

Mini Nutritional Assessment (MNA) as an Evaluation Tool in Community-Dwelling Nutrition Interventions for Older Adults: A Scoping Review
(Penilaian Mini Pemakanan (MNA) sebagai Kaedah Penilaian dalam Intervensi Pemakanan Komuniti untuk Warga Emas: Kajian Skop)

Azli Baharudin^{1*}, Norsyamline Che Abdul Rahim^{2,1}, Khairul Hasnan Amali¹, Suhaila Abdul Ghaffar¹, Lalitha Palaniveloo¹, Lai Wai Kent¹, Mohd Shaiful Azlan Kassim¹, Ahmad Ali Zainuddin¹

¹Institute for Public Health, National Institutes of Health, Ministry of Health Malaysia, Kompleks Institut Kesihatan Negara (NIH), No. 1, Jalan Setia Murni U13/52, Seksyen U13, Bandar Setia Alam, 40170 Shah Alam, Selangor, Malaysia.

²Faculty of Hospitality, Tourism and Wellness, Universiti Malaysia Kelantan (UMK), City Campus, Pengkalan Chepa, 16100 Kota Bharu, Kelantan, Malaysia.

*Corresponding Author: Azli Baharudin
Email address: ps_azlibaharudin@moh.gov.my

Abstract

Older adults living in community settings are at increased risk of malnutrition due to factors such as chronic illness, functional decline, and social isolation. This scoping review aimed to map the types of nutritional interventions implemented to prevent and manage malnutrition among community-dwelling older adults and to identify outcome measures used to assess their effectiveness, including the Mini Nutritional Assessment (MNA). A scoping review was conducted following established methodological frameworks. Literature searches were conducted in the Web of Science, PubMed, and Ovid databases to identify English-language studies that described nutrition-related interventions targeting malnutrition among older adults living in community settings. Two reviewers independently screened the articles, and relevant data were extracted and narratively synthesized. A total of 4,000 records were identified, of which 12 studies met the inclusion criteria. The most commonly reported interventions included oral nutritional supplementation, personalized dietary counselling, nutrition education, and social support-based approaches. The MNA was frequently used as a primary or secondary outcome measure to assess nutritional status. This review highlights the diversity of community-based nutritional interventions for older adults and the widespread use of the MNA in evaluating nutritional outcomes. The findings provide an overview of existing evidence and may inform future research, intervention development, and policy initiatives aimed at enhancing the nutritional status of community-dwelling older adults.

Keywords: Community-dwelling, Malnutrition, Mini Nutritional Assessment, Nutritional interventions, Older adults

Abstrak

Warga emas yang tinggal di persekitaran komuniti berisiko tinggi mengalami kekurangan zat makanan disebabkan oleh faktor-faktor seperti penyakit kronik, penurunan fungsi, dan pengasingan sosial. Kajian skop ini bertujuan untuk memetakan jenis intervensi pemakanan yang dilaksanakan untuk mencegah dan mengurus kekurangan zat makanan dalam kalangan warga emas yang tinggal di komuniti serta mengenal pasti ukuran keberkesanan yang digunakan untuk menilai keberkesanannya, termasuk Mini Penilaian Pemakanan (MNA-Mini Nutritional Assessment). Satu tinjauan skop telah dijalankan mengikut rangka kerja metodologi yang telah ditetapkan. Carian dilakukan dalam pangkalan data Web of Science, PubMed, dan Ovid untuk mengenal pasti kajian yang menerangkan intervensi berkaitan pemakanan yang menyasarkan malnutrisi dalam kalangan warga emas yang tinggal di persekitaran komuniti. Dua penilai secara bebas menapis artikel-artikel tersebut, dan data yang berkaitan telah diekstrak dan disintesis secara naratif. Sebanyak 4,000 artikel telah dikenal pasti, daripada jumlah itu 12 kajian memenuhi kriteria. Intervensi yang paling kerap dilaporkan termasuk suplemen pemakanan secara oral, kaunseling diet secara individu, pendidikan pemakanan, dan sokongan sosial. MNA sering digunakan sebagai ukuran hasil utama atau sekunder untuk menilai status pemakanan. Ulasan ini menunjukkan kepelbagaian intervensi pemakanan berasaskan komuniti bagi warga emas serta penggunaan meluas MNA dalam penilaian hasil pemakanan. Penemuan kajian ini dapat menyokong perancangan penyelidikan, pembangunan intervensi, dan penggubalan dasar bagi meningkatkan status pemakanan warga emas yang tinggal di komuniti.

Kata kunci: Komuniti, Malpemakanan, Mini Penilaian Pemakanan, Intervensi pemakanan, Warga emas

INTRODUCTION

According to the United Nations, an individual of 60 years and older is regarded as an older adult (WHO 2002). The World Health Organization (WHO) has predicted that the global population of older adults will increase substantially by 2050 (WHO 2019). This is due to improvements in the quality of social, economic, and healthcare services, which have resulted in a significant increase in life expectancy and transformed the demographic profiles in countries worldwide (Khoddam et al. 2019). Consequently, countries globally (either developed or developing) will be faced with an increasing number of older adults (Jakovljevic et al. 2020; Ferraro 2006).

With increasing age, the prevalence of health-related issues such as reduced appetite, impaired physical function, oral health problems, and cognitive decline tends to rise (O’Keeffe et al. 2019; Féart et al. 2007; Volkert et al. 2019). These age-related changes contribute to an increased risk of malnutrition among older adults (Kadariya et al. 2019), which is defined as a state of poor nutritional status resulting from undernutrition or overnutrition and leading to adverse effects on body function and health outcomes (Medeiros de Moraes 2021; Katsas et al. 2020). The risk factors for malnutrition in older adults are multifactorial and can be broadly classified into three categories: medical factors (e.g., loss of appetite, weight loss, mobility limitations, chronic illness, and medication-related interactions), social factors (e.g., limited food-related knowledge, difficulties in food preparation, social isolation, poverty, or inability to purchase food), and psychological factors (e.g., confusion, depression, sadness, and fear) (Rashid et al. 2020; Besora-Moreno et al. 2020; Jain & Khushboo 2018).

