Chapter 19
Optimal Nutrition for the Older Adults

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Key Points

- Dietary guidance specially targeted to older adults is intended to promote the maintenance of optimal health and forestall the onset of chronic diseases.
- With advancing years, energy needs decline and nutrient needs either remain the same or increase, necessitating the need to choose nutrient-dense foods frosm all food categories.
- Changes in social situations with advancing years may result in the need to reassess eating patterns and when appropriate make modifications to ensure nutrient adequacy.

It is never too early in the life cycle to adapt eating patterns consistent with optimal health outcomes.

Keywords Nutrition • Older adults • Diet quality • Aging • Sight • Taste • Smell • Mobility • MyPlate • Chronic disease

Introduction

In 2015, approximately 14.9% of the U.S. population, or 47.8 million people, was over 65 years of age. This percent is expected to increase to approximately 21.6%, or 82.3 million, in the next 25 years. In 2015, approximately 2.0% of the U.S. population, or 6.3 million people, was over 85 years of age, sometimes referred to as the oldest-old. This percent is expected to almost double, to 3.8%, in the next 25 years. Similar trends are seen in other populations globally. Evidence suggests that within a population, older adults who score in the higher categories for diet quality and measures of physical activity have the lowest mortality rates, particularly, for cardiovascular disease, cancer, and type 2 diabetes mellitus [1–5]. As an increasing proportion of the world population enters the older age categories, more emphasis needs to be placed on optimal dietary guidance to enable these older adults to stay healthy and active. This emphasis should be provided within the context of the biological and psychological changes known to occur with advancing years.

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Current Recommendations for Older Adults

The Recommended Dietary Allowances (RDA), established by the Food and Nutrition Board of the Institute of Medicine, has not been revamped since the late 1990s and early 2000s [6–12], with the exception of calcium and vitamin D [13]. Of note, prior to that time, no distinction was made for the nutrient requirements among adults above the age of 50 years. That category was expanded to include specific guidance for adults age 51–70 years and greater than 70 years [14].

RDAs and Adequate Intakes (AI) for most nutrients, including vitamin A, vitamin C, vitamin E, vitamin K, thiamin, riboflavin, niacin, folate, vitamin B_{12}, pantothenic acid, biotin, choline, chromium, copper, fluoride, iron, magnesium, manganese, molybdenum, phosphorus, selenium, and zinc, do not differ between adults above and below the age of 70 years. The nutrient recommendation for three nutrients, vitamin D, calcium, and vitamin B_6, is higher for adults greater than 70 years (Table 19.1) [14]. The nutrient recommendations for two nutrients, chromium and sodium, is lower for the older age group. Emerging evidence suggests future revisions in the DRIs for individuals over the age of 70 years may be necessary [15, 16].

Although the RDAs or AIs for most nutrients do not increase for adults above the age of 70 years, it can become increasingly difficult to achieve the recommended intakes. In general, total energy requirements decreases with advancing years to compensate for the diminished basal metabolic rate associated with a higher proportion of fat mass relative to lean muscle mass and lower levels of physical activity [17–19].

Nutrient needs must be met within the context of lower energy intakes. This can be accomplished by judiciously choosing foods with a relatively high nutrient density (amount of nutrient/calorie). A version of the USDA MyPlate, MyPlate for Older Adults, has been developed specifically to provide guidance to achieve this goal (Fig. 19.1). Modifications made to the original USDA MyPlate specifically for older adults include the addition of food icons in the different sectors of the plate to provide illustrative examples of nutrient-dense choices such as deeply colored vegetables, fruits, and whole grains; shift of the dairy sector into the protein sector; fusion of the vegetable and fruit sectors; creation of a fluid sector on the top right of the plate to emphasize the importance of adequate hydration with advancing years; construction of a physical activity panel to emphasize the importance of engaging in regular physical activity; insertion of a sector in the center of the plate containing "healthy fats" (liquid vegetable oil and soft margarine) to emphasize the importance across the diet of using these fats in place of animal fats in food preparation; and depiction of a broad range of different forms of foods particularly useful to older adults such as bags of frozen fruits, pre-cut and pre-washed vegetables, and canned low sodium foods.

Special Dietary Considerations for Older Adults

Approaches to maintaining optimal nutritional status in older adults should be considered in terms of both physiological and psychological factors. Consideration of both is critical to ensure optimal food intake and health outcomes.

