



An Analysis of the Contributors and Factors Influencing Dietary Patterns Among the Elderly Population

ANOUSHKA SENE, YASHWINEE BYE ISHNOO and RAJESH JEEWON*

Department of Health Sciences, Faculty of Medicine and Health Sciences,
University of Mauritius, Reduit, Mauritius.

Abstract

The normal process of aging consists of numerous behavioral, social, physical, psychological, and socioeconomic factors which may negatively affect the nutritional status of a senior. Old people are susceptible to poor nutritional status as they are mostly affected by nutritional deficiencies compared to individuals that belong to other age groups. The poor dietary pattern among the elderly leads to chronic diseases such as coronary heart disease, atherosclerosis, type 2 diabetes, hypertension, or malnutrition. Factors such as socioeconomic indicators, price of food items, marital status, psychological factors, changes in sensory functioning, access to food commodities, nutrition knowledge and cooking skills, gastrointestinal problems, oral health, and medication factors may influence the dietary pattern of an elderly individual. This review focuses on the factors affecting the eating habits of the elderly.



Article History

Received: 26 July 2022

Accepted: 14 September 2022

Keywords

Chronic Diseases;
Dietary Pattern;
Elderly;
Nutritional Status;
Socioeconomic Factors.

Introduction

Dietary habits have shifted dramatically over the last few decades.¹⁻³ Changes between our ancestral ancestors' eating patterns and the patterns nowadays prevalent in developed countries appear to have significant health repercussions. Humans are now dealing with diet-related issues which were previously unimportant. Chronic illness in elderly people may have had little impact during evolution, but it is currently the leading cause of morbidity and mortality in Western countries.⁴ In Mauritius, an increase in the intake of meat, eggs, dairy

products, oils, and fats has accompanied the shift in eating patterns, resulting in a significant rise in the incidence of overweight and obese people, as well as associated chronic diseases like cardiovascular disorders and diabetes.⁵

Older adults have been classified into three categories including as light eaters, heavy eaters, or heavy drinkers who also consume a lot of salty snacks, foods with animal fat, legumes, or sweets and desserts, depending on their eating habits.⁶ As human beings get older, they tend to eat less and

CONTACT Rajesh Jeewon ✉ r.jeewon@uom.ac.mu 📍 Department of Health Sciences, Faculty of Medicine and Health Sciences, University of Mauritius, Reduit, Mauritius.



© 2022 The Author(s). Published by Enviro Research Publishers.

This is an Open Access article licensed under a Creative Commons license: Attribution 4.0 International (CC-BY).

Doi: <http://dx.doi.org/10.12944/CRNFSJ.10.3.7>

make different food choices. For instance, evidence from nutrition studies shows that elderly tend to avoid fast foods and energy dense food and opt for fruits, vegetable and grains that are more.⁷

The aim of this article was to go into further details regarding the factors influencing dietary pattern in elderly. The method used was based on published papers from 1990 to 2022 that were evaluated to obtain the scientific information, from several databases (like PUBMED, IntechOpen, Science Direct, NCBI, MDPI journals, and Google Scholar). The following key terms were used: 'dietary pattern', 'elderly', 'socioeconomic factors', 'nutrition knowledge', 'chemosensory losses'. Research question and objectives were formulated. Based on these, extent literature and published articles were searched. Approximately ninety papers were scrutinised which were relevant. Out of these papers, sixty were cited in this review because the rest deal with almost the same findings, thereby avoiding same idea being discussed as well as shortening the paper.

Major Factors Affecting Dietary Pattern

Dietary patterns differ significantly and are influenced by one's culture and lifestyle.⁸ Pathological, physiological, economic, and social factors associated with aging may impair one's capacity to pick a diet of adequate quality and diversity to meet daily nutrient demands.⁹ The factors affecting dietary patterns are further discussed below.

