

Content identification for the development of a nutrition resource kit for malnourished and at-risk elderly: A review

Iman Nabihah Noor Azam¹, Aliza Haslinda Hamirudin^{1*}, Sakinah Harith², Mohd Aznan Md Aris³, Karimah Hanim Abd Aziz⁴, Siti Nur Amirah Sheikh Hishamuddin¹ & Nurul Syaireen A Rashid⁵

¹Department of Nutrition Sciences, Kulliyyah of Allied Health Sciences, International Islamic University Malaysia, Pahang, Malaysia; ²School of Nutrition and Dietetics, Faculty of Health Sciences, Universiti Sultan Zainal Abidin, Terengganu, Malaysia;

³Department of Family Medicine, Kulliyyah of Medicine, International Islamic University Malaysia, Pahang, Malaysia; ⁴Department of Community Medicine, Kulliyyah of Medicine, International Islamic University Malaysia, Pahang, Malaysia;

⁵Primary Health Care Unit, Pahang Health State Department, Bandar Indera Mahkota, Pahang, Malaysia

ABSTRACT

Introduction: Elderly population is more likely to suffer from malnutrition, thereby requiring appropriate nutrition education as part of nutrition intervention to overcome this issue. This review aims to identify content suitable for developing a nutrition resource kit that provides nutritional guidance to combat malnutrition among malnourished and at-risk elderly in health clinics setting, particularly in Malaysia. **Methods:** A literature search was conducted up to 15th December 2019 in four databases: PubMed, Scopus, COCHRANE, and ProQuest Health & Medical Collection. Potential literature on nutrition education, suitable dietary guidelines and existing educational materials for elderly in the community, in English and Malay languages, were searched to identify suitable content for the nutrition resource kit. All relevant documents were included based on inclusion and exclusion criteria. Data were extracted and analysed according to the PRISMA-ScR guidelines.

Results: A total of 27 documents consisting of articles, printed materials and guidelines were included for analysis. Suitable content included information related to malnutrition such as definition, signs and symptoms, cause-consequences, and nutrition management, which included food plate, serving size, menu suggestion, examples of recipes, tips to increase energy and protein intakes through food or drink, texture modification, a guide to using oral nutritional supplements, tips for maintaining nutrient content in food and drink, tips to encourage to eat, and oral health. **Conclusion:** A nutrition resource kit tailored for malnourished and at-risk elderly would be a beneficial nutrition intervention. There is a need to incorporate these information in the development of a nutrition resource kit to improve their dietary intake.

Keywords: malnutrition, elderly, community, nutrition education, scoping review

*Corresponding author: Dr. Aliza Haslinda Hamirudin

Department of Nutrition Sciences, Kulliyyah of Allied Health Sciences

International Islamic University Malaysia, Jalan Sultan Ahmad Shah, 25200 Kuantan, Pahang, Malaysia

Tel: (6)09-5716400 Ext 3370; Fax: (6)09-5716776; E-mail: aliza@iium.edu.my

doi: <https://doi.org/10.31246/mjn-2020-0118>

INTRODUCTION

The number of elderly worldwide continues to grow. According to United Nations estimates, the elderly population aged 60 years and above is expected to reach nearly 1.4 billion in 2030, 2.1 billion in 2050, and 3.1 billion in 2100 (United Nations, 2017). In Malaysia, recent data show that the percentage of Malaysian elderly increased from 6.5% in the year 2018 to 6.7% in the year 2019 (Department of Statistics Malaysia, 2019).

The elderly population is susceptible to suffering from malnutrition due to numerous factors, such as eating difficulties (Mann, Heuberger & Wong, 2013), depressive symptoms, poor functional status and lifestyle factors (Van Bokhorst-de van der Schueren *et al.*, 2013), as well as socioeconomic changes (Damiao *et al.*, 2017). The prevalence of malnutrition among the elderly differs according to the setting. A systematic review and meta-analysis of 240 studies by Cereda *et al.* (2016) reported a range of 3 to 29% for the prevalence of malnutrition among elderly in different types of settings. In the community, the pooled prevalence of high malnutrition risk across European countries was reported to be 8.5% using various malnutrition screening tools (Leij-Halfwerk *et al.*, 2019). Similarly, 1.3% to 36.3% and 25.3% to 48.5% of Malaysian elderly living in the community were found to be malnourished and at-risk, respectively, as reported in a systematic review by Zainudin *et al.* (2016). Meanwhile, 48% to 55% of hospitalised elderly were reportedly malnourished in Malaysia (Nur Fazimah, Sakinah & Rosminah, 2013).

In order to overcome this multifactorial issue, nutrition education is an important part of nutrition intervention to improve dietary intake. Nutrition experts are recommended

to provide information and education to malnourished and at-risk elderly in order to enhance their nutritional awareness and knowledge (Volkert *et al.*, 2019). Thus, providing a nutrition resource kit tailored for them would be a useful form of nutrition education (Hamirudin *et al.*, 2014), which could directly improve the nutrition knowledge of the elderly population. Higgins and Barkley (2004) also mentioned that the use of printed and other educational materials is effective in increasing the awareness and knowledge of elderly. Additionally, studies globally and locally have demonstrated the use of nutrition resource in delivering nutritional guidance for the elderly (Schoberer *et al.*, 2018; Shahar *et al.*, 2012; Yahya *et al.*, 2020). However, these materials were not specifically made for the at-risk and malnourished elderly. They were developed for the general elderly population to prevent and overcome common nutritional problems among the elderly, including malnutrition. Hence, developing and providing a nutrition resource kit tailored specifically for the at-risk and malnourished elderly group is warranted to improve their nutritional status.

In view of this, the content or outline of the kit should be identified before proceeding to the proper development of a nutrition resource kit. To the best of our knowledge, there is still a lack of comprehensive content and discussion about suitable content that could be incorporated into a nutrition resource kit for malnourished and at-risk elderly. A comprehensive content is needed to ensure all the necessary and important information are included to improve the elderly's nutritional knowledge, dietary intake, and nutritional status. Hence, this scoping review aims to identify suitable content for future development of a nutrition resource kit

for malnourished and at-risk elderly who receive primary care services in the Malaysian health clinics setting. Appropriate and suitable information that could contribute to malnutrition prevention and management among the elderly are essential to improve their nutritional status and health outcomes.

MATERIALS AND METHODS

Data source

This scoping review employed the Preferred Reporting Items for Systematic and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR), which was performed up to 15th December 2019. Four online databases (PubMed, Scopus, COCHRANE, and ProQuest Health & Medical Collection) were searched with no restrictions on publication date to identify potential literature related to nutrition education for the elderly in community settings. In addition, a manual search was performed for suitable guidelines and educational materials to supplement the database search. A manual search can be described as an additional approach to database searches in order to identify additional documents for review (Vassar, Atakpo & Kash, 2016). The search terms used for this review are shown in Box 1.

Selection of studies

The study's inclusion and exclusion criteria were determined before the

search. Studies included were the ones with (1) elderly aged 60 years old and above; (2) community setting; (3) documents written in English and Malay languages; and (4) full text only. Exclusion criteria included studies that involved (1) hospital setting; (2) medical conditions that required specific nutrition intervention; and (3) animal, nutrients or biomarkers studies. Articles that were not relevant to the specified criteria were excluded.

Data extraction, quality assessment, data synthesis and analysis

The author(s), title, year of publication, setting, study design, study objective, details of nutrition education, and findings were extracted from the reviewed studies. Selected relevant articles were further assessed for their level of evidence and study quality. The level of evidence was identified according to the rating scheme for Level of Research Evidence by Ackley *et al.* (2008), in which Level I is considered as the highest level of evidence consisting of systematic reviews and meta-analysis, while Level VII is the lowest level of evidence consisting of expert opinion or report. Providing information on the level of evidence would be beneficial for readers to prioritise these information.