Physiological Changes

The way the body handles nutrients can change with advancing age. These changes are generally attributed to alternations in the functioning of organ systems, which impact the utilization of some nutrients. Those systems most likely to be altered with advancing years include the stomach and small intestine, liver, heart, kidneys, skin, immune and oral cavity (Table 19.2).

Table 19.1 Recommended dietary allowances for older adults age 31–50 years, 51–70 years and greater than 70 years

	Females			Males		
	(years)					
Nutrient	31–50	51–70	>70	31–50	51–70	>70
Vitamin A (μg/d)[a]	700	700	700	900	900	900
Vitamin C (mg/d)	75	75	75	90	90	90
Vitamin D (μg/d)	15	15	20	15	15	20
Vitamin E (mg/d)	15	15	15	15	15	15
Vitamin K (μg/d)[b]	*90*	*90*	*90*	*120*	*120*	*120*
Thiamin (mg/d)	1.1	1.1	1.1	1.2	1.2	1.2
Riboflavin (mg/d)	1.1	1.1	1.1	1.3	1.3	1.3
Niacin (mg/d)	14	14	14	16	16	16
Vitamin B_6 (mg/d)	1.3	1.5	1.5	1.3	1.7	1.7
Folate (μg/d)	400	400	400	400	400	400
Vitamin B_{12} (μg/d)	2.4	2.4	2.4	2.4	2.4	2.4
Pantothenic Acid (mg/d)	*5*	*5*	*5*	*5*	*5*	*5*
Biotin (μg/d)	*30*	*30*	*30*	*30*	*30*	*30*
Choline (mg/d)	*425*	*425*	*425*	*550*	*550*	*550*
Calcium (mg/d)	1000	1200	1200	1000	1000	1200
Chromium (μg/d)	*25*	*20*	*20*	*35*	*30*	*30*
Copper (μg/d)	900	900	900	900	900	900
Fluoride (mg/d)	*3*	*3*	*3*	*4*	*4*	*4*
Iodine (μg/d)	150	150	150	150	150	150
Iron (mg/d)	18	8	8	8	8	8
Magnesium (mg/d)	320	320	320	420	420	420
Manganese (mg/d)	*1.8*	*1.8*	*1.8*	*2.3*	*2.3*	*2.3*
Molybdenum (μg/d)	45	45	45	45	45	45
Phosphorus (mg/d)	700	700	700	700	700	700
Selenium (μg/d)	55	55	55	55	55	55
Zinc (mg/d)	8	8	8	11	11	11
Potassium (g/d)	*4.7*	*4.7*	*4.7*	*4.7*	*4.7*	*4.7*
Sodium (g/d)	*1.5*	*1.3*	*1.2*	*1.5*	*1.3*	*1.2*
Chloride (g/d)	*2.3*	*2.0*	*1.8*	*2.3*	*2.0*	*1.8*

[a]Standard font – Recommended dietary allowance values

[b]Italic font – Adequate intake values

Of concern in older adults is that many individuals experience a decline in gastric hydrochloric acid secretion [20]. The resulting hypochlorydria causes a decline in the bioavailability of vitamin B_{12} [21]. Due to a decline in the skin's capacity to synthesize vitamin D from 7-dehydrocholesterol and less exposure to sunlight, older adults may be at a compromised status for vitamin D, and consequently, for calcium nurture. Changes in body composition (decreased lean muscle mass and increased fat mass) result in decreased basal metabolic rates, hence energy needs, and capacity for physical activity. Increased use of prescription and nonprescription medications, chronic drug therapy, and decreased capacity of the liver to metabolize drugs can compromise nutrient unitization. Health care providers need to be vigilant about identifying any changes that are of a sufficient magnitude to compromise nutrient status.

Taste, Smell

Retaining the desire to eat a variety of foods is fundamental to ensuring optimal nutritional status for older adults (Table 19.3). This is of particular concern because diminished taste and smell acuity associated with aging can lead to poor appetite. Changes that may occur include a decrease in taste