A study by Khoddam et al. (2019) has reported that the prevalence of malnutrition among older adults varies (10% to 60%) globally according to demographic factors related to the problem. However, there is a 32% risk of malnourishment among older adults, and this will increase over time, with a commensurate decline in health (Khoddam et al. 2019). However, there has been an increase in efforts to eradicate the malnutrition problem among older adults over recent decades, but there is still debate on which interventions will best address this issue (Visser et al. 2017).

The issue of malnutrition among older adults affects not only individuals but also the development of a country (Gkiouras et al. 2020). Malnourished older adults tend to have overwhelming impact on diseases, increase the length of hospitalization and incur a lot of healthcare charges (Besora-Moreno et al. 2020). However, healthcare funding in some countries, especially those with low incomes

and limited development, is likely to be limited, and individuals and the government will likely face a substantial financial burden (Abdu et al. 2020). Thus, a realistic and affordable prevention strategy must be sought to prevent this problem from country’s governance and economic growth. Therefore, the objective of this scoping review is to map and describe the existing literature on the use of the Mini Nutritional Assessment (MNA) as a pre- and post-intervention evaluation tool in nutrition care interventions for community-dwelling older adults. The findings of this review may inform the development of future intervention packages aimed at addressing malnutrition and supporting healthy ageing among older adults living in community settings.

METHODOLOGY

Search strategy and study selection

A comprehensive literature search was conducted using three electronic databases, namely Web of Science, PubMed, and Ovid. The search strategy was developed based on the research objectives and refined through preliminary searches. Key terms included combinations of controlled vocabulary and free-text terms related to the topic, such as (“keyword 1” OR “synonym 1”) AND (“keyword 2” OR “synonym 2”).

Database-specific search strategies were applied to ensure optimal retrieval of relevant studies. For PubMed, Medical Subject Headings (MeSH) terms were combined with free-text keywords. In Web of Science and Ovid, keyword searches were conducted using title, abstract, and keyword fields. Boolean operators (AND, OR) were used to combine search terms appropriately.

This scoping review was conducted in accordance with the methodological framework proposed by Arksey and O’Malley (2005) and further refined by Lima et al. (2017). The framework consists of six stages: (1) identification of the research question; (2) identification of relevant studies; (3) study selection; (4) data extraction; (5) interpretation and synthesis of findings; and (6) consultation with stakeholders, where applicable.

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram was used to document the study selection process (Figure 1).

Stage 1: Identifying the research questions

The development of one or more research questions is the initial stage of this study, and we utilized a modification of the PICO technique to develop the guiding research question (P: patient, I: intervention,

C: comparison, O: outcomes). The PICO technique can provide readers with a substantial amount of information regarding the emphasis, breadth, and relevance to their requirements of a review. New concerns were found in the sequence through an interactive process that included team discussions as we became more familiar with the literature.

Stage 2: Identifying the relevant studies

Relevant studies were identified through a systematic search using both Medical Subject Headings (MeSH) terms and free-text keywords. The MeSH terms included “Malnutrition”, “Nutritional Status”, “Dietary Intake”, “Diet Quality”, and “Aged”. In addition, free-text keywords such as “intervention”, “older adults”, “elderly”, “Mini Nutritional Assessment”, and “MNA” were used to ensure comprehensive retrieval of relevant literature.

The Mini Nutritional Assessment (MNA) was prioritized in this review because it is a validated and widely used nutritional screening tool specifically developed for older adults. The MNA allows for early identification of malnutrition risk and has demonstrated high sensitivity and reliability across various clinical and community settings. Compared to other nutritional assessment tools, the MNA is particularly suitable for older populations as it incorporates anthropometric, dietary, and functional components relevant to ageing-related nutritional changes.

Mendeley software and Microsoft Excel were used to manage references and remove duplicate records. We independently reviewed the titles, abstracts, and keywords for eligibility.

Stage 3: Selecting the studies

Two screening phases were involved in this process: “title and abstract review” and “full-text review.” During the first screening phase, the titles and abstracts of publications found in the search were scrutinized and analyzed by two independent investigators to identify potentially suitable articles. The second phase involved two investigators evaluating the full text of the papers separately to establish whether they met the inclusion or exclusion criteria. In the event of any disagreement regarding these papers, the full text was re-read, and any remaining issues concerning research eligibility were resolved in consultation with a third researcher until a complete agreement was reached. The articles included in this review were not subjected to a methodological quality assessment, as eliminating papers based on such criteria is prohibited in scoping reviews.

Stage 4: Charting the data

The research team designed a data collection tool to verify research relevance and extract research features, including information about the research proposal (year, language, country, and type of publication), the researcher (name and workplace), and the paper. We developed categories and priorities based on preliminary analysis, which guided the extraction and mapping of data. The Bibliography Management Software (Mendeley Desktop Version 1.15.2) was used as assistance in this stage.

Stage 5: Collating, summarizing, and reporting the results

We describe significant categories in our scoping review, such as target demographics, prominent action areas, intervention features, and questionnaires. We believed that this scoping review would be a useful database, providing recommendations for future studies. The data obtained were saved in an Excel 2010 electronic database. The findings of this study are presented in tables using a descriptive method.

Stage 6: A consultation exercise

This scoping review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR). Consistent with the methodological framework proposed by Arksey and O'Malley (2005), the consultation exercise was undertaken as an optional stage to enhance the relevance and applicability of the findings. During this stage, collaborators and subject-matter experts in the field of healthy ageing were consulted to provide feedback and to assist in refining the list of relevant references. A patient-centred perspective was considered through informal discussions with caregivers and, where appropriate, older adults regarding daily lifestyle practices related to nutrition and ageing. These consultations aimed to help identify potential research gaps and contextualize the findings of the review. The PRISMA-ScR checklist is provided as supplementary material to ensure transparency and methodological rigor.