Socioeconomic Status

Across all genders and age groups, one of the strongest determinants of eating habits is the socioeconomic status.¹⁰ The components of socioeconomic status include: education level, financial security, personal opinion of social status and income.¹¹ For instance, a study found a positive relationship between socioeconomic status and countries with high incomes when compared to low and middle income countries.¹² The higher the socioeconomic status, the healthier the eating choices, therefore the higher the consumption of fruits and vegetables.¹² Study in Mauritius revealed that middle and high socioeconomic status groups consume more dairy products than low socioeconomic status groups, with this difference attributed to the higher cost of dairy products.¹³

In Iran, elderly from rural areas had higher intake of fats and carbohydrate and higher energy intake daily than those living in urban areas.¹⁴ Elderly widowers who live in rural area or isolated places, smaller cities where food varieties and food services are limited, or financial resources are limited or poorer health, may have fewer options for preparation of meal.¹⁵ In another study, the authors found that 23.7% of male individual had inadequate energy intake due to poor education, age group being 75 years old and older and financial reason.

Moreover, about 1 in 3 of the older adults in America, have low socioeconomic status and chronic disease including hypertension, heart disease, type 2 diabetes mellitus and others and these individuals have financial difficulty to access food and medications.¹¹

Low-income people are also said to consume fast food more frequently because they can reach fast food restaurants more readily than supermarkets with fresh items.¹⁶ However, it should be emphasized that fast food consumption is higher among both high- and low-income individuals, thus they consume more energy.

Having low socioeconomic status, may lead to behaviours that promote the risk of developing obesity and type 2 diabetes mellitus. For example, those elicits behaviours might be preference and selection for a certain food and opting for more calorie dense food.¹⁷ In Asian countries, low SES individuals reduced their protein and fat intake and in other hand tend to consume more carbohydrate rich foods. This is due to the lack of nutrition knowledge and low price of energy-dense foods.¹⁸

It has been reported that in Mauritius, an individual's food choice is influenced by the price of the food.¹⁹ Mushrooming of grocery stores and fast foods outlets influence the eating habits of low socio-economic status individuals. Furthermore, the price per weight of food products influences food choices among low-income Mauritius residents. Low-income people prefer low-fat protein foods like pulses because they are less expensive per pound.¹⁹ However, studies carried out show that middle-income participants were found to consume more beans and pulses than low-income participants.¹³

Price of Food Items

Due to Russia and Ukraine conflict, there has been a rise in price of fertilizers and pesticides by 50 percent in the last year, which results in higher price of food items. Many things, including food, are affected by rising energy and transportation costs.²⁰ Therefore, people will pay more for food in shops and restaurants as fuel prices rise due to Russia and Ukraine conflict. "Food price inflation is already occurring, but this will exacerbate it," said James Bielby, CEO of the Federation of Wholesale Distributors.²¹ Likewise, when price of food increases, the ability to buy food decreases which distort the composition of an individual's diet and also may decrease total energy intake. High cost of food item affects dietary habits of individuals of all ages. For instance, as fat and sugar rich food provide energy at a low cost. To add, excessive consumption of added sugars and fat, as well as sedentary lifestyles, have been linked to the current obesity epidemic.²² However, an increase cost in soda and pizza lead to a reduced consumption of daily energy intake and a reduction in weight was also noted among individuals.²³ As in Mauritius, food choice is influenced by price, increased cost in food items may decrease quality of overall diet, decrease quantity of overall diet or both.¹⁹

However, in high socioeconomic status individuals, this might not be the case. However, due to Covid-19 pandemic and Russia-Ukraine conflict, there has been continuous increase in food prices which might affect eating habits and energy intake among elderly.

Marital Status

The structure and composition of a family are important social determinants that can influence health behaviours and outcomes.²⁴ Food is frequently shared and represents a means of connecting with others: sharing meals and cooking for loved ones.²⁵ Single elderly of both genders consumed more nutrients than married ones.²⁶ Moreover, social isolation and loneliness are linked to decreased appetite, lower food intake, decreased physical activity, and an increased risk of malnutrition in the elderly.²⁵ Widowed seniors are more prone to skip meals, enjoy mealtimes less, and have a poor appetite than the married senior citizens.¹⁵ Men may be more likely than women to make unhealthy dietary changes as a result of divorce, separation,

or widowhood. Furthermore, declines in fruit and vegetable consumption were more noticeable for variety than quantity.²⁷

