

Examining Physical Wellness as the Fundamental Element for Achieving Holistic Well-Being in Older Persons: Review of Literature and Practical Application in Daily Life

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Abstract: This review examines the impact of physical activity, nutrition, and sleep evaluations on the physical wellness (PW) and overall well-being of older individuals. A comprehensive search was conducted in databases like PubMed, Google Scholar, and EBSCO Information Services. The search spanned from January 2000 to December 2022, resulting in 19,400 articles, out of which 98 review articles met the inclusion criteria. Through the analysis of these articles, key characteristics of the literature were summarized, and opportunities to enhance the practical application of physical activity (PA), nutrition, and sleep evaluations in the daily lives of older persons were identified. Regular physical activity is crucial for older persons to maintain their physical, mental, and emotional well-being and prevent age-related health issues. Older persons have specific nutritional needs, including increased protein, vitamin D, calcium, and vitamin B12 intake. Poor sleep quality in older persons is associated with negative health outcomes such as cognitive decline, physical disability, and mortality. This review emphasizes the significance of considering physical wellness as a fundamental element for achieving holistic well-being in older persons and highlights the importance of physical activity, nutrition, and sleep evaluations in improving their overall health and well-being. By understanding and implementing these findings, we can enhance the quality of life and promote healthy aging in older persons.

Keywords: wellness, healthy aging, physical activity, nutrition, sleep

Introduction

Healthy aging involves maintaining functional ability for wellbeing in later age, according to the WHO.¹ Chronic diseases, falls, inactivity, oral health issues, and behavioral problems can impact quality of life. Creating conditions and opportunities that promote healthy aging can enable older persons to remain independent, secure, and productive.²

The term “wellness” was coined by Dr. Halbert L. Dunn in 1961, and later expanded upon by Dr. Bill Hettler, who promoted the six-dimension wellness model.³ This model emphasizes the interrelated nature of physical, emotional, spiritual, intellectual, environmental, and social wellness, and encourages individuals to pursue uplifting ideologies and meaningful pursuits that incorporate all aspects of their health.⁴ The promotion of health often involves discussions on the physical wellness dimension, encompassing aspects such as physical activity, nutrition, and sleep. We have a keen interest in exploring whether enhancing physical wellness can effectively improve the quality of life for older persons.

Research shows that physical activity and exercise engagement can significantly improve the health of older persons, with moderate to high intensity exercise for at least five days a week being essential.^{5,6} Balance exercises can also help prevent falls, which are a major concern for this population.⁷ Maintaining a healthy diet and paying attention to nutritional adequacy is important for all age-related disease states, as proper nutrient intake keeps the body strong.⁸ Chronic sleep issues can hinder

the ability of older persons to function, but establishing habits that promote quality sleep, such as exercise and avoiding substances that disrupt sleep, can help. Depression, anxiety, heart disease, diabetes, and pain are common sleep disruptors in older persons.⁹ Overall wellness involves taking care of physical, emotional, social, intellectual, environmental, and spiritual wellness, creating a comprehensive sense of fulfillment in life.¹⁰

Methods

Design

This article utilizes the essence of the integrative review method, which involves searching literature and reviewing past empirical or theoretical studies to provide a more comprehensive understanding of a specific phenomenon.

Literature Search

We searched for empirical research published between January 1, 2000, and January 31, 2022. We consulted the following databases: PubMed, Google Scholar, and EBSCO Information Services. We used the search terms physical wellness and older persons, physical activity and older persons, nutrition and older persons and sleep and older persons for all databases in the fields of title, abstract, keywords, and full text (see Table 1).

Inclusion/Exclusion Criteria and Extraction

After conducting the initial database searches, a focused search was carried out to narrow down the relevant articles. The inclusion criteria for this phase were studies that focused on physical wellness, physical activity, nutrition, and sleep evaluations for older persons. The research field of interest was physical wellness (PW) and overall well-being, and the articles had to be written in English. A screening of titles and abstracts revealed that most hits were not relevant, as many articles did not investigate the physical wellness for older persons. Our initial search yielded 19,400 articles; after eliminating irrelevant search matches, 98 articles that met all preliminary criteria remained. The next search steps included more detailed inclusion criteria to increase the comparability of the studies: studies were selected that mentioned a theoretical approach for physical activity and older persons, nutrition and older persons, and sleep and older persons. After a full-text reading, 30 articles were included in this review.

Review and Summary of Literature on Physical Wellness for Older Persons

PW refers to a state of overall health and well-being that is achieved through regular exercise, proper nutrition, adequate sleep, and avoiding harmful habits. While exercise is an important component of maintaining PW and healthy aging among older persons, it is necessary to prioritize other factors as well. Healthy eating habits, adequate sleep, and proper hydration are critical elements that work synergistically to support senior physical fitness and overall health.¹¹

According to the Centers for Disease Control and Prevention (CDC), by the age of 75, one in every three men and one in every two women are inactive.¹² Even if individuals are not currently physically active, research indicates that any form of exercise can have physical health benefits.¹² It is crucial to find an activity that one enjoys and stick with it until a routine is established, such as walking, stretching, weight training, and balance exercises.

Table 1 Keywords Literature Search

Database	Search Terms (Number of Hits)
PubMed	Physical wellness and older persons (4657); physical activity and older persons (3041); nutrition and older persons (1920); sleep and older persons (771)
Google Scholar	Physical wellness and older persons (21,000); physical activity and older persons (17,000); nutrition and older persons (17,800); sleep and older persons (21,800)
EBSCO Information Services	Physical wellness and older persons (1969); physical activity and older persons (1500); nutrition and older persons (385); sleep and older persons (490)

As individuals age, their metabolism slows down, necessitating fewer calorie intake.^{13–15} To ensure that they consume a variety of foods and obtain the necessary nutrients, seniors' plates should contain a variety of meals. According to the National Institutes of Health, a well-balanced meal should include lean protein, fruits and vegetables, healthy grains, and low-fat dairy.¹⁶

Sleep is a vital process for individuals of all ages as it can restore energy and repair damage to the body and mind. Despite the numerous advantages of sleep, many older persons find it difficult to fall or stay asleep, making it increasingly challenging to obtain adequate sleep as they age. However, as individuals age, various factors combine to make this more challenging to accomplish. Physical and mental health problems can also cause sleep disturbances. Health problems such as depression, anxiety, heart disease, diabetes, and diseases that cause discomfort and pain such as arthritis often interfere with an older person's ability to sleep.¹⁷ Sleep problems can also be induced by adverse drug reactions, with nearly 40% of people over the age of 65 taking five or more prescription drugs.¹⁸

According to a cross-sectional survey, older persons are particularly concerned with healthy eating, health problems (such as high blood pressure, arthritis, hearing loss, osteoporosis, and diabetes), promoting restful sleep, suggestions for delaying aging, coping with change, creating a living will, exercise, and dieting.¹⁹

Physical Activity for Older Persons

Physical activity (PA) refers to any bodily movement that expends energy and activates skeletal muscles. Physical function, on the other hand, pertains to an individual's capacity to perform daily physical tasks. As people age, it is natural to experience a decline in stamina and agility. However, regular moderate PA, as recommended by the Centers for Disease Control and Prevention (CDC), can provide numerous benefits for older persons, regardless of sex or underlying medical conditions.²⁰ PA serves as a preventative measure against noncommunicable diseases such as cardiovascular disease, stroke, diabetes, and several types of cancer.²¹ Additionally, engaging in PA has been linked to improved mental health, a delay in the onset of dementia, enhanced quality of life, and overall well-being.²²

Exercise is a subset of PA that is planned, structured, and repetitive and has as a final or an intermediate objective the improvement or maintenance of physical fitness. The duration, frequency, intensity, and mode of exercise is used to describe the dose.

