



## Geriatric Nutrition: A Technical Perspective on Nutritional Needs of the Elderly

\*Bratati Das, AA Joshi and VS Pawar

College of Community Science, Vasantrao Naik Marathwada Krishi Vidyapeeth,  
Parbhani, Maharashtra-431402, India

\*Corresponding Author's email: [444bratatidas@gmail.com](mailto:444bratatidas@gmail.com)

Geriatric nutrition is a specialized field focusing on the dietary needs and challenges of older adults. As individuals age, physiological changes such as reduced metabolic rate, decreased appetite, and altered nutrient absorption can impact nutritional status. Additionally, chronic conditions like diabetes, hypertension, and cognitive decline further complicate dietary requirements. Key nutritional considerations for the elderly include adequate protein intake to prevent sarcopenia, ensuring sufficient caloric intake to maintain energy balance, and addressing micronutrient deficiencies, particularly in vitamin D, B12, and calcium. Dietary patterns such as the Mediterranean-DASH Diet Intervention for Neurodegenerative Delay (MIND) diet have shown promise in reducing cognitive decline and promoting brain health. Furthermore, managing hydration and addressing issues like dysphagia are crucial for maintaining overall health in geriatric populations. Early identification and intervention in nutritional deficiencies are vital to prevent complications like malnutrition, frailty, and functional decline. Healthcare providers play a pivotal role in assessing and addressing the unique nutritional needs of older adults to enhance their quality of life and longevity.

**Keywords:** geriatric nutrition, aging, sarcopenia, malnutrition, MIND diet, protein intake, micronutrients, hydration, dysphagia, cognitive decline, dietary patterns, elderly health

### Introduction

In older adults, satisfaction with eating is a crucial component of overall quality of life. Many individuals over 65 experience partial or complete tooth loss, leading to diminished chewing efficiency. This reduction in masticatory function often results in dietary modifications, which can significantly affect health outcomes.

Restoring lost chewing ability in edentulous seniors presents a challenge for dental professionals. However, other factors also play a role in the nutritional status of older adults. Age-related health conditions, socioeconomic status, and dietary habits all influence food choices and nutritional intake.

By understanding the nutritional needs, signs of malnutrition, and environmental influences on food selection, dentists can identify patients at risk of malnutrition and provide appropriate dietary guidance. Since each patient's oral health and nutritional requirements are unique, personalized recommendations are essential. This article explores the connection between dental health and nutrition in the elderly population.

### Process of Ageing

Ageing is a natural biological process that commences at conception and continues throughout life, culminating only with death. Individuals experience ageing at varying rates, influenced by factors such as genetics, race, and gender. While heredity and proper nutrition can decelerate the ageing process, enabling individuals to maintain physical and mental

vitality into their eighties, the primary objective of nutritional care should be to assist older adults in achieving healthy, purposeful, and independent living.

A prominent theory explaining ageing is the free radical theory, which posits that the continuous formation of free radicals—highly reactive molecules resulting from oxygen exposure and environmental factors—leads to cellular damage. These free radicals can alter the structure of proteins, lipids, carbohydrates, and DNA, contributing to the physiological changes associated with ageing.

Tissue damage caused by free radicals and pro-oxidant radicals, such as superoxide, peroxide, and hydroxyl radicals, underpins inflammatory and degenerative changes. Endogenous antioxidants, including superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GPX), work synergistically with glutathione (GSH) and NADPH to neutralize these harmful radicals. However, with age and in certain diseases, these antioxidant defenses diminish, leading to excessive utilization of vitamins A, C, and E, resulting in deficiencies.

The ageing process induces physiological, psychological, and immunological changes that influence nutritional status. Free radicals are believed to cause degenerative changes, potentially leading to conditions such as cancer, cataract formation, atherosclerotic plaques, arthritis, and Parkinson's disease.

Factors such as the inability to prepare food, decreased purchasing capacity, and psychosocial issues negatively impact the health and nutritional status of the elderly. Reduced physical activity and dental problems can lead to decreased food intake and poor nutrient absorption. Additionally, changes in organ function associated with ageing may further influence nutritional status.

