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The Effects of Peanut Consumption on Various Health Conditions: A Mini Review

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ABSTRACT

Peanut (Arachis hypogaea) is one of the most consumed oilseeds worldwide. The composition of peanuts can vary depending on genotype, developmental stage, and environmental factors. Peanuts contain nutrients such as fats, carbohydrates, proteins, vitamin minerals, fiber, insoluble polysaccharides (cellulose and hemicellulose), and soluble oligosaccharides (raffinose, stachyose, and verbascose). Additionally, they are rich in bioactive compounds such as phenolics, flavonoids, polyphenols, and resveratrol. Peanuts are thought to provide potential health benefits due to their rich nutritional value. This study aimed to examine the possible health effects of peanuts on cognitive functions, memory, cardiovascular diseases, and obesity as well as the potential negative impacts of excessive peanut consumption.

Key words: Functional foods, Health benefits, Nutrition, Peanut.

Yer Fıstığı Tüketiminin Çeşitli Sağlık Durumları Üzerine Etkileri: Bir Mini İnceleme

ÖZ

Yer fıstığı (Arachis Hypogaea) dünya çapında en çok tüketilen yağlı tohumlardan biridir. Yer fıstığının bileşimi, genotipler, gelişim aşamaları ve çevresel faktörlere bağlı olarak değişiklik gösterebilir. Yer fıstığı, yağlar, karbonhidratlar, proteinler, vitaminler-mineraller, lif, çözünmeyen polisakkaritler (selüloz ve hemiselüloz) ve çözünür oligosakkaritler (raffinoz, stakiyoz ve verbaskoz) gibi besin maddelerini içerir. Ayrıca, fenolikler, flavonoidler, polifenoller ve resveratrol gibi biyoaktif bileşikler bakımından da zengindir. Yer fıstığının zengin besin değeri nedeniyle potansiyel sağlık faydaları sağladığı düşünülmektedir. Bu çalışma, yer fıstığının bilişsel fonksiyonlar, hafıza, kardiyovasküler hastalıklar ve obezite üzerindeki olası sağlık etkilerinin yanı sıra aşırı yer fıstığı tüketiminin potansiyel olumsuz etkilerini incelemeyi amaçlamaktadır.

Anahtar kelimeler: Beslenme, Fonksiyonel gıdalar, Sağlık faydaları, Yer fıstığı.

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INTRODUCTION

Peanut (Arachis hypogaea), which originated from South America, is widely cultivated in many tropical and subtropical regions worldwide, including Asia, Africa, and America. They are the third most valuable plant protein source globally. Unlike many other plants, peanuts grow underground. These plants consist of peanut shells, peanut skins, and peanut seeds, with the skins and seeds of which are edible. The beneficial bioactive components in peanuts play a role in human metabolism for the prevention or treatment of certain diseases such as diabetes, cardiovascular disease and cancer (Arya et al., 2016). In this study, we explored peanuts and peanut products, discussing their potential effects on cognitive functions and memory, cardiovascular diseases, and obesity, as well as the potential risks associated with **excessive consumption.**

1. Peanut

Peanuts are among the most consumed legumes worldwide due to their nutritive value, taste, and affordability. While botanically categorized as legumes, they are frequently grouped with oilseeds owing to their comparable nutritional compositions. Peanuts are cultivated in approximately 120 countries and over 26 million hectares of land. Globally, peanuts rank fourth among oilseed crops, following soybeans, rapeseed, and cotton. According to the Food and Agriculture Organization of the United Nations, worldwide peanut production exceeds 45 million tons annually, with an average yield of approximately 1.8 tons per hectare. This production volume constitutes 8.7% of the total oilseed production (Akram et al., 2018; Zahran & Tawfeuk, 2019). Many peanut varieties are favored for their high fat content, high yield, ease of peeling and low-shell availability (Akram et al., 2018).