Married individual specially men were found to be healthier and impose lower risk of mortality than those who are unmarried. This barrier to healthy eating and adequate energy intake is because unmarried, single, separated or widowed male elderly donot know how to prepare meal and groceries for themselves.²⁸ However, there is no established relationship between marital status and obesity.²⁹ Furthermore, a strong link was observed between all unmarried states for example those who are single, never married, divorced, and widowed and an increased risk of cardiovascular disease mortality due to changes in eating habits as a result of social isolation.²⁸ People living alone had not only higher risk of nutritional problems, they also consumed less protein, fruits, vegetables and meals, and had a lower BMI. Furthermore, elderly people who live alone are more likely to develop aging anorexia and other health problems.¹⁶

Psychological Factors

Depression affects many older persons, while it does not affect everyone,³⁰ and it might be a risk factor for poor nutrition.³¹ Depression can also cause a loss of interest in activities such as shopping, cooking, and eating. This can eventually lead to a poor diet.³⁰ Prospective and epidemiological studies have now proven a link between nutrition and depression.³² Studies from Turkey, Iran, Isfahan and south Africa demonstrated a relatively poor diet quality, as well as a lower intake of fruits, vegetables and oily fish among depressed older adults.³³ Another study argued that certain seniors develop anorexia due to lack of motivation to eat.³⁴ This eventually discourages the older adults from indulging in healthy behaviours. This lack of motivation could be caused by depression.³⁴ It was found that depressed seniors increased their food consumption as a result of negative emotions.³² Higher consumption of sweet foods was found to be associated with emotional eating.³² Evidences have shown that food consumption and depressed symptoms have a bidirectional link; it can either lead to a lack of interest in eating resulting in reduced food intake and weight loss or an increase in food intake and obesity.³³

Changes in Sensory Functioning

Chemosensory (smell and taste) losses are prominent examples of sensory changes associated with aging.³⁵ Around the age of 60, the sense of taste started to decrease significantly.³⁶ Older people's appetite and food intake may be diminished as a result of taste changes. Smell's main job is to keep track of what you are eating and how much you are eating. Approximately two-thirds of people over the age of 80 have difficulty identifying odours appropriately. According to several research, reduced odour has been linked to hunger suppression, weight loss, and malnutrition in older persons.³⁵ Also, the decline in chemosensory abilities can also lead to bad eating patterns, as the elders tend to increase their sugar and salt consumption to compensate for their inability to taste these substances in food at lower amounts.³⁷

Access to Food Commodities

In an obesity intervention, being closer to a supermarket was linked to greater improvements in fruit and vegetable intake and weight status.³⁸ Close vicinity and greater accessibility to any kind of food reseller were observed to be linked with lower ultra-processed foods ingestion in the majority of cases, with slightly robust relationship with exposure to restaurants and supermarkets.³⁹ The lower the consumption of lower ultra-processed foods, the lower the energy intake, the lower the risk of consuming poorer overall diet quality and the lower the risk of having high BMI.³⁹ Within 1000 meters of a supermarket, the probability of consuming greater than one snack rich in fats and less than five servings of fresh fruits and vegetables per day were higher, but the results were non-significant. Car owners living 500 meters from a general store had notably higher probability of snacking and being obese.⁴⁰

Greater food consumption is linked to food accessibility, hence resulting in a higher energy intake. To add, access to transportation is difficult in some rural areas, and food insecurity may result as a result of poor health and restricted access to food due to a lack of food commodities in the area. Physical disabilities may obstruct food intake-related activities such as shopping and cooking, resulting in significant changes in eating behaviour, but food security and Body Mass Index are not always linked.¹⁶

Nutrition Knowledge and Cooking Skills

Increased nutrition knowledge, including the capacity to translate nutrition knowledge into improved health practices, may be linked to education.¹⁶ Despite the fact that nutrition knowledge is usually linked to better eating habits, the literature on the link between eating habits and nutrition knowledge is contradictory. While some researchers have found a strong and positive link between nutrition knowledge and eating habits, others have found little association between nutrition knowledge and actual food choices time.²⁸

There is positive relationship poor education level, tooth pain and wearing of dentures.⁴¹ Poor educational status is linked to high-carbohydrate, low-fibre diets, and increased ingestion of sweets and red meats, whereas good nutritional status is associated to increased consumption of fruits, vegetables, and fish, as well as increased nutritional diversity and lower caloric intake.⁵⁹ Mauritian adults who attended nutrition education programme was found to have an increased knowledge in nutrition education, an increase consumption of fruits, a reduction the intake of snacks high in fat and sugar and mean energy intake and BMI was in the correct range.⁶⁰ Also, there is positive relationship poor education level, tooth pain and wearing of dentures.⁴¹