### Changes in organ function with ageing changes aging that may influence nutrient requirements

Organ function	Changes	Effect on nutrition
<b>Taste and smell</b>	<ul style="list-style-type: none"> <li>Decreased taste buds and papillae on tongue.</li> <li>Decrease in taste and olfactory nerve endings.</li> </ul>	<ul style="list-style-type: none"> <li>Loss of ability to detect salt and sweet.</li> <li>Decreased palatability causing poor food intake.</li> <li>Decreased sensory stimulation that may impair metabolic processes.</li> </ul>
<b>Salivary glands</b>	<ul style="list-style-type: none"> <li>Decrease in salivary secretion causes feeling of dry mouth, xerostomia.</li> </ul>	<ul style="list-style-type: none"> <li>Difficulty in chewing and swallowing make them avoid certain foods particularly crunchy, dry and sticky foods.</li> </ul>
<b>Teeth</b>	<ul style="list-style-type: none"> <li>Loss of teeth and wearing dentures</li> </ul>	<ul style="list-style-type: none"> <li>Decreased consumption of meats and fresh fruits and vegetables particularly which are hard (carrot) and have lot of seeds (guava). In turn this can result in inadequate intake of energy, iron and vitamins particularly vitamin C, folate and Beta-carotene.</li> </ul>
<b>Gastric function and emptying</b>	<ul style="list-style-type: none"> <li>Decreased secretion of hydro-chloric acid, intrinsic factor and pepsin.</li> <li>Above 60 years of age rapid rate of emptying of liquids.</li> </ul>	<ul style="list-style-type: none"> <li>Decreased bioavailability of minerals, vitamins and proteins.</li> <li>Decreased absorption of protein bound vitamin B12 and folate.</li> </ul>
<b>Small intestine</b>	<ul style="list-style-type: none"> <li>Increased proximal small bowel pH and bacterial over growth in bowel</li> <li>Decreased calcium absorption</li> <li>Decreased secretion of lactase</li> <li>Constipation-prolonged rectosigmoid transit</li> </ul>	<ul style="list-style-type: none"> <li>Increase in bacterial folate synthesis to counteract malabsorption.</li> <li>Poor vitamin D nutriture</li> <li>Can be a risk factor for developing osteoporosis</li> </ul>

<b>Liver and Biliary function</b>	<ul style="list-style-type: none"> <li>Decreased size and blood flow</li> <li>Minor structural and biochemical changes</li> <li>Gall bladder becomes sluggish in releasing bile</li> <li>Activity of drug metabolising enzymes reduced.</li> </ul>	<ul style="list-style-type: none"> <li>Rate of albumin synthesis may be decreased</li> <li>Susceptible to gallstones</li> <li>Drug dosages may need to be lowered.</li> </ul>
<b>Metabolic function</b>	<ul style="list-style-type: none"> <li>Impaired glucose tolerance</li> <li>Decreased metabolic rate due to changes in body composition and reduction in physical activity.</li> <li>Body protein level decreases</li> </ul>	<ul style="list-style-type: none"> <li>Requires dietary modifications, exercise and oral pharmacologic agents.</li> <li>Requirement of energy decreases.</li> <li>Activity decreases</li> </ul>
<b>Neurologic function</b>	<ul style="list-style-type: none"> <li>Confusional states</li> </ul>	<ul style="list-style-type: none"> <li>Decreased synthesis of serotonin: Carnitine derived from the amino acids lysine and methionine may be effective in slowing the mental deterioration in Alzheimer's disease.</li> <li>Carotenoids seem to play a protective role related to ageing and cognitive function.</li> </ul>
<b>Immuno competence</b>	<ul style="list-style-type: none"> <li>Declines with age</li> </ul>	<ul style="list-style-type: none"> <li>Supplementation with vitamin E, zinc and polyunsaturated fatty acid can be increased.</li> </ul>
<b>Ophthalmic function</b>	<ul style="list-style-type: none"> <li>Opacity of eye lens</li> </ul>	<ul style="list-style-type: none"> <li>Increased requirement of antioxidant</li> </ul>
<b>Cardiovascular function</b>	<ul style="list-style-type: none"> <li>Blood vessels become less elastic and total peripheral resistance increases.</li> </ul>	<ul style="list-style-type: none"> <li>Prevalence of hypertension, modification of diet accordingly.</li> </ul>
<b>Renal function</b>	<ul style="list-style-type: none"> <li>Glomerular filtration rate can diminish as much as 60 per cent, changes in fluid and acid base balance.</li> </ul>	<ul style="list-style-type: none"> <li>Protein, sodium and potassium nutrition may be affected.</li> </ul>
<b>Psychological factors</b>	<ul style="list-style-type: none"> <li>Depression</li> </ul>	<ul style="list-style-type: none"> <li>Can affect appetite, digestion, energy level, weight and well-being.</li> </ul>

