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# Geriatric Nutrition and Age-Related Physiological Changes

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**Abstract:** *Geriatric nutrition is an essential component of healthy ageing, focusing on the dietary management of physiological, metabolic, and psychosocial changes that occur with advancing age. The global increase in the elderly population has heightened the need for effective nutritional strategies to maintain health, functional independence, and quality of life. This review explores the major age-related changes affecting nutritional status, including sarcopenia, alterations in body composition, gastrointestinal dysfunction, reduced nutrient absorption, osteoporosis, sensory and oral health impairments, cardiovascular changes, declining renal function, and immunosenescence. The review further examines the influence of psychological and social factors, such as depression, loneliness, and social isolation, on food intake and nutritional wellbeing. Current evidence suggests that adequate intake of protein, vitamins, minerals, dietary fiber, and antioxidant-rich foods, combined with regular physical activity, can help mitigate age-related decline and reduce the risk of chronic diseases. Comprehensive nutritional assessment and individualized interventions are critical for promoting healthy ageing and improving overall health outcomes in older adults.*

**Keywords:** *Geriatric nutrition; Healthy ageing; Sarcopenia; Malnutrition; Immunosenescence.*

## I. INTRODUCTION

Geriatric nutrition is a specialized area of nutritional science that focuses on meeting the unique dietary needs of older adults. The primary goal of geriatric nutrition is to optimize health, maintain functional independence, prevent malnutrition, and delay the onset or progression of age-related diseases. As populations around the world continue to age, nutrition has become a critical component of healthy ageing strategies. Improvements in healthcare services, sanitation, vaccination programs, and disease management have significantly increased life expectancy, leading to a rapid growth in the proportion of older adults worldwide (WHO, 2021).

The global demographic transition has resulted in an unprecedented increase in the number of individuals aged 65 years and older. According to the World Health Organization (2021), the population of older adults is expected to double by 2050, with the most rapid growth occurring among individuals aged 85 years and above. Older adults are commonly classified into three categories: the young-old (65–74 years), the old-old (75–84 years), and the oldest-old (85 years and older). These categories recognize that ageing is not a uniform process and that significant physiological, functional, and nutritional differences exist among older individuals. Many older adults remain active and independent well into their seventies and eighties, whereas others experience significant declines in health and functional capacity.

Nutrition plays a fundamental role in promoting healthy ageing and preventing chronic diseases. Evidence indicates that dietary patterns rich in fruits, vegetables, whole grains, legumes, healthy fats, and lean protein sources are associated with lower risks of cardiovascular disease, type 2 diabetes, osteoporosis, cognitive decline, and certain forms of cancer (WHO, 2023). Furthermore, emerging research on dietary restriction, antioxidant-rich foods, and anti-inflammatory dietary patterns suggests that nutrition may influence biological ageing processes and contribute to increased longevity (Fontana & Partridge, 2015). Consequently, understanding the physiological changes associated with ageing is essential for developing effective nutritional interventions that support health and quality of life in older adults.

## II. CHANGES IN BODY COMPOSITION AND SARCOPENIA

One of the most significant physiological changes associated with ageing is the progressive alteration in body composition. Ageing is characterized by a gradual decline in skeletal muscle mass, strength, and function, a condition known as sarcopenia. Sarcopenia is now recognized as a major geriatric syndrome because of its association with frailty, falls, disability, hospitalization, and mortality (Cruz-Jentoft et al., 2019). The condition develops due to multiple factors, including hormonal changes, reduced physical activity, chronic inflammation, inadequate protein intake, mitochondrial dysfunction, and neuromuscular degeneration.

As muscle mass decreases, body fat percentage generally increases, even when body weight remains relatively stable. Fat accumulation often occurs in visceral regions and within muscle tissue itself, a phenomenon known as myosteatosis. These changes negatively affect physical performance, mobility, and metabolic health. Older adults with sarcopenia often experience difficulty performing activities of daily living, such as climbing stairs, carrying groceries, and maintaining balance, which increases their risk of falls and loss of independence (Dent et al., 2018).