Inclusion criteria for the studies

The inclusion criteria considered for this scoping review were as follows: articles published between 2013 and 2021, intervention studies, participants aged more than 60 years, studies conducted in a community setting, and the use of the Mini-Nutritional Assessment tool (Kalan et al. 2020; Soysal et al. 2019a) for pre- and post-measurements. Articles that did not meet the inclusion criteria were excluded.

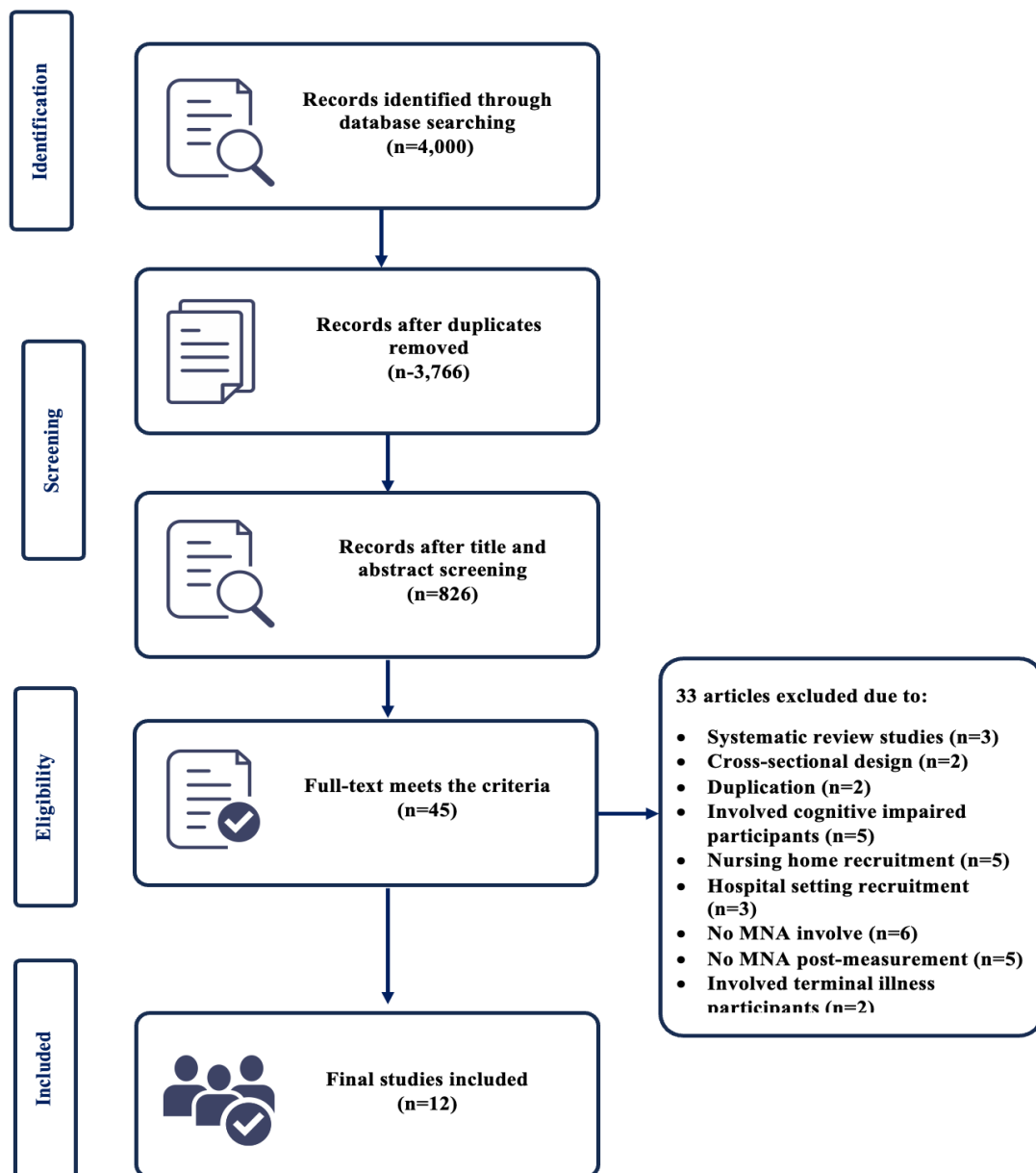
Exclusion criteria for the studies

The exclusion criteria of this scoping review were as follows: studies conducted among institutionalized older adults (such as in hospitals, nursing homes, or institutions that care for older adults), unhealthy participants (cognitive function impairments, mobility disabilities, and terminal illnesses), and studies not related to nutritional interventions. Articles were excluded if they were not published in English or if the full text was not available.

Data analysis

The included articles were thoroughly read and the data were summarized in the form of a table. The data included the aim of the study, sample, study duration, measurement tools, intervention package, and main findings.

FIGURE 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram for scoping review on nutritional interventions for the prevention and management of malnutrition



RESULTS

The initial search of online databases yielded 4,000 citations related to the topic. After screening titles and abstracts, forty-five (45) potentially relevant articles were identified and retrieved in full text. Following a thorough full-text review, 12 studies met the inclusion criteria and did not meet any exclusion criteria; therefore, they were included in this scoping review. Table 1 summarizes the characteristics of the included studies (n=12).