Regular exercise has been extensively researched and has consistently demonstrated a positive impact on physical, mental, and emotional well-being across various age groups. In particular, older persons are at a higher risk of experiencing age-related health problems, such as bone loss, arthritis pain, and chronic diseases such as cardiovascular disease, diabetes, and obesity. Regular exercise has been identified as an effective intervention to prevent and manage these health problems.^{23,24} PA has been widely recognized as a vital component of a healthy lifestyle. Besides its role in maintaining physical fitness, recent research has demonstrated that PA also serves as a preventive measure for a range of chronic diseases. Among the conditions that PA can help reduce the risk of are cardiovascular disease, colon cancer, diabetes, obesity, and hypertension. Engaging in regular PA has been shown to improve insulin sensitivity, lipid profile, and blood pressure, all of which are major risk factors for these diseases.^{25,26}

PA is a crucial component of healthy aging and can prevent many of the health issues that often arise with age.²⁷ The CDC recommends that older persons engage in regular PA to maintain their health. For significant health benefits, the CDC recommends that older persons engage in at least 150 minutes of moderate-intensity aerobic activity, such as brisk walking, per week, as well as muscle-strengthening activities on two or more days per week that work all major muscle groups.²⁸ Alternatively, they may perform 75 minutes of vigorous-intensity aerobic activity, such as running or jogging, along with muscle-strengthening exercises that target all major muscle groups each week. Older persons may also engage in an equivalent combination of moderate- to vigorous-intensity aerobic activity and muscle-strengthening exercises targeting all major muscle groups on two or more days per week to achieve the recommended amount of physical activity.²⁸

The objective of this section is to provide an overview of the existing literature on the impact of physical exercise on the aging process, as well as to identify key areas that should be considered when designing public health policies and programs. In order to ensure clarity and concision, this article presents a table (Table 2) that summarizes the findings of the relevant studies.

Table 2 Summarizes the Study Findings Correlating Physical Activity and Healthy Aging

Study	Methodology and Type of the Studies	Number of Subjects	Examined Results
Physical activity as a preventative factor for frailty; Peterson et al ²⁹	The Health ABC study followed participants for 5 years, defining frailty based on gait speed and chair rise ability, and explored the impact of physical activity on incident frailty and transition to severe frailty. (Longitudinal, prospective cohort study)	2964	Participation in self-selected exercise activities is independently associated with delaying the onset and the progression of frailty.
(SHARP-P) Study; Legault et al ³⁰	The SHARP-P pilot trial examined physical and cognitive training interventions on cognitive decline risk in older adults. (RCT)	73	The interventions produced marked changes in cognitive and physical performance measures and retention rates exceeded 90%. Four-month improvements in the composite measure increased with age among participants assigned to physical activity training but decreased with age for other participants.
Australian Longitudinal Study of Aging (ALSA); Andrews et al ³¹	The study utilized MacArthur criteria to classify subgroups based on function and compared them across various domains using ALSA data. (Observational population study)	1403	Lower levels of exercise and physical performance were linked to lower levels of functioning.
Effects of aerobic exercise on mild cognitive impairment; Baker et al ³²	This study investigates the impact of aerobic exercise on cognition and Alzheimer's biomarkers in older adults with mild cognitive impairment, while considering sex as a predictive factor. (RCT)	33	For women, aerobic exercise improved performance on multiple tests of executive function, increased glucose disposal during the metabolic clamp, and reduced fasting plasma levels of insulin, cortisol, and brain-derived neurotrophic factor.
Physical activity and cognitive functioning among older Indian adults; Kumar et al ³³	This study explored the link between physical activity and cognitive functioning in older adults in India, considering potential confounders and analyzing gender differences. Data from the Longitudinal Ageing Study in India (2017–2018) and propensity score matching were used to assess cognitive impairment across various domains.	31,464	The results demonstrate the possible beneficial effects of frequent physical activity on cognitive functioning among older persons. Regular physical activity can be considered as an effective lifestyle factor to promote healthy cognitive aging.
Physical activity improves verbal and spatial memory in older persons; Nagamatsu et al ³⁴	In a study, 86 women aged 70–80 with probable MCI underwent a 6-month training program involving aerobic exercise, resistance training, or balance and tone training. MRI scans and memory tests were conducted before and after the program. (RCT)	86	The results demonstrate a significant correlation between spatial memory performance and overall physical capacity after intervention in the aerobic training group.
Self-reported health and leisure time physical activity on mortality among an ageing population; Opdal et al ³⁵	The Tromsø Study followed 12,241 participants aged 25–97 from 1994 to 2015, analyzing the link between physical activity and self-reported health using a random coefficient model. (Observational population study)	12,241	Being sedentary was associated with an increased risk of mortality in the ageing cohort. Both hard and light physical activity were positively associated with self-reported health.

(Continued)

Table 2 (Continued).

Study	Methodology and Type of the Studies	Number of Subjects	Examined Results
Effect of physical activity on RBD, depression, and cognitive flexibility in healthy aged people; Lerche et al ³⁶	In a study involving 667 individuals, both cross-sectional and longitudinal analyses were conducted over six years. Participants were categorized based on their weekly sports activity, and various markers and parameters were compared to assess prodromal indicators, cognitive abilities, and task performance. (Cross-sectional and a subgroup longitudinal study)	667	The cognitive flexibility, depressive symptoms, and sleep are all indicators of a potential ongoing neurodegenerative process and are all positively impacted by physical exercise in sports.
Physical activity and memory functions; Ruscheweyh et al ³⁷	A study examined how varying intensity levels of physical activity impacted episodic memory in healthy elderly individuals through a six-month intervention with medium or low-intensity exercise or control group, measuring various factors such as fitness, memory score, neurotrophin, and catecholamine levels, alongside brain imaging scans at baseline and post-intervention. (Longitudinal study)	62	The results demonstrate that an increase in physical activity led to improved episodic memory performance in older person individuals. To achieve this aim, no high-intensity exercise was required.
Adults in their middle and later years and successful aging through physical activity; Lin et al ³⁸	Fifteen community-based cohort studies (189,192 participants aged 43.9–79.0 years) were assessed using the Newcastle-Ottawa Scale for quality, sourced from Pubmed, Web of Science, and Embase databases. (Observational population study)	189,192	This meta-analysis discovered that physical activity helps middle-aged and older persons age well.

Based on the results of the mentioned studies, the advantages of physical activity for older persons can be summarized as follows: 1. delaying the onset and progression of frailty, 2. improving cognitive function and reducing cognitive decline, 3. enhancing overall functioning, 4. positive effects on executive function and Alzheimer's biomarkers, 5. beneficial effects on cognitive functioning, 6. improving memory, 7. enhanced self-reported health and reduced mortality risk, 8. positive impact on neurodegenerative indicators, 9. improved episodic memory, 10. successful aging. Physical activity in older persons has a wide range of advantages, including delaying frailty, improving cognitive function, enhancing overall functioning, reducing cognitive decline, improving memory, promoting self-reported health, reducing mortality risk, impacting neurodegenerative indicators positively, and contributing to successful aging.^{29–38}

Regular physical activity, including exercise, is essential for maintaining physical, mental, and emotional well-being, particularly for older individuals. It has been shown to prevent and manage age-related health problems, chronic diseases, and reduce the risk of various health conditions. It is crucial for individuals to incorporate regular exercise and physical activity into their lifestyle to maintain good health and prevent chronic illnesses, particularly as they age.

Physical Activity Improving Strategies

Engaging in exercises with multiple components, moderate intensity exercise, and active living can improve physical function and prevent falls. Finding enjoyable activities and creating a balanced exercise plan, including cardiovascular, strength, balance, and flexibility exercises, is crucial for older individuals' general health and well-being. Multicomponent PA, such as athletics, dance, and gardening, can enhance physical function and reduce the risk of harm from falls. Moderate intensity exercise is safe for most individuals, but consultation with a healthcare provider is essential for those with medical conditions.