Meanwhile, the study quality was determined by using the available study quality assessment tool and was

Box 1. Search terms used in the review

```
(malnutrition OR undernutrition OR undernourished OR malnourished) AND  
(elder* OR geriatric OR senior* OR "older adult*" OR "old* people" OR aging OR ageing)  
NOT (children OR youth OR infant* OR pediatric OR paediatric OR adolescent*) AND  
community OR "health clinic*" OR clinic* OR outpatient OR "primary care" OR "general  
practice") NOT (ward* OR inpatient OR hospital*) AND ("diet* education" OR "nutrition*  
education" OR education* OR "health education" OR "food guide" OR "health promotion"  
OR "education* module*" OR "health information" OR "education* model*" OR "nutrition*  
module*" OR "nutrition* resource*" OR "nutrition* education* package*")
```

rated as good, fair or poor based on the judgement of two researchers. Two researchers independently assessed the study quality, and any inconsistency

was resolved through discussion and agreement with other researchers. For cross-sectional and controlled intervention studies, the National Heart,

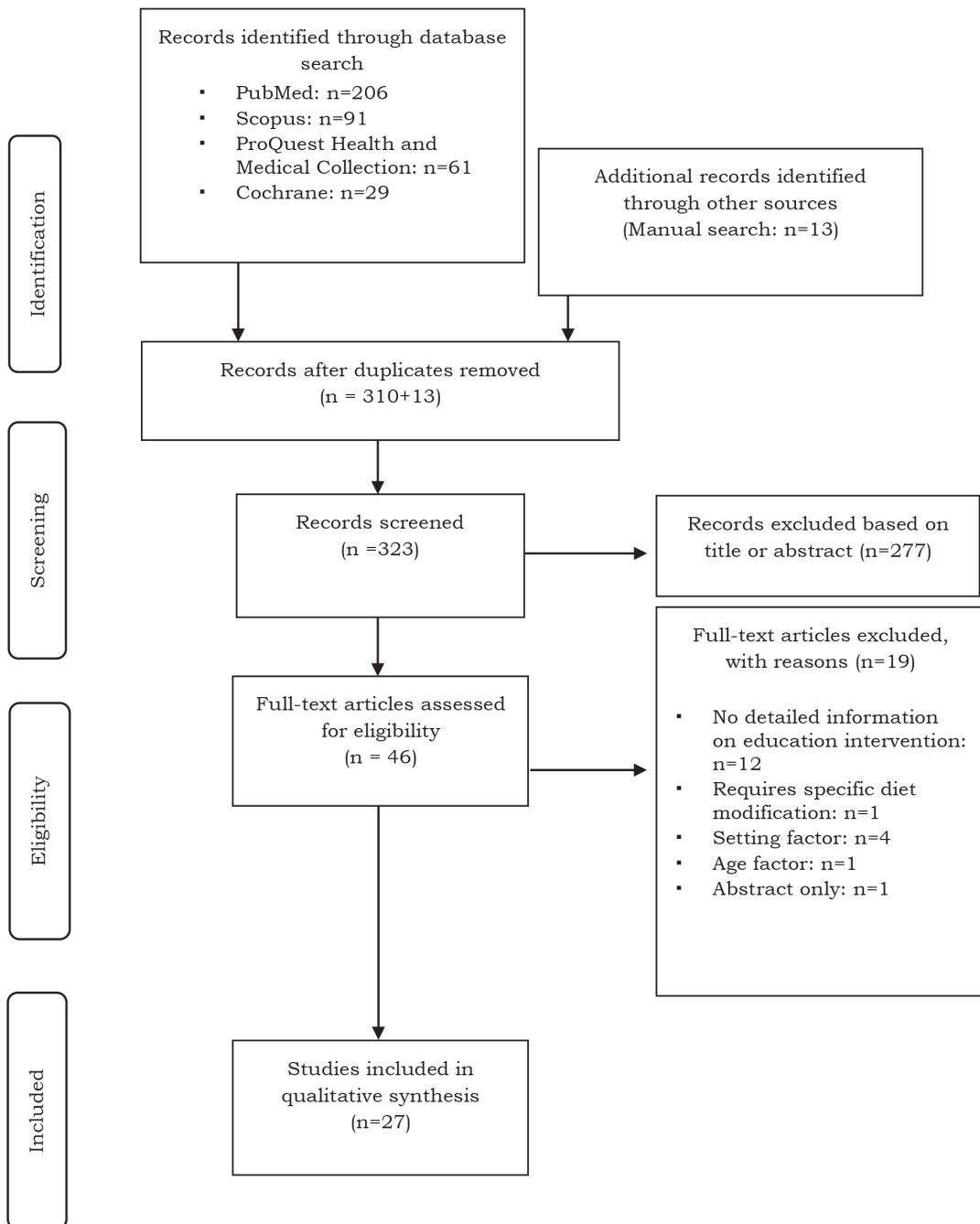


Figure 1. Study selection process for scoping review

Lung and Blood Institute (NLHBI) study quality assessment tool was used to rate the study quality. Qualitative and mixed-method studies were rated using the Critical Appraisal Skills Programme (CASP) checklist. For discussion paper and case report, they were not applicable to be rated for study quality. Currently, only the Joanna Briggs Institute (JBI) provides a critical appraisal checklist for these types of papers. So, it was used as a checklist for the papers to be included in the review.

Any information in the selected documents that could serve as topics in a nutrition resource kit were extracted. The information were listed as potential topics and discussed among the research team members before finalising the content of the nutrition resource kit.

RESULTS

Overview of studies identified

The process of identifying relevant studies is summarised in Figure 1. Electronic searches via online databases retrieved 487 articles and 13 documents from a manual search were found to be potentially relevant to the present scoping review. After duplicates were removed, a total of 323 records were screened thoroughly for relevant abstracts. This resulted in 47 records that were reviewed against the inclusion and exclusion criteria. Finally, 14 papers which consisted of seven controlled intervention studies, three cross-sectional studies, two mixed-method studies, one case report, and one discussion paper were selected. Overall, 27 records consisting of articles, printed materials and guidelines that met the criteria were included for this review. The level of evidence among these studies ranged from level II to level VII, which were of fair and good quality.

The results were summarised and tabulated in tables. Tables 1 and 2

indicate the summary of the outline or topics that can be included in a nutrition resource kit. Tables 3 and 4 mainly display the nutritional requirements for elderly, particularly for malnourished and at-risk populations, and act as references for content development. Meanwhile, Table 5 displays the summary of topics suitable to be included in the nutrition resource kit. In general, the suitable content was categorised into three components; 1) understanding malnutrition; 2) managing malnutrition; and 3) implementing malnutrition management, which will be explained below.

Content in nutrition resource kit

Understanding malnutrition

This review identified that general information related to malnutrition were given to the elderly and caregivers to ensure their understanding of the issue. The information provided to the target population included definition, signs and symptoms, as well as causes and consequences (Fernández-Barrés *et al.*, 2017; van Doorn-van Atten *et al.*, 2018). These kind of information would provide new insights for the elderly, which may directly increase their awareness of malnutrition issues.