Of the 12 included studies, five were conducted in the Oceania region (Australia) (Charlton et al. 2013; Hamirudin et al. 2017; Young et al. 2018; Arjuna et al. 2018; Hutchings et al. 2021), four in Europe (Finland, Austria, the United Kingdom, and Spain) (Nykänen et al. 2014; Luger et al. 2016; O'Leary et al. 2020; Pérez-Ros et al. 2020), and three in Asia (Hong Kong and Taiwan) (Chung & Chung 2014; Wong et al. 2015; Chen et al. 2017). The average age of participants across all studies was 60 years or older. Most studies recruited fewer than 100 participants, while only three studies involved more than 100 participants (Nykänen et al. 2014; Pérez-Ros et al. 2020; Chen et al. 2017). The duration of the interventions ranged from three weeks to 24 months.

Regarding study design, four studies employed randomized controlled trials (Arjuna et al. 2018; Nykänen et al. 2014; Luger et al. 2016; Wong et al. 2015), while the remaining eight adopted quasi-experimental designs (Charlton et al. 2013; Hamirudin et al. 2017; Young et al. 2018; Hutchings et al. 2021; Luger et al. 2016; O'Leary et al. 2020; Pérez-Ros et al. 2020; Chen et al. 2017). Eleven studies implemented an intervention, whereas one study focused solely on intervention planning and development (Wong et al. 2015). With regard to feedback mechanisms, only four studies reported participant feedback following the intervention, which was collected through questionnaires (Charlton et al. 2013; Arjuna et al. 2018; Chen et al. 2017) or telephone interviews (Chung & Chung 2014).

Regarding nutritional assessment tools, three studies utilized the short version of the MNA (MNA-SF) (Hutchings et al. 2021; Pérez-Ros et al. 2020; Wong et al. 2015), while the remaining nine studies employed the full version of the MNA (MNA-full). Only one study reported no significant improvement in MNA scores following the intervention (Chen et al. 2017).

The intervention packages included a range of initiatives, such as food supplementation or meal delivery (Charlton et al. 2013; Hamirudin et al. 2017; Young et al. 2018; Arjuna et al. 2018; Hutchings et al. 2021; O'Leary et al. 2020; Chung & Chung 2014;

Wong et al. 2015), medical interventions (Hutchings et al. 2021), physical activity programs (Nykänen et al. 2014; Luger et al. 2016; Pérez-Ros et al. 2020), social support (Hamirudin et al. 2017; Hutchings et al. 2021; Luger et al. 2016; Wong et al. 2015), personalized dietary counseling or meal planning (Hamirudin et al. 2017; Young et al. 2018; Arjuna et al. 2018; Hutchings et al. 2021; Nykänen et al. 2014; Wong et al. 2015), guidebooks or pamphlets (Hutchings et al. 2021; Wong et al. 2015; Chen et al. 2017), and nutrition education classes or workshops (Hutchings et al. 2021; Luger et al. 2016; Chung & Chung 2014; Wong et al. 2015; Chen et al. 2017). Table 2 illustrates the distribution of intervention initiatives across the included studies.

DISCUSSION

This scoping review highlights the widespread use of the Mini Nutritional Assessment (MNA) instrument in evaluating nutritional status and intervention outcomes among older adults. Previous studies have demonstrated that the MNA is a reliable tool, particularly for screening older adults at risk of malnutrition (Soysal et al. 2019b; Zhang et al. 2020; Woldekidan et al. 2021; Torbahn et al. 2021).

The short form of the MNA (MNA-SF) was developed to facilitate rapid screening by reducing administration time and respondent burden. However, several studies recommend the use of the full version of the MNA (MNA-full) due to its stronger test-retest reliability and higher sensitivity in identifying malnutrition risk (Torbahn et al. 2021; Bauer et al. 2008). Doroudi et al. (2019) recommend using the MNA-full to screen for the risk of malnutrition among older adults due to its stronger test-retest reliability. This does not indicate that the MNA-SF is invalid; however, its sensitivity may vary across different countries and populations (Hutchings et al. 2021; Woldekidan et al. 2021). In this review, the researchers found that both versions of the MNA have been utilized. The majority of the studies performed a reliability test on the instrument before employing it. Therefore, both versions of the MNA are considered valid. Nevertheless, further studies are required to determine which version is more appropriate and reliable across different settings, such as rural versus urban areas and across countries.

In this review, the authors found that the intervention package initiatives implemented in the studies were multi-component and included food supplementation or meal delivery, medical intervention, physical activity, social support, home visits, personalized dietary counseling or meal plans, guidebooks or pamphlets, and nutrition education classes or workshops. Only two studies did not use

a multi-component intervention approach: Charlton et al. (2013) preferred food supplementation or meal delivery initiatives, and Pérez-Ros et al. (2020) focused solely on physical activity to prevent falls among frail older adults. Previous studies have reported that multi-component strategies improve the nutritional status of older adults (Kimber et al. 2015; van Doorn-van Atten et al. 2018), but it remains unclear which initiatives can be regarded as optimal for the prevention and treatment of malnutrition in older adults (Correa-Pérez et al. 2018). This review reveals that no similar pattern was observed in the initiatives selected for the included studies. However, the differences may be influenced by the objectives of the studies, which makes every intervention study in this review unique.

The authors found that eight studies (Charlton et al. 2013; Hamirudin et al. 2017; Young et al. 2018; Arjuna et al. 2018; Hutchings et al. 2021; O'Leary et al. 2020; Chung & Chung 2014; Wong et al. 2015) included in this review chose food supplementation or meal delivery as intervention initiatives. As reported in a previous study, malnutrition problems can be treated or prevented by ensuring an adequate dietary intake (Esquivel 2018). One of the suggestions from previous studies is to increase the protein intake of older adults (Bauer et al. 2013). On the contrary, some of the studies included in this review increased participants' protein intake by fortifying meals or through oral nutritional supplements (ONSs), resulting in an improvement in their nutritional status (Charlton et al. 2013; Arjuna et al. 2018). However, uncertainties remain regarding the high-protein intake recommendations. Clegg and Williams (2018) suggest that older adults may develop a resistance to high protein intake due to a low metabolic rate and poor health status. In another study, Mathewson et al. (2021) note that poor appetite and dentition are also barriers to increasing protein intake, which may lead to unsuccessful initiatives. Even if an intervention study improves nutritional status through high dietary protein intake, it remains unclear whether participants will comply with the initiative over the long term.

