

Nutrition education for elders and their caregivers for nourishment restoration: a systematic review

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ABSTRACT

Introduction: Nutrition education for carers and elders seems effective in improving health and malnutrition, though evidence is limited. This review aims to assess its impact on malnutrition and quality of life for both groups.

Material and Methods: A systematic literature search was conducted across three databases (Scopus, PubMed, Google Scholar). Studies in Greek or English published in the last 20 years were selected. Inclusion criteria focused on participants aged ≥ 65 years, at risk of or malnourished. The Registration Number is 216473013268.

Results: The initial search yielded 249 papers from PubMed and Scopus, and 12 from Google Scholar. After removing duplicates, 241 studies remained. The title, abstract, and participant criteria of each were checked, and studies not meeting the criteria were excluded. Ultimately, 9 studies remained. The search process is outlined in the PRISMA flowchart (Figure 1).

Conclusions: This review found that nutrition education has a dual effect, as it equips caregivers with the knowledge and skills to reduce malnutrition's impact on older adults and improve both caregivers' and elders' well-being.

Keywords: elders, malnutrition, caregivers, inadequate food intake, caregiver, nutrition, education.

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INTRODUCTION

Ageing is a condition associated with physical and emotional challenges for elder people, resulting in an increasing demand for carers (Moreira et al., 2018). Difficulty in eating is often recognized as a widespread issue among the elderly population, leading to issues such as weight reduction, inadequate dietary intake, suppression of the immune system which can enhance high vulnerability to diseases (Chang & Roberts, 2008). Malnutrition is described as «a condition resulting from insufficient food intake, which leads to changes in body composition such as reduced fat-free mass and cell mass, resulting in impaired physical and mental function, as well as clinical outcomes in the context of the disease» (Fernández-Barrés et al., 2017). It has been estimated that malnutrition currently affects more than 3 million people in the UK, with almost 1.3 million of those aged 65 years old and over living in community settings (Rea, Walters, & Avgerinou, 2019). The effects of malnutrition are manifold, including increased risk of falls, loss of autonomy, reduced quality of life, increased frequency of hospitalizations and presence of comorbidities and mortality (Fernández-Barrés et al., 2017). Among the elderly, malnutrition is a major challenge for the scientific society, especially for those elders diagnosed with dementia (Meyer, Gräse, Worch, & Wolf-Ostermann, 2015). Moreover, older people experience different levels of unmet nutritional requirements after leaving a healthcare facility and in combination with the inadequate educational resources for both patients and caregivers can lead to misconceptions, anxiety, fear, negative impact on health, and emotional disorders, including depression (Hestevik, Molin, Debesay, Bergland, & Bye, 2020; Hafsteinsdóttir, Vergunst, Lindeman, & Schuurmans, 2011). Furthermore, the lack of involvement of the elderly patient and family caregivers in care and planning processes, as well as insufficient support for self-management during discharge and subsequent home care, may have a negative impact on the quality of care provided (Hestevik, Molin, Debesay, Bergland, & Bye, 2020). The involvement of caregivers in the nutritional care team during rehabilitation offers a distinct opportunity to improve nutritional care and outcomes, since these interventions are tailored to the specific needs and preferences of patients, family members, or friends who provide most of the care (Marshall, Reidlinger, Young, & Isenring, 2016).

Taking into account all the changes that elders undergo due to ageing, they are more vulnerable to malnutrition and inadequate nutritional intake. Therefore, it is needed to provide both elders and their carers with personalized

nutritional education to prevent or treat the health burden of malnutrition; however, there is limited research on the effectiveness of nutrition education for both elders and their carers in improving health. Consequently, the aim of this systematic review is to evaluate the effects of nutrition education on treating malnutrition and improving the quality of life for both elderly individuals and their carers.

MATERIAL AND METHODS

Search strategy

The searches in the international literature were performed using the following keywords: malnourished patients, ageing, elders, caregivers, caregiver training, caregiver training program, malnutrition, insufficient food intake, using electronic databases such as Scopus, PubMed, Google Scholar. Moreover, the protocol that was followed for this systematic review was the PRISMA 2020 checklist and the Registration Number 216473013268. The search process for articles about training caregivers in malnourished patients yielded 249 papers from PubMed and Scopus and 12 from Google Scholar. After removing the duplicates ($n=20$) and remained 241 articles, the title, abstract and participants' criteria were checked for key words, for each study. The results of this process were to remain 190 articles of which 29 were excluded due to supplements consumption. Secondly, a full screening of articles was done by two reviewers – authors, independently, so as to confirm the relevance with the content of this systematic review. Lastly, only 9 of those matched with the criteria concerning population and intervention process and were selected to present in this study. Additionally, it should be underlined that any doubts or clarifications or miss elections were solved via discussion among the two authors-reviewers. Lastly, it should be mentioned that none changes were made to the study protocol or registration information after the study began. It should be highlighted that the review of the bibliography was carried out until November 2023.