Managing malnutrition

Management of malnutrition including information on macronutrient and fluid requirements, and serving size or exchange should also be considered as content in a nutrition resource kit. Generally, most studies provided tailored and non-tailored information on the needs for adequate intake of macro- and micronutrients among elderly participants in order to prevent and overcome malnutrition (Ahmadzadeh Tori *et al.*, 2019; Brooke & Ojo, 2015; Endeveldt *et al.*, 2011; Fernández-Barrés *et al.*, 2017; Luger *et al.*, 2016;

Table 1. Studies included for qualitative synthesis to develop a nutrition resource kit

No	Title, author, year	Setting	Study design	Study objective	Details in nutrition education and key findings	Suggested topics to be included in nutrition resource kit	Level of evidence and risk of bias
1	Needs and preference assessment for an in-home nutrition education programme using Social Marketing Theory (Francis <i>et al.</i> , 2004)	Community-residing elderly in Guilford County, NC	Mixed-method study	Study One: (1) To identify the nutritional needs of caregivers and their care recipients. Study Two: (1) Develop nutrition education materials (2) Test nutrition education materials with caregivers and their care recipients and professional staff who work with elders (3) Compare responses regarding the education materials between the caregivers and their care recipients and the professional staff	For the elderly and caregiver. (1) Using social marketing theory (2) Content of NEWS materials (for CG and CR); 1. Water – Are you drinking enough? 2. Healthy snacks 3. Money matters-how to shop on a budget 4. Add some spice to your life – A guide to low sodium eating 5. Nutrition guidelines for older adults 6. Nutrients – Are you getting enough? Food guide pyramid for older adults 7. What's in a name – A guide to what the front of the food label is saying 8. Eating well when you don't feel well 9. Serving up good nutrition – A guide on serving sizes 10. Herb and spice combination list for vegetables and meats 11. Chewing problems left you hungry? 12. Diet and drugs: they don't always mix – A guide on drug nutrient interactions	-Serving size -Hydration -Menu suggestion -Recipe of high energy and protein -Tips to maintain nutrients content in food and drink	Level VI

*Participants chose nutrition topics that addressed:
-Hydration

-Serving sizes
-Healthy cooking tips
-Polypharmacy

*Participants did not desire this information:
-Shopping on budget

Table 1. Studies included for qualitative synthesis to develop a nutrition resource kit (continued)

No	Title, author, year	Setting	Study design	Study objective	Details in nutrition education and key findings	Suggested topics to be included in nutrition resource kit	Level of evidence and risk of bias
2	Factors influencing dietary intake frequencies and nutritional risk among community-residing older adults (MacNab <i>et al.</i> , 2018)	Community-residing older adults (aged 60+)	Cross-sectional study	To identify factors influencing dietary intake frequencies and nutritional risk among community-residing older adults	(1) Study found elderly who enrolled in lifestyle interventions in these three states have “low” intakes of lean protein and dairy and are “at possible nutritional risk” or “at nutritional risk” (2) Sociodemographic characteristics (e.g., state of residence, gender, and age) of participants were shown to influence both nutritional risk and dietary intake	-Recipe of high protein food/drink/ snack -How to increase protein intake through food or drink. -Suggestion of protein-dense food/ drink/snack	Level VI Fair quality
3	Effects of a home-based and volunteer-administered physical training, nutritional, and social support programme on malnutrition and frailty in older persons: a randomised controlled trial (Luger <i>et al.</i> , 2016)	Community-dwelling older persons at home in Vienna, Austria	RCT study	The aim of this study was to examine the effects of a home-based and volunteer-administered physical training and nutritional support programme on malnutrition and frailty in older persons: a randomised controlled trial	(3) Educators should consider sociodemographic factors to promote dairy and protein-rich foods to elderly at nutrition risk (1) The aim of the nutritional intervention-ensure adequate fluid, protein, and energy intake, preferably by regular foods and beverages, without the use of nutritional supplements (2) Provision of booklet: included 3 main nutritional aspects: fluid intake, animal and plant protein intake, and energy intake (3) Provision of ideas of how to enrich food with protein, and they were provided with recipes of dishes that are protein and energy rich (4) Equipped with the “Healthy-for-Life Plate” guide	Adequate intake of fluid, protein, and energy intake, preferably by regular foods and beverages -Hydration -Menu suggestion -Recipe of high energy food/drink/ snack -How to increase calorie and protein intake through food or drink	Level II Good quality

Table 1. Studies included for qualitative synthesis to develop a nutrition resource kit (continued)

No	Title, author, year	Setting	Study design	Study objective	Details in nutrition education and key findings	Suggested topics to be included in nutrition resource kit	Level of evidence and risk of bias
4	Development and analysis of acceptance of a nutrition education package among a rural elderly population: an action research study (Shahar et al., 2012)	Health clinics in a rural area of Malaysia	Action research (Data collected at one point. Therefore, we classified this paper as cross-sectional study)	To develop a nutrition education package about healthy ageing and reducing the risk of chronic diseases for implementation at health clinics in a rural area of Malaysia	For the elderly and healthcare staffs. Key: Nutrition guide and increase physical activity (1) Booklet Message 1: Take a variety of food Message 2: Be physically active for muscle strength Message 3: Take at least 3 main meals in a day Message 4: Increase the consumption of fruits and vegetables Message 5: Meet your calcium requirement Message 6: Reduced intake of foods high in fat and cholesterol Message 7: Reduced salt in cooking and foods high in sodium content Message 8: Reduced sugar and foods high in sugar Message 9: Drink plenty of water Message 10: Safe food handling (2) Flipchart Guide 1: Weight management Guide 2: To reduce fat & cholesterol Guide 3: To control blood pressure Guide 4: To control blood sugar Guide 5: To increase fibre in diet Guide 6: Exercise for older people (3) Placemat -Food Plate: Daily Food Portions for Older People*	-Serving size -Menu suggestion -Hydration -Tips to maintain nutrients content in food and drink	Level VI Fair quality

*Results also found that elderly subjects were easy to understand using food plate

Table 1. Studies included for qualitative synthesis to develop a nutrition resource kit (continued)

No	Title, author, year	Setting	Study design	Study objective	Details in nutrition education and key findings	Suggested topics to be included in nutrition resource kit	Level of evidence and risk of bias
5	Effects of a multi-component nutritional telemonitoring intervention on nutritional status, diet quality, physical functioning and quality of life of community-dwelling older adults	Dutch community-dwelling elderly aged > 65 years	RCT study	To evaluate the effects of an intervention including nutritional telemonitoring, nutrition education, and follow-up by a nurse on nutritional status, diet quality, appetite, physical functioning and quality of life of Dutch community-dwelling elderly	Nutrition education: -Tailored information: advice given, according to the score for that specific nutrient or food group -Non-tailored information: targeted determinants of dietary and physical activity behaviour such as awareness, knowledge and attitude	-Sign and symptoms of malnutrition -Cause and consequences of malnutrition -The needs of high energy and high protein to overcome and treat malnutrition -Menu suggestion -Recipe of high energy food/drink/snack -How to increase calorie and protein intake through food or drink -Suggestion of energy and protein-dense food/drink/snack	Level II Fair quality
6	The efficacy of a nutrition education intervention to prevent risk of malnutrition for dependent elderly patients receiving Home Care: a randomised controlled trial	10 Primary Care Centres, Spain (aged 65+)	RCT study	To assess the effect of a nutrition education intervention included in the Home Care Programme for caregivers to prevent the increasing risk of malnutrition of dependent patients at risk of malnutrition	(1) Nurse explained causes and consequences of malnutrition to the caregiver and the patient (2) The nurses gave general information about: -Foods, macronutrients and some micronutrients. They showed foods rich in nutritional content. -How to design a healthy diet, focusing in macronutrient distribution and food choices -Advice on dietary adaptation to address the most common nutritional problems in this group, such as energy, protein, vitamin, mineral and water deficiency and adaptation of textures. -Recommendations on basic cooking techniques	-Cause and consequences of malnutrition -Menu suggestion -Hydration -Recipe of high energy food/drink/snack -How to increase calorie and protein intake through food or drink -Suggestion of energy and protein-dense food/drink/snack -Tips to maintain nutrients content in food and drink	Level II Good quality

Table 1. Studies included for qualitative synthesis to develop a nutrition resource kit (continued)