Besides, six studies included in this review chose personalized dietary counseling or meal plan initiatives (Hamirudin et al. 2017; Young et al. 2018; Arjuna et al. 2018; Hutchings et al. 2021; Nykänen et al. 2014; Wong et al. 2015). Previous studies have shown that dietary counseling is remarkable effective in the treatment of malnourished older adults through changing their dietary habits (Ahn et al. 2018; Berendsen et al. 2018). However, one study that initiated dietary counseling or a meal plan did not show any improvement after the intervention via the MNA tool (Young et al.

2018). The authors of that study mention that the short intervention period, which involved six weeks of dietary counseling, would not have an impact on changing the participants' habits, even though the intervention package included food supplementation or meal delivery (Young et al. 2018). The intervention package they chose was similar to what was selected in another study by Berendsen et al. (2018) in that both involved dietary counseling and food supplementation or meal delivery. However, this study's intervention was conducted over a longer period, approximately one year, and required follow-up with the participants to ensure its success. Furthermore, a comparison of the participants in these studies show that Berendsen et al. (2018) recruited healthy older adults, while Young et al. (2018) recruited pre-hospitalized older adults, which is why there were different outcomes even though these two studies implemented the same initiatives.

Five studies chose social support as part of their intervention packages (Hamirudin et al. 2017; Hutchings et al. 2021; Luger et al. 2016; Wong et al. 2015; Chen et al. 2017). There was no exclusive definition of social support in these studies; it could refer to home visits, telephone calls, buddy visits, service meal outings, or shopping support. In an assessment study, Streicher et al. (2018) classified social support for malnourished older adults into three domains: support or help with shopping, cooking, or household chores. Correspondingly, Mohd et al. (2019) state that social support can vary and can be either received or perceived. Although social support is one of the key determinants of the malnutrition problem (Boulos et al. 2017; Rea et al. 2019), there is an urgent need to reinvestigate this initiative. A systematic review by O'Keeffe et al. (2019) reported limited data on social support.

Subsequently, we identified five studies (Hutchings et al. 2021; Luger et al. 2016; Chung & Chung 2014; Wong et al. 2015; Chen et al. 2017) that incorporated nutrition education classes or workshops into their intervention packages. In this review, we found that guidebooks or pamphlets are distributed at nutrition education classes or workshops to facilitate participants' understanding of the message delivered during the intervention. In their study, Chung & Chung (2014) did not distribute any guidebooks or pamphlets, which was mentioned as a limitation of their study. The authors of a systematic review reported that the behaviour of older adults can be effectively changed through nutrition education (Rea et al. 2019; Moloney & Jarrett 2021). However, there were challenges in conducting nutrition education classes or workshops for older adults, including their limited understanding of the content, illustrations, and text,

as well as participant motivation (Yahya et al. 2020). However, this initiative should be implemented.

Furthermore, only one study, conducted by Nykänen et al. (2014), implemented a medical intervention initiative to combat the malnutrition problem among older adults. This study notes that the focus of the intervention was on optimizing care and medication and managing major medical problems. However, the authors do not specify the type of medical intervention they implemented, such as the specific drugs or care they focused on. Perhaps the intervention focused on medication and the management of health problems that are common among older adults, such as diabetes, osteoporosis, and cardiovascular disease, and was suitable for non-hospitalized patients (Lampela et al. 2010; Akamine et al. 2007). Due to the lack of information, this initiative requires further investigation.

There are two limitations to this review. First, the authors found that all the studies were conducted in high-income countries (Bank 2022), which means that it is likely that there were sufficient resources and funds to plan, organize, and maintain the interventions among the older adults. However, there are still some barriers that can prevent the continuation of the intervention programs, such as self-limiting factors, financial limitations, catering limitations, or organizational barriers (Agarwal et al. 2013). In low- and middle-income countries, resources to maintain food-access initiatives are scarce, which means that, instead of focusing on the health problems of older adults, the focus is likely to shift to other age groups.

The second limitation of this review is that the intervention studies focused on populations in urban settings. Only one study, that of Chen et al. (2017), was conducted among rural and urban older adults. Based on previous studies, rural populations are more likely experience malnutrition compared to urban populations (Chen et al. 2015; Shahar et al. 2019), despite a study by Rosta (2020) that reported urban populations were at a higher risk of malnutrition. That study was conducted in Canada, where income status and dietary habits differ from those in other countries. Moreover, Chen et al. (2015) urged the implementation of further initiatives or programs among rural older adults to educate them about the risk of malnutrition.

CONCLUSION

This scoping review concludes by highlighting the need for more research on nutrition treatments that use the MNA as an assessment tool among older individuals who live in the community. Future interventions should prioritize straightforward, interesting, and easily comprehensible information

to raise awareness and prevent malnutrition, given the paucity of intervention research, especially in rural areas. Researchers and policymakers may use the review's conclusions as a guide when creating more successful nutrition intervention plans for senior citizens.

