeks ➔ Falls were recorded prospectively		• Similar baseline characteristics in each group, except for sex (higher proportion of females in IG) • no significant changes in Barthel score between IG and CG (adjusted mean difference = 0.28, 95% CI -0.28-0.84) • body weight increase in IG of 1.6 ± 4.2 kg and 0.8 ± 3.42 kg in CG; difference not significant; after adjusting for adherence to the supplement: mean difference 1.17 kg, 95% CI 0.07-2.27, p=0.04) • handgrip strength improved more in IG (adjusted mean difference= 1.48 kg, 95% CI 0.46-2.50; p=0.005) • IG exhibited modestly greater vector movement (overall activity) than CG (p=0.02) • No significant between-group differences in Sit-to-Stand test but showing a trend toward improvement in IG (mean change of -2.1 ±13.5 seconds vs. CG 0.6 ± 12,3 seconds, p=0.08) at 16 weeks • No significant between-group differences in health-related quality of life or falls • Adherence to nutritional supplement was 38.2% in IG and 50.0% in CG • Weight did not increase in IG as a whole; on treatment analysis adjusting for adherence → mean weight gain of 1.17 kg (95% CI 0.07-2.27, p=0.04) in IG than in CG • Accelerometry: (unadjusted) greater percentage change in vector movement in IG (2.87 ±4.40) vs. CG 0.93 ± 4.10, p=0.01); after correcting for sex: significantly more vector movement in IG than in CG (p=0.02); no between-group differences in time spent walking

		• Dietary intake: 23% (n=57) completed both of the 3-day dietary records; in this subgroup baseline mean energy intake was higher in CG (1573 kcal/d vs. 1365 kcal/d IG) and remained higher during second half (CG 1.643 kcal/d vs. 1439 kcal/d IG; p=0.04)

Neelemaat F, Bosmans JE, Thijs A et al. Post-discharge nutritional support in malnourished elderly individuals improves functional limitations. J Am Med Dir Assoc 2011; 12: 295-301 [197]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1++	**Countries:** Netherlands **Centers:** University Medical Center, Amsterdam **Setting:** n/a **Funding Sources:** The Netherlands Organisation for Health Research and Development (ZonMw) **Dropout rates:** 31.9 % **Study limitations:** a follow-up of only 3 months	**Total no. patients:** n = 210 **Inclusion criteria:** malnourished according to the following criteria: (1) Body Mass Index (BMI in kg/m^2) < 20 and/or (2) >5% unintentional weight loss in the previous month and/or (3) >10% unintentional weight loss in the previous six months. **Exclusion criteria:** Patients, who suffered from senile dementia, could not understand the Dutch language or were not able to or willing to give informed consent.	Hospital-admitted malnourished elderly patients ($60 years) were randomized to receive either nutritional supplementation (energy and protein enriched diet, oral nutritional support, calcium, vitamin D supplement, telephone counseling by a dietitian) for 3 months post discharge or usual care.
Notes	**Author's Conclusion:** Three months of oral nutritional support to malnourished elderly decreased functional limitations and increased body weight. It can be questioned if a follow-up of only 3 months was not too short to detect differences on physical performance and physical activities as well.		
Outcome measures/results	**primary outcome measure:** functional limitations, physical performance, physical activities, body weight, fat free mass, and handgrip strength		Body weight increased more in the intervention group than in the control group; this was significant for the highest body weight category (mean difference 3.4 kg, 95% CI 0.2–6.6). Functional limitations decreased more (mean difference –0.5 (95% CI –1.0–0.1) in the intervention group than in the control group. When excluding patients who had already received nutritional support before the start of the study, this reached significance. No significant differences could be demonstrated for physical performance, physical activities, fat-free mass, or handgrip strength.

Neelemaat F, Bosmans JE, Thijs A et al. Oral nutritional support in malnourished elderly decreases functional limitations with no extra costs. Clin Nutr 2012; 31: 183-190 [198]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+	**Countries:** Netherlands **Centers:** n/a **Setting:** From hospital admission until 3 months after discharge. **Funding Sources:** The Netherlands Organisation for Health Research and Development (ZonMw) **Dropout rates:** 28.57% **Study limitations:** • The follow-up period was three months only • The study was powered to detect differences in functionality, but underpowered to detect cost differences	**Total no. Patients:** 210 **Inclusion criteria:** hospital admitted malnourished (BMI ≤20 and/ or ≥5% unintentional weight loss in the previous month and/ or ≥10% unintentional weight loss in the previous six months) elderly (≥ 60 y) patients **Exclusion criteria:** Patients were excluded when they suffered from senile dementia, could not understand the Dutch language or were not able or willing to give informed consent.	Intervention group: Patients in the intervention group received nutritional supplementation (energy and protein enriched diet, oral nutritional support, calcium-vitamin D supplement, telephone counselling by a dietician) until three months after discharge from hospital. Control group: Patients in the control group received usual care (control).
Notes	**Author's Conclusion:** A multi-component nutritional intervention to malnourished elderly patients for three months after hospital discharge leads to significant improvement in functional limitations and is neutral in costs. A follow-up of three months is probably too short to detect changes in QALYs or physical activities.		
Outcome measures/results	• Primary outcomes : Quality Adjusted Life Years (QALYs) • Secondary outcomes: physical activities and functional limitations.		210 patients were included, 105 in each group. After three months, no statistically significant differences in quality of life and physical activities were observed between groups. Functional limitations decreased significantly more in the intervention group (mean difference -0.72, 95% CI-1.15; -0.28). There were no differences in costs between groups. Cost-effectiveness for QALYs and physical activities could not be demonstrated. For functional limitations we found a 0.95 probability that the intervention is cost-effective in comparison with usual care for ceiling ratios > €6500.

Persson M, Hytter-Landahl Å, Brismar K, et al. Nutritional supplementation and dietary advice in geriatric patients at risk of malnutrition. Clinical nutrition. 2007; 2: 216-224. [199]			
Study Type/	**Study details/limitations**	**Patient characteristics**	**Interventions**

Evidence Level			
Intervention study 1+	**Countries:** Sweden **Centers:** Department of Geriatric Medicine at Rosenlund Hospital, Stockholm **Setting:** n/a **Funding Sources:** financial support from The Swedish Research Council (04224), Karolinska Institutet and by grants from S. Persson Family Foundation (18:35) and Sempers Foods AB. **Dropout rates:** 50 % **Study limitations:** high dropout rate due to advanced age, multiorgan disease and cognitive dysfunction, lack of placebo treatment to the control group	**Total no. patients:** n = 108 **Inclusion criteria:** not described in detail (one ward mainly treated elderly adults after trauma with or without fracture; the other ward mainly took care of acutely ill elderly patients with various somatic disorders) **Exclusion criteria:** not described	Effects of combined nutritional treatment of patients at risk of protein-energy malnutrition (PEM) discharged from a geriatric service were evaluated. Patients (n = 108, age 85±6 years) at risk of malnutrition according to the short form of the mini nutritional assessment were randomly allocated to dietary counseling, including liquid and multivitamin supplementation, i.e. intervention (I, n = 51) and to controls (C, n = 57).
Notes	**Author's Conclusion:** Combined nutritional intervention prevented weight loss and improved ADL functions in discharged geriatric patients at risk of malnutrition.		
Outcome measures/results	**primary outcome measure:** Body weight, biochemical indices (e.g. insulin-like growth factor I (IGF-I)), Katz activities of daily living (ADL) index, mini mental status examination (MMSE) and quality of life (QoL) by SF-36		Fifty-four patients, 29 in the I-group (86±7 years, 66% females) and 25 in the C-group (85±7 years, 72% females) completed the study according to the protocol. Both modes of analysis revealed a significant positive effect of the combined nutritional intervention on weight maintenance. Treated-as-protocol analyses showed that Katz ADL index improved in the I-group ($p<0.001$; $p<0.05$ between the groups). Serum IGF-I levels increased in the I-group ($p<0.001$), but were unchanged in the C-group ($p = 0.07$ between the groups). QoL was assessed to be low and had not changed after nutritional treatment.

Woo J, Ho S, Mak Y et al. Nutritional status of elderly patients during recovery from chest infection and the role of nutritional supplementation assessed by a prospective randomized single-blind trial. Age Ageing 1994; 23: 40-48 [200]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+	**Countries:** China, Hong Kong **Centers:** n/a **Setting:** after discharge from hospital **Funding Sources:** Sandoz Foundation for Gerontological Research, Earmarked Grant for Research from the University and Polytechnic Grant Committee, Hong Kong **Dropout rates:** n/a **Study limitations:** Screening tools may not be sensitive enough, no examination of the effect of ONS on short-term mortality (number of patients who died was too small within 6 months), low number of subjects (statistical significance), no uniform scales for assessment of well-being in the elderly, no dietary intake data before illness and during hospital stay for comparison	**Total no. Patients:** n=81 **Inclusion criteria:** ≥65 years, chest infection, admitted to an acute medical ward **Exclusion criteria:** chronic disabled, demented patients, heart failure, renal/hepatic failure, stroke, malignancies, bedridden subjects who could not feed themselves	Nutritional supplementation 1) Supplement : 500 ml of Ensure liquid daily for 1 month after discharge (Intervention group, IG; n=40) 2) No supplement on discharge (Control group, CG; n=41)
Notes	• Patients recruited from only general district hospital serving one of the five geographical regions in Hong Kong • Patients were diagnosed to be suffering from chest infection if they had purulent sputum + increasing shortness of breath, pyrexia, elevated while cell count, with or without radiological changes on chest radiography • Compliance was checked during routine follow-up visits		

	• All assessments except for dietary assessment were performed by an investigator blinded to the randomized grouping • Anthropometric indices were analyzed in men and women separately **Author's Conclusion:** Various measures of well-being and biochemical status of the water-soluble vitamins were better in the supplement group. We conclude that nutritional supplementation may have a role in helping elderly patients to recover from chest infections.	
Outcome measures/results	• Questionnaire ▪ Health status ▪ Mental status: part of the Clifton Assessment Procedure for the Elderly; Geriatric Depression Scale ▪ Functional status; Barthel index ▪ Well-being: questions on appetite, sleep problems, self-rated health, physical activity, number of days due to illness during past month, number of visits to doctors, number of times admitted to hospital, duration of stay in hospital, participation in household tasks, community activities, physical exercise, smoking, alcohol intake, life satisfaction • Anthropometric measurements ▪ Height, weight, BMI ▪ Mid-arm circumference ▪ Biceps/triceps skinfold thickness ▪ Total body fat (TBF), fat-free mass (FFM) according to Durnin and Womersley ➔ Assessments at baseline, 1, 2, 3 months • Biochemical nutritional status: blood test ▪ Complete blood picture: renal/liver function, total protein, albumin, prealbumin, thiamine, riboflavin, pyridoxine, plasma retinol, folic/ascorbic acids ➔ Assessment at baseline, 1 and 3 months • Dietary intake (24 h recall) ➔ Assessment at 1 and 3 months	• No difference between groups at baseline • During 3 months recovery period patients in IG and CG reported improvement in appetite, life satisfaction, mental test score • During 2nd visit IG reported increased physical activity and during 3rd visit these subjects also reported fewer problems with sleeping ($p<0.05$) • 3rd visit functional ability of IG was better compared to CG • Both groups showed improvements in anthropometric indices during 3-month period; IG: improvements in more indices • CG only BMI and FFM showed improvements and the magnitude of increase was less than in IG (BMI 1.25 vs. 0.45; FFM 1.34 vs. 0.66; $p>0.05$) • Changes in women were less marked; only increase in TBF was observed in both groups, without difference between the groups • Baseline patients had lower plasma total protein, albumin, prealbumin, retinol compared with values for healthy elderly living in the community • During 3 months after discharge IG and CG showed a rise in serum albumin, prealbumin, retinol, folic/ascorbic acids; IG also improved transketolase and aspartate transaminase status, had better glutathione reductase, folate and ascorbate status at 1 months compared with CG • Difference in folate continued to be observed at 3 months • Supplement was effective in providing extra calories, vitamins, minerals • During recovery IG and CG showed improvements in various measures of well- being and biochemical status • CG showed a lower level of functional ability after 3 months

Empfehlung 31

Angebotene orale bilanzierte Diäten (Trinknahrung) für ältere Personen mit Mangelernährung oder Risiko für Mangelernährung sollen individuell verordnet werden, jedoch täglich mindestens 300 kcal enthalten und proteinreich (≥20 % der Energie) sein.

Empfehlungsgrad B

<table>
<tr><th colspan="4">Cawood AL, Elia M, Stratton RJ. Systematic review and meta-analysis of the effects of high protein oral nutritional supplements. Ageing research reviews. 2012;11:278-96. [188]</th></tr>
<tr><th>Study Type/ Evidence Level</th><th>Study details/limitations</th><th>Patient characteristics</th><th>Interventions</th></tr>
<tr><td>Systematic Review and Meta-Analysis
1+</td><td>Countries: n/a
Centers: n/a
Setting: n/a
Funding Sources: AC, RS employed by Nutricia, Advanced Medical Nutrition
Dropout rates: n/a
Study limitations: heterogeneity of the studies (duration, setting,..)</td><td rowspan="2">Total no. Studies: n=36
Inclusion criteria: Studies available as full papers, English language, only RCTs, subjects of any nutritional status, no restrictions on sample size/duration/year of publication/type of comparator/setting, using multi-nutrient high protein ONS of any consistency with at least 20% of energy provided from protein using or comparing with dietary counseling and/or standard diet/ONS, subjects ≥18 years
Exclusion criteria: animal studies, developing world, pregnancy/lactation, sport studies, dietary counselling only, parental nutrition only, enteral tube feeding, ONS with <2 macronutrients, no macronutrients, <20% energy from protein, language other than English, abstract only, conference proceedings</td><td>Intervention could provide some or the entire daily requirement for energy + could be nutritional complete or incomplete
3) high protein ONS (>20% energy from protein)
4) comparator arm = control or standard ONS</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>

Notes	• Studies had intervention and follow up periods ranging from as little as 2 weeks to a maximum of 1 year. The total number of patients studied in a single trial ranged from o 672 patients. High protein ONS had differing energy densities (0.75–3.85 kcal/ml) and the percentage energy from protein ranged from 20–54%. • Populations studied: hip fractures, pressure ulcers, COPD, cancer, gastro-intestinal disease, range of clinical and acute illness • Heterogeneous group → sub group analysis (setting); Confounder noted in statistical analysis **Author's Conclusion:** There are clinical, nutritional and functional benefits resulting from high protein ONS use and the available evidence suggests little suppression of normal food intake, with the ONS being mostly additive to food intake. The systematic review and meta-analysis provides evidence that high protein supplements produce clinical benefits, with economic implications.	
Outcome measures/results	• clinical, health care use: complications, mortality, length of stay, readmission to hospital • functional: strength, QoL, activities of daily living (ADL), mobility • nutritional: intake, weight, appetite, body composition	• positive effects of the (high protein) ONS: ▪ reduced complications (odds ratio (OR) 0.68 (95%CI 0.55–0.83), $p < 0.001$, 10 RCT, n = 1830) → average of 19% absolute reduction in complications ▪ reduced readmission to hospital (OR 0.59 (95%CI 0.41–0.84), $p = 0.004$, 2 RCT, n = 546); ONS reduced overall readmission by 30% ▪ improved grip strength (1.76 kg (95%CI 0.36–3.17), $p < 0.014$, 4 RCT, n = 219) ▪ increased intake of protein and energy ($p<0.001$) ▪ improvements in weight ($p<0.001$); Meta-analysis (12RCT) high protein ONS significantly increased weight compared to control (1.7 kg (95% CI 0.8–2.7) $p < 0.001$, n = 1224, random effects model); duration has an great impact (increasing length → higher improvements through ONS) • inadequate information to compare standard ONS with high protein ONS • none of 15 RCTs reported significant differences in mortality between groups; Meta-analysis showed the same • length of stay: mixed effects (4 of 9 studies showed effects in favor of ONS group); meta-analysis (7 studies)high protein ONS reduced length of stay not sig. (ca. 10% reduction) • ADL mixed results: 5 studies no significant effect, 2 studies improvements in ADL in ONS group; Quality of life: Improvements, some significant in the ONS group; mobility: no sig. difference between groups • Body composition: 6 of 10 studies significant improvements with ONS

<table>
<tr><th colspan="4">Milne AC, Potter J, Vivanti A et al. Protein and energy supplementation in elderly people at risk from malnutrition. Cochrane Database Syst Rev 2009. doi:10.1002/14651858.CD003288.pub3: Cd003288. doi:10.1002/14651858.CD003288.pub3 [191]</th></tr>
<tr><th>Study Type/ Evidence Level</th><th>Study details/limitations</th><th>Patient characteristics</th><th>Interventions</th></tr>
<tr><td>Systematic Review
1++</td><td>Countries: Europe, USA, Canada, Australia, Hong Kong
Centers: n/a
Setting: variety of settings, most participants (71%, 26 studies) were hospitalized in-patients with acute conditions; others: long-stay/care of elderly, care wards, nursing homes, at home in the community
Funding Sources: n/a
Dropout rates: n/a
Study limitations: poor quality of the included trials(blinding, not without placebo), bias: analysis of outcomes on “intention-to-treat bias”, often not reported: reasons for losses to follow-up, selective reporting</td><td>Total no. Studies: n=62
Inclusion criteria: RCTs, quasi-randomized CTs, oral protein and energy supplementation, minimum duration ≥2 weeks, age ≥ 65 years, mixed groups of patients (some recovering from cancer, some under clinical care, interventions: normal oral route
Exclusion criteria: groups recovering from cancer treatment or clinical care, dietary advice alone, specially designed immunomodulatory supplements, supplements with specific amino acids, protein-only supplementation</td><td>Interventions with the aim of improving the intake of protein/Energy:
3) Interventions:
▪ Commercial sip feeds
▪ Milk based supplements
▪ Via the fortification of normal food sources
4) Usual practice (no supplement, alternative supplement with different amount of calories or protein, placebo (low energy drink)</td></tr>
<tr><td>Notes</td><td colspan="3">• Duration varied from minimum 10 days to 18 months; minimum duration of intervention 1 week; number of participants varied from 10 to 4023
• Most included trials had poor quality; articles retrieved if there was some doubt about eligibility; all differences in data extraction/methodological quality were resolved by discussion with a third reviewer
• Short term outcomes: up to 3 months; medium term outcomes: 3 to 6 months; long term outcomes: over 6 months
• Subgroup analysis/investigations of heterogeneity: baseline nutritional status, health status, mean age, amount of kilocalories in supplement, duration of intervention (less than 35 days; 35 days or more); sensitivity Analyses
Author’s Conclusion: Supplementation produces a small but consistent weight gain in older people. Mortality may be reduced in older people who are undernourished. There may also be a beneficial effect on complications which needs to be confirmed. However, this updated review found no evidence of improvement in functional benefit or reduction in length of hospital stay with supplements. Additional data from large-scale multi-center trials are still required. Patients should have a variety of options for increasing intake.</td></tr>
</table>

Outcome measures/results	• Primary Outcomes: ▪ All-cause mortality ▪ Morbidity, number complications ▪ Functional status (cognitive, muscle, mobility, ADL) • Secondary Outcomes ▪ QoL (validated scale) ▪ Length of hospital stay (hospital patients only) ▪ Number of primary care contacts (non-hospital participants only) ▪ Adverse effects of nutritional supplementation ▪ Level of care/support required ▪ Number of hospital/care (re)admissions ▪ Nutritional status (change anthropometry) ▪ Percentage change dietary intake ▪ Compliance with intervention ▪ Economic outcomes	• Nutritional status: ▪ Weight mean difference (WMD) for percentage weight change: benefit of supplementation 2.2% (95% CI 1.8 to2.5; 42 trails) ▪ AMC: benefit of supplementation of 1.2% ▪ Intake: different results or not clear in the studies • Mortality: No significant reduction in mortality between groups (RR 0.92, CI 0.81 to 1.04; 42 trails); Mortality results significant: limited to trails in which participants (N=2461) were defined as undernourished (RR 0.79, 95% CI 0.64 to 0.97); post-hoc subgroup analyses for mortality: statistically significant within patients with geriatric conditions most in hospital (n=2701, RR 0.78; 95%CI 0.62 to 0.98); no benefit within hip fracture. • Risk of complications was reduced (RR 0.86, 95% CI 0.75 to 0.99; 24 trails); risk of developing pressure ulcer in control group increased vs. intervention group (n=672, RR 0.57, 95%CI 1.03 to 2.38) • Functional benefit from supplementations (few trails); no evidence of improvement in cognitive function between groups • QoL: some studies reported improvements in the intervention group vs control group • length of hospital stay: no benefit from supplementation • Adverse effects: nausea or diarrhea, vomiting, fatigue, loss of appetite → gastro-intestinal discomfort → often lead to drop-out • Compliance: varied in the studies; often reported “taste-problems” • No reduction in health care costs with supplementation

Schuetz P, Fehr R, Baechli V et al. Individualised nutritional support in medical inpatients at nutritional risk: a randomised clinical trial. Lancet 2019; 393: 2312-2321. doi:10.1016/s0140-6736(18)32776-4 [146]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+ ROB 2: low risk of bias	**Countries:** Switzerland **Centers:** University Clinic in Aarau, the University Hospital in Bern, the Cantonal hospitals in Lucerne, Solothurn, St Gallen,	**Total no. Patients:** 2088 **Inclusion criteria:** at least 18 years at nutritional risk of 3 or greater expected to stay in hospital for more than 4 days if they were willing to provide informed consent	Patients were randomly assigned (1:1) to receive either individualized nutritional support (intervention group) or standard hospital food (control group). In the intervention group, nutritional support was initiated as soon as possible after randomization and within 48 h after hospital admission. Patients received individualized nutritional support (figure 1) to reach protein and caloric goals, according to a previously published consensus protocol19 that follows 2018 inter-

	Muensterlingen, and Baselland, and the hospital in Lachen **Setting:** n/a **Funding Sources:** The Swiss National Science Foundation and the Research Council of the Kantonsspital Aarau, Switzerland **Dropout rates:** 2.9% **Study limitations:** Trial was pragmatic, and masking of participants and personnel was deemed to be impractical, thus observer Risk of Bias Moderate Inconsistency N/A Indirectness Low Imprecision Low Publication Bias N/A	within 48 h of hospital admission for any reason **Exclusion criteria:** patients who were initially admitted to intensive care units or surgical units; unable to ingest oral nutrition; already receiving nutritional support on admission; with a terminal condition; admitted to hospital because of anorexia nervosa, acute pancreatitis, acute liver failure, cystic fibrosis, or stem- cell transplantation; after gastric bypass surgery; with contraindications for nutritional support	national guidelines.7 Briefly, individualized nutritional goals were defined for each patient on hospital admission by a trained registered dietitian. Caloric requirements were predicted using the weight adjusted Harris-Benedict equation.20 Daily protein intake was set at 1·2–1·5 g/kg of bodyweight to adjust for increased protein breakdown during acute disease,21 with lower targets for patients with acute renal failure (0·8 g/kg of bodyweight). To reach these goals, an individual nutritional plan was developed by a trained registered dietitian for each patient. Patients in the control group received standard hospital food according to their ability and desire to eat, with no nutritional consultation and no recommendation for additional nutritional support.
Notes	**Author's Conclusion:** Understanding the optimal use of nutritional support is complex because timing, route of delivery, and the amount and type of nutrients might all affect clinical outcomes. In our trial, we asked the basic question of whether nutritional support during the hospital stay improves outcomes in medical patients at nutritional risk, compared with standard hospital food. This trial showed that early use of individualized nutritional support to reach protein and caloric goals in medical inpatients at nutritional risk is effective in increasing energy and protein intakes, and in lowering the risk of adverse outcomes and mortality within 30 days. Our findings strongly support the concept of systematically screening medical inpatients on admission to hospital for nutritional risk, irrespective of any underlying conditions, followed by a nutritional assessment and introduction of individualized nutritional support in at-risk patients.		
Outcome measures/results	adverse clinical outcome within 30 days		"In the intervention group, individualized nutritional support goals were defined by specialist dietitians and nutritional support was initiated no later than 48 h after admission. By day 30, 73 [7%] patients had died in the intervention group compared with 100 [10%] patients in the control group (adjusted OR 0·65 [0·47–0·91], p=0·011)"

Stratton RJ, Hebuterne X, Elia M. A systematic review and meta-analysis of the impact of oral nutritional supplements on hospital readmissions. Ageing Res Rev 2013; 12: 884-897. doi:10.1016/j.arr.2013.07.002 [192]

Study Type/ Evidence Level	Study details/limitations	Patient characteristics	Interventions
Systematic Review and Meta-analysis 1+	**Countries:** n/a **Centers:** n/a **Setting:** n/a **Funding Sources:** first author is employed by Nutricia Ltd. **Dropout rates:** n/a **Study limitations:** Most studies involved recruitment of patients who had been hospitalised, mainly for acute illness, often with pre-existing chronic conditions; all participants were above 65 years old;	**Total no. studies**: 9 **Inclusion criteria:** adults with a mean age ≥18 years; in the community; all studies using ONS; randomised controlled trials; outcomes: hospital admissions, including readmissions **Exclusion criteria:** animal studies; developing world; pregnancy and lactation; individuals in sports studies; studies in healthy adults; individuals in metabolic studies; dietary counselling only; enteral tube feeding; supplements containing only one macronutrient; micronutrient-only supplements; ONS vs. ONS studies; ONS with elemental formulations; all non-RCT study designs	n/a
Notes	**Author's Conclusion:** This systematic review shows that ONS significantly reduce hospital (re)admissions, particularly in older patient groups, with economic implications for health care.		
Outcome measures/results	- Hospital admissions, including readmissions		- Meta-analysis of 6 RCT (N = 852) with data on the proportion of patients (re)admitted to hospital showed significant reductions with ONS vs. routine care (OR 0.59, 95% CI 0.43–0.80, P = 0.001)

II.1.8. Individualisierte Ernährungsinterventionen

Empfehlung 42

Älteren Personen mit Mangelernährung oder einem Risiko für Mangelernährung sollen individualisierte Ernährungsinterventionen angeboten werden, um eine angemessene Nahrungsaufnahme zu ermöglichen, den Ernährungszustand zu erhalten oder zu verbessern, funktionelle Parameter und die Lebensqualität zu verbessern sowie das Mortalitätsrisiko zu reduzieren.

Empfehlungsgrad A

Baumgartner A, Pachnis D, Parra L et al. The impact of nutritional support on malnourished inpatients with aging-related vulnerability. Nutrition 2021; 89: 111279. doi:10.1016/j.nut.2021.111279 [269]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+ ROB2: Low risk of bias	**Countries:** Switzerland **Centers:** University Clinic in Aarau, the University Hospital in Bern, cantonal hospitals in Lucerne, Solothurn, St. Gallen, Muensterlingen, and Baselland, the hospital in Lachen **Setting:** clinical **Funding Sources:** the Swiss National Science Foundation; Nestle Health Science; Abbott Nutrition **Dropout rates:** n/a **Study limitations:** the prevalence of cognitive impairment might be underestimated due to lack of systematic screening of all patients at the time of admission; very high heterogeneity in the subgroup of cognitive impairment; the power of the results is limited by relatively small patient numbers and low event rates for most of the endpoints Risk of Bias Low Inconsistency n/a	**Total no. patients**: 881 **Inclusion criteria:** nutritional risk defined as NRS total score =/> 3 points, expected length of stay of >4 d, and written informed consent, increased aging related vulnerability, defined as the presence of either frailty syndrome, very old age (=/> 80y), or cognitive impairment **Exclusion criteria:** patients initially treated in intensive care or a surgical unit with >/= 1 of the following conditions: Inability to ingest food orally, preexisting nutritional support, terminal illness, past history of gastric bypass, anorexia nervosa, cystic fibrosis and stem cell transplantation, hospitalization for acute pancreatitis or liver failure, or any individuals with contraindications for nutritional support	Individualized nutritional support according to nutritional requirements vs. routine hospital food

	Indirectness Low Impreciseness Low Publication Bias n/a		
Notes	**Author's Conclusion:**		
Outcome measures/results	- Primary outcome: all cause 30 day mortality - Secondary outcomes: major adverse events, major complications, non-elective hospital readmission within the first 30 d, mean length of hospital stay, as well as mortality at 180 d		- >50% reduction in the risk of 30-day mortality (60 of 442 [13.6%] versus 31 of 439 [7.1%]; odds ratio: 0.48; 95% confidence interval, 0.31_0.76; P = 0.002) - adverse outcome (90 of 439 [20.5%] versus 131 of 442 [29.62%]; adjusted OR: 0.61; 95% CI, 0.45_0.83), which was similar to that of the initial trial (P = 0.095 [interaction analysis]) - Functional outcome (defined as a decline in Barthel's index of >10% at 30 d) showed significant improvement in the intervention group. - quality of life within the first 30 d, as well as 180 d after hospitalization, improved significantly in the intervention group - long-term mortality over 180 results was significantly improved in the intervention group (Fig. 3B).

Bonilla-Palomas JL, Gámez-López AL, Castillo-Domínguez JC et al. Nutritional Intervention in Malnourished Hospitalized Patients with Heart Failure. Arch Med Res 2016; 47: 535-540. doi:10.1016/j.arcmed.2016.11.005 [270]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1++ ROB2: Some concerns	**Countries:** Spain **Centers:** multicenter, hospitals **Setting:** n/a **Funding Sources:** this work was supported by the Spanish Society of Cardiology as a Project of the Spanish Society of Cardiology for Clinical Research in Cardiology **Dropout rates:** n/a **Study limitations**: high mortality rates in the control	**Total no. Patients:** 120 **Inclusion criteria:** patients > 18 years old, hospitalized for acute heart failure, either decompensated chronic heart failure or new onset heart failure, also presenting malnutrition **Exclusion criteria:** n/a	- PICNIC study (Nutritional Intervention Program in Hospitalized Patients with Heart Failure who are Malnourished): assess whether a nutritional intervention in malnourished hospitalized patients with heart failure provides benefits in terms of morbidity and mortality - patients were randomly assigned to a conventional treatment for heart failure or a conventional treatment for heart failure combined with a more individualized nutritional intervention - a total of 120 patients were included in the study: 59 in the intervention group and 61 in the control group - the diagnosis of malnutrition was established according to the Mini-Nutritional Assessment (MNA) score - the nutritional intervention, which began at admission and lasted 6 months, was performed by a physician specialist in nutrition assisted by a nutritionist

	group, preventing a bias-free assessment thus it is challenging to determine which aspects of the intervention had a greater impact on the observed effects Risk of Bias Moderate Inconsistency n/a Indirectness High Impreciseness Moderate Publication Bias n/a		
Notes	**Author's Conclusion:** PICNIC study results show that a nutritional intervention in malnourished hospitalized patients with heart failure reduces the risk of all-cause death and the risk of readmission for worsening of heart failure. PICNIC is the first study to show strong reductions of morbidity and mortality in patients with heart failure by acting on a comorbid condition. The results of our study highlight the need to identify and act on malnutrition, a prevalent comorbidity especially in hospitalized patients, and also emphasize the importance of addressing the patient both as a whole and using multidisciplinary teams		
Outcome measures/results	Primary outcome: composite of all-cause death or readmission for worsening of HF, with a maximum follow-up of 12 months Secondary outcome: time to all-cause mortality and the time to readmission for heart failure	At 12 months, the primary outcome (composite of all-cause death or readmission for worsening of HF) occurred in 27.1% of patients in the intervention group and in 60.7% of patients in the control group (hazard ratio 0.45; 95% CI, 0.19-0.62, p 0.0004). In total, 20.3% of patients died in the intervention group and 47.5% in the control group (hazard ratio 0.37, 95% CI, 0.19-0.72, p 0.003). Readmission due to heart failure was also lower in the intervention group (10.2 vs. 36.1%, p 0.001).	

Duncan DG, Beck SJ, Hood K, et al. Using dietetic assistants to improve the outcome of hip fracture: a randomised controlled trial of nutritional support in an acute trauma ward. Age and ageing. 2006;35:148-53. [271]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+	**Countries:** UK **Centers:** n/a **Setting:** 38 bedded acute trauma ward in a teaching hospital **Funding Sources:** Women´s Royal Voluntary Service	**Total no. Patients:** 363 **Inclusion criteria:** women over the age of 65 presenting to a single trauma ward with acute nonpathological hip fracture **Exclusion criteria:** pathological fracture, old fracture, ‚nil by mouth'	• Control group: conventional pattern of nurse- and dietitian-led care, normally provided on the trauma unit • Intervention: additional personal attention of the Das (dietetic assistants)

	(WRVS), British Dietetic Association (BDA), Shire Pharmaceuticals, Wales Office of Research and Development (WORD) **Dropout rates:** 16.8% **Study limitations:** trial was originally designed to look at LOS (length of stay)		
Notes	Assessments were based on the protocol of the Standardized Audit of Hip Fractures in Europe (SAHFE) **Author's Conclusion:** dietetic or nutrition assistants are being introduced in units across the UK. This, the largest ever study of nutritional support after hip fracture, shows that their employment significantly reduced patients´ risk of dying in the acute trauma unit; an effect that persisted at 4 month follow-up.		
Outcome measures/results	• Primary outcome measures: postoperative mortality in the acute trauma unit • Secondary outcome measure: postoperative mortality at 4 months after fracture, length of stay, energy intake and nutritional status	DA-supported participants were less likely to die in the acute ward (4.1 versus 10.1%, P=0.048). This effect was still apparent at 4 month follow-up (13.1 versus 22.9%, P= 0.036). DA-supported subjects had significantly better mean daily energy intake (1,105 kcal versus 756 kcal/24h, 95% CI 259-440 kcal/24h, P<0.001), significantly smaller reduction in mid-arm circumference during their inpatient stay (0.39 cm, P=0.002) and no significantly favorable results for other anthropometric and laboratory measurements.	

Ha L, Hauge T, Spenning AB et al. Individual, nutritional support prevents undernutrition, increases muscle strength and improves QoL among elderly at nutritional risk hospitalized for acute stroke: a randomized, controlled trial. Clin Nutr 2010; 29: 567-573. doi:10.1016/j.clnu.2010.01.011 [272]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+	**Countries:** Norway **Centers:** Østfold Hospital Trust **Setting:** medical acute care ward **Funding Sources:** **Dropout rates:** 85.28% **Study limitations:** • the nutritional intervention procedure was performed in	**Total no. Patients:** 842 **Inclusion criteria:** age >65 years, ischemic stroke, cerebral hemorrhage **Exclusion criteria:** stroke diagnosis could not be confirmed, critical illness, severe dementia, planned discharge within 24h	• Intervention: nutritional treatment, the main treatment goal in the intervention group was to maintain or improve nutritional status using established oral energy- and protein rich feedings or enteral tube feeding according to individual intake and needs. Resting energy requirements were estimated with gender and age group specific equations from the WHO, 18 and total energy need was calculated from an appropriate physical activity level factor (ranging from 1.25 to 1.40). • Control: routine care with use of oral sip feedings or tube feeding at the discretion of the attending physician. There were no pre-existing procedures neither for nutritional assessments, monitoring dietary intake or treating undernutrition.

	patients at the same ward as the control patients, by the same multidisciplinary team • dietary recording was not routinely used in stroke patients at the ward before the trial started, and hence there were control patients who otherwise would not have their dietary intake recorded • post-hoc analysis of the secondary outcomes data in the control group without dietary recording was not included due to the small number of patients which would bias the results.		
Notes	**Author's Conclusion:** Individualized, nutritional treatment strategy can prevent clinically significant weight loss and improve QoL in elderly acute stroke patients at nutritional risk.		
Outcome measures/results	Primary outcome measure was the percentage of patients with weight loss ≥5%. Secondary outcomes measures were quality of life (QoL), handgrip strength and length of hospital stay.	At follow-up, 20.7% of the intervention group (n = 58) lost ≥5% weight compared with 36.4% in the control group (n = 66) (P = 0.055). The intervention group had a significantly higher increase in QoL score (P = 0.009) and in handgrip strength (P = 0.002). There was no difference in length of hospital stay.	

Ingstad K, Uhrenfeldt L, Kymre IG et al. Effectiveness of individualised nutritional care plans to reduce malnutrition during hospitalisation and up to 3 months post-discharge: a systematic scoping review. BMJ open 2020; 10: e040439-e040439. doi:10.1136/bmjopen-2020-040439 [273]

Study Type/ Evidence Level	Study details/limitations	Patient characteristics	Interventions
Systematic review 1+ AMSTAR2: moderate quality	**Countries:** n/a **Centers:** n/a **Setting:** n/a **Funding Sources:** Faculty of Nursing and Health Sciences, Nord University; Aalborg University Hospital **Dropout rates:** n/a **Study limitations:** Three months' follow-up time may be insufficient, especially for determining whether an intervention can reduce the risk of readmission or mortality rates Risk of Bias n/a Inconsistency n/a Indirectness Low Impreciseness n/a Publication Bias n/a	**Total no. studies**: 9 **Inclusion criteria:** adult patients of both sexes; aged >18 years; received an individualised nutritional care plan; the nutritional care plan had to be written, obtained related to the patient's hospital stay, and followed-up in the next 3 months post-discharge from the hospital surgical, medical or rehabilitation unit **Exclusion criteria:** n/a	n/a
Notes	**Author's Conclusion:** Individualised nutritional care plans and follow-up home visits might improve patients' nutritional status. However, there is need for a systematic review that assesses study quality and extends the time to 6 months post-discharge.		
Outcome measures/results	- nutritional status - readmission		- four studies indicated that the intervention had a significant effect on nutritional status and four studies demonstrated that the intervention did not - One study showed significant effect on readmission,27 and four studies showed no such effect

Otsuki I, Himuro N, Tatsumi H et al. Individualized nutritional treatment for acute stroke patients with malnutrition risk improves functional independence measurement: A randomized controlled trial. Geriatr Gerontol Int 2019; 20: 176-182. doi:10.1111/ggi.13854 [274]

Study Type/ Evidence Level	Study details/limitations	Patient characteristics	Interventions
RCT 1+ ROB2: Some concerns	**Countries:** Japan **Centers:** Otaru General Hospital, Otaru, Japan **Setting:** clinical **Funding Sources:** n/a **Dropout rates:** 26% **Study limitations:** Albumin level was used as an eligibility criterion, however, recently albumin level has been shown to not specifically indicate malnutrition in the acute phase; the single-center and single blinded design might have limited the generalizability of the Results; there was a possibility of measurement error because of the differences in personnel and measuring equipment between the hospital and the recovery hospital; actual energy intake was calculated based on visual observation by nurses; the severity or type of stroke were not considered Risk of Bias: Moderate Inconsistency: n/a Indirectness: Low Impreciseness: Moderate Publication Bias: n/a	**Total no. patients**: 128 **Inclusion criteria:** acute stroke, age >65 years, malnutrition risk **Exclusion criteria:** critically ill and difficult to save; had severe dementia; were at the terminal stage of other diseases, such as cancer; had coexisting disease that required strict management; had liver cirrhosis; received albumin preparation; and were judged by the attending physician to be unsuitable for the study	standard or intensive group (individualized nutritional treatment)

Notes	**Author's Conclusion:** Individualized nutritional treatment improved the activities of daily living of older acute stroke patients with malnutrition risk	
Outcome measures/results	- primary: total functional independence measurement gain from the time of assignment to the time of discharge from the recovery hospital or at 3 months after the stroke onset, and motor and cognitive functional independence measurement gains	Compared with the standard group, the intensive group had significantly higher median energy intake ($P < 0.001$); significantly greater functional independence measurement gains in the total score (42 vs. 22; $P = 0.02$) and motor subscore ($P = 0.01$), but similar cognitive subscore

Rufenacht U, Ruhlin M, Wegmann M et al. Nutritional counseling improves quality of life and nutrient intake in hospitalized undernourished patients. Nutrition 2010; 26: 53-60. doi:10.1016/j.nut.2009.04.018 [275]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+	**Countries:** Switzerland **Centers:** Kantonsspital Winterthur **Setting:** n/a **Funding Sources:** Independent Research Fund of the Department of Internal Medicine of Kantonsspital Winterthur, Federation of the Swiss Medical Nutrition Industry **Dropout rates:** 32% **Study limitations:** potential confounding factor for the increased energy and protein intakes may be the spontaneously favorable course of the disease	**Total no. Patients:** 53 **Inclusion criteria:** LOS >10 d, unintended loss of body weight >5% of usual weight over the previous 2 mo., and loss of appetite **Exclusion criteria:** terminal illness, existing enteral or parenteral nutrition, ongoing nutritional counseling or interventions, e.g. intake of ONSs, impaired cognition, and incapability to give consent	• Nutritional therapy group: individual nutritional counseling and interventions, including oral nutritional supplements if appropriate, by a dietitian • Oral nutritional supplement group: oral nutritional supplements in addition to hospital meals without further instruction or counseling
Notes	**Author's Conclusion:** Both interventions caused a significant increase in energy and protein intakes and quality of life. In the NT group every patient received an efficacious individualized intervention. In contrast, the 7 of 18 patients in the ONS group who did not consume ONS had no intervention at all. Therefore, undernourished patients should be counseled individually by a dietitian.		
Outcome measures/results	• Primary endpoint: increase in energy and protein intakes, and improvement of QoL		Energy and protein intakes increased between baseline and time point 1 in both groups ($P=0.001$). The NT group (n=18) met the energy requirements at time point 1 by 107% and of protein by 94%, the ONS group (n=18) by 90% and 88%, respectively.