## Essential, nutrients for severs, Dietary recommendation for elderly balanced meal planning

### Essential Nutrients for Senior

As individuals age, their nutritional needs evolve, necessitating a balanced diet rich in specific nutrients to support overall health and well-being. This section explores the importance of protein, fiber, vitamins, and minerals for older adults.

### Protein

Protein is vital for maintaining muscle mass, supporting the immune system, and promoting wound healing. Older adults may require higher amounts of protein to preserve muscle mass and strength, which can decline with age. Incorporating lean meats, fish, eggs, dairy products, legumes, and nuts into the diet can help seniors meet their daily protein needs. It's advisable to spread protein intake throughout the day to maximize absorption and utilization by the body.

### Protein Sources and Content

Food Item	Protein (g) per Serving
Chicken Breast (3 oz)	26
Salmon (3 oz)	19
Eggs (1 large)	6
Almonds (1 oz)	6

## Fiber

Fiber plays a crucial role in digestive health, helps maintain a healthy weight, and can lower the risk of heart disease and type 2 diabetes. Older adults should aim to include a variety of fiber-rich foods in their daily diet, such as whole grains, fruits, vegetables, and legumes.

### Fiber Sources and Content

Food Item	Fiber (g) per Serving
Whole Wheat Bread (1 slice)	2
Apple (1 medium)	4
Black Beans (1/2 cup)	7
Broccoli (1 cup)	5

## Vitamins

Vitamins are essential for overall health and well-being. For older adults, certain vitamins like B12, which supports nerve function, and D, which aids in calcium absorption for bone health, are especially important. Older individuals should try to get these vitamins from a balanced diet, but in some cases, supplementation may be necessary.

### Vitamin Sources

Vitamin	Food Sources
Vitamin B12	Fish, poultry, meat, eggs, dairy
Vitamin D	Fatty fish, fortified dairy products, egg yolks

## Minerals

Minerals like calcium and potassium are also vital for elderly nutritional needs. Calcium is essential for maintaining bone health, while potassium can help regulate blood pressure. Dairy products, leafy green vegetables, and fruits like bananas and oranges are excellent sources of these minerals.

### Mineral Sources

Mineral	Food Sources
Calcium	Milk, yogurt, cheese, leafy green vegetables
Potassium	Bananas, oranges, potatoes, spinach