Selection Criteria

In order to prevent the existence of heterogeneity and miss election of articles from bibliography, specific criteria for the selection or the exclusion of articles were implemented and are analyzed below. Inclusion criteria included: 1) participation of caregivers in the nutritional training program was observed 2) elder's participants' age was ≥ 65 years old 3) relative score of malnutrition (Mini Nutritional Assessment) ranged between 17-23.5 points, which is an indicator of the risk of malnutrition. 4) elderly participants who had difficulties performing daily

living activities and therefore needed to have a caregiver 5) studies that were published in the last 20 years.

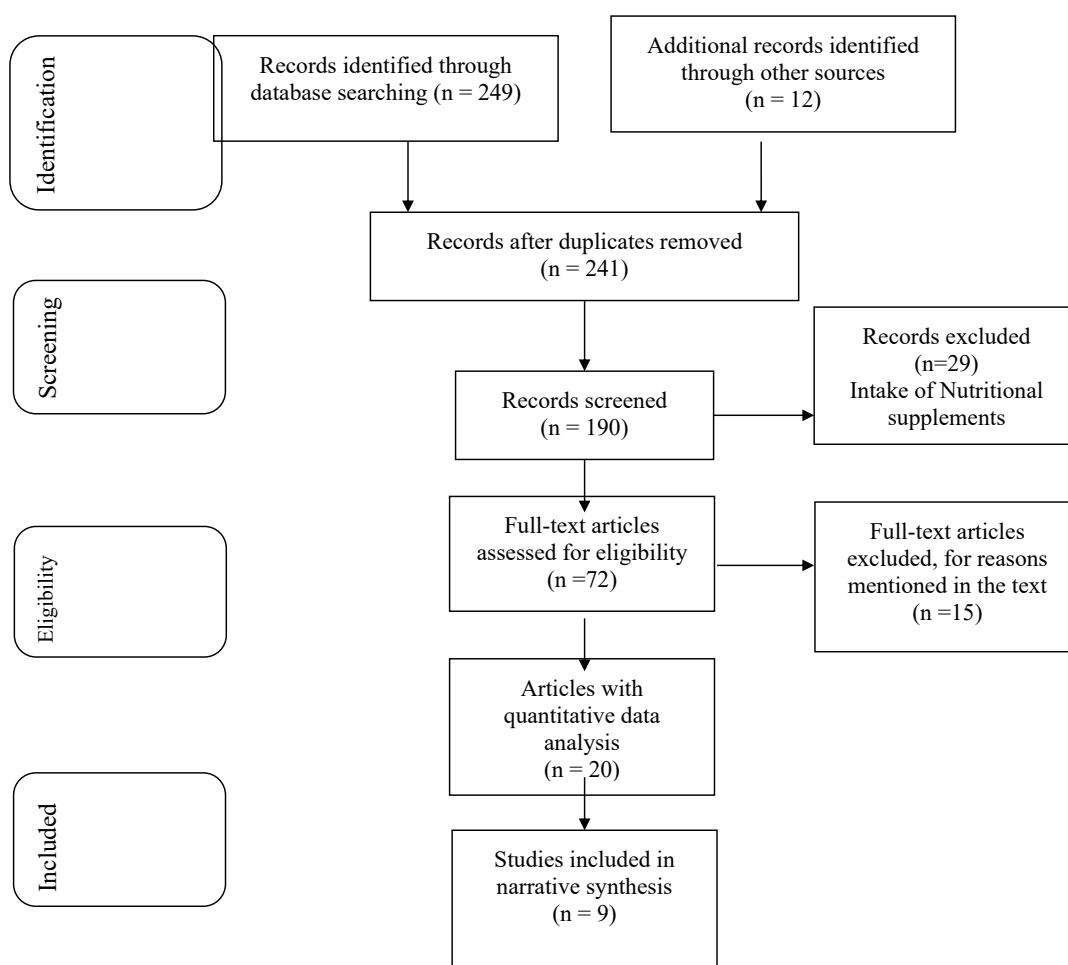
Studies were excluded if: 1) the score of the Mini Nutrition Assessment was outside the range of 17-23.5 points, since scoring under 17 points it indicates pre-existing, established malnutrition, whereas when the score is above 24 points, the elder is adequate nourished 2) cases where technical feeding was necessary, they were excluded 3) Studies included incidents suffering from severe swallowing disorders 4) any serious illness that progresses to malnutrition (e.g. cancer) 5) cases consuming vitamins and/or dietary supplements were involved in the study.