	• Secondary endpoints: maintenance of body weight, and better nutritional status	Hospital meals alone did not cover the requirements. From baseline to time point 1, quality of life increased in both groups. Quality of life increased further in the NT group from time point 1 to time point 2 (P=0.016), but not in the ONS group.

Schuetz P, Fehr R, Baechli V et al. Individualised nutritional support in medical inpatients at nutritional risk: a randomised clinical trial. Lancet 2019; 393: 2312-2321. doi:10.1016/s0140-6736(18)32776-4 [146]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+ ROB 2: low risk of bias	**Countries:** Switzerland **Centers:** University Clinic in Aarau, the University Hospital in Bern, the Cantonal hospitals in Lucerne, Solothurn, St Gallen, Muensterlingen, and Baselland, and the hospital in Lachen **Setting:** n/a **Funding Sources:** The Swiss National Science Foundation and the Research Council of the Kantonsspital Aarau, Switzerland **Dropout rates:** 2.9% **Study limitations:** Trial was pragmatic, and masking of participants and personnel was deemed to be impractical, thus observer Risk of Bias Moderate Inconsistency N/A Indirectness Low Imprecision Low Publication Bias N/A	**Total no. Patients:** 2088 **Inclusion criteria:** at least 18 years at nutritional risk of 3 or greater expected to stay in hospital for more than 4 days if they were willing to provide informed consent within 48 h of hospital admission for any reason **Exclusion criteria:** patients who were initially admitted to intensive care units or surgical units; unable to ingest oral nutrition; already receiving nutritional support on admission; with a terminal condition; admitted to hospital because of anorexia nervosa, acute pancreatitis, acute liver failure, cystic fibrosis, or stem- cell transplantation; after gastric bypass surgery; with contraindications for nutritional support	Patients were randomly assigned (1:1) to receive either individualized nutritional support (intervention group) or standard hospital food (control group). In the intervention group, nutritional support was initiated as soon as possible after randomization and within 48 h after hospital admission. Patients received individualized nutritional support (figure 1) to reach protein and caloric goals, according to a previously published consensus protocol19 that follows 2018 inter-national guidelines.7 Briefly, individualized nutritional goals were defined for each patient on hospital admission by a trained registered dietitian. Caloric requirements were predicted using the weight adjusted Harris-Benedict equation.20 Daily protein intake was set at 1·2–1·5 g/kg of bodyweight to adjust for increased protein breakdown during acute disease,21 with lower targets for patients with acute renal failure (0·8 g/kg of bodyweight). To reach these goals, an individual nutritional plan was developed by a trained registered dietitian for each patient. Patients in the control group received standard hospital food according to their ability and desire to eat, with no nutritional consultation and no recommendation for additional nutritional support.

Notes	**Author's Conclusion:** Understanding the optimal use of nutritional support is complex because timing, route of delivery, and the amount and type of nutrients might all affect clinical outcomes. In our trial, we asked the basic question of whether nutritional support during the hospital stay improves outcomes in medical patients at nutritional risk, compared with standard hospital food. This trial showed that early use of individualized nutritional support to reach protein and caloric goals in medical inpatients at nutritional risk is effective in increasing energy and protein intakes, and in lowering the risk of adverse outcomes and mortality within 30 days. Our findings strongly support the concept of systematically screening medical inpatients on admission to hospital for nutritional risk, irrespective of any underlying conditions, followed by a nutritional assessment and introduction of individualized nutritional support in at-risk patients.	
Outcome measures/results	adverse clinical outcome within 30 days	"In the intervention group, individualized nutritional support goals were defined by specialist dietitians and nutritional support was initiated no later than 48 h after admission. By day 30, 73 [7%] patients had died in the intervention group compared with 100 [10%] patients in the control group (adjusted OR 0·65 [0·47–0·91], p=0·011)"

Seemer J, Kiesswetter E, Fleckenstein-Sußmann D et al. Effects of an individualised nutritional intervention to tackle malnutrition in nursing homes: a pre-post study. Eur Geriatr Med 2022; 13: 741-752. doi:10.1007/s41999-021-00597-y [276]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Pre/post study NHLBI Pre-Post checklist: good quality	**Countries:** germany **Centers:** n/a **Setting:** nursing homes **Funding Sources:** Bayerische Milchindustrie eG; Federal Ministry of Education and Research; Open Access funding enabled and organized by Projekt DEAL **Dropout rates**: 9% **Study limitations:** no control group; limitation to 6 weeks; QoL was obrained through nursing staff, as assessments with residents were not possible due to the high rate of dementia; Due to	**Total no. patients**: 50 **Inclusion criteria:** Mini Nutritional Assessment-Short Form (MNASF) ≤ 7 points Risk of malnutrition was identified either by MNA-SF 8–11 points and a reduced score in at least one of the following MNA-SF questions: decreased food intake (A, < 2 points), unintentional weight loss (B, < 3 points), psychological stress or acute disease (D, < 2 points) and/or low Body Mass Index (BMI, F, < 3 points) [21]; or by receiving texture-modified diet and a reduced score in one of the described MNA-SF questions. **Exclusion criteria:** age < 65 years, enteral or parenteral	individualised nutritional intervention consisting of three supplement modules (offered single or combined) and reshaped texture-modified meals (for residents with chewing and/or swallowing difficulties) for 6 weeks (sweet and savoury protein creams and protein-energy drink, single or combined)

	staff constraints, deficiencies could not be reassessed before the start of the intervention; it is not possible to distinguish between the effects of the supplementation and the reshaped texture-modified meals Risk of Bias Low Inconsistency n/a Indirectness Low Impreciseness Moderate Publication Bias n/a	nutrition, acute illness, terminal stage of life (according to nurses' estimation) and BMI ≥ 30 kg/m2.	
Notes	**Author's Conclusion:** The intervention improved dietary intake and one QoL subscale in nursing home residents with (risk of) malnutrition.		
Outcome measures/results	- Primary: dietary intake - Secondary: body weight, handgrip strength and quality of life		- Mean daily energy intake increased by 207 (95%CI 47–368, $p = 0.005$) kcal and protein intake by 14 (7–21, $p < 0.001$) g (w12 vs w1) - Quality of life (QoL) increased in the subscale "care relationship" (+ 9 (3–15) points, $p = 0.002$, w12 vs w6)

Starke J, Schneider H, Alteheld B et al. Short-term individual nutritional care as part of routine clinical setting improves outcome and quality of life in malnourished medical patients. Clin Nutr 2011; 30: 194-201. doi:10.1016/j.clnu.2010.07.021 [277]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1++	**Countries:** Switzerland **Centers:** Kantonsspital Liestal **Setting:** general medical ward **Funding Sources:** Exchange Organisation StudEx/ Switzerland and the German Academic Exchange	**Total no. Patients:** 134 **Inclusion criteria:** NRS score >3 **Exclusion criteria:** no informed consent, terminal condition, expected stay <5d, previous participation in this study, patient in	• Intervention group: individualized nutritional support for maximum 28 days, including a detailed nutritional assessment, individual food supply, fortification of meals with maltodextrin, rapeseed oil, cram and/or protein powder, in-between snacks and oral nutritional supplements • Control group: standard hospital care including the prescription of oral nutritional supplements and nutritional therapy prescribed by the physician independently of this study

	Service(DAAD)/Germany, Nestlé Nutrition **Dropout rates:** 1.19% **Study limitations:** morbidity, LOS, quality of life or mortality are often influenced by other factors than nutrition alone	starvation, on parenteral nutrition, and/ or being on dialysis	
Notes	**Author's Conclusion:** Malnourished patients profit from nutrition support regarding nutrition status and quality of life. They have fewer complications, need fewer antibiotics and are less often re-hospitalized.		
Outcome measures/results	• Primary endpoints: average daily energy and protein intake • Secondary endpoints: changes in body weight during hospitalization, number of complications, number of antibiotic therapies due to infectious complications, length of hospital stay, quality of life (SF-36), hospital readmission (after 6 months), mortality, compliance with oral nutrition standard supplement consumption and plasma concentrations of 25-OH-D3, ascorbic acid and glutathione	Nutrition interventions led to higher intakes (mean [standard deviation]) in energy (1553 [341] kcal vs. 1115 [381] kcal, $p < 0.001$) and protein (65.4 [16.4] g vs. 43.9 [17.2] g, $p < 0.001$). Intervention patients (n = 66) kept their body weight in comparison to control patients (n = 66; 0.0 [2.9] kg vs. -1.4 [3.2] kg, $p = 0.008$). Positive effects on plasma ascorbic acid level (46.7 [26.7] µmol/l vs. 34.1 [24.2] µmol/l, $p = 0.010$), SF-36 function summary scale (37 [11] % vs. 32 [9] %, $p = 0.030$), number of complications (4/66 vs. 13/66, $p = 0.035$), antibiotic therapies (1/66 vs. 8/66, $p = 0.033$) and readmissions (17/64 vs. 28/61, $p = 0.027$) were recorded.	

II.1.9. Multimodale und multiprofessionelle Intervention

Empfehlung 43

Ernährungsinterventionen für ältere Personen mit Mangelernährung oder einem Risiko für Mangelernährung sollten Teil einer multimodalen und multiprofessionellen Teamintervention sein, um eine angemessene Nahrungsaufnahme zu unterstützen, das Körpergewicht zu halten oder zu erhöhen sowie den funktionellen und klinischen Verlauf und die Lebensqualität zu verbessern.

Empfehlungsgrad B

Beck AM, Damkjaer K, Beyer N. Multifaceted nutritional intervention among nursing-home residents has a positive influence on nutrition and function. Nutrition 2008; 24: 1073-1080. doi:10.1016/j.nut.2008.05.007 [282]

Study Type/ Evidence Level	Study details/limitations	Patient characteristics	Interventions
RCT 1+	**Countries:** Denmark **Centers:** n/a **Setting:** home-care or nursing home setting **Funding Sources:** Health Insurance Foundation and the Velux Foundation **Dropout rates:** 2% **Study limitations:** • The nurses who assessed the residents´ performance and the physiotherapist who tested handgrip strength and functional fitness were blinded to the treatment allocation and visited the nursing homes only during assessments. • Recruitment of nursing homes, which had shown a continuous interest in nutritional aspects before the study.	**Total no. Patients:** 246 **Inclusion criteria:** elderly people (65+ years of age) receiving home-care or living in the two nursing homes with staff caregivers, able to complete the planned tests **Exclusion criteria:** patients who were not able or willing to give informed consent	• Intervention group: new model for multidisciplinary nutrition support during the 11 wk. study, individual treatment of the potentially modifiable nutritional risk factors identified by the EVS
Notes	**Author's Conclusion:** It is possible to improve nutrition and function in elderly nursing-home residents by means of a multifaceted intervention consisting of chocolate, homemade supplements, group exercise, and oral care.		
Outcome measures/results	Quality of life by means of EuroQol-5D-3L, physical performance by means of a 30-second chair-stand, nutritional status by means of weight and hand-grip strength, oral care by means of RAI-NH, RAI-HC and observation, fall incidents, hospital admissions, rehabilitation stay, moving to nursing homes and mortality		A total of 121 subjects (61%) accepted the invitation and 62 were randomized to the intervention group. Six of these dropped out during the 11 wk. At the 4-mo follow-up there were 15 deaths in the intervention group and 8 in the control group. The nutrition and exercise were well tolerated. After 11 wk. the change in percentage of weight (P = 0.005), percentage of body mass index (P = 0.003), energy intake (P = 0.084), protein intake (P = 0.012), and Berg's Balance Scale (P = 0.004) was higher in

		the intervention group than in the control group. In addition, the percentage of subjects whose functional tests improved was higher in the intervention group. Both groups lost the same percentage of weight after the intervention (P = 0.908). The total percentage of weight loss from baseline to follow-up was higher in the control group (P = 0.019). Oral care was not well accepted and the prevalence of plaque did not change.

Beck AM, Damkjaer K, Sorbye LW. Physical and social functional abilities seem to be maintained by a multifaceted randomized controlled nutritional intervention among old (>65 years) Danish nursing home residents. Arch Gerontol Geriatr 2010; 50: 351-355. doi:10.1016/j.archger.2009.05.018 [283]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+	**Countries:** Denmark **Centers:** Copenhagen and surrounding municipalities **Setting:** three home-care areas, two nursing homes **Funding Sources:** Health Insurance Foundation, VELUX FOUNDATION **Dropout rates:** 5% **Study limitations:** • recruitment of nursing homes which had formerly shown a continuous interest in nutritional aspects • the sample size, which was estimated based on % BMI and therefore might have been too small	**Total no. Patients:** 119 **Inclusion criteria:** nursing home residents aged 65 years and older who could be weighed, were non-terminal, non-hospitalized , and living in one of seven nursing homes in Denmark **Exclusion criteria:** n/a	• Intervention: nutrition (chocolate, homemade oral supplements), group exercise (moderate intensity) and oral care
Notes	**Author's Conclusion:** It seems possible to maintain social and (physical) functional abilities in old nursing home residents by means of a multifaceted intervention consisting of chocolate, homemade oral supplements, group exercise and oral care.		
Outcome measures/results	Weight, BMI, energy and protein intake, and functional abilities (ADL, cognitive performance, and social engagement)	After 11 weeks the change in % weight (1.3 vs. -0.6%, p=0.005), %BMI (0.4 vs. -0.2%, p=0.003), energy intake (0.7 vs. -0.3 MJ/day, p=0.084) and protein intake (5 vs. -	

		2g/day, p=0.012) was higher in the intervention group than in the control group. Also after 11 weeks, social and physical function had decreased in the control group but was unchanged in the intervention group. The difference between groups was significant in relation to social engagement (p=0.009). After the end of the intervention both groups had lost weight and physical function. Cognitive performance did not change, at any time.

Beck AM, Christensen AG, Hansen BS et al. Multidisciplinary nutritional support for undernutrition in nursing home and home-care: A cluster randomized controlled trial. Nutrition 2016; 32: 199-205. doi:10.1016/j.nut.2015.08.009 [284]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+	**Countries:** Denmark **Centers:** Frederiksberg **Setting:** three home-care areas, two nursing homes **Funding Sources:** Danish National Board of Social Service **Dropout rates:** 5% **Study limitations:** difficult to compare to other studies (use of EQ-5D-3L)	**Total no. Patients:** 246 **Inclusion criteria:** Elderly people (65 + years of age) receiving home-care or living in the two nursing homes with an EVS (2 points according to EVS) made by the nursing staff caregivers and, according to the staff caregivers, able to complete the planned tests **Exclusion criteria:** People who were not able to complete the planned tests according to the staff caregivers	The intervention group received nutritional support consisting of: 1. Individual dietary counselling by a dietician including advice on the use of prescribed ONS 2. 30-45 minutes of resistance type exercise by a physiotherapist two times per week, either in groups in one of the participating nursing homes or alone in the participants own home in combination with the intake of 150 mL ONS providing an average of 1010 kJ and 14.4 g of protein per 100 mL 3. Dysphagia assessment and treatment, including texture modification of food and drinks, by an occupational therapist, as needed.
Notes	**Author's Conclusion:** Multidisciplinary nutritional support in older adults in nursing home and home-care identified with EVS is cost-effective since the cost effectiveness ratio compares reasonably well to other interventions found worthwhile in the Danish healthcare sector.		
Outcome measures/results	• Primary outcome parameters: quality of life (by means of Euroquol-5D-3L) • Secondary outcome parameters: physical performance (30-second chair stand), nutritional status (weight, and hand-grip strength), oral care, fall incidents, hospital admissions, rehabilitation stay, moving to nursing homes and mortality	A difference was seen after 11 weeks in quality of life (0.758 (±0.222) vs. 0.534 (±0.355), p=0.001). Even though a small gain in weight was observed in the intervention group there was no difference in change in weight. The effect on quality of life, measured in terms of Quality- Adjusted Life Year (QALY) gain relatively to the control group, gave a cost-effectiveness ratio of DKK 46,000 per QALY gained which compares reasonably well to other interventions found worthwhile the Danish healthcare sector.	

Edwards D, Carrier J, Hopkinson J. Mealtime assistance for older adults in hospital settings and rehabilitation units from the perspective of patients, families and healthcare professionals: a mixed methods systematic review. JBI Database System Rev Implement Rep 2016; 14: 261-357. doi:10.11124/jbisrir-2016-003100 [70]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1+ AMSTAR II: high quality	**Countries:** n/a **Centers:** n/a **Setting:** hospitals and rehabilitation units **Funding Sources:** **Dropout rates:** **Study limitations:** quality of the included studies; variety of interventions and outcome measures; mainly female patients; only westernized countries; patients who are too ill to consent are mostly those at the greatest risk of undernutrition Risk of Bias Moderate Inconsistency Moderate Indirectness Low Imprecision Low Publication Bias n/a	**Total no. studies**: 19 **Inclusion criteria:** studies that included older adults (65 years and over) from any ethnic background in hospital settings, including rehabilitation units, with any diagnosis; studies focusing on family members; volunteers, healthcare professionals **Exclusion criteria:** Patients under 65 years of age; Patients on artificial feeding; Patients residing in other healthcare settings such as nursing homes or long-term care facilities	- interventions for mealtime assistance, observed mealtime assistance, or discussed experiences of mealtime assistance with patients, families and healthcare professionals
Notes	**Author's Conclusion:** No firm conclusions can be drawn with respect to the most effective initiatives. Initiatives with merit include those that encourage social interaction, either through the use of a dining room, or employed staff or volunteers, relatives or visitors supporting the older patient during mealtimes. Volunteers value training and support and clarification of their roles and responsibilities.		
Outcome measures/results	- first objective: improved nutritional intake/status (energy & protein intake, nutritional status), length of stay, postoperative complications, mortality rates - second objective: description of the mealtime assistance from the perspective of the patient, healthcare professional, carer or family members		- Mealtimes should be viewed as high priority, healthcare staff should limit other activities during mealtimes and allow older patients to eat uninterrupted, providing support where required. - Nursing staff, employed mealtime assistants, volunteers or relatives/visitors can help prepare the older patient for meals; this includes opening packages and cutting up food as well as physically feeding patients. - Social interaction at mealtimes for older patients is effective in increasing food, energy and protein intake, and should be encouraged.

		- Communication between all members of the multi-disciplinary team, staff and volunteers is essential.

Edwards D, Carrier J, Hopkinson J. Assistance at mealtimes in hospital settings and rehabilitation units for patients (>65years) from the perspective of patients, families and healthcare professionals: A mixed methods systematic review. Int J Nurs Stud 2017; 69: 100-118. doi:10.1016/j.ijnurstu.2017.01.013 [71]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic review 1+ AMSTAR 2: critically low quality	**Countries:** USA; Australia; UK; Canada **Centers**: n/a **Setting:** hospital settings including rehabilitation units **Funding Sources:** n/a **Dropout rates:** n/a **Study limitations:** n/a Risk of Bias Moderate Inconsistency Moderate Indirectness High Impreciseness Moderate Publication Bias Moderate	**Total no. Studies: 19** **Inclusion criteria:** >65 years, English, including or focusing on carers, family members, volunteers and healthcare professionals perspectives **Exclusion criteria:** <65 years of age, artificial feeding such as patients obtaining their nutrition exclusively by enteral or parenteral means and patients residing in other healthcare settings such	qualitative, quantitative and mixed methods studies; interventions for mealtime assistance, observed mealtime assistance or discussed experiences of mealtime assistance with staff, patients, relatives, volunteers or stakeholders
Notes	Three aggregated mixed methods syntheses were developed: 1) Mealtimes should be viewed as high priority. 2a) Nursing staff, employed mealtime assistants, volunteers or relatives/visitors can help with mealtime assistance. 2b) Social interaction at mealtimes should be encouraged. 3) Communication is essential. **Author's Conclusion:** A number of initiatives were identified which can be used to support older patients (>65 years) at mealtimes in hospital settings and rehabilitation units. However, no firm conclusions can be drawn in respect to the most effective initiatives. Initiatives with merit include those that encourage social interaction. Any initiative that involves supporting the older patient (>65 years) at mealtimes is beneficial. A potential way forward would be for nurses to focus on the training and support of volunteers and relatives to deliver mealtime assistance, whilst being available at mealtimes to support patients with complex nutritional needs.		
Outcome measures/results	the effectiveness of the varying types of mealtime assistance provided in both hospital settings and rehabilitation units and the views of patients, health care professionals, family members and volunteers on mealtime assistance for patients Protein intake (g), Energy intake (KJ), % meeting nutritional requirements Experiences of volunteers, nurses and patients in relation to	TSE1 Lunch time and daily energy intake, breakfast, lunch time and daily protein intake can be increased in patients (>65 years) in hospital settings when trained volunteers are present to provide support TSE2 Daily energy intake, nutritional status, mortality four months post discharge can be increased in patients (>65 years) in hospital settings when employed assistants are present to provide support TSE3 Lunch time energy intake can be increased in patients (>65 years) in hospital	

	feeding assistance, Tasks completed by the volunteer Time spent with each patient Addressing barriers to consumption, Interruptions Infection rates (number of antibiotics prescribed) Functional status (GS (kgf)) Nutritional status, Mortality; LOS; albumin Feasibility of delivering mealtime assistance	settings when they eat their meals in a supervised dining room as opposed to on the ward TSE4 Eating in a communal dining room in hospital settings is associated with better protein intake for patients (>65 years)

Hoekstra JC, Goosen JH, de Wolf GS et al. Effectiveness of multidisciplinary nutritional care on nutritional intake, nutritional status and quality of life in patients with hip fractures: a controlled prospective cohort study. Clin Nutr 2011; 30: 455-461. doi:10.1016/j.clnu.2011.01.011 [52]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Cohort study 2+	**Countries:** the netherlands **Centers:** n/a **Setting**: in hospital and in aftercare **Funding Sources:** Medical Insurance Company Achmea **Dropout rates:** 10% **Study limitations:** no parallel group design was possible, as personal contact between control and intervention patients during admission was inevitable; blinding of patients and caretakers was not possible due to nature of the intervention; it was not possible to determine the relative effectiveness of each part of the multidisciplinary nutritional care program; possible	**Total no. patients**: 127 **Inclusion criteria:** aged over 65; sustaining a hip fracture with subsequent operative intervention **Exclusion criteria:** additional Fractures, severe dementia, a diagnosed malignancy affecting nutritional status, suspicion of a pathological fracture, liver or kidney dysfunction, pacemaker or the impossibility to be weighed for bioelectrical impedance assessment, not fluent in the Dutch language, when communicating through family and updating dietary records at home was not possible	- control group: standard nutritional care - intervention group; multidisciplinary nutritional care that focused on nutritional support during hospitalisation and a transfer of nutritional care after discharge

	observer and patient bias; the prognostic caracteristics of the patients may be unequally distributed between the groups; seasonal changes could have affected QoL and nutritional intake		
Notes	**Author's Conclusion:** Among elderly patients with a hip fracture, a multidisciplinary postoperative approach of nutritional care was associated with an increase of energy and protein intake during hospitalisation. After three months follow-up there were fewer malnourished patients in the intervention group, and the decline in quality of life was lower than in the control group. There were no advantages of multidisciplinary nutritional care on body cell mass.		
Outcome measures/results	At admission and 3 months postoperatively: - nutritional status - body cell mass - quality of life		- daily energy intake was significantly higher during the first seven days postoperatively in the intervention group (1292 kcal (+-280)) than in the control group (1127 kcal (+-309) (P ¼ 0.002)) - mean protein intake in the intervention group (57 g (+-12)) was significantly higher than in the control group (48 g (+-14), P ¼ 0.000) - the intervention group demonstrated a significantly stronger increase in quality of life compared with the control group (P ¼ 0.004) after three months - at three months, significantly fewer patients in the intervention group were classified as malnourished or at risk of malnutrition

Mawardi F, Lestari AS, Kusnanto H et al. Malnutrition in older adults: how interprofessional teams see it? A systematic review of the qualitative research. Fam Pract 2020; 38: 43-48. doi:10.1093/fampra/cmaa091 [121]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1- AMSTAR II: Low quality	**Countries:** Indonesia **Centers:** n/a **Setting:** community settings; nursing homes **Funding Sources:** n/a **Dropout rates:** n/a **Study limitations:** limited number of studies	**Total no. patients**: 109 **Inclusion criteria:** qualitative studies using data collection; analysis; explored the views or perceptions of health care providers regarding malnutrition in elderly; English language; published from 2016 to 2020	Semi-structured interview

	Risk of Bias Low Inconsistency Moderate Indirectness High Impreciseness N/A Publication Bias N/A	**Exclusion criteria:** quantitative design; conference abstracts; commentaries; reviews	
Notes	**Author's Conclusion:** Nutritional knowledge and skills, management of malnutrition and the need for multidisciplinary teams are the main themes of this systematic review. Some solution and recommendations for management of malnutrition in older adult such as supportive interventions include environmental changes, nutritional counselling, food modification, ONS and pharmacotherapy if needed, routine screening and interprofessional approach		
Outcome measures/results	Outcome: views and perceptions of health care providers	The results showed that there are three main themes that reflect their malnutrition experiences: (i) knowledge and skills about malnutrition, (ii) management of malnutrition and (iii) the need for collaborative teams.	

Munk T, Svendsen JA, Knudsen AW et al. A multimodal nutritional intervention after discharge improves quality of life and physical function in older patients – a randomized controlled trial. Clin Nutr 2021; 40: 5500-5510. doi:10.1016/j.clnu.2021.09.029 [285]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+ ROB 2: High risk of bias	**Countries:** Denmark **Centers:** Herlev-Gentofte University Hospital **Setting:** clinical and at home **Funding Sources:** Innovation Fund Denmark, Research Unit, Herlev Gentofte Hospital, University of Copenhagen **Dropout rates**: 0% **Study limitations:** single blinded; performance and detection bias; Risk of Bias High Inconsistency N/A Indirectness High Impreciseness Moderate Publication Bias N/A	**Total no. patients**: 191 **Inclusion criteria:** 50+ years old; in need of preventive nutritional therapy or nutritional support due to being at nutritional risk according to the Nutrition Risk Screening 2002 tool; provided with a targeted nutritional effort consisting of a special energy- and dairy protein enriched food concept (Herlev's Glories) with close follow-up of a hospital clinical dietician; able to read, hear, and understand the Danish language; discharged to own home; cognitively intact **Exclusion criteria:** Food allergy or intolerance; planning weight loss or	- The intervention group received dietetic counselling including a recommendation of daily training, an individual nutrition plan and a package containing foods and drinks covering dietary requirements for the next 24 h. and a goodie-bag containing samples of protein-rich milk-based drinks - The control group (CG) received standard treatment - follow-ups on day 4 and 30 and a home visit at 16 weeks

		following a special diet; accelerated and disseminated cancer; in late palliative or terminal phase, assessed from 6 months of expected survival; in droplet infection isolation, therefore not allowed to bring in weighing scales for baseline data collection; discharged to nursing home or rehabilitation stay; moderate to severe dysphagia, defined as a need for a texture-modified diet; permanently bedridden and hence not expected to be discharged to own home; receiving enteral or parenteral nutrition at discharge; previously included patients	
Notes	**Author's Conclusion:** The present study, using a multimodal nutritional approach, revealed no significant effect on readmissions however a significant positive effect on nutritional status, quality of life and physical function was found. The improvements in quality of life and physical function were of clinical relevance. No significant effect was found on LOS and mortality.		
Outcome measures/results	- primary: readmissions within 6 months - secondary: Length of Stay (LOS), Health Related Quality of Life (EQ-5D-3L), nutritional status, physical function (30s-CST) and mortality		- No significant difference was seen in readmissions within 6 month (IG: 45% vs. CG: 45%, Risk Ratio (RR): 0.96 0.71e1.31, p ¼ 0.885) - At the 16-weeks follow-up more patients in the IG reached at least 75% of energy and protein requirements (82% vs. CG: 61%, p ¼ 0,007) - The energy (kcal) and protein intake (g) per kg was significantly higher in the IG (26.4 kcal/kg (±7.4) vs. 22.6 (±7.4), p ¼ 0.0248) (1.1 g/kg (±0.3) vs. 0.9 g/kg (±0.3). - significant lower weight loss was seen in IG (0.7 (±4.3) vs. _1.4 (±3.6), p ¼ 0.002). A significant and clinically relevant difference was found in the Quality of Life assessment (IG: mean 61.6 ± 16.2 vs. CG: 53.3 ± 19.3, p ¼ 0.011) (D14.3 (±15.5) vs. D5.6 (±17.2), p ¼ 0.002). - A significant difference in mean 30s-CST in IG was also found (7.2 (±4.3) vs. 5.3 (±4.1), p ¼ 0.010). - The improvements in physical function were of clinical relevance in both groups, but significantly higher in the IG (D4.2 (±4.4) vs. D2.2 (±2.5), p ¼

		0.008). In fact, 86% in IG experienced improvements in the 30s-CST compared with 68% in the CG (p ¼ 0.022). - LOS was found to be lower at all time points, however not significant (30 days: _3 (_8.5 to 2.5), p ¼ 0.276, 16 weeks: _4 (_10.2 to 2.2, p ¼ 0.204), 6 months: _3 (_9.3 to 3.3, p ¼ 0346)). - All-cause mortality was not different between groups

Neelemaat F, Bosmans JE, Thijs A et al. Post-discharge nutritional support in malnourished elderly individuals improves functional limitations. J Am Med Dir Assoc 2011; 12: 295-301 [197]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1++	**Countries:** Netherlands **Centers:** University Medical Center, Amsterdam **Setting:** n/a **Funding Sources:** The Netherlands Organisation for Health Research and Development (ZonMw) **Dropout rates:** 31.9 % **Study limitations:** a follow-up of only 3 months	**Total no. patients:** n = 210 **Inclusion criteria:** malnourished according to the following criteria: (1) Body Mass Index (BMI in kg/m^2) < 20 and/or (2) >5% unintentional weight loss in the previous month and/or (3) >10% unintentional weight loss in the previous six months. **Exclusion criteria:** Patients, who suffered from senile dementia, could not understand the Dutch language or were not able to or willing to give informed consent.	Hospital-admitted malnourished elderly patients ($60 years) were randomized to receive either nutritional supplementation (energy and protein enriched diet, oral nutritional support, calcium, vitamin D supplement, telephone counseling by a dietitian) for 3 months post discharge or usual care.
Notes	**Author's Conclusion:** Three months of oral nutritional support to malnourished elderly decreased functional limitations and increased body weight. It can be questioned if a follow-up of only 3 months was not too short to detect differences on physical performance and physical activities as well.		
Outcome measures/results	**primary outcome measure:** functional limitations, physical performance, physical activities, body weight, fat free mass, and handgrip strength		Body weight increased more in the intervention group than in the control group; this was significant for the highest body weight category (mean difference 3.4 kg, 95% CI 0.2–6.6). Functional limitations decreased more (mean difference –0.5 (95% CI –1.0–0.1) in the intervention group than in the control group. When excluding patients who had already received nutritional support before the start of the study, this reached significance. No significant differences could be demonstrated for physical performance, physical activities, fat-free mass, or handgrip strength.

Neelemaat F, Lips P, Bosmans JE et al. Short-term oral nutritional intervention with protein and vitamin D decreases falls in malnourished older adults. J Am Geriatr Soc 2012; 60: 691-699 [286]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+	**Countries:** Netherlands **Centers:** n/a **Setting:** From hospital admission until 3 months after discharge. **Funding Sources:** The Netherlands Organisation for Health Research and Development (ZonMw) **Dropout rates:** 28.6 % **Study limitations:** not blinded, a 2-week dietary history was used to assess participants' nutritional intake, loss to follow-up was 30%	**Total no. Patients:** 210 **Inclusion criteria:** Malnourished older adults (≥ 60) newly admitted to an acute hospital **Exclusion criteria:** dementia	Participants were randomized to receive nutritional intervention (energy- and protein-enriched diet, oral nutritional supplements, calcium-vitamin D supplement, and telephone counseling by a dietitian) for 3 months after discharge or usual care.
Notes	**Author's Conclusion:** A short-term nutritional intervention consisting of oral nutritional supplements and calcium and vitamin D supplementation and supported by dietetic counseling in malnourished older adults decreases the number of patients who fall and fall incidents.		
Outcome measures/results	Fat-Free Mass and Hand Grip Strength, Physical Activities, Functional Limitations and Physical Performance, Fall Incidents		Three months after discharge, 10 participants (10%) in the intervention group had fallen at least once, compared with 24 (23%) in the control group (hazard ratio = 0.41, 95% confidence interval (CI) = 0.19-0.86). There were 57 fall incidents (16 in the intervention group; 41 in the control group). A significantly higher intake of energy (280 kcal, 95% CI = 37-524 kcal) and protein (11 g, 95% CI = 1-25 g) and significantly higher serum 25-hydroxyvitamin D levels (10.9 nmol/L, 95% CI = 2.9-18.9 nmol/L) were found in participants in the intervention group than in controls.

Neelemaat F, Bosmans JE, Thijs A et al. Oral nutritional support in malnourished elderly decreases functional limitations with no extra costs. Clin Nutr 2012; 31: 183-190 [198]

Study Type/ Evidence Level	Study details/limitations	Patient characteristics	Interventions
RCT 1+	**Countries:** Netherlands **Centers:** n/a **Setting:** From hospital admission until 3 months after discharge. **Funding Sources:** The Netherlands Organisation for Health Research and Development (ZonMw) **Dropout rates:** 28.57% **Study limitations:** - The follow-up period was three months only - The study was powered to detect differences in functionality, but underpowered to detect cost differences	**Total no. Patients:** 210 **Inclusion criteria:** hospital admitted malnourished (BMI ≤20 and/ or ≥5% unintentional weight loss in the previous month and/ or ≥10% unintentional weight loss in the previous six months) elderly (≥ 60 y) patients **Exclusion criteria:** Patients were excluded when they suffered from senile dementia, could not understand the Dutch language or were not able or willing to give informed consent.	- Intervention group: Patients in the intervention group received nutritional supplementation (energy and protein enriched diet, oral nutritional support, calcium-vitamin D supplement, telephone counselling by a dietician) until three months after discharge from hospital. - Control group: Patients in the control group received usual care (control).
Notes	**Author's Conclusion:** A multi-component nutritional intervention to malnourished elderly patients for three months after hospital discharge leads to significant improvement in functional limitations and is neutral in costs. A follow-up of three months is probably too short to detect changes in QALYs or physical activities.		
Outcome measures/results	- Primary outcomes : Quality Adjusted Life Years (QALYs) - Secondary outcomes: physical activities and functional limitations.		210 patients were included, 105 in each group. After three months, no statistically significant differences in quality of life and physical activities were observed between groups. Functional limitations decreased significantly more in the intervention group (mean difference -0.72, 95% CI-1.15; -0.28). There were no differences in costs between groups. Cost-effectiveness for QALYs and physical activities could not be demonstrated. For functional limitations we found a 0.95 probability that the intervention is cost-effective in comparison with usual care for ceiling ratios > €6500.

Neelemaat F, van Keeken S, Langius J et al. Survival in malnourished older patients receiving post-discharge nutritional support; long-term results of a randomized controlled trial. J Nutr Health Aging 2017; 21: 855-860 [287]

Study Type/ Evidence Level	Study details/limitations	Patient characteristics	Interventions
RCT 1+ ROB2: High risk of bias	**Countries:** Netherlands **Centers**: VU University Medical Center **Setting:** departments of general internal medicine, rheumatology, gastroenterology, dermatology, nephrology, orthopedics, traumatology and vascular surgery **Funding Sources:** no grant/funding **Dropout rates:** 0,1% **Study limitations:** design of the study was not double-blind Risk of Bias High Inconsistency N/A Indirectness High Impreciseness Moderate Publication Bias N/A	**Total no. Patients:** 210 **Inclusion criteria:** patients aged ≥ 60 years with Malnutrition (BMI < 20 and/or ≥ 5% unintentional weight loss in the previous month and/or ≥ 10% unintentional weight loss in the previous six months) **Exclusion criteria:** patients who could not understand the Dutch language, were suffering from senile dementia and/or were unable to or not willing to give informed consent	- participants allocated to the intervention group (n=104) received nutritional intervention starting in the hospital and continued for three months after discharge, the nutritional intervention included two servings of an oral nutritional supplement per day (in total 600 kcal and 24 g protein/day), an energy and protein enriched diet (during the in-hospital period), 400 IU vitamin D3 and 500 mg calcium per day and telephone counseling with a dietitian every two weeks - Participants allocated to the control group (n=104) received usual care; these patients only received nutritional support on prescription from their physician
Notes	**Author's Conclusion:** the current study failed to demonstrate an effect of a three-months post-discharge multi-component nutritional intervention in malnourished ill older patients on long-term survival, despite the positive effects on short-term outcomes such as functional limitations and falls. In the literature, inconsistent results were found for the effect of a nutritional intervention on survival in older patients. Recommendations for further research are large scale multicenter studies designed for survival analysis in malnourished older patients with an individualized multi-component nutritional intervention with a minimal intervention time of 6 months		
Outcome measures/results	Primary outcome: ability to perform activities of daily living (functional limitation, physical performance and physical activity) Secondary outcome: changes in body weight, body composition, quality of life, muscle strength and fall incidents		There were no statistically significant differences in survival between the two groups 1 year (HR= 0.933, 95% CI=0.675-1.289) and 4 years after enrollment (HR=0.928, 95% CI=0.671-1.283)

Olofsson B, Stenvall M, Lundstrom M et al. Malnutrition in hip fracture patients: an intervention study. J Clin Nurs 2007; 16: 2027-2038. doi:10.1111/j.1365-2702.2006.01864.x [288]

Study Type/ Evidence Level	Study details/limitations	Patient characteristics	Interventions
RCT 1+	**Countries:** Sweden **Centers:** Umea University Hospital **Setting:** orthopedic department **Funding Sources:** Borgerskapet in Umea Research Foundation, the Dementia Fund, the ‚Vardal Foundation' **Dropout rates:** 21.1% **Study limitations:** • MNA has not generally been used to detect changes in nutritional status in relation to different variables over time, as it is used in the present study • Study sample is rather small • The assessment for MNA was not made on more than one occasion soon after admission and then the questions referred to the prefracture conditions	**Total no. Patients:** 199 **Inclusion criteria:** patients aged 70 years and above with femoral neck fracture **Exclusion criteria:** severe rheumatoid arthritis, severe hip osteoarthritis, severe renal failure, metastatic fracture and patients who were bedridden before their injury	• **Intervention group:** The staffing ratio was 1·07 nurses or aids per bed. Patients in the intervention group were admitted to a geriatric ward specializing in geriatric orthopedic patients. A nutritional journal was established for each patient and the patient's intake of food and liquid was registered in this journal for the first four postoperative days. Protein-enriched meals were served during the first four postoperative days and longer if necessary. All the patients in the intervention group also received two nutritional and protein drinks daily during their whole hospitalization period. The environment surrounding the meal was adjusted. • **Control group:** The staffing ratio at the orthopedic ward was 1·01 nurses or aids per bed. The control group received their postoperative care in the orthopedic department in accordance with conventional postoperative care routines.
Notes	**Author's Conclusion:** Malnutrition was common among older people with hip fractures admitted to hospital. The nutritional intervention might have contributed to the patients suffering fewer days with delirium, fewer decubitus ulcers and shorter hospitalization but did not improve the long-term nutritional status, at least not in women.		
Outcome measures/results	Nutritional status (MNA), cognitive status (MMSE), delirium (OBS Scale), Depression (GDS-15)		Malnutrition was common and low MNA scores were associated with postoperative complications such as delirium and decubitus ulcers. There were significantly fewer

		days of delirium in the intervention group, seven patients in the intervention group developed decubitus ulcers vs. 14 patients in the control group and the total length of hospitalization was shorter. There were no detectable significant improvements regarding nutritional parameters between the intervention and the control group at the four-month follow-up but men improved their mean BMI, body weight and MNA scores in both the intervention and the control groups while women deteriorated in both groups.