Approximately two-thirds of the total peanut production is used for oil production, while the remaining one-third is utilized as food (Zahran & Tawfeuk, 2019). Peanut consumption varies greatly worldwide, and commercial products are often locally produced and differ. Peanuts have been applied in a diverse range of products, including peanut oil, peanut paste, roasted peanuts, peanut butter, peanut milk, peanut-based beverages, peanut flour, peanut sauce, as well as both salty and sweet peanut snacks, and peanut cheese alternatives (Arya et al., 2016). The addition of ingredients such as hydrogenated fats, stabilizers, sugar, and salt enhances the shelf life and sensory appeal of these products. However, due to increasing health consciousness, some consumers have started to avoid foods containing additives. The concept of "less (ingredients) is more" has become increasingly popular for peanut butter and many other foods (Sithole et al.,2022). This could lead to an increase in the production of peanut products with fewer or no additives, aligning with consumer preferences in the future.

1.1. Energy and Nutrient Composition of Peanuts

The composition of peanut can vary depending on genotype, developmental stage, and environmental factors. Specifically, the oleic acid fraction is closely associated with the oxidative stability and shelf life of the oil. Additionally, abiotic stresses (drought, soil properties, climate change, etc.) can significantly affect fatty acid and total fat content (Akram et al., 2018).

On a dry weight basis, peanut seeds contain approximately 44-56% oil, 22-30% protein, and 9.5-19.0% carbohydrates. They are also known to be good sources of minerals (phosphorus, calcium, magnesium, and potassium) and vitamins (E and B groups). Peanuts are rich in bioactive components such as phenolics, flavonoids, polyphenols, and resveratrol. They also contain many important functional components such as coenzyme Q10, arginine, and phytosterols, making it functional food (Akram et al., 2018). The nutrient composition of the peanuts is shown in Table 1, and the fatty acid and amino acid compositions are shown in Table 2.

Peanut oil contains both saturated fatty acids (SFAs) and unsaturated fatty acids (UFAs). The amount of SFAs and UFAs in peanut oil ranged from 11-17% and 81-94%, respectively. The oleic acid (C18:1) content in peanut plant genotypes ranges from 21-85%, while the linoleic acid (C18:2) content ranges from 2-43% (Zahran & Tawfeuk, 2019). Additionally, peanuts contain essential fatty acids such as omega-3 and omega-6 fatty acids synthesized by plants and found in legumes and soybeans. They also consist of other fatty

Table 1. Nutrient composition of peanuts (all types, raw, per 100 g) (United States Department of Agriculture, 2019; Campos et al., 2023)

Name	Amount	Name	Amount
Water (g)	6.5	Zinc (mg)	3.27
Energy (kkal)	567	Copper (mg)	1.14
Carbohydrate (g)	16.1	Manganese (mg)	1.93
Protein (g)	25.8	Selenium (µg)	7.2
Fiber (g)	8.5	Thiamin (mg)	0.64
Fat (g)	49.2	Riboflavin (mg)	0.135
Total sugars (g)	4.72	Niacin (mg)	12.1
Calcium (mg)	92	Pantothenic acid (mg)	1.77
Iron (mg)	4.58	Vitamin B-6 (mg)	0.348
Magnesium (mg)	168	Folate (µg)	240
Phosphorus (mg)	376	Betaine (mg)	0.6
Potassium (mg)	705	Vitamin E (mg)	8.33
Sodium (mg)	18	Choline (mg)	52.5
Total Phenolic Compounds (µmol TE/g DW)	16.2	Tocopherols (mg)	8.33

acids such as arachidic, arachidonic, stearic, lignoceric, and behenic acids. The fatty acid composition plays a significant role in the nutritional and storage qualities of peanuts (Akram et al., 2018).

Peanuts, as a plant-based sources, are rich in essential nutrients but generally have lower bioavailability than animal-based sources. Animal-based sources often provide these nutrients at higher concentrations and with better bioavailability, making them more accessible for the body to utilize. This difference in nutrient absorption can be attributed to various factors, including the presence of compounds that inhibit nutrient availability. For instance, while peanuts contain a high amount of calcium (Ca), the presence of fiber and antinutrients significantly reduces the bioavailability of Ca (Singh & Prasad, 2023).

