REVIEW ARTICLE

Interventions to optimise nutrition in older people in hospitals and long-term care: Umbrella review

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Abstract

Background: Inpatients have a high need for protein-energy intake because of increased physical stress metabolism due to illnesses. Protein-energy undernutrition in older patients increases the risk of complications such as falls, pressure ulcers and even death. An overview of effective interventions addressing this complex issue of malnutrition in older people is missing.

Aims: To give an overview of effective interventions to optimise nutrition in older people in hospitals and long-term care.

Design: An umbrella review, according to the Joanna Briggs Institute and PRISMA statement, was conducted in April 2020.

Methods: A systematic search of publications from 2010 until 2020 was conducted in CINAHL, PubMed and Cochrane Database. Included were studies reporting nutrition interventions that involved nurses or the interprofessional team in optimising older hospitalised people's nutrition. Excluded were studies investigating the effects of parenteral nutrition, certain food supplements or tube feeding and research from intensive, community or palliative care. Components of interventions were classified according to the intervention *Nutrition management*: *Patients' assistance*, *patients' instruction*, *foodservice*, *environment for meals* and *nutrient-dense snacks*.

Findings: Included were 13 reviews from 19 countries of the continents Asia, Australia, Europe and North America from hospitals and long-term care settings. 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.

Conclusion: Several studies synthesised that optimising nutrition in older people in hospitals and long-term care is achievable. Interventions were effective if—on a

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meta-level—*staff training* was addressed as part of a *multi-component measure* to reach an *interprofessional food promoting culture*.

Implications for practice: Interventions to optimise older people's nutrition have to consider an *interprofessional food promoting culture*, including *staff training* about the importance of nutrition, patients' assistance and an appropriate environment for meals.

INTRODUCTION

Malnutrition, concerning protein-energy undernutrition in older people, is described by the European Society for Clinical Nutrition and Metabolism as follows:

> Older persons are at risk of malnutrition if oral intake is markedly reduced (e.g., below 50% of requirements for more than three days) or if risk factors, which either may reduce dietary intake or increase requirements (e.g., acute disease, neuropsychological problems, immobility, chewing problems, swallowing problems), are present. [1]"

The risk of malnutrition in older people (aged 65 years and above) is of worldwide concern, with a prevalence ranging from 21% in community settings [2] and can rise to 50% in hospitalised elderly [3, 4]. Older people are at high risk of malnutrition due to multiple factors such as impaired cognitive function, physiological loss of muscle mass, loss of taste and worsened oral health [5–7]. Multimorbidity and polypharmacy are other appetite-reducing factors enhancing malnutrition risk [8, 9]. Consequently, protein-energy undernutrition increases the risk of complications such as falls, pressure ulcers, care dependency and even death [10, 11].

Therefore, it is highly suggested to assess and treat the risk for malnutrition in older people in hospitals and long-term care (LTC) [1]. Nevertheless, omitting nutritional risk screening was described as a gap in practice [12], while several systematic reviews for nutrition-improving interventions exist. They often have a narrow focus either only on one specific setting (e.g. dementia care unit) [13] or on one type of intervention (e.g. oral nutrition supplement) [14]. Despite current research on the topic, the risk for malnutrition in older people in hospitals and long-term care often remains unrecognised and untreated [11, 15, 16]. According to observations and focus group discussions, one reason for this lack of recognition might be the complexity of the nutrition process from the beginning of diet prescription, cooking, food ordering and serving the meal with up to six professions that are involved in institutions such as hospitals [17].

Further reasons could be a lack of awareness for the importance of nutrition and, consequently, not prioritising patient support during food intake [18–20]. However, an overview of effective interventions is missing. Therefore, with the scope of filling this gap, an umbrella review was undertaken to encompass an aggregation of evidence-based, effective interventions to treat the risk of malnutrition in older people in hospitals and long-term care.

BACKGROUND

An umbrella review is supposed to summarise systematic reviews: authors do not need to re-synthesise findings but are structuring them in an existing order [21]. Some systematic reviews conclude that neither interventions nor outcomes are comparable because of a lack of standardised language [22], or relevant studies might be missing [14]. Research about standardised nursing language (SNL) points out that nursing diagnoses, linked to evidence-based, classified nursing interventions, are essential to make nursing and its effects visible and evaluable [23].

Nutrition has traditionally and professionally been the responsibility of nurses [24]. Nurses are accountable for planning, conducting and evaluating evidence-based, effective interventions according to the Nursing Intervention Classification (NIC) [25, 26]. Therefore, the following activities subsumed under the intervention *Nutrition management* as reported in the Nursing Intervention Classification (NIC) [26] served as components of effective interventions for data summary: *patients' assistance*, *patients' instruction*, *food-service*, *environment for meals* and *nutrient-dense snacks*. For a closer look, these components are characterised in more detail below:

Patients' assistance: "Perform or assist patients with oral care before eating (…) assist patients with cutting food or eating, if needed" (Butcher et al. 2018, p. 300–302).

Patients' instruction: "Instruct patients about nutritional needs (i.e., discuss dietary guidelines and food pyramids)" [26].

Foodservice: "Ensure food is served in attractive manner and at temperature most suited for optimal consumption" [26].

Environment for meals: "Provide an optimal environment for meal consumption" [26].

Nutrient-dense snacks: "Adjust diet (i.e., provide high protein foods, (…) increase or decrease calories (…)), as necessary" [26].

The term 'patient' or 'patients' refers to older people in hospital as well as older people otherwise called residents or inhabitants of nursing homes; as by the NIC, the term patient is defined as 'any individual, group, family or community who is the focus of nursing intervention' [26]. The variability of activities in the NIC *Nutrition management* showed that improving nutrition in older people in hospitals and long-term care needed a complex intervention. Complex in this context meant entailing various elements (tableware, food-content), different professions (dieticians, nurses, doctors, service staff) and multiple levels (knowledge, staff organisation, infrastructure, foodservice) [27, 28]. Existing literature and research gave an idea about the complexity and variability of interventions to improve older people's nutritional status in hospitals and long-term care [29]. Still, practitioners, researchers or policymakers might get lost by the vast amount of current evidence. An overview of evidence-based, effective interventions is needed to summarise effective interventions into components that may be used to build a complex intervention. To display current research evidence for such components of nutrition-optimising interventions, we conducted an umbrella review.

Aim and research question

The aim was to summarise components of an effective complex intervention that will optimise older people's nutrition in hospitals and long-term care. An umbrella review was performed to answer the following research question:

What are effective interventions to optimise the nutritional status of older people in hospitals or long-term care?

DESIGN

An umbrella review is determined as an overview of evidence derived from several systematic research syntheses for different interventions within the same condition [30]. This design was chosen for its main scope of summarising knowledge into one easily accessible document. We followed the action-guiding procedure and criteria of the Joanna Briggs Institute [21]. An umbrella review was performed describing a nutritional healthcare problem investigated by several interventions to optimise food intake and nutritional status [31, 32]. This design enabled us to provide an overall picture so that interventions addressing the risk of malnutrition in older people in hospitals and long-term care from all over the world could be included. Conducting an umbrella review facilitated comparing and summarising multiple treatments for managing this complex condition following review experts' claims [33].