Rasmussen NML, Belqaid K, Lugnet K et al. Effectiveness of multidisciplinary nutritional support in older hospitalised patients: A systematic review and meta-analyses. Clin Nutr ESPEN 2018; 27: 44-52. doi:10.1016/j.clnesp.2018.07.002 [289]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic review 1+ AMSTAR II: Moderate quality	**Countries**: n/a **Centers**: n/a **Setting**: during hospitalisation and after discharge 2 x medical pat. 3 x orthopaedic patients **Funding Sources**: Nordic Nutrition Academy (NNA): universities in the Nordic region, PEN societies, Baxter, Nestle Health Care **Dropout rates**: n/a **Study limitations**: search from 2013 to 2017 small number of studies no sub-group analysis, according to e.g. nutrition risk only studies published in English, Danish, Norwegian or Swedish Risk of Bias Moderate Inconsistency High Indirectness High	**Total no. patients**: 5; 598 Pat **Inclusion criteria**: older (65+) patients. Controlled trial **Exclusion criteria**: no specific description of who provided the intervention.	Intervention more than one profession incorporating a nutritional component: - use of oral nutritional supplements (ONS), - improved nutritional care, and/or - dietary counselling Control: Usual care

	Impreciseness Moderate Publication Bias N/A		
Notes	For quality assessment of studies, “Cochrane Collaboration's tool for assessing risk of bias” was used. - three studies to have high quality and hence a low risk of bias and two studies were assessed as having low and moderate quality, respectively **Author’s Conclusion:** Although a small number of studies and a relatively small sample size, a suggestion is that provision of multidisciplinary nutritional support may have a positive effect on mortality and improves quality of life in older patients.		
Outcome measures/results	Critical: Mortality, readmissions, and quality of life, Important: nutritional status, drop outs and adverse events		Meta-analyses found improved QoL (MD 0.13 (0.02, 0.23), P ¼ 0.01) and indicated tendencies towards lower mortality (OR 0.50 (0.22, 1.14), P ¼ 0.10), in the intervention group vs. control group. Meta-analysis showed no difference between intervention and control group regarding readmissions during intervention (OR 1.04 (0.40, 2.70)) or at a 26 weeks follow up (OR 0.84 (0.18, 3.82))

Stenvall M, Olofsson B, Lundstrom M et al. A multidisciplinary, multifactorial intervention program reduces postoperative falls and injuries after femoral neck fracture. Osteoporos Int 2007; 18: 167-175. doi:10.1007/s00198-006-0226-7 [290]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+	**Countries:** Sweden **Centers:** Umea University Hospital **Setting:** orthopedic and geriatric departments **Funding Sources:** Vardal Foundation, the Joint Committee of the Northern Health Region of Sweden **Dropout rates:** 0% **Study limitations:** some falls could have been missed, the fall registration could not be blinded regarding group allocation, small study sample size	**Total no. Patients:** 199 **Inclusion criteria:** patients with femoral neck fracture aged ≥70 years **Exclusion criteria:** severe rheumatoid arthritis, severe hip osteoarthritis, or pathological fracture	• Intervention group: Active prevention, detection and treatment of postoperative complications such as falls, delirium, pain and decubitus ulcers was systematically implemented daily during the hospitalization. The staffing at the intervention ward were 1.07 nurses/aides per bed. • Control group: conventional postoperative routines, the staffing at the orthopedic unit was 1.01 nurses/aides per bed and 1.07 for the geriatric control ward
Notes	**Author's Conclusion:** A team applying comprehensive geriatric assessment and rehabilitation, including prevention, detection, and treatment of fall risk factors, can successfully prevent inpatient falls and injuries, even in patients with dementia.		
Outcome measures/results	Complications during hospitalization, including falls, length of stay, morbidity, and mortality.		Twelve patients fell 18 times in the intervention group compared with 26 patients suffering 60 falls in the control group. Only one patient with dementia fell in the intervention group compared with 11 in the control group. The crude postoperative fall incidence rate was 6.29/1,000 days in the intervention group vs 16.28/1,000 days in the control group. The incidence rate ratio was 0.38 [95% confidence interval (CI): 0.20 – 0.76, p = 0.006] for the total sample and 0.07 (95% CI: 0.01–0.57, p=0.013) among patients with dementia. There were no new fractures in the intervention group but four in the control group.

Stenvall M, Olofsson B, Nyberg L et al. Improved performance in activities of daily living and mobility after a multidisciplinary postoperative rehabilitation in older people with femoral neck fracture: a randomized controlled trial with 1-year follow-up. J Rehabil Med 2007; 39: 232-238. doi:10.2340/16501977-0045 [291]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+	**Countries:** Sweden **Centers:** Umea University Hospital **Setting:** orthopedic and geriatric departments **Funding Sources:** Vardal Foundation, the Joint Committee of the Northern Health Region of Sweden **Dropout rates:** 0% **Study limitations:** • the outpatient rehabilitation after discharge was not as standardized as during in-hospital stay • the assessors were not blinded concerning group allocation during the home visit and therefore bias cannot be excluded • no figures for cost effectiveness	**Total no. Patients:** 199 **Inclusion criteria:** patients with femoral neck fracture, aged >or= 70 years **Exclusion criteria:** severe rheumatoid arthritis, severe hip osteoarthritis, or pathological fracture	The intervention consisted of staff education, individualized care planning and rehabilitation, active prevention, detection and treatment of postoperative complications. The staff worked in teams to apply comprehensive geriatric assessment, management and rehabilitation. A geriatric team assessed those in the intervention group 4 months postoperatively, in order to detect and treat any complications. The control group followed conventional postoperative routines.
Notes	**Author's Conclusion:** A multidisciplinary postoperative intervention program enhances activities of daily living performance and mobility after hip fracture, from both a short-term and long-term perspective.		
Outcome measures/results	primary outcomes: living conditions, walking ability and activities of daily living performance on discharge, 4 and 12 months postoperatively		Despite shorter hospitalization, significantly more people from the intervention group had regained independence in personal activities of daily living performance at the 4- and 12-month follow-ups; odds ratios (95% confidence interval (CI)) 2.51 (1.00-6.30) and 3.49 (1.31-9.23), respectively. More patients in the intervention group had also regained the ability to walk independently indoors without walking

		aids by the end of the study period, odds ratio (95% confidence interval) 3.01 (1.18-7.61).

II.2. Besonderheiten bei häufigen geriatrischen Krankheiten und Syndromen

II.2.1 Hüftfraktur

Empfehlung 44

Älteren Patienten mit Hüftfraktur sollen postoperativ orale bilanzierte Diäten (Trinknahrung) angeboten werden, um die Nahrungsaufnahme zu verbessern und das Komplikationsrisiko zu reduzieren.

Empfehlungsgrad A

Avenell A, Smith TO, Curtain JP et al. Nutritional supplementation for hip fracture aftercare in older people. Cochrane Database Syst Rev 2016; 11: Cd001880. doi:10.1002/14651858.CD001880.pub6 [302]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1++	**Countries:** n/a **Centers:** n/a **Setting:** hospital, rehabilitation, any location after discharge from either of these facilities **Funding Sources:** National Institute for Health Research via Cochrane Infrastructure funding to the Cochrane Bone, Joint and Muscle Trauma Group **Dropout rates:** n/a **Study limitations:** outcome data were limited, risk of bias →studies often methodologically flawed, Quality of evidence ranged from very low to low (GRADE	**Total no. Studies:** n=41 (3881 participants) **Inclusion criteria:** randomized, quasi-randomized controlled trials, nutritional interventions (started within the first months after hip fracture), patients >65 years, hip fracture, studies with mixed populations (orthopedic/other geriatric) only if separate data from hip fracture patients available **Exclusion criteria:** nutritional interventions that examined the secondary prevention of osteoporotic fractures after hip fracture, studies focused on mainly on younger patients, studies with patients with multiple trauma/pathological fractures, trials	Nutritional interventions aimed to improve the recovery from hip fracture by increasing energy intake, protein, vitamins/minerals, alone or in combination 1) Oral multinutrients feeds (non-protein energy, protein, vitamins, minerals; n=18 trials) 2) Enteral (Nasogastric) multinutrient feeding (n=4) 3) Tube feeding (n=1) 4) Combination of intravenous (parental) feeding and oral supplementation (n=1) 5) Increased protein intake (n=4); Comparison of different protein sources (n=1) 6) (Intravenous) Vitamin Supplementation (n=4); Comparison of different Vit. D sources (n=1); Iron suppl. Vs Control (n=3); Vit., mineral, amino acid vs. control (n=1); Isonitrogenous ornithine alpha-ketoglutarate versus peptide supplement (n=1); taurine vs. placebo (n=1) 7) Dietetic assistance (n=1)

	Assessment), pooled mortality, complications, unfavorable outcome data irrespective of length of follow-up	published before 1980 with undefined geriatric population, mixed populations with fewer than 5 patients with hip fracture,	
Notes	• studies also included that could not be analyzed on a intention-to-treat basis, lack of blinding, use of placebo treatment • authors independently assessed risk of bias (Cochrane Risk of Bias tool) • RCT n=37; quasi-RCT n=4; sample size ranged from 10 to 318; Majority of participants were female **Author's Conclusion:** There is low-quality evidence that oral multinutrient supplements started before or soon after surgery may prevent complications within the first 12 months after hip fracture, but that they have no clear effect on mortality. There is very low-quality evidence that oral supplements may reduce 'unfavorable outcome' (death or complications) and that they do not result in an increased incidence of vomiting and diarrhea.		
Outcome measures/results	• Main Outcomes: ▪ All-cause mortality ▪ Morbidity ▪ Postoperative complications (wound infection, pressure sores, etc.) ▪ Unfavorable outcome (participants who died + number of survivors with complications) • Secondary outcomes: ▪ Length of hospital/rehabilitation unit stay ▪ Postoperative functional status (cognitive functioning, mobility, activities daily living) ▪ Level of care/extent of support required after discharge ▪ Quality of life after discharge ▪ Fracture healing ▪ Adverse events (diarrhea) • Other outcomes ▪ Tolerance of/compliance with nutrition intervention ▪ Career burden and stress ▪ Economic outcomes	• Oral multinutrient feeds little effect on mortality (risk ratio (RR) 0.81 favoring supplementation; 95% CI 0.49 to 1.32; 15 trials) Complications: evidence that the number of participants with complications may be reduced (RR 0.71, 95%CI 0.59 to 0.86; n=11) Lower numbers of unfavorable outcome due to oral supplement (RR 0.67, 95% CI 0.51 to 0.89; n=6) No increased incidence of vomiting/diarrhea due to oral supplementation (RR 0.99, 95% CI 0.47 to 2.05; n=6) Results Influence Interventions on length of hospital stay varies, but seems to be positive; functional status results different; QoL/fracture healing no difference between Groups • Nasogastric feeding (n=3): poorly tolerated; no effects on mortality/complications; no unfavorable outcome; no homogenous results for length of stay/ADL • Tube feeding (n=1): poorly tolerated; no effects on mortality/complications/length of stay/ADL • Combination (intravenous, oral; n=1): Intervention may reduce complications (significant reduction: RR 0.21, 99% CI 0.08 to 0.59); no difference between groups: length of stay • Increased protein intake (n=4): no clear effect on mortality/complications/adverse events; low contradictory evidence of a reduction in unfavorable outcomes (RR 0.78, 95% CI 0.65 to 0.95; n=2) • Intravenous vitamins (many versions): low/very low quality evidence of no clear effect on mortality/complications

		• Dietetic assistance: may reduce mortality, no clear effect on complications/length of stay

Ekinci O, Yanık S, Terzioğlu Bebitoğlu B et al. Effect of Calcium β-Hydroxy-β-Methylbutyrate (CaHMB), Vitamin D, and Protein Supplementation on Postoperative Immobilization in Malnourished Older Adult Patients With Hip Fracture. Nutr Clin Pract 2016; 31: 829-835. doi:10.1177/0884533616629628 [303]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+ ROB2: Some concerns	**Countries:** Turkey **Centers:** Haydarpaşa Numune Research and Training Hospital, Istanbul, Marburg**,** **Setting:** Surgery unit **Funding Sources:** no inf. **Dropout rates:** 17% (n=13) **Study limitations:** High risk of Bias, incorrect blinding, antropometry match not optimal Risk of Bias Moderate Inconsistency n/a Indirectness Low Impreciseness Moderate Publication Bias n/a	Total no. Patients 75 **Inclusion criteria:** Female, ≥65 years of Age, hip fracture Ex**clusion criteria:** diabetes, organ failure, renal and hepatic failure, gastrointestinal intolerance, and endocrine pathology such as thyroid disorders dementia, Alzheimer disease	Standard postoperative diet (1900 kcal) plus nutritional supplement (CaHMB 3 g, vitamin D 1000 IU, protein 36 g) twice /day Vs Standard postoperative diet
Notes	Nutrition support of older adults with a CaHMB/vitamin D/protein combination accelerated wound healing after orthopedic surgery, reduced the immobilization period, and increased muscle strength without changing BMI.		
Outcome measures/results	Follow-up: 30 d Oucomes: grip strength, BMI, Calf and arm circumference Triceps skinfold thickness (TST) praeop. and days 15 and 30. wound healing, CRP, Lenth of Hospitals stay, NRS		Wound-healing period was significantly shorter in the intervention group than in the control group ($P < .05$). The number of patients in interv. group who were mobile on days 15 and 30 (81.3%) was significantly higher than patients in the control group, who were mobile on days 15 and 30 (26.7%) ($P = .001$). Muscle strength on day 30 was significantly higher in the CaHMB/vitamin D/protein group vs the control group.

Liu M, Yang J, Yu X et al. The role of perioperative oral nutritional supplementation in elderly patients after hip surgery. Clin Interv Aging 2015; 10: 849-858. doi:10.2147/cia.S74951 [304]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1+	**Countries:** China **Centers:** n/a **Setting:** n/a **Funding Sources:** National Natural Sciences Foundation of China **Dropout rates:** n/a **Study limitations:** small number of available studies	**Total no. Patients:** 986 **Inclusion criteria:** 1. Target population: patients aged over 65 years who had hip fractures and undergone surgery 2. Intervention measure: perioperative ONS 3. Design type: RCT **Exclusion criteria:** 1. Patients with multiple systemic fractures or pathologic fractures 2. Data without standard deviations 3. Participants with hip fractures who had undergone nonsurgical treatment	Perioperative ONS
Notes	Each of the ten included studies was an RCT and two of them were double blind. **Author's Conclusion:** Based on the evidence available, this meta-analysis is consistent with the hypothesis that perioperative ONS can help elderly patients recover after hip surgery and reduce complications.		
Outcome measures/results	1. Total protein, 2. Complications (including all infections, bed sores, cardiac disease, cognitive impairment, prolonged immobilization, thrombophlebitis, deep vein thrombosis, vomiting diarrhea, pressure ulcers, dysphasia, severe hyponatremia, anaphylaxis, pneumonedema, pulmonary embolism, and myocardial infarction), 3. Change in serum albumin levels (the difference in serum albumin levels before and after intervention, 4. Mortality		The combined trials showed that ONS had a positive effect on the serum total protein ($P<0.00001$) and led to a significantly decreased number of complications ($P=0.0005$). Furthermore, data from the infection subgroups showed significant decreases in wound infection ($P=0.02$), respiratory infection ($P=0.04$), and urinary tract infection ($P=0.03$). Clinical observation suggest that the intervention may improve the level of serum albumin, although the data did not reach statistical significance ($P=0.48$). Regarding mortality, there was no significant statistical difference between the intervention group and the control ($P=0.93$).

Malafarina V, Uriz-Otano F, Malafarina C et al. Effectiveness of nutritional supplementation on sarcopenia and recovery in hip fracture patients. A multi-centre randomized trial. Maturitas 2017; 101: 42-50. doi:10.1016/j.maturitas.2017.04.010 [305]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+ ROB2: Some concerns	**Countries:** Spain **Centers:** Hospital San Juan de Dios, Pamplona, Hospital Viamed Valvanera, Logroño, **Setting:** post-acute rehabilitation centres: **Funding Sources:** none **Dropout rates:** 14 % **Study limitations:** Lacking information: Randomization process, Intervention Deviations, Missing data. No follow-up of our patients after discharge Risk of Bias Moderate Inconsistency n/a Indirectness Low Impreciseness Moderate Publication Bias n/a	**Total no. Patients:** 107 **Inclusion criteria:** age ≥65, and a diagnosis of hip fracture **Exclusion criteria:** diabetes, Barthel index scores<40 prior to the fracture or with pathological fractures	**Exercise:** 5 x a week, 50-min supervised rehabilitation therapy. Exercises to strengthen the lower limbs, balance exercises, and walking re-training in individual or group **Standard diet**: 1500 kcal, 23.3% protein (87.4 g/day), 35.5% fat (59.3 g/day) and 41.2% carbohydrates (154.8 g/day). **Intervention group**: + 2 x 220ml, 330 kcal (Ensure® Plus Advance, Abbott Lab S.A.): 1.5 kcal/mL, 24% protein (9.1 g/100 ml), 29% fat (5 g/100 ml) and 46% carbohydrates (16.8 g/100 ml). The supplement was enriched with β-hydroxy-β-methylbutyrate, CaHMB 0.7 g/100 ml, 25(OH)D 227 IU/100 ml and 227 mg/100 ml of calcium **Control group:** standard diet + Excercise
Notes	**Author's Conclusion**: A diet enriched in HMB improves muscle mass, prevents the onset of sarcopenia and is associated with functional improvement in elderly patients with hip fractures. Orally administered nutritional supplements can help to prevent the onset of sarcopenic obesity		
Outcome measures/results	At admission and discharge. BIA: aLM: appendicular lean mass, ASMM: appendicular skeletal muscle mass, FFM: fat free mass, FM: fatty mass, MM: muscle mass, SMM: Skeletal Muscle Mass. hand grip strength, BMI, BI gait speed at discharge Laboratory: blood count and kidney, function, total proteins, albumin, transthyretine, and 25(OH)D levels, cholesterol and triglycerides, glycemic levels and the blood concentration of insulin, C-reactive protein (CRP), interleukin-1 (IL-1), interleukin −6 (IL-6),		BMI and aLM were stable in IG patients, whilst these parameters decreased in the CG. A significant difference was observed between the two groups ($p < 0.001$, and $p = 0.020$ respectively). The predictive factors for Δ-aLM were ONS ($p = 0.006$), FAC prior to fracture ($p < 0.001$) and BI prior to fracture ($p = 0.007$). The concentration of proteins ($p = 0.007$) and vitamin D ($p.001$) had increased more in the IG than in the CG

	tumour necrosis factor-alpha (TNF-α), Once: Previous BI, Previous FAC, Charlson index, MMSE, Social assessment

Takahashi K, Momosaki R, Yasufuku Y et al. Nutritional Therapy in Older Patients With Hip Fractures Undergoing Rehabilitation: A Systematic Review and Meta-Analysis. J Am Med Dir Assoc 2020; 21: 1364-1364.e1366. doi:10.1016/j.jamda.2020.07.005 [306]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions multitailored????**
Systematic Review 1- AMSTAR 2: Low quality	**Countries:** Spain, Japan Turkey, Sweden, China, UK, Australia **Centers:** n/a **Setting:** rehabilitation **Funding Sources:** none **Dropout rates**: 0 **Study limitations:** duration of interventions for rehabilitation and nutrition therapy differed Some studies had high risk of bias for blinding methods Risk of Bias Moderate Inconsistency Moderate Indirectness High Impreciseness Moderate Publication Bias Low	**Total no. of Studies:** n=10 **Inclusion criteria:** Patients age 65 years and over undergoing rehabilitation after hip fracture. **Exclusion criteria:**	(1) nutritional guidance based on individualized nutritional assessment of the patients; (2) nutritional counseling; (3) provision of oral nutrition products; and (4) implementation of intravenous and enteral nutrition. Comparator: Alternative intervention or no intervention Six studies compared the addition of a high-protein nutritional supplements to a standard diet with a standard diet alone. One study compared the addition of high-energy, high-protein nutritional supplements to a normal diet with that of milk to a normal diet. One study compared usual hospital diet plus nasogastric tube feeding with usual hospital diet. One study compared individual nutritional support by dietetic assistants with conventional nursing care. One study compared counseling by a managing dietitian at a visit and exercise guidance by a physical therapist with only usual care
Notes	**Author's Conclusion**: the combination of rehabilitation and nutritional therapy for older patients with hip fractures reduced mortality and postoperative complications and promoted functional recovery.		
Outcome measures/results	Mortality, postoperative complications. grip strength, ADL, QOL, knee extension strength,		nutritional therapy for patients with hip fractures undergoing rehabilitation reduced mortality and postoperative complications and it improved grip strength. The effect of nutritional therapy on ADL, QOL, and knee extension strength remains unclear because of small numbers

Wyers CE, Reijven PLM, Breedveld-Peters JJL et al. Efficacy of Nutritional Intervention in Elderly After Hip Fracture: A Multicenter Randomized Controlled Trial. J Gerontol A Biol Sci Med Sci 2018; 73: 1429-1437. doi:10.1093/gerona/gly030 [307]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+ ROB2: Some concerns	**Countries: NL** **Centers:** 3 Maastricht Unive.Medical Center Zuyderland Medical Center, Heerlen Sittard-Geleen **Setting:** postacute ambulant **Funding Sources:** Netherlands Organization for Health Research and Development **Dropout rates**: 9 % **Study limitations:** not blinded, moment of hospital discharge is partly influenced by space limitations in rehabilitation clinics and by home conditions for giving informed consent, delayed interv. Risk of Bias Moderate Inconsistency n/a Indirectness Low Impreciseness Moderate Publication Bias n/a	**Total no. Patients:** 152 **Inclusion criteria:** elderly patients admitted for surgical treatment of hip fracture **Exclusion criteria:** age < 55 years, bone disease, life expectancy < 1 year, bedridden, using oral nutritional supplements (ONS) before hospitalization, and cognitive impairment	weekly dietetic consultation, energy/protein– enriched diet, and ONS (400 mL per day) for 3 months after surgery vs. Control: usual nutritional care
Notes	**Author's Conclusion**: Intensive nutritional intervention after hip fracture improved nutritional intake and status, but not LOS or clinical outcomes. Paradigms underlying nutritional intervention in elderly after hip fracture may have to be reconsidered.		
Outcome measures/results	Primary outcome: total LOS in hospital and rehabilitation clinic, including readmissions over 6 months Secondary outcomes: nutritional and functional status, cognition,		Median total LOS was 34.0 days (range 4–185 days) in the intervention group versus control 35.5 days (3–183 days; plogrank = .80; adjusted hazard ratio (adjHR): 0.98; 95% CI: 0.68–1.41). Hospital LOS: 12.0 days (4–56 days) versus 11.0

	quality of life, postoperative complications (6 months); subsequent fractures and all-cause mortality (1 and 5 years). Effect modification by baseline nutritional status was also tested.	days (3–115 days; p = .19; adjHR: 0.75; 95% CI: 0.53–1.06) and LOS in rehabilitation clinics: 19.5 days (0–174 days) versus 18.5 days (0–168 days; p = .82; adjHR: 1.04; 95% CI: 0.73–1.48). The intervention improved nutritional intake/status at 3, but not at 6 months, and did not affect any other outcome. No difference in intervention effect between malnourished and well-nourished patients was found.

Empfehlung 45

Bei älteren Patienten mit Hüftfraktur kann postoperative Trinknahrung mit perioperativer parenteraler Ernährung kombiniert werden, um die Energie- und Nährstoffversorgung zu verbessern und das Komplikationsrisiko zu reduzieren.

Empfehlungsgrad 0

Avenell A, Smith TO, Curtain JP et al. Nutritional supplementation for hip fracture aftercare in older people. Cochrane Database Syst Rev 2016; 11: Cd001880. doi:10.1002/14651858.CD001880.pub6 [302]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1++	**Countries:** n/a **Centers:** n/a **Setting:** hospital, rehabilitation, any location after discharge from either of these facilities **Funding Sources:** National Institute for Health Research via Cochrane Infrastructure funding to the Cochrane Bone, Joint and Muscle Trauma Group **Dropout rates:** n/a **Study limitations:** outcome data were limited, risk of bias →studies often methodologically flawed,	**Total no. Studies:** n=41 (3881 participants) **Inclusion criteria:** randomized, quasi-randomized controlled trials, nutritional interventions (started within the first months after hip fracture), patients >65 years, hip fracture, studies with mixed populations (orthopedic/other geriatric) only if separate data from hip fracture patients available **Exclusion criteria:** nutritional interventions that examined the secondary prevention of osteoporotic fractures after hip fracture, studies focused on mainly on younger patients, studies with	Nutritional interventions aimed to improve the recovery from hip fracture by increasing energy intake, protein, vitamins/minerals, alone or in combination 8) Oral multinutrients feeds (non-protein energy, protein, vitamins, minerals; n=18 trials) 9) Enteral (Nasogastric) multinutrient feeding (n=4) 10) Tube feeding (n=1) 11) Combination of intravenous (parental) feeding and oral supplementation (n=1) 12) Increased protein intake (n=4); Comparison of different protein sources (n=1) 13) (Intravenous) Vitamin Supplementation (n=4); Comparison of different Vit. D sources (n=1); Iron suppl. Vs Control (n=3); Vit., mineral, amino acid vs. control (n=1); Isonitrogenous ornithine alpha-ketoglutarate versus peptide supplement (n=1); taurine vs. placebo (n=1) 14) Dietetic assistance (n=1)

	Quality of evidence ranged from very low to low (GRADE Assessment), pooled mortality, complications, unfavorable outcome data irrespective of length of follow-up	patients with multiple trauma/pathological fractures, trials published before 1980 with undefined geriatric population, mixed populations with fewer than 5 patients with hip fracture,	
Notes	• studies also included that could not be analyzed on a intention-to-treat basis, lack of blinding, use of placebo treatment • authors independently assessed risk of bias (Cochrane Risk of Bias tool) • RCT n=37; quasi-RCT n=4; sample size ranged from 10 to 318; Majority of participants were female **Author's Conclusion:** There is low-quality evidence that oral multinutrient supplements started before or soon after surgery may prevent complications within the first 12 months after hip fracture, but that they have no clear effect on mortality. There is very low-quality evidence that oral supplements may reduce 'unfavorable outcome' (death or complications) and that they do not result in an increased incidence of vomiting and diarrhea.		
Outcome measures/results	• Main Outcomes: ▪ All-cause mortality ▪ Morbidity ▪ Postoperative complications (wound infection, pressure sores, etc.) ▪ Unfavorable outcome (participants who died + number of survivors with complications) • Secondary outcomes: ▪ Length of hospital/rehabilitation unit stay ▪ Postoperative functional status (cognitive functioning, mobility, activities daily living) ▪ Level of care/extent of support required after discharge ▪ Quality of life after discharge ▪ Fracture healing ▪ Adverse events (diarrhea) • Other outcomes ▪ Tolerance of/compliance with nutrition intervention ▪ Career burden and stress ▪ Economic outcomes	• Oral multinutrient feeds little effect on mortality (risk ratio (RR) 0.81 favoring supplementation; 95% CI 0.49 to 1.32; 15 trials) Complications: evidence that the number of participants with complications may be reduced (RR 0.71, 95%CI 0.59 to 0.86; n=11) Lower numbers of unfavorable outcome due to oral supplement (RR 0.67, 95% CI 0.51 to 0.89; n=6) No increased incidence of vomiting/diarrhea due to oral supplementation (RR 0.99, 95% CI 0.47 to 2.05; n=6) Results Influence Interventions on length of hospital stay varies, but seems to be positive; functional status results different; QoL/fracture healing no difference between Groups • Nasogastric feeding (n=3): poorly tolerated; no effects on mortality/complications; no unfavorable outcome; no homogenous results for length of stay/ADL • Tube feeding (n=1): poorly tolerated; no effects on mortality/complications/length of stay/ADL • Combination (intravenous, oral; n=1): Intervention may reduce complications (significant reduction: RR 0.21, 99% CI 0.08 to 0.59); no difference between groups: length of stay • Increased protein intake (n=4): no clear effect on mortality/complications/adverse events; low contradictory evidence of a reduction in unfavorable outcomes (RR 0.78, 95% CI 0.65 to 0.95; n=2)

		• Intravenous vitamins (many versions): low/very low quality evidence of no clear effect on mortality/complications • Dietetic assistance: may reduce mortality, no clear effect on complications/length of stay

Eneroth M, Olsson UB, Thorngren KG. Insufficient fluid and energy intake in hospitalised patients with hip fracture. A prospective randomised study of 80 patients. Clin Nutr 2005; 24: 297-303. doi:10.1016/j.clnu.2004.12.003 [295]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+	**Countries:** Sweden **Centers:** University Hospital in Lund Sweden, Department für Orthopaedics **Setting:** hospitalisation **Funding Sources:** supported by Medical Faculty of Lund University, County of Skane, Swedish National Board of Health and Welfare **Dropout rates:** 86% (n=590 eligiblepatients) **Study limitations:** generalitydue to selection of most healthy hip fractures patients, no golden standard to diagnose PEM (MNA seems best available tool), used recommendations in literature but there is still a great uncertainty about actual needs of the elderly	**Total no. Patients:** n=80 **Inclusion criteria:** >60 years, cervical/trochanteric hip fracture <24h old, admitted to Department of Orthopaedics, surgery had to be performed <48h from trauma, comparatively healthy patients (able to participate in a number of functional outcome measurements **Exclusion criteria:** multiple fractures, pathologic fractures, malignant disease, inflammatory joint disease, pain or functional impairment other than hip fracture which might hamper normal mobilization, dementia, depression, acute psychosis, known alcohol/medication abuse, epileptic seizures, insulin-treated diabetes mellitus, heart/kidney/liver insufficiency, suspected acute myocardial infarction, hematemesis	Intervention: 1) Control Group (n=40): ordinary hospital food and beverage 2) Intervention Group (n=40): ordinary hospital food and beverage + intravenous supplementary nutrition (1000 kcal/day, Vitimix) for 3 days, then followed by oral supplementary nutrition (400 kcal/day, Fortimel) for 7 days or until discharge
Notes	• Block randomisation by research nurse; All study cases were managed within the same unit in a non-blinded fashion • All tests and recordings were performed by the same person • Food: from hospital kitchen, known energy content; food/fluid intake: recorded daily in both groups on charts → staff observed all meals and noted the contents of the patient´s plate and beverages; water content of food was not included in fluid intake		

	• Optimal dietary intake based on basal demand of 25 kcal/kg bodyweight/day; optimal fluid intake: 30 ml/kg bodyweight/day **Author's Conclusion:** Malnutrition is common even in a selection of healthy patients with hip fractures. During hospital stay the fluid and energy intake was considerably lower than that needed in the control group. Supplementary nutritional intake for ten days increased the total fluid and energy intake in the treatment group to near needed levels.	
Outcome measures/results	• Mini mental test for exclusion of patients with dementia (score <6 excluded) • Care programs were the same within groups (intravenous infusions in pre-, per-, and postoperative phases, infection prophylaxis, full weight-bearing postoperatively) • Day 1: Nutritional status: Subjective Global Assessment (SGA), blood samples (serum protein, immunological test) • Day 3: Anthropometric measurements (AMC, TSF, BMI) →BMI<22 = underweight, serum albumin <36 g/l, serum transthyretin <0.18 g/l (females)/>0.20 g/l (males), total lymphocyte count <1.5 x 10^9/l = markers malnutrition	• Mean age treatment group 84 years; control group 78 years (p=0.001), no difference: sex, pre-fracture living conditions, hip fracture type, time to surgery from trauma, signs of PEM; median stay: 13 days • 1/3 of the patients (of both groups): malnourished (abnormal nutritional parameters → strong indicators of PEM) • Fluid intake (p<0.0001); energy intake (p=0.003) days 1-10 ▪ Control group: 1300 ml; 916 kcal ▪ Intervention group: 1856 ml; 1296 kcal ▪ Fluid intake based on drink only (days 1-10) higher in treatment group (p=0.04; 1136 vs. 1017 ml) ▪ Energy intake based on food and drink only (days 1-10) higher in control group (444 vs. 388 kcal, p=0.01) • Difference between actual and needed fluid (p<0.0001)and energy intake (p=0.0003) days 1-10 ▪ Control group: -739 ml by mean needed of 2039 ml; -783 kcal/day by mean needed of 1699 kcal ▪ Intervention group: +27 ml by mean needed of 1829 ml; -228 kcal/day by mean needed of 1524 kcal →there seem to be small negative influence on appetite in treatment group (but is compensated by extra intake by the supplements)

Eneroth M, Olsson UB, Thorngren KG. Nutritional supplementation decreases hip fracture-related complications. Clin Orthop Relat Res 2006; 451: 212-217. doi:10.1097/01.blo.0000224054.86625.06 [249]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+	**Countries:** Sweden **Centers:** Department of Orthopedics, Lund University Hospital	**Total no. Patients:** n=80	1) Intervention group (n=40, IG): hospital food and beverages of known energy content + 1000 kcal daily intravenous supplement (Virtimix, peripheral veins,3 days), followed by 400 kcal oral nutritional supplements (Fortimel, 7 days) 2) Control Group (n=40; CG): hospital food and beverages of known energy content

	Setting: n/a **Funding Sources:** 1 author received from the Medical Faculty of Lund University, the Country of Skane and Swedish National Board of Health and Welfare **Dropout rates:** 5% **Study limitations:** balanced protein/energy supplement → unknown whether effect was because of protein or increased balanced overall caloric/fluid intake, selection of most healthy patients → generality?	**Inclusion criteria:** cervical/trochanteric hip fractures treated by orthopedic department, >60 years, surgery less than 48 hours after trauma, no diseases or other fractures that might hamper normal mobilization **Exclusion criteria:** multiple fractures, pathologic fractures, malignant disease, inflammatory joint disease, pain, functional impairment other than hip fracture, substantial cognitive impairment, depression, acute psychosis, known alcohol/medication abuse, epileptic seizures, insulin-treated diabetes mellitus, heart, kidney, liver insufficiency, (suspected) acute myocardial infarct, hematemesis	
Notes	• Daily record of: fluid and energy intake during first 10 days of hospitalization and fracture-related complications up to 4 months • Mini-mental test → for exclusion of patients with cognitive impairment (score <6) • Research nurse: randomization (block-) • All patients treated in the same unit; all tests performed by the same nurse; all nurses and physicians were blinded to provided treatment and results; all clinical data were viewed by one UBO (unblinded) • meals observed by nurse, noted content of the patient´s plate and beverage; Proportion of each component of the meal and beverage consumed was calculated on charts on a daily basis • optimal dietary intake based on basal demand of 25 kcal(kg body weight/day; optimal fluid intake: 30 ml/kg body weight/day • definition of complications: clinical symptoms/signs, positive objective investigation; registered at days 3, 10, 30, 120 • poor compliance with oral supplement → no issue in this study, since all patients received oral nutritional supplementation while hospitalized, none had mental impairment **Author's Conclusion:** The comprehensive balanced nutrition supplement resulted in lower complication rates and mortality at 120 days postoperatively.	
Outcome measures/results	• Nutritional status: SGA • Anthropometric measurements: arm muscle circumference, triceps skinfold thickness, BMI • blood samples: Serum protein (albumin, transthyretin), total lymphocyte count	• Median age: 78 years CG vs. 84 years IG; no differences in age, gender comorbidities, living conditions, hip fracture type, time to surgery to trauma; no perioperative differences in signs of PEM; mean stay: 12,5 days

		• SGA: 9% of patients abnormal values (indicating PEM); tree or more abnormal nutritional parameters (PEM) in 38% in the IG and 33% in the CG; 1-2 abnormal nutritional parameters in 60% IG and 58% CG 1/3 of patients were PEM • Energy and fluid intake: ▪ Energy: CG: 54% Energy vs. IG 85% ▪ Fluid: CG 64% fluid of optimal intake vs. IG 101% ▪ Average daily intake (kcal; ml) first 3 days: CG 665 kcal vs. IG 1468 kcal (p=0.001); CG 1704 ml vs. IG 2358 ml (p=0.04) Days 1-10: CG 916 kcal vs. IG 1296 kcal/day (P=0.003); CG 1300 ml vs. IG1856 ml (p=0.0001) • Hip-fracture complications: greater in control group (70%) vs. Intervention (15%; p<0.0001); within 30 days: 33 complications CG and 6 IG (p<0.0001); no difference of risk PEM-patients vs. no-PEM-patients • Cumulative number of infections greater in CG than in IG at days 10, 30, 120; for example: wound infection CG 12 vs. IG 2 patients within 30 days from surgery (p=0.006) • No differences: serum parameters (decrease both groups day 10; increase to higher levels day 30 • Overall mortality 1% (within 30 days); 5% within 4 months; 4 patients died in CG within 70 days

Eschbach D, Kirchbichler T, Wiesmann T et al. Nutritional intervention in cognitively impaired geriatric trauma patients: a feasibility study. Clin Interv Aging 2016; 11: 1239-1246. doi:10.2147/CIA.S109281 [308]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Feasibility study 2+ NHLBI Pre-Post Checklist: Poor quality	**Countries:** Germany **Centers:** University of Marburg, Marburg **Setting:** Surgery unit **Funding Sources:** none **Dropout rates:** 0% **Study limitations:**	**Total no. Patients:** 20 **Inclusion criteria:** geriatric patients (age 60 years or older) with proximal femoral fractures (ICD 10 S 72.0–72.2) admitted to emergency department, cognitively impaired by Mini–Mental State Examination	Parenteral nutritional supplementation, offering 800 kcal/d as well as 1.206 L of fluid supplementation for the 96-hour perioperative period. Parenteral nutrition was started in all cases directly after admission and provided for 96 hours. Two patients did not tolerate peripheral venous line and therefore did not receive more than 48 hours of parenteral nutrition. No control group

	One Intervention, only one dimension, no control Group Risk of bias: high Inconsistency: n/a Indirectness: moderate Impreciseness: high Publication bias: n/a	(<25) and at risk of malnutrition or manifestly malnourished **Exclusion criteria:** pathological fractures or malignancy-associated fractures, multiple traumas, contraindications for parenteral nutrition (such as a soy protein or peanut allergy), and severe liver impairment	
Notes	**Author's Conclusion:** Cognitively impaired trauma patients proved to be especially at risk of malnutrition. Since 96 hours of parenteral nutrition as a crisis intervention was insufficient, additional supplementation could be considered. Laboratory and functional outcome parameters for measuring successive supplementation certainly need further evaluations involving randomized controlled trials.		
Outcome measures/results	Mini Nutritional Assessment (MNA) Elderly, Nutritional Risk Screening (NRS 2002)' BMI, calf circumference (CC), prefracture Barthel Index, and American Society of Anesthesiologists' class. (ASA).The type of surgery (osteosynthesis or prosthesis) and the lengths of the patients' stays in the intensive care unit and in the hospital were documented. Laboratory parameters: albumin, pseudocholinesterase (PCHE), and triglycerides at admission and discharge, and additionally albumin and triglycerides once a day during the intervention. Intervention-associated local complications (e.g., increased rate of intravenous accesses or local infections) and systemic complications (e.g., hypervolemia and elevated liver enzymes or fatty acids) were documented. Further local and systemic complications as well as hospital mortality were recorded. Prefracture mobility was measured using the new mobility score as a validated predictor of long-term mortality and rehabilitation outcome in patients with hip fractures, TUG used as well, if possible. Risk stratification for decubital ulcers (Braden Scale).	The median albumin level was 34 mg/dL (range: 18–41 mg/dL) at admission and 29 mg/dL (range: 26–30 mg/dL) at discharge. This difference was statistically significant (Figure 1A; P=0.016). median new mobility score for pretrauma mobility was only 0.5 (range: 0–5). Postoperative assessments showed that only one patient could perform the TUG test. The mobilization scores included some good results, with 15 patients achieving at least a standing position. The Braden Scale underlined the high risk of developing decubital ulcers, as 18 patients were in the high-risk group The mean hospital stay lasted 13 days (range: 7–17 days), including a mean of 1 day in the intensive care unit (range: 0–17 days). One patient spent 17 days in the intensive care unit before dying due to pneumonia and respiratory failure. 12 patients with nonsurgical complications; the mortality rate was 10%.

Empfehlung 46

Bei älteren Patienten mit Hüftfraktur sollte das ERAS-Konzept mit prä-/perioperative Ernährungsmaßnahmen umgesetzt werden, um Komplikationsrisiko und Dauer des Klinikaufenthalts zu reduzieren.