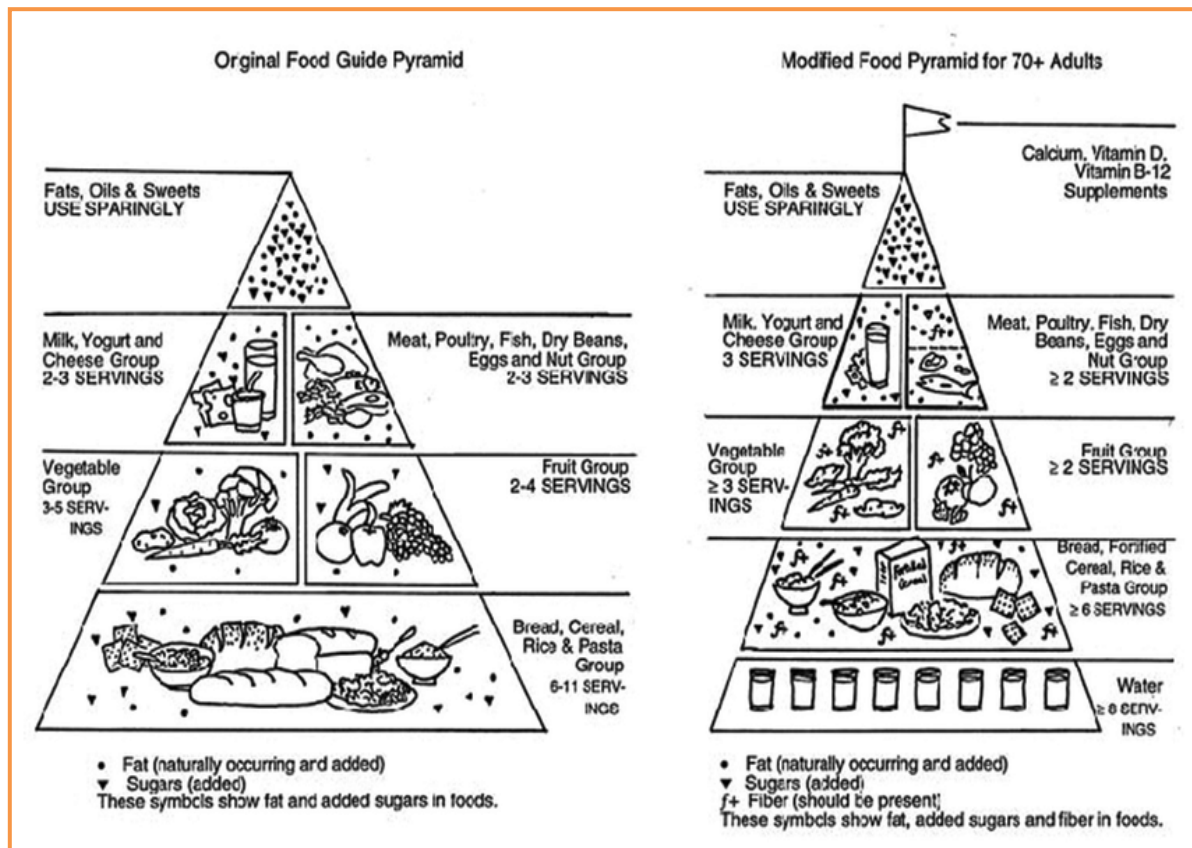
It's important to note that each individual's nutritional needs can vary, and it's always best to consult with a healthcare professional or dietitian to determine the most appropriate diet. Ensuring a balanced intake of these essential nutrients can significantly contribute to the health and wellness of seniors.

### Daily nutrient Recommendations for the Elderly, ICMR 2024

Nutrient	Men (≥60 years)	Women (≥60 years)
Energy	1700 kcal	1500 kcal
Protein	54.0 g	45.7 g
Dietary Fibre	32 g	25 g
Vitamin A	1000 µg	840 µg
Thiamine (B1)	1.4 mg	1.4 mg
Riboflavin (B2)	2.0 mg	1.9 mg
Niacin	12 mg	9 mg
Vitamin C	80 mg	65 mg
Vitamin B6	1.9 mg	1.9 mg
Folate	300 µg	200 µg
Vitamin B12	2.2 µg	2.2 µg
Vitamin D	800 IU	800 IU
Calcium	1200 mg	1200 mg
Magnesium	440 mg	370 mg
Iron	19 mg	19 mg
Zinc	17 mg	13.2 mg
Iodine	150 µg	150 µg



## Modified Food Pyramid for Elderly



## Modification of diet to suit the needs of old age

As individuals age, various physical, physiological, and psychological changes occur, necessitating specific dietary modifications to maintain health and well-being. The following adjustments are recommended:

1. **Dental Health Considerations:** Due to potential tooth loss or dental issues, it's advisable to include soft-textured foods that are easy to chew, such as cooked vegetables, tender meats, and well-cooked grains.
2. **Digestive Efficiency:** With a decrease in the production of digestive enzymes, it's beneficial to consume easily digestible foods like soups, stews, and pureed dishes to facilitate nutrient absorption.
3. **Fat Intake:** Limiting the intake of saturated fats and avoiding foods high in unhealthy fats can help prevent obesity and reduce the risk of cardiovascular diseases.
4. **Energy-Dense Foods:** Limiting the consumption of energy-rich foods such as sweets, fried items, and starchy foods can help manage weight and prevent metabolic issues.
5. **Calcium-Rich Foods:** Incorporating foods high in calcium, like dairy products and leafy greens, supports bone health and helps mitigate the effects of osteoporosis.
6. **Fruits and Vegetables:** Including a variety of fresh fruits, vegetables, and green leafy vegetables provides essential vitamins, minerals, fiber, and antioxidants. These can be consumed as juices, purees, soups, or salads to enhance nutrient intake.
7. **Caffeine and Stimulants:** Limiting the intake of coffee, tea, and carbonated beverages can help prevent insomnia and promote better sleep quality.
8. **Meal Frequency:** Opting for smaller, more frequent meals throughout the day can aid in digestion and ensure adequate nutrient intake.
9. **Hydration:** Consuming an adequate amount of fluids is essential to prevent dehydration and support overall health.
10. **Salt Intake:** Reducing salt consumption can help manage blood pressure and reduce the risk of cardiovascular issues.

Ensuring a diet that is nutritionally adequate, well-balanced, and tailored to the specific needs of older adults is crucial for maintaining health and quality of life.

## Nutritional Screening and Assessment

Routine screening using tools like:

**MNA (Mini Nutritional Assessment):** The Mini Nutritional Assessment (MNA) is a widely used, validated screening tool designed to evaluate the nutritional status of elderly individuals, particularly those over the age of 65. Developed in the 1990s by Vellas and colleagues, the MNA helps identify malnutrition and the risk of malnutrition before significant weight loss or other clinical signs appear. It consists of two forms: the MNA-Short Form (MNA-SF), which includes six basic questions, and the full MNA, comprising 18 items that assess dietary intake, anthropometry, lifestyle, and subjective health status. The tool is non-invasive, cost-effective, and can be administered by healthcare professionals or caregivers in community and clinical settings. A score of 12–14 on the MNA-SF indicates normal nutritional status, 8–11 suggests a risk of malnutrition, and 0–7 reflects malnutrition. The MNA has shown high sensitivity (96%) and specificity (98%) in identifying nutritional issues and is strongly correlated with clinical outcomes such as increased morbidity, hospitalizations, and mortality in older adults (Guigoz, 2006; Kaiser et al., 2010). Its ease of use and reliability make it a cornerstone of geriatric nutritional assessment worldwide.

**MUST (Malnutrition Universal Screening Tool):** The Malnutrition Universal Screening Tool (MUST) is a validated, evidence-based screening instrument developed by the British Association for Parenteral and Enteral Nutrition (BAPEN) to identify adults at risk of malnutrition in hospital, community, and care home settings. It is a simple five-step tool that assesses body mass index (BMI), unintentional weight loss, and the presence of acute disease with no nutritional intake for more than five days. Each parameter is scored, and the total score categorizes individuals into low (score 0), medium (score 1), or high risk (score  $\geq 2$ ) of malnutrition. MUST is widely recognized for its practicality and reliability and is recommended in clinical guidelines across the UK and Europe for routine nutritional screening. Studies have shown that MUST is effective in predicting adverse outcomes such as increased length of hospital stay, complications, and mortality in both community and clinical populations (Stratton et al., 2004; Elia, 2003). Its widespread adoption has contributed significantly to early identification and intervention for malnutrition, thereby improving patient outcomes and reducing healthcare costs.

**SNAQ (Short Nutritional Assessment Questionnaire):** The Short Nutritional Assessment Questionnaire (SNAQ) is a quick and practical screening tool developed to identify individuals at risk of malnutrition, particularly in hospitalized patients and elderly populations. Designed to be completed in less than five minutes, SNAQ consists of three to four simple questions that assess unintentional weight loss, decreased appetite, and the use of supplemental feeding such as nutritional drinks or tube feeding. Each response is scored, and a total score of 2 or more indicates a risk of malnutrition, prompting further nutritional assessment or intervention. The tool has been validated in various clinical settings and has demonstrated good sensitivity and specificity for predicting weight loss and poor clinical outcomes in hospitalized patients (Kruizenga et al., 2005). Its brevity, ease of use, and strong predictive value make SNAQ particularly useful in busy healthcare environments where rapid screening is essential to ensure early nutritional support and improve recovery outcomes.