Data Synthesis

The data synthesis was carried out as follows: In the

first stage 261 titles and abstracts were found in the searches. After the first screening, the abstract was read for those papers which passed it and remained 190. Then, full-text was screened, for the articles that met the abstract's criteria. After completed all this procedure, the 9 articles that remain were chosen for this systematic review. Lastly, it must be mentioned that for the needs of this systematic review, only a narrative synthesis was carried out concerning the effects of elders' caregiver's educational interventions in the nutritional status, physical activity level and quality of life of older people. The reason of selecting a narrative - descriptive synthesis instead of conducting a meta-analysis was the high heterogeneity of the studies that made this accomplishment difficult. Figure 1 is the PRISMA flowchart showing the study selection process and the reasons for excluding articles.

Figure 1. PRISMA flowchart



Risk of bias

Studies that have high risk of bias can mislead the results of this systematic review. Firstly, in Chang et al. study as a risk bias can be considered that it includes small sample size, there is lack of a control group, there is short duration of the intervention and there is a possibility of not selecting all the eligible articles (Chang & Roberts, 2008). In Hestevik et al. qualitative study, the researchers are not sure about the validity of elders' responses (Hestevik, Molin, Debesay, Bergland, & Bye, 2020). Also, the WGQual study was funded by the German Federal Ministry of Education and Research as part of the funding line SILQUA-FH - Social innovation for the quality of life of older people. Additionally, another risk of bias in this research is that the number of caregiver participants was too small and inadequate in order to draw conclusions that can be generalized to the geriatric population (Marshall, Reidlinger, Young, & Isenring, 2016). The Rea, et al., 2018, systematic review refers that there is suspicion for the occurrence of risk

of bias concerning random sequence generation, in the allocation of participants, in the intentional report of some data and results and in incomplete outcomes (Rea, Walters, & Avgerinou, 2019). Subsequently, another study was funded by the Alzheimer's Society of Canada and the Université de Montréal and the authors state that there are no conflicts of interest (Silva, Kergoat, & Shatenstein, 2012).

RESULTS

Description of included studies

In most of the studies participated elderly people at risk of malnutrition or with established malnutrition along with their caregivers. The main goal was to evaluate the effectiveness of providing information concerning healthy nutrition, eating habits and physical activity, in elders' and their carers' well-being. The characteristics and results from all studies are presented in detail, in the above-mentioned Table 1.

Table 1. Description of the studies and interventions included in the review

Article	Study design	Sample characteristics & country	Intervention & duration	Assessment of malnutrition -other measures	Findings
Chang, 2008	Systematic review	71 articles, focusing on older adults with dementia experiencing feeding difficulties.	The study reviewed various interventions, including verbal cuing, music therapy, environmental modifications, and caregiver training. Duration varied across studies.	Tools like the Edinburgh Feeding Evaluation in Dementia (EdFED) scale and Eating Behaviour Scale (EBS) were used to assess feeding difficulties, nutritional intake, and caregiver burden.	Identification of the characteristics of feeding difficulty, its antecedents and consequences. The study developed a conceptual model of feeding difficulty to guide future research and evidence-based practice in the assessment and management of eating difficulties in older adults with dementia.
Fernández-Barrés, 2017	Randomised Control Trial (RCT)	10 Primary Care Centers in Spain of which 173 patients participated in the Home Care Program who were dependent and at risk of malnutrition (average score of 25.4 ± 3.7 points), older than 65, and had caregivers (intervention n = 101; control n = 72). - Mean age was 87.8 ± 8.9 years, 68.2% were women. Difference were found between the groups for Mini Nutritional Assessment test score change (repeated measures ANOVA, $F = 10.1$; $P < 0.001$).	- Intervention: 6 months Follow up: 12 months. All the measures were recorded in a schedule of 0–6–12 months. The nurses conducted initial educational intervention sessions for caregivers. - The nurses of the Home Care Program-ATDOM conducted an individual session and a 1-hour group session among several caregivers and further individual dietary monitoring of the patient in the presence of his caregiver. - Control group: visited once to complete an initial assessment and received regular Home Care visits, and the study-specific 6 months and 12 months visits.	- Nutritional status was assessed using the Mini Nutritional Assessment test (primary outcome), diet, anthropometry and biochemical parameters (albumin, prealbumin, hemoglobin and cholesterol) - Outcome measures: current medical history, Activities of daily living (Barthel test), cognitive state (Pfeiffer test), and mood status (Yesavage test)	- 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. - Nutrition education program for caregivers prevented the progression of nutritional decline and lowered the risk of malnutrition in dependent elders.