Empfehlungsgrad B

Hu Z-C, He L-J, Chen D et al. An enhanced recovery after surgery program in orthopedic surgery: a systematic review and meta-analysis. J Orthop Surg Res 2019; 14: 77-77. doi:10.1186/s13018-019-1116-y [309]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic review and meta-analysis 1++ AMSTAR 2: high	**Countries**: n/a **Centers**: n/a **Setting**: in-patient **Funding Sources:** National Natural Science Foundation of China, Zhejiang Provincial Natural Science Foundation, Zhejiang Provincial Medical and Health Technology Foundation, Wenzhou leading talent innovative project, Wenzhou Municipal Science and Technology Bureau **Dropout rates:** n/a **Study limitations:** Non-randomized trials, short follow-up, confounding factors, incomplete data, varied Enhanced Recovery After Surgery (ERAS) definitions Risk of bias: moderate Inconsistency: low Indirectness: low Impreciseness: low	**Total no. studies**: 15 **Inclusion criteria:** Patients after orthopedic surgery, prospective/observational trials, ERAS vs. non-ERAS **Exclusion criteria:** Abstracts, case reports, reviews, animal studies, duplicates, lack of outcome data	ERAS (standardized care, multimodal analgesia, physical therapy) vs. Control (traditional care)

	Publication bias: low		
Notes	**Author's Conclusion:** the ERAS group had more advantages in reducing incidence of postoperative complications, 30-day mortality rate, and Oswestry Disability Index (ODI) after orthopedic surgery, but not of 30-day readmission rate.		
Outcome measures/results	• Primary: Postoperative complications • Secondary: 30-day mortality, 30-day readmission, ODI		Lower complications (OR 0.70), lower mortality (OR 0.40), reduced ODI (WMD −7.86), no difference in readmission

Liu VX, Rosas E, Hwang J et al. Enhanced Recovery After Surgery Program Implementation in 2 Surgical Populations in an Integrated Health Care Delivery System. JAMA surgery 2017; 152: e171032-e171032. doi:10.1001/jamasurg.2017.1032 [310]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
A pre-post study 2+ NHLBI Pre-Post Checklist: Good quality	**Countries**: USA **Centers**: 20 hospitals in Northern California **Setting**: Emergency Hip Fracture Repair **Funding Sources**: Gordon and Betty Moore Foundation, Permanente Medical Group Kaiser Foundation. **Dropout rates**: n/a **Study limitations**: residual confounding and baseline differences, no standardized, validated complications data on all patients short-term outcomes Risk of bias: High Inconsistency: n/a Indirectness: Moderate Impreciseness: High Publication bias: n/a	**Total no. Patients:** Pre (n = 2488) Post (n = 2514) **Inclusion criteria:** Osteoporotic hip fracture patients, > 65 years, consecutively enrolled 3 months after hip fracture, with total hip replacement, **Exclusion criteria:** n/a	A multifaceted Enhanced Recovery After Surgery (ERAS) program designed with a particular focus on perioperative pain management, mobility, nutrition, and patient engagement. Nutrition was enhanced by reducing prolonged perioperative surgical fasting through the use of a preoperative high-carbohydrate beverage within 2 to 4 hours and/or solids within 8 to 12 hours before surgery. Postoperative nutrition was provided within 12 hours after surgery.
Notes	**Author's Conclusion**: Implementation of the ERAS program successfully altered the process-of-care metrics for patients emergency hip fracture repair across 20 hospitals		

Outcome measures/results	primary outcome was hospital length of stay. Secondary outcomes included hospital mortality, home discharge, 30-day readmission rates, and complication rates.	Implementation was associated with significant absolute and relative improvements in hospital, length of stay and surgical complication rates, increased rate of early ambulation (4.44; 95% CI, 3.19-6.21; P < .001). decreased rate of opioid use (0.73; 95% CI, 0.63- 0.85; P < .001). increased rate of discharge to home (1.24; 95% CI, 1.06-1.44; P = .007).

Liu S-Y, Li C, Zhang P-X. Enhanced recovery after surgery for hip fractures: a systematic review and meta-analysis. Perioper Med (Lond) 2021; 10: 31-31. doi:10.1186/s13741-021-00201-8 [311]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review and Meta- Analysis 1+ AMSTAR 2: moderate	**Countries:** n/a **Centers:** n/a **Setting:** n/a **Funding Sources:** Key Laboratory of Trauma and Neural Regeneration (Peking University), Ministry of Education, and several other Chinese foundations, including the National Natural Science Foundation **Dropout rates:** n/a **Study limitations:** High heterogeneity in outcomes like length of stay and time to surgery; potential publication bias; no high-quality randomized controlled trials (RCTs) included; variability in surgical techniques and patient comorbidities across studies. Risk of bias: moderate Inconsistency: high Indirectness: low	**Total no. studies**: 7 **Inclusion criteria:** Studies implementing ERAS programs for hip fracture surgeries; studies covering pre-, intra-, and postoperative management. **Exclusion criteria:** case reports, editorials, commentaries, and reviews were excluded; studies not covering the full spectrum of ERAS components.	**Intervention**: Enhanced Recovery After Surgery (ERAS) programs, including preoperative nutritional support, early mobilization, opiate-sparing analgesia, and standardized postoperative care. **Control**: Usual care without the implementation of ERAS protocols.

	Impreciseness: low Publication bias: moderate		
Notes	**Author's Conclusion:** ERAS programs significantly reduce time to surgery, length of stay, and overall complication rates in patients undergoing hip fracture surgeries without increasing the 30-day readmission or mortality rates. The findings support the implementation of ERAS in hip fracture management, but further high-quality trials are needed to strengthen the evidence**.**		
Outcome measures/results	**Primary Outcomes**: Time to surgery (TTS) and Length of Stay (LOS). **Secondary Outcomes**: 30-day readmission rates, 30-day mortality, 1-year mortality, overall complication rate, delirium rate, and urinary tract infection (UTI) rate.		**Primary Outcomes**: Time to Surgery: Significant reduction in mean TTS (MD = −2.96 hours, 95% CI: −5.40 to −0.53, P = 0.02). Length of Stay: Significant reduction in mean LOS (MD = −2.64 days, 95% CI: −3.63 to −1.65, P < 0.00001). **Secondary Outcomes**: **30-day Readmission Rate**: No significant increase (OR = 1.09, 95% CI: 0.97–1.24, P = 0.16); 30-day Mortality: No significant reduction (OR = 0.84, 95% CI: 0.67–1.06, P = 0.14); 1-year Mortality: No significant reduction (OR = 0.99, 95% CI: 0.87–1.14, P = 0.92); Overall Complication Rate: Significant reduction (OR = 0.68, 95% CI: 0.57–0.80, P < 0.00001); Delirium Rate: Significant reduction (OR = 0.46, 95% CI: 0.23–0.93, P = 0.03); UTI Rate: Significant reduction (OR = 0.39, 95% CI: 0.21–0.71, P = 0.002).

Schmid S, Blobner M, Haas B et al. Perioperative multi-system optimization protocol in elderly hip fracture patients: a randomized-controlled trial. Can J Anaesth 2019; 66: 1472-1482. doi:10.1007/s12630-019-01475-9 [312]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+ ROB 2: some concerns	**Countries:** Germany **Centers:** Klinikum rechts der Isar, Technische Universität München, Munich, Germany **Setting:** in-patient **Funding Sources:** institutional support **Dropout rates:** 0% **Study limitations:** The study was underpowered to detect significant differences in postoperative complications; no blinding of patients or outcome assessors; limited	**Total no. patients**: 127 **Inclusion criteria:** Patients aged 60 years or older undergoing surgery for hip fracture (femoral neck fracture or trochanteric femoral fracture) **Exclusion criteria:** Pathologic fractures, multiple trauma, and fractures occurring during a hospital stay for a different disease.	**Intervention**: Perioperative multi-system optimization protocol, including intensive pain management, goal-directed hemodynamic management, oxygen therapy, and optimized nutrition. **Control**: Standard care without the multi-system optimization protocol.

	generalizability due to being a single-center study; potential bias due to lack of blinding and possible overestimation of the protocol's effect Risk of bias: moderate Inconsistency: n/a Indirectness: low Impreciseness: low Publication bias: n/a		
Notes	**Author's Conclusion:** The perioperative multi-system optimization protocol did not significantly reduce the incidence of postoperative complications in elderly hip fracture patients. However, it resulted in better pain control, more stable hemodynamics, and possibly reduced the incidence of acute kidney injury. A larger, multicenter trial would be necessary to confirm these findings**.**		
Outcome measures/results	**Primary Outcome**: Incidence of postoperative complications. **Secondary Outcomes**: Pain control, mean arterial pressure, oxygen saturation, incidence of acute kidney injury, ICU and hospital length of stay, in-hospital mortality, and one-year mortality.		**Primary Outcome**: 39% of patients in the intervention group experienced at least one postoperative complication compared to 49% in the control group (RR = 0.79; 95% CI, 0.53 to 1.17; P = 0.23). **Secondary Outcomes**: **Pain Control**: 81% of patients in the intervention group had a postoperative NRS < 4, compared to 25% in the control group (P < 0.001); Mean Arterial Pressure (MAP): A median of 75% of patients in the intervention group maintained MAP > 70 mmHg during surgery compared to 57% in the control group (P = 0.001); Acute Kidney Injury (AKI): Incidence was lower in the intervention group (8%) compared to the control group (22%) (P = 0.04); In-hospital mortality: 3% in both groups (P = 0.96); One-year mortality: 14% in the intervention group vs. 11% in the control group (P = 0.68).

Tan P, Huo M, Zhou X et al. The safety and effectiveness of enhanced recovery after surgery (ERAS) in older patients undergoing orthopedic surgery: a systematic review and meta-analysis. Arch Orthop Trauma Surg 2023; 143: 6535-6545. doi:10.1007/s00402-023-04963-2 [313]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review and Meta-Analysis 1++	**Countries**: n/a **Centers**: n/a **Setting**: Orthopedic surgical procedures	**Total no. Patients:** 2591 **Inclusion criteria:** Patients aged 60 or older undergoing orthopedic surgery, use of ERAS protocol, comparison with conventional care,	ERAS protocols (e.g., early ambulation, early catheter removal) compared to conventional care, with details varying by included study.

AMSTAR 2: critically low	**Funding Sources**: Education Department of Liaoning Province, China (Grant LJKZ1109) **Dropout rates**: n/a **Study limitations**: Bias in randomization, outcome measure descriptions, and variation in ERAS protocol designs across studies. Risk of bias: high Inconsistency: moderate Indirectness: low Impreciseness: moderate Publication bias: moderate	outcomes related to complications, length of stay (LOS), readmission, pain, and blood loss. **Exclusion criteria:** Studies without a specific focus on ERAS, case reports, reviews, non-subgroup older patients, and studies lacking full-text access.	
Notes	**Author's Conclusion**: ERAS implementation in older orthopedic patients is generally effective, showing reduced complications, shorter LOS, and lower pain scores without increased blood loss or readmission.		
Outcome measures/results	Main outcomes included complication rates, LOS, and pain; additional measures included blood loss and 30-day readmission.		ERAS group showed significantly lower complication rates (14.9% ERAS vs. 24.39% conventional care, RR 0.52, 95% CI: 0.42-0.65), shorter LOS by 3.37 days on average, and reduced pain scores.

<u>Empfehlung 47</u>

Ernährungsinterventionen für ältere Personen mit Hüftfraktur sollen Teil einer individuell zugeschnittenen, multimodalen und multidisziplinären Teamintervention sein, um eine bedarfsgerechte Nahrungsaufnahme zu ermöglichen sowie den klinischen und funktionellen Verlauf zu verbessern.

Empfehlungsgrad A

Handoll HH, Cameron ID, Mak JC et al. Multidisciplinary rehabilitation for older people with hip fractures. Cochrane Database Syst Rev 2021; 11: Cd007125. doi:10.1002/14651858.CD007125.pub3 [314]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1++	**Countries:** n/a **Centers:** n/a **Setting:** inpatient rehabilitation, ambulatory	**Total no. patients**: 5351 **Inclusion criteria:** Age 65 years or older, hip fracture requiring surgery, participants who were	• Intervention group: Multidisciplinary rehabilitation delivered by a team (physiotherapists, geriatricians, occupational therapists, nurses, etc.). • Control group: Usual care, which varied but typically included less structured or coordinated rehabilitation efforts.

AMSTAR2: High quality	rehabilitation at home, and nursing homes **Funding Sources:** no funding **Dropout rates:** n/a **Study limitations:** Limitations in methodological quality of included studies, risk of bias due to lack of blinding, heterogeneity in interventions, outcome measures varied significantly between studies, unclear reporting of randomization and allocation concealment. Risk of Bias Moderate Inconsistency Moderate Indirectness Low Imprecision Moderate Publication Bias Low	living in the community or in nursing homes prior to the fracture **Exclusion criteria:** Severe cognitive impairment (specific thresholds varied), other major injuries or fractures not related to the hip, significant medical conditions precluding rehabilitation.	
Notes	**Author's Conclusion:** Multidisciplinary rehabilitation likely results in fewer cases of "poor outcome" (death or deterioration in residential status). There is some evidence it improves mobility and reduces dependency but insufficient evidence for other outcomes, such as quality of life.		
Outcome measures/results	Primary outcomes: Mortality, poor outcome (death or dependency), and quality of life. Secondary outcomes: Mobility, independence in activities of daily living (ADL), length of hospital stay, and complications.		• Poor outcome: Fewer cases in intervention group (RR 0.88; 95% CI: 0.80 to 0.98). • Mortality at discharge: RR 0.77 (95% CI: 0.58 to 1.04). • Mortality at follow-up: RR 0.91 (95% CI: 0.80 to 1.05). • Dependency in ADL: Reduced at 1–4 months (RR 0.87; 95% CI: 0.76 to 0.99). • Mobility: Improved at 6–12 months (RR 0.83; 95% CI: 0.71 to 0.98).

Li HJ, Cheng HS, Liang J et al. Functional recovery of older people with hip fracture: does malnutrition make a difference? J Adv Nurs 2013; 69: 1691-1703 [299]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT	**Countries:** Taiwan	**Total no. Patients:** n=162	<u>Experimental group:</u>

1+	**Centers:** n/a **Setting:** trauma ward **Funding Sources:** Grant no. NHRI-EX92–9023PL from the National Health Research Institute in Taiwan **Dropout rates:** 25 % **Study limitations:** single-blinded design, large lost-tp-follow-up number, long time between data collection and data analysis	**Inclusion criteria:** 60 years or older; non-pathologic, accidental single-side hip fracture; hip arthroplasty or internal fixation; able to perform a full range of motion against gravity and against some (or full) resistance prior to the hip fracture; Chinese Barthel Index score >70 before the hip fracture; living in northern Taiwan **Exclusion criteria:** severe cognitive impairment; terminally ill	An interdisciplinary three-component community-based intervention program in-hospital and 3-month postdischarge rehabilitation was provided by geriatric nurses, a physical therapist, and a geriatrician. Geriatric Consultation: provision of a comprehensive geriatric assessment and medical supervision to detect potential medical and functional problems and to decrease delays before surgery Rehabilitation program: provision of early postoperative physical rehabilitation to facilitate mobility and plan for hospital discharge, with rehabilitation in the patient's usual environment (home visits). Discharge planning: conducted by a geriatric nurse <u>Control group:</u> Routine care from the hospital
Notes	Analysis of <u>four</u> groups: malnourished experimental, malnourished control, non-malnourished experimental, and the non-malnourished control group. **Author's Conclusion:** Healthcare providers should develop a nutritional assessment management system in their interdisciplinary intervention program to improve the functional recovery of older people with hip fracture.		
Outcome measures/results	Nutritional status (via Mini Nutritional Assessment, MNA); Physical function (via Chinese Barthel Index, CBI); Instrumental fuction (via the Chinese version of Lawton and Brody's instrumental activities of daily living, IADL)		The recovery rate of ADL and walking ability in the malnourished control group was the worst and the recovery rate in the non-malnourished experimental group was the best at 3, 6, and 12 months following hospital discharge. The recovery rate of ADL in the malnourished experimental group was higher than in the non-malnourished control group at 1 and 3 months postdischarge. At 6 and 12 months postdischarge, the recovery rate of ADL in the non-malnourished control group was higher than in the malnourished experimental group. The recovery rate of walking ability in the malnourished experimental group was higher than in the non-malnourished control group at 1, 3, and 6 months postdischarge. At month 12, the recovery rate of walking ability in the non-malnourished control group was higher than in the malnourished experimental group. The intervention is more effective on the performance of activities of daily living and recovery of walking ability in malnourished patients than in non-malnourished patients.

Liu VX, Rosas E, Hwang J et al. Enhanced Recovery After Surgery Program Implementation in 2 Surgical Populations in an Integrated Health Care Delivery System. JAMA surgery 2017; 152: e171032-e171032. doi:10.1001/jamasurg.2017.1032 [310]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Pre-Post Study 2+ NHLBI Pre-Post checklist: good quality	**Countries:** n/a **Centers:** n/a **Setting:** n/a **Funding Sources:** National Natural Sciences Foundation of China **Dropout rates**: n/a **Study limitations:** small number of available studies; different follow-up times of included studies; Risk of Bias Moderate Inconsistency n/a Indirectness Low Impreciseness Moderate Publication Bias n/a	**Total no. patients**: **Inclusion criteria:** 1) patients aged over 65 years who had had hip fractures (femoral neck, intertrochanteric or subtrochanteric, acetabulum fractures) and undergone surgery (open reduction and internal fixation or arthroplasty); 2) perioperative ONS (orally taking high-calorie or high-protein diets); 3) RCT **Exclusion criteria:** 1) patients with multiple systemic fractures or pathologic fractures; 2) data without standard deviations; 3) participants with hip fractures who had undergone nonsurgical treatment.	n/a
Notes	**Author's Conclusion:** Based on the evidence available, this meta-analysis is consistent with the hypothesis that perioperative ONS can help elderly patients recover after hip surgery and reduce complications.		
Outcome measures/results	1) total protein; 2) complications (including all infections, bed sores, cardiac disease, cognitive impairment, prolonged immobilization, thrombophlebitis, deep vein thrombosis, vomiting, diarrhea, pressure ulcers, dysphasia, severe hyponatremia, anaphylaxis, pneumonedema, pulmonary embolism, and myocardial infarction); 3) wound infection 4) respiratory infection 5) Urinary tract infection	1) There was a statistically significant increase of the total protein levels in ONS group before patients were discharged (SMD =1.56 [95% CI: 1.06, 2.07]; P□0.00001) 2) the ONS had a measurable effect on reducing complications after hip surgery in elderly patients (OR =0.49 [95% CI: 0.32, 0.73]; P=0.0005) 3) the ONS group had a lower rate of wound infection than the control group (OR =0.17 [95% CI: 0.04, 0.79]; P=0.02) 4) there were significant statistical difference in the baseline and the length of hospitalization between the two groups (OR =0.26 [95% CI: 0.07, 0.94]; P=0.04) 5) there were significant differences between the two groups both on baseline and hospitalization time (OR =0.22 [95% CI: 0.05, 0.90]; P=0.03)	

	6) change in serum albumin levels (the difference in serum albumin levels before and after intervention [g/L]); 7) mortality	6) the change in serum albumin did not have any statistically significant difference between ONS patients and control group (SMD =0.82 [95% CI: -1.47, 3.10]; *P*=0.48) 7) ONS had no statistically significant effect on mortality (ONS group 35/198 versus control group 39/218; OR =1.02 [95% CI: 0.62, 1.70]; *P*=0.93)

Lundström M, Olofsson B, Stenvall M et al. Postoperative delirium in old patients with femoral neck fracture: a randomized intervention study. Aging Clin Exp Res 2007; 19: 178-186 [315]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+	**Countries:** Sweden **Centers:** University Hospital in Umeå **Setting:** n/a **Funding Sources:** Vardal Foundation, Joint Committee of the Northern Health Region of Sweden, JC Kempe Memorial Foundation, Foundation of the Medical Faculty, University of Umeå, County Council of Västerbotten (“Dagmar”, “FoU” and “Äldre centrum Västerbotten”) and Swedish Research Council, Grant K2005-27VX-15357-01A. **Dropout rates:** 0 % **Study limitations:** psychiatric symptoms and cognitive testing of patients was only carried out on one occasion during hospitalization	**Total no. Patients:** n=199 **Inclusion criteria:** age ≥ 70 yrs.; femoral neck fracture **Exclusion criteria:** age under 70, severe rheumatoid arthritis, severe hip osteoarthritis, severe renal failure, pathological fracture, and patients who were bedridden before the fracture due to the operation methods that were planned to be used in the study.	Intervention: Special care in a geriatric ward, applying a comprehensive geriatric assessment including a multidisciplinary team, individual care planning, assessment of delirium, bowel/bladder function, sleep apnoea, decubitus ulcers, pain, saturation, body temperature, blood pressure, nutrition, as well as rehabilitation and secondary preventions of falls and fractures and osteoporosis prophylaxis. Control: Conventional care in the orthopedic department

Notes	**Author's Conclusion:** postoperative delirium can be successfully treated by a team applying comprehensive geriatric assessment, management and rehabilitation. It seems that successful intervention programs must include all aspects of good medical and nursing care, and the total effect of the multi-factorial intervention program is without doubt greater than the sum of its separate parts.	
Outcome measures/results	Primary outcome measures: number of days of postoperative delirium tested by Mini Mental State Examination (MMSE), Organic Brain Symptom Scale (OBS) and Geriatric Depression Scale (GDS-15). Secondary outcome measures: Secondary outcome measures were complications during hospitalization, length of stay, and in-hospital and one-year mortality.	The number of days with postoperative delirium among intervention patients were fewer (5.0±7.1 days. Intervention patients additionally had delirium postoperatively, seven days postoperatively and at the day of discharge. Intervention patients suffered from fewer complications, such as decubitus ulcers, urinary tract infections, nutritional complications, sleeping problems and falls, than controls. Total postoperative hospitalization was shorter in the intervention ward (28.0±17.9 days vs 38.0±40.6 days, p=0.028).

Olofsson B, Stenvall M, Lundstrom M et al. Malnutrition in hip fracture patients: an intervention study. J Clin Nurs 2007; 16: 2027-2038. doi:10.1111/j.1365-2702.2006.01864.x [288]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+	**Countries:** Sweden **Centers:** Umea University Hospital **Setting:** orthopedic department **Funding Sources:** Borgerskapet in Umea Research Foundation, the Dementia Fund, the ‚Vardal Foundation' **Dropout rates:** 21.1% **Study limitations:** • MNA has not generally been used to detect changes in nutritional status in relation to different variables over time, as it is used in the present study	**Total no. Patients:** 199 **Inclusion criteria:** patients aged 70 years and above with femoral neck fracture **Exclusion criteria:** severe rheumatoid arthritis, severe hip osteoarthritis, severe renal failure, metastatic fracture and patients who were bedridden before their injury	• **Intervention group:** The staffing ratio was 1·07 nurses or aids per bed. Patients in the intervention group were admitted to a geriatric ward specializing in geriatric orthopedic patients. A nutritional journal was established for each patient and the patient's intake of food and liquid was registered in this journal for the first four postoperative days. Protein-enriched meals were served during the first four postoperative days and longer if necessary. All the patients in the intervention group also received two nutritional and protein drinks daily during their whole hospitalization period. The environment surrounding the meal was adjusted. • **Control group:** The staffing ratio at the orthopedic ward was 1·01 nurses or aids per bed. The control group received their postoperative care in the orthopedic department in accordance with conventional postoperative care routines.

	• Study sample is rather small • The assessment for MNA was not made on more than one occasion soon after admission and then the questions referred to the prefracture conditions		
Notes	**Author's Conclusion:** Malnutrition was common among older people with hip fractures admitted to hospital. The nutritional intervention might have contributed to the patients suffering fewer days with delirium, fewer decubitus ulcers and shorter hospitalization but did not improve the long-term nutritional status, at least not in women.		
Outcome measures/results	Nutritional status (MNA), cognitive status (MMSE), delirium (OBS Scale), Depression (GDS-15)	Malnutrition was common and low MNA scores were associated with postoperative complications such as delirium and decubitus ulcers. There were significantly fewer days of delirium in the intervention group, seven patients in the intervention group developed decubitus ulcers vs. 14 patients in the control group and the total length of hospitalization was shorter. There were no detectable significant improvements regarding nutritional parameters between the intervention and the control group at the four-month follow-up but men improved their mean BMI, body weight and MNA scores in both the intervention and the control groups while women deteriorated in both groups.	

Shyu Y-IL, Liang J, Tseng M-Y et al. Comprehensive care improves health outcomes among elderly Taiwanese patients with hip fracture. J Gerontol A Biol Sci Med Sci 2013; 68: 188-197 [316]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+	**Countries:** Taiwan **Centers:** n/a **Setting:** n/a **Funding Sources:** National Health Research Institute, Taiwan (grant number: NHRI-EX98-9404PI). **Dropout rates:** 10 %	**Total no. Patients:** n=299 **Inclusion criteria:** > 60 years; admitted to hospital for an accidental first-time, single-side, simple femoral neck fracture, intertrochanteric, or subtrochanteric hip fracture; receiving hip arthroplasty or internal	Interdisciplinary care group (n= 101): Comprehensive geriatric assessment and medical supervision, rehabilitation started on the first day after surgery and was continued at home, discharge planning Comprehensive care group (n= 99): Components of the interdisciplinary care model, as well as nutrition consultation, depression management, and fall prevention

	Study limitations: single blinded study, sample section bias	fixation; ability to perform full range of motion against gravity and against some or full resistance of the unaffected limb as assessed by a research nurse; self-reported to have a prefracture Chinese Barthel Index (CBI) score >70; admission from a home setting, and; living in northern Taiwan. **Exclusion criteria:** severely cognitively impaired and completely unable to follow orders; inability to communicate; terminal illness; admission from a nursing home	<u>Usual care group (n = 99):</u> Teaching of exercices by nurses during the first 2-3 days after surgery, physiotherapy usually starting on the third day after surgery, no home rehsabilitation
Notes	**Author's Conclusion:** A comprehensive care program with nutrition consultation, depression management, and fall prevention along with interdisciplinary care components (geriatric hip-fracture assessment and rehabilitation and discharge support) appeared to be more beneficial than only interdisciplinary care for older persons with hip fracture in Taiwan.		
Outcome measures/results	Self-care ability (CBI), depressive symptoms (Geriatric Depression Scale short form, GDS-s), nutritional status by Mini Nutritional Assessment (MNA), frequency and duration of exercises, occurrence of falls, visits to the hospital and emergency rooms		The comprehensive care group had 3.19 times greater likelihood than the usual care group of recovering complete independence in ADL. The probability of recovery in ADL independence increased more rapidly for both the comprehensive care and interdisciplinary care groups than for the usual care group during the first 6 mo. However, from 6 to 12 months, the ADL recovery rate gradually declined for the comprehensive care and interdisciplinary care groups, whereas the recovery rate of the usual care group was more stable. Risk of malnutrition was consistently lower for the comprehensive care group than for the interdisciplinary and usual care groups. The risk of depression was lower for the comprehensive care group. The three groups did not differ significantly in their trajectories for subsequent falls.

Shyu Y-IL, Liang J, Tseng M-Y et al. Comprehensive and subacute care interventions improve health-related quality of life for older patients after surgery for hip fracture: a randomised controlled trial. Int J Nurs Stud 2013; 50: 1013-1024 [317]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT	**Countries:** Taiwan	**Total no. Patients:** n=299	<u>Subacute care group (n= 101):</u>

1+	**Centers:** n/a **Setting:** n/a **Funding Sources:** National Health Research Institute, Taiwan (grant number: NHRI-EX98-9404PI). **Dropout rates:** 10 % **Study limitations:** single blinded study, sample section bias	**Inclusion criteria:** > 60 years; admitted to hospital for an accidental first-time, single-side, simple femoral neck fracture, intertrochanteric, or subtrochanteric hip fracture; receiving hip arthroplasty or internal fixation; ability to perform full range of motion against gravity and against some or full resistance of the unaffected limb as assessed by a research nurse; self-reported to have a prefracture Chinese Barthel Index (CBI) score >70; admission from a home setting, and; living in northern Taiwan. **Exclusion criteria:** severely cognitively impaired and completely unable to follow orders; inability to communicate; terminal illness; admission from a nursing home	Comprehensive geriatric assessment and medical supervision, rehabilitation started on the first day after surgery and was continued at home, discharge planning <u>Comprehensive care group (n= 99):</u> Components of the interdisciplinary care model, as well as nutrition consultation, depression management, and fall prevention <u>Usual care group (n = 99):</u> Teaching of exercices by nurses during the first 2-3 days after surgery, physiotherapy usually starting on the third day after surgery, no home rehsabilitation
Notes	**Author's Conclusion:** Both comprehensive care and subacute care programmes may improve health outcomes of elders with hip fracture.		
Outcome measures/results	Health-related quality of life by SF-36 (consisting of 36 items representing eight generic health concepts)		The comprehensive care group and subacute care group had significantly better physical functioning than the usual care group. The comprehensive care and subacute care groups had better role physical than the usual care group from 3 to 12 months following discharge. The comprehensive care group had better general health than the usual care group at 12 months following discharge.

Shyu Y-IL, Liang J, Tseng M-Y et al. Enhanced interdisciplinary care improves self-care ability and decreases emergency department visits for older Taiwanese patients over 2 years after hip-fracture surgery: A randomised controlled trial. Int J Nurs Stud 2016; 56: 54-62 [318]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT	**Countries:** Taiwan	**Total no. Patients:** n=299	<u>Interdisciplinary care group (n= 101):</u>

1+	**Centers:** n/a **Setting:** n/a **Funding Sources:** National Health Research Institute, Taiwan (grant number: NHRI-EX98-9404PI). **Dropout rates:** 10 % **Study limitations:** single blinded study, sample section bias	**Inclusion criteria:** > 60 years; admitted to hospital for an accidental first-time, single-side, simple femoral neck fracture, intertrochanteric, or subtrochanteric hip fracture; receiving hip arthroplasty or internal fixation; ability to perform full range of motion against gravity and against some or full resistance of the unaffected limb as assessed by a research nurse; self-reported to have a prefracture Chinese Barthel Index (CBI) score >70; admission from a home setting, and; living in northern Taiwan. **Exclusion criteria:** severely cognitively impaired and completely unable to follow orders; inability to communicate; terminal illness; admission from a nursing home	Comprehensive geriatric assessment and medical supervision, rehabilitation started on the first day after surgery and was continued at home, discharge planning <u>Comprehensive care group (n= 99):</u> Components of the interdisciplinary care model, as well as nutrition consultation, depression management, and fall prevention <u>Usual care group (n = 99):</u> Teaching of exercices by nurses during the first 2-3 days after surgery, physiotherapy usually starting on the third day after surgery, no home rehsabilitation
Notes	**Author's Conclusion:** Our comprehensive care programme, which integrated interdisciplinary care components (geriatric hip-fracture assessment, rehabilitation and discharge-support) with interventions to manage nutrition, prevent falls, and manage depression, enhanced the self-care ability and decreased emergency department visits for older persons well beyond the first 12 months following hip-fracture surgery. These results reinforce the rationale for offering comprehensive care.		
Outcome measures/results	Self-care ability was measured in terms of performance of activities of daily living (ADLs) and instrumental ADLs (IADLs). ADL performance was assessed using the Chinese Barthel Index (CBI) and IADL performance was measured by the Chinese version of a measure for instrumental IADLs, data on health care use including hospital readmission		Relative to usual care, those who received comprehensive care had a higher mean CBI. The level of CBI and its rates of change did not differ between usual care and interdisciplinary care. Participants in the comprehensive care group were less likely than those in the usual care group to visit the emergency department during the 24 months after discharge. The three care groups did not differ significantly in hospital readmissions. The three groups did not differ in mortality during the 2-year follow-up.

Stenvall M, Olofsson B, Lundstrom M et al. A multidisciplinary, multifactorial intervention program reduces postoperative falls and injuries after femoral neck fracture. Osteoporos Int 2007; 18: 167-175. doi:10.1007/s00198-006-0226-7 [290]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+	**Countries:** Sweden **Centers:** Umea University Hospital **Setting:** orthopedic and geriatric departments **Funding Sources:** Vardal Foundation, the Joint Committee of the Northern Health Region of Sweden **Dropout rates:** 0% **Study limitations:** some falls could have been missed, the fall registration could not be blinded regarding group allocation, small study sample size	**Total no. Patients:** 199 **Inclusion criteria:** patients with femoral neck fracture aged ≥70 years **Exclusion criteria:** severe rheumatoid arthritis, severe hip osteoarthritis, or pathological fracture	• Intervention group: Active prevention, detection and treatment of postoperative complications such as falls, delirium, pain and decubitus ulcers was systematically implemented daily during the hospitalization. The staffing at the intervention ward were 1.07 nurses/aides per bed. • Control group: conventional postoperative routines, the staffing at the orthopedic unit was 1.01 nurses/aides per bed and 1.07 for the geriatric control ward
Notes	**Author's Conclusion:** A team applying comprehensive geriatric assessment and rehabilitation, including prevention, detection, and treatment of fall risk factors, can successfully prevent inpatient falls and injuries, even in patients with dementia.		
Outcome measures/results	Complications during hospitalization, including falls, length of stay, morbidity, and mortality.		Twelve patients fell 18 times in the intervention group compared with 26 patients suffering 60 falls in the control group. Only one patient with dementia fell in the intervention group compared with 11 in the control group. The crude postoperative fall incidence rate was 6.29/1,000 days in the intervention group vs 16.28/1,000 days in the control group. The incidence rate ratio was 0.38 [95% confidence interval (CI): 0.20 – 0.76, p = 0.006] for the total sample and 0.07 (95% CI: 0.01–0.57, p=0.013) among patients with dementia. There were no new fractures in the intervention group but four in the control group.

Stenvall M, Olofsson B, Nyberg L et al. Improved performance in activities of daily living and mobility after a multidisciplinary postoperative rehabilitation in older people with femoral neck fracture: a randomized controlled trial with 1-year follow-up. J Rehabil Med 2007; 39: 232-238. doi:10.2340/16501977-0045 [291]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+	**Countries:** Sweden **Centers:** Umea University Hospital **Setting:** orthopedic and geriatric departments **Funding Sources:** Vardal Foundation, the Joint Committee of the Northern Health Region of Sweden **Dropout rates:** 0% **Study limitations:** • the outpatient rehabilitation after discharge was not as standardized as during in-hospital stay • the assessors were not blinded concerning group allocation during the home visit and therefore bias cannot be excluded • no figures for cost effectiveness	**Total no. Patients:** 199 **Inclusion criteria:** patients with femoral neck fracture, aged >or= 70 years **Exclusion criteria:** severe rheumatoid arthritis, severe hip osteoarthritis, or pathological fracture	The intervention consisted of staff education, individualized care planning and rehabilitation, active prevention, detection and treatment of postoperative complications. The staff worked in teams to apply comprehensive geriatric assessment, management and rehabilitation. A geriatric team assessed those in the intervention group 4 months postoperatively, in order to detect and treat any complications. The control group followed conventional postoperative routines.
Notes	**Author's Conclusion:** A multidisciplinary postoperative intervention program enhances activities of daily living performance and mobility after hip fracture, from both a short-term and long-term perspective.		
Outcome measures/results	primary outcomes: living conditions, walking ability and activities of daily living performance on discharge, 4 and 12 months postoperatively		Despite shorter hospitalization, significantly more people from the intervention group had regained independence in personal activities of daily living performance at the 4- and 12-month follow-ups; odds ratios (95% confidence interval (CI)) 2.51 (1.00-6.30) and 3.49 (1.31-9.23), respectively. More patients in the intervention group had also regained the ability to walk independently indoors without walking

		aids by the end of the study period, odds ratio (95% confidence interval) 3.01 (1.18-7.61).

Tseng M-Y, Liang J, Shyu Y-IL et al. Effects of interventions on trajectories of health-related quality of life among older patients with hip fracture: a prospective randomized controlled trial. BMC Musculoskelet Disord 2016; 17: 114 [319]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+	**Countries:** Taiwan **Centers:** medical center in northern Taiwan **Setting:** n/a **Funding Sources:** National Health Research Institutes, Taiwan, Healthy Aging Research Center, Chang Gung University, Chang Gung Medical Foundation **Dropout rates:** **Study limitations:** The generalizability of the findings are limited to older patients with hip fracture, but without severe cognitive impairment and relatively independent in pre-fracture performance of ADLs due to our sample inclusion criteria. The study was single blinded; only subjects and families were blinded to the interventions. HRQoL was not assessed at baseline, making it difficult to explore the intervention effects more completely.	**Total no. Patients:** n = 281 **Inclusion criteria:** ≥ 60 years old; hospitalized for an accidental first time, single-side simple hip fracture and receiving hip arthroplasty or internal fixation; with a pre-fracture Chinese Barthel Index (CBI) score >70 at admission and able to perform full range of motion against gravity and against some or full resistance with the unaffected lim; living in northern Taiwan. **Exclusion criteria:** Severely cognitively impaired and completely unable to follow orders determined by a score <10 on the Chinese Mini-Mental State Examination; terminally ill	Three treatment care models: • Interdisciplinary care (n = 97) consisted of geriatric consultation, discharge planning, and 4 months of in-home rehabilitation. • Comprehensive care (n = 91) consisted of interdisciplinary care plus management of malnutrition and depressive symptoms, fall prevention, and 12 months of in-home rehabilitation. • Usual care (n = 93) included only in-hospital rehabilitation and occasional discharge planning, without geriatric consultation and in-home rehabilitation.

	The sample size estimated might not support the current hypotheses.		
Notes	**Author's Conclusion:** The interdisciplinary and comprehensive care models improved recovery from hip fracture by increasing subjects' odds for following a trajectory of good physical functioning after hospitalization.		
Outcome measures/results	• Mental and physical Health-related quality of life (HRQoL) were measured at 1, 3, 6, and 12 months after discharge by the physical component summary scale (PCS) and mental component summary scale (MCS), respectively, of the Medical Outcomes Study Short Form 36, Taiwan version. • Pre-fracture ADL performance was retrospectively assessed using the Chinese Barthel Index (CBI) before randomization and before hip-fracture surgery.	We identified three quadratic PCS trajectories: poor PCS (n = 103, 36.6 %), moderate PCS (n = 96, 34.2 %), and good PCS (n = 82, 29.2 %). In contrast, we found three linear MCS trajectories: poor MCS (n = 39, 13.9 %), moderate MCS (n = 84, 29.9 %), and good MCS (n = 158, 56.2 %). Subjects in the comprehensive care and interdisciplinary care groups were more likely to experience a good PCS trajectory (b = 0.99, odds ratio [OR] = 2.69, confidence interval [CI] = 7.24–1.00, p = 0.049, and b = 1.32, OR = 3.75, CI = 10.53–1.33, p = 0.012, respectively) than those who received usual care. However, neither care model improved MCS.	

II.2.2 Delir

Empfehlung 49

Ältere Patienten mit erhöhtem Delir-Risiko sollen eine nicht-pharmakologische Mehrkomponenten-Intervention erhalten, die ein Hydratations- und Ernährungsmanagement beinhaltet, um ein Delir zu verhindern.

Empfehlungsgrad A

Abraha I, Trotta F, Rimland JM et al. Efficacy of Non-Pharmacological Interventions to Prevent and Treat Delirium in Older Patients: A Systematic Overview. The SENATOR project ONTOP Series. PLoS One 2015; 10: e0123090. doi:10.1371/journal.pone.0123090 [338]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic overview of systematic reviews	**Countries:** n/a **Centers:** n/a	**Total no. studies:** n=24 systematic reviews with 31 primary studies	Non-pharmacological intervention to treat or prevent delirium - Multicomponent interventions

1-	**Setting:** surgical setting, medical departments, hospitalized patients, post-acute care facilities **Funding Sources:** work is part of ONTOP project, a workpackage of a European Union funded FP7 research named SENATOR; none of the included SRs sponsored by a company, 6 funded by a governmental institution or non-profit organization **Dropout rates:** n/a **Study limitations:** all studies suffered from performance bias (no blinding), heterogeneity of the studies, arbitrary age cut-off, lack of assessment of cost-effectiveness	**Inclusion criteria:** experimental comparative study (randomized/non-randomized) from the included systematic reviews/meta-analysis with non-pharmacological intervention for prevention or treatment delirium **Exclusion criteria:** other language than English, Italian or Spanish, primary study which were observational or before-after studies with historical controls	- Single component intervention Earplugs, eye masks, educational stuff, multidisciplinary team, use of sitter, family support, ortho-geriatric consultation, pharmacological and non-pharmacological, supportive reorientation, thromboprophylaxis, anesthesia, analgesia, surgical fixation of fractures, nutritional status, mobilization, rehabilitation, daily proactive geriatrics consultation
Notes	• AMSTAR criteria: 12 reviews moderate quality, 3 high quality • Identification of important and critical outcomes; only results of critical outcomes presented • Assessment of risk of bias (included primary studies): using criteria from Cochrane Collaboration (low/high/unclear risk) • Quality of evidence assessed with GRADE (high/moderate/low/very low) based on judgements for the primary outcome • Heterogeneous reviews: in addition to intervention → some evaluated pathogenesis, role of sitters, diagnosis of delirium, etc.) • Categorization of the studies by design, provision of intervention, setting and risk of bias **Author's Conclusion:** In older patients multi-component non-pharmacological interventions as well as some single-components intervention were effective in preventing delirium but not to treat delirium.		
Outcome measures/results	• Delirium incidence (critical outcome) • Delirium improvement (Delirium treatment, delirium resolution/reduction in its severity; critical outcome) • Functional status (degree of functional autonomy; critical outcome)		• Multicomponent non-pharmacological interventions significantly reduced incidence of delirium in surgical wards by 29% (RR 0.71, 95% CI 0.59 to 0.86) Combining former results with single CCT (similar characteristics): results which remained statistically significant with no change in heterogeneity (RR 0.71, 95%CI 0.60 to 0.84) • No evidence supporting efficacy of the non-pharmacological interventions to prevent delirium in low risk populations (RR 1.75, 95% CI 0.50 to 6.10)

		• Single component intervention: staff education (RR 0.50, 95% CI 0.26 to 0.96), reorientation protocol in ICU (delirium sig. lower in intervention group; RR 0.63, 95% CI 0.26 to 0.96), Geriatric Risk Assessment MedGuide software ((HR 0.42, 95%CI 0.14 to 4.00)) were effective in preventing delirium • Patients who developed delirium: no evidence of efficacy of multicomponent non-pharmacological interventions to treat delirium • Pooled data across studies with patients received orthopedic surgery: meta-analysis statistically significant result in favor of the multicomponent interventions (RR 0.57, 95% CI 0.39 to 0.85; p=0.25) • Functional status: n=2 studies, Barthel Index score; results not statistically significant • Post-acute care facilities: nursing facilities, better identification of delirium but ineffective at reducing delirium

The American Geriatrics Society Expert Panel on Postoperative Delirium in Older Adults. Postoperative Delirium in Older Adults: Best Practice Statement from the American Geriatrics Society. J Am Coll Surg 2015; 220: 136–148.e131. doi: 10.1016/j. jamcollsurg.2014.10.019 [332]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Expert Panel	**Countries:** USA **Centers:** n/a **Setting:** n/a **Funding Sources:** American Geriatrics Society Geriatrics-for-Specialists Initiative (AGS-GSI) **Dropout rates:** n/a **Study limitations:** Feasibility restrictions in completeness of the literature search; limited quality of available evidence; extrapolation from studies conducted outside the surgical setting.	**Total no. patients**: n/a **Inclusion criteria:** n/a **Exclusion criteria:** n/a	Multicomponent nonpharmacologic and pharmacologic interventions for preventing and treating postoperative delirium.