No	Title, author, year	Setting	Study design	Study objective	Details in nutrition education and key findings	Suggested topics to be included in nutrition resource kit	Level of evidence and risk of bias
7	Effect of BASNEF-based nutrition education on nutritional behaviours among the elderly people and Mini Nutritional Assessment on nutritional status in elderly with diabetes with type 2 diabetes (A clinical trial intervention)	Community includes all elderly people with diabetes in health centres of Babol city, Iran (aged 60+ years)	RCT study	To investigate the nutritional status of elderly people with diabetes and the effect of educational intervention based on the BASNEF model	Educational intervention was based on the BASNEF model Nutrition education intervention was done aiming: -To increase the number of meals based on the BASNEF model on promoting nutritional behaviours in the elderly with type 2 diabetes with diabetes of intervention group	-Menu suggestion -Promoting intake of fruits and vegetables -How to increase calorie and protein intake through food or drink. -Suggestion of energy and protein-dense food/drink/snack.	Level II Fair quality
8	The eating experience; Adaptive and maladaptive strategies of older adults with tooth loss.	Older adults attending the clinics of an urban northeast US school of dental medicine	Mixed-method study	The aim of this study was to explore the impact of tooth loss on the eating experience and ERQOL of older adults attending the clinics of an urban northeast US school of dental medicine	Adaptive and maladaptive behavioural responses to tooth loss: (1) Adaptive strategies included: -Modification in food preparation and cooking methods -Food texture selection -Meal timing -Approaches to chewing (2) Maladaptive behaviours included: -Food avoidance -Limiting eating and smiling in front of others	-Tips to modify texture of the food during food preparation and cooking	Level IV Good quality

Table 1. Studies included for qualitative synthesis to develop a nutrition resource kit (continued)

No	Title, author, year	Setting	Study design	Study objective	Details in nutrition education and key findings	Suggested topics to be included in nutrition resource kit	Level of evidence and risk of bias
9	Older consumers' readiness to accept alternative, more sustainable protein sources in the European Union. (Grasso <i>et al.</i> , 2019)	Community-dwelling older adults aged 65 years or above in five EU countries (United Kingdom, the Netherlands, Poland, Spain, and Finland)	Cross-sectional study	(1) To assess the level of acceptance to consume the following alternative, potentially more sustainable protein sources: plant-based protein, insects, single-cell protein and in vitro meat. (2) To investigate how different food-related attitudes and behaviour and sociodemographic influence the acceptance to consume such protein sources	-Dairy-based protein was generally the most accepted protein source in food products (75% of the respondents found its consumption acceptable or very acceptable) -Plant-based protein was the most accepted alternative, more sustainable protein source (58%) -Single-cell protein (20%) -Insect-based protein (9%) -In vitro meat-based protein (6%)	-Source of protein (include protein menu from dairy, plant-based and meat -Protein exchange	Level IV Fair quality

Table 1. Studies included for qualitative synthesis to develop a nutrition resource kit (continued)

No	Title, author, year	Setting	Study design	Study objective	Details in nutrition education and key findings	Suggested topics to be included in nutrition resource kit	Level of evidence and risk of bias
10	Oral and enteral nutrition in dementia: an overview (Brooke & Ojo, 2015)	NA	Discussion paper	Discussion of interventions to improve oral nutrition	Recommendation: (1) Environment: -Use of tablecloths, placemats and laying of cutlery -Coloured crockery, such as dark blue or red -Good-quality lighting -Music -Smell of freshly baked bread -Tables to seat four people	-Tips to encourage eating/ enhance mood for eating -Tips to modify texture of the food during food preparation and cooking. -How to increase calorie and protein intake through food or drink. -Suggestion of energy and protein-dense food/drink/snack. -Suggestion on the use of ONS.	Level V NA

Table 1. Studies included for qualitative synthesis to develop a nutrition resource kit (continued)

No	Title, author, year	Setting	Study design	Study objective	Details in nutrition education and key findings	Suggested topics to be included in nutrition resource kit	Level of evidence and risk of bias
11	Intensive dietary intervention by a dietitian as a case manager among community-dwelling older adults: the eddit study (Endevelt <i>et al.</i> , 2011) an intensive nutritional intervention led by a dietitian, or a Medical Treatment (MT)	Community-dwelling patients aged 75 or over at nutritional risk were identified from two districts, the north (haifa) and Sharon (petach-tikva) districts of maccabi healthcare Services	RCT study	To determine the impact of an intensive nutritional intervention programme led by a dietitian on the health and nutritional status of malnourished community-dwelling older adults	(1) Dietetic intervention treatment (DIT): -Nutritional assessment -Nutritional tailored treatment -Food supplements, if needed -Information regarding centres for subsidised prepared food, if needed -Evaluation of dietary intake -Recommendation for improving consumption with the goal of increasing quantity and quality of dietary intake -Evaluation of dietary intake -Adjust recommendations according to the patient's nutritional status and personal	-The needs of high energy and high protein to overcome and treat malnutrition -How to increase calorie and protein intake through food or drink. -Suggestion of energy and protein-dense food/drink/snack. -Suggestion on the use of ONS if needed	Level II
12	Effects of individual dietary counselling as part of a comprehensive geriatric assessment (CGA) on nutritional status: a population-based intervention study (Nykänen <i>et al.</i> , 2014)	Community-dwelling people aged 75 years or older. *Subpopulation of participants in the population-based Geriatric Multidisciplinary Strategy for the Good Care of the Elderly (GeMS)	RCT study	To evaluate the effects of individual dietary counselling as part of a Comprehensive Geriatric Assessment on nutritional status among:	(1) Nutrition intervention (based on the recommendations of the National Nutrition Council) -Aim: Increasing the frequency of meals and/or adding energy (if necessary) and proteins to the meals without nutritional supplements -Tailored meal plan with enough energy and proteins. -Special leaflets were given; for example: snacking (2) Nutritional interventions need to reflect different energy needs and include the provision of nutrient-dense food	-Menu suggestion -How to increase calorie and protein intake through food or drink -Suggestion of energy and protein-dense food/drink/snack	Level II

Table 1. Studies included for qualitative synthesis to develop a nutrition resource kit (continued)

No	Title, author, year	Setting	Study design	Study objective	Details in nutrition education and key findings	Suggested topics to be included in nutrition resource kit	Level of evidence and risk of bias
13	Dietary management of older people with diabetes	Elderly living in the community or in a care home	Case report	Focus on older people living in the community or in a care home who have or are at risk of malnutrition	Interventions to manage or prevent malnutrition include an increase in foods high in energy and protein, regular meals and snacks and fortification of foods with high protein, high-energy foods such as milk powder, cheese, cream or butter	-How to increase calorie and protein intake through food or drink -Suggestion of energy and protein-dense food/drink/snack.	Level VII NA
14	Guidance improves nutrient intake and quality of life, and may prevent falls in aged persons with Alzheimer disease living with a spouse (NuAD Trial) (McClinchy, 2018)	People with Alzheimer disease (≥ 65 years) living with their spouses in the Helsinki metropolitan area.	RCT study	To examine the effect of tailored nutritional guidance on nutrition, health-related quality of life (HR QoL) and falls in persons with Alzheimer disease (AD)	The nutritional care plan and personal guidance covered the following themes: -Adequate energy intake, sufficient protein intake -The benefits of fresh fruit and vegetables	-Menu suggestion -How to increase calorie and protein intake through food or drink -Suggestion of energy and protein-dense food/drink/snack. -The possible need for dietary supplements	Level II Fair quality
	(Suominen et al., 2015)				Received booklet about:	-Promoting intake of fruits and vegetables	RCT: Randomised Controlled Trial

Table 2. Additional sources included from manual search for qualitative synthesis to develop a nutrition resource kit