METHODS

Search methods

The search procedure and reporting were performed in correspondence with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Group [34] by two independent reviewers. No review protocol has been registered, as this review was part of a larger quality-improvement project Req-2016–0067. Studies were included if they fulfilled all criteria for the type of participants/population, the interventions of interest, comparison, outcome measures, time, setting and study characteristics (PICOTSS) (Table 1). Reviews from the last ten years were included, as the most recent references from the nursing intervention Nutrition Management dated back to 2010 [26]. Besides, nutrition-related therapies have been under continuous development, and institutions' procedures have changed since then. Included were studies reporting on nutrition interventions that involved nurses or the interprofessional team. Interventions aimed to enhance appetite (fresh air, oral hygiene before serving a meal), to increase the amount of food or protein-energy intake (assistance to open food packages, adjusted tableware, assessing patients' preferences or fortified meals and oral nutrition supplements). Examples of interventions searched for were as follows: food intake, appetite regulation, colour plate, biography, patient positioning, eating behaviour, environment, education, as displayed in Table S2 Block G. Studies needed to focus on older people in hospitals or long-term care and their nutrition-related outcomes. Hospitals (acute care) and long-term care settings (nursing homes) were included because they appeared to have comparable risk factors of malnutrition in older people. The authors aimed to get the broadest possible results while the assessment of study quality using the critical appraisal tool should help readers to situate the study and assess the relevance of the findings to their context.

As the aim was to investigate on how to improve energy- and protein intake of elderly hospitalised patients or people living in long-term care settings with any cognitive status, our purpose was to improve nutritional status through interventions that the health care team could provide. Thus, interventions with the primary aim to improve food literacy or such that mainly focused on self-care abilities were not within the scope of this publication.

TABLE 1 Selection criteria for inclusion or exclusion of reviews alongside the PICOTSS format

	Inclusion criteria	Exclusion criteria
Population	Geriatric patients or People aged 65 years or older (mean age of included population ≥65 years) with physical, social or cognitive functional ability	Children, young adults Terminally ill, palliative patients
Intervention	Treatment of the risk for protein-/energy malnutrition, e.g. any intervention to improve food intake or the amount of energy or protein intake including assessment, risk screening, controlled environment (ambiance), education, positioning by nurses or the interprofessional team including nutrition management, nutrition therapy, nutritional counselling, nutritional monitoring, delivering oral nutrition supplements (ONS) or experiences of interventions.	Micronutrients or molecular level only, tube feeding, parenteral nutrition, Validation of screening tools
Comparison	No intervention, 'standard care'.	None
Outcome measures	Nutritional status, nutrient intake, body mass index, functional status, appetite, quality of life, patient satisfaction, maybe in combination with laboratory findings	Laboratory signs only, Prevalence of malnutrition as main outcome
Time	Published within the last 10 years (2010–2020)	
Setting	Acute care, long-term care institution, rehabilitation	Homecare, ambulatory care, intensive care units, palliative care, hospice
Study characteristics	Systematic reviews, narrative review, meta-analysis, meta-synthesis, other types of review	review of low quality (no flow chart of study selection, without explicit inclusion, exclusion criteria)
Language of publication	Abstract in English, full text in English or German	

Regarding the type of our study, we included effectiveness reviews, prognostic reviews, experiential reviews or other reviews [35]. Excluded were publications without method sections, such as expert reports, education materials or editorials. In addition, we excluded studies investigating the effects of parenteral nutrition, certain food supplements or tube feeding and research from the critical, intensive, community and ambulatory care or explicit palliative care setting because nutritional objectives differ in those contexts.

Palliative care can be defined in different ways, such as in a broad context and time frame when referring to 'symptom management in situations where healing of an illness is not possible' or in a narrow context and time frame, such as 'care for dying persons'. When we excluded research *focusing on* 'patients in palliative care situations' we relied on the following definition: 'Palliative care is patient and family-centred care that optimises quality of life by anticipating, preventing and treating suffering'.[36] In this sense, many over 80-year-old hospitalised people could be considered 'palliative patients', as they may suffer from chronic disease such as osteoporosis, which cannot be healed. However, the aim of this study was to optimise nutrition in older patients whose aim is to maintain or improve functional abilities and to reduce the risk of complications during a hospital stay. Therefore, studies referring to explicitly named palliative settings were excluded.

Three databases, CINAHL, PubMed and Cochrane Library, were systematically screened for studies meeting the eligibility criteria (Table 1). The literature search was conducted from April 7–10, 2020. Full search strings are presented in Table 2 (Cochrane library), Table S1 (Ebsco host, CINAHL) and Table S2 (PubMed). These three databases were chosen as they indexed all significant nursing journals, geriatric care journals and nutrition science journals. Furthermore, they contain the major repositories of systematic reviews from the JBI Database of Systematic Reviews and Implementation Reports, the Database of Abstracts of Reviews of Effectiveness (DARE) and the PROSPERO register [33]. The search strategy was developed in close collaboration with the co-authors and the broader research group. 'Frail Elderly' [MeSH], 'Nutritional Support,' 'Caregiver Support,' 'Hospital Units,' 'Residential Facilities,' 'Feeding Behaviour/Therapy' [MeSH], 'Patients' Rooms' [MeSH], 'Patient Positioning' and 'Diet, Food, and Nutrition' were some of the keywords and Medical Subject Headings (MeSH terms) combined with Boolean operators AND or OR. The following search filters were activated: 'Reviews or Meta-analysis,' 'Aged: 65+ years', 'English or German.' Subsequently, literature answering the research question was identified, and selected full texts were retrieved.

Search outcomes

Predefined search outcomes were primarily descriptions of interventions that influenced nutritional status or food intake.

TABLE 2 Search strategy Database: Cochrane 8 April 2020

Search ID	Search term	Result
#1	MeSH descriptor: [Aged, 80 and over] explore all trees	1982
#2	MeSH descriptor: [Nutritional Status] explore all trees	2374
#3	MeSH descriptor: [Nutrition Therapy] explore all trees	9065
#4	MeSH descriptor: [Nursing] in all MeSH products	3216
#5	MeSH descriptor: [Inpatients] explore all trees	901
#6	MeSH descriptor: [Nursing Homes] explore all trees	1303
#7	MeSH descriptor: [Hospitals] explore all trees	3487
#8	(elderly):ti,ab,kw	46,678
#9	MeSH descriptor: [Geriatric Nursing] explore all trees	175
#10	(#1 or #8) and (#2 or #3 or #4 or #9) and (#5 or #6 or #7)	134,805
#11	MeSH descriptor: [Treatment Outcome] explore all trees	134,805
#12	MeSH descriptor: [Combined Modality Therapy] explore all trees	21,085
#13	MeSH descriptor: [Therapies, Investigational] explore all trees	
#14	Geriatric*	14,433
#15	Oldest old	245
#16	MeSH descriptor: [Protein-Energy Malnutrition] explore all trees	247
#17	MeSH descriptor: [Malnutrition] explore all trees	4076
#18	(#1 or #8 or #14 or #15) and (#2 or #16 or #17)	558
#19	#18and (#5 or #6 or #7)	69

The nutritional status was measured with the Mini Nutritional Assessment or the Nutrition Risk Screening according to Kondrup et al. [37–39] Other nutrition-related outcomes as weight gain, Body Mass Index, behaviour during food intake, functional status, appetite, quality of life or patient satisfaction might be investigated in combination with laboratory findings or muscle mass.

Study selection and quality appraisal

Two co-authors discussed inclusion and exclusion criteria to enhance interrater reliability, as suggested by experts in nursing research and the Joanna Briggs Institute (JBI) [40, 41]. The PICOTSS-format was strictly applied to the research question. In a further step, the two authors independently assessed included studies for risk of bias using the critical appraisal tool [21, 40]. The process of summarising interventions to components was precisely documented and discussed repeatedly with the co-authors. The quality of this umbrella review was ensured by following recommendations for conducting and presenting an umbrella review [21] and by the use of the corresponding critical appraisal tool of the JBI [42], as well as complying with the PRISMA Statement [34].