Hafsteinsdóttir, 2011	Systematic review	21 cross-sectional or descriptive studies 15 quantitative studies, 5 qualitative studies and 2 used a combination of both designs. - Studies focused on the needs of patients, while 9 studies on the needs of caregivers and seven focused on the needs of both patients and caregivers. 6 studies were conducted in the UK, 5 in the USA, 3 in the Netherlands, 1 in Germany, 3 in Australia, 2 in South Korea, 1 in Hong Kong and 1 in New Zealand. - Sample: 1029 stroke patients, 749 caregivers	Duration varied across studies.	It does not specify the exact tools used to assess malnutrition.	- Educational needs of stroke patients and caregivers were about the clinical aspects of stroke, prevention, treatment and functional recovery. - The most commonly reported educational needs of caregivers involved patients' moving and lifting, exercises, psychological changes and nutritional challenges. - Patients and caregivers wanted information concerning their situation.
Hestevik, 2020	Qualitative study	- They interviewed face-to-face 15 older patients with malnutrition or malnourishment, two and five weeks after hospital discharge and nine family caregivers once during this period, in Norway. - Sample: The were 10 women and 5 men elders aged 74–97 years (mean age: 85 years) and among the caregivers there were 6 women and 3 men, which were the patients' spouses, children and grandchildren and were aged 52–86 years (mean age: 65 years).	33 semi-structured face-to-face interviews (25–90 minutes duration) with 15 older patients and 9 of their family members.	MNA	- The study found that nutritional care at home often lacks personalization. Participants reported problems related to communication and joint decision-making in the process of nutritional care. - The study concluded that the organization of nutritional care and the provision of food to the elderly and joint decision-making in the process of nutritional care.
Marshall, 2017	Longitudinal qualitative investigation	4 Australian female family carers of malnourished rehabilitation patients aged ≥65 years at risk of malnutrition were interviewed	Semi-structure, audiotaped interviews during their care-recipients' rehabilitation admission and again at 2 weeks post-discharge	MNA	- This guide was related to the recognition and support of family caregivers of malnourished patients, which can lead to improved perceived benefit of care and patient outcomes. - The study identified three key drivers: (1) the sense of responsibility of family carers in providing nutrition support, (2) the carers' personal beliefs and knowledge impacting their nutrition approach, and (3) the focus on improving the patient's quality of life, all of which influence carers' burden and patient outcomes in the context of malnutrition rehabilitation.