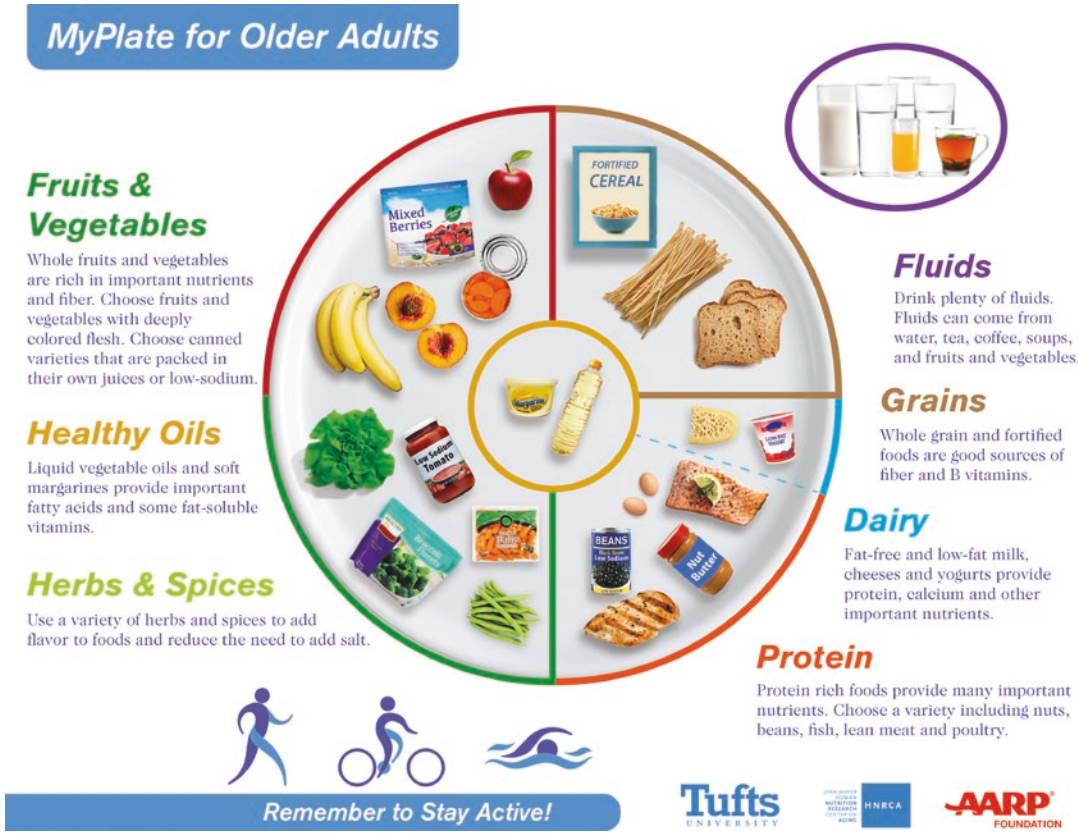

Fig. 19.1 MyPlate for older adults (http://hnrca.tufts.edu/my-plate-for-older-adults/)

Table 19.2 Potential physiological changes that may contribute to altered nutrient status in older adults

System	Potential changes
Digestive system	↓ Hydrochloric acid secretion
	↓ Digestive juice secretion (pancreas and small intestine)
	↓ Absorptive capacity (malabsorption)
	↓ Muscles tone large intestine (↓ gastrointestinal motility)
	↓ Chronic blood loss due to ulcers and hemorrhoids
Liver	↓ Hepatic and biliary function
	↓ Rate detoxification
Heart	↓ Cardiac output
	↓ Strength and flexibility of blood vessels
Kidneys	↓ Blood flow
	↓ Glomerular filtration
Skin	↓ Synthesis vitamin D
Body composition	↓ Lean muscle mass and ↑ fat mass
	↓ Physical activity
Immune system	↓ T cell-mediated function
	↑ Susceptibility to infection and malignancy
Oral cavity	↑ Peritoneal disease
	↑ Ill-fitting dentures
	↓ Salivary gland secretions
	↑ Altered bite pattern due to tooth loss
Phamacokinetics	↑ Prescription and nonprescription drug use
	↑ Chronic drug therapy
	↓ Capacity to metabolize drugs

sensitivity, primarily to salt and sweet. This, in turn, may result in greater sensitivity to acid and bitter [22]. Another change that may occur with advancing years is diminished sense of smell. Older adults with poor odor perception have lower nutrient intakes than those with more acute odor perception [23–25].