A well-rounded exercise plan should incorporate cardiovascular exercise, strength and power training, balance exercises, and flexibility exercises.^{39–42} Cardiovascular exercise, such as walking, stair climbing, swimming, and dancing, increases endurance and independence for daily activities.⁴³ Strength and power training, involving repetitive motions using weight or external resistance, builds muscle, prevents bone mass loss, and improves balance.⁴⁰ Balance exercises, such as yoga, tai chi, and posture exercises, improve balance and walking quality and lower the risk of falling.⁴² Finally, exercises that increase flexibility, like yoga, can increase the range of motion for everyday physical activities.⁴¹

Healthy Eating for Older Persons

Healthy aging involves not only increasing lifespan but also extending healthy, active years. The importance of consuming adequate nutrition increases as people age, as a healthy diet can impact physical, emotional, and social wellbeing.^{44,45} However, both men and women become less active as they age, leading to decreased appetite and lower caloric intake, which can contribute to the development of vitamin and mineral deficiencies. Moreover, age-related chronic diseases such as heart disease, diabetes, and osteoporosis can exacerbate dietary inadequacies. A nutritious diet can reduce the risk of chronic diseases, improve quality of life, and even extend lifespan for older persons.⁴⁶

As people age, their nutritional needs change. Some important nutritional considerations for older persons include:

1. **Decreased Calorie Needs:** As people age, they tend to move and exercise less, and the amount of muscle decreases due to the aging process. Therefore, calorie needs may decrease. If older persons maintain the same calorie intake as they did when they were young, they may gain more fat, especially around the abdomen.^{47,48}
2. **Increased Protein, Vitamin D, Calcium, and Vitamin B12 Needs:** Even though older persons require fewer calories than younger people, they still require more protein, vitamin D, calcium, and vitamins B₁₂ than younger people do.⁴⁸
3. **Muscle Loss:** With aging, it is typical to lose strength and muscle. The average adult loses 3–8% of their muscle mass every decade after the age of 30. Protein-rich diets can help slow muscle loss, increase mass, and build more muscle.⁴⁹
4. **Constipation:** Older persons are more likely to experience constipation than younger people, and women are 2.3 times more likely to have it than males. Adequate fiber intake can help relieve constipation.⁵⁰
5. **Calcium and Vitamin D:** Calcium and vitamin D are crucial for maintaining healthy bones. Long-term calcium insufficiency can encourage bone loss and increase the risk of fractures.⁵¹
6. **Vitamin B₁₂:** Vitamin B₁₂ supports the production of red blood cells and keeps the brain healthy. Older persons may have difficulty absorbing vitamin B₁₂ from food, and a vegan or vegetarian diet can lead to a greater vitamin B₁₂ shortage.⁵²
7. **Other Nutrients:** Potassium, omega-3 fatty acids, magnesium, and iron are also beneficial for older persons' health.^{53–56}
8. **Dehydration:** Older persons are more prone to dehydration. They should continue to drink enough water each day, even if they are not thirsty.⁵⁷
9. **Loss of Appetite:** Older persons may experience a loss of appetite, which can lead to unintended weight loss, nutritional inadequacies, and deteriorated health. Eating smaller meals frequently can help.⁵⁸

The purpose of this section is to provide an overview of the current scientific understanding of how a healthy diet can impact the aging process. To facilitate comprehension, the article includes tables summarizing the studies mentioned in the text (Table 3).

Based on the results of the research studies mentioned, the advantages of nutrition or dietary habits for older persons can be summarized as follows: 1. reduced risk of type 2 diabetes, 2. lower risk of type 2 diabetes through improved diet quality, 3. fewer depressive symptoms, 4. improved cognitive performance, 5. higher likelihood of healthy aging, 6. lower risk of physical function impairment, 7. association with longevity, 8. reduced risk of cancer and cardiovascular disease, 9. weight management, 10. impact on cardiovascular risk factors. Overall, the advantages of nutrition or dietary habits for older persons include a reduced risk of type 2 diabetes, better mental health, improved cognitive function,

Table 3 Studies Correlating Healthy Eating and Healthy Aging

Study	Type of Study	Number of Subjects	Examined Results
Prospective investigation into how often and when older people who live in the community eat breakfast and their risk of developing type 2 diabetes; Carew et al ⁵⁹	Baseline questionnaire data on weekly breakfast frequency and daily breakfast time were collected from 3747 older adults (aged ≥ 65 y) in the Cardiovascular Health Study. These individuals, without cancer or T2DM, were followed for 17.6 years, and hazard ratios were calculated to assess the relationship with T2DM. (Prospective study)	3747	The majority of participants in the Cardiovascular Health Study (CHS) ate breakfast every day (85.5%), and 73% had their first meal of the day between 7:00 and 9:00. These behaviors were linked to higher socioeconomic status, indicators of a healthier lifestyle, and lower baseline levels of cardiometabolic risk indicators.
Changes in Dietary Quality Overall and the Risk of Type 2 Diabetes Subsequently; Ley et al ⁶⁰	Over a span of 20 years, 124,607 participants from the Nurses' Health Study, NHS II, and the Health Professionals Follow-up Study were examined for diabetes risk, with diet quality evaluated using the AHEI score every 4 years. (Three prospective cohorts)	124,607	A reduced risk of type 2 diabetes is linked to an improvement in diet quality overall, whereas a higher risk is linked to a decline. Only a portion of the relationship between diet quality changes and diabetes risk can be attributed to body weight changes.
Greater Healthy Eating Index-2005 scores are linked to fewer depressive symptoms in urban populations; Kuczmarski et al ⁶¹	Nutrition data obtained through dietary recalls and the Healthy Eating Index were used to assess diet quality, while depressive symptoms were measured using the CES-D scale. (Diversity across the life span study)	1118	Diet quality and reported depressive symptoms were substantially correlated. However, compared to food quality, education, and sex, income was a noticeably larger predictor of depression.
Healthy Aging findings on the relationship between diet quality and cognitive performance in an urban population; Wright et al ⁶²	In a study involving 2090 African Americans and Whites, researchers analyzed diet quality, race, and poverty's impact on cognitive performance using baseline data from the HANDLS study. (Diversity across the life span study)	2090	The findings show that among those living below the poverty line, better nutrition quality was linked to better performance on measures of attention and cognitive flexibility, visuospatial ability, and perceptual quickness.
Intake of dietary flavonoids in women at midlife and healthy aging; Samieri et al ⁶³	A study involving 13,818 women from the Nurses' Health Study examined the relationship between midlife flavonoid intake and healthy aging outcomes at age 70, based on survival and maintenance of key health domains. (Cohort study)	13,818	Women who consumed more of many flavonoid subclasses in the top quintile at midlife had higher odds of aging healthily compared to those in the lowest quintile. Intake of flavonoids, particularly flavones, flavanones, anthocyanins, and flavonols, is higher in midlife and is linked to a higher likelihood of health and wellbeing in those who live to older ages.
Physical Function Impairment in Men and the Alternative Healthy Eating Index; Hagan et al ⁶⁴	A longitudinal cohort study followed 12,658 men from 2008–2012 to investigate the association between the Alternative Healthy Eating Index-2010 (AHEI) and physical function impairment using multivariable logistic regression models. (Longitudinal cohort study)	12,658	Higher consumption of certain foods like lettuce, broccoli, blueberries, peanuts, walnuts, and other nuts was linked to a lower risk of impairment. A reduced likelihood of physical function impairment was significantly associated with improved overall food quality in this large population of older men. This may be an especially compelling public health justification for older men to change their diets given the importance of physical fitness to good aging and quality of life.

(Continued)

Table 3 (Continued).

Study	Type of Study	Number of Subjects	Examined Results
Dietary habits of the healthiest older person in the study on healthy aging; Gu et al ⁶⁵	A study compared the dietary patterns of 122 super seniors (aged 85+ without major diseases) to 12,626 participants aged 65–86. Logistic regression analyzed the odds of being a super senior based on different dietary patterns. (Cohort study)	122	A western diet, which included French fries, red meat, and processed meat, and a nutrient-rich diet, which featured fruits, vegetables, whole grains, nuts, and seeds in addition to other nutritious food options, were both recognized as two distinct dietary patterns. The likelihood of being a super-senior was associated with higher scores for both dietary trends.
Dietary habits in later life affect the risk of developing cancer and cardiovascular disease; Nobbs et al ⁶⁶	This study analyzed data from the Australian Longitudinal Study of Ageing (ALSA) to identify dietary patterns and investigate their association with cancer and cardiovascular disease development and mortality. (Longitudinal study)	2087	These findings imply that in people who are free of cancer or CVD at age 70 or older, the development of either condition or mortality from either may be independent of the majority of dietary patterns. Importantly, a correlation between the pattern of “red meat and protein alternatives” and cancer growth and death was found.
Dietary patterns and weight change; Arabshahi et al ⁶⁷	A study conducted in 1992 and 2007 examined body weight, socio-demographic factors, and lifestyle characteristics, identifying two dietary patterns ('meat-and-fat' and 'fruit-and-vegetable') using principal component analysis on food frequency questionnaire data. Multivariable regression models were used, adjusting for changes in other variables. (Cohort study)	1186	Males in the highest tertile of the meat-and-fat pattern experienced an average gain in body weight that was more than twice as high as men in the lowest tertile. Males in the top tertile of the fruit-and-vegetable pattern experienced average weight increase that was only roughly half that of men in the lowest tertile. In this cohort, males who followed a diet high in fruit and vegetables gained less weight than those who followed a diet heavy in meat and fat.
Ethnicity, dietary habits, alcohol use, and cardiovascular risk factors in women aged 50 and older; López et al ⁶⁸	This study utilized cluster analysis to assess diet patterns and their correlation with major cardiovascular disease risk factors in women aged 50 years and older using NHANES 2001–2002 data. (Cross-sectional study)	1313	Six distinct, non-overlapping food patterns were identified by cluster analysis, including those for pasta and yellow vegetables, sweets, beef, starches, fruits, and milk, frozen meals, burritos, and pizza, meat dishes, and soft drinks and poultry. The bulk of the women were placed in the diet plan for sweets group. There were significant correlations between food habits and the main CVD risk variables.