Meyer, 2015	Longitudinal study	Conducted in Germany, the study included 45 residents (mean age: 78.4 years, 73.3% female) from shared-housing arrangements (SHA) in Berlin, with 88.9% diagnosed with dementia.	One-year observation of nutritional status.	- Malnutrition: Mini Nutritional Assessment (MNA) - Cognitive Capacity: Mini Mental State Examination (MMSE) - Daily Living Activities: Extended Barthel Index (EBI)	80.6% of participants were at risk of malnutrition at baseline. - The average MNA score declined over one year (from 20.8 to 19.7). - Malnutrition was linked to lower survival rates. - Regular nutritional screenings and flexible care structures in shared-housing arrangements are recommended to prevent malnutrition.
Moreira, 2018	Quasi-experimental study	- Conducted in Sobral, Ceará, Brazil. - Final Sample: 34 caregivers completed the intervention and evaluation. 47.82 years (range: 18–77). 85.4% were women. 68.3% were unemployed. 82.9% were unpaid caregivers. 56.1% were children of the older adults. 75.6% lived with the older adult	- Data collected from February to July 2015 - Intervention: Educational sessions for caregivers focused on improving knowledge, attitude, and practice (KAP) in caregiving. - Duration: 4-hour session with discussions, educational videos, simulations, and written guidelines. - Topics Covered: Relationship between caregiver and older adult / Feeding / Bathing and hygiene / Mobility and transportation	Main Assessment Tool: Knowledge, Attitude, and Practice (KAP) survey, developed by specialists.	- Statistically Significant Improvements in KAP Scores: Feeding: Knowledge ($p<0.001$), practice ($p=0.003$). Bathing & Hygiene: Knowledge ($p<0.001$), practice ($p<0.001$). - Mobility & Transportation: Knowledge ($p<0.001$), attitude ($p<0.001$), practice ($p<0.001$). - Attitude Improvement: Significant in caregiver-older adult relationship ($p=0.020$) and mobility ($p=0.001$). - Practice Improvement: Statistically significant in all caregiving domains. - High caregiver burden due to long care hours (average 19.56 hours/day).
Silva, 2013	Quasi-experimental pre-post nutritional intervention study	- Conducted at the Centre de recherche de the Institut Universitaire de Gériatrie de Montréal, Canada 33 caregiver-patient in the intervention group. 30 caregiver-patient dyads in the control group. 24 caregivers from the intervention group were interviewed for qualitative analysis. 58% of caregivers were aged 70 or older - Patients aged 70 or older.	- Duration: 6 months. - Group 1 (Intervention): Received individualized nutritional support from a dietitian. Intervention methods included personalized counseling, written materials, dietary recommendations, and follow-up sessions. - Group 2 (Control): Received regular healthcare.	- Zarit Burden Interview (ZBI): Assessed caregiver burden. Semi-structured Interviews: Collected qualitative data on dietary challenges, changes in food preferences, feeding difficulties, and coping strategies. - Nutritional Assessment: Evaluated patient dietary intake, including protein, calcium, vitamin D, vegetables, legumes, and fish consumption.	- Dietary Challenges: Changes in food preferences (50% of patients). Decreased food intake (46%) and appetite (29%). Increased dependency on caregivers for eating (63%). Forgetting meals (29%). - Caregivers' Coping Strategies: Motivating patients verbally. Preparing meals in advance. Using reminders (calls, written instructions). Monitoring food intake and meal safety.
Rea, 2019	Systematic review of randomized controlled trials (RCTs) and quasi-experimental studies	Included 8 studies with 772 participants from the U.S., Sweden, Canada, Spain, Finland, and Denmark. Participants were community-dwelling older adults (≥ 60 years), mostly at risk of malnutrition.	Nutrition education interventions varied in format (written materials, face-to-face, telephone, group sessions). Duration ranged from 3 weeks to 6 months.	Used tools like Mini Nutritional Assessment (MNA), self-reported dietary intake, and weight measurements. Other outcomes included physical performance, hospital readmission, and quality of life.	Some evidence suggested improvements in nutritional risk, dietary intake, and reduced hospital readmission. However, the overall quality of studies was low, with mixed results.

Specifically, Silva, et al., 2013 conducted a study which included 33 caregivers of patients with dementia in a non-institutional setting, based in Canada. They performed individual interviews via telephone calls, for a six-month period and they collected data which were analyzed for this qualitative study, highlighting issues related to dietary practices faced by caregivers. In this study, caregivers of elders with Alzheimer disease, had being interviewed about changes in food preference and reduce energy intake are commonly observed in patients with dementia (Silva, Kergoat, & Shatenstein, 2012). In one-year study that took place in Australia, Marshall et al., carried out interviews with female caregivers of malnourished elders at rehabilitation state, which were conducted in two phases one during the rehabilitation admission and the other one 2-weeks after. Furthermore, the aim of this study was to assess nutritional status, cognitive abilities, daily living activities, sociodemographic characteristics and supporting information needed, concerning nutrition in geriatrics (Marshall, Reidlinger, Young, & Isenring, 2016). Additionally, Hafsteinsdottir, et al., 2011 systematic review consists of articles from different countries and its main goal is to analyze the type of educational needs that caregivers have especially when they take care of patients with stroke. The sample included 1029 patients with stroke and 749 caregivers from South Korea, Australia, United Kingdom and New Zealand (Hafsteinsdóttir, Vergunst, Lindeman, & Schuurmans, 2011). Chang et al., study is a systematic review with primary objective the analysis and synthesis of the existing bibliography concerning conceptual feeding difficulty model in older adults with dementia (Chang & Roberts, 2008). In a qualitative study, that was performed in Norway, 2020, Hestevik's et al., mentions psychological and physical factors that lead elders to malnutrition. In this study, participated 15 elders with a score in MNA, that listed them at risk of malnutrition. Moreover, it should be mentioned that not all elders had carers, so the final sample of caregivers was consisted of 9 people. The duration of this study was 5 weeks in which carers were interviewed about their perception concerning hospitals' meals, home-made meals and their thoughts and concerns about the transition from hospitalization to taking care elders alone at home (Hestevik, Molin, Debesay, Bergland, & Bye, 2020). In Meyer S et al., 2015, study took place in Germany, for 2 years. This study, at baseline had 45 participants in 28 share-housing arrangements and most of them were women with dementia. They used MNA to assess the nutritional status and others indexes to screen the cognitive and activity status of elders. The main goal of this study was to observe the changes in elders nutritional status, who live in share-