No	Title	Source	Target group	Details in nutrition education materials	Suggested topics to be included in nutrition resource kit
1	Pamphlet – Nutrition for the elderly (<i>Risalah - Pemakanan Warga Tua</i>) (Kementerian Kesihatan Malaysia, no date-a)	Malaysian Ministry of Health	-Elderly with NCD -Elderly with eating difficulty, overweight	1. Introduction ('Pengenalan') 2. Tips on healthy practices ('Tips amalan secara sihat') 3. Issues on food intake and how to overcome it ('Masalah pengambilan makanan dan cara penyelesaian') 4. Menu suggestion (1 day menu) ('Cadangan menu 1 hari') 5. Food measurement ('Sukatan makanan')	-Cause and consequences of malnutrition -Adequate energy, protein and fluid intake -Menu suggestion -Serving size -Recipe of high energy food/ drink/ snack -How to increase calorie and protein intake through food or drink. -Suggestion of energy and protein-dense food/drink/snack. -Tips to maintain oral health
2	Pamphlet – Nutrition Guide for the elderly (<i>Risalah - Panduan Pemakanan Untuk Warga Tua</i>) (Kementerian Kesihatan Malaysia, no date-b)	Malaysian Ministry of Health	-General elderly population -Healthy eating for the elderly	1. Healthy foods for health ('Makanan yang baik untuk kesihatan') 2. Unhealthy foods for health ('Makanan yang tidak baik untuk kesihatan') 3. Menu suggestion (1 day) ('Cadangan menu 1 hari') 4. Tips to promote happiness during eating ('Tips - Jadikan masa makan mengembirakan')	A section related to healthy eating: <i>Makanan sihat (1 bahagian):</i> 1. Food pyramid ('Piramid makanan') 2. Menu suggestion ('Cadangan menu') 3. Feeding assistance for the elderly ('Cara bantu warga emas makan')
3	Booklet – Guide for Caregivers of the elderly (<i>Buku kecil - Panduan untuk Perjaga Warga Emas</i>) (Kementerian Kesihatan Malaysia, 2008)	Malaysian Ministry of Health	-For caregiver		1. Factors associated with food intake ('Perkara yang mempengaruhi pengambilan pemakanan') 2. Food for good health (complete meal) ('Makanan yang baik untuk kesihatan (makanan lengkap)') 3. Information on vitamin and minerals needed for the elderly ('Ketahui vitamin
4	Booklet – Nutrition Guide for the elderly (<i>Buku kecil - Panduan Pemakanan Warga Tua</i>) (Kementerian Kesihatan Malaysia, 2000)	Malaysian Ministry of Health	-General elderly population		

Table 2. Additional sources included from manual search for qualitative synthesis to develop a nutrition resource kit (continued)

No	Title	Source	Target group	Details in nutrition education materials	Suggested topics to be included in nutrition resource kit
4				<p><i>dan mineral yang penting untuk warga emas]</i></p> <p>4. Food pyramid ('Piramid makanan')</p> <p>5. Menu suggestion (1 day) ('Contoh menu (1 hari)')</p> <p>6. Tips to prepare soft foods ('Petua menyediakan makanan lembut')</p> <p>7. Soft Food Recipe ('Resepi makanan lembut')</p> <p>8. Tips to maintain nutrients content in food ('Cara mengelakkan zat dalam makanan')</p> <p>9. Requirement on additional vitamin and minerals ('Keperluan vitamin dan mineral tambahan')</p> <p>10. Tips to maintain oral health ('Jagalah kesihatan mulut anda')</p>	<ul style="list-style-type: none"> -Cause and consequences of malnutrition -The needs of high energy and high protein to overcome and treat malnutrition -Menu suggestion -Serving size -Recipe of high energy food/drink/snack -How to increase calorie and protein intake through food or drink. -Suggestion of energy and protein-dense food/drink/snack.
5	Booklet – Nutrition Guide for the elderly in Institution (<i>Buku kecil - Panduan Pemakanan Warga Tua di Institusi</i>)	Malaysian Ministry of Health	General elderly population	<p>-Elderly with anaemia, underweight, NCDs, constipation, vegetarian</p>	<ol style="list-style-type: none"> 1. Problem and tips to overcome ('Masalah dan cara penyelesaian') 2. Food hygiene ('Kebersihan makanan') 3. Oral hygiene ('Kebersihan mulut') 4. Menu suggestion (7 days) ('Cadangan menu (7 hari)') 5. Menu suggestion for Chinese, Indian and Westerner (1 day) ('Cadangan menu (1 hari) untuk warga Cina, India dan Barat')
6	Booklet – Guidelines for Menu Planning in Institution (<i>Buku kecil - Garis Panduan Perancangan Menu di Pusat Jagaan</i>)	Malaysian Ministry of Health	-Institution		<ol style="list-style-type: none"> 1. Menu suggestion for main meals and snacks (7 days) – 1800kcal ('Contoh menu untuk hidangan utama dan sampingan (7 hari) – 1800kcal')

NCD: non-communicable disease

Table 3. Energy and macronutrients requirement for the elderly

No	Guideline	Gender	Energy (kcal/day)	Carbohydrates intake @ g/day)	Fat (% of energy intake)	Fluid
1	Recommended Nutrient Intake (RNI), 2017	Male	2030	50-65%	25-30	
		Female	1770		25-30	
2	Malaysian Dietary Guideline, 2010	All	1500			6-8 glasses of plain water daily
3	ESPEN guideline on clinical nutrition and hydration in geriatrics, 2019	All	30kcal/kg BW	50-55%		2.0 litres per day for women and 2.5 litres per day for men (from a combination of drinking water, beverages and food)
4	Haute Autorité de santé, Nutritional support strategy for protein-energy malnutrition in the elderly, 2007	All	30-40kcal/kg BW			1.0 to 1.5 litres of water per day (or other drinks; herbal tea, fruit juice, etc.) and drinking before feeling thirsty
5	Dietary Guidelines for Americans (8 th edition), 2015-2020	Male	2000-2200 (Sedentary)	130g/day (45-65%)	20-35	
		Female	1600 (Sedentary)	130g/day (45-65%)	20-35	

BW: body weight

Table 4. Protein requirement for malnourished elderly

No	Source	Protein Requirement
1	ESPEN guideline on clinical nutrition and hydration in geriatrics, 2019	1.2-1.5g/kg BW and up to 2.0g/kg BW
2	Haute Autorité de santé, Nutritional support strategy for protein-energy malnutrition in the elderly, 2007	1.2-1.5g/kg BW

BW: body weight

Table 5. Summary of suitable topics to be included as content in nutrition resource kit

No	Component	Suitable topics to be included in nutrition resource kit
1	Understanding on malnutrition	<ul style="list-style-type: none"> • Definition • Signs and symptoms • Cause-consequences
2	Malnutrition management	<ul style="list-style-type: none"> • Food plate • Serving size
3	Implementation of malnutrition management	<ul style="list-style-type: none"> • Menu suggestion • Examples of recipes • Tips to increase energy and protein intakes through food or drink • Texture modification • Guide to use oral nutritional supplements • Tips to maintain nutrients content in food and drink • Tips to encourage to eat • Oral health

Nykänen *et al.*, 2014; Shahar *et al.*, 2012; Suominen *et al.*, 2015; van Doorn-van Atten *et al.*, 2018). Serving size was also mentioned (Francis *et al.*, 2004; Shahar *et al.*, 2012). In addition, several studies targeted on hydration status (Fernández-Barrés *et al.*, 2017; Luger *et al.*, 2016) or educational materials (Francis *et al.*, 2004; Shahar *et al.*, 2012). Most available educational materials and guidelines also provided information related to fluid requirement. The use of a plate to portray and deliver information was also mentioned in two studies (Luger *et al.*, 2016; Shahar *et al.*, 2012).