increased chances of healthy aging and longevity, lower risk of physical function impairment, reduced risk of cancer and cardiovascular disease, weight management, and improved cardiovascular health. These findings highlight the importance of maintaining a healthy diet in promoting overall well-being and quality of life in older individuals.^{59–68}

Older persons require special attention to their nutritional needs as they age. Decreased calorie needs, increased protein, vitamin D, calcium, and vitamin B₁₂ needs, muscle loss, constipation, calcium and vitamin D deficiencies, vitamin B₁₂ deficiency, other beneficial nutrients, dehydration, and loss of appetite are some of the important nutritional considerations for older persons. A well-balanced diet that meets their unique needs can improve their health and overall well-being.

Healthy Eating Improving Strategies

As people age, their dietary needs change, and it is important to adopt a healthy eating pattern that fits their nutritional requirements. According to the Healthy Eating Index (HEI), older persons have the highest diet quality compared to other age groups, with an HEI score of 63 out of 100, based on the Dietary Guidelines for Americans.⁶⁹ However, older people require fewer calories as they age because their metabolism slows down. As a result, their bodies require more nutrients, making it important to eat foods that are high in nutrients.⁴⁷ The Institute of Medicine recommends that adults over 50 should consume at least 30 grams of fiber per day for men and 21 grams for women.⁷⁰ The USDA has developed Food Patterns to help people understand different approaches to a balanced diet. Among the food patterns, there are three types of eating styles: a healthy American-style, a vegetarian-style, and a Mediterranean-style.⁷¹ Regular moderate physical activity can help maintain a healthy weight and lower the risk of heart disease. Choosing vegetables, fruits, whole grains, high-fiber foods, and lean sources of protein such as fish, while limiting saturated fat and salt intake, is essential. Additionally, it is important to avoid smoking to promote healthy aging.

Adequate Sleep for Older Persons

Sleep disorders are common among older individuals, with insomnia being the most frequent one.⁷² Sleep apnea, restless legs syndrome, periodic limb movement disorder, and rapid eye movement sleep behavior disorder are other disorders that can affect sleep patterns among the elderly.⁷³ Sleep apnea, if left untreated, can lead to other health issues such as high blood pressure, stroke, and memory loss.⁷⁴ Additionally, Alzheimer's disease can disrupt sleep patterns, with some patients sleeping excessively and others not getting enough sleep.⁷⁵ It is imperative to diagnose and manage sleep disorders to prevent further health complications.

As people age, they often experience changes in their sleep patterns and difficulties with sleep. Older person may have a harder time falling asleep and staying asleep, and they may spend more time in lighter stages of sleep than in deep sleep.⁷⁶ Conditions that commonly affect sleep in older person include depression, anxiety, heart disease, diabetes, and conditions that cause discomfort and pain, such as arthritis.⁷⁷ In fact, poor sleep habits and a general lack of sleep can lead to major health problems in up to 40% of older persons.⁷⁷ Daytime tiredness, which is when older people feel exhausted all day but are unable to fall asleep due to their sleepiness, can be the most dangerous side effect of sleep loss.^{78,79} This can lead to difficulties with simple activities, as well as anger, depression, memory issues, lack of concentration, poor energy, a lack of drive, a lack of interest in social interaction, and problems with concentration.⁸⁰ Lack of sleep has been linked to several major health issues, such as high blood pressure, obesity, substance dependence, and early death.^{77,81} Furthermore, research has found a strong link between getting five or fewer hours of sleep and an increased risk of dementia.⁸² A restful night's sleep strengthens memory and attention, enables the body to heal any daytime cell damage, and revitalizes the immune system, which aids in illness prevention.⁷⁶ It is important for older people to prioritize good sleep habits to maintain their overall health and wellbeing.

Table 4 provides a summary of some of the key studies examining the relationship between sleep quality and the aging process.

Based on the results of the mentioned studies, the advantages of sleep for older persons can be summarized as follows: 1. subjective sleep quality in noncomplaining elderly subjects, 2. work, eat and sleep, 3. the effects of yoga compared to active and inactive controls on physical function and health-related quality of life in older adults, 4. sleep duration and snoring at midlife in relation to healthy aging, 5. sleep duration, snoring habits, and cardiovascular disease risk factors, 6. daytime sleepiness predicts mortality and cardiovascular disease in older persons, 7. increased risk of heart failure in women with symptoms of sleep-disordered breathing, 8. sleep disorders and their impacts on healthy, dependent, and frail older adults, 9. both habitual short sleepers and long sleepers are at greater risk of obesity, 10. sleep quality, duration, and associated sexual function at older age. The advantages of sleep for older persons include maintaining consistent sleep quality, promoting physical function, improving quality of life, reducing the risk of chronic diseases, enhancing cardiovascular health, reducing mortality risk, and supporting sexual function. Adequate sleep duration and healthy sleep habits are crucial for overall well-being and healthy aging in older individuals.^{83–92} These studies have used a variety of methods to assess sleep quality. Sleep disorders are prevalent in older individuals, with

Table 4 Key Studies Examining the Relationship Between Sleep Quality and the Aging Process

Study	Type of Study	Number of Subjects	Examined Results
Subjective sleep quality in noncomplaining elderly subjects; 76. Danker-Hopfe et al ⁸³	This study examines sleep quality in elderly individuals using the PSQI, with 91 subjects participating at baseline and a follow-up study conducted 16±5 months later (82.4% response rate). (Investigative study)	91	According to the findings, sleep quality does not change systematically over the time course of this study.
Work, eat and sleep: towards a healthy ageing; Riethmeister et al ⁸⁴	A mixed methods design incorporating interviews and focus groups was utilized to develop a questionnaire, which was then administered to 450 offshore workers. Subgroup analyses explored age-related variations in health and work-related aspects. (Semi-structured interviews and focus-group)	450	The qualitative data analysis revealed the value of healthy working surroundings, nutrition, and tiredness management. For a healthy ageing at work and sustained employability program offshore, both qualitative and quantitative evaluations highlighted work, food, and sleep/fatigue management as the most essential program objectives.
The effects of yoga compared to active and inactive controls on physical function and health related quality of life in older adults; Sivaramakrishnan et al ⁸⁵	In September 2017, various databases were searched for randomized controlled trials comparing yoga interventions with controls in older adults, focusing on physical function and HRQoL outcomes. (Systematic review and meta-analysis)	22	Results indicate that yoga interventions improve multiple physical function and HRQoL outcomes in this population compared to both control conditions. This study provides robust evidence for promoting yoga in physical activity guidelines for older adults as a multimodal activity that improves aspects of fitness like strength, balance and flexibility, as well as mental wellbeing.
Sleep duration and snoring at midlife in relation to healthy aging; Shi et al ⁸⁶	The Nurses' Health Study analyzed participants free of major chronic diseases in 1986 and aged 70 or older in 1995–2001, using logistic regression for odds ratios and confidence intervals in assessing healthy aging. (Prospective cohort study)	121,701	The findings show a non-linear relationship between sleep duration and the likelihood of experiencing good aging. Regular snoring was linked to a 31% lower likelihood of aging healthily, which was mostly caused by a decreased likelihood of not having any severe chronic illnesses.
Sleep duration, snoring habits, and cardiovascular disease risk factors; Mosca et al ⁸⁷	A CVD screening program in NYC assessed sleep habits and CVD risk factors among participants (n=371), revealing associations through logistic regression. (Investigative study)	371	Sleeping for fewer than six hours each night was linked to a number of traditional and psychosocial CVD risk factors, and snoring was linked to poor HDL cholesterol, probably caused by being overweight or obese.
Daytime sleepiness predicts mortality and cardiovascular disease in older persons; Newman et al ⁸⁸	This study employs an interview-administered questionnaire to assess health and sleep habits, while continuously monitoring total mortality and cardiovascular disease morbidity and mortality, including incidents of myocardial infarction and congestive heart failure. (Investigative study)	5888	The findings show that myocardial infarction, congestive heart failure, acute cardiovascular disease morbidity and mortality, and mortality were all associated with daytime sleepiness, the only sleep disturbance symptom. These results were more prevalent in women than in men.