## Dietary Tips for elderly

As we age, our nutritional needs evolve, requiring thoughtful dietary choices to maintain strength, immunity, and metabolic health. For seniors in India, a balanced diet should emphasize easily digestible, fiber-rich foods such as whole grains (e.g., dalia, brown rice, and millets), along with seasonal fruits and vegetables like papaya, banana, and guava. These choices aid digestion and are rich in antioxidants. Incorporating calcium-rich foods like low-fat curd, paneer, and ragi is essential for bone health. Adequate protein intake is crucial for maintaining muscle mass; options include soft-cooked dals, legumes, eggs, or curd.

Hydration is often overlooked in older adults, so it's important to ensure they drink enough water, coconut water, and light herbal teas. Reducing consumption of salt, sugar, and greasy foods can help manage age-related issues like hypertension and diabetes. Eating smaller, more frequent meals tends to be easier on the stomach than having large, infrequent ones. Additionally, spices like turmeric, ajwain, and jeera not only enhance flavor but also aid digestion and reduce inflammation. These dietary recommendations align with the guidelines from the National Institute of Nutrition (ICMR-NIN) and the Ministry of Health and Family Welfare (MoHFW), making them both culturally relevant and medically sound.

### **Nutrition related problems of old age**

As individuals age, physiological changes often lead to nutritional challenges among the elderly in India. Common issues include reduced appetite, dental problems, and impaired digestion, resulting in insufficient nutrient intake. Deficiencies in micronutrients such as calcium, vitamin D, vitamin B12, and iron are prevalent, contributing to conditions like osteoporosis, anemia, and general weakness. Chronic illnesses such as diabetes, hypertension, arthritis, and gastrointestinal disorders further complicate nutrient absorption and dietary habits. Socioeconomic factors, including living alone, limited income, and decreased mobility, also affect access to nutritious food. Additionally, dental issues like tooth loss can lead to the avoidance of fiber-rich foods, exacerbating problems like constipation and malnutrition. Psychological conditions such as depression and dementia can disrupt regular eating patterns. To address these concerns, the ICMR-NIN and FSSAI recommend an integrated approach that includes easily chewable, nutrient-dense meals, and fortified foods. Personalized diets tailored to individual health conditions, along with regular nutritional assessments, are essential components of geriatric care in India.

### **Nutritional Requirements for the Elderly in India**

The ICMR Expert Group on Nutrient Requirements has updated the Recommended Dietary Allowances (RDA) for Indians, aligning with international guidelines from FAO/WHO/UNU. The 2020 recommendations introduce three key dietary reference values: Estimated Average Requirement (EAR), RDA, and Tolerable Upper Intake Level (TUL). While EAR represents the average requirement for a population, RDA is designed to meet the nutritional needs of nearly all healthy individuals in a specific age, gender, and physiological group. TUL indicates the maximum daily intake unlikely to cause adverse health effects. These values were derived using a factorial approach, considering factors like energy expenditure and nutrient bioavailability, and adjusting for age, gender, and physiological status.

For the elderly population ( $\geq 60$  years), the ICMR-2020 guidelines suggest a decrease in energy intake—by 100 kcal per decade for men and 70 kcal for women—due to reduced physical activity. Conversely, vitamin D intake is recommended to be higher to counteract age-related bone loss and prevalent deficiencies. These adjustments are based on the understanding that age-related physiological and sensory changes may affect nutrient requirements in older adults. Therefore, more evidence-based nutrient requirement recommendations need to be derived and adopted for the elderly in India.

### **Conclusion**

Geriatric nutrition is pivotal in enhancing the health and quality of life of older adults. Aging brings about physiological changes that can lead to malnutrition, frailty, sarcopenia, and other geriatric syndromes. Addressing these challenges requires personalized nutritional strategies that consider individual needs and conditions. Effective interventions include adequate protein intake, adherence to balanced diets like the Mediterranean diet, and the use of oral nutritional supplements when necessary. Additionally, addressing issues such as dysphagia and sensory impairments is crucial to ensure proper nutrition. Technological advancements offer promising tools for monitoring and managing nutritional status in the elderly. In conclusion, a comprehensive approach to geriatric nutrition, encompassing early detection,



personalized care, and ongoing support, is essential for promoting healthy aging and preventing nutrition-related complications.