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CONFLICTS OF INTEREST

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TABLE 1: Summary of the included studies (n = 12) analysed in this scoping review

No.	Author's name & publication year	Aim	Sample, Mean Age, Duration & Study Design	Intervention Package	Outcomes
1.	Charlton et al. Australia 2013	To determine the impact of providing a high energy, high protein daily mid-meal snack to Meals-on-Wheels (MOW) clients in a regional center of New South Wales, Australia, in terms of both nutrition-related outcomes as well as the acceptability of the program.	a. Total participants 12 (women = 7; men = 5) b. Mean age: 81.3 ± 10.9 years c. Study duration: 4 weeks d. Study design: Quasi experimental	1. Participants received a snack Monday through to Friday, in addition to their standard MOW delivery. 2. Five types of commercially available sweet and savory snack options were provided each week (random snacks each day). 3. The snacks provided a mean of 620 kJ and 6.6 g of protein per serve.	1. Trend of energy intake increased significantly. 2. The MNA score increased significantly. 3. Mean body weight and BMI increased significantly
2.	Hamirudin et al. Australia 2017	To determine whether a model of home-based dietetic care improves nutritional status and weight in a sample of Department of Veterans' Affairs (DVA) patients over a 3-month period following hospital discharge	a. Total number of participants 68 (women = 36; men = 32) b. Mean age: 85.5 ± 5.8 years c. Study duration: 3 months d. Study design: Quasi experimental	1. Personalized dietetic advice started post hospital discharge. 2. Subjects were visited at home by single dietitian within two weeks of discharge from hospital. 3. Diet history and food frequency checklist were performed. 4. Repeated at three months post discharge by the same dietitian, unless subjects had been readmitted to hospital, withdrew or were deceased. 5. Individualized prescription of oral nutrition supplements (ONS) and/or referral to the Meals-on-Wheels (MOW) service.	1. Mean body weight increased significantly. 2. Mean MNA score improved significantly, from being "at risk of malnutrition" to the "well-nourished" category. 3. No significant change in BMI was detected after 3 months. 4. No significant changes were detected in energy intake and macronutrient distribution after three months.

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3.	Young et al. Australia 2018	To introduce a dietitian-led discharge planning and follow-up program for older patients at risk of malnourishment and admitted to internal medicine services to improve their nutritional and functional recovery, as measured 6 weeks after hospitalization	a. Total number of participants 80. b. Divided into two groups: i. Pre-HHOME group (n = 39; women = 24; men = 15) [mean age: 81.9 ± 7.9] ii. HHOME group (n = 41; women = 30; men = 11) [mean age: 82.7 ± 8.6] c. Study duration: 6 weeks d. Study design: Quasi experimental	1. Individualized discharge assessment with patient and family, including nutrition goal, barriers and strategies, and written summary. 2. Dietary counselling and supply of ONS. 3. Telephonic follow-up in the community at one week by the dietitian.	1. Over the 6-week post-discharge period, both groups maintained average weight. 2. The MNA score improved in both groups, but there was no significant difference between the groups. 3. Gait speed improved in both groups, but the HHOME group showed significantly greater improvement. 4. No significant differences in grip strength, BMI score or QoL score.
4.	Arjuna et al. Australia 2018	To compare the effects of fortified and nonfortified hot lunchtime meals at least 3 days/ week combined with standard dietetic counselling compared to only dietetic counselling (no meal provided) on the primary outcomes of energy and protein intakes and nutritional status.	a. Total participants 29 (women = 16; men = 13) b. Divided into 3 groups: i. Standard (STD) group = 7 ii. Protein- and energy-enriched (HEHP) group = 12 iii. Control group = 11 d. Mean age: 83.1 ± 1.1 years old e. Study duration: 12 weeks f. Study design: Quasi experimental	1. Baseline, all groups received dietetic counselling for one hour from a qualified dietitian who estimated each individual's energy and other nutrient requirements. Strategies on how to achieve RDIs were provided to individuals. 1. Meals were supplied on at least three days a week and consisted of the standard three-course meal (main dish, soup, and dessert). 2. The main dish recipes for the STD and HEHP meals were basically the same. The STD meal's energy and protein levels were controlled by fortifying the soups and desserts recipes. 3. The final nutrient content for the STD meals was 2.3 MJ energy, 30g protein, and 33% estimated daily energy, while HEHP meals were 4.6 MJ, 60g protein, and 66% estimated daily energy.	1. From baseline to week 12, the intake of energy, protein, carbohydrate, total fat, and saturated fat in the HEHP group was significantly increased, while the STD and control group did not experience any significant changes. 2. The HEHP group received a significantly higher percentage of their RDI for energy and protein than the STD group. 3. The MNA score was significantly increased in the HEHP but not in the STD and control groups. 4. In contrast to the HEHP and STD groups, the triceps skinfold was dramatically reduced in control group. 5. There were no differences in the weight, arm and calf circumference, handgrip strength, gait speed, QoL score, SNAQ score, and GDS score in any of the groups between baseline and week 12.

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5.	Hutching et al. Australia 2021	To assess whether nutritional screening and interventions implemented by the MOW service via referrals from the My Aged Care portal was effective in improving the nutritional status of older adults living at home.	a. Total participants 41 (women = 25; men = 16) b. Mean age: 79.8 ± 8.9 years old c. After follow-up period (n = 22) (refused reassessment = 5; died = 4; moved away = 4; could not be contacted = 3; awaiting reassessment = 6) d. Study duration: 21 months e. Study design: Quasi experimental	1. An online portal (The My Aged Care) launched an intervention to provide older people living at home with access to government-funded community-based services, including a range of ongoing personnel services, support, and clinical care. 2. My Aged Care operates through self-referral via a website or telephone line. 1. Types of interventions under the My Aged Care portal after nutritional screening: (1) provide eating-well booklet, (2) results of screening sent to general practitioners, (3) education on high protein and good energy sources, (4) recommendations on regular weighing, (5) Meal-on-Wheels service (MOW), (6) service meal outings, (7) shopping support, (8) recipe ideas, and (9) referral to a dietitian.	1. The MNA score of all participants improved significantly between baseline and post intervention (p = 0.008) 2. Two participants initially increased their MNA score by two points but then had a reduced score between 6 and 9 months. 3. The greatest improvement was found for the four malnourished participants (n = 4), whose MNA score increased by 4.5 points after the intervention (p <0.001)
6.	Nykänen et al. Finland 2014	To evaluate the effect of individual dietary counselling as part of a Comprehensive Geriatric Assessment (CGA) on nutritional status among community-dwelling people aged 75 years or older.	d. Total participants 173, consisting of: e. control group of 89 (women = 64; men = 25; mean age = 82.5 ± 4.9) f. intervention group: 84 (women = 55; men = 29; mean age = 82.9 ± 4.9) g. Study duration: 2 years h. Study design: RCT	1. Medical intervention, including optimization of care and medication and management of major medical problems. 2. Physical activity intervention, including individually tailored physical activity, counselling by a physiotherapist, and a focus on strength and balance training on lower extremities to prevent mobility disabilities, once a week. 3. Nutritional intervention, including individual dietary counselling and an individual treatment strategy designed by a nutritionist according to the participant's medical and nutritional characteristics to help subjects to improve the wholesomeness of their diet in line with Finnish recommendation by increasing the frequency of meals and/or adding energy and protein to the meals without nutritional supplement.	1. Mean MNA scores increased significantly in the intervention group but decreased in the control group. 2. Serum albumin increased significantly in the intervention group but the control group remained unchanged. 3. Mean body weight and BMI increased in both groups but did not show significant differences between the two groups.