The skills and capacity of older persons to make food may be particularly crucial to evaluate. Inability or unwillingness to attempt and handle household cooking may result in increased risk for malnutrition.⁴² But majority of existing research has focused on nutritional advantages in adults, with little work examining the links between cooking skills and health outcomes in elderly individuals.⁴³ The first study to look at the links between culinary skills and poor eating habits in older persons, observed that female individuals greater levels of cooking skills than males, and that cooking skills were linked to eating choices.⁴³

Gastrointestinal Problems

Gastrointestinal changes are prevalent in the geriatric population, and while some gastrointestinal disorders are more common in this age range, there is no gastrointestinal disease that is specific to this age.⁴⁴ The gastrointestinal changes include alterations in motor function and thus intestinal transit, mechanical breakdown of food, and chemical

digestion; and as a result of these changes, the body's ability to produce necessary amounts of nutrients gradually declines, resulting in malnutrition.⁴⁵ Food intake is also affected; for example, alterations in oesophageal peristaltic activity may cause a delay in oesophageal emptying.⁴⁶

A study investigated the link between dietary patterns and gastrointestinal discomforts, but found no significant correlation.⁴⁷ The latter also discovered that consumption of bean products was negatively associated with the severity of gastrointestinal discomforts; gastrointestinal discomforts, such as bloating and increased faecal gas output, resulted from poor complex carbohydrate digestion.⁴⁷ In Beijing, a study reported that constipation was linked to a decreased intake of staple foods such fish, fruits, and vegetables.⁴⁷ In addition, there is more satiation after eating and a delay in gastric emptying in the older adults which further affect their food intake.⁴⁶ Future research should look into the relationship between dietary intake and gastrointestinal discomforts.⁴⁷

Oral Health

Within the last ten years, several studies have found a link between dentition and malnutrition.⁴⁸ Another study shows that there was a relationship between malnutrition and impaired dentition among older adults.⁴⁹ For example, if a person's dentition will be affected if they have missing or damaged teeth or dentures that do not fit properly and resulting in poor nutrition status.⁵⁰ In addition, poor dentition was found to reduce the ability of an elderly to masticate resulting in malnutrition.⁵¹

Tooth loss, periodontal disease, and dry mouth are all common oral health problems in people over the age of 65, and they have serious health consequences including less ingestion of protein, calorie, vitamins and minerals.⁵² As a consequence of poor oral health like fewer natural teeth, impaired dentition, or dental caries, dietary restrictions may be imposed on the elderly. Inadequate calorie intake was reported in elderly people with compromised functional dentition.¹⁶ Furthermore, among Brazilian senior citizens, it was found that due to dental problems and oral problems, they choose softer meats such as chicken to ease mastication process and digestion process rather than beef who has a harder flesh.⁵³

A decrease in masticatory ability may have an effect on dietary eating patterns, such as avoiding fibrous foods including fruit, vegetables, and nuts.⁵⁴ However, a study found no significant difference between number of teeth, removable dentures or occlusion contacts and nutrition.⁴⁸ A cross-sectional study carried out in Sweden found only a minor effect of dental status on dietary habits.⁵⁵

Medication Factors

Multiple medications can influence eating behaviour and, as a result, nutrient absorption, leading to the onset of nutritional issues in the elderly as well as increased morbidity and mortality.⁵⁶ Medicines can reduce appetite in a variety of ways; some medications can make you feel sick; some can influence taste; and some can be the source of depression.³⁰ Another review, reported that a higher usage of medications was linked to more frequent consumption of fruits and vegetables, skimmed milk and fish, as well as less frequent consumption of sugary meals, soft drinks, artificial juices, and fatty meat.⁵⁶

In order to maximize absorption, many medications include specific dose recommendations based on food intake. Tetra cycline, for example, should not be used with milk since it can greatly impair absorption; therefore, many older adults decrease their typical food consumption and may lower their total intake to comply with dose guidelines.⁵⁷