(Continued)

Table 4 (Continued).

Study	Type of Study	Number of Subjects	Examined Results
Increased risk of heart failure in women with symptoms of sleep-disordered breathing; Ljunggren et al ⁸⁹	The Sleep and Health in Women study (SHE) followed 5990 women from 2000 to 2011, examining snoring, sleepiness, and heart failure using Swedish national registers. (Population-based cohort study)	5990	During follow-up, 5.3% of women with both snoring and excessive daytime sleepiness developed heart failure, compared to 0.9% in the control group with neither snoring nor excessive daytime sleepiness. Obstructive sleep apnea symptoms, which include snoring and excessive daytime sleepiness, are linked to an increased risk of developing heart failure in women.
Sleep disorders and their impacts on healthy, dependent, and frail older adults; Cochen et al ⁹⁰	A multidisciplinary review task force examined 106 articles from Ovid Medline to analyze age-related sleep disorders in older adults. (Integrative reviews)	106	Sleep disturbances are common in healthy older adults, with changes in sleep architecture and increased prevalence of sleep disorders. Sleep problems worsen in dependent older adults, including those with Alzheimer's disease. Further research is needed to understand sleep in frail older adults.
Both habitual short sleepers and long sleepers are at greater risk of obesity; Theorell-Haglöw et al ⁹¹	A 10-year follow-up study with 4903 participants examined the relationship between changes in sleep duration and various factors such as obesity, weight gain, and waist circumference increase using logistic regression analysis. (Investigative study)	4903	In women who were older than 40 at the time of the follow-up, there were no correlations between variations in sleep patterns and any markers of obesity. Both habitual short sleepers and habitual long sleepers exhibited a higher prevalence of overall and central obesity among younger women (aged 40 years) than habitual normal sleepers.
Sleep Quality, Duration, and Associated Sexual Function at Older Age; Smith et al ⁹²	This study analyzed data from 2568 men and 1376 women aged 50 years or older, assessing the relationship between sleep quality and sexual function while considering various factors such as age, ethnicity, and health status. (Longitudinal Study)	3944	Moderate sleep quality was linked to an increased risk of erectile dysfunction in men. Sleep quality was not associated with difficulty achieving an orgasm in men, but it was associated with an increased risk of orgasmic difficulty in women.

insomnia being the most common. Conditions like sleep apnea and Alzheimer's disease can further disrupt sleep patterns. Poor sleep habits can lead to health problems and decreased quality of life. Prioritizing good sleep is crucial for maintaining overall well-being in older persons.

Appropriate Sleep Improving Strategies

Establishing a regular sleep routine is one of the most important strategies for promoting better sleep. Going to bed and waking up at the same time every day, including weekends, can help regulate the body's internal clock and promote better sleep.⁹³ Additionally, including PA in the daily routine can promote better sleep. Regular PA, such as walking or swimming, can help reduce stress and promote relaxation.⁹³ However, it is important to avoid exercising too close to bedtime, as this may interfere with sleep.

Creating a comfortable sleep environment is another essential strategy for promoting better sleep. The bedroom should be quiet, dark, and cool, and comfortable bedding should be used.⁹⁴ Additionally, it is important to avoid stimulants before bedtime. Limiting caffeine, sugar, and alcohol intake, and avoiding eating right before bed can help promote better sleep.⁹⁵ Engaging in relaxing activities, such as reading or taking a warm bath, can help promote relaxation and prepare the mind for sleep.⁹⁵ It is also important to manage worries and avoid engaging in stimulating or stressful activities close to bedtime.

Taking short, 20–30-minute naps during the day can help promote wakefulness, but longer naps can interfere with nighttime sleep.⁹⁶ Therefore, it is important to avoid long naps during the day. Using relaxation techniques such as deep breathing, meditation, or progressive muscle relaxation techniques can also help promote relaxation and sleep.⁹⁶

Managing medical conditions is an important strategy for improving sleep quality. Chronic pain or other medical conditions can interfere with sleep, so it's important to manage these conditions with proper medical care.⁹⁷

Conclusion

Based on the reviewed research studies from the fields of physical activity, nutrition, and sleep for older persons, several key findings emerge. First and foremost, regular physical activity has been consistently linked to numerous benefits for older individuals. Engaging in exercise promotes cardiovascular health, improves muscle strength and flexibility, enhances cognitive function, and reduces the risk of chronic diseases such as diabetes and osteoporosis. Moreover, exercise has been shown to have a positive impact on mental well-being, including reducing symptoms of anxiety and depression. Secondly, nutrition plays a crucial role in maintaining optimal health in older adults. The studies highlight the importance of a balanced diet rich in fruits, vegetables, whole grains, lean proteins, and healthy fats. Adequate nutrition supports the immune system, maintains bone health, and reduces the risk of malnutrition and age-related diseases. Furthermore, certain nutrients, such as vitamin D and calcium, have been found to be particularly beneficial for older individuals in promoting bone density and preventing fractures. Lastly, sleep is a vital component of healthy aging. The research emphasizes the significance of sufficient and quality sleep for older adults' overall well-being. Poor sleep patterns and insomnia have been associated with an increased risk of cognitive decline, cardiovascular diseases, and mood disorders. On the other hand, regular sleep habits, proper sleep hygiene, and the maintenance of a consistent sleep schedule have been shown to improve cognitive function, immune response, and emotional resilience.

There are several areas that warrant further investigation to enhance our understanding and improve the PW of older individuals. Firstly, future studies may focus on examining the long-term effects of specific types of physical activity on various aspects of health in older adults. While the studies in the review highlighted the benefits of regular exercise, further research could delve deeper into the optimal duration, intensity, and frequency of different exercise modalities, such as aerobic exercises, strength training, and flexibility exercises. Additionally, investigating the potential benefits of newer exercise trends, such as high-intensity interval training (HIIT) or mind-body exercises like yoga and tai chi, could provide valuable insights into their effects on physical wellness for older persons. Secondly, it would be beneficial to explore the impact of personalized nutrition interventions on the health outcomes of older individuals. Customized dietary plans that consider an individual's unique nutritional needs, medical conditions, and preferences could prove highly effective in promoting optimal health. Future studies could assess the efficacy of personalized nutrition strategies, such as individualized meal plans or dietary counseling, in improving specific health markers, including immune function, cognitive health, and cardiovascular health, in older adults. Furthermore, additional research is needed to understand the interplay between physical activity, nutrition, and sleep in older individuals. Examining the synergistic effects of these three domains and their cumulative impact on overall health and well-being could provide valuable insights for developing comprehensive lifestyle interventions.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors report no conflicts of interest in this work.

