



## Nut consumption and age-related disease



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### ABSTRACT

Current knowledge on the effects of nut consumption on human health has rapidly increased in recent years and it now appears that nuts may play a role in the prevention of chronic age-related diseases. Frequent nut consumption has been associated with better metabolic status, decreased body weight as well as lower body weight gain over time and thus reduce the risk of obesity. The effect of nuts on glucose metabolism, blood lipids, and blood pressure is still controversial. However, significant decreased cardiovascular risk has been reported in a number of observational and clinical intervention studies. Thus, findings from cohort studies show that increased nut consumption is associated with a reduced risk of cardiovascular disease and mortality (especially that due to cardiovascular-related causes). Similarly, nut consumption has been also associated with reduced risk of certain cancers, such as colorectal, endometrial, and pancreatic neoplasms. Evidence regarding nut consumption and neurological or psychiatric disorders is scarce, but a number of studies suggest significant protective effects against depression, mild cognitive disorders and Alzheimer's disease. The underlying mechanisms appear to include antioxidant and anti-inflammatory actions, particularly related to their mono- and polyunsaturated fatty acids (MUFA and PUFA, as well as vitamin and polyphenol content). MUFA have been demonstrated to improve pancreatic beta-cell function and regulation of postprandial glycemia and insulin sensitivity. PUFA may act on the central nervous system protecting neuronal and cell-signaling function and maintenance. The fiber and mineral content of nuts may also confer health benefits. Nuts therefore show promise as useful adjuvants to prevent, delay or ameliorate a number of chronic conditions in older people. Their association with decreased mortality suggests a potential in reducing disease burden, including cardiovascular disease, cancer, and cognitive impairments.

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## 1. Introduction

Global life expectancy has increased from 65 years in 1990 to about 71 years in 2013 [1]. As life expectancy has increased, the number of healthy years lost due to disability has also risen in most countries, consistent with greater morbidity [2]. Reduction of mortality rates in developed countries has been associated with a shift toward more chronic non-communicable diseases [1]. Cardiovascular diseases (CVDs) and related risk factors, such as hypertension, diabetes mellitus, hypercholesterolemia, and obesity are the top causes of death globally, accounting for nearly one-third of all deaths worldwide [3]. Equally, the estimated incidence, mortality, and disability-adjusted life-years (DALYs) for cancer rose to 14.9 million incident cancer cases, 8.2 million deaths, and 196.3 million DALYs, with the highest impact of prostate and breast cancer in men and women, respectively [4]. Depression is a leading cause of disability worldwide (in terms of total years lost due to disability), especially in high-income countries, increasing from 15th to 11th rank (37% increase) and accounting for 18% of total DALYs (almost 100 million DALYs) [5]. Overall, the global rise in chronic non-communicable diseases is congruent with a similar rise in the elderly population. The proportion of people over the age of 60 is growing faster than any other age group and is estimated to double from about 11% to 22% within the next 50 years [6]. Public health efforts are needed to face this epidemiological and demographic transition, both improving the healthcare systems, as well as assuring a better health in older people. Accordingly, a preventive approach is crucial to dealing with an ageing population to reduce the burden of chronic disease.

In this context, lifestyle behaviors have demonstrated the highest impact for older adults in preventing and controlling the morbidity and mortality due to non-communicable diseases [7]. Unhealthy behaviors, such as unbalanced dietary patterns, lack of physical activity and smoking, play a central role in increasing both cardiovascular and cancer risk [7]. Equally, social isolation and depression in later life may boost health decline and significantly contribute to mortality risk [8]. The role of diet in prevention of disability and death is a well-established factor, which has an even more important role in geriatric populations. Research has focused on the effect of both single foods and whole dietary patterns on a number of health outcomes, including mortality, cardiovascular disease (CVD), cancer and mental health disorders (such as cognitive decline and depression) [9–13]. Plant-based dietary patterns demonstrate the most convincing evidence in preventing chronic non-communicable diseases [14–17]. Among the main components (including fruit and vegetables, legumes and cereals), only lately has attention focused on foods such as nuts. Knowledge on the effect of nut consumption on human health has increased rapidly in recent years. The aim of this narrative review is to examine recent evidence regarding the role of nut consumption in preventing chronic disease in older people.

## 2. Overview of nut types and nutrient content

Tree nuts are dry fruits with an edible seed and a hard shell. The most popular tree nuts are almonds (*Prunus amigdalis*), hazelnuts (*Corylus avellana*), walnuts (*Juglans regia*), pistachios (*Pistachia*

*vera*), cashews (*Anacardium occidentale*), pecans (*Carya illinoensis*), pine nuts (*Pinus pinea*), macadamias (*Macadamia integrifolia*), Brazil nuts (*Bertholletia excelsa*), and chestnuts (*Castanea sativa*). When considering the “nut” group, researchers also include peanuts (*Arachis hypogea*), which technically are groundnuts. Nuts are nutrient dense foods, rich in proteins, fats (mainly unsaturated fatty acids), fiber, vitamins, minerals, as well as a number of phytochemicals, such as phytosterols and polyphenols [18]. Proteins account for about 10–25% of energy, including individual aminoacids, such as L-arginine, which is involved in the production of nitric oxide (NO), an endogenous vasodilator [19].

The fatty acids composition of nuts involves saturated fats for 4–15% and unsaturated fatty acids for 30–60% of the content. Unsaturated fatty acids are different depending on the nut type, including monounsaturated fatty acids (MUFA, such as oleic acid in most of nuts, whereas polyunsaturated fatty acids (PUFA, such as alpha-linolenic acid) in pine nuts and walnuts [20]. Also fiber content is similar among most nut types (about 10%), although pine nuts and cashews hold the least content. Vitamins contained in nuts are group B vitamins, such as B6 (involved in many aspects of macronutrient metabolism) and folate (necessary for normal cellular function, DNA synthesis and metabolism, and homocysteine detoxification), as well as tocopherols, involved in anti-oxidant mechanisms [21]. Among minerals contained in vegetables, nuts have an optimal content in calcium, magnesium, and potassium, with an extremely low amount of sodium, which is implicated on a number of pathological conditions, such as bone demineralization, hypertension and insulin resistance [22]. Nuts are also rich in phytosterols, non-nutritive components of certain plant-foods that exert both structural (at cellular membrane phospholipids level) and hormonal (estrogen-like) activities [23]. Finally, nuts have been demonstrated to be a rich source of polyphenols, which account for a key role in their antioxidant and anti-inflammatory effects.

## 3. Nut consumption and metabolic disorders

Metabolic disorders are mainly characterized by obesity, hypertension, dyslipidemia, and hyperglycemia/hyperinsulinemia/type-2 diabetes, all of which act synergistically to increase morbidity and mortality of aging population.

### 3.1. Obesity

Increasing high carbohydrate and fat food intake in the last decades has contributed significantly to the rise in metabolic disorders. Nuts are energy-dense foods that have been thought to be positively associated with increased body mass index (BMI). As calorie-dense foods, nuts may contain 160–200 calories per ounce. The recommendation from the American Heart Association to consume 5 servings per week (with an average recommended serving size of 28 g) corresponds to a net increase of 800–1000 calories per week, which may cause weight gain. However, an inverse relation between the frequency of nut consumption and BMI has been observed in large cohort studies [24]. Pooling the baseline observations of BMI by category of nut consumption in 5 cohort studies found a significant decreasing trend in BMI values with increasing nut intake [24]. While the evidence regarding

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