Medication side effects that may affect older adults' nutritional status include anorexia, weight loss, weight gain, depression, diarrhoea, dry mouth, dehydration, electrolyte abnormalities, diabetes, osteoporosis, and Parkinsonism.⁵⁸

Conclusion

This review sheds light on the different factors that may influence older people's energy intake, and there is abundant data to demonstrate that the factors addressed do have an impact. Several researches have shown that older adult's dietary pattern is influenced by numerous factors such as socioeconomic factors, price of food items, marital status, psychological factors, changes in sensory functioning, access to food commodities, nutrition knowledge and cooking skills, gastrointestinal problems, oral health and medication factors may

influence the dietary pattern of an elderly individual. However, more scientific and nutritional researches, like follow up studies or nutritional interventions are mandatory in order to establish a stronger relation between dietary pattern and the factors as mentioned above.

Acknowledgement

The University of Mauritius is thanked for support.

Funding

This work did not receive any funding.

Conflict of interest

The authors declare that there is no conflict of interest.

References

1. Kourkouta L, Ouzounakis P, Monios A, Iliadis C. Nutritional habits in the elderly. *Progress in Health Sciences*. 2016;6(2):155-159. doi:10.5604/01.3001.0009.5163
2. Kaur D, Rasane P, Singh J, et al. Nutritional Interventions for Elderly and Considerations for the Development of Geriatric Foods. *Curr Aging Sci*. 2019;12(1):15-27. doi:10.2174/1874609812666190521110548
3. Eberle U. Dietary Patterns and Their Impact. *Technik folgenabschätzung – Theorie und Praxis*. 2014;23:32-40. doi:10.14512/tatup.23.3.32
4. Eaton SB, M.D, Konner M. Paleolithic Nutrition, A consideration of its nature and current implications. *The New England Journal of Medicine*. Published online 1985:1-7. doi:312:283-289
5. Dunneram Y, Jeewon R. A Scientific Assessment of Sociodemographic Factors, Physical Activity Level, and Nutritional Knowledge as Determinants of Dietary Quality among Indo-Mauritian Women. *Journal of Nutrition and Metabolism*. 2013;2013:1-9. doi:http://dx.doi.org/10.1155/2013/572132
6. Akin JS, Guillkey DK, Popkin B, Kuczmarski MTF. Cluster analysis of food consumption patterns of older Americans. *Journal of the American Dietetic Association*. 1986;86(5):616-624. doi:10.1016/S0002-8223(21)03991-2
7. Drewnowski A, Shultz JM. Impact of aging on eating behaviors, food choices, nutrition, and health status. *J Nutr Health Aging*. 2001;5(2):75-79. https://pubmed.ncbi.nlm.nih.gov/11426286/
8. Lin YH, Hsu HC, Bai CH, Wu WC. Dietary Patterns among Older People and the Associations with Social Environment and Individual Factors in Taiwan: A Multilevel Analysis. *International Journal of Environmental Research and Public Health*. 2022;19(3982):1-10. doi:https://doi.org/10.3390/ijerph19073982
9. Dean M, Raats MM, Grunert KG, Lumbers M, The Food in Later Life Team. Factors influencing eating a varied diet in old age. *Public Health Nutrition*. 2009; 1:1-7. doi:10.1017/S1368980009005448
10. Kell KP, Judd SE, Pearson KE, Shikany JM, Fernández JR. Associations between socio-economic status and dietary patterns in US black and white adults. *British Journal of Nutrition*. 2015;113(11):1792-1799. doi:10.1017/S0007114515000938
11. American Psychological Association. AGING & SOCIOECONOMIC STATUS. Published online 2022. Accessed June 14, 2022 at https://www.apa.org/pi/ses/resources/publications/factsheet-age.pdf
12. Czarnocinska J, Wadolowska L, Lonnie M, Kowalkowska J, Jezewska-Zychowicz M, Babicz-Zielinska E. Regional and socioeconomic variations in dietary patterns in a representative sample of young polish females. *Nutrition Journal*. 2020;19(26):2-14. doi:https://doi.org/10.1186/s12937-020-00546-8
13. Hurree N, Pem D, Bhagwant S, Jeewon R. A pilot study to investigate energy intake and food frequency among middle aged and elderly people in Mauritius. *Mediterranean Journal of Nutrition and Metabolism*. 2017;10:61-77. doi:10.3233/MNM-16118