housing arrangement, within a year (Meyer, Gräske, Worch, & Wolf-Ostermann, 2015). In Rea, et al., 2019 systematic review, the mean age of the sample was above the 60 years old and it included only randomized clinical trials (RCTs). All the RCTs comprised 772 participants with some being the malnourished older people and the others being their caregivers. The RCTs were carried out mostly in European countries including Sweden, Denmark, Finland, Spain and a non - European country, Canada. The follow - up period for each RCT range from 1 month to 1 year and the way of dietary counseling was via telephone calls in some RCTs, by post in others or face-to-face individually or in groups for some others. The purpose of this systematic review was to find whether the nutritional education of caregivers could improve the nutritional status and quality of life in both elders and their caregivers (Rea, Walters, & Avgerinou, 2019). In Moreira, et al., 2018, experimental study, there was 82 carers involved in the first stage. At the following two stages only 34 people, in each phase, participated. At the first phase, nurses and researchers interviewed caregivers so as to collect data concerning their knowledge about elders' hygiene, nutritional and feeding needs, mobility and what they do in everyday practice so as to provide them in older people. The second stage, in group educational sessions that lasted 4 hours, instructed by nurses, they tried to provide caregivers information about elders' feeding, bathing, hygiene, mobility and transportation. They gave and written recommendations so as to facilitate the process. In the last phase, they performed interviews similar with those in the first stage so as to confirm the effectiveness of the educational intervention in caregivers (Moreira et al., 2018). Fernández-Barrés et al., is a multicenter randomized clinical trial that took place in Spain, 2017 consisted of 190 elders with caregivers participated in a six-month intervention and a twelve - month follow up. The sample in clinical trial was allocated in the intervention and control group randomly. The allocation ratio was 3:2 with more participants in the intervention group. The nurses that participated in the intervention group performed an individual session to inform caregivers about the causes and consequences of elders' malnutrition. Afterwards, they provided group educational sessions, lasting 1 hour, so as to give general recommendations about foods' composition in macro- and micronutrients, protein consumption, vitamins needs in elders and information about cooking techniques. It must be mentioned that they use MNA to screen elders that are at risk of malnutrition and they performed anthropometry biochemical test and food frequency questionnaire for the consumption of foods. On the other hand, the control group did not receive any nutritional support. Lastly, the main

purpose of this RCT was to confirm statistically the effect of caregivers' educational support in elders' nutritional status (Fernández-Barrés et al., 2017).

Nutritional knowledge and other nutrition-related effects

Chang et al., study presents that among the difficulties that an elder with dementia has there are included lack of motor and impairment in the cognitive system. All these lead to unrecognition of foods and eating tools, hardness of using these tools and difficulties in swallowing and chewing. All these result in reducing the ability of self-eating which affects their feeling of independence, their energy intake, increase risk of malnutrition and even increase the probability of choking or pneumonia aspiration. It refers, that caregivers and family members should be informed about these impairments of the dementia disease and be able to recognize them and take them into consideration when try to feed older people with dementia. Specifically, in case the elder can chew they should distinguish whether the elder needs someone to feed him or needs physical assistance or verbal cuing so as to eat. Moreover, refers that listening to music during meal time can reduce elders' resistance to eat their meals and might have a positive impact on increase their energy intake. Furthermore, it insists caregivers to create a friendly and family environment during the meal time and let elders try to eat alone, enhancing their feeling of independence. This study, includes Conye & Hoskins, 2017 study that was performed so as to analyze elders and caregivers feeding behaviours and concludes that their outcomes about improving both groups their eating behaviours via the use of behavioral strategies, is extremely important (Chang & Roberts, 2008). In this systematic review, stroke patients at the rehabilitation stage referred that there are questions about side effects of medication, the type of their stroke and ways to manage symptoms such as pain and loss of taste. Moreover, this study included researches about the educational needs of stroke patients' caregivers and found that many had questions about physical care, moving, nutritional matters, adequate energy intake and suitability of specific foods concerning swallowing safety. Concerning patients and caregivers, found that both of them have nutritional deficiencies as a consequence of lacking nutritional knowledge. Additionally, suggests that nurses should focus more on giving nutritional information in patients and caregivers so as to prevent malnutrition in both groups. Lastly, lack of caregivers education concerning moving and lifting elders leads to caregivers' injuries. Injuries along with nutritional issues result in poor quality of life for caregivers (Fernández-Barrés et al., 2017). In Silva 2013 study, caregivers were interviewed referred for elders