References

1. World Health Organization: Ageing and Health; 2023. Available from: <https://www.who.int/news-room/fact-sheets/detail/ageing-and-health>. Accessed January 26, 2023.
2. Maresova P, Javanmardi E, Barakovic S, et al. Consequences of chronic diseases and other limitations associated with old age - a scoping review. *BMC Public Health*. 2019;19(1):1431. PMID: 31675997; PMCID: PMC6823935. doi:10.1186/s12889-019-7762-5
3. Oliver MD, Baldwin DR, Subimal D. Health to wellness: a review of wellness models and transitioning back to health. *Int J Health Wellness Soc*. 2018;9(1):41–56. doi:10.18848/2156-8960/CGP/v09i01/41-56
4. Global Wellness Institute: What is Wellness? 2023. Available from: <https://globalwellnessinstitute.org/what-is-wellness/>. Accessed January 26, 2023.
5. Langhammer B, Bergland A, Rydwick E. The importance of physical activity exercise among older people. *Biomed Res Int*. 2018;2018:7856823. PMID: 30627571; PMCID: PMC6304477. doi:10.1155/2018/7856823
6. Gammack JK. Physical activity in older persons. *Mo Med*. 2017;114(2):105–109. PMID: 30228555; PMCID: PMC6140016.
7. Thomas E, Battaglia G, Patti A, et al. Physical activity programs for balance and fall prevention in elderly: a systematic review. *Medicine*. 2019;98(27):e16218. PMID: 31277132; PMCID: PMC6635278. doi:10.1097/MD.00000000000016218
8. Robinson SM. Improving nutrition to support healthy ageing: what are the opportunities for intervention? *Proc Nutr Soc*. 2018;77(3):257–264. Epub 2017 Nov 27. PMID: 29173227; PMCID: PMC6064642. doi:10.1017/S0029665117004037
9. Suzuki K, Miyamoto M, Hirata K. Sleep disorders in the elderly: diagnosis and management. *J Gen Fam Med*. 2017;18(2):61–71. PMID: 29263993; PMCID: PMC5689397. doi:10.1002/jgf2.27
10. Fair SE. *Wellness and Physical Therapy*. 1st ed. F.A. Davis Company; 2012.
11. Sleep Foundation: Diet, Exercise, and Sleep; 2023. Available from: <https://www.sleepfoundation.org/physical-health/diet-exercise-sleep>. Accessed January 27, 2023.
12. Center for Chronic Disease Prevention and Health Promotion: Adults 50 and Older Need More Physical Activity; 2023. Available from: <https://www.cdc.gov/physicalactivity/inactivity-among-adults-50plus/index.html>. Accessed January 29, 2023.
13. Manini TM. Energy expenditure and aging. *Ageing Res Rev*. 2010;9(1):1–11. PMID: 19698803; PMCID: PMC2818133. doi:10.1016/j.arr.2009.08.002
14. Roberts SB, Rosenberg I. Nutrition and aging: changes in the regulation of energy metabolism with aging. *Physiol Rev*. 2006;86(2):651–667. PMID: 16601270. doi:10.1152/physrev.00019.2005
15. Lüthmann PM, Bender R, Edelmann-Schäfer B, Neuhäuser-Berthold M. Longitudinal changes in energy expenditure in an elderly German population: a 12-year follow-up. *Eur J Clin Nutr*. 2009;63(8):986–992. doi:10.1038/ejcn.2009.1
16. National Institutes of Health: Healthy Eating as You Age: Know Your Food Groups; 2023. Available from: <https://www.nia.nih.gov/health/healthy-eating-you-age-know-your-food-groups>. Accessed January 26, 2023.
17. Fernandez-Mendoza J, Vgontzas AN. Insomnia and its impact on physical and mental health. *Curr Psychiatry Rep*. 2013;15(12):418. PMID: 24189774; PMCID: PMC3972485. doi:10.1007/s11920-013-0418-8
18. Davies EA, O'Mahony MS. Adverse drug reactions in special populations - the elderly. *Br J Clin Pharmacol*. 2015;80(4):796–807. PMID: 25619317; PMCID: PMC4594722. doi:10.1111/bcp.12596
19. Talley KMC, Cheung C, Mathiason MA, Schorr E, McMahon S, Wyman JF. Aging adults' preferences for wellness program activities and delivery characteristics: a cross-sectional survey. *Top Geriatr Rehabil*. 2019;35(4):289–299. PMID: 32099271; PMCID: PMC7041904. doi:10.1097/tgr.0000000000000247
20. Center for chronic disease prevention and health promotion. Available from: <https://www.cdc.gov/nccdphp/sgr/olderad.htm>. Accessed January 29, 2023.
21. Katzmarzyk PT, Friedenreich C, Shiroma EJ, Lee IM. Physical inactivity and non-communicable disease burden in low-income, middle-income and high-income countries. *Br J Sports Med*. 2022;56(2):101–106. doi:10.1136/bjsports-2020-103640
22. Livingston G, Huntley J, Sommerlad A, et al. Dementia prevention, intervention, and care: 2020 report of the Lancet Commission. *Lancet*. 2020;396(10248):413–446. PMID: 32738937; PMCID: PMC7392084. doi:10.1016/S0140-6736(20)30367-6
23. Hong AR, Kim SW. Effects of resistance exercise on bone health. *Endocrinol Metab*. 2018;33(4):435–444. PMID: 30513557; PMCID: PMC6279907. doi:10.3803/EnM.2018.33.4.435
24. Nieman DC, Wentz LM. The compelling link between physical activity and the body's defense system. *J Sport Health Sci*. 2019;8(3):201–217. PMID: 31193280; PMCID: PMC6523821. doi:10.1016/j.jshs.2018.09.009
25. Liang KY, Mintun MA, Fagan AM, et al. Exercise and Alzheimer's disease biomarkers in cognitively normal older persons. *Ann Neurol*. 2010;68(3):311–318. PMID: 20818789; PMCID: PMC2936720. doi:10.1002/ana.22096
26. Campbell JP, Turner JE. Debunking the myth of exercise-induced immune suppression: redefining the impact of exercise on immunological health across the lifespan. *Front Immunol*. 2018;9:648. doi:10.3389/fimmu.2018.00648
27. Manini TM, Pahor M. Physical activity and maintaining physical function in older persons. *Br J Sports Med*. 2009;43(1):28–31. PMID: 18927164; PMCID: PMC3104323. doi:10.1136/bjism.2008.053736
28. Centers for Disease Control and Prevention: How Much Physical Activity Do Older Adults Need? ;2023. Available from: https://www.cdc.gov/physicalactivity/basics/older_adults/index.htm. Accessed January 27, 2023.
29. Peterson MJ, Giuliani C, Morey MC, et al; Health, Aging and Body Composition Study Research Group. Physical activity as a preventative factor for frailty: the health, aging, and body composition study. *J Gerontol a Biol Sci Med Sci*. 2009;64(1):61–68. PMID: 19164276; PMCID: PMC2913907. doi:10.1093/gerona/gln001