The antioxidant capacity of peanuts is primarily attributed to the presence of various hydroxycinnamic acids, including vitamin E, resveratrol, flavonoids, and hydroxycinnamic acids such as caffeic, chlorogenic, coumaric, and ferulic acids. Peanuts exhibit greater antioxidant activity than other foods, such as red wine and green tea. Boiling is known to increase antioxidant levels, resulting in a higher concentration of isoflavones in boiled peanuts. Similarly, roasting enhances the antioxidant potential of the peanut. Peanut shells also contain potent antioxidants. Consuming peanuts with their shells has been shown to provide even greater antioxidant benefits (Bhat et al., 2019).

The dietary fiber content of dry roasted peanuts is 8.4 g/100 g. Peanut dietary fiber contains insoluble polysaccharides (cellulose and hemicellulose) and soluble oligosaccharides (raffinose, stachyose, and verbascose). Soluble fibers can be fermented by the intestinal microbiota in the colon to produce short-chain fatty acids such as butyrate, propionate, and acetate. An important property of insoluble fibers is

Table 2. Fatty Acid and Amino Acid Composition of Peanuts (all types, raw, per 100 g) (United States Department of Agriculture, 2019)

Name	Amount	Name	Amount
Saturated (g)	6.28	Methionine (g)	0.317
Monounsaturated (MUFA) (g)	24.4	Cystine (g)	0.331
Oleic acit (MUFA 18:1) (g)	23.8	Phenylalanine (g)	1.38
Polyunsaturated (PUFA) (g)	15.6	Tyrosine (g)	1.05
Linoleic acid (PUFA 18:2) (g)	15.6	Valine (g)	1.08
α-linolenic acid (PUFA 18:3) (g)	0.003	Arginine (g)	3.08
Trans (g)	0	Histidine (g)	0.652
Cholesterol (g)	0	Alanine (g)	1.02
Tryptophan (g)	0.25	Aspartic acid (g)	3.15
Threonine (g)	0.883	Glutamic acid (g)	5.39
İsoleucine (g)	0.907	Glycine (g)	1.55
Leucine (g)	1.67	Proline (g)	1.14
Lysine (g)	0.926	Serine (g)	1.27

their ability to bind carcinogenic, mutagenic, and other toxic chemicals formed during the digestion of foods, facilitating their excretion through feces (Bonku & Yu, 2020).

2. Peanut Consumption and Health Benefits

Peanuts are among the most consumed oilseeds worldwide. They constitute a significant source of protein, fat, and dietary fiber. Apart from having a low SFA content, these plants are composed of high levels of oleic acid, and antioxidant capacity and are a valuable source of plant-based proteins. Additionally, due to their high content of magnesium, potassium, and various bioactive compounds such as phytosterols and polyphenols, peanuts are associated with reduced risks of various diseases (Campos et al., 2023).

2.1. Potential Effects of Peanut Consumption on Cognitive Functions and Memory

Evidence suggests that nut consumption preserves brain health and enhances cognitive functions, including memory and executive functions. Nuts, particularly peanuts, are implicated in positive effects on cognitive functions due to their fatty acid profile and phytochemical content. The impact of fiber and polyphenol contents on the gut microbiota is also noted as another aspect associated with cognitive functions (Theodore et al., 2021).

Systematic reviews indicate a relationship between the gut microbiota and the brain, highlighting the emerging role of diet in the microbiota–gut–brain axis. Metabolites produced by the microbiota have been shown to modulate brain biochemistry by acting as neurotransmitters in the central nervous system. Short-chain fatty acids (SCFAs), the main metabolites produced by the gut microbiota, appear to have effects on various diseases, including depression and neurodegenerative diseases (Dahiya & Nigam, 2022). Additionally, studies have shown that interventions rich in polyphenols contribute to improving brain health, including cognitive functions, in healthy young and middle-aged adults

(Ammar et al., 2020; Wightman et al., 2018).