Implementing malnutrition management
A few studies highlighted the possible methods to prevent and overcome

malnutrition, such as texture adaptation and modification in food preparation and methods of cooking (Brooke & Ojo, 2015; Fernández-Barrés *et al.*, 2017; Zelig *et al.*, 2019), recommended cooking methods (Fernández-Barrés *et al.*, 2017), healthy cooking tips (Francis *et al.*, 2004), menu suggestion (Brooke & Ojo, 2015; Nykänen *et al.*, 2014), and recipes for high energy and high protein menu (Luger *et al.*, 2016). Other studies mentioned promoting energy and protein-rich foods (Brooke & Ojo, 2015; Fernández-Barrés *et al.*, 2017; MacNab *et al.*, 2018; McClinchy, 2018; Nykänen *et al.*, 2014) including food fortification and nutritional supplementation (Brooke & Ojo, 2015; Endevelt *et al.*, 2011; McClinchy, 2018; Suominen *et al.*, 2015). Ways to control certain nutrients in foods

and oral health were also mentioned in several studies and available educational materials. Information related to the implementation of malnutrition management are suggested to be included in the nutrition resource kit as this may guide the target population specifically on how to improve their nutritional status in their daily lives.

DISCUSSION

Malnutrition is linked to various adverse clinical outcomes, including prolonged hospitalisation due to longer time needed to recover, increased risk of complications, effect on the patient's recovery, and increased risk of morbidity and mortality (Correia & Waitzberg, 2003). The health status of elderly is highly dependent on their nutritional risk. Wallace, Lo and Devine (2016) advocated the view that tailored nutrition education in elderly can lead to sustained dietary behaviour changes. Therefore, it is recommended to provide a nutrition resource kit to this target group in order to combat this issue. Previous systematic reviews concluded that nutrition education interventions might help improve malnutrition-related outcomes in elderly populations. However, more studies are required to support this evidence (Rea, Walters & Avgerinou, 2019).

This review is mainly to identify relevant topics for the content development of a nutrition resource kit for malnourished and at-risk elderly, with the purpose of providing nutritional knowledge and information for them to improve their dietary intake in order to overcome and prevent malnutrition. Suitable content identified through this review included information related to malnutrition such as definition, signs and symptoms, cause-consequences, and nutrition management, which included food plate, serving size, menu suggestion,

examples of recipes, tips to increase energy and protein intakes through food or drink, texture modification, guide to using oral nutritional supplements, tips for maintaining nutrient content in food and drink, and oral health. The level of evidence among these research papers ranged from levels II to VII. All papers included in this review were of fair and good quality. All papers provided credibility to the body of knowledge.

Available printed versions of educational materials from the Ministry of Health, Malaysia, were also included in the manual search. However, it is worth noting that none of them were designed specifically for malnourished and at-risk elderly. Nevertheless, the details in these nutrition education materials were extracted to identify suitable content for the nutrition resource kit.

This nutrition resource kit will act as a guide to which malnourished and at-risk elderly would be able to refer to whenever needed. Even though the kit is mainly targeted for the elderly, participation of family members and caregivers would be beneficial as this would facilitate the use of this kit in the target group (Marshall & Hale, 2017).

Understanding malnutrition

Information related to malnutrition is suitable for the kit (Fernández-Barrés *et al.*, 2017; van Doorn-van Atten *et al.*, 2018). This includes a brief explanation on the definition, signs and symptoms, and causes and consequences. The purpose of this information is to provide an overview of malnutrition to the elderly. Therefore, they will acquire general information and awareness about this issue. Besides, this general information primarily aims to enhance belief selection and consciousness, as well as to provide information on the consequences of behaviour (van Doorn-van Atten *et al.*, 2018).

Managing malnutrition

The nutritional requirement of the elderly could differ considerably from other age groups due to the normal ageing process, medical condition or lifestyle. Generally, nutritional requirements, specifically energy and protein, are higher for the elderly at risk of malnutrition or are already malnourished. Therefore, a specific nutritional recommendation for this target group is needed to be incorporated in the nutrition resource kit according to any available and suitable dietary guidelines. Several studies highlighted the need for adequate fluid intake among the elderly (Fernández-Barrés *et al.*, 2017; Francis *et al.*, 2004; Luger *et al.*, 2016; Shahar *et al.*, 2012), as inadequate fluid intake could contribute further to dehydration and affect the elderly's quality of life (Begum & Johnson, 2010). Hence, information on fluid requirement needs to be considered as a content in the nutrition resource kit.

Implementing malnutrition management

In addition, information related to strategies to increase their daily energy and protein intakes should be incorporated into the kit. Most of the studies emphasised the need to include menu suggestion, examples of recipes, tips to increase energy and protein intakes through food or drink, texture modification, a guide to using oral nutritional supplements, and tips to maintain nutrients content in food and drink. Offering texture-modified, enriched foods for the elderly who are malnourished or at risk of malnutrition is a good practice to ensure adequate dietary intake among them (Volkert *et al.*, 2019).

Several studies emphasised the use of food or nutritional supplements for malnourished and at-risk elderly

(Brooke & Ojo, 2015; Endevelt *et al.*, 2011; McClinchy, 2018; Suominen *et al.*, 2015). Oral nutritional supplement (ONS) can be described as an energy and nutrient-dense product aimed at increasing one's dietary intake when diet alone is unable to meet the daily energy requirements of the elderly (Volkert *et al.*, 2019). ONS can be categorised as standard ONS and disease-specific ONS. ONS are frequently recommended for those malnourished and at risk of malnutrition (Úi Dhuibhir, Collura & Walsh, 2019). According to Parsons *et al.* (2017), the use of ONS is quite effective as one of the options to increase a person's oral dietary intake. Hence, a brief guide on the use of ONS that are commonly found in the Malaysian setting should be included in the kit. Additionally, instructions for elderly to get advice from a dietitian and nutritionist on the use of ONS should also be mentioned for accurate prescription on ONS intake upon referral by physician.

Information about oral health should be included as well in the nutrition resource kit (Zelig *et al.*, 2019). Oral health is one of the contributing factors to malnutrition among the elderly. Oral health issues could reduce the ability of elderly to chew and eat, which directly leads to practical issues in the provision of adequate nutrition (Krishnamoorthy *et al.*, 2018). A study conducted by Rosli *et al.* (2019) in Kuala Pilah, Malaysia, demonstrated that oral health-related quality of life was significantly associated with nutritional condition among the elderly participants. Therefore, it is important for the elderly to maintain their oral health in order to prevent and overcome malnutrition.

Furthermore, studies have aimed to develop nutrition education materials that suit not only the elderly population but also their caregivers (Francis *et al.*, 2004) or healthcare professionals

(Shahar *et al.*, 2012). This has been demonstrated in '*Panduan untuk Penjaga Warga Emas*', an educational material provided by the Ministry of Health, Malaysia, that is aimed to provide information for caregivers. Francis *et al.* (2004) also included caregivers as their target audience as they were required to be actively involved in healthcare delivery. Shahar *et al.* (2012) also developed a nutrition education package that healthcare professionals can use as a teaching tool. Nevertheless, this review is important as it identified suitable topics to be included in a nutrition resource kit. Thus, any suitable and relevant information to caregivers or healthcare staffs were extracted and included.

The strengths of this review were that it followed the PRISMA-ScR guidelines, and the data were checked and discussed among the researchers. This research nevertheless had its limitations. Since articles were limited to English and Malay languages only, other articles that might have provided relevant information to develop content for the nutrition resource kit were not included.

CONCLUSION

To conclude, this scoping review offered new insights into the content that can be included in the future development of a nutrition resource kit aimed at tackling malnutrition among the elderly in community settings. The content identified included information related to malnutrition such as definition, signs and symptoms, cause-consequences, and nutrition management, which included food plate, serving size, menu suggestion, examples of recipes, tips to increase energy and protein intakes through food or drink, texture modification, a guide to using oral

nutritional supplements, tips to maintain nutrients content in food and drink, and tips to encourage to eat, and oral health. The topics identified can be incorporated into the kit in order to facilitate the elderly in improving their dietary intake. Therefore, a nutrition resource kit that provides nutritional guidance for malnourished and at-risk elderly can be useful for healthcare professionals as a nutrition intervention strategy. Further review could be performed in the future to measure its outcomes, particularly in providing nutrition education materials for the elderly to overcome malnutrition.