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7.	Luger et al. Austria 2016	To explore the effects of a home-based and volunteer-administered physical training and nutritional program compared with a social support only intervention on nutritional and frailty status in pre-frail and frail older persons living at home.	a. Total participants 80 (women = 67; men = 13) b. Divided into two group: iii. Physical training and nutrition intervention (PTN) group; act as intervention (n = 39) iv. Social support (SoSu) group; act as control (n = 41) e. Mean age: 82.8 ± 8.0 years old f. Study duration: 12 weeks g. Study design: RCT	1. Physical training and nutrition (PTN) group: a. Nutritional aspects, which include discussion between group members about nutritional-related messages, aid with guidebook designed by nutritionist that contains three main nutritional aspects (fluid intake, animal and plant protein intake, energy intake), and eight nutrition-related messages, including a section on individual goal setting and tools to reinforce self-efficacy and a healthy eating plate guide. b. Physical training aspect that includes a warm-up with mobilization exercises followed by six strength exercises (designed by sport scientist), then strength exercise in circuit form with two sets; strength exercise was practiced once a week and subjects were provided with a Dyna-band and guidebook. 2. Social Support (SoSu) group: a. No discussion of nutrition-related aspects or performing strength training. b. Visited by buddies twice a week over 12 weeks, to go out, have a chat, or share interests.	1. PTN group showed significant increases in the MNA score as opposed to the SoSu group. 2. Mean SHARE-FI score decreased significantly in both groups.
8.	O'Leary et al. United Kingdom 2020	To evaluate the effectiveness of a 3-week, daily meal provision service by a non-profit provider on the physical and psychological wellbeing of an older adult population	a. Total participants 19 (women = 11; men = 8) b. Mean age: 78.3 ± 8.7 years old c. Study duration: 3 weeks d. Study design: Quasi experimental	1. Free food was delivered to the participants. 2. Participants were presented with a menu with four breakfast choices, 22 main course choices, and four supper choices. 3. Meals were suitable for home refrigeration 4. Delivered twice per week, with 3 meals provided per day. 5. Participants were instructed to consume additional meals and snacks ad libitum. 6. Participants were asked to return any unconsumed food to the delivery men for weighing.	1. The MNA scores increased significantly after the intervention. 2. No significant change in physical wellbeing after 3 weeks. 3. Participants reported significantly less depression. 4. No significant changes in measure of loneliness, satisfaction with life, or social capital and belonging were observed.

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9.	Perez-Ros et al. Spain 2020	To assess the effects of a one-year home-based proprioception exercise program on the incidence of falls in robust, pre-frail, and frail community-dwelling older people	- Total participants 564 (women = 356; men = 208; mean age = 76.1 ± 4.0) - Study duration: 12 months - Study design: Quasi experimental	- A daily proprioceptive home exercise program was implemented by eight community nurses who are expert in physical activity-related fall prevention programs in primary care centers, and the duration was one year. - When possible, subjects were urged to perform the exercises five mornings of each week. - The exercises took approximately 40–50 minutes (10 minutes warm-up, 20-30 minutes of proprioceptive exercises, 10 minutes cool-down). - The exercises featured both dynamic and static positions, and the intensity and period were customized according to the participant's abilities.	- Significant increases in weekly hours of physical activity. - Mean falls and fear of falls in both frail and pre-frail groups decreased moderately. - The program was more effective in frail and pre-frail groups than with robust subjects. - Exercise compliance lowers the occurrence of falls and the frailty criteria in community-dwelling older adults.
10.	Chung & Chung Hong Kong 2014	To evaluate a 3-week food education program for elderly adults living at home, which included knowledge regarding nutrition, the enhancement of cooking skills to produce low-cost nutrient-rich recipes, and the provision of food samples.	- Baseline (n = 60) [group A = 30; group B = 30] 12 participants refused to be involved in MNA assessment [group A = 21; group B = 27] - End of study [group A = 9; group B = 13] - Mean age: 74.4 ± 7.8 years old - Study duration: 3 weeks - Study design: Quasi experimental	- Participants were divided into two groups randomly: group A (one serving of free food sample one day per week for three weeks) and group B (a serving of free food samples three days per week for three weeks). - All participants participated in a three-week food education program that comprised three nutrition seminars led by nutritionists on Mondays, covering healthy food choices, food labelling, classification of nutrients, and their functions. - A 1-day recipe was provided in each seminar, where the participants received a sample of free ingredients and the cooking process was demonstrated in a film.	- The compliance rate of group B was nearly twice that of group A. - The results indicate that there was a significant change in the MNA score pre- and post-intervention in group B. - Group B had a better understanding of the cooking instructions and the rating of the usefulness of the program. - Group A showed a higher level of ease in buying ingredients and remembering cooking steps. - However, group B showed a significant difference in recalling the cooking steps between the 1st week and the 3rd week. - Overall satisfaction with the food education program, group A (37%) and group B (38%)