It is believed that peanuts may have positive effects on the cognitive system due to the nutrients and bioactive compounds they contain. Several studies have investigated this topic, but the results appear promising (Parilli-Moser et al., 2021; Reeder et al., 2022).

Parilli-Moser et al. (2021) conducted a randomized controlled trial on 63 healthy adults aged 18-33 years. Participants were randomized into three different intervention groups after two weeks of no peanut consumption. The first group consumed 25 g of roasted peanuts per day, the second group consumed 32 g of peanut butter per day, and the third group consumed 32 g of control butter per day. The control butter was made with peanut oil and provided similar levels of energy (and macronutrient composition) while lacking phenolic components and fiber. A study indicated that regular peanut and peanut butter consumption may improve memory function and stress response in healthy young people (Parilli-Moser et al., 2021). In another study, Reeder et al. (2022) investigated the effects of peanut consumption on cognitive function and mood in healthy young adult women. They reported that consuming 49 g of roasted salted peanuts daily for 12 weeks did not lead to significant improvements in depression, anxiety, or stress scores compared to peanut-free diet. However, they found a significant increase in psychomotor velocity in the peanut consumption group. These findings suggest the need for further research to explore the specific effects of peanut consumption on this particular cognitive function component (Reeder et al., 2022).

2.2. Effects of Peanuts on Cardiovascular Disease

Cardiovascular diseases (CVDs) are reported as the leading cause of death worldwide and often resulting in morbidity, disability, and mortality. A study of 39,167 women over 19 years suggested an inverse relationship between the consumption of oilseeds and the risk of cardiovascular mortality (Imran et al., 2021).

Various studies suggest that the consumption of peanuts or peanut oil is associated with a reduced risk of cardiovascular disease (CVD) and may improve serum lipid profiles, reduce LDL oxidation, and exert a cardioprotective effect (Bhat et al., 2019; Parilli-Moser et al., 2022). In a prospective study examining the relationship between peanut consumption and CVD risk in Japanese men and women, data from 74,793 participants aged 45-74 years who completed a food frequency questionnaire were analyzed. A study revealed that increased peanut consumption was associated with a decreased risk of total stroke, ischemic stroke, and cardiovascular disease in both men and women (Ikehara et al., 2021).

In a randomized controlled trial and meta-analysis involving 63 healthy participants, individuals consumed 25 grams of roasted peanuts daily, two tablespoons (32 grams) of peanut butter daily, or two tablespoons (32 grams) of peanut oil daily in addition to their usual diets. The results showed that the group consuming roasted peanuts exhibited lower total cholesterol/HDL cholesterol and LDL-cholesterol/HDL-cholesterol ratios than did the control group. A meta-analysis of clinical trials further indicated that peanut consumption is associated with reduced triglyceride levels, and individuals with regular peanut intake had lower total cholesterol and LDL-cholesterol/HDL-cholesterol ratios than individuals in the control groups. It has been suggested that regular peanut consumption may regulate lipid metabolism and decrease serum triglyceride levels (Parilli-Moser et al., 2022).

A systematic review and meta-analysis of 13 studies, including 10 parallel clinical trials and 3 crossover studies, revealed no significant effect of peanuts on most variables related to CVD risk factors (body weight, waist circumference, body mass index, glucose, serum insulin, systolic blood pressure, diastolic blood pressure, LDL-cholesterol, total cholesterol, and triglycerides). However, it significantly increased HDL-cholesterol levels (Azad et al., 2020). Another randomized controlled trial involving adults at risk of type 2 diabetes reported a significant decrease in systolic blood pressure among participants consuming 35 grams of peanuts daily for 6 months compared to the control group (Petersen et al., 2022).

2.3. Relationship between Peanut and Obesity

Obesity is defined as excessive fat accumulation in the body and has led to a global pandemic, posing a threat to public

health. It has been reported that 21.1% of individuals aged 15 years and older in Turkiye are living with obesity (Turkish Statistical Institute, 2019). Several systemic and metabolic diseases accompany obesity, including cardiovascular diseases, dyslipidemia, sleep apnea, type 2 diabetes, osteoarthritis, certain types of cancer, and depression. Additionally, obesity can lead to psychosocial problems, as indicated by reports of discrimination against individuals with obesity accessing healthcare, education, and employment opportunities (Darling, 2019).