ANALYSIS

Data collection and data extraction

The following data were extracted from included reviews according to the data abstraction procedure described by the JBI recommendations: reference, number of databases and names, study design, type and aims, the total number of participants, settings, countries of original research, duration of the study, interventions bundled by components and their effects ((↑) improvement or (↓) deterioration). Inclusion criteria of the reviews, their keywords and the primary studies' time frame were displayed in supporting information (Table S3).

Two reviewers developed the search string, discussed the inclusion and exclusion of studies, and assessed the included studies' quality by applying the critical appraisal tool independently.

Synthesis

As the study designs of the systematic reviews and their included original trials were heterogeneous, there was no intention to conduct a meta-analysis. The main findings and

quality assessments were presented in a tabular format, allowing the reader to quickly interpret the results [41]. Different interventions were aggregated to predefined components of effective interventions [30, 33]. These components are theoretically based on the NIC intervention of *Nutrition management* because it is known from research on nursing languages and classification systems that if a phenomenon is not named, it is not recognised and cannot be addressed [43]. Research about SNL and the related *Advanced Nursing Process* describes that interventions are effective when correctly formulated according to classification systems. This SNL makes interventions and patient-centred outcomes comparable and enables evaluation [44, 45]. Since nutritional interventions affect several levels, three additional components of effective interventions were defined on a meta-level, according to a first analysis of the literature: *staff training*, *multi-component measures* and *interprofessional food promoting culture* [46, 47]. These interventions' effects were displayed in a table to deliver a clear overview of interventions' effectiveness [33]. Describing and structuring findings was facilitated by the qualitative data analysis software MAXQDA [48].

ETHICS

Data were collected in the same manner for each review in tabular format to avoid the risk of discrimination within the present umbrella review, according to suggestions of the JBI data extraction tool and the description by Holly et al. [30, 33] All the review steps were conducted by analyses, discussion and agreement of at least two co-authors. The review was registered with the local ethical committee to overview the current evidence on effective interventions to treat the risk of malnutrition in older people in hospitals and LTC.

RESULTS

Selected studies

Titles and abstracts of 788 publications were read and checked against the eligibility criteria. Reasons for exclusion were provided in a flow chart following the PRISMA 2009 Flow Diagram (Figure 1), and the reasons for excluding a review are described in Table 3. After screening, 40 full texts were identified, assessed for eligibility and summarised in a tabular format. Individual results were compared, and discrepancies were discussed to gain agreement. Any disagreements that arose between the reviewers were resolved by re-reading the studies and by discussion. A total of 13 reviews from 19 countries of the continents North America, Asia, Europe and Australia from hospitals and long-term care settings, dating from 2013 to 2019, fulfilled all PICOTSS criteria.

This umbrella review summarises data from 18,568 participants, including health care workers and older people, such as patients or residents. Three included studies focused on LTC, whereas the other reviews included data from inpatient settings such as hospitals or rehabilitation care units.

Study characteristics

Seven systematic reviews with meta-analysis, four systematic reviews with narrative synthesis, one scoping review and one mixed-method review were included (Table 4). Study types were effectiveness review ($n = 10$), experiential review with quantitative and qualitative findings ($n = 1$), prognostic review ($n = 1$) and economic evaluation ($n = 1$). Different interventions' effectiveness could not be compared, as nutritional interventions are complex depending on the involvement of various professions and the organisational context (Table S3).

Risk of bias across studies

The risk of bias across included studies is shown in Table 5. A high risk of bias was found in two systematic reviews that met less than 7 out of 11 critical appraisal tool criteria. Methodological quality was impaired when no explicitly stated research question had been described, or publication bias had not been mentioned within a review (Table 5, Q1, Q9) [32]. A research question or PICOTSS-format for eligibility criteria was missing in some studies; however, there was a clear statement of the study aims (e.g. Hugo et al. (2018) and Mills et al. [14]). The question (Q6) 'Was critical appraisal conducted by two or more reviewers independently?' remained unclear or answered in the negative in five out of 13 reviews. Therefore, we assumed that the risk of publication bias in our umbrella review was low, especially since the included reviews presented high-quality and low-quality research, originated in various countries and employed effective interventions in different settings. One of the recently published included studies described a rigorous investigation to detect potential reporting bias [22].

Synthesis of results—components of effective interventions to optimise nutrition in older people in hospitals and LTC

Each of the eight components *(patients' assistance*, *patients' instruction*, *foodservice*, *environment for meals*, *nutrient-dense snacks*, and the meta-level components *staff training*, *multi-component measures* and *interprofessional food promoting culture)* is described in detail in the subsequent

FIGURE 1 Flow Chart of Identification—screening—eligibility—inclusion according to the PRISMA Group statement [34]
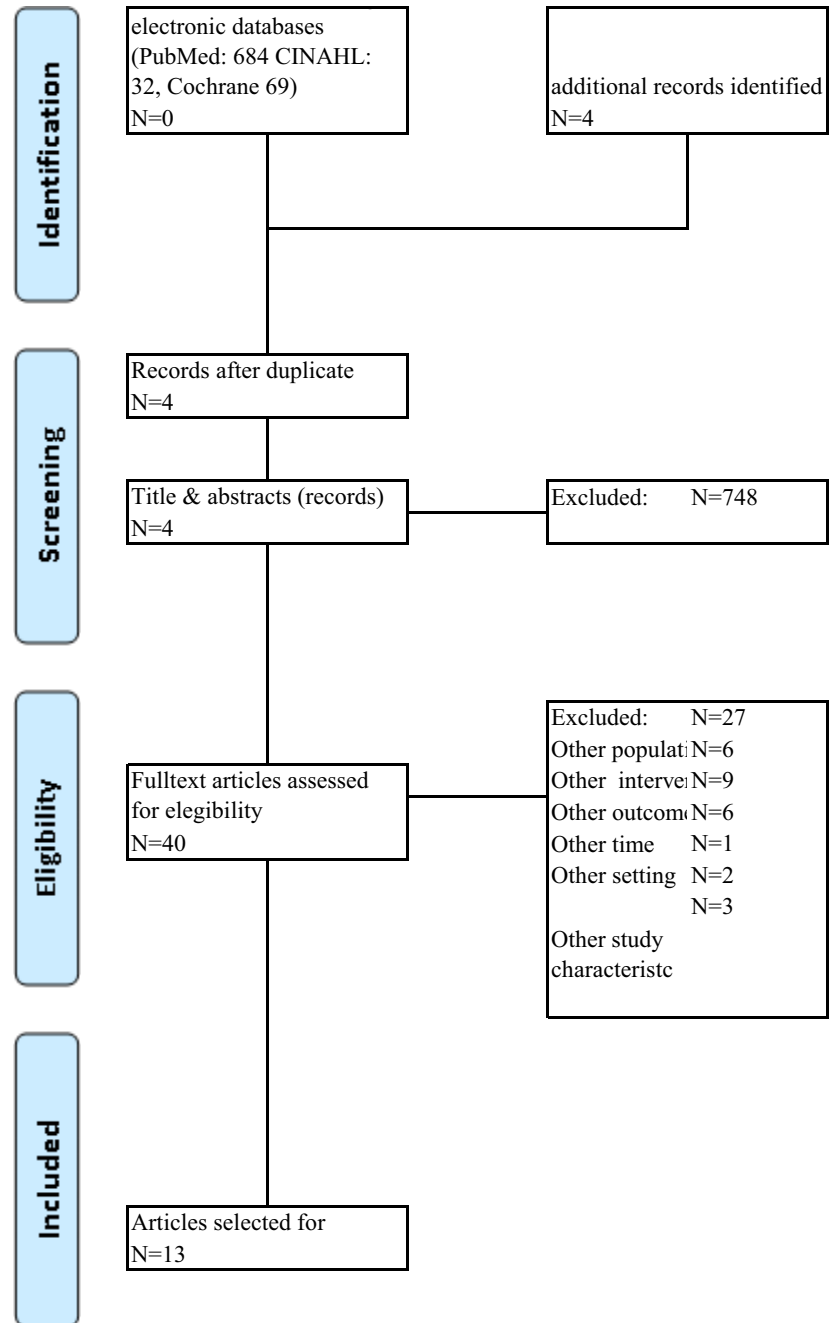
paragraph. The effectiveness of components of interventions is summarised in Table 6.