## References

1. ICMR-NIN Dietary Guidelines for Indians (2020) – <https://www.nin.res.in/downloads/DietaryGuidelinesforNINwebsite.pdf>
2. Ministry of Health and Family Welfare (GoI) – Guidelines for Elderly Nutrition – [https://fnhw-aajeevika.lokos.in/pdfs\\_english/Facilitator%20Guides/Health%20and%20Nutrition%20for%20the%20Elderly.pdf](https://fnhw-aajeevika.lokos.in/pdfs_english/Facilitator%20Guides/Health%20and%20Nutrition%20for%20the%20Elderly.pdf)
3. WHO India – Nutrition and Healthy Ageing – <https://www.who.int/india/health-topics/nutrition>
4. FSSAI Eat Right India (for senior citizens) – <https://eatrightindia.gov.in>
5. FSSAI Elderly Nutrition Factsheet – [https://www.fssai.gov.in/upload/uploadfiles/files/Compendium\\_Nutra\\_29\\_09\\_2021.pdf](https://www.fssai.gov.in/upload/uploadfiles/files/Compendium_Nutra_29_09_2021.pdf)
6. National Programme for Health Care of the Elderly (NPHCE) – MoHFW – <https://dghs.mohfw.gov.in/national-programme-for-the-health-care-of-the-elderly.php#:~:text=The%20National%20Programme%20for%20the,the%20Government%20of%20India%20in>
7. WHO India – Ageing and Health – <https://www.who.int/india>
8. <https://pmc.ncbi.nlm.nih.gov/articles/PMC10101356/>
9. <https://www.h2hhc.com/blog/elderly-nutritional-needs>
10. [https://www.brainkart.com/article/Modification-Of-Diet-To-Suit-The-Needs-Of-Old-Age\\_2612/](https://www.brainkart.com/article/Modification-Of-Diet-To-Suit-The-Needs-Of-Old-Age_2612/)
11. Cava, E., & Lombardo, M. (2024). Editorial for the Special Issue: Geriatric Nursing Nutrition. *Nutrients*, 16(24), 4420.
12. Derouiche, A., Bouaziz, G., Brulin, D., Campo, E., & Piau, A. (2023). Empowering health in aging: Innovation in undernutrition detection and prevention through comprehensive monitoring.
13. Volkert, D., Beck, A. M., Cederholm, T., Cruz-Jentoft, A., Goisser, S., Hooper, L., et al. (2019). ESPEN guideline on clinical nutrition and hydration in geriatrics. *Clinical Nutrition*, 38(1), 10–47.
14. <https://mitaksharaacademy.com/wp-content/uploads/2024/05/RDA-revised-2024.pdf>
15. [en.wikipedia.orgencyclopedia.com](https://en.wikipedia.orgencyclopedia.com)
16. [icliniq.com](https://icliniq.com)
17. Zarb GA, Hobkirk J, Eckert S, Jacob R. Prosthodontics Treatment for Edentulous Patients: Complete Dentures and Implant Supported Prostheses. 13th edition. St. Louis Missouri, US: Mosby Inc; 2012
18. Atwood DA. Reduction of residual ridges: a major oral disease entity. *J Prosthet Dent* 1971;26(03):266–279
19. Bandodkar KA, Aras M. Nutrition for geriatric denture patients. *J Indian Prosthodont Soc* 2006;6(01):22–28
20. Ramsey WO. The role of nutrition in conditioning edentulous patients. *J Prosthet Dent* 1970;23(02):130–135
21. Sanford AM. Anorexia of aging and its role for frailty. *Curr Opin Clin Nutr Metab Care* 2017;20(01):54–60
22. 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(01):15–27
23. Visvanathan R. Anorexia of aging. *Clin Geriatr Med* 2015;31(03): 417–427
24. de Boer A, Ter Horst GJ, Lorist MM. Physiological and psychosocial age-related changes associated with reduced food intake in older persons. *Ageing Res Rev* 2013;12(01):316–328
25. Landi F, Calvani R, Tosato M, et al. Anorexia of aging: risk factors, consequences, and potential treatments. *Nutrients* 2016;8(02):69