Acknowledgement

Funding for this study was received from the Fundamental Research Grant Scheme (FRGS), Ministry of Education, Malaysia (Reference number: FRGS/1/2018/SKK06/UIAM/02/5).

Authors' contributions

INNA, conducted the study, data analysis and interpretation, prepared the draft of the manuscript and reviewed the manuscript; AHH, principal investigator, conceptualised and designed the study, contributed expertise, data analysis and interpretation, and reviewed the manuscript; SH, contributed expertise and reviewed the manuscript; MAMA, contributed expertise and reviewed the manuscript; KHA, contributed expertise and reviewed the manuscript; SNASH, contributed to data analysis and interpretation; NSAR, contributed expertise and reviewed the manuscript.

Conflict of Interest

The authors declare no conflict of interest.

References

- Ackley BJ, Swan BA, Ladwig GB & Tucker SJ (2008). *Evidence-Based Nursing Care Guidelines: Medical-Surgical Interventions*. St. Louis, Missouri: Mosby, Inc.
- Ahmazadeh Tori N, Shojaeizadeh D, Sum S & Hajian K (2019). Effect of BASNEF-based nutrition education on nutritional behaviors among the elderly people and Mini Nutritional Assessment on nutritional status in elderly with diabetes with type 2 diabetes (A clinical trial intervention). *J Educ Health Promot* 8:94. https://doi.org/10.4103/jehp.jehp_222_18

- Begum MN & Johnson CS (2010). A review of the literature on dehydration in the institutionalised elderly. *E-SPEN, E Spen Eur E J Clin Nutr Metab* 5(1): e47-e53. <https://doi.org/10.1016/j.eclnm.2009.10.007>
- Brooke J & Ojo O (2015). Oral and enteral nutrition in dementia: an overview. *Br J Nurs* 24(12): 624-628. <https://doi.org/10.12968/bjon.2015.24.12.624>
- Cereda E, Pedrolli C, Klersy C, Bonardi C, Quarleri L, Cappello S, Turri A, Rondanelli M & Caccialanza R (2016). Nutritional status in older persons according to healthcare setting: A systematic review and meta-analysis of prevalence data using MNA®. *Clin Nutr* 35(6):1282-1290. <https://doi.org/10.1016/j.clnu.2016.03.008>
- Damião R, Santos ÁDS, Matijasevich A & Menezes PR (2017). Factors associated with risk of malnutrition in the elderly in south-eastern Brazil. *Rev Bras Epidemiol* 20(4):598-610. <https://doi.org/10.1590/1980-5497201700040004>
- Department of Statistics Malaysia (2019). *Department Of Statistics Malaysia Press Release Current Population Estimates, Malaysia, 2018-2019*.
- Donini LM, Scardella P, Piombo L, Neri B, Asprino R, Proietti AR, Carcaterra S, Cava E, Cataldi S, Cucinotta D, Di Bella G, Barbagallo M & Morrone A (2013). Malnutrition in elderly: social and economic determinants. *J Nutr Health Aging* 17(1):9-15. <https://doi.org/10.1007/s12603-012-0374-8>
- Endevelt R, Lemberger J, Bregman J, Kowen G, Berger-Fecht I, Lander H, Karpati T & Shahar DR (2011). Intensive dietary intervention by a dietitian as a case manager among community dwelling older adults: the EDIT study. *J Nutr Health Aging* 15(8):624-630. <https://doi.org/10.1007/s12603-011-0074-9>
- Fernández-Barrés S, García-Barco M, Basora J, Martínez T, Pedret R & Arija V (2017). The efficacy of a nutrition education intervention to prevent risk of malnutrition for dependent elderly patients receiving Home Care: a randomised controlled trial. *Int J Nurs Stud* 70:131-141. <https://doi.org/10.1016/j.ijnurstu.2017.02.020>
- Francis SL, Taylor ML & Strickland AW (2004). Needs and preference assessment for an in-home nutrition education program using Social Marketing Theory. *Journal of Nutrition for the Elderly* 24(2):73-92. https://doi.org/10.1300/J052v24n02_07
- Grasso AC, Hung Y, Olthof MR, Verbeke W & Brouwer IA (2019). Older Consumers' Readiness to Accept Alternative, More Sustainable Protein Sources in the European Union. *Nutrients* 11(8):1904. <https://doi.org/10.3390/nu11081904>
- Hamirudin AH, Charlton K, Walton K, Bonney A, Potter J, Milosavljevic M, Hodgkins A, Albert G, Ghosh A & Dalley A (2014). Feasibility of implementing routine nutritional screening for older adults in Australian general practices: a mixed-methods study. *BMC Family Practice* 15:186. <https://doi.org/10.1186/s12875-014-0186-5>
- Higgins MM & Barkley MC (2004). Improving Effectiveness of Nutrition Education Resources for Older Adults. *Journal of Nutrition for the Elderly* 23(3): 19-54. <https://doi.org/10.1300/J052v23n03>
- Kementerian Kesihatan Malaysia (no date-a). *Pemakanan Warga Tua*. Cawangan Pemakanan, Bahagian Pembangunan Kesihatan Keluarga, Kementerian Kesihatan Malaysia. From <http://fh.moh.gov.my/v3/index.php/component/jdownloads/send/23-sektor-kesihatan-warga-emas/499-pemakanan-warga-tua-risalah?Itemid=0> [Retrieved August 27 2019].
- Kementerian Kesihatan Malaysia (no date-b). *Panduan Pemakanan Untuk Warga Tua*. Bahagian Pendidikan Kesihatan, Kementerian Kesihatan Malaysia. From <https://www.infosihat.gov.my/multimedia/risalah/item/warga-tua-panduan-pemakanan.html> [Retrieved August 27 2019].
- Kementerian Kesihatan Malaysia (2008). *Panduan Untuk Penjaga Warga Emas*. Bahagian Pembangunan Kesihatan Keluarga, Kementerian Kesihatan Malaysia. From <https://www.infosihat.gov.my/index.php/multimedia/buku-kecil/item/panduan-untuk-penjaga-warga-emas> [Retrieved August 27 2019].
- Kementerian Kesihatan Malaysia (2000). *Panduan Pemakanan Warga Tua*. Bahagian Pendidikan Kesihatan, Kementerian Kesihatan Malaysia. From <https://www.infosihat.gov.my/multimedia/buku-kecil/item/panduan-pemakanan-warga-emas.html> [Retrieved August 27 2019].
- Kementerian Kesihatan Malaysia (2001). *Panduan Pemakanan Warga Tua di Institusi*. Cawangan Pemakanan, Bahagian Pembangunan Kesihatan Keluarga, Kementerian Kesihatan Malaysia. From <http://fh.moh.gov.my/v3/index.php/pages/orang-awam/kesihatan-warga-emas-1>. [Retrieved August 27 2019].