with Alzheimer and their changes in food preference and reduce energy intake. Moreover, in this experimental study for nutritional support, caregivers mentioned an increase in protein intake, foods rich in Vitamin D and calcium, fruits, vegetables and fishes due to the nutritional information that experts gave them. Concerning only caregivers' educational intervention, they reported that there was an increase in their awareness of high - quality and adequate eating benefits for their health. Also, caregivers reported that the nutritional information helped them be more confident with the selection and preparation of foods for patients with Alzheimer (Silva, Kergoat, & Shatenstein, 2012). At the one - year follow up study that was conducted in elders with dementia living in shared - house arrangements, the results indicates that their accommodation in these social structures, decrease the prevalence of adequate nutritional status and respectively increase the risk of malnutrition. According to the article, some explanations for this are that most of the participants had dementia which is a factor affecting nutritional intake via changes in food preferences and motor difficulties. So, it is suggested that caregivers and nurses should be informed about dementia's effects on nutritional status and should be educated to face them (Meyer, Gräske, Worch, & Wolf-Ostermann, 2015). In an RCT, concerning home care nutritional intervention in caregivers and patients, the results for the intervention group was increase in eggs, fruits consumption, protein, micronutrients, polyunsaturated fatty acids, folate and Vitamin E intake. Furthermore, at 6 - month follow - up the intervention group had a 9% prevalence of malnutrition whereas the control group had 22.6% malnourished elders. At 12 - month follow - up the prevalence of malnutrition in the intervention group was 4.8% while the control group was 35.4%, almost seven - fold higher. Regarding the educational effects of this intervention, the intervention group had improved his nutritional awareness by 1.5 points, according to the questionnaire they gave them. The numbers, confirm that educational intervention in caregivers improve nutritional status of elders and knowledge about nutritional issues in older people (Fernández-Barrés et al., 2017). In addition, the outcomes of Marshall et al., descriptive study, was that nutritional education of elders' carers enhancing the improvement in both carers' and elders' nutrition without an increase in stress and pressure that caregivers' feel, as the result of being responsible for nursing elders (Marshall, Reidlinger, Young, & Isenring, 2016). Moreover, Chang et al., educational intervention in carers, led to improvement in their knowledge concerning bathing, hygiene, mobility, lifting and feeding older people. At the end of this program, the knowledge of caregivers about these matters had raised.

The increase in carers' information about nursing elders' not only are important so as to improve elders' nutrition but also to facilitate the life of older people and secondly the caregivers' everyday life (Moreira et al., 2018). Outcomes from Rea's et al. systematic review showed that the nutritional training of carers reduced the risk of malnutrition in elder population of the sample. At the same time, nutritional counseling after hospital discharge reduced the likelihood of readmission (Rea, Walters, & Avgerinou, 2019). Hestevik's et al. descriptive study mentions psychological and physical factors that lead elders to malnutrition. Also, underlies the necessity to educate carers about the nutritional needs of older people, tailored to the particularities of each individual (Hestevik, Molin, Debesay, Bergland, & Bye, 2020).

Physical performance

The clinical trial, which took place in 2010 - 2012 and was a nutritional intervention program for carers, was the only study that assessed functional performance. The results showed no apparent effect in the intervention group since it maintained their baseline level of daily activities. Remarkable is the fact that the level of physical activity was slightly decreased in the control group (Fernández-Barrés et al., 2017). The data of Rea's et al. study were contradictory with those of the before-mentioned study, regarding the effect of nutrition education in improving the functional abilities of the elderly. In particular, the latter reported that the results were not particularly convincing and sufficient to prove a positive correlation (Rea, Walters, & Avgerinou, 2019).