Notes	**Author's Conclusion:** The guideline provides recommendations for the prevention and treatment of postoperative delirium, emphasizing both nonpharmacologic and pharmacologic approaches.		
Outcome measures/results	n/a		n/a

Burton JK, Craig L, Yong SQ et al. Non-pharmacological interventions for preventing delirium in hospitalised non-ICU patients. Cochrane Database Syst Rev 2021; 11: Cd013307. doi:10.1002/14651858.CD013307.pub3 [339]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1+ AMSTAR2: High quality	**Countries:** n/a **Centers:** n/a **Setting:** n/a **Funding Sources:** National Institute for Health Research **Dropout rates:** n/a **Study limitations:** in many studies researchers were not blinded, limited data on people with dementia, failure to exclude prevalent delirium at admission, heterogeneity n the measurement of outcomes Risk of Bias Moderate Inconsistency Moderate Indirectness Low Impreciseness Low Publication Bias Low	**Total no. studies**: 22 **Inclusion criteria:** randomised controlled trials (RCTs) of single and multicomponent non-pharmacological interventions for preventing delirium in hospitalised adults cared for outside intensive care or high dependency setting; non-pharmacological interventions which were designed and implemented to prevent delirium **Exclusion criteria:** studies conducted in long-term care, nursing homes, intensive care unit (ICU), high dependency units (HDU); studies of delirium associated with psychoactive substance misuse or withdrawal; pharmacological interventions	n/a
Notes	**Author's Conclusion:** There is moderate-certainty evidence regarding the benefit of multicomponent non-pharmacological interventions for the prevention of delirium in hospitalised adults, estimated to reduce incidence by 43% compared to usual care. We found no evidence of an effect on mortality. There is emerging evidence that these interventions may reduce hospital length of stay, with a trend towards reduced delirium duration, although the effect on delirium severity remains uncertain.		

Outcome measures/results	Primary: - Incidence of delirium - Mortality - New diagnosis of dementia	- multi-component non-pharmacological interventions probably reduce the incidence of delirium compared to usual care ((RR)=0.57, (CI)=0.46 to 0.71, I2 = 39%; 14 studies; 3693 participants; moderate-certainty evidence, downgraded due to risk of bias) - little or no effect of multicomponent interventions on inpatient mortality compared to usual care (RR=1.17, 95% CI 0.79 to 1.74, I2 = 15%; 10 studies; 2640 participants; low-certainty evidence downgraded due to inconsistency and imprecision) - attention to nutrition and hydration, oxygenation, medication review, assessment of mood and bowel and bladder care were probably associated with a reduction in incident delirium but estimates included the possibility of no benefit or harm

Woodhouse R, Burton JK, Rana N et al. Interventions for preventing delirium in older people in institutional long-term care. Cochrane Database Syst Rev 2019; 4: Cd009537. doi:10.1002/14651858.CD009537.pub3 [330]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1- AMSTAR2: Moderate quality	**Countries:** n/a **Centers:** n/a **Setting:** LTC **Funding Sources:** National Institute for Health Research **Dropout rates**: n/a **Study limitations:** small number of included trials, very low study quality Risk of Bias Moderate Inconsistency Moderate Indirectness Moderate Imprecision Low Publication Bias Low	**Total no. studies**: 3 **Inclusion criteria:** RCTs and cluster-RCTs; single and multicomponent, non-pharmacological and pharmacological interventions for preventing delirium in older people (aged 65 years and over) in permanent LTC residence **Exclusion criteria:** different setting, different study design	n/a
Notes	**Author's Conclusion:** The review identified limited evidence on interventions for preventing delirium in older people in LTC. A soIware-based intervention to identify medications that could contribute to delirium risk and trigger a pharmacist-led medication review, probably reduces incidence		

	of delirium in older people in institutional LTC. Future trials of multicomponent non-pharmacological delirium prevention interventions for older people in LTC are needed to help inform the provision of evidence-based care for this vulnerable group.	
Outcome measures/results	- Primary outcomes**:** Prevalence and incidence of delirium, Severity of delirium, Mortality	- It was not possible to determine an effect on delirium prevalence - It was not possible to determine an effect on delirium incidence in two of three studies, one study showed a reduction in delirium incidence compared to control (12-month HR 0.42, CI 0.34 to 0.51) - None of the included trials reported data on the severity of delirium. - Two studies showed little or no effect on mortality (HR 0.88, CI 0.66 to 1.17) and (RR 0.82, 95% CI 0.50 to 1.34)

II.2.3 Dekubitus

Empfehlung 50

Älteren Patienten mit Mangelernährung oder Risiko für Mangelernährung und einem Risiko für Dekubitus sollten Ernährungsmaßnahmen angeboten werden, um das Dekubitusrisiko zu reduzieren.

Empfehlungsgrad B

Langer G, Wan CS, Fink A et al. Nutritional interventions for preventing and treating pressure ulcers. Cochrane Database Syst Rev 2024; 2: Cd003216. doi:10.1002/14651858.CD003216.pub3 [342]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1++ AMSTAR2: High quality	**Countries:** n/a **Centers:** n/a **Setting:** n/a **Funding Sources:** National Institute for Health and Care Research, via Cochrane Infrastructure funding to the Cochrane Wounds Group **Dropout rates:** n/a **Study limitations:** many studies were small and of low quality; lack of robust evidence due to small	**Total no. studies**: 33 **Inclusion criteria:** Randomized controlled trials (RCTs) evaluating the effect of nutritional interventions on the prevention and treatment of pressure ulcers; participants with or without existing pressure ulcers, in any care setting, regardless of primary diagnosis **Exclusion criteria:** Studies providing nutrition supplementation as part of a multifactorial intervention (e.g.,	Intervention: Various nutritional interventions, including energy, protein, micronutrients, arginine, zinc, antioxidants, collagen, and disease-specific diets. Control: Standard diet or placebo.

	sample sizes, short follow-up periods, and inconsistent reporting; potential influence of pharmaceutical funding on study results; high risk of bias in many studies; limited data on clinically relevant outcomes Risk of Bias Moderate Inconsistency Low Indirectness Low Imprecision Low Publication Bias Low	education and physical activity); quasi-randomized trials.	
Notes	**Author's Conclusion:** The benefits of nutritional interventions for pressure ulcer prevention and treatment are uncertain. There may be little to no difference compared to standard nutrition or placebo. Larger studies with similar nutrient compositions are needed to reduce these uncertainties.		
Outcome measures/results	**Primary Outcomes**: Prevention: Incidence of pressure ulcers. Treatment: Time to complete healing, number of healed pressure ulcers, change in ulcer area/depth/volume, and progress of healing. **Secondary Outcomes**: Prevention: Time to pressure ulcer development. Prevention and Treatment: Acceptability of nutritional supplements, side effects (e.g., gastrointestinal), costs, health-related quality of life.	**Prevention**: Energy, protein, and micronutrients: Little to no difference in pressure ulcer incidence compared to standard diet (RR 0.92, 95% CI 0.71 to 1.19). Protein: Little to no difference in pressure ulcer incidence (RR 0.75, 95% CI 0.49 to 1.14). **Treatment**: Energy, protein, and micronutrients: May slightly increase the number of healed pressure ulcers (RR 1.45, 95% CI 1.14 to 1.85). Arginine and micronutrients: May slightly reduce pressure ulcer area but with very low certainty (MD 15.8% lower, 95% CI 25.11 lower to 6.48 lower).	

Lee Y-F, Hsu T-W, Liang C-S et al. The efficacy and safety of tube feeding in advanced dementia patients: a systemic review and meta-analysis study. J Am Med Dir Assoc 2021; 22: 357-363 [343]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1+ AMSTAR2: High quality	**Countries:** n/a **Centers:** n/a **Setting:** n/a **Funding Sources:** Kaohsiung Veterans General Hospital **Dropout rates:** n/a **Study limitations:** most of the studies have a small	**Total no. studies**: 12 **Inclusion criteria:** (1) patients diagnosed with terminal dementia, (2) a prospective, retrospective, or case-control study reported in a peer-reviewed publication; (3) a comparison between an intervention group and	Feeding with nasogastric tube or percutaneous endoscopic gastrostomy (PEG)

	sample size; no detailed clinical status, including comorbid disease, nutrition status, and laboratory data, which affected the prognosis of patients with dementia; only peer-reviewed articles published in English; metaregression could not be performed for some outcomes; several assessment and diagnostic criteria for dementia may have limited the comparability Risk of Bias Moderate Inconsistency Low Indirectness Low Impreciseness Low Publication Bias Low	a control group (no tube/artificial feeding); (4) sufficient data for both the intervention group and control group; and (5) articles written in English language **Exclusion criteria:** case series or case reports, review articles, conference abstracts, studies published in languages other than English	
Notes	**Author's Conclusion:** This meta-analysis indicates that tube feeding is associated with increased mortality rate and possible tube-related complications, but not improves with prolonging survival days and nutritional status. Shared decision-making routinely before insertion of a tube between caregivers and physicians is recommended.		
Outcome measures/results	Primary: mean survival time, mortality rate Secondary: tube-related complication events (pneumonia and pressure ulcers), nutritional indices (mean change in albumin level, hemoglobin level, and cholesterol level)		- Patients with advanced dementia with tube feeding are associated with significantly higher mortality rate [k ¼ 8; odds ratio (OR) 1.79; 95% confidence interval (CI) 1.04e3.07; P ¼ .03] - no association was found for the risk of pneumonia and pressure sore between groups - sensitivity analysis showed patients with advanced dementia with PEG tube feeding have significantly higher risk of pneumonia (OR 3.56; 95% CI 2.32e5.44; P < .001) and pressure sore (OR 2.25; 95% CI 1.92e2.63; P < .001) - No association was found for the survival period and nutritional status between groups.

Lozano-Montoya I, Velez-Diaz-Pallares M, Abraha I et al. Nonpharmacologic Interventions to Prevent Pressure Ulcers in Older Patients: An Overview of Systematic Reviews (The Software ENgine for the Assessment and optimization of drug and non-drug Therapy in Older peRsons [SENATOR] Definition of Optimal Evidence-Based Non-drug Therapies in Older People [ONTOP] Series). J Am Med Dir Assoc 2016; 17: 370.e371-310. doi:10.1016/j.jamda.2015.12.091 [344]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1+	**Countries:** Spain **Centers:** n/a **Setting:** different care settings **Funding Sources:** the European Union Seventh Framework Program **Dropout rates:** n/a **Study limitations:** Limitations of this study include the potential skipping of some primary studies (such as recently published primary studies that are not listed in systematic reviews and published trials on PU prevention that differ in their terminology), the omission of some original manuscripts from old	**Total no. Studies:** 65 **Inclusion criteria:** The included SRs were examined to identify any experimental comparative study, either randomized or nonrandomized, that investigated any nonpharmacological interventions to prevent PUs in older patients (65 years of age or over). **Exclusion criteria:** Primary studies were excluded if they were observational studies or before-after (BA) studies with historical controls. Conference proceedings or program abstracts were also excluded. Studies were also excluded when the mean age of participants was under 65 years, when they addressed patients with nonpressure-related ulcers (such as venous or diabetic foot ulcers),	Any nonpharmacological interventions to prevent PUs in older patients (65 years of age or over)

	journals (i.e., over 35 years ago, even when all attempts to get them from authors were made), the large heterogeneity of the trials for some interventions (precluding proper comparisons), the wide range of time of the listed studies (more than 30 years, with potential relevant changes in standards of care), and the inability to separate, in some trials, results specific for PUs from a minority of non- PUs.	studies of ulcers because of immobilization in patients with neurologic disorders or spinal cord injury, or exclusively considered patients admitted in intensive care or palliative care units. Studies using individual vitamins or micronutrients were excluded, as these were considered a pharmacologic intervention.	
	Author's Conclusion: In older patients at high risk to suffer PUs, high-technology and low- technology support surfaces can significantly reduce the incidence of PUs. Nutrition intervention may also have a role in preventing PUs in hospital settings. More evidence is needed to support other recommendations, which is specially lacking for repositioning.		
Outcome measures/results	Rates of incidence of new Pus was used as the outcome measure, as recommended by a panel of independent experts. Other important outcomes were only used occasionally as secondary outcomes in some trials, and some "hard" outcomes (mortality, readmissions, cost) were not considered.		One hundred ten SRs with 65 primary studies satisfied the inclusion criteria. The most frequent interventions explored in these trials were support surfaces (41 studies), repositioning (8), and nutrition interventions (5). High quality of evidence was not found for any intervention, mainly because of a high risk of bias and imprecision. There is moderate quality evidence to support the use of alternating pressure support mattresses over usual hospital mattresses in medical and surgical inpatients, low quality evidence to support constant low pressure devices and Australian medical sheepskin over usual mattresses, and very low quality evidence to support nutrition interventions in hospital settings. No recommendations on hydration, repositioning, standardized risk assessment, or multicomponent interventions can be done.

Stratton RJ, Ek AC, Engfer M et al. Enteral nutritional support in prevention and treatment of pressure ulcers: a systematic review and meta-analysis. Ageing Res Rev 2005; 4: 422-450. doi:10.1016/j.arr.2005.03.005 [345]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1+	**Countries:** UK, Sweden, Netherlands, Ireland, USA **Centers:** **Setting:** hospital or community **Funding Sources:** Numico **Dropout rates:** n/a **Study limitations:** the quality of evidence available, including RCTs is generally poor	**Total no. Studies:** 15 **Inclusion criteria:** • Population: all adult human studies, nutritional status either well-nourished or malnourished, patients with pressure/ decubitus ulcers, or those at risk of developing them • Intervention: all studies using ONS and/ or ETF, including those simultaneously using or comparing with dietary counselling and/or parenteral nutrition and/ or simultaneous standard diet • Main outcome measures: Pressure ulcer incidence, pressure ulcer healing, Quality of life, complications, mortality, dietary intake, nutritional status **Exclusion criteria:** • Population: animal studies • Intervention: dietary counselling only, parenteral nutrition only, interventions <2	ONS and/ or ETF

		macronutrients, interventions with no micronutrients	
Notes	**Author's Conclusion:** This systematic review shows enteral nutritional support, particularly high protein ONS, can significantly reduce the risk of developing pressure ulcers (by 25%). Although studies suggest ONS and ETF may improve healing of PU, further research to confirm this trend is required.		
Outcome measures/results	• **Primary outcome measures**: pressure ulcer incidence and pressure ulcer healing • **Secondary outcomes**: quality of life, complications, mortality, dietary intake and nutritional status		Meta-analysis showed that ONS (250-500 kcal, 2-26 weeks) were associated with a significantly lower incidence of pressure ulcer development in at-risk patients compared to routine care (odds ratio 0.75, 95% CI 0.62-0.89, 4 RCTs, n=1224, elderly, post-surgical, chronically hospitalized patients). Similar results were obtained when a combined meta-analysis of ONS (4 RCT) and ETF (1 RCT) trials was performed (OR 0.74, 95% CI 0.62-0.88, 5 RCTs, n=1325). Individual studies showed a trend towards improved healing of existing pressure ulcers with disease-specific (including high protein) versus standard formulas, although robust RCTs are required to confirm this. Although some studies indicate that total nutritional intake is improved, data on other outcome measures (quality of life) are lacking.

Tuffaha HW, Roberts S, Chaboyer W et al. Cost-effectiveness analysis of nutritional support for the prevention of pressure ulcers in high-risk hospitalized patients. Adv Skin Wound Care 2016; 29: 261-267 [346]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Economic model 2++	**Countries:** n/a **Centers:** n/a **Setting:** n/a **Funding Sources:** n/a **Dropout rates:** n/a **Study limitations:** data on national Pressure Ulcers (PrU) had to be estimated; the authors had to adopt certain cost estimates from other countries	**Total no. patients**: n/a **Inclusion criteria:** n/a **Exclusion criteria:** n/a	Standard care included PrU prevention strategies, such as redistribution surfaces, repositioning, and skin protection strategies, along with standard hospital diet. In addition to the standard care, the intervention group received nutritional support comprising patient education, nutrition goal setting, and the consumption of high-protein supplements.
Notes	**Author's Conclusion:** Nutritional support to prevent PrUs in high-risk hospitalized patients is cost-effective with substantial cost savings predicted. Hospitals should implement the recommendations from the current PrU practice guidelines and offer nutritional support to high-risk patients.		

Outcome measures/results	Average costs and quality-adjusted life years	Compared with standard care, nutritional support was cost saving at AU $425 per patient and marginally more effective with an average 0.005 quality-adjusted life years gained. The probability of nutritional support being cost-effective was 87%.

European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel and Pan Pacific Pressure Injury Alliance. Prevention and Treatment of Pressure Ulcers/Injuries: Quick Reference Guide. Emily Haesler (Ed.). EPUAP/NPIAP/PPPIA: 2019. [347]	
Guideline **Relevant recommendations/ statements**	4.3 Develop and implement an individualized nutrition care plan for individuals with, or at risk of, a pressure injury who are malnourished or who are at risk of malnutrition. (B2, ↑↑) 4.4 Optimize energy intake for individuals at risk of pressure injuries who are malnourished or at risk of malnutrition. (B2, ↑) 4.5 Adjust protein intake for individuals at risk of pressure injuries who are malnourished or at risk of malnutrition. (GPS) 4.6 Provide 30 to 35 kcalories/kg body weight/day for adults with a pressure injury who are malnourished or at risk of malnutrition. (B1, ↑) 4.7 Provide 1.2 to 1.5 g protein/kg body weight/day for adults with a pressure injury who are malnourished or at risk of malnutrition. (B1, ↑↑) 4.8 Offer high-calorie, high-protein fortified foods and/or nutritional supplements in addition to the usual diet for adults who are at risk of developing a pressure injury and who are also malnourished or at risk of malnutrition, if nutritional requirements cannot be achieved by normal dietary intake. (C, ↑) 4.9 Offer high-calorie, high-protein nutritional supplements in addition to the usual diet for adults with a pressure injury who are malnourished or at risk of malnutrition, if nutritional requirements cannot be achieved by normal dietary intake. (B1, ↑↑) 4.10 Provide high-calorie, high-protein, arginine, zinc and antioxidant oral nutritional supplements or enteral formula for adults with a Category/Stage II or greater pressure injury who are malnourished or at risk of malnutrition. (B1, ↑) 4.11 Discuss the benefits and harms of enteral or parenteral feeding to support overall health in light of preferences and goals of care with individuals at risk of pressure injuries who cannot meet their nutritional requirements through oral intake despite nutritional interventions. (GPS) 4.12 Discuss the benefits and harms of enteral or parenteral feeding to support pressure injury treatment in light of preferences and goals of care for individuals with pressure injuries who cannot meet their nutritional requirements through oral intake despite nutritional interventions. (B1, ↑) 4.13 Provide and encourage adequate water/fluid intake for hydration for an individual with or at risk of a pressure injury, when compatible with goals of care and clinical conditions. (GPS) 4.14 Conduct age-appropriate nutritional screening and assessment for neonates and children at risk of pressure injuries. (GPS) 4.15 For neonates and children with or at risk of pressure injuries who have inadequate oral intake, consider fortified foods, age-appropriate nutritional supplements, or enteral or parenteral nutritional support. (GPS)

<u>Empfehlung 51</u>

Älteren Patienten mit Mangelernährung oder Risiko für Mangelernährung und mit Druckgeschwüren sollten Ernährungsmaßnahmen angeboten werden, um eine ausreichende Energie- und Nährstoffzufuhr zu ermöglichen und die Wundheilung zu unterstützen.

Empfehlungsgrad B

Cereda E, Klersy C, Andreola M et al. Cost-effectiveness of a disease-specific oral nutritional support for pressure ulcer healing. Clin Nutr 2017; 36: 246-252 [348]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic review 1+ AMSTAR 2: High quality	**Countries:** n/a **Centers:** n/a **Setting**: in patient **Funding Sources:** none **Dropout rates:** n/a **Study limitations**: limited number of high-quality trials available; the studies had a small sample size and were underpowered; studies were conducted in specific long-term care settings, which may limit generalizability; potential bias in one study due to differences in baseline characteristics between treatment arms**.** Risk of Bias Low Inconsistency Low Indirectness Low Imprecision Low Publication Bias n/a	**Total no. studies**: 3 **Inclusion criteria:** patients with pressure ulcers (PUs), moderate-severe stages (II-IV); trials comparing disease-specific nutritional support enriched with arginine, zinc, and antioxidants against standard nutritional support. **Exclusion criteria:** Short duration trials (less than 4 weeks); studies that did not include a control group receiving standard high-calorie, high-protein formulas; studies that included patients with different types of chronic wounds were excluded.	**Intervention**: Disease-specific nutritional support (oral supplements or tube feeds) enriched with arginine, zinc, and antioxidants. **Control**: Standard nutritional support (high-calorie, high-protein formulas without specific nutrients).
Notes	**Author's Conclusion:** The use of disease-specific formulas enriched with arginine, zinc, and antioxidants for at least 8 weeks is associated with improved pressure ulcer healing compared to standard high-calorie, high-protein formulas. This support should be preferred in clinical practice when available.		
Outcome measures/results	Primary Outcome: Percentage of reduction in ulcer area at 8 weeks. Secondary Outcomes: Reduction in ulcer area ≥40% and complete healing at 8 weeks, percentage of change in ulcer area at 4 weeks.		Primary Outcome: Significant reduction in ulcer area at 8 weeks (-15.7%, 95% CI, -29.9 to -1.5, p=0.030). Secondary Outcomes: Reduction in ulcer area ≥40% at 8 weeks (OR 1.72, 95% CI, 1.04 to 2.84, p=0.033); Complete healing at 8 weeks (OR 1.72, 95% CI, 0.86 to 3.45, p=0.127); Percentage of change in ulcer area at 4 weeks (-7.1%, 95% CI, -17.4 to 3.3, p=0.180).

Langer G, Wan CS, Fink A et al. Nutritional interventions for preventing and treating pressure ulcers. Cochrane Database Syst Rev 2024; 2: Cd003216. doi:10.1002/14651858.CD003216.pub3 [342]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1++ AMSTAR2: High quality	**Countries:** n/a **Centers:** n/a **Setting:** n/a **Funding Sources:** National Institute for Health and Care Research, via Cochrane Infrastructure funding to the Cochrane Wounds Group **Dropout rates:** n/a **Study limitations:** many studies were small and of low quality; lack of robust evidence due to small sample sizes, short follow-up periods, and inconsistent reporting; potential influence of pharmaceutical funding on study results; high risk of bias in many studies; limited data on clinically relevant outcomes Risk of Bias Moderate Inconsistency Low Indirectness Low Imprecision Low Publication Bias Low	**Total no. studies**: 33 **Inclusion criteria:** Randomized controlled trials (RCTs) evaluating the effect of nutritional interventions on the prevention and treatment of pressure ulcers; participants with or without existing pressure ulcers, in any care setting, regardless of primary diagnosis **Exclusion criteria:** Studies providing nutrition supplementation as part of a multifactorial intervention (e.g., education and physical activity); quasi-randomized trials.	Intervention: Various nutritional interventions, including energy, protein, micronutrients, arginine, zinc, antioxidants, collagen, and disease-specific diets. Control: Standard diet or placebo.
Notes	**Author's Conclusion:** The benefits of nutritional interventions for pressure ulcer prevention and treatment are uncertain. There may be little to no difference compared to standard nutrition or placebo. Larger studies with similar nutrient compositions are needed to reduce these uncertainties.		
Outcome measures/results	**Primary Outcomes**: Prevention: Incidence of pressure ulcers. Treatment: Time to complete healing, number of healed pressure		**Prevention**: Energy, protein, and micronutrients: Little to no difference in pressure ulcer incidence compared to standard diet (RR 0.92, 95% CI 0.71 to 1.19). Protein: Little to no difference in pressure ulcer incidence (RR 0.75, 95% CI 0.49 to 1.14).

	ulcers, change in ulcer area/depth/volume, and progress of healing. **Secondary Outcomes**: Prevention: Time to pressure ulcer development. Prevention and Treatment: Acceptability of nutritional supplements, side effects (e.g., gastrointestinal), costs, health-related quality of life.	**Treatment**: Energy, protein, and micronutrients: May slightly increase the number of healed pressure ulcers (RR 1.45, 95% CI 1.14 to 1.85). Arginine and micronutrients: May slightly reduce pressure ulcer area but with very low certainty (MD 15.8% lower, 95% CI 25.11 lower to 6.48 lower).

Velez-Diaz-Pallares M, Lozano-Montoya I, Abraha I et al. Nonpharmacologic Interventions to Heal Pressure Ulcers in Older Patients: An Overview of Systematic Reviews (The SENATOR-ONTOP Series). J Am Med Dir Assoc 2015; 16: 448-469. doi:10.1016/j.jamda.2015.01.083 [349]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1+	**Countries:** Spain, Italy, UK, Ireland **Centers:** Hospital Universitario Ramón y Cajal, Madrid; Italian National Research Center in Aging, Ancona; NHS Grampian, Aberdeen; University College Cork **Setting:** n/a **Funding Sources:** European Union Seventh Framework Program **Dropout rates:** 0% **Study limitations:** High or moderate quality of evidence was found in none of the interventions, mainly because of the very serious risk of bias of most studies and imprecision in the treatment effect.	**Total no. Studies:** 110 **Inclusion criteria:** randomized or nonrandomized studies, that investigated any nonpharmacologic intervention to treat PUs in older patients (65 or older) **Exclusion criteria:** observational studies, mean age of participants under 65 years, patients with nonpressure-related ulcers, studies of sacral ulcers attributable to immobilization in patients with neurologic disorders or spinal cord injury, studies considering usual PU treatment, biophysical agents, growth factors or surgery, studies considering exclusively patients admitted in intensive care or palliative care	The most frequent interventions explored in the trials were support surfaces (13 Studies), nutrition (8), and electrotherapy (6).
Notes	**Author's Conclusion:** In older patients with PUs, evidence to use any nonpharmacological therapy to increase the rates of wound healing is inconclusive, except for low quality evidence that supports the use of electrotherapy. This situation is especially alarming for interventions that are		

	usually standard clinical practice (repositioning, support surfaces). Although there is some evidence in younger populations and other types of ulcers, studies in older populations with PUs using sound methodology are needed.	
Outcome measures/results	• Complete ulcer healing • Reduction of pain • Time to complete wound (ulcer) healing • Quality of life • Reduction of wound size • Length of hospital stay • Admission to care homes • Lower incidence of infections or use of antibiotic therapy • Nursing time used in wound care • In hospital mortality • Costs of hospital admission • Hospital readmission in a given time after discharge	One hundred ten SRs with 45 primary studies satisfied the inclusion criteria. The most frequent interventions explored in these trials were support surfaces (13 studies), nutrition (8), and electrotherapy (6). High or moderate quality of evidence was found in none of the interventions, mainly because of the very serious risk of bias of most studies and imprecision in the treatment effect. Evidence grade is very low or insufficient to support the use of any support surface, nutrition intervention, multicomponent interventions, repositioning or other adjunctive therapy (ultrasound, negative pressure, laser, electromagnetic, light, shock wave, hydrotherapy, radiofrequency, or vibration therapy) to increase the rates of PU healing in older patients. Electrotherapy showed some beneficial effect in the treatment of PUs, although the quality of evidence is low.

II.2.4 Chronisch obstruktive Lungenerkrankung (COPD)

Empfehlung 52

Mangelernährten älteren Patienten mit stabiler COPD sollten orale bilanzierte Diäten (Trinknahrung) angeboten werden, um das Körpergewicht zu erhöhen und funktionelle Parameter zu verbessern.

Empfehlungsgrad B

Aldhahir AM, Rajeh AMA, Aldabayan YS et al. Nutritional supplementation during pulmonary rehabilitation in COPD: A systematic review. Chron Respir Dis 2020; 17: 1479973120904953-1479973120904953. doi:10.1177/1479973120904953 [350]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic review 1+ AMSTAR2: High quality	**Countries:** n/a **Centers:** n/a **Setting:** n/a **Funding Sources:** Nutricia **Dropout rates:** n/a **Study limitations:** very heterogeneous designs, supplements and	**Total no. studies**: 22 **Inclusion criteria:** studies of patients with a confirmed diagnosis of COPD; no evidence of recent exacerbation, as described in the individual studies; patients enrolled on a PR or other	n/a

	Outcomes; small sample sizes; Risk of Bias Moderate Inconsistency Moderate Indirectness Low Imprecision Low Publication Bias n/a	exercise training programme and patients receiving nutritional supplementation (caloric, non-caloric, powder, liquid, capsule or tablets) during pulmonary rehabilitation (PR) **Exclusion criteria:** book chapters, systematic reviews (but screened the reference lists), non-English manuscripts, conference abstracts with no full-text and non-full text articles.	
Notes	**Author's Conclusion:** It is not possible to draw a definitive conclusion due to the heterogeneity of the supplements used, rehabilitation programmes and outcome measures. However, nutritional supplements may enhance the benefit of PR programmes, which would be of considerable benefit to those living with COPD.		
Outcome measures/results	exercise function, body composition, peripheral muscle strength, respiratory muscle function and quality of life	Sixteen of 19 studies that used nutritional supplements in addition to PR did not show additional benefit compared to PR alone when measuring exercise capacity.Nutritional supplements significantly increased body weight in 7 of 11 studies. Bodymass index increased significantly in two of six studies. Handgrip strength did not improve, while quadricepsmuscle strength significantly improved in 3 of 11 studies. Four of eight studies showed a significant improvement in inspiratorymuscle function. Only 2 of 14 studies demonstrated a significant improvement in quality of life with supplementation in addition to PR	

Baldi S, Aquilani R, Pinna GD et al. Fat-free mass change after nutritional rehabilitation in weight losing COPD: role of insulin, C-reactive protein and tissue hypoxia. Int J Chron Obstruct Pulmon Dis 2010; 5: 29-39. doi:10.2147/copd.s7739 [351]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1- ROB2: Some concerns	**Countries:** Italy **Centers:** Scientific Institute of Montescano, Salvatore Maugeri Foundation I.R.C.C.S., Pavia, Italy	**Total no. patients**: 28 **Inclusion criteria:** severe COPD according to ATS criteria; experiencing dynamic weight loss (>5% of body weight) over the previous 6 months	**Intervention**: 12-week rehabilitation program with essential amino acid supplementation (EAAs), including a 4-week inpatient and 8-week outpatient rehabilitation program with 2 sessions a day of 30-minute unloaded bicycle training. **Control**: Same 12-week rehabilitation program without EAAs.

	Setting: rehabilitation programm **Funding Sources:** n/a **Dropout rates**: 7% **Study limitations:** Small sample size. Assessor was not blinded to patient allocation, leading to potential bias. Potential randomization bias due to an uneven distribution of females in the control group.Some participants had low adherence to the home-based nutrition-rehabilitation intervention. Risk of Bias Moderate Inconsistency n/a Indirectness Low Imprecision Moderate Publication Bias n/a	**Exclusion criteria:** Malignancy, gastrointestinal disorders, severe endocrine disorders, recent surgery, recent respiratory tract infection, abnormal fluid balance (presence of edema), or regular use of diuretics	
Notes	**Author's Conclusion:** The study suggests that EAAs, combined with physical training, can halt or even reverse lean body mass depletion in hypoxemic COPD patients with dynamic weight loss. This outcome is supported by the relationship between FFM gain and insulin levels, as well as C-reactive protein (C-RP) and oxygen extraction tension (PaO2x). However, the results should be interpreted with caution due to the small sample size and potential biases.		
Outcome measures/results	**Primary Outcome**: Changes in fat-free mass (FFM). **Secondary Outcomes**: Changes in body weight, fasting insulin, C-reactive protein (C-RP) levels, and oxygen extraction tension (PaO2x).		**FFM Increase**: FFM increased by 1.5 ± 2.6 kg in the EAAs group (P = 0.05) and decreased by −0.1 ± 2.3 kg in the control group (P = 0.94). **Body Weight Increase**: Body weight increased by 3.8 ± 2.6 kg in the EAAs group (P = 0.0002) and decreased by −0.1 ± 1.1 kg in the control group (P = 0.81). **Insulin, C-RP, and PaO2x**: FFM changes were significantly related to insulin (r2 = 0.68, P < 0.0005), C-RP (r2 = 0.46, P < 0.01), and PaO2x (r2 = 0.46, P < 0.01) at the end of treatment.

Degirmenci D, Şahin H, Soylu M. The effect of enteral nutrition support on muscle function capacity and pulmonary functions in malnourished patients with Chronic Obstructive Pulmonary Disease. Prog Nutr 2018; 20 [352]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+ ROB2: Some concerns	**Countries:** Turkey **Centers:** Clinic of Chest Diseases and clinics of Pulmonary Disease in Trabzon Ahi Evren Thoracic and Cardiovascular Surgery Training and Research Hospital (outpatient) **Setting:** clinical and outpatient **Funding Sources:** n/a **Dropout rates:** 23/63 **Study limitations:** some patient details were recorded by means of an interview; many dropout due to non-compliance especially by the older patients, that resulted in a significantly lower mean age in the treatment group than the control group Risk of Bias Moderate Inconsistency n/a Indirectness Low Imprecision Moderate Publication Bias n/a	**Total no. patients**: 40 **Inclusion criteria:** receiving a diagnosis of COPD by specialist doctors, having BMI below 18.5 kg/m2, being over 18 years old, cognitively intact, not pregnant and lactating **Exclusion criteria:** n/a	Nutrition education was given to all patients then the patients were divided into two groups as treatment and control. Treatment group consumed two bottles of enteral nutrition product in addition to oral nutrition for three months
Notes	**Author's Conclusion:** enteral nutrition support increased hand grip strength and FEV1 without any significant effect on FEV1/FVC values in malnourished patients with COPD		
Outcome measures/results	handgrip dynamometer FEV1 and FVC tiffeneau indexes		no difference between individuals in the control group concerning the hand grip strength ($p>0.05$) whereas handgrip strength increased significantly ($p<0.001$) after the enteral nutrition support in COPD patients

		At the end of study, increases in FEV1 values were observed in control and treatment groups but the increase in FEV1 was significant ($p<0.05$) solely in patients supported with enteral nutrition support. There were slight but not significant ($p>0.05$) decreases in FEV1/FVC values in both groups at the end of the study compare to the initial values

Deutz NE, Ziegler TR, Matheson EM et al. Reduced mortality risk in malnourished hospitalized older adult patients with COPD treated with a specialized oral nutritional supplement: Sub-group analysis of the NOURISH study. Clin Nutr 2021; 40: 1388-1395. doi:10.1016/j.clnu.2020.08.031 [353]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1++ ROB2: Low risk of bias	**Countries:** United States **Centers:** multicenter **Setting:** hospitals **Funding Sources:** NOURISH Study was funded by Abbott Nutrition. The post-hoc analysis was conducted by the Biostats group at Abbott Nutrition in consultation with the study investigators. All authors take responsibility for the accuracy and completeness of the data, statistical analyses, and compliance of the study with the protocol **Dropout rates**: 7% **Study limitations:** limited generalizability (selected group of hospitalized patients); it was not designed to determine the effect of individual nutrients, specific	**Total no. Patients:** 214 **Inclusion criteria:** from original NOURISH Study publication**:** hospitalized, malnourished older adults (65 y), with admission diagnosis of COPD **Exclusion criteria:** from original NOURISH Study publication**:** diabetes mellitus (type 1 or 2), current active or treated cancer, and impaired renal or liver function	- Sub-group analysis of the NOURISH study (Nutrition effect On Unplanned Readmissions and Survival in Hospitalized patients) - Post-hoc, sub-group analysis from the NOURISH study cohort examined the effect of a high-protein oral nutritional supplement (ONS) containing HMB (HP-HMB) in malnourished, hospitalized older adults with COPD and to identify predictors of outcomes - The COPD subgroup (n = 214) included hospitalized, malnourished (based on Subjective Global Assessment), older adults (65 y), with admission diagnosis of COPD who received either: - standard-of-care plus HP-HMB (n = 109) or - standard-of-care and a placebo supplement (n = 105) - prescribed 2 servings/day from within 3 days of hospital admission (baseline) and up to 90 days after discharge

	components in HP-HMB that may be responsible for the reduced mortality risk cannot be determined; limited amount of dietary intake data; generalizability of the results may be limited (concerns only malnourished older adult patients with COPD) Risk of Bias Low Inconsistency n/a Indirectness Moderate Impreciseness Moderate Publication Bias n/a		
Notes	**Author's Conclusion:** Among malnourished, hospitalized patients with COPD, supplementation with HP-HMB was associated with a markedly decreased mortality risk, and improved handgrip strength, body weight, and nutritional biomarkers within a 90-day period after hospital discharge. This post-hoc, subgroup analysis highlights the importance of early identification of nutritional risk and administration of high-protein ONS in older, malnourished patients with COPD after hospital admission and continuing after hospital discharge.		
Outcome measures/results	Primary outcome: Primary significant reduction in mortality risk, improvements in HGS and nutritional status suggest that the HP-HMB intervention has important clinical benefits in patients with COPD		NOURISH sub-group analysis, 214 COPD inpatients: 30, 60, and 90-day mortality risk -71%, increased body weight from baseline to hospital discharge (0.66 kg vs. 0.01 kg), improvements in blood nutritional biomarker concentrations

Sugawara K, Takahashi H, Kasai C et al. Effects of nutritional supplementation combined with low-intensity exercise in malnourished patients with COPD. Respir Med 2010; 104: 1883-1889. doi:10.1016/j.rmed.2010.05.008 [354]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1 -	**Countries:** Japan **Centers:** Akita City General Hospital; Akita University Graduate School of Health Sciences **Setting:** out-patient **Funding Sources:** n/a **Dropout rates**: 0%	**Total no. patients**: 32 **Inclusion criteria:** (1) clinical diagnosis of moderate to severe COPD, (2) a clinically stable condition without recent exacerbations, and (3) the absence of significant	**Intervention**: Nutritional supplementation + low-intensity exercise **Control**: Monthly education program

	Study limitations: Small sample size; short duration; specific population (malnourished COPD); lack of long-term follow-up	associated medical problems that might interfere with the patient's ability to undergo PR **Exclusion criteria:** Malignant disorders; gastrointestinal abnormalities; severe endocrine disorders; inability to visit hospital biweekly	
Notes	**Author's Conclusion:** The combination of nutritional supplementation with low-intensity exercise training was successful in increasing weight and energy intake as well as exercise capacity and health-related QOL in our patients. Moreover, REE and major inflammatory cytokines decreased significantly after nutritional supplementation with low-intensity exercise training. The present study results suggest a potential role for the combination of nutritional supplementation and low-intensity exercise in the management of malnourished patients with COPD.		
Outcome measures/results	Lung function, maximum inspiratory and expiratory muscle force, the Chronic Respiratory Disease Questionnaire (CRQ), the 6-min walking distance (6MWD), and the Borg scale		Body Weight: +3.1% (intervention) vs. -1.1% (control) 6MWD: +8.7% (intervention) vs. -8.8% (control) Inflammation Markers: Significant reduction in intervention group

Sugawara K, Takahashi H, Kashiwagura T et al. Effect of anti-inflammatory supplementation with whey peptide and exercise therapy in patients with COPD. Respir Med 2012; 106: 1526-1534. doi:10.1016/j.rmed.2012.07.001 [355]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+	**Countries:** Japan **Centers:** Akita City General Hospital **Setting:** n/a	**Total no. Patients:** 36	-**Nutrition group**: active nutritional supplementation therapy with 200 kcal/pack of nutritional supplement twice a day in addition to normal meals and dietary instruction

	Funding Sources: n/a **Dropout rates:** 13.89% **Study limitations:** The sample size and the time period were insufficient to reach a definitive conclusion.	**Inclusion criteria:** COPD patients with %IBW <110% and %FEV1 <80% who underwent low-intensity exercise therapy following the pulmonary rehabilitation (PR) program, and who met the diagnostic criteria of the COPD guidelines established by the American Thoracic Society (ATS) **Exclusion criteria:** Patients with a current cigarette smoking habit and complication of unstable heart disease, those for whom the medication was changed during the study period, those with severe disorders interfering with exercise including mental diseases and difficulty in oral ingestion of the nutritional supplement, and those in whom the condition was acutely aggravated after study initiation	**-Control group:** normal meals alone with dietary instruction
Notes	**Author's Conclusion:** Concomitant use of an anti-inflammatory nutritional supplement containing whey peptide, which exhibits an anti-inflammatory effect, with exercise therapy in stable elderly COPD patients with %IBW < 110% and %FEV1 < 80% may not only increase body weight but may also inhibit systemic inflammation and thus improve exercise tolerance and HRQOL.		
Outcome measures/results	Resting energy expenditure (REE); food intakes over 3 consecutive days in order to assess dietary intake; albumin (Alb), hemoglobin (Hb), and transferrin (Tf) were measured as nutrition indices, TNF-a, IL-6, IL-8, and high-sensitivity C-reactive protein (hsCRP) as inflammatory markers; mouth pressure was measured as respiratory muscle strength; weight-bearing index (WBI); maximum isometric extension and contraction of the quadriceps femoris muscle; corridor walk for 6 min according to the ATS guidelines; disease-specific HRQOL was measured using the Japanese version of the Chronic Respiratory Disease Questionnaire (CRQ)	In the nutritional support group, the body weight, %IBW, FM, energy intake, %AC, Alb, PImax, PEmax, 6MWD, WBI, emotional function, and CRQ total were significantly increased, and the levels of hsCRP, IL-6, IL-8, and TNF-a were reduced significantly, while no significant change was noted in any item of physiological evaluation or any biomarker in the control group.	