14. Iranagh JA, Motaleb SA, Chan YM, Iranagh NA, Iranagh EA, Rasouli J. Energy and macronutrient intakes in older urban and rural Iranian adults. *Southeast Asian J Trop Med Public Health*. 2014;45(4):949-955. at <https://www.thaiscience.info/Journals/Article/TMPH/10959737.pdf>
15. Vesnaver E, Keller H, Sutherland O, Maitland SB. Alone at the Table: Food Behavior and the Loss of Commensality in Widowhood. *The Journals of Gerontology Series B Psychological Sciences and Social Sciences*. 2015;71(6). doi:10.1093/geronb/gbv103
16. Hurree N, Jeewon R. An Analysis of Contributors to Energy Intake Among Middle Aged and Elderly Adults. *Current Research in Nutrition and Food Science*. 2016;4(3):8-18. doi:<http://dx.doi.org/10.12944/CRNFSJ.4>
17. Cheon BK, Hong Y yi. Mere experience of low subjective socioeconomic status stimulates appetite and food intake. *Proc Natl Acad Sci USA*. 2017;114(1):72-77. doi:10.1073/pnas.1607330114
18. Mazmanyar V. Beef vs Chicken meat - Health impact and Nutrition Comparison. Accessed June 14, 2022. <https://foodstruct.com/compare/beef-vs-chicken-meat>
19. Bhurosy T, Jeewon R. Changes in eating habits and food traditions of Indo-Mauritians. *Indian Journal of Traditional Knowledg*. 2016;15(3):355-362. https://www.researchgate.net/publication/304883045_Changes_in_eating_habits_and_food_traditions_of_Indo-Mauritians
20. War in Ukraine. *cbsews.com*. Published 2022. <https://www.cbsnews.com/>
21. Austin K. Fuel price jump will hit food bills, distributors warn. *bbc.com*. 2022; at <https://www.bbc.com/news/business-60674028>
22. French SA. Pricing effects on food choices. *J Nutr*. 2003;133(3):841S-843S. doi:10.1093/jn/133.3.841S
23. Duffey KJ, Gordon-Larsen P, Shikany JM, Guilkey D, Jacobs Jr DR, Popkin BM. Food price and diet and health outcomes: 20 years of the CARDIA Study. *Arch Intern Med*. 2010;170(5):420-426. doi:10.1001/archinternmed.2009
24. Turagabeci AR, Nakamura K, Kizuki M, Takano T. Family structure and health, how companionship acts as a buffer against ill health. *Health Qual Life Outcomes*. 2007;5(61). doi:10.1186/1477-7525-5-61
25. Murphy C. The Impact of Social Isolation on Eating Behaviour and Nutrition. *khni.kerry.com*. Accessed June 15, 2022; at <https://khni.kerry.com/news/the-impact-of-social-isolation-on-eating-behaviour-and-nutrition/>
26. Mahajan KH, Schafer E. Influence of selected psychosocial factors on dietary intake in the elderly. *J Nutr Elder*. 1993;12(4):21-41. doi:10.1300/J052v12n04_04
27. Vinther JL, Conklin AI, Wareham NJ, Monsivais P. Marital transitions and associated changes in fruit and vegetable intake: Findings from the population-based prospective EPIC-Norfolk cohort, UK. *Soc Sci Med*. Published online 2016; 120-126. doi:10.1016/j.socscimed.2016.04.004
28. Dunneram Y, Jeewon R. Determinants of eating habits among older adults. *Progr Nutr*. 2015;17(4):274-283. at <https://www.mattioli1885journals.com/index.php/progressinnutrition/article/view/4111>
29. Sobal J, Rauschenbach BS, Frongillo EA. Marital status, fatness and obesity. *Social Science & Medicine*. 1992;35(7):915-923. doi:[https://psycnet.apa.org/doi/10.1016/0277-9536\(92\)90106-Z](https://psycnet.apa.org/doi/10.1016/0277-9536(92)90106-Z)
30. Hermann J. Nutrition for Older Adults: Factors Which Affect Food Intake. Published online 2017. Accessed May 20, 2022; at <https://extension.okstate.edu/fact-sheets/nutrition-for-older-adults-factors-which-affect-food-intake.html>
31. Sheehan J. Ten Factors That Affect an Older Adult's Nutrition. *Healthy Eating | SF Gate*. Published 2018. Accessed May 20, 2022. <https://healthyeating.sfgate.com/ten-factors-affect-older-adults-nutrition-5925.html>
32. Kaner G, Soyulu M, Yüksel N, Inanç N, Ongan D, Basmisirlı E. Evaluation of Nutritional Status of Patients with Depression. *BioMed Research International*. Published online 2015; 1-9. doi:<http://dx.doi.org/10.1155/2015/521481>
33. Wallace SM. *Factors Affecting Dietary Intake, Dietary Change, Nutritional Status and Appetite in Older Adults: Impact of Oral Health Status*. Doctor of Philosophy (PhD). 2020. Accessed May 18, 2022. <https://pureadmin.com>