Psychological effects

This systematic review, reports high prevalence of psychological issues in both patients with stroke and their caregivers. Although, from a meta-analysis, it is observed that there is a reduction in the severity of psychological symptoms when information and educational needs are given and answered (Hafsteinsdóttir, Vergunst, Lindeman, & Schuurmans, 2011). In Silva et al., nutritional intervention, carers referred that they were less stressed for the selection and preparation of foods so as to feed older people with Alzheimer. All this leads to reduction of psychological effects concerning the increased stress of caregivers about providing the suitable help for the elders that they take care of (Silva, Kergoat, & Shatenstein, 2012). In Marshall et al., qualitative study, women carers of older people mentioned that they feel extremely stressed since they have the whole responsibility for the nutritional care of their older relatives. Moreover, it was observed that wife carers felt less stressed for taking care of their older husband than their daughters

when they looked after their father. One explanation for this is the fact that wife carers think of taking care of their husband as an extension of their marital relationship (Marshall, Reidlinger, Young, & Isenring, 2016). In Rea's et al. systematic review about caregivers' nutrition education showed no effect in depression scores in the geriatric population measured by various indicators (Rea, Walters, & Avgerinou, 2019).

Quality of life

Regarding the improvement in general quality of life and well-being, Rea's et al. systematic review did not indicate any difference between the group that received information on the nutritional status of older people and the control group that received no education (Rea, Walters, & Avgerinou, 2019).

DISCUSSION

The following discussion examines the results of nine different research studies, each focusing on different aspects of nutrition, care and health of the elderly population. These studies offer valuable insights into the challenges faced by older people, particularly patients with dementia, stroke and malnutrition, and the caregivers who support them. Research covers a wide range of methodologies, from qualitative research to randomized controlled trials, contributing to the overall understanding not only of the anatomical and emotional changes that an elderly person undergoes but also the need to educate themselves and their caregivers in finding ways to cope with them. In particular, this study focuses on the significant feeding difficulties faced by older people with various comorbidities. Moreover, elders' feeding problems induce reduce energy intake resulting in malnutrition. Specifically, elders are a vulnerable population with high risk of malnutrition which is a matter of concern. Malnutrition in the geriatric population is an alarming phenomenon that seems to affect not only public health but also the global economy and the functioning of hospitals. For this reason, health professionals try to find the most effective solutions to face this global phenomenon. One solution that it has been analyzed in this systematic review is the attempt to provide nutrition training in both elders and their carers. The results from the included researches in this systematic review agree with those of other studies and RCTs. The outcomes highlight that education programmes for caregivers can raise awareness of the importance of older people's good nutrition (Volkert et al., 2019). Additionally, carers' training programs usually focus on imparting knowledge about nutrition, including the specific nutritional needs of the elderly population, key nutrients,

portion sizes and meal planning that are tailored to their loved one's health status which can help in the treatment of malnutrition [11, 12]. Also, these training programs can help in management of malnutrition's phenomenon by producing strategies to encourage the older person to eat and drink more efficiently. This could include creating a pleasant eating environment, helping during meals, and adapting feeding techniques for people with swallowing difficulties (Sauer, Li, Partridge, & Sulo, 2018). Lastly, when caregivers are better equipped with nutritional knowledge and caring skills, it is more possible to help elders increase their energy intake, treat or prevent malnutrition, enhance elders immune system and improve their general quality of life (Li et al., 2021). From another point of view, educational interventions can help caregivers recognize the signs of malnutrition in older adults. This early detection allows early intervention, preventing deterioration of their condition and possible hospitalizations (Muscaritoli et al., 2017). Last but not least, although this systematic review observed that nutrition training for carers can have positive effects only nutritional status further research should be carried out so as to confirm and effect in quality of life, physical activity level and psychological status in both elders and their carers.

Advantages and limitations

In general, systematic review is a powerful researching tool for reading several surveys with common themes but conflicting results and drawing conclusions based on literature review. However, this systematic review is based

on existing literature until February 2023 and therefore may not cover the most recent research findings. Furthermore, no digital tools were used during the review processes to confirm or facilitate the reviewers' choices. Additionally, this systematic review included limited range of studies, which can restrict the breadth of insights, applicability of the findings to broader contexts and generalizability of outcomes. Although, it is important to note that this systematic review is distinctive in its focus on nutrition education for older adults and their caregivers, an area in which research and systematic reviews remain limited.

CONCLUSION

In summary, these studies refer in the complex interactions between diet, care, and health in older adults. Also, they highlight the need for tailored interventions, education and support to address the unique challenges faced by this demographic group. The importance of holistic approaches to ensure the well-being and quality of life of the elderly population, especially those with special health conditions, as well as their carers has been underlined in this systematic review.

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