III. Hypertone Dehydratation

III.1 Prävention

Empfehlung 56

Zur Prävention der Dehydratation sollten Einrichtungen verhaltensorientierte Mehrkomponentenstrategien für ältere Personen implementieren.

Empfehlungsgrad B

Abdelhamid A, Bunn D, Copley M et al. Effectiveness of interventions to directly support food and drink intake in people with dementia: systematic review and meta-analysis. BMC Geriatr 2016; 16: 26 [94]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic review and meta-analysis 1++	**Countries:** Europe, North America, Brazil, Taiwan, New Zealand **Centers:** n/a **Setting:** most institution or hospital setting, 4 day centers/community, 1 unclear setting **Funding Sources :**National Institute for Health research, Collaboration for Leadership in Applied Health Research&Care, National Insitute of Health Research Fellowship programme **Dropout rates:** n/a **Study limitations:** some studies might have been missed due to poor indexing and abstracts omitting to identify participants as having dementia or cognitive impairment; transferability interventions for people with	**Total no. Studies:** n=43 **Inclusion criteria:** RCT and non-RCT: ≥3 adults with any type/stage of dementia or mild cognitive impairment or MMSE score plus one standard deviation ≤26, ≥5 days, interventions: aimed modify food and/or drink, provide food- or drink-based supplements, assist with eating/drinking/manage swallowing problems, and see "outcomes" **Exclusion criteria:** n/a	Direct intervention: - Oral supplements - Food/drink modification - Swallowing problems management - Eating assistance - Social support

	swallowing problems without dementia to people with dementia; lack of data in the studies (for ex. Nutritional status); interventions might be stage- or problem-specific; no definite evidence on effectiveness of one or more interventions		
Notes	• Data and quality characteristics were extracted independently by two reviewers/Methodological quality was assessed using Cochrane risk of bias tool: study was at low risk of bias when it was at low risk of both selection bias and detection bias • Studies were grouped by type of intervention, study design → many studies underpowered → unable to suggest statistically significant benefits or harms **Author's Conclusion:** We found no definitive evidence on effectiveness, or lack of effectiveness, of specific interventions but studies were small and short term. People with cognitive impairment and their carers have to tackle eating problems despite this lack of evidence, so promising interventions are listed. The need remains for high quality trials tailored for people with cognitive impairment assessing robust outcomes.	
Outcome measures/results	• At least one of these outcomes: Nutrition or hydration status→quantity, quality or adequacy of food or fluid intake, ability to eat independently, swallow without aspirating, enjoyment of food or meaningful activity • Quality of life, functional, cognitive status, views or attitudes, cost effectiveness, resource use, mortality, health outcomes	• ONS intervention: some no effect on weight >12 weeks, some RCTs→ [MD] 0.72 kg, 95 % CI −1.02-2.45, 382 participants) but with high heterogeneity (I2 89 %); some had an effect on weight: RCTs 3-12 weeks →2.02 kg, 95 % CI 1.53-2.50, 344 participants, I2 0 %; effects on other anthropometric measures were mixed; MNA improved; Quality of life, functional, cognitive status, mortality→ no effect • Food and drink modification: no significant/mixed effect; but finger food seems to be positive for improving energy intake/weight (+2.06 kg vs +0.32 kg, $p < 0.05$), no effect on MNA, cognition, mortality • Eating and drinking assistance: energy intake, cost effectiveness → no significant on weight, mixed effects on energy intake • Social support: low effects on weight and BMI (weight: 1.3% vs. -0.6%, p=0.005; BMI: 0.4 % vs. -0.2 %, p = 0.003). Energy intake (0.7 vs.-0.3 MJ/day, p = 0.084), functional and cognitive status did not alter; Family-style meals showed improvements for example on satisfaction/enjoyment, weight, autonomy • Swallowing problems: reformed foods/thickened fluids vs standard → some found improvements, some not

Bruno C, Collier A, Holyday M et al. Interventions to Improve Hydration in Older Adults: A Systematic Review and Meta-Analysis. Nutrients 2021; 13. doi:10.3390/nu13103640 [406]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review, Meta-Analysis 1+ AMSTAR2: High quality	**Countries:** n/a **Centers:** n/a **Setting:** n/a **Funding Sources:** none **Dropout rates:** n/a **Study limitations**: high heterogeneity between studies, limited use of objective and validated measures for assessing hydration; small sample sizes in individual studies; lack of high-quality studies, with many rated as neutral or low quality Risk of Bias Moderate Inconsistency Moderate Indirectness Low Impreciseness Moderate Publication Bias n/a	**Total no. studies**: 19 **Inclusion criteria:** Acutely unwell patients (≥65 years) in hospital settings or residents (≥65 years) in nursing homes or long-term rehabilitation settings. **Exclusion criteria:** Studies involving older adults living in the community, palliative patients, individuals under 65 years, or strategies involving parenteral nutrition, enteral nutrition, or intravenous fluids.	**Intervention**: Various interventions aimed at improving hydration, including behavioral, environmental, multifaceted, and nutritional strategies. **Control**: Usual care or standard practices without specific hydration interventions.
Notes	**Author's Conclusion:** Behavioral interventions, such as verbal prompting and increased availability of drinks, are associated with improved hydration. However, the overall quality of evidence is low, and further high-quality studies are necessary.		
Outcome measures/results	**Primary Outcome**: Changes in fluid intake (measured in mL/day). **Secondary Outcomes**: Hydration status, incidence of hydration-linked events (constipation, falls, UTIs), and patient satisfaction.		**Fluid Intake**: Interventions resulted in an average increase of 300.93 mL more fluid per day compared to controls (95% CI: 289.27 mL, 312.59 mL; $p < 0.00001$). **Hydration-Linked Events**: Mixed results; some studies showed improvements, while others did not report significant changes.

Bunn D, Jimoh F, Wilsher SH et al. Increasing fluid intake and reducing dehydration risk in older people living in long-term care: a systematic review. J Am Med Dir Assoc 2015; 16: 101-113. doi:10.1016/j.jamda.2014.10.016 [407]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**

Systematic Review 1++	**Countries:** Canada, US, UK, Ireland, Germany, Japan, Taiwan **Centers:** n/a **Setting:** long-term care facilities, US for-profit and not-for-profit home, nursing homes **Funding Sources:** National Institute for Health Research (NIHR; Program LH), Sponsor: Sue Steel, Contracts Manager, Research and Enterprise Hub **Dropout rates:** n/a **Study limitations:** high risk of bias (selection, attrition) , lack of valid outcome measures of fluid intake and dehydration, many definitions of "fluids", different methods of assessing fluid intake, varying periods of time over which fluid intake was measured	**Total no. Studies:** n=23 (Intervention n=19, observational studies n=4) **Inclusion criteria:** Intervention and observational studies, increasing fluid intake and/or reduce dehydration risk, older people (≥65 years) living in long-term care facilities who can drink orally **Exclusion criteria:** n/a	Many different intervention designs/possibilities 1) Multicomponent strategies: greater choice and availability of beverages, increased staff awareness, increased staff assistance with drinking and toileting, etc. 2) Implementation of the US Resident Assessment Instrument 3) Different colors of tableware 4) Drinks prethickened vs drinks thickened at bedside 5) Increased choices of drinks
Notes	• No blinding of residents or staff in any study; Blinding of outcome (n=2); Fluid intake assessments judged high risk if they were conducted for part of the day or method of a ascertainment was not considered to be accurate; dehydration status (n=4): high risk if not validated against serum osmolarity; combination fluid intake and dehydration status (n=6); **Author's Conclusion:** A wide range of interventions and exposures were identified, but the efficacy of many strategies remains unproven due to the high risk of bias present in many studies. Adequate research support has been recognized as a key challenge in developing high-quality research in nursing homes, but this is what is required to improve fluid intake and hydration status in older care home residents.		
Outcome measures/results	• Assessment of fluid intake (International Classification of Disease Ninth Revision (ICD-9, n=1), fluid intake over 24-hours (n=1), serum osmolarity (n=2), fluid intake only (n=8), observation, weighed)		• Multicomponent strategies: positive effect • Implementation of the US Resident Assessment Instrument (RAI-MDS): reduced dehydration prevalence from 3% to 1% (p=0.01) • High-contrast red cups: positive effect on men with Alzheimer disease

	• Dehydration status (n=4) (urine specific gravity, urine color, dry eyes and mouth, RAI-MDS definitions, BIA (Total Body Water (TBW), Total body Resistance (TBR))	• Supplementing mildly dehydrated residents with oral hydration solution over 5 days: positive effect • No clear effects: Modifications to the dining environment, advice to residents, presentation of beverages, mode of delivery • Canada for-profit ownership: increased hospital admission for dehydration • No difference in dehydration prevalence between US for-profit and not-for-profit homes or staffing levels • No changes in fluid intake due to color of tableware (Dunne et al.) • No differences in fluid intake prethickened vs. thickened at bedside • Changes in environment: Risk of dehydration unaltered (RR 0.36; 95%CI 0.06-2.04, p=0.25); lower fluid intake for participants in the dining room vs. bedroom (OR 0.18; 95% CI 0.06-0.63), no affection by number of residents, presence of family members or noise level • No evidence that staff grade or number of staffing hours had an effect on residents´ dehydration level

Bunn DK, Abdelhamid A, Copley M et al. Effectiveness of interventions to indirectly support food and drink intake in people with dementia: Eating and Drinking Well IN dementiA (EDWINA) systematic review. BMC Geriatr 2016; 16: 89 [95]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1++	**Countries:** North America, Europe, Asia, New Zealand, South America **Centers:** n/a **Setting:** any setting(most institutional settings) **Funding Sources:** This article summarizes independent research funded in part by the National Institute for Health Research, Collaboration for Leadership in Applied	**Total no. Studies:** n=51 **Inclusion criteria:** RCT,CCTs→≥3 adults diagnosed any stage/type of dementia or mild cognitive impairment or MMSE score+standard deviation ≤26, ≥consecutive days; included interventions: see “interventions”; Included studies only with outcomes: see “outcomes” **Exclusion criteria: c**ase reports	Studies were grouped by type of Intervention 11. Dining environment and food service (any alteration (for ex. Noise, sensory adjustments, furniture,..) of the physical environment in which food/drink was taken) 12. Education/training of people with dementia or their care givers 13. behavioral intervention: alter behavior such as verbal prompting 14. exercise (any exercise component) 15. multicomponent intervention (>3 interventions, including at least 1 listed here) then grouped by study design

	Health Research & Care, East of England, and in part by the National Institute of Health Research Fellowship programme **Dropout rates:** n/a **Study limitations:** high risk of bias (small number of patients included in the studies+ low validity), effective interventions may be underpowered, shortage of potentially useful interventions/research, inability to pool outcome data (no meta-analysis possible → interventions too different)		
Notes	• Meta-analysis (statistical pooling) was not appropriate so data were tabulated and synthesized narratively; Methodological quality was assessed using Cochrane risk of bias tool; assessed also: funding bias, validity of dementia diagnosis, outcome measures and baseline comparability between groups • Intervention duration differed from 5 days to 1 year **Author's Conclusion:** We found no definitive evidence on effectiveness, or lack of effectiveness, of specific interventions but studies were small and short term. A variety of promising indirect interventions need to be tested in large, high-quality RCTs, and may be approaches that people with dementia and their formal or informal care-givers would wish to try.		
Outcome measures/results	• Primary outcomes: - Nutrition or hydration status - Meaningful activity or enjoyment of food/drink - Quality of life • Secondary outcomes - Quantity, quality, adequacy of food/fluid intake • Other outcomes of interest: - Functional or cognitive status - Views, attitudes - Cost effectiveness	• No clearly effective or clearly ineffective interventions - Mixed results: some examples: Charras et al. shared mealtimes → weight increased (+5.64 kg, $p>0.024$), improved autonomy, longer meals; no effect on weight/BMI (Desai et al.) by comparing bulk service vs. pre-plated but increased intake of energy, protein, carbohydrate; education: (Riviere et al.)improved weight (1.4 kg, $p<0.05$) compared to usual care/(Hanson et al.) significant decrease in %weight loss compared to control; behavioral intervention → longer mealtimes (Van Ort et al.); exercise interventions no improve in nutritional status in any study	

	- Resource use - Mortality, health outcomes	• Promising interventions included: - eating meals with care-givers - family style meals - soothing mealtime music - constantly accessible snacks and longer mealtimes - education and support for formal and informal care-givers - spaced retrieval and Montessori activities - facilitated breakfast clubs (Santo Pietro et al., 1998, CCT) multisensory exercise and multicomponent interventions

III.2 Erfassung und Beurteilung des Hydratationsstatus

Empfehlung 57

Bei Verdacht auf Dehydratation und bei unerwarteten Veränderungen des Gesundheitszustands sollte die Diagnose einer hypertonen Dehydratation anhand der Serum-Osmolalität und/oder des Gesamtbilds der Symptome und Befunde geprüft werden.

Empfehlungsgrad B

Deißler L, Wirth R, Frilling B et al. Hydration Status Assessment in Older Patients. Dtsch Arztebl Int 2023; 120: 663-669. doi:10.3238/arztebl.m2023.0182 [410]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic review 1+ AMSTAR 2: moderate	**Countries:** Germany **Centers:** n/a **Setting**: n/a **Funding Sources:** n/a **Dropout rates:** n/a **Study limitations:** Variability in methods; no standard definitions; lack of diagnostic accuracy in commonly used clinical signs; need for new or combined diagnostic criteria Risk of Bias Moderate Inconsistency Moderate Indirectness Moderate	**Total no. studies**: 30 **Inclusion criteria:** Patients aged 65 years or older, or groups representing a geriatric population (e.g., nursing facility residents, multimorbidity, frailty) **Exclusion criteria:** n/a	Assessment of hydration status using various methods including serum osmolality, serum sodium, inferior vena cava ultrasonography, bioelectrical impedance analysis (BIA)

	Imprecision High Publication Bias Moderate		
Notes	**Author's Conclusion**: Only five of the 107 methods considered appear to be suitable for determining that a patient is dehydrated. Thus, the available scientific evidence indicates that all clinicians should critically reconsider their own techniques for assessing hydration status in elderly patients. To optimize the clinical assessment of patients' hydration status, there seems to be a need for the rejection of unsuitable methods in favor of either newly developed criteria or of a combination of the best criteria already in use.		
Outcome measures/results	Primary outcome: diagnostic accuracy of methods to assess hydration status secondary outcomes: Identification of reliable diagnostic methods; comparison of traditional vs. new methods; recommendations for clinical practice; evaluation of current methods' limitations	Only five out of 107 methods deemed suitable for diagnosing dehydration: serum osmolality, serum sodium, inferior vena cava ultrasonography, missed drinks between meals, and axillary dryness .	

Empfehlung 58

Einzelne diagnostische Zeichen und Tests, die zur Beurteilung der hypertonen Dehydratation üblich sind, wie Hautturgor, Mundtrockenheit, Gewichtsänderung, Farbe oder spezifisches Gewicht des Urins, sollen NICHT als alleinige Kriterien zur Beurteilung des Hydratationsstatus bei älteren Personen verwendet werden.

Empfehlungsgrad A

Bunn DK, Hooper L. Signs and Symptoms of Low-Intake Dehydration Do Not Work in Older Care Home Residents-DRIE Diagnostic Accuracy Study. J Am Med Dir Assoc 2019; 20: 963-970. doi:10.1016/j.jamda.2019.01.122 [417]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Prospective diagnostic accuracy study QUADAS-2: High risk of bias Low concerns regarding applicability	**Countries:** United Kingdom **Centers:** Norwich Research Park, University of East Anglia, Norwich, Norfolk, United Kingdom **Setting:** in-patient **Funding Sources:** National Institute for Health Research (NIHR) Career Development Fellowship program **Dropout rates**: 0%	**Total no. patients**: 188 **Inclusion criteria:** Residents aged 65 years or older from care homes offering residential, nursing, and/or dementia care. **Exclusion criteria:** Residents with cardiac or renal failure, those receiving palliative care, or considered too ill, frail, or anxious by their home manager.	**Intervention**: Assessment of diagnostic accuracy of 49 commonly used signs and symptoms of dehydration. **Control**: Serum osmolality measurement used as the reference standard.

	Study limitations: High risk of bias due to lack of blinding in some assessments; potential selection bias as only participants who were considered not too ill, frail, or anxious by their care home managers were included; limited generalizability due to the specific population studied (older adults in care homes); underpowered for some tests due to low prevalence of certain conditions**.**		
Notes	Author's Conclusion: Commonly used signs and symptoms of dehydration lack diagnostic accuracy in older adults. The study suggests replacing these tests with a two-stage screening process involving serum osmolarity followed by serum osmolality measurement for those identified as high risk.		
Outcome measures/results	**Primary Outcome**: Diagnostic accuracy of clinical signs and symptoms of dehydration. **Secondary Outcomes**: Sensitivity, specificity, and area under the curve (AUC) for the various index tests compared to serum osmolality.	None of the commonly used signs and symptoms met the predetermined criteria of both sensitivity and specificity >70% or AUC >0.7. The most promising tests showed limited diagnostic value, with wide confidence intervals and low sensitivity.	

Fortes MB, Owen JA, Raymond-Barker P et al. Is this elderly patient dehydrated? Diagnostic accuracy of hydration assessment using physical signs, urine, and saliva markers. J Am Med Dir Assoc 2015; 16: 221-228. doi:10.1016/j.jamda.2014.09.012 [385]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Prospective cross-sectional diagnostic accuracy Study 2++	**Countries:** UK **Centers:** Gwynedd Hospital, Bangor, UK **Setting:** hospital acute medical care and emergency department	**Total no. Patients:** n=178 (85=m; 93=w) → after further exclusion: n=130 (59=m; 71=w) **Inclusion criteria:** any primary diagnosis, >60 years, admitted to acute medical care unit or emergency department	Forms of dehydration: 1) Water-loss dehydration (n=27(21%)): Plasma osmolality > 295 mOsm/kg 2) Water-and-solute-loss dehydration (n=25(19%)): BUN: creatinine ratio ≥20, and normal plasma osmolality →forms of dehydration: n=52

	Funding Sources: HydraDx Inc. **Dropout rates:** 26.7% **Study limitations:** 25µL of salvia sample for analysis meant that only 75% of the samples could be analyzed, nanotechnology for assessment of salvia osmolality are under development, salvia: confounding effect possible!, unclear physiological mechanisms responsible for an increase in salvia osmolality during dehydration	**Exclusion criteria:** oral trauma, dental surgery within 14 days, swallowing problems, salivary gland tumors, were deemed too unwell by the medical staff to participate, assessed as not having capacity to consent, already begun any form of medical treatment or rehydration therapy, renal disease, cardiac failure, reference test not available, abnormally low BUN:Cr (<10), syndrome of inappropriate antidiuretic hormone, glucocorticoid medication	3) Euhydration (n=78(60%)): Normal Plasma osmolality and BUN: creatinine ratio
Notes	• hydration assessment within 30 min of admittance to hospital; reference standard to hydration: Plasma osmolality, blood urea nitrogen to creatinine ratio • all physical examinations and assessments of confidential medical information was carried out by the same clinical research fellow, who was blinded to the results of the reference standards and the salvia and urine index test results/salvia and urine samples: independent research assistant, who was blinded • separated comparison of dehydration forms to euhydrated control group • Salvia osmolality assessed in 98(75%) of participants; Urine color/Usg analyzed in 84 (65%) of the participants **Author's Conclusion:** With the exception of low systolic blood pressure, which could aid in the specific diagnosis of water-and-solute-loss dehydration, physical signs and urine markers show little utility to determine if an elderly patient is dehydrated. Saliva osmolality demonstrated superior diagnostic accuracy compared with physical signs and urine markers, and may have utility for the assessment of both water-loss and water-and-solute-loss dehydration in older individuals. It is particularly noteworthy that saliva osmolality was able to detect water-and-solute-loss dehydration, for which a measurement of plasma osmolality would have no diagnostic utility.		
Outcome measures/results	• Hydration assessment: 7 physical signs ▪ Tachycardia >100 bpm ▪ Low systolic blood pressure <100 mmHg ▪ Dry mucous membrane ▪ Axillary dryness ▪ Poor skin turgor ▪ Sunken eyes	• Participants with water-loss dehydration: elevated plasma osmolality Participants with water-and-solute-loss dehydration: elevated BUN:Cr Compared with euhydrated control • No discrimination between dehydration and euhydration: Urine color, Usg, SFR (AUCroc range 0.49-0.57, all p>0.05) • All physical signs: poor sensitivity (0-44%) for detecting either form of dehydration; better in detecting euhydration (Specificity 60-99%)	

	▪ Long capillary refill time >2 seconds • Urine color, urine specific gravity (Usg) • Salvia flow rate, salvia osmolality • Plasma osmolarity • Blood urea nitrogen to creatinine ratio	• Salvia osmolality greater in groups with dehydration than euhydrated control (p<0.001) • Low systolic blood pressure: potential utility for aiding the diagnosis of water-and-solute-loss dehydration (OR= 14.7) • Salvia osmolality: moderate diagnostic accuracy (area under the receiver operating characteristic curve = 0.76; p<0.01) to distinguish both dehydration types →water-loss dehydration: 70% sensitivity, 68% specificity, OR= 5.0; 95% CI 1.7-15.1 →water-and-solute-loss-dehydration: 78% sensitivity, 72% specificity, OR= 8.9; 95% CI 2.5-30.7 Salvia osmolality cut-off that provided the optimum balance between sensitivity and specificity: 95, 97 and 94 mOsm/kg for water-loss only, water-and-solute-loss only, and both forms of dehydration combined

Hooper L, Abdelhamid A, Atreed NJ et al. Clinical symptoms, signs and tests for identification of impending and current water-loss dehydration in older people. Cochrane Database Syst Rev 2015; 2015: CD009647 [382]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1++	**Countries:** n/a **Centers:** n/a **Setting:** hospitalized, living in community or institution **Funding Sources:** n/a for Cochrane review; stated for every study included in this review **Dropout rates:** n/a **Study limitations:** heterogeneity in the reference standards accepted, equivalence of different levels of cut-offs for the different reference standards, combining index	**Total no. Studies:** n=212 (full-text records assessed) n= 24 (included) n= 21 (included in meta-analysis) **Inclusion criteria:** diagnostic**,** cohort, cross-sectional studies obtained in full text, assessed independently in duplicate, disagreements resolved by a third author, collected data on at least one reference standard, at least one index test, in at least 10 people aged ≥65 years who were hospitalized, living in the community, in institutions, in a developed country, may have had chronic or acute	• 3 studies included with published diagnostic accuracy data • Further 21 provided datasets that were analyzed • Assessment of 67 tests for diagnostic accuracy of water-loss dehydration (primary target) and current dehydration (secondary target)

	tests that may have been carried out differently in different studies/different equipment, insufficient published data to confidently pre-set three appropriate cut-offs for continuous index tests, lacking power to combine tests/develop combined diagnostic test	illnesses (stroke, fracture, diabetes, infection) requesting original dataset → creation of 2 x 2 tables; studies only included where proportion of those under 65 years was less than 10% **Exclusion criteria:** studies with more than 10% of participants having one or more of the following: kidney failure, cardiac failure, had not recently been prepared for surgery/undergo surgery, age <65 years in mixed populations	
Notes	• Diagnostic accuracy of each test was assessed against best available reference standard for water-loss dehydration: serum/plasma osmolality cut-off ≥ 295 mOsm/kg, serum osmolarity or weight change; impeding (serum osmolality 295-300 mOsm/kg) or current (serum osmolality >300 mOsm/kg) dehydration → having water-loss dehydration, contrasted with being euhydrated (serum osmolality 275 to <295 mOsm/kg • Each index test: data presented in forest plots of sensitivity (minimum of a useful test: 60%) and specificity (minimum 75%) • Index tests for dehydration: dry axilla and other markers of transepidermal water loss, dry mucous membrane, dry or furrowed tongue, extended capillary refill time, measures of skin blood flow, etc. • Body mass (weight) change: impeding dehydration reduction of 3% to 5% of body weight within 7 days or less/ or increase of 3% to 5% of body weight within 7 days as an indication that a person was dehydrated before rehydration; current dehydration: changes more than 5% of body weight; weight change over a period less than 7 days was not multiplied up to 7 day equivalent • Heterogeneity due to different cut-off values for each index test were examined by comparing results of the bivariate random-effects meta-analyses at each cut-off point • Risk of bias: low risk n=6, high risk n=13, unclear risk n=5 **Author's Conclusion:** There is limited evidence of the diagnostic utility of any individual clinical symptom, sign or test or combination of tests to indicate water-loss dehydration in older people. Individual tests should not be used in this population to indicate dehydration; they miss a high proportion of people with dehydration, and wrongly label those who are adequately hydrated. Promising tests identified by this review need to be further assessed, as do new methods in development. Combining several tests may improve diagnostic accuracy.		
Outcome measures/results	• Primary target: water-loss dehydration (including impending or current water-loss dehydration) • Body mass (weight) change: included where at baseline weight was measured and re-weighing occurred within 7 days • Secondary targets:	• 3 tests showed any ability to diagnose water-loss dehydration (both impeding and current) as stand-alone tests: ▪ expressing fatigue (sensitivity 0.71 (95% CI 0.29 to 0.96), specificity 0.75 (95% CI 0.63 to 0.85), in one study with 71 participants, but two additional studies had lower sensitivity);	

	1. To assess the effect of different cut-offs of index test results assessed using continuous data on sensitivity and specificity in diagnosis of water-loss dehydration. 2. To identify clinical symptoms, signs and tests that may be used in screening for water-loss dehydration in older people. 3. To identify clinical symptoms, signs and tests that are not useful in screening for water-loss dehydration in older people. 4. To assess clinical symptoms, signs and tests of current dehydration (including all those with serum osmolality > 300 mOsm/kg). 5. To assess clinical symptoms, signs and tests of impending dehydration (including all those with serum osmolality 295 to 300 mOsm/kg). 6. To directly compare promising index tests (sensitivity ≥ 0.60 and specificity ≥ 0.75) where two or more are measured in a single study (direct comparison). 7. To carry out an exploratory analysis to assess the value of combining the best three index tests where the three tests each have some predictive ability of their own, and individual studies include participants who had all three tests.	▪ missing drinks between meals (sensitivity 1.00 (95% CI 0.59 to 1.00), specificity 0.77 (95% CI 0.64 to 0.86), in one study with 71 participants) ▪ BIA resistance at 50 kHz (sensitivities 1.00 (95% CI 0.48 to 1.00) and 0.71 (95% CI 0.44 to 0.90) and specificities of 1.00 (95% CI 0.69 to 1.00) and 0.80 (95% CI 0.28 to 0.99) in 15 and 22 people respectively for two studies, but with sensitivities of 0.54 (95% CI 0.25 to 0.81) and 0.69 (95% CI 0.56 to 0.79) and specificities of 0.50 (95% CI 0.16 to 0.84) and 0.19 (95% CI 0.17 to 0.21) in 21 and 1947 people respectively in two other studies) ▪ In post-hoc ROC plots drinks intake, urine osmolality and axillial moisture also showed limited diagnostic accuracy • Combining two tests so that an individual both missed some drinks between meals and expressed fatigue was sensitive at 0.71 (95% CI 0.29 to 0.96) and specific at 0.92 (95% CI 0.83 to 0.97) • No test was consistently useful in more than one study and in diagnosing current water-loss dehydration

Hooper L, Bunn DK, Abdelhamid A et al. Water-loss (intracellular) dehydration assessed using urinary tests: how well do they work? Diagnostic accuracy in older people. Am J Clin Nutr 2016; 104: 121-131. doi:10.3945/ajcn.115.119925 [418]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Diagnostic Accuracy study/cohort study 2++	**Countries:** UK **Centers:** n/a **Setting:** living in long-term care or in the community **Funding Sources:** NHS England, National Institute for Health Research fellowship programme, European Union´s Seventh Framework Program	**Total no. Patients:** n=313 **Inclusion criteria:** ≥65years NEW-AGE: free from frailty and current or recent chronic diseases, free living, able and willing to provide informed consent **Exclusion criteria:** DRIE: renal/heart failure, receiving palliative care, unlikely to survive ≥3 months, too anxious or unwell to be approached,	2 prospective cohort studies included: (cross-sectional) 1) DIRE (Dehydration Recognition in our Elders; living in long-term care): women: 67%; mean age: 86 y; n = 162 Aim: quantify the diagnostic accuracy of clinical and physical signs of water-loss dehydration in frail older people ≥65 years, living in residential care, nursing homes, specialist dementia care, mixed homes in Norfolk/Suffolk, UK Laboratory for blood samples: Norfolk/Norwich University Hospital 2) NU-AGE (Dietary Strategies for Healthy Aging in Europe; living in the community): women: 64%; mean age: 70 y; n = 151

	Dropout rates: n/a **Study limitations:** no reproducibility of assessments of the 2 studies, urine color may be altered (food, medication, medical condition),different urine collection in the 2 cohorts, older people with different characteristics in the 2 cohorts	care home manager who reported that the resident did not wish to participate, if sample was not obtained at the second attempt	RCT, multicenter (n=5); Norfolk, UK Aim: assess the effects of a year's dietary intervention based on recommendations, specifically developed for the elderly, on markers of inflammation and a series of related health outcomes including cognitive function, physical ability, bone mineral density, body composition, and cardiovascular markers age 65-79 Laboratory: Norwich Clinical Research Trials Unit (CRTU)
Notes	• Minimum useful diagnostic accuracy was set at sensitivity and specificity ≥ 70%, or receiver operating characteristic plot area under the curve ≥0.70 • Classification dehydration: normally hydrated (serum osmolality 275 to <295 mOsm/kg), having impending dehydration (295–300 mOsm/kg), or current dehydration (>300 mOsm/kg) • DIRE study: researchers were blinded to each other's readings • Reproducibility of the assessment of urine color, pH and protein was low for both studies • The interrater reliability was high for most urinary tests with exceptions being urinary color, pH, and protein. Protein readings were all either negative or trace, and we had already decided, as raters, that negative and trace readings could not be distinguished • Urine collection was different: 24-h samples taken over the day before the blood sample and frozen; and urine samples taken from 30 min before to 120 min after phlebotomy and analyzed fresh **Author's Conclusion:** Although USG, urine color, and urinary osmolality have been widely advocated for screening for dehydration in older adults, we show, in the largest study to date to our knowledge, that their diagnostic accuracy is too low to be useful, and these measures should not be used to indicate hydration status in older people (either alone or as part of a wider tranche of tests). There is a need to develop simple, inexpensive, and noninvasive tools for the assessment of dehydration in older people.		
Outcome measures/results	• Reference standard: serum osmolality • index test included: ▪ USG (Urine specific gravity) ▪ urine color ▪ urine osmolality ▪ urine cloudiness ▪ additional dipstick measures ▪ ability to provide a urine sample ▪ volume of a random urine sample • Functional status: Barthel Index (DRIE); Katz´s Activities of daily living scale (NEW-AGE)		• DRIE participants more limited cognitive and functional abilities that did NU-AGE participants (MMSE: NEW-AGE 28.4 ± 1.5 vs. DIRI 21.8 ± 5.7) • Functional NEW-AGE participants also more able • Mean BMI higher in NEW-AGE (26.8 ± 4.0) vs. DRIE 25.6 ± 5.6) • 19% of DIRE and 22% of NU-AGE participants were dehydrated (serum osmolality >300 mOsm/kg) • impeding dehydration : NEW-AGE 41% vs. DRIE 27% • normally hydrated: NEW-AGE 37% vs. DRIE5 54% • None of the urinary measures had an ROC (AUC) >0.7 in diagnosis of current dehydration or impeding and current dehydration

	• Cognitive status: Mini-Mental State Examination (MMSE) (DRIE; NEW-AGE)	• None of the potential tests at any cutoff and for either current or impeding dehydration had both sensitivity and specificity ≥70% • Neither USG nor any other potential urinary tests were usefully diagnostic for water-loss dehydration

III.3 Therapie

Empfehlung 61

Bei älteren Personen mit schwerer hypertoner Dehydratation soll die Flüssigkeitsgabe intravenös erfolgen.

Empfehlungsgrad A

Barreto Annes LM, Andrade R, Pontes IEA et al. Subcutaneous Versus Intravenous Rehydration in Hospitalized Older Adults: A Meta-Analysis. J Infus Nurs 2020; 43: 283-291. doi:10.1097/nan.0000000000000388 [420]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Meta-Analysis 1- AMSTAR2: High quality	**Countries:** Brazil **Centers:** Professor Fernando Figueira Integral Medicine Institute (IMIP), Recife, Pernambuco, Brazil **Setting**: in-patient **Funding Sources:** none **Dropout rates:** 0% **Study limitations:** High risk of bias due to unclear randomization processes and lack of blinding, small sample size and low quality of evidence, differences in volume and type of rehydration solutions used across studies Risk of Bias Moderate Inconsistency Low Indirectness Low	**Total no. studies**: 3 **Inclusion criteria:** Adults over 60 years of age with mild-to-moderate dehydration, hospitalized, and requiring fluid rehydration. **Exclusion criteria:** Quasi-randomized, controlled, and crossover clinical trials.	**Intervention**: Subcutaneous rehydration (hypodermoclysis). **Control**: Intravenous (IV) rehydration.

	Imprecision Moderate Publication Bias n/a		
Notes	**Author's Conclusion**: Subcutaneous rehydration is an effective alternative to IV rehydration in reversing mild-to-moderate dehydration in hospitalized older adults. It also offers protection against phlebitis. However, the quality of evidence is low, and further research is needed.		
Outcome measures/results	**Primary Outcome**: Reversal of dehydration (measured by serum osmolality). **Secondary Outcomes**: Incidence of phlebitis, cellulitis, edema, erythema, hyponatremia, and patient satisfaction.		**Reversal of Dehydration**: No statistically significant difference between subcutaneous and IV rehydration after 48 hours (mean difference = 5.8; P = 0.17). **Phlebitis**: Significantly lower incidence in the subcutaneous group (RR = 0.10; P = 0.03). **Other Adverse Events (Cellulitis, Edema, Erythema, Hyponatremia)**: No significant differences between groups, but very low levels of evidence.

Danielsen MB, Andersen S, Worthington E et al. Harms and Benefits of Subcutaneous Hydration in Older Patients: Systematic Review and Meta-Analysis. J Am Geriatr Soc 2020; 68: 2937-2946. doi:10.1111/jgs.16707 [421]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1++ AMSTAR2: High quality	**Countries:** Denmark **Centers:** n/a **Setting:** n/a **Funding Sources:** Department of Clinical Medicine, Aalborg University, and the Department of Geriatric Medicine, Aalborg University Hospital **Dropout rates:** n/a **Study limitations:** High risk of bias in some RCTs due to lack of blinding and absence of an a priori protocol; the use of non-standardized measures across studies led to difficulty in combining results;many studies had small sample sizes, reducing	**Total no. Studies:** 29 **Inclusion criteria:** Studies involving older patients (aged >65 years or mean age >60 years) who received subcutaneous (SC) hydration as an intervention with hydration as an indication for infusion. **Exclusion criteria:** Studies on SC infusion of drugs, parenteral nutrition, studies without patient information, and cross-sectional studies or case reports without adverse effects data.	**Intervention**: Subcutaneous (SC) hydration. **Control**: Intravenous (IV) hydration.

	the power to detect differences Risk of Bias Moderate Inconsistency Low Indirectness Low Imprecision Low Publication Bias Low		
Notes	**Author's Conclusion:** SC hydration is a safer alternative to IV hydration with fewer adverse effects and a lower risk of agitation in older patients. However, SC hydration is less effective in reducing serum osmolality and delivers a lower volume of fluid. More high-quality studies are needed to confirm these findings.		
Outcome measures/results	**Primary Outcome**: Incidence of adverse effects. **Secondary Outcomes**: Time to catheter insertion, fluid volume infused, reduction in serum osmolality, incidence of agitation, and mortality.		Adverse Effects: SC hydration had a 31% lower risk of adverse effects compared to IV hydration (RR = 0.69; 95% CI = 0.53–0.88). Serum Osmolality: IV hydration was more effective in reducing serum osmolality (MD = 5.75 mmol/kg; 95% CI = 0.13–11.37 mmol/kg). Agitation: SC hydration significantly reduced the risk of agitation (RR = 0.42; 95% CI = 0.22–0.79). Fluid Volume: IV hydration delivered a higher volume of fluid (SMD = 0.62; 95% CI = 0.24–1.01). Mortality: No significant difference in mortality between SC and IV hydration (RR = 1.26; 95% CI = 0.25–6.34)

Rochon PA, Gill SS, Litner J et al. A systematic review of the evidence for hypodermoclysis to treat dehydration in older people. J Gerontol A Biol Sci Med Sci 1997; 52: M169-176 [422]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1+	**Countries:** Canada **Centers:** University of Toronto **Setting:** n/a **Funding Sources:** The Max and Roslyn Gordon Summer Scholarship **Dropout rates:** n/a	**Total no. Studies:** 13 **Inclusion criteria:** English- language articles involving hypodermoclysis (defined as the subcutaneous infusion of fluids) that contained original patient data on adults receiving fluids for the purpose of rehydration	Hypodermoclysis using three types of fluid, specifically electrolyte-containing solution, nonelectrolyte solutions and hypertonic solutions. The type of fluid infused was unspecified in 3 case reports, whilst in 2 randomized controlled trials (RCTs), the control groups received intravenous infusions.