Age-related reductions in lean body mass contribute directly to declines in basal metabolic rate (BMR). Research indicates that energy expenditure decreases by approximately 3–5% per decade after adulthood due primarily to reductions in metabolically active tissues (Roberts & Rosenberg, 2021). Consequently, older adults require fewer calories than younger individuals. However, nutrient requirements remain relatively unchanged or may even increase for certain nutrients. This creates a challenge whereby older adults must obtain adequate vitamins, minerals, and protein from fewer calories, emphasizing the importance of nutrient-dense foods.

Another consequence of reduced lean body mass is a decline in total body water content. Since muscle tissue contains a substantial amount of water, its loss contributes to dehydration risk among older adults. Reduced thirst sensation, medication use, and impaired kidney function further increase susceptibility to dehydration. Adequate hydration and sufficient protein intake are therefore essential components of geriatric nutrition. Studies consistently demonstrate that resistance exercise combined with adequate dietary protein intake can effectively slow sarcopenia progression and improve muscle strength and functional capacity in older populations (Cruz-Jentoft et al., 2019).

### III. GASTROINTESTINAL CHANGES AND NUTRIENT ABSORPTION

The gastrointestinal tract undergoes numerous structural and functional changes with advancing age. Although digestion and absorption generally remain adequate in healthy older adults, age-related changes may compromise nutritional status, particularly in individuals with chronic diseases or multiple medications. Reduced secretion of digestive enzymes, diminished gastric acid production, delayed gastric emptying, and alterations in intestinal motility can affect nutrient digestion and absorption (Soenen et al., 2016).

One common condition among older adults is hypochlorhydria, which refers to reduced stomach acid production. Gastric acid plays an important role in releasing vitamin B12 from food proteins and facilitating mineral absorption. Consequently, older adults with hypochlorhydria are at increased risk of vitamin B12 deficiency, which may lead to pernicious anemia, neurological impairment, cognitive decline, and fatigue (Green et al., 2017). Vitamin B12 deficiency is particularly common among individuals taking proton pump inhibitors or other acid-suppressing medications.

Constipation is another prevalent gastrointestinal complaint among older adults. Multiple factors contribute to constipation, including reduced intestinal motility, inadequate dietary fiber intake, insufficient fluid consumption, medication side effects, and physical inactivity. Chronic constipation can negatively affect appetite, quality of life, and nutritional status. Increasing dietary fiber intake through fruits, vegetables, legumes, and whole grains, along with adequate hydration and physical activity, has been shown to improve bowel function and reduce constipation-related symptoms (Bharucha et al., 2015).

Recent studies have also highlighted the role of the gut microbiome in healthy ageing. Age-related alterations in microbial diversity may influence immune function, inflammation, nutrient metabolism, and gastrointestinal health. Emerging evidence suggests that dietary strategies aimed at supporting a healthy gut microbiota, including increased consumption of dietary fiber and fermented foods, may provide additional benefits for older adults (O'Toole & Jeffery, 2025).

### IV. MUSCULOSKELETAL CHANGES AND BONE HEALTH

Ageing is associated with progressive reductions in bone mineral density and bone strength. Bone remodeling becomes imbalanced as bone resorption exceeds bone formation, resulting in gradual bone loss. This process is particularly accelerated in women after menopause due to declining estrogen levels. Consequently, osteoporosis becomes increasingly common among older adults and significantly increases the risk of fractures, disability, and mortality (Compston et al., 2019).

Hip fractures represent one of the most serious consequences of osteoporosis because they are associated with substantial reductions in mobility and independence. Following a hip fracture, many older adults experience long-term functional limitations and require institutional care. Therefore, maintaining skeletal health is a major objective of geriatric nutrition.

Adequate calcium and vitamin D intake are essential for preserving bone health throughout ageing. Calcium provides the structural framework for bones, whereas vitamin D facilitates calcium absorption and supports bone mineralization. Deficiencies in either nutrient can accelerate bone loss and increase fracture risk.

Current recommendations emphasize adequate dietary intake, supplementation when necessary, and regular weight-bearing exercise to maintain bone density (International Osteoporosis Foundation, 2024). Additionally, sufficient protein intake has been shown to support both muscle and bone health, further reducing fracture risk in older adults. Sensory and Oral Changes

Ageing is frequently accompanied by gradual declines in sensory function, including taste, smell, vision, and hearing. These sensory alterations can significantly influence food preferences, appetite, dietary intake, and overall nutritional status. Taste and smell play crucial roles in stimulating appetite and enhancing the enjoyment of food. However, older adults often experience a reduction in the number and sensitivity of taste buds, as well as diminished olfactory function, resulting in a decreased ability to perceive sweet, salty, bitter, and sour flavors (Schiffman, 2018). Consequently, foods may appear bland or less appealing, leading to reduced food intake and an increased risk of undernutrition.