Vision, Dexterity, and Mobility

Diminished vision, dexterity, and mobility can make food accusation and preparation challenging (Table 19.3). Difficulty opening jars, cans, or packaged foods due to arthritis or diminished strength can lead to decreased variety and the ability to consume preferred foods. Small accommodations to an individual's environment such as ergonomically designed kitchen aides (e.g., can openers and scissors), kitchen reorganization (e.g., eliminating clutter and shifting frequently used items to most accessible places), and shifts to the use of partially prepared foods can minimize a decline in diet quality. For example, re-sealable bags of frozen vegetables and fruits are particularly good choices because they allow for easy apportioning of single or double servings, minimize pre-preparation which can be difficult or even painful, eliminate waste due to spoilage, reduce the need for frequent trips to the market, and provide variety during inclement weather. Likewise, purchasing boneless chicken breasts can decrease preparation and cooking times, and is adaptable to preparation of individual small portions. Older adults may not automatically take advantage of newer forms of common food items (e.g., pre-washed and cut salad, shredded cheese) and require some regular guidance in this area.

Social Factors

In addition to dealing with declines in physical capacity associated with the aging process, there are also changes in the social environment that can have an impact on nutritional status (Table 19.4). With advancing years, the loss of a spouse or other family members with whom an individual shared and

Table 19.3 Activity of daily life factors potentially contributing to compromised food intake in older adults

Factor	Change
Senses	↓ Acuity vision and hearing
	↓ Taste (loss taste buds, mainly salt and sweet)
	↓ Smell
Mobility	↓ Physical activity
	↓ Respiratory capacity
	↓ Lean muscle mass (strength, physical disability)
	↑ Physical isolation
Dexterity	↑ Sarcopenia
	↑ Arthritic involvement in finger and hand joints
	↑ Tremor
	↓ Manual dexterity
	↓ Gait
	↓ Balance
Energy needs	↓ Energy requirements
	↑ Geriatric cachexia
	↓ Volume capacity

Table 19.4 Potential psycho-social factors contributing to compromised nutrient status in older adults

Factor	Change
Companionship	↑ Loss of spouse
	↑ Social isolation
	↑ Loss of contemporaries
	↓ Social interaction secondary to ↓ mobility
	↓ Social interaction secondary to ↓ change in domicile
Mental state	↑ Depression
	↑ Mental deterioration (dementia)
	↑ Alcohol abuse
Economic	↑ Fixed income
	↓ Choice, variety, and availability of foods
Nutrition knowledge	↑ Susceptibility to food fads
	↑ Susceptibility to dietary supplement claims
Housing	↑ Change in status (loss of home)
	↑ Change in availability of preferred foods

prepared meals is common. This can lead to social isolation, especially during mealtime, and diminished desire to prepare balanced and varied meals. Due to deterioration in mental or economic status, older adults are frequently faced with having to adapt to a new living environment. This can result in dramatic changes in meal times, food preparation, and foods available. The onset of chronic disease can further limit food choices and make older adults susceptible to the lures of food fads or dietary supplements that promise a fountain of youth. At worst, these claims risk draining scarce resources available for food purchases and overconsumption of individuals nutrients which can interfere with prescription drug actions or the utilization of other essential nutrients. Depression can accompany the aging process, particularly, in individuals without adequate support to make the necessary adaptations that come with advancing years. Older adults may be at increased risk of alcohol abuse. All of these factors may contribute to poor food consumption patterns [26].

Nutrition Knowledge/Susceptibility to Food Fads and Nutrient Supplement Claims

Nutrient supplement use is more common in older than younger adults [27–31]. The primary reasons cited by older adults for taking nutrient supplements are to improve health and delay the onset of chronic disease [32–34]. This issue is of particular concern because, in general, older adults who choose to use nutrient supplements are least likely to have biomarkers of nutrient inadequacy or diets rated as a poor [31, 35]. In light of the widespread availability of fortified foods, this group may be particularly vulnerable to excess nutrient intakes and drug-nutrient interactions [28, 30, 36–38]. The latter issue is of particular concern given the limited amount of information available on the topic [39]. General characteristics of individuals using supplements, in addition to being older [27–31], include being female [29–31], non-Hispanic white [30, 31], college educated or beyond [27, 29–31], and affluent [31]. In addition, nutrient supplement users are more likely to have body mass indices within the normal range [27, 30], engage in regular physical activity [27, 30], have optimal chronic disease biomarkers [31], have low rates of smoking [27], achieve nutrient requirement recommendations, and hold strong attitudes about the importance of a good diet [33, 35, 38]. Recent work on the potential adverse effects of excess vitamin A intake and risk of bone fracture in older women highlight the importance of this issue [40].

Chronic Diseases of Particular Concern in Older Adults Related to Lifestyle Behaviors

Nutrient-related chronic diseases, particularly prevalent in middle and later years, include disorders of dentition and associated senses, cardiovascular disease, osteoporosis, Type 2 diabetes, hypertension, immune, and cancer. In some cases, the goals of nutrient recommendations for older adults are aimed at delaying the onset of chronic disease while in others it is aimed at treatment or accommodating the disorder.