Patients' assistance was an intervention component examined in several studies. The included systematic reviews described that employed assistants effectively increased energy intake and nutritional status in older people in hospitals during mealtimes [49]. Abbott et al. [47] integrated research on the effect of positive reinforcement, correct positioning or one-to-one feeding assistance leading to increased food intake. *Patients' assistance* led to increased time for eating as well as self-care abilities to eat solid food [50].

Patients' instruction was reported as self-feeding training programs that demonstrated moderate evidence to increase

eating time and decrease feeding difficulties [50]. This component was investigated in LTC, where Montessori-based activities or spaced retrieval (that entailed skills of learning and memorising) achieved significant positive effects on self-feeding frequencies [13, 51]. In a Cochrane review focusing on behavioural modifications, *patients' instruction* was rated as low evidence [22]. One systematic review pointed out the probable positive effect on hospitalised older people's quality of life, readmission rate and mortality [52].

Foodservice was the third component, with interventions such as a bulk service instead of a pre-plated service or delivering smaller portions to increase appetite [47]. Thanks to *foodservice* components such as buffet-style dining, the

TABLE 3 Reasons for exclusion of each excluded review according to PICOTSS-format

Screening of title and abstract CINAHL: *n* = 73, PubMEd =	1	2	3	4	5	6
Artaza-Artabe I, Sáez-López P, Sánchez-Hernández N, Fernández-Gutierrez N, Malafarina V. (2016)	1	1	0	1	1	1
Aselage, M. B., & Amella, E. J. (2010)	1	1	0	1	1	0
Astvaldsdottir, A., Bostrom, A. M., Davidson, T., Gabre, P., Gahnberg, L., Sandborgh Englund, G., … Nilsson, M. (2018)	1	0	0	1	1	0
Avenell, A., O Smith, T. Curtain, J.P., Mak, J.C.S., Myint P K., (2016)	1	0	0	1	1	1
Cawood AL, Elia M, Stratton RJ. **(2012)**	0	1	1	1	1	1
Chang CC, Roberts BL. (2011)	0	1	0	1	1	0
Cheng H, Kong J, Underwood C, Petocz P, Hirani V, Dawson B, O'Leary F. Br J (2018)	1	1	0	1	1	1
Collins, A. J., Clemett, V., & McNaughton, A. (2019)	1	1	1	1	1	0
Cruz-Jentoft AJ, Landi F, Schneider SM, Zúñiga C, Arai H, Boirie Y, Chen LK, Fielding RA, Martin FC, Michel JP, Sieber C, Stout JR, Studenski SA, Vellas B, Woo J, Zamboni M, Cederholm T. (2014)	0	0	0	1	1	1
Feinberg, J., Nielsen, E. E., Korang, S. K., Halberg Engell, K., Nielsen, M. S., Zhang, K., … et al. (2017)	0	1	1	1	1	1
Hanson, Ruth M. (2014)	1	0	0	1	1	1
Kuo YW, Yen M, Fetzer S, Lee JD. (2013)	0	0	0	1	0	1
Liu M, Yang J, Yu X, Huang X, Vaidya S, Huang F, Xiang Z. (2015)	1	1	0	1	1	0
Milne et. al. (2009)	1	1	1	0	1	1
Muñoz-González C, Vandenberghe-Descamps M, Feron G, Canon F, Labouré H, Sulmont-Rossé C.J. (2018)	0	0	0	1	1	1
Murimi MW, Kanyi M, Mupfudze T, Amin MR, Mbogori T, Aldubayan K. (2017)	0	0	0	1	0	1
Namasivayam AM, Steele CM. (2015)	1	0	0	1	1	1
Omidvari, Amir-H., Vali Y., Murray S. M, Wonderling, D., Rashidian, A. (2013)	0	1	1	1	1	1
Richards, David A., Hilli, Angelique, Pentecost, Claire, Goodwin, Victoria A., & Frost, Julia. (2018)	0	1	1	1	1	1
Schulz RJ, Maurmann M, Noreik M. (2014)	1	1	1	1	1	0
Syed Q, Hendler KT, Koncilja K. (2016)	1	0	0	1	1	0
Van Ancum JM, Scheerman K, Jonkman NH, Smeenk HE, Kruizinga RC, Meskers CGM, Maier AB. (2017)	1	0	0	1	1	1
Veronese N, Stubbs B, Punzi L, Soysal P, Incalzi RA, Saller A, Maggi S. (2019)	1	1	0	1	1	1
Wells JL, Seabrook JA, Stolee P, Borrie MJ, Knoefel F. (2003)	1	0	1	0	1	1
Wells JL, Seabrook JA, Stolee P, Borrie MJ, Knoefel F. (2003)	1	1	1	0	1	1
Zhou X, Perez-Cueto FJA, Santos QD, Monteleone E, Giboreau A, Appleton KM, Bjørner T, Bredie WLP, Hartwell H. A (2018)	1	1	0	1	0	1
Zurakowski, T. L. (2004)	0	0	1	0	0	0

(1) **Population:** aged, elderly, ≥65 y. → yes = 1, no = 0.

(2) **Intervention:** nutrition support, supplement… → yes = 1, no = 0.

(3) **Outcome/measurements:** nutritional status → yes = 1, no = 0.

(4) **Time:** published within the last 10 years (2010–2020) yes = 1, no = 0.

(5) **Setting:** institution: → yes = 1, no = 0.

(6) **Study characteristics:** review → yes = 1, no = 0.

motor skills remained stable while decreasing in the control group [51].