	Study limitations: Only two RCTs were included in the review, and these provided limited evidence of benefit for the intervention.	**Exclusion criteria:** n/a	
Notes	**Author's Conclusion:** Hypodermoclysis can be used to most safely provide fluids when electrolyte-containing fluids are administered. Hypodermoclysis may have fallen into disuse because of reports of severe adverse reactions related to infusions of electrolyte-free or hypertonic solutions that would likely be considered inappropriate today. Whether or not hyaluronidase is required to promote subcutaneous fluid absorption remains unresolved. Limited evidence suggests that potassium chloride may, with caution, be safely added to subcutaneous infusions. The majority of the available studies evaluating hypodermoclysis are of poor quality. Because of the tremendous potential benefits of administering fluid subcutaneously, there is a need for good quality studies to evaluate the efficacy of hypodermoclysis.		
Outcome measures/results	Efficacy and adverse effects of administration of fluid by hypodermoclysis		Eighteen articles met the inclusion criteria. Since we hypothesized that adverse effects associated with hypodermoclysis may have been related largely to the use of nonelectrolyte or hypertonic solutions, the studies were evaluated according to the type of fluid administered. Six hundred and eighty-five patients were described in 13 studies evaluating the efficacy and toxicity of subcutaneously administered fluid. Four studies evaluated hypodermoclysis using electrolyte-containing solutions in 25 patients. Two of these were randomized control trials (RCT) that compared hypodermoclysis to intravenous therapy. Both reported similar absorption of fluids. In the single RCT that evaluated adverse effects, 4 of 17 patients receiving hypodermoclysis reported minor side effects similar to those reported with intravenous therapy. Adverse effects were more severe when electrolyte-free or hypertonic solutions were evaluated. Of the 639 patients who may have received electrolyte-free solutions, 16 patients (2.5%) reported adverse effects, 8 of which were severe. Both patients reported to have received hypertonic solutions noted adverse effects, one of which was severe. The use of hyaluronidase to facilitate absorption was evaluated in 74 patients. These studies suggest that hyaluronidase improves the speed of fluid absorption but may not change the patient's comfort level. A single case report of 350 subcutaneous infusions in 67 patients investigated the administration of up to 34 mmol/L of potassium chloride (KCl) by hypodermoclysis. The only adverse reaction observed was discomfort at the infusion site.

Turner T, Cassano AM. Subcutaneous dextrose for rehydration of elderly patients - an evidence-based review. BMC Geriatr 2004; 4: 2 [423]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
Systematic Review 1+	**Countries:** Australia **Centers:** Centre for Clinical Effectiveness, Monash Institute of Health Services Research, Monash Medical Centre, Clayton, Victoria; Rehabilitation and Aged Care Services, Kingston Centre, Cheltenham, Victoria **Setting:** n/a **Funding Sources** n/a **Dropout rates:** n/a **Study limitations:** the evidence in this area is limited and the studies appraised each have methodological flaws that limit the strength of the conclusions that can be drawn	**Total no. Studies:** 4 **Inclusion criteria:** articles published in English in the last 10 years, primary studies or systematic reviews of primary studies providing evidence as to the effectiveness and safety of subcutaneous infusion of dextrose solutions for rehydration of elderly patients **Exclusion criteria:** n/a	Subcutaneous infusion of dextrose solutions
Notes	**Author's Conclusion:** The four studies appraised all provide evidence that appropriate volumes of subcutaneous dextrose infusions (in the form of half-normal saline-glucose 5%, 40 g/L dextrose and 30 mmol/L NaCl, or 5% dextrose solution and 4 g/L NaCl, or two-thirds 5% glucose and one-third normal saline) can be used effectively for the treatment of dehydration, with similar rates of adverse effects to intravenous infusion. The evidence in this area is limited, and larger randomized controlled trials using validated outcome measures would be useful to confirm these results.		
Outcome measures/results	Effectiveness and safety of subcutaneous infusion of rehydration with subcutaneous 5% dextrose solutions compared with intravenous 5% dextrose solutions		From our search we identified 15 potentially relevant articles. We obtained the full text of these articles to determine their relevance. After application of the inclusion criteria, four articles remained for appraisal including one systematic review, two randomized controlled trials and one cohort study.

IV. Therapie von Sarkopenie

Empfehlung 63

Älteren Menschen mit Sarkopenie können ergänzend zu strukturierten Trainingsprogrammen proteinreiche Supplemente angeboten werden, um den Erhalt bzw. Aufbau von Muskelmasse und -kraft zu unterstützen und die körperliche Funktionalität zu verbessern.

Evidenzgrad 0

Mori H, Tokuda Y. De-Training Effects Following Leucine-Enriched Whey Protein Supplementation and Resistance Training in Older Adults with Sarcopenia: A Randomized Controlled Trial with 24 Weeks of Follow-Up. J Nutr Health Aging 2022; 26: 994-1002. doi:10.1007/s12603-022-1853-1 [431]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1++ ROB2: Some concerns	**Countries:** Japan **Centers:** Institute of Advanced Medical Sciences, Tokushima University, Japan; Hyogo Locomotion-senior-tera-koya, Hyogo, Japan **Setting:** out-patient **Funding Sources:** Dairy Products Health Science Council; Japan Dairy Association **Dropout rates:** 13,6% **Study limitations:** Small sample size; lack of biomarkers such as serum IGF-1; no improvement in walking speed was observed; the study did not use dual-energy X-ray absorptiometry (DXA) for assessing body composition Risk of Bias Moderate Inconsistency n/a	**Total no. patients**: 81 **Inclusion criteria:** Adults aged 65 years or older; diagnosed with sarcopenia according to the Asian Working Group for Sarcopenia (AWGS) 2014 criteria. **Exclusion criteria:** Individuals without sarcopenia; those on nutritional therapies for conditions like type 2 diabetes or chronic kidney disease within 1 year before the intervention; individuals who refused participation or resistance training therapy.	Intervention: RT + PRO Group: Resistance training combined with leucine-enriched whey protein supplementation; RT Group: Resistance training only; PRO Group: Leucine-enriched whey protein supplementation only. Control: No direct control group; comparisons made among the three intervention groups.

	Indirectness Low Impreciseness Low Publication Bias n/a		
Notes	**Author's Conclusion:** The combined intervention of resistance training and leucine-enriched whey protein supplementation showed superior long-term maintenance of increased skeletal muscle mass and strength compared to resistance training alone after a 24-week de-training period. This combined approach may be effective for treating sarcopenia in older adults.		
Outcome measures/results	**Primary Outcome**: Mean change in appendicular skeletal muscle mass index (ΔASMI). **Secondary Outcomes**: Handgrip strength (ΔHGS), usual walking speed (ΔUWS), knee extension strength (ΔKES), and sarcopenia remission rate.		**Primary Outcome**: **ΔASMI**: Significant increase in the RT + PRO group compared to RT alone at 24 weeks of de-training ($p < 0.05$). **Secondary Outcomes**: **ΔHGS**: Higher in the RT + PRO group at 24 weeks of de-training compared to the RT and PRO groups ($p < 0.01$); **ΔKES**: Higher in the RT + PRO group at 24 weeks of de-training compared to the RT and PRO groups ($p < 0.01$); **Sarcopenia remission rate**: Higher in the RT + PRO group compared to the RT group at 12 and 24 weeks of de-training ($p < 0.05$).

Rondanelli M, Peroni G, Gasparri C et al. Is a Combination of Melatonin and Amino Acids Useful to Sarcopenic Elderly Patients? A Randomized Trial. Geriatrics (Basel) 2018; 4: 4. doi:10.3390/geriatrics4010004 [433]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1- ROB2: High risk of bias	**Countries:** Italy **Centers:** Santa Margherita Institute, Pavia, Italy **Setting:** n/a **Funding Sources:** none **Dropout rates:** 20.5% **Study limitations:** no assessment of insulin in sarcopenic patients; short frame of intervention, did not assay blood melatonin concentrations; use of routine parameters instead of gold standard Risk of Bias High Inconsistency n/a Indirectness Moderate	**Total no. Patients:** 200 **Inclusion criteria:** aged 65 years or older and sarcopenic, defined as suffering loss of muscle mass as assessed by DXA and loss of strength; not affected by acute illness, severe liver, heart or kidney dysfunction, or severe dementia and had a bodyweight that had been stable for 6 months **Exclusion criteria:** subjects with uncontrolled diabetes, dysthyroidism and other endocrinopathies, or neoplasia, or patients treated with steroids or entirely unable to walk	The groups were randomly assigned to one of the four intervention groups: placebo (P) (n = 44), melatonin (M) (n = 42), essential amino acids (eAA) (n = 40), essential amino acids + melatonin (eAAM) (n = 33). (1) Placebo: (P) (2) Melatonin (M) 1 mg/daily 30 min before going to sleep. (3) Essential amino acids (eAA) 4 g/daily every morning during breakfast (4) Essential amino acids (eAA) 4 g/daily every morning during breakfast + melatonin 1 mg/daily 30 min before going to sleep.

	Impreciseness High Publication Bias n/a		
Notes	**Author's Conclusion:** In conclusion, this preliminary study demonstrates that the intake of melatonin alone in sarcopenic elderly patients tends to worsen protein metabolism. However, this supposed detrimental effect of melatonin on protein metabolism can be counteracted by supplementation with eAAs. In fact, the association of melatonin with eAAs increased fat-free mass.Given the high number of elderly people who take melatonin for sleep/wake rhythm disorders, if these subjects are sarcopenic, we recommend caution in the intake of melatonin and advise supplementation with essential amino acids. New randomized trials in sarcopenic elderly subjects are needed to confirm the results of our study, and also evaluate the hormonal status (insulin, GH, IGF-I, glucagon), the genetic analysis regarding the melatonin receptor 1B gene (MTNR1B) and the gold standard evaluation of protein metabolism and muscle strength, such as labelled amino acid uptake or isokinetic muscle force of these subjects.		
Outcome measures/results	Total fat-free mass, albumin levels, gynoid fat, android fat, inflammation, strength		- Compared with P and M, supplementation with eAA plus M increased total fat-free mass (vs. P: +2190 g; $p < 0.01$; vs. M: +2107 g; $p < 0.05$). - M alone lowered albumin levels (vs. P: −0.39 g; $p < 0.01$; vs. eAA: −0.47 g; $p < 0.01$). This data on albumin was confirmed by within-group analysis (M −0.44g; $p < 0.001$; eAAM: −0.34 $p < 0.05$). - M and eAA seemed to lower the percentage of gynoid fat ($p < 0.05$) and android fat ($p < 0.01$). - No significant changes in inflammation or strength were reported.

Rondanelli M, Cereda E, Klersy C et al. Improving rehabilitation in sarcopenia: a randomized-controlled trial utilizing a muscle-targeted food for special medical purposes. J Cachexia Sarcopenia Muscle 2020; 11: 1535-1547. doi:10.1002/jcsm.12532 [432]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1++ ROB2: Some concerns	**Countries:** Italy **Centers:** Geriatric Physical Medicine and Reha- bilitation Division, Santa Margherita Hospital, Azienda Human Service of Pavia **Setting:** n/a **Funding Sources:** Azienda di Servizi alla Persona of Pavia and the University of Pavia	**Total no. Patients:** 140 **Inclusion criteria:** old adults (age ≥ 65 years) candidates for inpatient rehabilitation without severe cognitive impairment who were found to have sarcopenia **Exclusion criteria:** subjects who had severe renal failure, moderate to severe liver failure, endocrine diseases associated with calcium	Patients were assessed at admission and discharge after minimum 4 weeks and maximum 8 weeks of intervention with physical exercise and nutritional supplementation or an iso-caloric control formula. An individualized dietary programme was drawn up for each patient, taking nutritional and mastication issues, as well as any swallowing issues into consideration. In addition to hospi- tal diet, subjects were randomly allocated to receive twice daily: Experimental formula: A whey protein-based food for special medical purposes enriched with leucine and vitamin D or Control formula: An isocaloric formula consisting of 40 g of a flavoured (vanilla or strawberry) powder containing maltodextrins.

	Dropout rates: 9% **Study limitations:** study has been conducted at a single site and has addressed only the short-term efficacy of a multidisciplinary intervention Risk of Bias Moderate Inconsistency n/a Indirectness Low Impreciseness Moderate Publication Bias n/a	metabolism disorders (except osteoporosis), known psychiatric disorders, cancer, or hypersensitivity to any component of the investigational nutritional supplement and those who were adhering to a high-energy or high-protein diet or were taking calcium supplements or vitamin D supplements or protein/amino acid supplements	An individualized, moderate-level physical fitness and muscle mass promoting program was set up for all in-patients.
Notes	**Author's Conclusion:** In conclusion, in old adults with sarcopenia admitted to hospital for rehabilitation the consumption of a muscle- targeted whey protein-based nutritional formula enriched with leucine and vitamin D improved physical performance and function, as well as muscle mass, and reduced the intensity and costs of care. Confirmatory trials addressing the value of a muscle-targeted nutritional formula in combination with exercise on the key features of sarcopenia are needed and benefits should be also explored in patients with pre- served physical performance.		
Outcome measures/results	primary outcome: mean change (between admission and discharge) in gait speed per month (m/s/month). secondary outcome: change (per month) in physical performance outcome measures: chair-stand test, TUG, SPPB	Primary outcome - gait speed did not change importantly in the control group, whereas it significantly improved [+0.061 m/s/month (95%CI, 0.043 to 0.080); P < 0.001] in the intervention group receiving the experimental formula: mean difference, +0.062 m/s/month [95%CI, 0.043 to 0.082], P < 0.001 secondary outcome - In the experimental formula group, all the secondary end- points addressing physical performance, functional status, and cognitive functions improved significantly vs. baseline - Improvements per month were +28% for chair-stand test; +12.5% for TUG test; and +65% for SPPB. A substantial increase in muscle mass (AMM and SMMI) was also obtained. - In the control formula group, only an improvement in SPPB (+8%) and the mental component of QoL vs. baseline was observed, while handgrip strength, the chair stand, and TUG tests worsened.	

Tokuda Y, Mori H. Essential Amino Acid and Tea Catechin Supplementation after Resistance Exercise Improves Skeletal Muscle Mass in Older Adults with Sarcopenia: An Open-Label, Pilot, Randomized Controlled Trial. J Am Nutr Assoc 2023; 42: 255-262. doi:10.1080/07315724.2022.2025546 [437]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT	**Countries:** Japan	**Total no. Patients:** 54	• Intervention groups:

1+ ROB2: Some concerns	Centers: Harima Care Center and community in Hyogo **Setting:** Community-based **Funding Sources:** Foundation for Dietary Scientific Research **Dropout rates:** 14.8% **Study limitations:** Open-label study design, no placebo for EAA or TCC, small sample size, frequency of EAA and TCC intake was low (twice per week), BIA used for muscle mass assessment instead of dual-energy X-ray absorptiometry Risk of Bias Moderate Inconsistency n/a Indirectness Low Impreciseness Moderate Publication Bias n/a	**Inclusion criteria:** Older people aged ≥65 years, sarcopenia defined by AWGS 2019 criteria (low hand-grip strength <28.0 kg for males and <18.0 kg for females, slow gait speed <1.0 m/s, low skeletal muscle mass index <7.0 kg/m² for males and <5.7 kg/m² for females), non-participation in resistance exercise or EAA/TCC supplement intake within one year of the study, no heart or respiratory diseases. **Exclusion criteria:** Refusal to participate, no diagnosis of sarcopenia, undertaking nutritional therapies for conditions like type 2 diabetes or chronic kidney disease within one year pre-intervention.	○ RE + EAA group: Resistance exercise plus essential amino acid supplementation (3,000 mg). ○ RE + EAA + TCC group: Resistance exercise plus essential amino acid (3,000 mg) and tea catechin supplementation (540 mg). • Control group: Resistance exercise only.
Notes	Supplementation with EAA and TCC after resistance exercise improved skeletal muscle mass in older adults with sarcopenia compared to resistance exercise alone. This suggests that combining resistance exercise with EAA and TCC supplementation may help improve sarcopenia outcomes.		
Outcome measures/results	• Primary outcome: Skeletal muscle mass (SMM). • Secondary outcomes: Grip strength, knee extension strength, gait speed, physical quality of life (QOL), and mental QOL.		• **Skeletal muscle mass (SMM):** ○ Significant increase in the RE + EAA + TCC group compared to the RE group (p = 0.010). ○ %Δ SMM: RE group 1.49%; RE + EAA group 1.53%; RE + EAA + TCC group 3.47% (p = 0.010). • **Grip strength:** No significant differences among groups (p = 0.732). • **Knee extension strength:** Improvement in all groups but no significant difference among groups. • **Gait speed:** Minor improvement in RE + EAA + TCC group (p = 0.270). • **Physical QOL:** Slight improvement in RE + EAA + TCC group (p = 0.961). • **Mental QOL:** No significant differences among groups (p = 0.857).

Yamada M, Kimura Y, Ishiyama D et al. Synergistic effect of bodyweight resistance exercise and protein supplementation on skeletal muscle in sarcopenic or dynapenic older adults. Geriatr Gerontol Int 2019; 19: 429-437. doi:10.1111/ggi.13643 [434]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+ ROB2: Some concerns	**Countries:** Japan **Centers:** n/a **Setting:** n/a **Funding Sources:** Japan Geriatrics Society grant and by grant #28-30 from the National Center for Geriatrics and Gerontology (NCGG) Research Fund for Longevity Science **Dropout rates:** 19.6 % **Study limitations:** sample sizes in the subgroup analysis were insufficient, and these findings might suffer from a type 2 error; echo intensity measurements were carried out by ultrasonography, a recent review indicated that the validity of this measurement method is controversial Risk of Bias Moderate Inconsistency n/a Indirectness Low Impreciseness Moderate Publication Bias n/a	**Total no. Patients:** 112 **Inclusion criteria:** older adults (aged ≥65 years and able to walk independently) were screened for sarcopenia and dynapenia **Exclusion criteria:** stroke; Parkinson's disease; diabetes; chronic kidney disease; severe cognitive impairment; severe psychiatric impairment; severe cardiac, pulmonary and musculo-skeletal disorders; regular exercise habits; and regular use of protein or vitamin D supplements in the past 12 months; older adults with artificial implants, such as cardiac pacemakers and joints	A four-arm randomized controlled trial, randomized the participants into the combined resistance exercise and nutritional supplementation (Ex+Nutr) group, the exercise alone (Ex) group, the nutritional supplementation alone (Nutr) group and the control (Control) group. Participants randomized to the Ex+Nutr and Ex group carried out 30 min of physical therapist-supervised bodyweight resistance exercise with slow movement speeds twice a week for 12 weeks at a healthcare center. In addition, participants were instructed to carry out self-exercise daily at home according to a pamphlet for the resistance exercise program. Protein and vitamin D supplements were provided every day to the participants in the Ex+Nutr and Nutr groups for 12 weeks.
Notes	**Author's Conclusion:** In conclusion, a 12-week combined program of bodyweight resistance exercise and protein and vitamin D supplementation is an effective measure to improve muscle quality and muscle strength in older adults with sarcopenia or dynapenia.		
Outcome measures/results	appendicular muscle mass, maximum walking time		subgroup analysis in sarcopenic older adults

		- significant differences in appendicular muscle mass (H = 10.11, P = 0.02) and maximum walking time (H = 10.96, P = 0.01) were observed among the four groups by the Kruskal–Wallis test. - Participants in the Ex+Nutr group had a significantly greater improvement in appendicular muscle mass than the Control group by the Bonferroni test (P < 0.05). - Similarly, participants in the Ex+Nutr group and Ex group had a significantly greater improvement in maximum walking time than the Control group (P < 0.05).

Zdzieblik D, Oesser S, Baumstark MW et al. Collagen peptide supplementation in combination with resistance training improves body composition and increases muscle strength in elderly sarcopenic men: a randomised controlled trial. Br J Nutr 2015; 114: 1237-1245. doi:10.1017/S0007114515002810 [435]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1- ROB2: Some concerns	**Countries:** Germany **Centers:** n/a **Setting:** n/a **Funding Sources:** part of the costs were paid by Gelita AG, Uferstraße 7, Eberbach, Germany **Dropout rates:** 6.7 % **Study limitations:** statistical analysis was a completers' analysis and not an intention-to-treat analysis; placebo that did not deliver any extra calories; randomization yielded two groups with baseline differences in FM and FFM isk of Bias Moderate Inconsistency n/a Indirectness Low Impreciseness Moderate	**Total no. Patients:** 60 **Inclusion criteria:** healthy men, aged>65 years, who experienced a considerable loss in muscular strength or physical performance within the last 3–4 years; able to participate in the 3-month resistance training and be free of acute diseases or illness-related cachexia **Exclusion criteria:** chronic illnesses (liver, kidney, cancer without recurrence for 5 years, CVD, advanced arthrosis) or other diseases that made participation in the exercise programme impossible	participants of the study were randomly assigned to the treatment group (TG) (collagen peptide supplementation) or to the placebo group (PG). The subjects assigned to the TG (n 30) were given 15 g of collagen peptides/d. Subjects in the PG (n 30) received silicon dioxide (Sipernat 350; Evonik). Collagen peptides as well as placebo were given in powder form and were dissolved by the participants in 250 ml water. Subjects were instructed to drink the solution as soon as possible following each training session but not later than 1 h after training. During the first hour after training, no other food was allowed, except for water to compensate for sweat loss. The resistance training was carried out at the University of Freiburg and consisted of a 12-week guided training programme on fitness devices (pull down, leg press, bench press, back press, etc.) involving all larger muscle groups. Subjects took part in the resistance training programme in the afternoon three times a week over a time period of 60 min.

	Publication Bias n/a		
Notes	**Author's Conclusion:** In conclusion, the findings of the present study have confirmed previous results that 60 min of resistance exercise, performed three times per week, is well suited to significantly increase muscle mass, muscular strength and motor control in subjects with sarcopenia class I or II. Moreover, the study has demonstrated that the combination of resistance exercise and collagen peptide supplementation resulted in a more pronounced improvement of body composition, as indicated by a significant increase in muscle mass and decrease in FM, compared with placebo. In addition, muscular strength was significantly improved after collagen peptide intake compared with the training programme plus placebo.		
Outcome measures/results	change in fat-free mass (FFM), fat mass (FM), bone mass (BM), and isokinetic quadriceps strength (IQS) before and after the intervention		- Following the training programme, all the subjects showed significantly higher ($P < 0.01$) levels for FFM, BM, IQS and SMC with significantly lower ($P < 0.01$) levels for FM. - The effect was significantly more pronounced in subjects receiving collagen peptides: FFM (TG +4.2 (SD 2.31) kg/PG +2.9 (SD 1.84) kg; $P < 0.05$); IQS (TG +16.5 (SD 12.9)Nm/PG +7.3 (SD 13.2)Nm; $P<0.05$); and FM (TG –5.4 (SD 3.17)kg/PG –3.5 (SD 2.16)kg; $P<0.05$).

Zhu L-Y, Chan R, Kwok T et al. Effects of exercise and nutrition supplementation in community-dwelling older Chinese people with sarcopenia: a randomized controlled trial. Age Ageing 2018; 48: 220-228. doi:10.1093/ageing/afy179 [436]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+ ROB2: Some concerns	**Countries:** China **Centers:** n/a **Setting:** n/a **Funding Sources:** grants from the Institute of Ageing, and the Centre for Nutritional Studies of the Chinese University of Hong Kong. **Dropout rates:** 22.1% **Study limitations:** current sample size and the attrition of 22% at 12 weeks and 32% at 24 weeks warrant concern regarding the internal validity of this study; results may not be generalized to those living	**Total no. Patients:** 113 **Inclusion criteria:** Chinese adults aged ≥65 years with sarcopenia **Exclusion criteria:** n/a	Eligible participants were randomly assigned to one of the three groups: exercise program alone, combined-exercise program and nutrition supplement, or waitlist control group. Two group exercise sessions and one-home exercise session were conducted on weekly basis for 12 weeks. Group exercises included 5–10 min warm-up and cool-down routine, 20–30 min chair-based resistance exercises using Thera- Bands, and 20-min aerobic exercises. This group received nutrition supplement and the above exercise program. The nutrition supplement consisted of two sachets of Ensure NutriVigor daily from baseline to 12 weeks. Waitlist control group: they were asked to maintain their usual physical activities and dietary habits during the 6-month study period

	in the residential care or hospital settings; self-report on home exercise session compliance was subject to reporting bias; no cognitive function measures Risk of Bias Moderate Inconsistency n/a Indirectness Moderate Impreciseness Moderate Publication Bias n/a		
Notes	**Author's Conclusion:** To conclude, the exercise program with and without nutrition supplementation had no significant effect on the primary outcome of gait speed in community-dwelling Chinese sarcopenic older adults. However, improvements were seen in the secondary outcomes of strength and the five-chair stand test, and these beneficial effects extended to 12 weeks after cessation of intervention. Nutrition supplement had additive effect on lower limb muscle mass only during the period of intervention.		
Outcome measures/results	primary outcome: change in gait speed over 12 weeks assessed using the 6-m walk test secondary outcomes: change of muscle strength, muscle power, body composition, health related quality of life (SF- 12), Physical Activity Scale for the Elderly, Instrumental Activities of Daily Living and cardiorespiratory fitness from baseline to 12 weeks and 24 weeks	Primary outcome: - No between group differences in gait speed were observed between baseline and 12 weeks, after adjusting for baseline gait speed Secondary outcomes: - Improvement in lean muscle mass especially in lower limbs was only observed in the combined-exercise program and nutrition supplement group (P = 0.015). Such increment was not maintained till 24th week. No change in limb fat mass were observed at any time point. - Compared with the control group, leg extension (P < 0.001), five-chair stand test (P = 0.004) and physical activity level (P = 0.026) showed significant improvement in both intervention groups from baseline to 12th week. However, no additive effect of nutrition supplement was observed. By 24 weeks, some improvements were maintained in leg extension (P = 0.027) and five-chair stand test (P = 0.0003) in both intervention groups compared to baseline and the control group. Improvement in physical was also maintained in the combined group till 24 weeks. - Reduction in impairments of daily activity tended to be greater in the combined group than the other two groups at 12-week assessment (P = 0.055). However, the reduction was not sustained at 24-week assessment. - Health status (SF-12) increased in all groups during the study period but no significant group difference was observed.

Empfehlung 64

Älteren Menschen mit Sarkopenie, die nicht an strukturierten Trainingsinterventionen teilnehmen können oder möchten, können proteinreiche Supplemente angeboten werden, um den Erhalt bzw. Aufbau von Muskelmasse und -kraft zu unterstützen.

Evidenzgrad 0

Bauer JM, Verlaan S, Bautmans I et al. Effects of a Vitamin D and Leucine-Enriched Whey Protein Nutritional Supplement on Measures of Sarcopenia in Older Adults, the PROVIDE Study: A Randomized, Double-Blind, Placebo-Controlled Trial. J Am Med Dir Assoc 2015; 16: 740-747. doi:10.1016/j.jamda.2015.05.021 [438]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1++ ROB2: Some concerns	**Countries:** Belgium, Germany, Ireland, Italy, Sweden, and the United Kingdom **Centers:** 18 study centers **Setting:** n/a **Funding Sources:** Nutricia Research, Nutricia Advanced Medical Nutrition **Dropout rates:** 20.5% **Study limitations:** hand grip strength is less sensitive to intervention changes than other measures of strength; SPPB is by nature a categorical score, and is less sensitive to changes than a continuous numerical scale; no inclusion of full spectrum of older adults in the population at large Risk of Bias Moderate Inconsistency n/a Indirectness Low Impreciseness Moderate Publication Bias n/a	**Total no. Patients:** 380 **Inclusion criteria:** older adults (≥ 65 years) were screened for mild to moderate limitations in physical function, and for low skeletal muscle mass index [SMI] using bioelectric impedance analysis; participants were eligible to participate if they had a body mass index (BMI) between 20 and 30 kg/m^2, no major cognitive impairment, and were able and willing to provide informed consent **Exclusion criteria:** comorbidities such as kidney or liver failure, malignancies over the past 5 years, anemia, or acute inflammation, or presented with contraindications for calcium/vitamin D supplementation and/or were using medication interfering with the nutritional intervention	Participants were randomized to receive either the active or an iso-caloric control product. The active product contained, per serving, 20 g whey protein, 3 g total leucine, 9 g carbohydrates, 3 g fat, 800 IU vitamin D, and a mixture of vitamins, minerals, and fibers, whereas the iso-caloric control product did not contain any protein or micronutrients, and only carbohydrates, fat, and some trace elements Both were delivered as 40 g powder to be reconstituted with 100 to 150 mL water and consumed twice daily before breakfast and lunch to provide an adequate bolus of protein in addition to the meals.

Notes	**Author's Conclusion:** We present here a 13-week intervention of a vitamin D and leucine-enriched whey protein oral nutritional supplement that resulted in improvements in muscle mass and lower-extremity function among sarcopenic older adults. This study shows proof-of-principle that specific nutritional supplementation alone might benefit geriatric patients, especially relevant for those who are unable to exercise. These results warrant further investigations into the role of a specific nutritional supplement as part of a multimodal approach to prevent adverse outcomes among older adults at risk for disability.	
Outcome measures/results	Primary outcome: grip strength, short physical performance battery (SPPB) secondary outcomes: appendicular muscle mass (by DXA) and questionnaires of self-reported physical activity, activities of daily living, and health-related quality of life	Primary outcome: - no significant difference in handgrip strength changes over time between the control and active groups. Handgrip strength improved significantly over time in the intervention group (P = .005), whereas there was likely no time effect in the control group (P = .06). - SPPB scores increased significantly over time in both active and control groups (P < .001), but with no significant treatment x time effect Secondary outcomes: - The increase in appendicular muscle mass was significantly greater in the active group than the control group, leading to a mean estimated difference of 0.17 kg (95% confidence interval [CI] 0.004-0.338) (P = .045). There was a significant gain over time in appendicular muscle mass in the active group alone (P < .001). - No treatment x time effects were observed in the PASE questionnaire, Barthel index, or quality of life as measured with the EQ-5D index. There was a significant time effect observed in the active group in the quality-of-life EQ-5D VAS score, leading to a trend for a mean treatment x time effect of 2.5 mm (95% CI -0.17-5.16; P = .07).

Bo Y, Liu C, Ji Z et al. A high whey protein, vitamin D and E supplement preserves muscle mass, strength, and quality of life in sarcopenic older adults: A double-blind randomized controlled trial. Clin Nutr 2019; 38: 159-164. doi:10.1016/j.clnu.2017.12.020 [439]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+ ROB2: Low risk of bias	**Countries:** China **Centers:** n/a **Setting:** n/a **Funding Sources:** Danone Institute Diet, Nutrition Research and	**Total no. Patients:** 60 **Inclusion criteria:** 60-85 years old with sarcopenia **Exclusion criteria:** mental disorders, had disabilities that significantly affect the data collected, such as	The 6-month double-blind, randomized, placebo-controlled trial was conducted to evaluate the effect of the combined supplementation containing whey protein, vitamin D and E (intervention group) or an isocaloric control product (placebo group) on muscle mass, muscle strength, physical function, nutritional status, inflammation, and quality of life in sarcopenic older adults.

	Communication Grant (No. DIC2015-02) **Dropout rates:** 0% **Study limitations:** no control of subjects' dietary intakes; not completely effective and true control of the correct use of supplements Risk of Bias Low Inconsistency n/a Indirectness Low Impreciseness Low Publication Bias n/a	severe deafness, blindness; had severe somatic diseases (diabetes with severe complications, patients with severe renal disease, or tumor); participating in other clinical trials; and other reasons that are not suitable for clinical trials	Both active and the iso-caloric control product were provided by the company of BY-HEALTH. They were similar in taste and appearance and were delivered as 40 g powder to be reconstituted with 100 to 150mL water per serving. Subjects were asked to consume one serving before breakfast and another serving before dinner
Notes	**Author's Conclusion:** In conclusion, this study demonstrated that the combined supplementation of whey protein, vitamin D and E supplementation can significantly improve RSMI, muscle strength, and anabolic markers such as IGF-I and IL-2 in older adults with sarcopenia. Further larger well-designed studies are warranted to evaluate whether long-term whey protein supplementation can blunt the declines of muscle function and mass in older adults with sarcopenia.		
Outcome measures/results	RSMI, handgrip strength, SF-36 mental component summary, SF-36 physical component summary, serum IGF-1, IL-2, serum vitamin D3, serum vitamin E		Compared to placebo group, nutritional supplementation improves RSMI (mean difference: 0.18kg/m^2, 95%CI: 0.01- 0.35, P=0.040), handgrip strength (mean difference: 2.68kg, 95%CI: 0.71~4.65, P=0.009), SF-36 mental component summary (SF-36 MCS) (mean difference: 11.26, 95%CI:3.86~18.65, P=0.004), SF-36 physical component summary (SF-36 PCS) (mean difference: 20.21, 95%CI:11.30~29.12, P<0.001), serum IGF-1 (mean difference: 14.34 ng/mL, 95%CI:2.06~26.73), IL-2 (mean difference: -575.32 pg/mL, 95%CI: -1116.94 ~ -33.70,P=0.038), serum vitamin D3(mean difference: 11.01 ng/mL, 95%CI: 6.44~15,58,P<0.001), and serum vitamin E (mean difference: 4.17 ng/L, 95%CI: 1.89~ 6.45,P=0.001).

Cramer JT, Cruz-Jentoft AJ, Landi F et al. Impacts of High-Protein Oral Nutritional Supplements Among Malnourished Men and Women with Sarcopenia: A Multicenter, Randomized, Double-Blinded, Controlled Trial. J Am Med Dir Assoc 2016; 17: 1044-1055. doi:10.1016/j.jamda.2016.08.009 [440]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+ ROB2: Some concerns	**Countries:** 8 countries across Europe and North America **Centers:** n/a **Setting:** n/a **Funding Sources:** Abbott Nutrition **Dropout rates:** 16.1 % **Study limitations:** n/a Risk of Bias Moderate Inconsistency n/a Indirectness Low Impreciseness Moderate Publication Bias n/a	**Total no. Patients:** 330 **Inclusion criteria:** age ≥ 65 years, with both malnutrition and sarcopenia **Exclusion criteria:** n/a	Enrolled individuals were stratified for gender and age at each study site and randomized into ONS treatment groups: (1) Control ONS (C_{ONS}) and (2) Experimental ONS (E_{ONS}). Participants were instructed to drink 2 servings of the ONS daily between regular meals throughout the duration of the study. Participants also were instructed to continue their usual diet, physical activity, and lifestyle habits, with the following exceptions: (1) consumption of study product daily and (2) the recommended ad libitum diet contained a minimum of 0.8 g protein per kg body weight. Ready-to-drink 220-mL ONSs were packaged indistinguishably except for a 5-digit code to maintain the double-blind study design. Products were isocaloric, providing 330 kcal per serving. Each serving of the C_{ONS} (Ensure Plus; Abbott, Zwolle, Netherlands) contained 14 g protein, 11 g fat, 44 g carbohydrate, 147 IU vitamin D3, and additional vitamins and minerals. Each serving of the E_{ONS} provided 20 g protein, 11 g fat, 36 g carbohydrate, 1.5 g CaHMB, 499 IU vitamin D3, and other vitamins, minerals, and nutrients in varying amounts.
Notes	**Author's Conclusion:** In conclusion, the strengths of the current study include a well-controlled, adequately powered, large sample, multicentered study with multiple familiarization visits to minimize the learning effects associated with effort-based outcome variables, such as leg strength, grip strength, and gait speed. The present study demonstrated that improvements in clinically relevant measures, such as strength and functionality, can be achieved by daily supplementation with a high- quality ONS. Furthermore, sarcopenia staging seems to affect the leg strength adaptations to the ONS interventions, which supports the incorporation of the EWGSOP conceptual framework of sarcopenia staging into clinical practice. Populations with mild-moderate sarcopenia are more responsive to the EONS enriched in key nutrients compared with the standard CONS. Populations with severe sarcopenia may need multimodal interventions (good nutrition and possibly exercise) to achieve similar magnitudes of leg strength improvement as the mild-moderate sarcopenia subgroups, particularly within a limited time course. Therefore, sarcopenia staging should be considered in future intervention study designs.		
Outcome measures/results	Isokinetic peak torque (PT, Nm), leg strength, grip strength, gait speed, muscle quality (MQ)		Both ONS groups (E_{ONS} and C_{ONS}) improved PT, MQ, grip strength, and gait speed from baseline with no treatment differences. Those with severe sarcopenia (44%) exhibited lower baseline PT and MQ, with no differences in strength improvements between treatments. Participants with mild- moderate sarcopenia exhibited higher baseline PT and MQ, with differences in strength improvements at 12 weeks (E_{ONS} > C_{ONS}, P = .032) in those with normal grip strength. There were no treatment differences based on sarcopenic severity for either grip strength or gait speed.

Lin C-C, Shih M-H, Chen C-D et al. Effects of adequate dietary protein with whey protein, leucine, and vitamin D supplementation on sarcopenia in older adults: An open-label, parallel-group study. Clin Nutr 2021; 40: 1323-1329. doi:10.1016/j.clnu.2020.08.017 [441]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+ ROB2: Some concerns	**Countries:** Taiwan **Centers:** n/a **Setting:** n/a **Funding Sources:** grant (900400110685) from SMAD Biotechnology Co., Ltd. (Taipei, Taiwan **Dropout rates:** n/a **Study limitations:** subjects were recruited from a single medical center in the northern part of the country and the sample size was relatively small; use of BIA to analyze the body composition; dietary vitamin D intake was not recorded and plasma vitamin D concentrations were not measured; Risk of Bias Moderate Inconsistency n/a Indirectness Low Impreciseness Moderate Publication Bias n/a	**Total no. Patients:** 56% **Inclusion criteria:** ambulatory older adults who were aged !65 years and were recruited as having sarcopenia **Exclusion criteria:** life expectancy was expected to be shorter than 6 months, were staying in a nursing home, had chronic comorbidities (i.e. kidney or liver failure or diabetes mellitus), or performing resistance exercise on a regular basis	Participants were randomly assigned to either a Diet (control) group or a Supp (intervention) group according to the order of entry into this study. Each participant received nutritional counseling by a registered dietitian at the beginning of the clinical cohort, who recommended that each of them consume 1.5 g protein/kg BW/day. Participants were encouraged to consume a balanced diet with six food groups following the "Daily Dietary Guideline of 2012" as recommended by the Ministry of Health and Welfare of Taiwan. Subjects in the Diet group were instructed to consume ordinary high-protein foods to achieve 1.5 g protein/kg BW/day on the basis of this guidelines, and were suggested to equally distribute their meal time, while the Supp group was provided with a sachet containing supplements in addition to their regular daily meals to achieve the recommended protein intake. Contents of each supplement sachet included 88 kcal, 12.8 g of protein (including 8.5 g of whey protein concentrate), 1.2 g leucine, 7.3 g carbohydrates, 0.8 g fat and 120 IU vitamin D per serving. This supplement was added 200 ml of water and stirred well, then drunk before a meal. The amount and timing of the increased protein intake were similar between the Diet and Supp groups.
Notes	**Author's Conclusion:** In conclusion, this study demonstrated that as long as older adults with sarcopenia consumed sufficient dietary protein either by ordinary food intake through dietary counselling or by high- protein supplementation, the AMMI can be improved in this population. However, the advantage of protein supplementation with meal is that it allows sarcopenic elderly more conveniently to meet the protein requirement of 1.2-1.5 g/kg BW/day. For older adults younger than 75 years, nutritional supplement with leucine- enriched, vitamin D-fortified whey protein packs not only increased the muscle mass but also improved physical functioning such as the gait speed.		
Outcome measures/results	appendicular muscle mass index (AMMI), hand grip strength, total energy intake, total protein intake, gait speed		- no differences in total energy intake or the distribution of macronutrient intake between the two groups at the beginning of the study. Increases in total energy

		and protein intake were observed in both groups after dietary counseling and supplementation. - However, participants in the Supp group achieved a higher protein intake at 4 ($p < 0.001$) and 12 weeks ($p = 0.02$) and a lower fat intake at 4 ($p < 0.02$) and 12 weeks ($p = 0.001$) compared to the Diet group. - The Diet and Supp groups both showed an increased AMMI, while only participants in the Diet group showed improved handgrip strength after 4 and 12 weeks of intervention. - when analyzed by the GEE model, no significant differences in AMMI ($p = 0.87$ at week 4; $p = 0.3$ at week 12) or handgrip strength ($p = 0.83$ at week 4; $p = 0.66$ at week 12) were found between the 2 groups. - Compared to the Diet group by the GEE analysis, participants in the Supp group exhibited greater improvement in gait speed in reference to their own baseline ($p = 0.02$) at the end of the study period.