- qub.ac.uk/ws/portalfiles/portal/202433129/SMWallace_thesis_and_appendices_final.pdf
34. Matringe CH. *Nutrition and Eating Behaviour in Older Adulthood*. Bachelor of Science (Psychology) Honours. Edith Cowan University; 2007. https://ro.ecu.edu.au/theses_hons/1417
 35. Mathieu ME, Reid RE, King NA. Sensory Profile of Adults with Reduced Food Intake and the Potential Roles of Nutrition and Physical Activity Interventions. *Advances in Nutrition, An International Review journal*. 2019;10(6):1120-1125. doi:10.1093/advances/nmz044
 36. Jeon S, Kim Y, Min S, Song M, Son S, Lee S. Taste Sensitivity of Elderly People Is Associated with Quality of Life and Inadequate Dietary Intake. *Nutrients*. 2021;13(5). doi:10.3390/nu13051693
 37. Spence C, Youssef J. Aging and the (Chemical) Senses: Implications for Food Behaviour Amongst Elderly Consumers. *Foods*. 2021;10(1):2-16. doi:10.3390/foods10010168
 38. Fiechtner L, Kleinman K, Melly SJ, et al. Effects of Proximity to Supermarkets on a Randomized Trial Studying Interventions for Obesity. *Am J Public Health*. 2016;106(3):557-562. doi:10.2105/AJPH.2015.302986
 39. Pinho MGM, Lakerveld J, Harbers MC, et al. Ultra-processed food consumption patterns among older adults in the Netherlands and the role of the food environment. *Eur J Nutr*. 2021;60(5):2567-2580. doi:10.1007/s00394-020-02436-5
 40. Macdonald L, Ellaway A, Ball K, Macintyre S. Is proximity to a food retail store associated with diet and BMI in Glasgow, Scotland? *BMC Public Health*. 2011;11(464). doi:10.1186/1471-2458-11-464
 41. Baniyadi K, Armoon B, Higgs P, et al. The Association of Oral Health Status and socio-economic determinants with Oral Health-Related Quality of Life among the elderly: A systematic review and meta-analysis. *Int J Dent Hyg*. 2021;19(2):153-165. doi:10.1111/idh.12489
 42. Bostic SM, McClain A. Older adults' cooking trajectories: shifting skills and strategies. *British Food Journal*. 2017;119(5):1102-1115. doi:10.1108/BFJ-09-2016-0436
 43. Tani Y, Fujiwara T, Kondo K. Cooking skills related to potential benefits for dietary behaviors and weight status among older Japanese men and women: a cross-sectional study from the JAGES. *International Journal of Behavioral Nutrition and Physical Activity*. 2020;17(82):2-12. doi:https://ijbnpa.biomedcentral.com/articles/10.1186/s12966-020-00986-9
 44. Dumic I, Nordin T, Jecmenica M, Lalosevic MS, Milosavljevic T, Milovanovic T. Gastrointestinal Tract Disorders in Older Age. *Canadian Journal of Gastroenterology and Hepatology*. Published online 2019; 1-19. doi:https://doi.org/10.1155/2019/6757524
 45. Cristina NM, Lucia d'Alba. Nutrition and Healthy Aging: Prevention and Treatment of Gastrointestinal Diseases. *Nutrients*. 2021;13(12):1-23. doi:https://doi.org/10.3390/nu13124337
 46. Amarya S, Singh K, Sabharwal M. *Ageing Process and Physiological Changes*. Intech Open; 2018.
 47. Zhao A, Wang MC, Szeto IMY, et al. Gastrointestinal discomforts and dietary intake in Chinese urban elders: A cross-sectional study in eight cities of China. *World Journal of Gastroenterology*. 2019;25(45):6681-6692.
 48. Kazemi S, Savabi G, Khazael S, et al. Association between food intake and oral health in elderly: SEPAHAN systematic review no. 8. *Dental Research Journal*. 2011;8(5):S15-S20. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3556278/pdf/DRJ-8-15.pdf>
 49. Nordenram G, Ljunggren G, Cederholm T. Nutritional status and chewing capacity in nursing home residents. *Aging (Milano)*. 2001;13(5):370-377. doi:10.1007/BF03351505
 50. Impaired dentition nursing diagnosis and nursing care plan. *nursestudy.net*. Published 2022. <https://nursestudy.net/impaired-dentition-nursing-diagnosis/>
 51. Dion N, Cotart JL, Rabilloud M. Correction of nutrition test errors for more accurate quantification of the link between dental health and malnutrition. *Nutrition*. 2007;23(4):301-307. doi:10.1016/j.nut.2007.01.009