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11.	Wong et al. Hong Kong 2015	To describe the research protocol that will be used to determine the effectiveness of a health-social partnership intervention program among community-dwelling older adults.	- Community-dwelling older adults aged 60 years and above - Study duration (expected): 12 weeks (3 months) - Study design: RCT	- The intervention plan will be implemented for three months and the two main methods will be telephone follow-ups and home visits. - The nurse case manager will be in charge of the first home visit, while the following home visits as well as telephone follow-ups will be conducted by the community staff, under the direction of the nurse case manager, to support and monitor the participants' progress. - The nurse case manager and older individuals will set contract goals and develop an individual care plan based on the identified physiological, psychosocial, environmental, and health-related behavior problems. - The nurse manager and community staff will identify, measure, and manage the first signs and symptoms of disease conditions worsening; provide basic knowledge about the participants' chronic illnesses; and promote the importance of health and self-care activities. - A booklet will be given to the participants for reference, to enable them to remember and integrate the knowledge. - For the self-efficacy part, the plan is that the medical-social team will review past successful experiences with health issues, share excerpts from the diaries of famous people who experienced similar situations, and provide verbal encouragement to the participants during home visits and telephone follow-up if they comply with the care and treatment. - Other than social service referrals (emergency alert response system and home-delivered meals), the nurse case manager also will manage timely health service referrals to, for example, community nursing services (CNS), medical transportation, and primary care consultation.	- The goal of this study is to create a health-social partnership model to support healthy aging. - If the results show that the program's interventions can improve functional and health outcomes and perceived well-being, as well as reduce the rate of institutionalization and health-care utilization among community-dwelling older adults, the program can be replicated in other districts and countries.
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12.	Chen et al. Taiwan 2017	To examine the effectiveness of a 12-week dietary self-management program related to salt-, fluid-, fat-, and cholesterol-intake behaviors of community-dwelling older adults and to compare these effects in rural- and urban-dwelling older adults.	- Total participants 120 (women = 84; men = 36; mean age = 72.8 ± 4.9) - Divided into two groups: - Intervention group (n = 58) (women = 38; men = 20; mean age = 73.1 ± 5.2) - Control group (n = 62) (women = 46; men = 16; mean age = 72.5 ± 4.7) - Study duration: 12 weeks - Study design: Quasi experimental	- A Dietary Self-Management Program (DSMP) was created according to the self-efficacy theory by Bandura and was implemented for 12 weeks. - Performance accomplishment, vicarious experience, social persuasion, and physiological and emotional states were the independent variables. The program was intended to improve the elderly's nutritional health practices through the following: (1) education to acquire healthy eating awareness skills, (2) assistance in creating weekly action plans, (3) engagement in peer storytelling, (4) demonstration of healthy nutritional behaviors and problem-solving techniques, (5) provision of feedback on their progress, (6) reinterpretation of physiological symptoms, (7) home visits and phone calls, and (8) encouragement. - A simple behavioral approach was chosen in this study, and the program was simplified by focusing on the key dietary factors such as salt, cholesterol, fat, and fluid. - The cultural background of the elderly was taken into consideration, for instance, including simple behavioral techniques, using suitable graphics to illustrate program points, sizing food samples to indicate portion sizes, and writing all texts in the program booklet at a reading level $\leq$ 6th grade. - The booklet covered goal-setting and featured self-monitoring worksheets to assist participants in setting and achieving realistic objectives, as well as self-monitoring and self-evaluating their eating habits in relation to salt, fluid, fat, and cholesterol intake.	- The mean MNA score in the control group declined from baseline, while it remained constant in the intervention group. - There was a greater improvement in self-efficacy in the control group than in the intervention group over time. - The HLC and IHLC scores increased significantly in the intervention group while decreasing marginally in the control group. - CHLC score decreased in both groups. - The MNA (dietary domain), IHLC, and self-efficacy means changed significantly between rural and urban groups, where the rural participants improved slightly more than the urban group. - In general, the intervention groups were satisfied with the program, with the majority of respondents stating in the feedback questionnaire that they enjoyed it and suggested that it should be implemented in the community.
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TABLE 1. Summary of the included studies (n = 12) analysed in this scoping review

Author name & publication year	Food Supplementation/ Meal Delivery	Medical Intervention	Physical Activity	Social Support	Personalized Dietary Counselling/ Meal Plan	Guide Book/ Pamphlet	Nutrition Education Class/ Workshop
Charlton et al.; Australia; 2013	Yes	-	-	-	-	-	-
Hamirudin et al.; Australia; 2017	Yes	-	-	Yes	Yes	-	-
Young et al.; Australia; 2018	Yes	-	-	-	Yes	-	-
Arjuna et al.; Australia; 2018	Yes	-	-	-	Yes	-	-
Hutching et al.; Australia; 2021	Yes	-	-	Yes	Yes	Yes	Yes
Nykänen et al.; Finland; 2014	-	Yes	Yes	-	Yes	-	-
Luger et al.; Austria; 2016	-	-	Yes	Yes	-	Yes	Yes
O’Leary et al.; United Kingdom; 2020	Yes	-	-	-	-	-	-
Perez-Ros et al.; Spain; 2020	-	-	Yes	-	-	-	-
Chung & Chung; Hong Kong; 2014	Yes	-	-	-	-	-	Yes
Wong et al.; Hong Kong; 2015	Yes	-	-	Yes	Yes	Yes	Yes
Chen et al.; Taiwan; 2017	-	-	-	Yes	-	Yes	Yes

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