Environment for meals was a component that had positive effects on behaviour, weight gain or calories-intake as synthesised in nine reviews (e.g. Abbott et al., 2013, Edwards et al., 2016). Older people in the intervention group received more food and fluids and demonstrated more self-feeding skills than the control group [51]. Herke et al. confirmed that physical touch linked with verbal encouragement improved calorie-consumption per meal [22]. The component *environment for meals* included family-style meals. To give an example, the staff had eaten

TABLE 4 Summary of 13 included reviews with study characteristics, interventions, and their effects

Authors, Year, Journal	Number of databases, and names	Study design, Type and aims of the systematic review	a. Included participants; b. setting; c. countries of original research	Duration of study (incl. Follow-up) d = day, w = week, m = month, y. = year	Components of intervention	Effect of interventions ↑ improvement, better; ↓ lower, decrease, worse
Abbott et al. (2013) Ageing Research Review	15; MED-LINE, PsycINFO, Embase, HMIC, AMED (OvidSp); CDSR, CENTRAL, DARE (Cochrane Library); CINAHL (EBSCOhost); British Nursing Index (NHS Evidence); ASSIA (ProQuest); Social Science Citation Index (Web of Science); EThOS (British Library); Social Care Online and OpenGrey (Abbott 2013 sysReview MetaSynthese, S. 1: 6122)	*Study design:* Systematic review, meta-analysis *Type:* Effectiveness review *Aim:* To determine the effectiveness of mealtime interventions	a) N = 3538, mean age 84 y. b) LTC (37) c) GB, US, NL, CA, SE, TW	1) 16 week 2) 6–24 w 3) 3 m–1 y. 4) 4 × 1 h, 2 d, up to 6 × 2–3 h, 6 m 5) 6 months 1:1 assistance	1) Nutrient-dense snacks (enhance flavour) 2) Nutrient-dense snacks (choice) 3) Environment for meals; 4) Staff training 5) Patients' assistance, nutrient-dense snacks 6) Foodservice	1) No sig. difference 2) ↑BMI, ↑ body weight 3) ↑ weight, ↑ energy intake 4) ↓ in the level of malnutrition 5) ↑ weight 6) ↑ weight, ↑ energy-intake, weak evidence
Beck et al. (2016), J Hum Nutr Diet	6; Cochrane Library, PubMed, CINAHL, Campbell Collaboration Library, Occupational Therapy Seeker, and Center for International Rehabilitation Research Information and Exchange Database	*Study design:* Systematic review (PRISMA), Meta-analysis *Type:* Effectiveness review *Aim:* To determine the impact of nutritional intervention	a) N = 1340, aged ≥65 y. b) LTC (2), outpatient (3) c) DK, SE, ES	3–12 m	1) Nutrient-dense snacks 2) Patients' instruction	↑ energy-intake ↑ protein-intake
Correa et al. (2019)	4; Cochrane Library, PubMed, EMBASE, CINAHL	*Study design:* Systematic review, Meta-analysis *Type:* Effectiveness review *Aim:* To summarise the evidence for all tested nutritional interventions and relevant clinical outcomes	a) N = 2207, mean age 65 y. b) hospital (8), nursing homes (2), community-care (9)	4 w–6 m	1) Nutrient-dense snacks 2) Multi-component measure (counselling + ONS)	↑ body weight gain ↑ MNA scores in some studies ↑ Barthel-Index score (ADL) no sig. effects in: QoL, BMI, hand-grip strength, TUG

T A B L E   4   (Continued)

Authors, Year, Journal	Number of databases, and names	Study design, Type and aims of the systematic review	a. Included participants b. setting c. countries of original research	Duration of study (incl. Follow-up) d = day, w = week, m = month, y. = year	Components of intervention	Effect of interventions ↑ improvement, better; ↓ lower, decrease, worse
Edwards et al. (2016) JBI Database System Rev Implement Rep	7; CINAHL, MEDLINE, British Nursing Index, Cochrane Central Register of Controlled Trials, EMBASE, PsycINFO, Web of Science	*Study design*: Mixed Method systematic review *Type*: Prognostic review *Aim*: To develop an aggregated synthesis of quantitative and qualitative data on assistance at mealtimes for older adults (>65 years) in hospital settings and rehabilitation	a) $n = 2790$ quant. $n = 431$ qual. b) hospital (17) rehabilitation (5) c) AU, GB, CA, US	1 w 3–6 m 1 y. up to >3 y.	1) Interprofessional food promoting culture 2) Patients' assistance	Synthesis: 1) Attitude: mealtime = high priority 1) interprofessional communication = essential 2a) volunteers, assistance = effective 2b) social interaction
Herke et al. (2018), Cochrane Database of Systematic Reviews	1 - in 10; ALOIS, the register of Cochrane Dementia and Cognitive Improvement (CDCI) - searched in MEDLINE, Embase, CINAHL, PsycINFO, and Lilacs; metaRegister, UMIN, WHO-trial registry, ISRCTN, CENTRAL,	*Study design*: Systematic review (PRISMA) *Type*: Effectiveness review *Aim*: To assess the effects of environmental or behavioural modifications in connection with nutrition	a) $N = 1502$, mean age 76–87 y. b) LTC including dementia care units (7) ambulatory care (2) c) TW, US, BR, ES, FI	3 w (Coyne/Eaton) to 12 m (Salva/ Suominen)	1) Nutrient-dense snacks 2) Multi-component measure 3 &4) patients' instruction 5) Patients' instruction (Montessori-based) 6) Staff training 7) Environment for meals (encouraging)	1) ↑ energy-intake, ↓weight 2) ↑protein, ↓MNA 3) ↓ food intake 4) ↑ intake, BMI, weight 5) ↓ food intake, ↓MNA 6) ↓ food intake 7) ↑ energy-intake
Hugo et al. (2018), Age Ageing.	5; MEDLINE (PubMed), Cochrane, CINAHL, EMBASE, EBSCO Megafile Complete, Business Source Complete, EconLit, NHS EED, and Web of Science	*Study design*: Systematic review (PRISMA), narrative summary *Type*: Economic evaluation *Aim*: To compare the cost-effectiveness of implementing nutrition interventions in care homes versus no intervention or usual care	a) $N = 931$, mean age 74–88 y. b) LTC (8) c) US, TW, NL, GB, SE	6 w–1 y.	1) Nutrient-dense snacks (ONS) 2) Nutrient-dense snacks 3) Environment for meals	1) ↑ weight, ↑ mid-arm-circumference, ↑ BMI 2) ↑ energy-intake 3) ↑ food intake, ↑ cost-effectiveness

TABLE 4 (Continued)

Authors, Year, Journal	Number of databases, and names	Study design, Type and aims of the systematic review	a. Included participants / b. setting / c. countries of original research	Duration of study (incl. Follow-up) d = day, w = week, m = month, y. = year	Components of intervention	Effect of interventions ↑ improvement, better; ↓ lower, decrease, worse
Liu W, Galik E, et al. (2015), Worldviews Evid Based Nurs	5; PubMed, Medline (OVID), EBM Reviews (OVID), PsychINFO (OVID), and CINAHL (EBSCOHost	*Study design:* Systematic review of intervention studies. *Type:* Effectiveness review. *Aim:* To evaluate the effectiveness of interventions on eating performance	a) N = 530 patients with dementia, N = 86 nursing caregivers; *mean age: 72–90 y* b) Dementia care units, assistive living (ambulatory care) c) TW, US, CA	1) 8 w–6 m 2) 3 d–2 m 3) 4 w 4) 5 × 2 meals – 12 w	1) Staff training and patients' instruction 2) Patients' assistance 3) Environment for meals 4) Multi-component measures (environment, exercise, staff training)	1) ↑ attitude towards feeding and elderly ↑ eating time ↑ agitation, ↑ EdFED score 2) ↑ functional ability ↑ assistance, ↑eating performance, ↑ energy intake 3) ↑ energy-intake, ↑ anxiety 4) ↑ communication of assistants, ↑ food-intake
Liu, W.; Cheon J.; Thomas, S. A. (2014), International Journal of Nursing Studies	5; Pubmed, Medline (OVID), CINAHL (EBSCOHost), EBM Reviews (OVID), PsychINFO (OVID)	*Study design:* Systematic review (PRISMA), Meta-analysis. *Type:* Effectiveness review. *Aim:* To evaluate the effects of interventions on mealtime difficulties	a) N = 2082 older persons with dementia, N = 95 professionals; *mean age: 79–87 y.* b) dementia care institutions; outpatient care centres c) FR, ES, CA, US, NL, TW, FI, NZ	1) 42 d–6 m 2) 8 w–2 y 3) 2 × 4 d–12 m 4) 2 d–6 m 5) 36 w, 6 m	1) Nutrient-dense snacks 2) Staff training 3) Environment for meals 4) Patients' assistance 5) Multi-component measures	1) ↑ energy- and protein intake, ↑ BMI 2) ↑ attitude towards feeding and elderly ↑ energy intake ↑ eating time 3) ↑ food and energy intake 4) ↑ energy intake, ↑weight, ↑ assistance time 5) ↑ energy intake, ↑weight
Mills et al. (2018), HC J Hum Nutr Diet.	4; PubMed, EMBASE, CINAHL and the Cochrane Database	*Study design:* Systematic review (PRISMA), narrative summary. *Type:* Effectiveness review. *Aim:* To summarise the evidence for the use of energy or protein-dense nutrition to increase the dietary energy and protein intake	a) N = 546, mean age 60–83 y. b) Hospital (5), rehabilitation centre (3), LTC centre (3), LTC (2) c) DK, ES, SE, NL, GB, AU	assessments during 3–7 d interventions periods: 10 d–12 w	1) Nutrient-dense snacks	1) ↑ energy-intake ↑ protein-intake