30. Legault C, Jennings JM, Katula JA, et al; SHARP-P Study Group. Designing clinical trials for assessing the effects of cognitive training and physical activity interventions on cognitive outcomes: the Seniors Health and Activity Research Program Pilot (SHARP-P) study, a randomized controlled trial. *BMC Geriatr*. 2011;11:27. PMID: 21615936; PMCID: PMC3126708. doi:10.1186/1471-2318-11-27
31. Andrews G, Clark M, Luszcz M. Successful aging in the Australian longitudinal study of aging: applying the MacArthur model cross-nationally. *J Soc Issues*. 2002;58(4):749–765. doi:10.1111/1540-4560.00288
32. Baker LD, Frank LL, Foster-Schubert K, et al. Effects of aerobic exercise on mild cognitive impairment: a controlled trial. *Arch Neurol*. 2010;67(1):71–79. PMID: 20065132; PMCID: PMC3056436. doi:10.1001/archneurol.2009.307
33. Kumar M, Srivastava S, Muhammad T. Relationship between physical activity and cognitive functioning among older Indian adults. *Sci Rep*. 2022;12(1):2725. PMID: 35177736; PMCID: PMC8854730. doi:10.1038/s41598-022-06725-3
34. Nagamatsu LS, Chan A, Davis JC, et al. Physical activity improves verbal and spatial memory in older persons with probable mild cognitive impairment: a 6-month randomized controlled trial. *J Aging Res*. 2013;2013:861893. PMID: 23509628; PMCID: PMC3595715. doi:10.1155/2013/861893
35. Opdal IM, Larsen LS, Hopstock LA, Schirmer H, Lorentz GF. A prospective study on the effect of self-reported health and leisure time physical activity on mortality among an ageing population: results from the Tromsø study. *BMC Public Health*. 2020;20(1):575. Erratum in: *BMC Public Health*. 2021 May 12;21(1):900. PMID: 32345261; PMCID: PMC7189588. doi:10.1186/s12889-020-08681-x
36. Lerche S, Gutfreund A, Brockmann K, et al. Effect of physical activity on cognitive flexibility, depression and RBD in healthy elderly. *Clin Neurol Neurosurg*. 2018;165:88–93. Epub 2018 Jan 9. PMID: 29331872. doi:10.1016/j.clineuro.2018.01.008
37. Ruscheweyh R, Willemer K, Krüger K, et al. Physical activity and memory functions: an interventional study. *Neurobiol Aging*. 2011;32(7):1304–1319. PMID: 19716631. doi:10.1016/j.neurobiolaging.2009.08.001
38. Lin YH, Chen YC, Tseng YC, Tsai ST, Tseng YH. Physical activity and successful aging among middle-aged and older persons: a systematic review and meta-analysis of cohort studies. *Aging*. 2020;12(9):7704–7716. PMID: 32350152; PMCID: PMC7244057. doi:10.18632/aging.103057
39. Bai X, Soh KG, Omar Dev RD, et al. Aerobic exercise combination intervention to improve physical performance among the elderly: a systematic review. *Front Physiol*. 2022;12:798068. doi:10.3389/fphys.2021.798068
40. Mayer F, Scharhag-Rosenberger F, Carlsohn A, Cassel M, Müller S, Scharhag J. The intensity and effects of strength training in the elderly. *Dtsch Arztebl Int*. 2011;108(21):359–364. PMID: 21691559; PMCID: PMC3117172. doi:10.3238/arztebl.2011.0359
41. Stathokostas L, Little RM, Vandervoort AA, Paterson DH. Flexibility training and functional ability in older persons: a systematic review. *J Aging Res*. 2012;2012:306818. PMID: 23209904; PMCID: PMC3503322. doi:10.1155/2012/306818
42. Halvarsson A, Dohrn IM, Ståhle A. Taking balance training for older persons one step further: the rationale for and a description of a proven balance training programme. *Clin Rehabil*. 2015;29(5):417–425. PMID: 25200877; PMCID: PMC4419050. doi:10.1177/0269215514546770
43. Mazzeo RS, Tanaka H. Exercise prescription for the elderly: current recommendations. *Sports Med*. 2001;31(11):809–818. PMID: 11583105. doi:10.2165/00007256-200131110-00003
44. Martin P, Kelly N, Kahana B, et al. Defining successful aging: a tangible or elusive concept? *Gerontologist*. 2015;55(1):14–25. PMID: 24840916; PMCID: PMC4542894. doi:10.1093/geront/gnu044
45. Rizzoli R, Stevenson JC, Bauer JM, et al; ESCEO Task Force. The role of dietary protein and vitamin D in maintaining musculoskeletal health in postmenopausal women: a consensus statement from the European Society for Clinical and Economic Aspects of Osteoporosis and Osteoarthritis (ESCEO). *Maturitas*. 2014;79(1):122–132. Epub 2014 Jul 17. Erratum in: *Maturitas*. 2015 Mar;80(3):337. PMID: 25082206. doi:10.1016/j.maturitas.2014.07.005
46. Giezenaar C, Chapman I, Luscombe-Marsh N, Feinle-Bisset C, Horowitz M, Soenen S. Ageing is associated with decreases in appetite and energy intake—a meta-analysis in healthy adults. *Nutrients*. 2016;8(1):28. PMID: 26751475; PMCID: PMC4728642. doi:10.3390/nu8010028
47. Hunter GR, Gower BA, Kane BL. Age related shift in visceral fat. *Int J Body Compos Res*. 2010;8(3):103–108. PMID: 24834015; PMCID: PMC4018766.
48. Thomas DR. Vitamins in aging, health, and longevity. *Clin Interv Aging*. 2006;1(1):81–91. PMID: 18047260; PMCID: PMC2682456. doi:10.2147/ciia.2006.1.1.81
49. Walston JD. Sarcopenia in older persons. *Curr Opin Rheumatol*. 2012;24(6):623–627. PMID: 22955023; PMCID: PMC4066461. doi:10.1097/BOR.0b013e328358d59b
50. Mayo foundation for medical education and research. Available from: <https://www.mayoclinic.org/diseases-conditions/diverticulitis/symptoms-causes/syc-20371758>. Accessed January 30, 2023.
51. Khazai N, Judd SE, Tangpricha V. Calcium and vitamin D: skeletal and extraskeletal health. *Curr Rheumatol Rep*. 2008;10(2):110–117. PMID: 18460265; PMCID: PMC2669834. doi:10.1007/s11926-008-0020-y
52. O'Leary F, Samman S. Vitamin B12 in health and disease. *Nutrients*. 2010;2(3):299–316. PMID: 22254022; PMCID: PMC3257642. doi:10.3390/nu2030299
53. Weaver CM. Potassium and health. *Adv Nutr*. 2013;4(3):368S–77S. PMID: 23674806; PMCID: PMC3650509. doi:10.3945/an.112.003533
54. Mozaffarian D, Wu JH. Omega-3 fatty acids and cardiovascular disease: effects on risk factors, molecular pathways, and clinical events. *J Am Coll Cardiol*. 2011;58(20):2047–2067. PMID: 22051327. doi:10.1016/j.jacc.2011.06.063
55. Barbagallo M, Veronese N, Dominguez LJ. Magnesium in aging, health and diseases. *Nutrients*. 2021;13(2):463. PMID: 33573164; PMCID: PMC7912123. doi:10.3390/nu13020463
56. Mayo foundation for medical education and research. Available from: <https://www.mayoclinic.org/diseases-conditions/iron-deficiency-anemia/symptoms-causes/syc-20355034>. Accessed January 30, 2023.
57. Beck AM, Seemer J, Knudsen AW, Munk T. Narrative review of low-intake dehydration in older persons. *Nutrients*. 2021;13(9):3142. PMID: 34579019; PMCID: PMC8470893. doi:10.3390/nu13093142
58. Pilgrim AL, Robinson SM, Sayer AA, Roberts HC. An overview of appetite decline in older people. *Nurs Older People*. 2015;27(5):29–35. PMID: 26018489; PMCID: PMC4589891. doi:10.7748/nop.27.5.29.e697
59. Carew AS, Mekary RA, Kirkland S, et al. Prospective study of breakfast frequency and timing and the risk of incident type 2 diabetes in community-dwelling older persons: the cardiovascular health study. *Am J Clin Nutr*. 2022;116(2):325–334. PMID: 35380627; PMCID: PMC9348984. doi:10.1093/ajcn/nqac087