- Kementerian Kesihatan Malaysia (no date-c). *Garis Panduan Perancangan Menu di Pusat Jagaan*. Bahagian Pemakanan, Kementerian Kesihatan Malaysia. From <http://nutrition.moh.gov.my/buku> [Retrieved August 27 2019].
- Krishnamoorthy Y, Vijayageetha M, Kumar SG, Rajaa S & Rehman T (2018). Prevalence of malnutrition and its associated factors among the elderly population in rural Puducherry using mini - nutritional assessment questionnaire. *J Family Med Prim Care* 7(6):1429–1433. https://doi.org/10.4103/jfmpc.jfmpc_22_18
- Luger E, Dorner TE, Haider S, Kapan A, Lackinger C & Schindler K (2016). Effects of a home-based and volunteer-administered physical training, nutritional, and social support program on malnutrition and frailty in older persons: A randomized controlled trial. *J Am Med Dir Assoc* 17(7):671.e9-671.e16. <https://doi.org/10.1016/j.jamda.2016.04.018>
- MacNab L, Francis SL, Lofgren I, Violette C, Shelley MC, Delmonico M & Xu F (2018). Factors influencing dietary intake frequencies and nutritional risk among community-residing older adults. *J Nutr Gerontol Geriatr* 37(3-4):255–268. <https://doi.org/10.1080/21551197.2018.1524809>
- Mafauzy M (2000). The problems and challenges of the aging population of Malaysia. *Malaysian Journal of Medical Sciences* 7(1):1-3. From <http://www.ncbi.nlm.nih.gov/pubmed/22844207%0A> [Retrieved February 12 2020].
- Mann T, Heuberger R & Wong, H (2013). The association between chewing and swallowing difficulties and nutritional status in older adults. *Aust Dent J* 58(2):200–206. <https://doi.org/10.1111/adj.12064>
- Marshall K & Hale D (2017). Caregiver education and support. *Home Healthc Now* 35(6):341–342. <https://doi.org/10.1097/NHH.0000000000000554>
- McClinchy J (2018). Dietary management of older people with diabetes. *Br J Community Nurs* 23:248–251.
- NCCFN (2010). *Malaysian Dietary Guidelines*. National Coordinating Committee on Food and Nutrition, Ministry of Health Malaysia, Putrajaya.
- NCCFN (2017). *Recommended Nutrient Intakes for Malaysia. A Report of The Technical Working Group on Nutritional Guidelines*. National Coordinating Committee on Food and Nutrition, Ministry of Health Malaysia, Putrajaya.
- Nur Fazimah S, Sakinah H & Rosminah M (2013). Hospitalised geriatric malnutrition: A perspective of prevalence, identification and implications to patient and healthcare cost. *Health Environ J* 4(1):55–67. Retrieved from <https://pdfs.semanticscholar.org/2adb/57651a660017f86c818e7daa18e853964ac4.pdf>
- Nykänen I, Rissanen TH, Sulkava R & Hartikainen S (2014). Effects of individual dietary counseling as part of a comprehensive geriatric assessment (CGA) on nutritional status: a population-based intervention study. *J Nutr Health Aging* 18(1):54–58. <https://doi.org/10.1007/s12603-013-0342-y>
- Parsons EL, Stratton RJ, Cawood AL, Smith TR & Elia M (2017). Oral nutritional supplements in a randomised trial are more effective than dietary advice at improving quality of life in malnourished care home residents. *Clin Nutri* 36(1):134–142. <https://doi.org/10.1016/j.clnu.2016.01.002>
- Rea J, Walters K & Avgerinou C (2019). How effective is nutrition education aiming to prevent or treat malnutrition in community-dwelling older adults? A systematic review. *Eur Geriatr Med* 10:339–358. <https://doi.org/10.1007/s41999-019-00172-6>
- Rosli TI, Chan YM, Kadir RA & Hamid TAA (2019). Association between oral health-related quality of life and nutritional status among older adults in district of Kuala Pilah, Malaysia. *BMC Public Health* 19(Suppl 4): 547. <https://doi.org/10.1186/s12889-019-6867-1>
- Schoberer D, Eglseer D, Halfens RJG & Lohrmann C (2018). Development and evaluation of brochures for fall prevention education created to empower nursing home residents and family members. *Int J Older People Nurs* 13(2):e12187. <https://doi.org/10.1111/opn.12187>
- Shahar S, Adznam SN, Rahman SA, Yusoff NAM, Yassin Z, Arshad F, Sakian NI, Salleh M & Samah AA (2012). Development and analysis of acceptance of a nutrition education package among a rural elderly population : an action research study. *BMC Geriatr* 12:24. <https://doi.org/10.1186/1471-2318-12-24>
- Stratton RJ & Elia M (2010). Encouraging appropriate, evidence-based use of oral nutritional supplements. *Proc Nutr Soc* 69(4):477–487. <https://doi.org/10.1017/S0029665110001977>

- Suominen MH, Puranen TM, Jyväkorpı SK, Eloniemi-Sulkava U, Kautiainen H, Siljamäki-Ojansuu U & Pitkalä KH (2015). Nutritional guidance improves nutrient intake and quality of life, and may prevent falls in aged persons with alzheimer disease living with a spouse (NuAD Trial). *J Nutr Health Aging* 19(9):901-907. <https://doi.org/10.1007/s12603-015-0558-0>
- Ui Dhuibhir P, Collura N & Walsh D (2019). Complete oral nutritional supplements: Dietitian preferences and clinical practice *J Diet Suppl* 16(1):40–50. <https://doi.org/10.1080/19390211.2018.1428260>
- United Nations (2017). *World Population Prospects: The 2017 Revision, Key findings & Advance Tables*. Department of Economic and Social Affairs, Population Division, United Nations. Retrieved from Working Paper No. ESA/P/WP/248
- Van Bokhorst-de van der Schueren MAE, Lonterman-Monasch S, de Vries, OJ, Danner SA, Kramer, MHH & Muller M (2013). Prevalence and determinants for malnutrition in geriatric outpatients. *Clin Nutr* 32(6)1007–1011. <https://doi.org/10.1016/j.clnu.2013.05.007>
- van Doorn-van Atten MN, Haveman-Nies A, Pilichowski P, Roca R, De Vries JHM & De Groot CPGM (2018). Telemonitoring to improve nutritional status in community-dwelling elderly: design and methods for process and effect evaluation of a non-randomised controlled trial. *BMC Geriatr* 18(1):284. <https://doi.org/10.1186/s12877-018-0973-2>
- van Doorn-van Atten MN, Haveman-Nies A, van Bakel MM, Ferry M, Franco M, de Groot LCPGM & de Vries JHM (2018). Effects of a multi-component nutritional telemonitoring intervention on nutritional status, diet quality, physical functioning and quality of life of community-dwelling older adults. *Br J Nutr* 119(10):1185-1194. <https://doi.org/10.1017/S0007114518000843>
- Vassar M, Atakpo P & Kash MJ (2016). Manual search approaches used by systematic reviewers in dermatology. *J Med Libr Assoc* 104(4):302–304. <https://doi.org/10.3163/1536-5050.104.4.009>
- Volkert D, Beck AM, Cederholm T, Cereda E, Cruz-Jentoft A, Goisser S, de Groot L, Grobßhauser F, Kiesswetter E, Norman K, POurhassan M, Reinders I, Roberts HC, Rolland Y, Schneider SM, Sieber CC, Thiem U, Visser M, Wijnhoven HAH & Wirth R (2019). Management of malnutrition in older patients—Current approaches, evidence and open questions. *J Clin Med* 8(7):974. <https://doi.org/10.3390/jcm8070974>
- Volkert D, Beck AM, Cederholm T, Cruz-Jentoft A, Goisser S, Hooper L, Kiesswetter E, Maggio M, Raynaud-Simon A, Sieber CC, Sobotka L, van Asselt D, Wirth R & Bischoff SC (2019). ESPEN guideline on clinical nutrition and hydration in geriatrics. *Clin Nutr* 38(1):10–47. <https://doi.org/10.1016/j.clnu.2018.05.024>
- Wallace R, Lo J & Devine A (2016). Tailored nutrition education in the elderly can lead to sustained dietary behaviour change. *J Nutr Health Aging*, 20(1):8–15. <https://doi.org/10.1007/s12603-015-0529-5>
- Yahya HM, Z NAA, Shahar S & KA Singh D (2020). Development and evaluation of a booklet on nutrition education for falls prevention among older adults. *Jurnal Sains Kesihatan Malaysia* 18(2):9–17. <https://doi.org/10.17576/jskm-2020-1802-02>
- Zelig R, Jones VM, Touger-Decker R, Hoskin ER, Singer SR, Byham-Gray L, Radler DR & Rothpletz-Puglia P (2019). The eating experience: Adaptive and maladaptive strategies of older adults with tooth loss. *JDR Clin Trans Res* 4(3):217–228. <https://doi.org/10.1177/2380084419827532>