Dentition and Associated Senses

Salivary secretions decrease with increasing age. Changes in bite pattern from partial or complete tooth extraction/loss are common. Poorly fitted dentures can make eating painful and distasteful. The prevalence of root canals is higher in older than younger adults [41, 42]. Increased incidence of tooth disease in older adults has been related, in part, to high levels of sugar consumption [43]. Any one or combination of these factors can restrict the type and variety of foods consumed. For example, chewing and swallowing fibrous foods may be difficult due to poor dentition, resulting in a shift towards highly processed foods or juices that are low in fiber [44]. It is critical when evaluating dietary intakes of older adults to consider possible concerns regarding food textures and preparation methods and to assess dentition.

Cardiovascular Disease

The rate of cardiovascular disease increases with age, especially after menopause in females [45]. Higher saturated fat coupled with lower polyunsaturated fat intakes has consistently been associated with higher rates of cardiovascular disease [46, 47]. The American Heart Association (AHA) [48], the AHA/American College of Cardiology [49], and the 2015 Dietary Guidelines Advisory Committee [50] recommend dietary patterns that are higher in vegetables, fruits, whole grains, low- or nonfat dairy, seafood, legumes, and nuts; moderate in alcohol; lower in red and processed meat; and low in sugar sweetened foods and drinks and refined grains. Individuals should be encouraged to adapt this general dietary pattern to personal and cultural preferences to enhance enjoyment of their food. No specific recommendations for dietary change are made for adults as they age. The response to these recommendations in terms of plasma lipids appears consistent for both genders and age groups [51, 52].

Osteoporosis

Age-related or type II osteoporosis (bone loss) is positively associated with the aging process. It has been estimated that osteoporotic fractures affect 50 % of females and 30 % of males over the age of 50 years [53]. Age-associated bone loss is attributed to diminished estrogen production, decreased calcium absorption from the gastrointestinal tract, decreased calcium resorption by the kidney, decreased rates of physical activity, compromised vitamin D status, and decreased calcitriol production secondary to hyperparathyroidism [53, 54]. In older adults, calcium balance is favorably affected by attaining

adequate vitamin D nutriture and negatively affected by high sodium, protein, alcohol, and caffeine intakes [54]. Supplemental calcium and vitamin D in postmenopausal women living in northern latitudes (42°N) may minimize bone loss [55]. Because serum osteocalcin, calcidiol, and vitamin D fluctuate seasonally due to sun exposure, vitamin D intake is particularly important during the periods of winter and spring in this group. These data strongly support routine screening of older adults for vitamin D status.

Glucose Intolerance/Type 2 Diabetes

The incidences of glucose intolerance and Type 2 diabetes mellitus increase with age [56, 57]. The increased incidence has been strongly associated with weight gain in later years. Lifestyle interventions have been shown to be efficacious in preventing or delaying the onset of Type 2 diabetes mellitus in some but not all studies [58–61]. These include regular daily physical activity, weight loss, and dietary modification consistent with that advocated to the prevention and treatment of cardiovascular disease.

Hypertension

The incidence of hypertension, particularly increases in systolic blood pressure, occur with age [45]. This increase is associated with changes in the vasculature and kidneys, and is exacerbated by weight gain. A number of clinical trials have demonstrated clear benefits of dietary modification to treat hypertension in older adults. The Dietary Approaches to Stop Hypertension (DASH) type dietary pattern, rich in vegetables, fruits, and fat-free and low-fat dairy products, decreases blood pressure in a wide range of individuals [62]. Further coupling this dietary pattern with sodium restriction can lead to an additional decrease in blood pressure [63].

Immune Function

The most commonly associated age-related change in the immune response is cell-mediated function [64, 65]. Vitamin E supplementation may be beneficial in decreasing the incidence of respiratory infections in older adults [66].

Cancer

The incidence of cancer shows tremendous variability on the basis of worldwide distribution, type, and site in the body. The incidence of all types of cancer increases with age. Support for a diet/cancer incidence link comes from data suggesting associations between markedly divergent food consumption patterns and incidence rates of cancer among populations worldwide [67]. Some data has suggested a positive association with cancer incidence and alcohol intake (laryngeal) and total fat intake

(breast, colon, prostate); and negative association with cancer incidence and calcium and vitamin D intake (stomach, colon, breast), fiber intake (breast), antioxidant vitamin and/or orange and dark green vegetable intake (rich in vitamin A and beta-carotene, vitamin C, vitamin E), and trace elements (wide range of sites) [67–71]. Results from randomized controlled trials are limited [72]. At this time, the general dietary guidance to reduce cancer risk is consistent with the dietary guidance to prevent the onset of chronic diseases of concern in the twenty-first century.