TABLE 4 (Continued)

Authors, Year, Journal	Number of databases, and names	Study design, Type and aims of the systematic review	a. Included participants b. setting c. countries of original research	Duration of study (incl. Follow-up) d = day, w = week, m = month, y. = year	Components of intervention	Effect of interventions ↑ improvement, better; ↓ lower, decrease, worse
Morilla-Herrera (2016), Nutr Health Aging	6; CINAHL, Cuiden Plus, EMBASE, LILACS, Cochrane, and Medline databases	*Study design:* Systematic review of RCTs, quasi-experimental and interrupted time series, Meta-analysis, narrative synthesis *Type:* Effectiveness review *Aim:* To determine the effectiveness of food-based fortification	a) N = 588, mean age > 65 y b) hospital, LTC, community-setting c) SE, US, CN, CH, NZ, GB, DK	3 d–6 m	1) Nutrient-dense snacks	1) ↑ energy-intake ↑ protein-intake
Rasmussen et al. (2018), Clin Nutr ESPEN	6; The Cochrane Library", "PubMed", CINAHL, "Campbell Collaboration Library", "Occupational Therapy Seeker" and "Centre for International Rehabilitation Research Information and Exchange Databases".	*Study design:* Systematic review of trials *Type:* Effectiveness review *Aim:* Effectiveness of multidisciplinary nutritional support on mortality, readmissions and quality of life in older patients (>65 years)	a) N = 598; mean age 72–85 y. b) hospital (3); outpatient (2) hospital (3); outpatient (2) c) DK, AU, TW	12 w–12 m	1) Patients' instruction 2) Multi-component measures 3) Interprofessional food promoting culture	↑ mortality, ↑ Quality of life
Vucea et al. (2014), J Nutr Gerontol Geriatr.	6; PubMed, Scopus, OvidSp, CINAHL (EBSCOhost), and PsychINFO (Vucea 2014, S. 5: 1479)	*Study design:* Scoping review *Type:* Experiential review *Aim:* To describe mealtime interventions that have been developed, implemented, or evaluated to improve mealtime experiences in LTC	a) N = total number of included patients not given; *mean age: 75–87 y* b) LTC c) US, CA, SE, TW, NL, F, DK, GB, IE, FI, AU	2 × 5 d, 2 × 4 d 2 × 4 w, 4 d baseline, 4 d intervention, 2 × 6 w, 16 w, 1 y-intervention	1) Environment for meals 2) Foodservice 3) Staff training 4) Patients' instruction	1) ↓agitation with music 1) ↑ calorie intake with music, nursing staff education and environmental adaptations (light, furniture) 3) ↑ food intake with more time for assistance by nursing staff

TABLE 4 (Continued)

Authors, Year, Journal	Number of databases, and names	Study design, Type and aims of the systematic review	a. Included participants b. setting c. countries of original research	Duration of study (incl. Follow-up) d = day, w = week, m = month, y. = year	Components of intervention	Effect of interventions ↑ improvement, better; ↓ lower, decrease, worse
Wright & Baldwin (2018), Clin Nutr. LOE 1a, GR A	3; Ovid MEDLINE, Cochrane Central Register of Controlled Trials and Web of Science Core Collection (SCI-EXPANDED)	*Study design:* Systematic review (PRISMA), Meta-analysis *Type: Effectiveness review* *Aim:* To assess the effect of combining nutrition interventions with exercise	a) N = 1459, 65 y. and over b) hospital (3) community (5) service, long-term care n c) FR, NL, US, IN, JP, AU, SG, SE	1–24 m	1) Multi-component measures (ONS + exercise)	1) ↑ muscle strength ↑ gait speed

LTC = long-term care, Country of authors according to ISO-code; d = day, m = months, w = week, ONS = oral nutrition supplements, such as protein-enriched drinks, g = gram, kcal = kilocalories, energy intake is used synonymous to calorie-intake, Type of study according to (Munn et al. 2018); TUG = Time-up-and-go test, ADL = activities of daily living, MNA = Mini Nutritional Assessment.

together with residents [47], consciously enhanced social interaction, and had avoided interruption during mealtimes [49]. One original study described augmented food intake with high contrast coloured tableware [53], which had been cited in several reviews [47, 50, 51, 54]. Another way of optimising the *environment for meals* was with music or encouraging appropriate mealtime behaviour. That behaviour improved older people's food intake [13, 51]. Placing a fish aquarium in the dining area was another means to enhance the *environment for meals* [55].

Nutrient-dense snacks encompassed either adding sauce to meals or increasing the taste of food by sprinkling flavourings directly onto food before serving [47]. It has been shown that delivered additional hot chocolate or homemade oral nutrition supplements or between-meal snacks increased daily energy and protein intake [56]. In general, oral nutrition supplements increased food intake with a moderate level of evidence [14, 50, 54, 57].

Staff training was defined as one of three components on the meta-level. It includes education about the importance of food intake, incorporating nutrition as part of patients' integrity and feeding skills training for nurses, volunteers or mealtime assistants or other health care professions, as defined by Abbott et al. [47]. The *staff training* component was subject to investigation in six systematic reviews (e.g. Vucea et al., 2014). As blinding was hardly possible and the duration of the interventions seemed to be too short for reaching significant effects, *staff training* did not appear as a single-intervention to improve food intake or even to enhance nutritional status [13, 22, 49].