52. Kotronia E, Brown H, Papacosta AO, et al. Poor oral health and the association with diet quality and intake in older people in two studies in the UK and USA. *Br J Nutr.* 2021;126(1):118-130. doi:10.1017/S0007114521000180
53. Angelica D, Tucunduva S., Sandra P., Lima M. Food lists from the diet of a group of elderly individuals: Analysis and perspectives. *Rev Bras Epidemiol.* 2011;14(1):1-16. <https://www.scielo.br/j/rbepid/a/VM6CxXc7zSFzhgkZjzbQXSJ/?format=pdf&lang=en>
54. Watson S, McGowan L, McCrum LA, et al. The impact of dental status on perceived ability to eat certain foods and nutrient intakes in older adults: cross-sectional analysis of the UK National Diet and Nutrition Survey 2008–2014. *International Journal of Behavioral Nutrition and Physical Activity.* 2019;16(43):1-13. doi:oral Nutrition and <https://doi.org/10.1186/s12966-019-0803-8>
55. Osterberg T, Tsuga K, Rothenberg E, Carlsson G, Steen B. Masticatory ability in 80-year-old subjects and its relation to intake of energy, nutrients and food items. *Gerontology.* 2002;19(2):95-101. at https://www.academia.edu/62345240/Masticatory_ability_in_80_year_old_subjects_and_its_relation_to_intake_of_energy_nutrients_and_food_items
56. Bento IC, Souza MAN, Peixoto SV. Association between number of medications used and nutritional markers among elderly persons with chronic diseases: National Health Survey (2013). *Revista Brasileira de Geriatria e Gerontologia.* 2019;22(1):2-10. doi:<http://dx.doi.org/10.1590/1981-22562019022.180112>
57. White R. Symposium 8: Drugs and nutrition Drugs and nutrition: how side effects can influence nutritional intake. *Proceedings of the Nutrition Society.* 2010;69:558-564. doi:10.1017/S0029665110001989
58. Machira J. Assessment of Factors Affecting Dietary Intake among Elderly People a Case Study at Morogoro Municipality. Degree. Sokoine University of Agriculture; 2017. Accessed May 18, 2022. at https://www.academia.edu/38289436/FACTORS_AFFECTING_DIETARY_INTAKE_AMONG_ELDERLY_pdf
59. AziziFard, N., De Francisci Morales G., Mejova Y. et al. On the interplay between educational attainment and nutrition: a spatially-aware perspective. *EPJ Data Sci.* 2021; 10(18):11-14. at <https://doi.org/10.1140/epjds/s13688-021-00273-y>
60. Pem D, Bhagwant S, Jeewon R. A Pre and Post Survey to Determine Effectiveness of a Dietitian-Based Nutrition Education Strategy on Fruit and Vegetable Intake and Energy Intake among Adults. *Nutrients.* 2016; 8(3):127. <https://doi.org/10.3390/nu8030127>.