60. Ley SH, Pan A, Li Y, et al. Changes in overall diet quality and subsequent type 2 diabetes risk: three U.S. prospective cohorts. *Diabetes Care*. 2016;39(11):2011–2018. PMID: 27634391; PMCID: PMC5079614. doi:10.2337/dc16-0574
61. Kuczmarski MF, Cremer Sees A, Hotchkiss L, Cotugna N, Evans MK, Zonderman AB. Higher healthy eating index-2005 scores associated with reduced symptoms of depression in an urban population: findings from the Healthy Aging in Neighborhoods of Diversity Across the Life Span (HANDLS) study. *J Am Diet Assoc*. 2010;110(3):383–389. PMID: 20184988; PMCID: PMC2850196. doi:10.1016/j.jada.2009.11.025
62. Wright RS, Waldstein SR, Kuczmarski MF, et al. Diet quality and cognitive function in an urban sample: findings from the Healthy Aging in Neighborhoods of Diversity across the Life Span (HANDLS) study. *Public Health Nutr*. 2017;20(1):92–101. PMID: 27256509; PMCID: PMC5646273. doi:10.1017/S1368980016001361
63. Samieri C, Sun Q, Townsend MK, Rimm EB, Grodstein F. Dietary flavonoid intake at midlife and healthy aging in women. *Am J Clin Nutr*. 2014;100(6):1489–1497. PMID: 25411284; PMCID: PMC4232017. doi:10.3945/ajcn.114.085605
64. Hagan KA, Grodstein F. The alternative healthy eating index and physical function impairment in men. *J Nutr Health Aging*. 2019;23(5):459–465. PMID: 31021363. doi:10.1007/s12603-019-1185-y
65. Gu Q, Sable CM, Brooks-Wilson A, Murphy RA. Dietary patterns in the healthy oldest old in the healthy aging study and the Canadian longitudinal study of aging: a cohort study. *BMC Geriatr*. 2020;20(1):106. PMID: 32178631; PMCID: PMC7077120. doi:10.1186/s12877-020-01507-w
66. Nobbs HM, Yaxley A, Thomas J, et al. Do dietary patterns in older age influence the development of cancer and cardiovascular disease: a longitudinal study of ageing. *Clin Nutr*. 2016;35(2):528–535. Epub 2015 Apr 11. PMID: 25912186. doi:10.1016/j.clnu.2015.04.003
67. Arabshahi S, Ibiebele TI, Hughes MCB, Lahmann PH, Williams GM, van der Pols JC. Dietary patterns and weight change: 15-year longitudinal study in Australian adults. *Eur J Nutr*. 2017;56(4):1455–1465. Epub 2016 Feb 26. PMID: 26919993. doi:10.1007/s00394-016-1191-3
68. López EP, Rice C, Weddle DO, Rahill GJ. The relationship among cardiovascular risk factors, diet patterns, alcohol consumption, and ethnicity among women aged 50 years and older. *J Am Diet Assoc*. 2008;108(2):248–256. PMID: 18237573; PMCID: PMC2760339. doi:10.1016/j.jada.2007.10.043
69. Zhao H, Andreyeva T. Diet quality and health in older Americans. *Nutrients*. 2022;14(6):1198. PMID: 35334855; PMCID: PMC8955752. doi:10.3390/nu14061198
70. Dahl WJ, Stewart ML. Position of the academy of nutrition and dietetics: health implications of dietary fiber. *J Acad Nutr Diet*. 2015;115(11):1861–1870. PMID: 26514720. doi:10.1016/j.jand.2015.09.003
71. Snetselaar LG, de Jesus JM, DeSilva DM, Stoddy EE. Dietary guidelines for Americans, 2020–2025: understanding the scientific process, guidelines, and key recommendations. *Nutr Today*. 2021;56(6):287–295. PMID: 34987271; PMCID: PMC8713704. doi:10.1097/NT.0000000000000512
72. Sabia S, Dugravot A, Léger D, Ben Hassen C, Kivimäki M, Singh-Manoux A. Association of sleep duration at age 50, 60, and 70 years with risk of multimorbidity in the UK: 25-year follow-up of the Whitehall II cohort study. *PLoS Med*. 2022;19(10):e1004109. PMID: 36256607; PMCID: PMC9578599. doi:10.1371/journal.pmed.1004109
73. Hornyak M, Trenkwalder C. Restless legs syndrome and periodic limb movement disorder in the elderly. *J Psychosom Res*. 2004;56(5):543–548. PMID: 15172211. doi:10.1016/S0022-3999(04)00020-0
74. Mansukhani MP, Kolla BP, Somers VK. Hypertension and cognitive decline: implications of obstructive sleep apnea. *Front Cardiovasc Med*. 2019;6:96. PMID: 31355211; PMCID: PMC6636426. doi:10.3389/fcvm.2019.00096
75. McCurry SM, Logsdon RG, Vitiello MV, Teri L. Treatment of sleep and nighttime disturbances in Alzheimer's disease: a behavior management approach. *Sleep Med*. 2004;5(4):373–377. PMID: 15222994. doi:10.1016/j.sleep.2003.11.003
76. Gulia KK, Kumar VM. Sleep disorders in the elderly: a growing challenge. *Psychogeriatrics*. 2018;18(3):155–165. PMID: 29878472. doi:10.1111/psyg.12319
77. Sleep Foundation: Aging and Sleep; 2023. Available from: <https://www.sleepfoundation.org/aging-and-sleep>. Accessed January 30, 2023.
78. American Academy of Sleep Medicine: Sleep Problems are More Likely as We Get Older; 2023. Available from: <https://aasm.org/sleep-problems-are-more-likely-as-we-get-older/>. Accessed January 30, 2023.
79. Murray BJ. A practical approach to excessive daytime sleepiness: a focused review. *Can Respir J*. 2016;2016:4215938. PMID: 27445538; PMCID: PMC4904525. doi:10.1155/2016/4215938
80. Alhola P, Polo-Kantola P. Sleep deprivation: impact on cognitive performance. *Neuropsychiatr Dis Treat*. 2007;3(5):553–567. PMID: 19300585; PMCID: PMC2656292.
81. Grandner MA, Alfonso-Miller P, Fernandez-Mendoza J, Shetty S, Shenoy S, Combs D. Sleep: important considerations for the prevention of cardiovascular disease. *Curr Opin Cardiol*. 2016;31(5):551–565. PMID: 27467177; PMCID: PMC5056590. doi:10.1097/HCO.0000000000000324
82. Robbins R, Quan SF, Weaver MD, Bormes G, Barger LK, Czeisler CA. Examining sleep deficiency and disturbance and their risk for incident dementia and all-cause mortality in older persons across 5 years in the United States. *Ageing*. 2021;13(3):3254–3268. PMID: 33570509; PMCID: PMC7906211. doi:10.18632/aging.202591
83. Danker-Hopfe H, Hornung O, Regen F, Hansen ML, Albrecht N, Heuser I. Subjective sleep quality in noncomplaining elderly subjects: results of a follow-up study. *Anthropol Anz*. 2006;64(4):369–376. PMID: 17240955. doi:10.1127/anthranz/64/2006/369
84. Riethmeister V, Brouwer S, van der Klink J, Bültmann U. Work, eat and sleep: towards a healthy ageing at work program offshore. *BMC Public Health*. 2016;16:134. PMID: 26861452; PMCID: PMC4748638. doi:10.1186/s12889-016-2807-5
85. Sivaramakrishnan D, Fitzsimons C, Kelly P, et al. The effects of yoga compared to active and inactive controls on physical function and health related quality of life in older adults- systematic review and meta-analysis of randomised controlled trials. *Int J Behav Nutr Phys Act*. 2019;16(1):33. PMID: 30953508; PMCID: PMC6451238. doi:10.1186/s12966-019-0789-2
86. Shi H, Huang T, Ma Y, Eliassen AH, Sun Q, Wang M. Sleep duration and snoring at midlife in relation to healthy aging in women 70 years of age or older. *Nat Sci Sleep*. 2021;13:411–422. PMID: 33762862; PMCID: PMC7982569. doi:10.2147/NSS.S302452
87. Mosca M, Aggarwal B. Sleep duration, snoring habits, and cardiovascular disease risk factors in an ethnically diverse population. *J Cardiovasc Nurs*. 2012;27(3):263–269. PMID: 21743341; PMCID: PMC3627372. doi:10.1097/JCN.0b013e31821e7ad1
88. Newman AB, Spiekerman CF, Enright P, et al. Daytime sleepiness predicts mortality and cardiovascular disease in older persons. The Cardiovascular Health Study Research Group. *J Am Geriatr Soc*. 2000;48(2):115–123. PMID: 10682939. doi:10.1111/j.1532-5415.2000.tb03901.x
89. Ljunggren M, Byberg L, Theorell-Haglöw J, Lindahl B, Michaëlsson K, Lindberg E. Increased risk of heart failure in women with symptoms of sleep-disordered breathing. *Sleep Med*. 2016;17:32–37. PMID: 26847971. doi:10.1016/j.sleep.2015.09.018

90. Cochen V, Arbus C, Soto ME, et al. Sleep disorders and their impacts on healthy, dependent, and frail older adults. *J Nutr Health Aging*. 2009;13(4):322–329. PMID: 19300867. doi:10.1007/s12603-009-0030-0
91. Theorell-Haglöw J, Berglund L, Berne C, Lindberg E. Both habitual short sleepers and long sleepers are at greater risk of obesity: a population-based 10-year follow-up in women. *Sleep Med*. 2014;15(10):1204–1211. PMID: 25113417. doi:10.1016/j.sleep.2014.02.014
92. Smith L, Grabovac I, Veronese N, et al. Sleep quality, duration, and associated sexual function at older age: findings from the english longitudinal study of ageing. *J Sex Med*. 2019;16(3):427–433. PMID: 30773496. doi:10.1016/j.jsxm.2019.01.005
93. Tucker RM, Contreras DA, Carlson BR, Carter A, Drake CL. Sleep Education for Elders Program (SLEEP): promising pilot results of a virtual, health educator-led, community-delivered sleep behavior change intervention. *Nat Sci Sleep*. 2021;13:625–633. PMID: 34040471; PMCID: PMC8141400. doi:10.2147/NSS.S304035
94. Harding EC, Franks NP, Wisden W. The temperature dependence of sleep. *Front Neurosci*. 2019;13:336. PMID: 31105512; PMCID: PMC6491889. doi:10.3389/fnins.2019.00336
95. Sejbuk M, Mironczuk-Chodakowska I, Witkowska AM. Sleep quality: a narrative review on nutrition, stimulants, and physical activity as important factors. *Nutrients*. 2022;14(9):1912. PMID: 35565879; PMCID: PMC9103473. doi:10.3390/nu14091912
96. Hilditch CJ, Centofanti SA, Dorrian J, Banks S. A 30-minute, but not a 10-minute nighttime nap is associated with sleep inertia. *Sleep*. 2016;39(3):675–685. PMID: 26715234; PMCID: PMC4763354. doi:10.5665/sleep.5550
97. Whale K, Gooberman-Hill R. The importance of sleep for people with chronic pain: current insights and evidence. *JBM Plus*. 2022;6(7):e10658. PMID: 35866153; PMCID: PMC9289983. doi:10.1002/jbm4.10658

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