The multi-component measure was the second summarised component of interventions on the meta-level. As synthesised by Liu et al. [13], family-style meal delivery and staff training on prompting appropriate mealtime behaviours improved residents' participation in food intake. Similarly, Rasmussen et al. [52] displayed an increased dietary intake in a multimodal approach, which combined counselling, meal enrichment and offering snacks between meals. A scoping review synthesis considered that calm music, changing the physical and psychosocial environment for eating to be more 'home-like', and bulk or restaurant-style foodservice enhanced the mealtime experience [51]. Oral nutrition supplements combined with physical exercise were found to improve nutritional, functional and quality of life outcomes in older people with Chronic Obstructive Pulmonary Disease [57]. Enhanced assistance for eating combined with music increased the Body Mass Index [50]. Another synthesis comparing the effects of a physical training and dietary counselling program showed no significant differences in body weight or quality of life after 6 months' follow-up [57]. The education of older people, coupled with nutrition promotion, led to improved protein intake without any differences in the Mini Nutritional Assessment or Body Mass Index [22]. No

TABLE 5 Critical appraisal of included studies

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
Abbott et al. 2013	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Beck et al. 2016	yes	yes	yes	yes	yes	no	no	yes	yes	unclear	yes
Correa et al. 2019	yes	no	yes	yes	yes	yes	yes	yes	yes	unclear	yes
Edwards et al. 2016	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Herke et al. 2018	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Hugo et al. 2018	no	yes	yes	yes	yes	no	yes	unclear	yes	yes	yes
Liu W, Galik E, et al. 2015	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Liu, W.; Cheon et al. 2014	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Mills et al. 2018	no	yes	yes	yes	yes	yes	yes	unclear	no	unclear	yes
Morilla-Herrera et al. 2016	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Rasmussen et al. 2018	no	yes	yes	yes	yes	no	yes	yes	unclear	yes	yes
Vucea et al. 2014	no	yes	yes	yes	unclear	unclear	yes	yes	no	yes	yes
Wright et al. 2018	yes	yes	yes	yes	yes	no	yes	unclear	yes	unclear	yes

JBI questions for critical appraisal of systematic reviews (Aromataris & Munn, 2017).

Q1. Is the review question clearly and explicitly stated?

Q2. Were the inclusion criteria appropriate for the review question?

Q3. Was the search strategy appropriate?

Q4. Were the sources and resources used to search for studies adequate?

Q5. Were the criteria for appraising studies appropriate?

Q6. Was critical appraisal conducted by two or more reviewers independently?

Q7. Were there methods to minimise errors in data extraction?

Q8. Were the methods used to combine studies appropriate?

Q9. Was the likelihood of publication bias assessed?

Q10. Were recommendations for policy and/or practice supported by the reported data?

Q11. Were the specific directives for new research appropriate?

☹ = no, 🙂 = yes, 😐 = unclear, 3 = not applicable.

DISCUSSION

significant difference could be demonstrated between the effects of nutrition supplements and exercise versus exercise only [58].

Interprofessional food promoting culture was defined as the third meta-level component of effective interventions to optimise older people's nutrition in hospitals and LTC. This component was determined as a multidisciplinary nutritional intervention if more than one profession was involved in nutritional support [52]. The effectiveness of *interprofessional food promoting culture* was explicitly investigated in two systematic reviews [49, 52]. One synthesis was that 'Mealtimes should be viewed as a high priority,' which was considered in multidisciplinary projects [49]. Hospitalised older people benefited from close collaboration and clear and timely communication of dieticians, nurses and catering staff [52].

This umbrella review summarised evidence for components of effective interventions to optimise older people's nutritional status in hospitals and LTC. An *interprofessional food promoting culture*, including *staff training* as part of a *multicomponent measure*, has shown to be a successful element in implementing the standardised NIC intervention components: *patients' assistance*, *patients' instruction*, *foodservice*, *environment for meals* and *nutrient-dense snacks*. Effective interventions contributing to the SNL of NIC are imminent to reach positive patient outcomes and communicate in the intra- and interprofessional team successfully [59]. Recent research has shown that nurses need to be well-educated in the use of SNL. If they reach an understanding of SNL and its utilisation, they perceive positive patient outcomes by its

TABLE 6 Presentation of components of effective interventions

Optimise nutrition in older people in hospitals or LTC

Component	First author/year	No of reviews	Details of intervention	Aggregated finding: is this intervention effective and suggested?
Patients' assistance	1) Abbott/2013 2) Edwards/2016 3) Liu Galik/2015 4) Liu& Cheon, Thomas/2014	4	1) Provision of mealtime assistance: positive reinforcement, correct positioning 2) Support by volunteers, socialising, verbal encouragement 3) Verbal motivation 4) Mealtime assistance, between-meal snack delivery	1) ↑ Weight 2) Qualitative statements: positive effects of mealtime experience on staff and patients 3) ↑ functional ability and independence, longer assistance time 4) ↑ weight, ↑ energy intake, ↑ assistance time
Patients' instruction	1) Beck/2016 2) Herke/2018 3) Liu Galik/2015 4) Rasmussen/2018 5) Vucea/2014	5	1) Counselling by a dietician or delivering ONS 2) Education and nutrition program for people with dementia 3) Montessori-based activities, or spaced retrieval (learning by repeating) 4) Counselling by nurse or dietician 5) Montessori-based activities	1) ↑ energy intake and ↑ protein intake but: higher mortality and hospitalisation 2) Low evidence, unsure 3) ↑ self-feeding, less anxiety 4) Probable positive effect on the quality of life, reduced the readmission rate 5) ↑ self-feeding, less eating difficulty
Foodservice	1) Abbott/2013 2) Vucea/2014	2	1) Provision of snacks, more choice 2) Bulk-/restaurant-style foodservice (more choice)	1) ↑ weight, ↑ energy-intake, weak evidence 2) ↑ mealtime experience
Environment for meals	1) Abbott/2013 2) Herke/2018 3) Hugo/2018 4) Liu Galik/2015 5) Liu& Cheon, Thomas/2014 6) Vucea/2014	6	1) Enhancing ambiance, family-style meals 2) Encouragement, positive ambiance by research staff 3) Fish aquarium in the dining area of the dementia care unit 4) Light, enhanced contrast on table settings, red coloured plates 5) High-contrast tableware, no mealtime disturbances 6) Music, light, home-like furniture, high-contrast tableware	1) ↑ weight & ↑ energy intake in single studies, no pooled effect 2) ↑ energy intake 3) ↑ food intake, ↑ cost-effectiveness 4) ↑ energy intake less anxiety 5) Food and energy intake 6) ↑ energy intake, less agitation
Nutrient-dense snacks	1) Abbott/2013 2) Beck/2016 3) Correa/2019 4) Herke/2018 5) Hugo/2018 6) Liu, Cheon, Thomas/2014 7) Mills/2018 8) Morilla-Herrera/2016	8	1) Mono-sodium glutamate -based food flavours to meal or to protein part 1) Snacks 2&3&5&6) Oral nutrition supplements (ONS) 4) Between-meal snacks 7) Food fortification and supplementation 8) Enrichment (more volume = more calories), or densification (more calories in a smaller volume)	1) No sig. diff. for mono-sodium glutamate intervention ↑BMI, ↑ weight with snacks 2) ↑ energy intake and ↑ protein intake 4) ↑ energy intake 7) ↑ energy intake and ↑ protein intake 8) ↑ energy intake and ↑ protein intake

(Continues)

TABLE 6 (Continued)