Dietary Guidance for Older Adults

Current Intake Patterns

Older adults (>70 years) have a Healthy Eating Index of approximately 65, higher than that of their younger counterparts (Fig. 19.2). Nevertheless, there is room for improvement. Although older adults consume approximately 90 % of the recommended servings for total fruit, whole fruit, total protein foods and seafood/plant proteins, and 80 % of the recommended servings for total vegetables, they consume under 60 % of the recommended servings for greens and beans and dairy and under 50 % of whole grains.

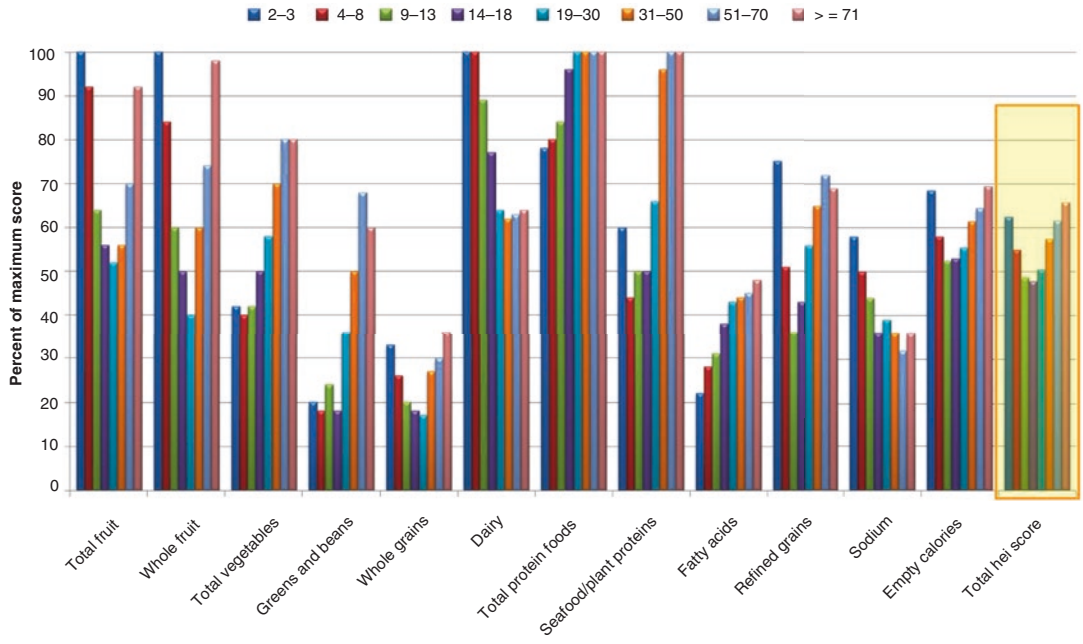

Fig. 19.2 Average HEI-2010 scores for Americans by age group (*Source*: What we eat in America NHANES 2007–2010)

Conclusions

The aim of dietary guidance specifically targeted for older adults is to maintain optimal health and forestall the onset of chronic disorders. The actual dietary recommendations, for the most part, are consistent throughout the adult lifecycle. Diet quality can have an important effect on the ability to perform activities of daily life and survival rates. Due to lower levels of physical activity, decreased metabolic rates secondary to increased proportions of fat to lean muscle mass, energy requirements decline with advancing years yet nutrient requirements remain unchanged, or in some cases increase. This situation requires a greater emphasis on choosing nutrient-dense foods within each food category. With advancing years special attention needs to be given to adapting living environments to retain the ability to acquire and prepare food. Changes in social situations that could impact on food intake should be monitored on a regular basis. Evidence suggests that diet and lifestyle interventions can forestall the onset of cardiovascular disease, osteoporosis, diabetes, hypertension, immune function, and possibly cancer. There are no data to suggest a person is too old to benefit from improvements in diet quality. The definitions for old age and expectations for the period of time individuals can remain active, productive, and live independently are expanding. Efforts towards improving diet quality and levels of physical activity as individuals get older should keep up with this trend.

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