The decline in sensory perception may also contribute to inappropriate dietary choices. Some older adults compensate for reduced taste sensitivity by adding excessive amounts of salt or sugar to foods, which may adversely affect the management of hypertension, diabetes, and cardiovascular disease. Furthermore, sensory impairments can reduce the ability to detect spoiled foods, increasing the risk of foodborne illness.

Oral health is another critical determinant of nutritional status in older adults. Age-related changes in oral tissues, combined with chronic diseases and medication use, can significantly impair chewing and swallowing functions. Xerostomia, commonly referred to as dry mouth, affects a substantial proportion of older individuals and is frequently associated with medication use, autoimmune disorders, and salivary gland dysfunction (Villa et al., 2015). Saliva plays an essential role in lubricating food, facilitating swallowing, and maintaining oral health. Reduced salivary secretion can therefore interfere with food consumption and increase the risk of dental caries, oral infections, and difficulty swallowing.

Tooth loss and denture use are also prevalent among older populations. Individuals with missing teeth or poorly fitting dentures often avoid foods that require extensive chewing, such as fruits, vegetables, nuts, and lean meats. This dietary modification can lead to inadequate intake of dietary fiber, vitamins, minerals, and high-quality protein (Kossioni, 2018). Consequently, regular dental care, proper denture maintenance, and dietary counseling are essential components of comprehensive geriatric nutritional management.

## V. METABOLIC AND RENAL CHANGES

Several metabolic changes occur during ageing that influence nutrient utilization and increase susceptibility to chronic diseases. One of the most important alterations involves glucose metabolism. Ageing is associated with progressive insulin resistance and reduced pancreatic  $\beta$ -cell function, leading to impaired glucose tolerance and an increased risk of type 2 diabetes mellitus (Chang & Halter, 2015). These metabolic changes may be exacerbated by reduced physical activity, increased adiposity, and loss of skeletal muscle mass, all of which contribute to diminished glucose disposal.

The development of insulin resistance has important nutritional implications. Dietary interventions emphasizing complex carbohydrates, dietary fiber, lean proteins, and healthy fats can improve glycemic control and reduce the risk of diabetes-related complications. Regular physical activity further enhances insulin sensitivity and contributes to the maintenance of healthy body composition.

Renal function also declines progressively with age. Structural changes within the kidneys include reductions in renal mass, nephron number, and renal blood flow, resulting in decreased glomerular filtration rate (GFR) (Denic et al., 2016). Although these changes may occur gradually, they can significantly affect fluid balance, electrolyte regulation, and nutrient metabolism.

Reduced kidney function can impair the body's ability to concentrate urine and conserve water, increasing the risk of dehydration among older adults. Furthermore, age-related renal decline may alter the metabolism and excretion of medications, necessitating careful monitoring of drug-nutrient interactions. Nutritional management of older adults should therefore include adequate hydration, appropriate protein intake based on renal function, and regular assessment of kidney health.

Recent evidence suggests that chronic low-grade inflammation, often referred to as "inflammaging," may contribute to metabolic dysfunction and accelerate age-related diseases. Nutritional strategies that emphasize anti-inflammatory dietary patterns, including increased consumption of fruits, vegetables, whole grains, legumes, and omega-3 fatty acids, may help mitigate these effects and promote healthier ageing (Calder, 2024).

## VI. CARDIOVASCULAR CHANGES

Cardiovascular disease remains one of the leading causes of morbidity and mortality among older adults worldwide.

Ageing is associated with structural and functional changes in the cardiovascular system, including arterial stiffening, endothelial dysfunction, and reduced elasticity of blood vessels. These changes contribute to increases in systolic blood pressure and place greater demands on the heart (Whelton et al., 2018).