Yamada M, Kimura Y, Ishiyama D et al. Synergistic effect of bodyweight resistance exercise and protein supplementation on skeletal muscle in sarcopenic or dynapenic older adults. Geriatr Gerontol Int 2019; 19: 429-437. doi:10.1111/ggi.13643 [434]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+ ROB2: Some concerns	**Countries:** Japan **Centers:** n/a **Setting:** n/a **Funding Sources:** Japan Geriatrics Society grant and by grant #28-30 from the National Center for Geriatrics and Gerontology (NCGG) Research Fund for Longevity Science **Dropout rates:** 19.6 % **Study limitations:** sample sizes in the subgroup analysis were insufficient, and these findings might suffer from a type 2 error; echo intensity	**Total no. Patients:** 112 **Inclusion criteria:** older adults (aged ≥65 years and able to walk independently) were screened for sarcopenia and dynapenia **Exclusion criteria:** stroke; Parkinson's disease; diabetes; chronic kidney disease; severe cognitive impairment; severe psychiatric impairment; severe cardiac, pulmonary and musculo-skeletal disorders; regular exercise habits; and regular use of protein or vitamin D supplements in the past 12 months; older adults with	A four-arm randomized controlled trial, randomized the participants into the combined resistance exercise and nutritional supplementation (Ex+Nutr) group, the exercise alone (Ex) group, the nutritional supplementation alone (Nutr) group and the control (Control) group. Participants randomized to the Ex+Nutr and Ex group carried out 30 min of physical therapist-supervised bodyweight resistance exercise with slow movement speeds twice a week for 12 weeks at a healthcare center. In addition, participants were instructed to carry out self-exercise daily at home according to a pamphlet for the resistance exercise program. Protein and vitamin D supplements were provided every day to the participants in the Ex+Nutr and Nutr groups for 12 weeks.

	measurements were carried out by ultrasonography, a recent review indicated that the validity of this measurement method is controversial Risk of Bias Moderate Inconsistency n/a Indirectness Low Impreciseness Moderate Publication Bias n/a	artificial implants, such as cardiac pacemakers and joints	
Notes	**Author's Conclusion:** In conclusion, a 12-week combined program of bodyweight resistance exercise and protein and vitamin D supplementation is an effective measure to improve muscle quality and muscle strength in older adults with sarcopenia or dynapenia.		
Outcome measures/results	appendicular muscle mass, maximum walking time		subgroup analysis in sarcopenic older adults - significant differences in appendicular muscle mass ($H = 10.11$, $P = 0.02$) and maximum walking time ($H = 10.96$, $P = 0.01$) were observed among the four groups by the Kruskal–Wallis test. - Participants in the Ex+Nutr group had a significantly greater improvement in appendicular muscle mass than the Control group by the Bonferroni test ($P < 0.05$). - Similarly, participants in the Ex+Nutr group and Ex group had a significantly greater improvement in maximum walking time than the Control group ($P < 0.05$).

V. Therapie von Übergewicht und Adipositas

Empfehlung 67

Wenn eine Gewichtsreduktion bei älteren Personen mit Adipositas erwogen wird, soll diese im Rahmen einer multimodalen Therapie bestehend aus Ernährungs-, Bewegungs- und Verhaltenstherapie erfolgen.

Empfehlungsgrad A

Ard JD, Carson TL, Shikany JM et al. Weight loss and improved metabolic outcomes amongst rural African American women in the Deep South: six-month outcomes from a community-based randomized trial. J Intern Med 2017; 282: 102-113. doi:10.1111/joim.12622 [477]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
1+ ROB2: Some concerns	**Countries:** USA **Centers:** 3 different centers **Setting:** Community-based **Funding Sources:** grant number U54CA153719 from the Center to Reduce Cancer Health Disparities (CRCHD) of the National Cancer Institute **Dropout rates:** 3.7% **Limitations:** Generalizability limited to higher-educated African American women in rural communities in the southern USA, short follow-up period (6 months), longer-term outcomes beyond one year not addressed. Risk of Bias Moderate Inconsistency n/a Indirectness High Impreciseness Low Publication Bias n/a	**Total no. patients**: 409 **Inclusion criteria:** Overweight or obese (BMI ≥ 25 kg/m²), self-identified Black women, residing in rural counties in Alabama or Mississippi, aged 30–70 years. **Exclusion criteria:** Pregnancy or plans to become pregnant in the next year, diagnosed major medical or psychological conditions affecting weight loss, history of gastric bypass or bariatric surgery, psychiatric hospitalization in the past 2 years, history of substance abuse or eating disorders, contraindications for weight reduction interventions.	• **Intervention (Weight Loss Plus)**: Evidence-based behavioral weight loss program + community strategies to promote healthy eating and physical activity. • **Control (Weight Loss Only)**: Behavioral weight loss program without additional community strategies.

Notes	**Author's Conclusion:** Trained lay staff and volunteers effectively delivered a high-intensity behavioral weight loss intervention in rural Southern communities. The intervention achieved clinically meaningful weight loss and improved metabolic outcomes, comparable to results seen in intensive interventions conducted in academic settings.	

Outcome measures/results	• **Primary**: Weight change.
	• **Secondary**: Waist circumference, blood pressure, blood lipids, fasting blood glucose.
		• Average weight loss:
		  ○ Weight Loss Only: 2.2 kg
		  ○ Weight Loss Plus: 3.2 kg
		• Proportion losing ≥5% of body weight: 27.1% (no significant difference between groups).
		• Reduction in blood pressure, waist circumference, and triglycerides (statistically significant).
		• □ No significant changes in blood glucose or cholesterol levels.

Frimel TN, Sinacore DR, Villareal DT. Exercise attenuates the weight-loss-induced reduction in muscle mass in frail obese older adults. Med Sci Sports Exerc 2008; 40: 1213-1219. doi:10.1249/MSS.0b013e31816a85ce [478]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+	**Countries:** USA **Centers:** Washington University School of Medicine **Setting:** n/a **Funding Sources:** National Institute of Health (General Clinical Research center and Clinical Nutrition Research Unit); T. Frimel supported by a fellowship from the Foundation for Physical Therapy **Dropout rates:** 9.09 % **Study limitations:** low number of participants, no control group, no examination of sex	**Total no. Patients:** n=30 **Inclusion criteria:** older (≥ 65 years), obese (BMI ≥ 30 kg/m²) adults, sedentary (exercise ≤2 per week), stable medications, stable weight and 2 of three criteria for mild-moderate physical frailty (1)modified physical performance test (PPT) score between 18 and 32 (maximum score = 36); 2) peak aerobic power ($\dot{V}O_2$peak) between 10 and 18 mL/kg*min; and 3) self-reported difficulty and/or assistance with up to two instrumental activities of daily living and/or one basic activity of daily living	Diet/behavioral therapy: 1) Diet group (DG; n=15): balanced diet; energy deficit 750 kcal/day; weight loss goal no more than 1.5% body weight loss per week; weekly group meetings with a study dietician; prohibition of exercise training program during the study 2) Diet or behavioral therapy + exercise (PRT; diet + exercise group; n=15): exercise= incorporated progressive resistance training; weekly group diet meets as DG ➔ 6 months, randomly assigned to one of the groups

	differences possible(small sample size)	**Exclusion criteria:** severe cardiopulmonary disease, diabetes mellitus, musculoskeletal or neuromuscular impairments, sensory or cognitive deficits, cancer diagnosis within last 5 yr., and use of corticosteroids, androgens, or estrogen-containing compounds within the last year	
Notes	• Participants who dropped out early (n=3) were excluded from the study • All assessments were performed by individuals blinded to group assignment at baseline and after 6 months of diet plus exercise therapy • All exercise testing sessions were medically supervised • all participants in the diet + exercise group were required to complete the 72 exercise sessions, compliance with the exercise program was 100% **Author's Conclusion:** Exercise added to diet reduces muscle mass loss during voluntary weight loss and increases muscle strength in frail obese older adults. Regular exercise that incorporates PRT should be used to attenuate muscle mass loss in frail obese older adults on weight-loss therapy.		
Outcome measures/results	• Body composition: dual-energy x-ray absorptiometry (DXA) • Muscle strength (1-rep max): hoist machines • Volume of upper extremity (UE) and lower extremity (LE): determines by multiplying average number of repetitions performed by average weight lifted during first three exercise sessions and during the last three exercise sessions		• No difference between groups: physical frailty and VO2peak ($p>0.05$) • DG and diet + exercise groups similar decrease in weight (10.7 ± 4.5 vs. 9.7 ± 4.0 kg) and fat mass (6.8 ± 3.7 vs. 7.7 ± 2.9 kg)($p>0.05$) • Diet + exercise group lost less: fat free mass (FFM; 1.8 ± 1.5 vs. 3.5 ± 2.1 kg; $p=0.02$) LE lean mass (0.9 ± 0.8 vs.2.0 ± 0.9 kg; $p=0.001$) UE lean mass (0.1 ± 0.2 vs. 0.2 ± 0.2 kg; $p=0.03$) Than diet group • Diet + exercise group had greater increases in % of weight as FFM than diet group (7.9 ± 3.3 vs. 5.4 ± 3.7%; $p=0.04$) • Diet + exercise group increased UE and LE strength in response to exercise (17-43%); diet group maintained strength • Volume of UE and LE exercise correlated with amount of UE and LE lean mass ($r= 0.64$-0.84; $p<0.05$) • Volumes of weight lifts did not correlate strongly with the changes in lean mass for diet + exercise group • Weight loss alone did not result in a significant loss of lean mass at the UE in diet + exercise group ($p=0.35$ compared with baseline)

Nicklas BJ, Gaukstern JE, Beavers KM et al. Self-monitoring of spontaneous physical activity and sedentary behavior to prevent weight regain in older adults. Obesity (Silver Spring) 2014; 22: 1406-1412. doi:10.1002/oby.20732 [479]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+ ROB2: Some concerns	**Countries:** USA **Centers:** Wake Forest School of Medicine, Winston-Salem, NC, USA. **Setting:** out-patient **Funding Sources:** NIH grants R21HL097252 and R01 HL093713, and the WFU Claude D. Pepper Older Americans Independence Center **Dropout rates:** 14.6% **Study limitations: s**mall sample size; short follow-up period of only 5 months; the study was a pilot trial, so findings need to be confirmed in a larger trial; no blinding of participants or investigators, leading to potential bias	**Total no. patients**: 48 **Inclusion criteria:** Adults aged 65–79 years; sedentary (less than 2 structured exercise sessions per week); obese (BMI = 30–40 kg/m²); weight stable within the past year (±5%); non-smokers and normal cognitive function **Exclusion criteria:** Clinical depression, heart disease, cancer, liver or renal disease, chronic pulmonary disease; physical impairments that would prevent walking; uncontrolled hypertension or any contraindications for exercise or weight loss.	**Intervention**: Hypocaloric diet combined with aerobic exercise, with or without a self-regulatory intervention (SRI) designed to promote spontaneous physical activity (SPA) and decrease sedentary behavior. **Control**: Hypocaloric diet and aerobic exercise without the SRI component.
Notes	**Author's Conclusion:** Adding a self-regulatory intervention focused on increasing spontaneous physical activity and reducing sedentary behavior to a standard weight loss program enhances the maintenance of lost weight in older adults. The findings suggest that this strategy could be beneficial for long-term weight management in this population.		
Outcome measures/results	**Primary Outcome**: Change in body weight during and after the weight loss intervention. **Secondary Outcomes**: Changes in physical activity, resting energy expenditure, and body composition.		**Primary Outcome**: Significant reduction in body weight, with the SRI+DIET+EX group maintaining approximately 10% lower weight than baseline, compared to 5% in the DIET+EX group at 10 months ($p < 0.01$). **Secondary Outcomes**: Physical Activity: Significant increase in light physical activity in the SRI+DIET+EX group during the weight loss phase ($p = 0.02$); Resting Energy Expenditure: Greater increase in the SRI+DIET+EX group compared to the DIET+EX group during the weight loss phase.

Shah K, Stufflebam A, Hilton TN et al. Diet and exercise interventions reduce intrahepatic fat content and improve insulin sensitivity in obese older adults. Obesity (Silver Spring) 2009; 17: 2162-2168. doi:10.1038/oby.2009.126 [480]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+	**Countries:** USA **Centers:** Washington University School of Medicine **Setting:** n/a **Funding Sources:** National Center for Research Resource **Dropout rates:** 5% **Study limitations:** n/a	**Total no. Patients:** 18 **Inclusion criteria:** BMI ≥30 kg/m², age 65-82 years, sedentary lifestyle, stable body weight (±2kg) over the past year, and no changes in medications for at least 6 months before enrolling in the study **Exclusion criteria:** diabetes, current smoking history, anemia, severe cardiopulmonary disease, renal disease, visual, hearing, or cognitive impairments, history of malignant neoplasm, and recent use of corticosteroid or sex-steroid compounds agents	• **Diet therapy**: balanced diet to provide energy deficit of 500-1000 kcal/day from daily energy requirement, 30% of energy as fat, 50% as carbohydrate, and 20% as protein. Once 10% body weight was lost, total caloric intake was again adjusted to maintain a constant body weight and prevent further weight loss. On a weekly basis, the subjects met as a group for ~60 minutes with a dietitian. • **Diet and exercise training**: combination of diet and exercise training, dietary intervention identical to that of the Diet group, because of the calories burned during exercise, slightly higher caloric intake to achieve the same 10% weight loss, exercise-training program focused on improving endurance, strength, and balance, 90 min group sessions on three days each week
Notes	**Author's Conclusion:** Diet with or without exercise results in significant decreases in IHF content accompanied by considerable improvements in insulin sensitivity in obese older adults. The addition of exercise to diet therapy improves physical function and other obesity- and aging-related metabolic abnormalities.		
Outcome measures/results	• **Primary outcome**: IHF quantified by magnetic resonance spectroscopy (MRS) • **Secondary outcomes**: insulin sensitivity (assessed by oral glucose tolerance), body composition (assessed by dual-energy X-ray absorptiometry), physical function (VO_2 peak) and strength), glucose, lipids, and blood pressure (BP)	Body weight (D: -9 +/- 1%, D+E: -10 +/- 2%, both $P < 0.05$) and fat mass (D: -13 +/- 3%, D+E -16 +/- 3%, both $P < 0.05$) decreased in both groups but there was no difference between groups. IHF decreased to a similar extent in both groups (D: -46 +/- 11%, D+E: -45 +/- 8%, both $P < 0.05$), which was accompanied by comparable improvements in insulin sensitivity (D: 66 +/- 25%, D+E: 68 +/- 28%, both $P < 0.05$). The relative decreases in IHF correlated directly with relative increases in insulin sensitivity index (ISI) ($r = -0.52$; $P < 0.05$). Improvements in VO_2 peak, strength, plasma triglyceride (TG), and low-density lipoprotein-cholesterol concentration, and diastolic BP occurred in the D+E group (all $P < 0.05$) but not in the D group.	

Villareal DT, Banks M, Sinacore DR et al. Effect of Weight Loss and Exercise on Frailty in Obese Older Adults. Arch Intern Med 2006; 166: 860. doi:10.1001/archinte.166.8.860 [461]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+ ROB2: Some concerns	**Countries:** USA **Centers:** Washington University School of Medicine, St. Louis, Missouri **Setting:** Clinical research setting **Funding Sources:** Funded by the National Institutes of Health and the Barnes Jewish Hospital Foundation **Dropout rates: 11.1%** **Study limitations:** Small sample size, evaluated a combined intervention without independent assessment of diet and exercise effects, 6-month duration limited long-term assessment, study population was selected and may not represent the general obese older adult population. Risk of Bias Moderate Inconsistency n/a Indirectness Low Impreciseness Low Publication Bias n/a	**Total no. Patients: 27** **Inclusion criteria:** Obese (BMI ≥30), age ≥65 years, sedentary (no regular exercise >2 times per week), stable body weight (±2 kg) over the past year, stable medications for at least 6 months, mild-to-moderate frailty (defined by PPT score 18-32, VO_2peak 11-18 mL/min/kg, and difficulties in ADLs). **Exclusion criteria:** Severe cardiopulmonary disease, musculoskeletal or neuromuscular impairments preventing exercise, visual, hearing, or cognitive impairments, history of malignant neoplasms, recent use of corticosteroids or sex-steroid compounds.	• **Intervention group**: Diet-induced weight loss (750 kcal/day deficit) combined with exercise training (flexibility, endurance, strength, and balance exercises, 3 times per week for 90 minutes). • **Control group**: No lifestyle changes, instructed to maintain usual diet and activities.
Notes	**Author's Conclusion:** Moderate weight loss combined with exercise training improves physical function and ameliorates frailty in obese older adults. Diet and exercise should be considered primary therapy for this population.		
Outcome measures/results	• **Primary**: Physical Performance Test (PPT) score improvement.		• **PPT score**: Treatment group improved by +2.6±2.5 (9.2% increase), control group remained unchanged (+0.1±1.0).

	• **Secondary**: Changes in body composition, VO_2peak, strength, balance, gait, and quality of life.	• **Body weight**: Treatment group lost 8.2±5.7 kg (8.4%±5.6% reduction), control group remained constant. • **Fat mass**: Reduced in the treatment group (-6.6±3.4 kg) vs. control group (+1.7±4.1 kg). • **VO_2peak**: Increased by 1.7±1.6 mL/min/kg in the treatment group, control group remained stable (+0.3±1.1 mL/min/kg). • **Functional Status Questionnaire**: Treatment group improved by +2.9±3.7 points, control group declined slightly (-0.2±3.9). • **Strength, gait, and balance**: Improved significantly in the treatment group but not in the control group.

Villareal DT, Chode S, Parimi N et al. Weight loss, exercise, or both and physical function in obese older adults. N Engl J Med 2011; 364: 1218-1229. doi:10.1056/NEJMoa1008234 [476]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1++	**Countries:** USA **Centers:** Washington University School of Medicine, St. Louis, New Mexico Veterans Affairs Health Care System, University of New Mexico School of Medicine **Setting:** n/a **Funding Sources:** National Institutes of Health **Dropout rates:** 13% **Study limitations:** study was not powered to determine potential differences in the outcomes between sexes, small sample size, most of the participants were women, white, well	**Total no. Patients:** 107 **Inclusion criteria:** 65 years of age or older, obese (BMI of 30 or more), sedentary lifestyle, stable body weight during the previous year, stable medications for 6 months before enrollment, mild- to-moderate frailty **Exclusion criteria:** severe cardiopulmonary disease, musculoskeletal or neuromuscular impairments that preclude exercise training, visual, hearing or cognitive impairments, history of cancer, persons receiving drugs that affect bone health and metabolism, current smoking	• **Control group**: Participants assigned to the control group did not receive advice to change their diet or activity habits and were prohibited from participating in any weight-loss or exercise program. They were provided general information about a healthy diet during monthly visits with the staff. • **Diet group**: Participants assigned to the diet group were prescribed a balanced diet that provided an energy deficit of 500 to 750 kcal per day from their daily energy requirement. The diet contained approximately 1 g of high-quality protein per kilogram of body weight per day. Participants met weekly as a group with a dietitian for adjustments of their caloric intake and for behavioral therapy. The goal was to achieve a weight loss of approximately 10% of their baseline body weight at 6 months and to maintain that weight loss for an additional 6 months. • **Exercise group**: Participants in the exercise group were given information regarding a diet that would maintain their current weight and participated in three group exercise-training sessions per week. Each session was approximately 90 minutes in duration and consisted of aerobic exercises, resistance training, and exercises to improve flexibility and balance.

	educated, and older (70±4 years of age)		• **Diet-exercise group**: Participation in both the weight-management and exercise programs.
Notes	**Author's Conclusion:** These findings suggest that a combination of weight loss and exercise provides greater improvement in physical function than either intervention alone.		
Outcome measures/results	• **Primary outcome:** change in score on the modified Physical Performance Test • **Secondary outcomes**: other measures of frailty, body composition, bone mineral density, specific physical functions, and quality of life.		A total of 93 participants (87%) completed the study. In the intention-to-treat analysis, the score on the Physical Performance Test, in which higher scores indicate better physical status, increased more in the diet-exercise group than in the diet group or the exercise group (increases from baseline of 21% vs. 12% and 15%, respectively); the scores in all three of those groups increased more than the scores in the control group (in which the score increased by 1%) (P<0.001 for the between-group differences). Moreover, the peak oxygen consumption improved more in the diet-exercise group than in the diet group or the exercise group (increases of 17% vs. 10% and 8%, respectively; P<0.001); the score on the Functional Status Questionnaire, in which higher scores indicate better physical function, increased more in the diet-exercise group than in the diet group (increase of 10% vs. 4%, P<0.001). Body weight decreased by 10% in the diet group and by 9% in the diet-exercise group, but did not decrease in the exercise group or the control group (P<0.001). Lean body mass and bone mineral density at the hip decreased less in the diet-exercise group than in the diet group (reductions of 3% and 1%, respectively, in the diet-exercise group vs. reductions of 5% and 3%, respectively, in the diet group; P<0.05 for both comparisons). Strength, balance, and gait improved consistently in the diet-exercise group (P<0.05 for all comparisons). Adverse events included a small number of exercise-associated musculoskeletal injuries.

Villareal DT, Aguirre L, Gurney AB et al. Aerobic or Resistance Exercise, or Both, in Dieting Obese Older Adults. N Engl J Med 2017; 376: 1943-1955. doi:10.1056/NEJMoa1616338 [475]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+ ROB2: Some concerns	**Countries:** USA **Centers:** University of New Mexico School of Medicine and New Mexico Veterans Affairs Health Care System **Setting:** hospital	**Total no. Patients:** 160 **Inclusion criteria:** 65 years or older, obese (BMI ≥30), sedentary (regular exercise <1 hour/week), stable body weight and medication use for 6 months before enrollment, mild-to-moderate	• **Intervention groups**: o **Aerobic group**: Weight-management program + aerobic exercise (treadmill walking, cycling, stair climbing). o **Resistance group**: Weight-management program + resistance training (upper and lower body exercises). o **Combination group**: Weight-management program + combined aerobic and resistance training.

	Funding Sources: National Institutes of Health (grants RO1-AG031176, UL1-TR000041, and P30-DK020579), Alkek Foundation **Dropout rates:** 11.9% **Study limitations:** Participants physically able to participate in a lifestyle program may not represent the general obese older adult population, sample size insufficient to analyze differences by sex, most participants were women, white, and well-educated, limiting broader generalizability. Risk of Bias Moderate Inconsistency n/a Indirectness Low Impreciseness Low Publication Bias n/a	frailty (Physical Performance Test score 18–31). **Exclusion criteria:** Severe cardiopulmonary disease (e.g., recent myocardial infarction or unstable angina), musculoskeletal or neuromuscular impairments precluding exercise, cognitive impairments, use of drugs affecting bone metabolism.	• **Control group**: Monthly educational sessions on healthful diet, no structured weight-management or exercise program.
Notes	**Author's Conclusion:** Weight loss combined with aerobic and resistance training was most effective in improving physical function and reducing frailty compared to either intervention alone, with relative preservation of lean mass.		
Outcome measures/results	• **Primary**: Change in Physical Performance Test (PPT) score from baseline to 6 months. • **Secondary**: Changes in frailty measures, body composition, bone mineral density, specific physical functions, and quality of life.		• PPT score: Greatest improvement in the combination group (27.9 to 33.4, 21% increase) compared to aerobic (14% increase) and resistance (14% increase). • Body weight: Decreased by 9% in all exercise groups; no significant change in the control group. • Lean mass: Decreased less in the combination group (3% decrease) and resistance group (2% decrease) compared to aerobic group (5% decrease). • Bone mineral density: Total hip density decreased in aerobic (3% decrease) and combination groups (1% decrease), but not in the resistance group.

Empfehlung 69

Im Rahmen der multimodalen Therapie bei älteren Personen mit Adipositas soll ein strukturiertes körperliches Training erfolgen, um dem durch die Ernährungsintervention induzierten Verlust von Muskelmasse entgegenzuwirken sowie den funktionellen Status zu verbessern.

Empfehlungsgrad A

Frimel TN, Sinacore DR, Villareal DT. Exercise attenuates the weight-loss-induced reduction in muscle mass in frail obese older adults. Med Sci Sports Exerc 2008; 40: 1213-1219. doi:10.1249/MSS.0b013e31816a85ce [478]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+	**Countries:** USA **Centers:** Washington University School of Medicine **Setting:** n/a **Funding Sources:** National Institute of Health (General Clinical Research center and Clinical Nutrition Research Unit); T. Frimel supported by a fellowship from the Foundation for Physical Therapy **Dropout rates:** 9.09 % **Study limitations:** low number of participants, no control group, no examination of sex differences possible(small sample size)	**Total no. Patients:** n=30 **Inclusion criteria:** older (≥ 65 years), obese (BMI ≥ 30 kg/m²) adults, sedentary (exercise ≤2 per week), stable medications, stable weight and 2 of three criteria for mild-moderate physical frailty (1)modified physical performance test (PPT) score between 18 and 32 (maximum score = 36); 2) peak aerobic power ($V\dot{}O_2$peak) between 10 and 18 mL/kg*min; and 3) self-reported difficulty and/or assistance with up to two instrumental activities of daily living and/or one basic activity of daily living **Exclusion criteria:** severe cardiopulmonary disease, diabetes mellitus, musculoskeletal or neuromuscular impairments, sensory or cognitive deficits, cancer diagnosis within last 5 yr., and use of corticosteroids, androgens, or	Diet/behavioral therapy: 3) Diet group (DG; n=15): balanced diet; energy deficit 750 kcal/day; weight loss goal no more than 1.5% body weight loss per week; weekly group meetings with a study dietician; prohibition of exercise training program during the study 4) Diet or behavioral therapy + exercise (PRT; diet + exercise group; n=15): exercise= incorporated progressive resistance training; weekly group diet meets as DG ➔ 6 months, randomly assigned to one of the groups

		estrogen-containing compounds within the last year	
Notes	• Participants who dropped out early (n=3) were excluded from the study • All assessments were performed by individuals blinded to group assignment at baseline and after 6 months of diet plus exercise therapy • All exercise testing sessions were medically supervised • all participants in the diet + exercise group were required to complete the 72 exercise sessions, compliance with the exercise program was 100% **Author's Conclusion:** Exercise added to diet reduces muscle mass loss during voluntary weight loss and increases muscle strength in frail obese older adults. Regular exercise that incorporates PRT should be used to attenuate muscle mass loss in frail obese older adults on weight-loss therapy.		
Outcome measures/results	• Body composition: dual-energy x-ray absorptiometry (DXA) • Muscle strength (1-rep max): hoist machines • Volume of upper extremity (UE) and lower extremity (LE): determines by multiplying average number of repetitions performed by average weight lifted during first three exercise sessions and during the last three exercise sessions		• No difference between groups: physical frailty and VO2peak (p>0.05) • DG and diet + exercise groups similar decrease in weight (10.7 ± 4.5 vs. 9.7 ± 4.0 kg) and fat mass (6.8 ± 3.7 vs. 7.7 ± 2.9 kg)(p>0.05) • Diet + exercise group lost less: fat free mass (FFM; 1.8 ± 1.5 vs. 3.5 ± 2.1 kg; p=0.02) LE lean mass (0.9 ± 0.8 vs.2.0 ± 0.9 kg; p=0.001) UE lean mass (0.1 ± 0.2 vs. 0.2 ± 0.2 kg; p=0.03) Than diet group • Diet + exercise group had greater increases in % of weight as FFM than diet group (7.9 ± 3.3 vs. 5.4 ± 3.7%; p=0.04) • Diet + exercise group increased UE and LE strength in response to exercise (17-43%); diet group maintained strength • Volume of UE and LE exercise correlated with amount of UE and LE lean mass (r= 0.64-0.84; p<0.05) • Volumes of weight lifts did not correlate strongly with the changes in lean mass for diet + exercise group • Weight loss alone did not result in a significant loss of lean mass at the UE in diet + exercise group (p=0.35 compared with baseline)

Kelleher JL, Beavers DP, Henderson RM et al. Weighted Vest Use during Dietary Weight Loss on Bone Health in Older Adults with Obesity. J Osteoporos Phys Act 2017; 5. doi:10.4172/2329-9509.1000210 [482]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1-	**Countries:** USA **Centers:** Wake Forest University, Winston-Salem, NC, USA	**Total no. patients**: 37 **Inclusion criteria:** Adults aged 65-79 years, sedentary, with a BMI of 30-40 kg/m², non-smokers, weight	Intervention: Dietary weight loss with daily weighted vest use. Control: Dietary weight loss without weighted vest use.

ROB2: Some concerns	**Setting:** out-patient **Funding Sources:** Arthritis and Musculoskeletal Disease Research Center; Translational Science Center; and Center for Integrated Medicine at Wake Forest School of Medicine. n in-kind product donation was made by Jason Pharmaceuticals, Inc. **Dropout rates:** 11% **Study limitations**: Small, predominantly female sample size; insufficient power to detect statistically significant treatment effects; inconsistency in treatment effects across bone regions and biomarkers; measurement challenges in the lumbar spine due to obesity and osteoarthritis Risk of Bias Low Inconsistency n/a Indirectness Low Impreciseness Low Publication Bias n/a	stable (<5% weight change in the past 6 months), and without comorbidities contraindicating the intervention. **Exclusion criteria:** Not explicitly listed but implied exclusion for those outside the age range, with comorbidities, smokers, or those with significant recent weight change.	
Notes	**Author's Conclusion**: The use of a weighted vest during dietary weight loss may modestly attenuate hip bone mineral density (BMD) loss and increase bone formation in older adults with obesity. Further research with a larger, adequately powered sample is needed to confirm these findings.		
Outcome measures/results	Primary Outcome: Changes in bone mineral density (BMD). Secondary Outcomes: Changes in biomarkers of bone turnover (OC, BALP, P1NP, CTX).		BMD: Hip BMD loss was greater in the diet-only group compared to the Diet+Vest group (−18.7 mg/cm² vs. −6.1 mg/cm², p=0.08). Biomarkers: The Diet+Vest group saw an increase in BALP (0.59 µg/L, +3.8%) compared to a decrease in the diet-only group (−0.70 µg/L, −4.6%, p=0.07).

Napoli N, Shah K, Waters DL et al. Effect of weight loss, exercise, or both on cognition and quality of life in obese older adults. Am J Clin Nutr 2014; 100: 189-198. doi:10.3945/ajcn.113.082883 [483]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1- ROB2: Some concerns	**Countries:** USA **Centers:** Washington University School of Medicine, St. Louis, MO, USA **Setting:** out-patient **Funding Sources:** Supported by grants from the NIH; New Mexico VA Health Care System. **Dropout rates:** 13% **Study limitations:** Potential selection bias due to the exclusion of participants with severe cardiopulmonary disease or musculoskeletal impairments; limited generalizability to the broader population of older adults; no correction for the multiplicity of tests performed Risk of Bias Moderate Inconsistency n/a Indirectness Low Impreciseness Moderate Publication Bias n/a	**Total no. patients**: 107 **Inclusion criteria:** Adults aged 65 years or older, obese (BMI ≥ 30 kg/m²), sedentary, with stable body weight and stable medication use for at least 6 months, and meeting criteria for mild-moderate frailty. **Exclusion criteria:** Severe cardiopulmonary disease, musculoskeletal or neuromuscular impairments that precluded exercise, known diagnosis of dementia or Mini-Mental State Examination score <24, history of malignant neoplasm, and current smoking.	Intervention: Four groups: 1) Control, 2) Weight-management (diet), 3) Exercise, 4) Weight-management plus exercise (diet-exercise). Control: General information on a healthy diet with no specific intervention.
Notes	**Author's Conclusion**: Weight loss and exercise each improve cognition and health-related quality of life (HRQOL) in obese older adults. However, combining weight loss with exercise may provide benefits similar to exercise alone. These findings can inform guidelines for treating obesity in older adults.		

Outcome measures/results	Primary Outcome: Changes in Modified Mini-Mental State Examination (3MS) and total Impact of Weight on Quality of Life-Lite (IWQOL) scores. Secondary Outcomes: Word Fluency Test, Trail Making Test Parts A and B, Geriatric Depression Scale (GDS) scores.	3MS: Significant improvement in the diet (1.7), exercise (2.8), and diet-exercise (2.9) groups compared to the control (0.1) (p=0.0001–0.04). IWQOL: Improvement in the diet (7.6), exercise (10.1), and diet-exercise (14.0) groups compared to the control (0.3) (p=0.0001–0.03). Word Fluency: Improved in the exercise (4.1) and diet-exercise (4.2) groups compared to the control (-0.8) (p=0.001). Trail Making Test Part A: Improved in the diet-exercise group (-11.8) compared to control (-0.8) (p=0.001).

Normandin E, Yow D, Crotts C et al. Feasibility of Weighted Vest Use during a Dietary Weight Loss Intervention and Effects on Body Composition and Physical Function in Older Adults. J Frailty Aging 2018; 7: 198-203. doi:10.14283/jfa.2018.17 [484]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1- ROB2: Some concerns	**Countries:** United States **Centers:** Wake Forest School of Medicine, Winston-Salem, NC, USA **Setting:** out-patient **Funding Sources:** Arthritis and Musculoskeletal Disease Research Center, Translational Science Center, and Center for Integrated Medicine at Wake Forest School of Medicine, Jason Pharmaceuticals, Inc. **Dropout rates:** 11% **Study limitations:** Small sample size; lack of power to detect small differences in outcomes; high adherence to vest usage but reports of discomfort and	**Total no. patients**: 37 **Inclusion criteria:** Adults aged 65-79 years, sedentary, BMI of 30-40 kg/m², non-smokers, weight stable (<5% weight change in the past 6 months), and without insulin-dependent or uncontrolled diabetes, cognitive impairment, or any contraindications for weight loss. **Exclusion criteria:** Severe cardiopulmonary disease, physical impairments requiring dependency on a cane or walker, osteoporosis, recent surgery, or chronic severe back pain.	Intervention: Dietary weight loss with daily use of a weighted vest. Control: Dietary weight loss without weighted vest use.

	back pain, potentially impacting the outcomes Risk of Bias Moderate Inconsistency n/a Indirectness Low Impreciseness Moderate Publication Bias n/a		
Notes	**Author's Conclusion:** The study found that the use of a weighted vest during a dietary weight loss intervention is feasible and may help preserve lower extremity muscle power in older adults with obesity. However, further studies with larger sample sizes are needed to confirm these findings.		
Outcome measures/results	Primary Outcome: Changes in body composition (fat mass, lean mass, and percentage of body fat). Secondary Outcomes: Physical function measures, including leg power, gait speed, chair rise time, and stair climb time.	Body Composition: Both groups lost a similar amount of weight and fat mass, with no significant differences between the groups. Leg Power: The Diet+Vest group experienced less decline in leg power compared to the Diet-only group (right leg: -11.4 ± 20.9 W vs. 2.5 ± 29.8 W, p=0.022; left leg: -9.2 ± 15.2 W vs. -0.78 ± 22.1 W, p=0.007).	

Shah K, Stufflebam A, Hilton TN et al. Diet and exercise interventions reduce intrahepatic fat content and improve insulin sensitivity in obese older adults. Obesity (Silver Spring) 2009; 17: 2162-2168. doi:10.1038/oby.2009.126 [480]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1+	**Countries:** USA **Centers:** Washington University School of Medicine **Setting:** n/a **Funding Sources:** National Center for Research Resource **Dropout rates:** 5% **Study limitations:** n/a	**Total no. Patients:** 18 **Inclusion criteria:** BMI ≥30 kg/m², age 65-82 years, sedentary lifestyle, stable body weight (±2kg) over the past year, and no changes in medications for at least 6 months before enrolling in the study **Exclusion criteria:** diabetes, current smoking history, anemia, severe cardiopulmonary disease, renal disease, visual, hearing, or cognitive impairments, history of malignant neoplasm, and recent use of corticosteroid or sex-steroid compounds agents	• **Diet therapy**: balanced diet to provide energy deficit of 500-1000 kcal/day from daily energy requirement, 30% of energy as fat, 50% as carbohydrate, and 20% as protein. Once 10% body weight was lost, total caloric intake was again adjusted to maintain a constant body weight and prevent further weight loss. On a weekly basis, the subjects met as a group for ~60 minutes with a dietitian. • **Diet and exercise training**: combination of diet and exercise training, dietary intervention identical to that of the Diet group, because of the calories burned during exercise, slightly higher caloric intake to achieve the same 10% weight loss, exercise-training program focused on improving endurance, strength, and balance, 90 min group sessions on three days each week

Notes	**Author's Conclusion:** Diet with or without exercise results in significant decreases in IHF content accompanied by considerable improvements in insulin sensitivity in obese older adults. The addition of exercise to diet therapy improves physical function and other obesity- and aging-related metabolic abnormalities.	
Outcome measures/results	• **Primary outcome**: IHF quantified by magnetic resonance spectroscopy (MRS) • **Secondary outcomes**: insulin sensitivity (assessed by oral glucose tolerance), body composition (assessed by dual-energy X-ray absorptiometry), physical function (VO_2 peak) and strength), glucose, lipids, and blood pressure (BP)	Body weight (D: -9 +/- 1%, D+E: -10 +/- 2%, both P < 0.05) and fat mass (D: -13 +/- 3%, D+E -16 +/- 3%, both P < 0.05) decreased in both groups but there was no difference between groups. IHF decreased to a similar extent in both groups (D: -46 +/- 11%, D+E: -45 +/- 8%, both P < 0.05), which was accompanied by comparable improvements in insulin sensitivity (D: 66 +/- 25%, D+E: 68 +/- 28%, both P < 0.05). The relative decreases in IHF correlated directly with relative increases in insulin sensitivity index (ISI) (r = -0.52; P < 0.05). Improvements in VO_2 peak, strength, plasma triglyceride (TG), and low-density lipoprotein-cholesterol concentration, and diastolic BP occurred in the D+E group (all P < 0.05) but not in the D group.

Villareal DT, Chode S, Parimi N et al. Weight loss, exercise, or both and physical function in obese older adults. N Engl J Med 2011; 364: 1218-1229. doi:10.1056/NEJMoa1008234 [476]			
Study Type/ Evidence Level	**Study details/limitations**	**Patient characteristics**	**Interventions**
RCT 1++	**Countries:** USA **Centers:** Washington University School of Medicine, St. Louis, New Mexico Veterans Affairs Health Care System, University of New Mexico School of Medicine **Setting:** n/a **Funding Sources:** National Institutes of Health **Dropout rates:** 13% **Study limitations:** study was not powered to determine potential differences in the outcomes between sexes, small sample size, most of the participants were	**Total no. Patients:** 107 **Inclusion criteria:** 65 years of age or older, obese (BMI of 30 or more), sedentary lifestyle, stable body weight during the previous year, stable medications for 6 months before enrollment, mild- to-moderate frailty **Exclusion criteria:** severe cardiopulmonary disease, musculoskeletal or neuromuscular impairments that preclude exercise training, visual, hearing or cognitive impairments, history of cancer, persons receiving drugs that affect bone health and metabolism, current smoking	• **Control group**: Participants assigned to the control group did not receive advice to change their diet or activity habits and were prohibited from participating in any weight-loss or exercise program. They were provided general information about a healthy diet during monthly visits with the staff. • **Diet group**: Participants assigned to the diet group were prescribed a balanced diet that provided an energy deficit of 500 to 750 kcal per day from their daily energy requirement. The diet contained approximately 1 g of high-quality protein per kilogram of body weight per day. Participants met weekly as a group with a dietitian for adjustments of their caloric intake and for behavioral therapy. The goal was to achieve a weight loss of approximately 10% of their baseline body weight at 6 months and to maintain that weight loss for an additional 6 months. • **Exercise group**: Participants in the exercise group were given information regarding a diet that would maintain their current weight and participated in three group exercise-training sessions per week. Each session was

	women, white, well educated, and older (70±4 years of age)		approximately 90 minutes in duration and consisted of aerobic exercises, resistance training, and exercises to improve flexibility and balance. • **Diet-exercise group**: Participation in both the weight-management and exercise programs.
Notes	**Author's Conclusion:** These findings suggest that a combination of weight loss and exercise provides greater improvement in physical function than either intervention alone.		
Outcome measures/results	• **Primary outcome:** change in score on the modified Physical Performance Test • **Secondary outcomes**: other measures of frailty, body composition, bone mineral density, specific physical functions, and quality of life.		A total of 93 participants (87%) completed the study. In the intention-to-treat analysis, the score on the Physical Performance Test, in which higher scores indicate better physical status, increased more in the diet-exercise group than in the diet group or the exercise group (increases from baseline of 21% vs. 12% and 15%, respectively); the scores in all three of those groups increased more than the scores in the control group (in which the score increased by 1%) (P<0.001 for the between-group differences). Moreover, the peak oxygen consumption improved more in the diet-exercise group than in the diet group or the exercise group (increases of 17% vs. 10% and 8%, respectively; P<0.001); the score on the Functional Status Questionnaire, in which higher scores indicate better physical function, increased more in the diet-exercise group than in the diet group (increase of 10% vs. 4%, P<0.001). Body weight decreased by 10% in the diet group and by 9% in the diet-exercise group, but did not decrease in the exercise group or the control group (P<0.001). Lean body mass and bone mineral density at the hip decreased less in the diet-exercise group than in the diet group (reductions of 3% and 1%, respectively, in the diet-exercise group vs. reductions of 5% and 3%, respectively, in the diet group; P<0.05 for both comparisons). Strength, balance, and gait improved consistently in the diet-exercise group (P<0.05 for all comparisons). Adverse events included a small number of exercise-associated musculoskeletal injuries.

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