Optimise nutrition in older people in hospitals or LTC

Component	First author/year	No of reviews	Details of intervention	Aggregated finding: is this intervention effective and suggested?
Staff training	1) Abbott/2013 2) Herke/2018 3) Liu, Galik/2015 4) Liu, Cheon, Thomas/2014 5) Vucea/2014	5	1) Education + discussion groups, 4-38h depending on the study 2) Training on how to give vocal and tactile feedback 3) Feeding skills training program 4) Feeding skills training, nutrition education for caregivers 5) Education about promoting individualised care, eating assistance, volunteers - instruction	1) ↑ Unclear, no meta-analyses, some ↑ nutritional status 2) ↓ food intake 3) ↑ attitude towards feeding, ↑ eating time, 4) ↑ knowledge, ↑ attitude towards older people, ↑ eating time 5) ↑ weight, ↑ self-care abilities
Multi-component measure	1) Correa/2019 2) Herke/2018 3) Liu, Galik/2015 4) Liu, Cheon, Thomas/2014 5) Rasmussen/2018 6) Wright/2018	6	1) ONS + counselling 2) Education and nutrition promotion 3) Family-style meal + staff training 4) Feeding assistance + music + change of routines 5) Counselling + food enrichment + snacks between meals 6) ONS + exercise	1) ↑ MNA score (improvement), ↑ hand-grip strength 2) ↑ protein ↓ MNA 3) ↑ communication, ↑ food intake 4) ↑ energy intake, ↑ weight 5) ↑ food intake 6) ↑ muscle strength, ↑ gait speed, unclear effect on quality of life and nutritional status
Interprofessional food promoting culture	1) Edwards/2016 2) Rasmussen/2018	2	1) &2) Multidisciplinary approach for foodservice to identify barriers at mealtimes 2) Close collaboration	1) Mealtime became a high priority 2) ↑ quality of life, no sig. difference in mortality, low evidence

↑ Improvement, enhancement due to the intervention; ↓ reduction; all the synthesized interventions were effective in one or more outcomes, and are suggested to be considered.

use [60]. Communicating professional nursing practice interventions to other nurses and other health care team members requires SNL to improve patient outcomes [61]. On the other hand, a synthesis of *fundamentals of care* described a low quality of studies and difficulties in comparing various effects if an SNL is missing [62].

The component *patients' assistance* led to improvements in energy intake, functional ability, eating performance, social interaction and weight gain, to give an example [13, 47, 49]. Another vital component is *nutrient-dense snacks*. This component was synthesised from eight out of 13 reviews. Nutrient-dense snacks were successfully delivered in protein supplementation, enriched soups or any kind of between-meal snacks [14, 54]. There was no funding by the food industry in included studies investigating the effects of oral nutrition supplements. As older people are commonly at risk of protein-energy malnutrition due to lack of appetite and ageing itself, assessing patients' weight regularly and increase protein intake in nutritional risks has been strongly suggested by different nutrition associations [1, 63]. The repeatedly observed fact that too little importance and attention is given to older people's nutrition in hospitals and LTC [19] was answered in two reviews and was subsumed under the component *interprofessional food promoting culture* [49, 52]. This umbrella review's findings indicate that not one single task, but the described components' combination leads to positive effects. Consequently, optimising nutrition in older people in hospitals or LTC needs to rely on an *interprofessional food promoting culture*.

Interprofessional food promoting culture could entail malnutrition screening and early involvement of dieticians, and a fast start with oral nutrition supplements. The effects of such interventions were investigated in two systematic reviews focusing on adult hospitalised patients [64, 65]. Besides these quantitative interventional studies, qualitative studies could reveal facilitating factors, as well as challenges of implementing nutritional interventions in hospitals and LTC. Organisational and staff support, resident agency, mealtime culture, meal quality and enjoyment were the main themes of nursing home residents' experiences [66]. Nevertheless, the patients' relatives and the care team's perspectives and experiences were missing in our synthesis. Some of the included reviews took patients' quality of life into account, whereas one qualitative study pointed at patients' unmet need for getting the proper diet and consistency of food [18]. In future research, more consideration is needed for older people's experiences.

Applicability and transferability

Applicability and transferability can be assumed for the SNL components of effective NIC interventions to optimise older people's nutrition [26]. One reason is the high number of primary studies and the increasing number of systematic reviews highlighting different nutrition aspects in older people. This statement is strengthened because the effective interventions were synthesised from other Asian and Western countries with patients in hospitals and LTC. Besides, these components might be valid and applicable in various contexts as they could be adapted to other populations (any adults) or different settings (such as community care).

Theoretical implications

The summarised components can be adapted to any context and tested as a complex effective nursing intervention in future evidence-based research projects. The high prevalence of malnutrition, existing knowledge on how to treat it, and the lack of implementation of such necessary interventions have been summarised [67]. Thus, further expert validation of these intervention components is highly recommended.

Practical implications

By continuously assessing older people's needs and context-specific nutrition processes, careful implementation of *multicomponent measures* can improve older people's nutritional status in hospitals and LTC. Our umbrella review stresses the urge to change practice and to develop an *interprofessional food promoting culture*.

Implications for practice and policy include the argument of cost-effectiveness, which was investigated in several studies. Even if the prices for oral nutrition supplements increased treatment costs, the total healthcare expenditures per patient decreased due to diminished readmission rates [68].

Strengths and limitations

Our umbrella review's significant strength is the level of evidence due to publications' syntheses, incorporating randomised controlled trials, which enabled the authors to include various approaches. The findings provide a broad picture of valid components for nutrition-improving interventions in older people in hospitals and LTC. Another strength was the best-practice procedure. All authors debated and agreed upon effective interventions' main components, supported by this umbrella review's findings.

As for any umbrella review, we only included interventions that were already synthesised. Other desirable nutrition interventions were not reported, and probably relevant details were omitted. The authors did not pay particular attention to food literacy, which could be a weakness. Still, *patients'*

instruction has been one part of the NIC intervention *Nutrition Management* and might enhance food literacy. The literature search was restricted to studies published in English and German. Therefore, research findings published in other languages were missed. However, as English is the primary language of science, especially for systematic reviews, and as we identified and included studies from a broad range of countries, we assume that the relevant study findings have been summarised.

CONCLUSION

As synthesised by this umbrella review, effective interventions are *patients' assistance*, *patients' instruction*, *food-service*, *environment for meals* and *nutrient-dense snacks*. *Multi-component measures* and interventions targeting an *interprofessional food promoting culture* are convincing. This review provides an overarching summary to inform and sensitise healthcare students on effective, standardised NIC components of nutrition-improving interventions. Further research is needed to test the feasibility and implementation of these components in specific hospital care contexts.

CONFLICT OF INTEREST
All authors declare no conflict of interest.

AUTHORS' CONTRIBUTION
The authors declare that they agree to be accountable for all aspects of the study titled **Interventions to optimise nutrition in older people in hospitals and long-term care: Umbrella review** that aims to be published in the *Scandinavian Journal of Caring Sciences*.

The authors ensure that questions related to any part of the work's accuracy or integrity are appropriately investigated and resolved. Each author has participated sufficiently in the umbrella review to take public responsibility for appropriate portions of the content. They confirm to have given final approval of the version to be published.

Silvia BRUNNER[1,2,] MScN, RN, as the first author, has made substantial contributions to conception and design, including analysis and interpretation of data. She conducted the whole writing and intern revising process.

Hanna MAYER[2,*] Univ. Prof. Dr., RN, as a supervisor, has been involved in conception and design and drafted the manuscript and revised it critically for important intellectual content.

Hong QIN[2] doctoral student has made substantial contributions to conception and design. She elaborated on the search strategy (as the second reviewer), including the search terms and search strings. She participated in the discussion for the method and critically discussed the aggregation of interventions to components.

Matthias BREIDERT[1,3] PD, Dr. med. substantially contributed to the interpretation of data and revised the manuscript.

Michael DIETRICH[1,4] PD, Dr. med. substantially contributed to the interpretation of data and revised the manuscript.

Maria MÜLLER-STAUB[5,‡] Prof. Dr. MNS substantially contributed to conception and design. She double-checked the critical appraisal with the risk of bias tool. In addition, she substantially contributed to the interpretation and aggregation of data and critically revised the manuscript.

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SUPPORTING INFORMATION

Additional Supporting Information may be found online in the Supporting Information section.