Hypertension becomes increasingly prevalent with advancing age and is a major risk factor for stroke, coronary artery disease, heart failure, and chronic kidney disease. Dietary modifications play a central role in cardiovascular risk reduction. Limiting sodium intake, increasing consumption of potassium-rich foods, and adopting dietary patterns such as the Mediterranean diet or DASH (Dietary Approaches to Stop Hypertension) diet have been shown to effectively reduce blood pressure and improve cardiovascular outcomes.

Age-related changes in lipid metabolism also contribute to cardiovascular risk. Total cholesterol and low-density lipoprotein (LDL) cholesterol levels often increase with age, particularly among women following menopause due to hormonal changes. Elevated cholesterol levels contribute to atherosclerosis, which can impair blood flow and increase the likelihood of cardiovascular events (American Heart Association, 2019).

In addition to lipid management, adequate intake of dietary fiber, unsaturated fats, antioxidants, and plant-based foods has been associated with reduced inflammation and improved cardiovascular health. These dietary approaches not only reduce disease risk but also support overall functional capacity and quality of life among older adults.

## VII. IMMUNOSENESCENCE AND NUTRITIONAL IMMUNOLOGY

The ageing process is characterized by a gradual decline in immune function, a phenomenon known as immunosenescence. This age-related deterioration affects both innate and adaptive immunity, reducing the body's ability to respond effectively to infections, vaccinations, and malignant cells (Nikolich-Zugich, 2018). As a result, older adults are more susceptible to respiratory infections, influenza, pneumonia, and certain cancers.

Immunosenescence is also associated with chronic low-grade systemic inflammation, often referred to as "inflammaging." Persistent inflammation contributes to the development of numerous age-related diseases, including cardiovascular disease, diabetes, neurodegenerative disorders, and frailty. Nutritional status plays a crucial role in maintaining immune competence throughout the ageing process.

Several micronutrients have been identified as particularly important for immune health. Vitamin E functions as a potent antioxidant and helps protect immune cells from oxidative damage. Zinc is essential for immune cell development, signaling, and inflammatory regulation. Deficiencies in either nutrient can impair immune responses and increase susceptibility to infection (Gombart et al., 2020). Other nutrients, including vitamin D, selenium, vitamin C, and omega-3 fatty acids, have also been associated with improved immune function and reduced inflammation.

Emerging evidence indicates that dietary patterns rich in fruits, vegetables, nuts, seeds, fish, and whole grains provide bioactive compounds that support immune health and reduce oxidative stress. Therefore, maintaining adequate nutritional status is considered a key strategy for promoting resilience and healthy ageing.

## VIII. PSYCHOSOCIAL FACTORS AFFECTING NUTRITIONAL STATUS

Nutritional health in older adults is influenced not only by physiological factors but also by a wide range of psychological, social, and economic determinants. Retirement, bereavement, social isolation, reduced mobility, financial constraints, and chronic illness can significantly affect dietary habits and nutritional status. These factors may reduce motivation to prepare meals, limit access to nutritious foods, and contribute to inadequate dietary intake (WHO, 2024).

Loneliness and social isolation have emerged as important public health concerns among ageing populations. Research demonstrates that socially isolated older adults are more likely to experience poor dietary quality, reduced appetite, weight loss, and malnutrition. Shared meals and social engagement have been shown to improve food intake and overall nutritional wellbeing.

Depression is one of the most common psychological disorders affecting older adults and is frequently associated with unexplained weight loss, reduced appetite, and nutritional deficiencies (Fávaro-Moreira et al., 2016). Symptoms such as fatigue, hopelessness, and loss of interest in daily activities can significantly impair an individual's ability to maintain healthy eating behaviors. Depression is particularly prevalent among residents of long-term care facilities, where social isolation and functional dependency may be more pronounced.

Economic factors also influence food security and dietary quality among older adults. Fixed incomes and rising healthcare costs may limit the ability to purchase nutrient-dense foods, increasing reliance on inexpensive, energy-dense options.

Consequently, effective geriatric nutritional care requires a multidisciplinary approach that addresses not only physiological needs but also psychosocial, economic, and environmental factors.

Overall, successful ageing depends on a combination of adequate nutrition, physical activity, social engagement, disease prevention, and psychological wellbeing. Comprehensive nutritional assessment and individualized dietary interventions are therefore essential for promoting health, independence, and quality of life among older adults.

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