26. Martone AM, Onder G, Vetrano DL, et al. Anorexia of aging: a modifiable risk factor for frailty. *Nutrients* 2013;5(10): 4126–4133
27. Grassi M, Petraccia L, Mennuni G, et al. Changes, functional disorders, and diseases in the gastrointestinal tract of elderly. *Nutr Hosp* 2011;26(04):659–668
28. Krall E, Hayes C, Garcia R. How dentition status and masticatory function affect nutrient intake. *J Am Dent Assoc* 1998;129(09): 1261–1269
29. Gombart AF, Pierre A, Maggini S. A review of micronutrients and the immune system-Working in harmony to reduce the risk of infection. *Nutrients* 2020;12(01):236
30. El-Kadiki A, Sutton AJ. Role of multivitamins and mineral supplements in preventing infections in elderly people: systematic review and meta-analysis of randomised controlled trials. *BMJ* 2005;330(7496):871
31. Rodriguez RM. Psychosocial issues in geriatric rehabilitation. *Phys Med Rehabil Clin N Am* 2017;28(04):693–704
32. [https://www.researchgate.net/figure/Original-food-guide-pyramid-and-modified-food-pyramid-for-elderly\\_fig2\\_322857257](https://www.researchgate.net/figure/Original-food-guide-pyramid-and-modified-food-pyramid-for-elderly_fig2_322857257)
33. <https://deepahospital.in/blogs/indian-food-for-strong-bones/>
34. [https://www.nin.res.in/RDA\\_Full\\_Report\\_2024.html](https://www.nin.res.in/RDA_Full_Report_2024.html)
35. <https://www.revistanutricion.org/articles/geriatric-nutrition-system-for-health-and-wellbeing105954.html>
36. Cichero, J. A., et al. (2013). Standardising the terminology and definitions for modified foods and thickened liquids. *Dysphagia*, 28(2), 139–150.
37. Volkert, D., Beck, A. M., Cederholm, T., et al. (2019). ESPEN guideline on clinical nutrition and hydration in geriatrics. *Clinical Nutrition*, 38(1), 10–47.
38. Laur, C., McNicholl, T., & Valaitis, R. (2017). Improving nutritional care through the integration of registered dietitians into primary health care teams: A qualitative study. *BMC Family Practice*, 18(1), 1–11.
39. Kruizenga HM, Seidell JC, de Vet HC, Wierdsma NJ, van Bokhorst-de van der Schueren MA. (2005). Development and validation of a hospital screening tool for malnutrition: the Short Nutritional Assessment Questionnaire (SNAQ). *Clinical Nutrition*, 24(1), 75–82.
40. Wierdsma NJ, van Bokhorst-de van der Schueren MAE, Guaitoli PR, et al. (2009). Nutritional screening tools in clinical care: Validity and predictive value of the Short Nutritional Assessment Questionnaire (SNAQ). *Clinical Nutrition*, 28(1), 22–28.
41. Elia M. (2003). The "MUST" report: Nutritional screening of adults: a multidisciplinary responsibility. *BAPEN*.
42. Stratton RJ, Hackston A, Longmore D, et al. (2004). Malnutrition in hospital outpatients and inpatients: prevalence, concurrent validity and ease of use of the 'malnutrition universal screening tool' (MUST) for adults. *British Journal of Nutrition*, 92(5), 799–808.
43. Guigoz Y. (2006). The Mini Nutritional Assessment (MNA) review: What does it tell us? *Journal of Nutrition, Health and Aging*, 10(6), 466–485.
44. Kaiser MJ, Bauer JM, Ramsch C, et al. (2010). Frequency of malnutrition in older adults: A multinational perspective using the Mini Nutritional Assessment. *Journal of the American Geriatrics Society*, 58(9), 1734–1738.