Studies have suggested that the consumption of oilseeds reduces the risk of obesity and weight gain (Lindstörm et al., 2003; Tuomilehto et al., 2001). The potential mechanisms underlying this relationship are thought to include increased satiety, reduced caloric absorption, and increased energy expenditure. Furthermore, the consumption of oilseeds is associated with improved diet quality. A study involving 262 sixth-grade students showed that children in the peanut consumption group had a lower risk of being overweight or obese than children in the nonpeanut consumption group did. They also consumed higher amounts of various vitamins and micronutrients and had lower LDL-cholesterol and total cholesterol levels (Bonku & Yu, 2020).

In a randomized controlled trial conducted on overweight or obese men, participants consumed either 56 g of regular peanuts (RP) or high oleic acid peanuts (HP) daily as part of a hypocaloric diet for four weeks. One study reported that regular peanut consumption as part of a hypocaloric diet, especially in the HP group, increased fat oxidation and reduced body fat percentage (Alves et al., 2014). Another study investigated the effect of consuming RPs or HPs as a high-fat meal (49% fat) on postprandial plasma lipopolysaccharide (LPS) concentrations in overweight or obese men. The study showed that peanut consumption delayed the increase in serum triacylglycerol levels and particularly supported a faster return to normal insulin levels, especially in the RP group. Consequently, RP or HP consumption may help reduce the risk of metabolic disorders (Moreira et al., 2016).

A randomized controlled trial was conducted to observe the effect of peanut consumption on body composition, lipid profiles, inflammation, and oxidative stress biomarkers in 24 obese women. Participants consumed either 56 g of unshelled peanuts (UP) or shelled peanuts (SP) daily as part of a hypocaloric diet for 8 weeks. The study revealed a significant reduction in body mass index (BMI) analysis in the peanut-consuming groups. Additionally, the UP group had lower body weight, BMI, waist circumference, total lean mass, and total body fat than did the SP group. After 4 weeks of intervention, for both the UP and SP groups, there was a significant decrease in total cholesterol and LDL-cholesterol levels. Furthermore, improvements in platelet and plasma homocysteine levels were observed in the UP group (de Oliveira Fialho et al., 2022).

A randomized controlled trial was conducted to investigate the effect of peanut consumption on satiety and snack consumption in individuals' daily diet. In this study, healthy adults aged 50-75 years were given peanuts for 12 weeks. The study showed that the peanut group had higher total energy intake and snacking frequency. Despite this, it was reported that peanut consumption could improve the diet by reducing the consumption of low-nutrient, high-energy density unhealthy snacks (Barbour et al., 2017).

3. The Health Impacts of Excessive Peanut Consumption

While peanuts offer several health benefits, excessive consumption can have adverse effects. Peanuts are high in fat and energy, and overconsumption is a potential cause of undesirable weight gain and obesity. Moreover, peanut allergies are common. Even minimal consumption can provoke allergic reactions such as atopic dermatitis, gastrointestinal discomfort, and severe outcomes such as anaphylactic shock and death. Additionally, peanuts are often contaminated by Aspergillus flavus, a fungal species that produces aflatoxins. These aflatoxins are highly toxic and carcinogenic secondary metabolites that can have long-term detrimental effects on health. Therefore, it is essential to consume peanuts in moderation and adhere to dietary guidelines to minimize these risks (Bonku & Yu, 2020; Arya et al., 2016).

CONCLUSION

Peanuts are functional foods with low environmental impact, biodiversity richness, and high nutritional value. Studies

indicate that regular consumption of peanuts in our daily diet has protective effects against cardiovascular diseases, obesity, neurological disorders, and other chronic diseases. This is primarily due to their high content of functional compounds such as resveratrol, tocopherols, phytosterols, and other bioactive compounds, as well as fibers and fatty acids. However, further research is needed to better understand the full extent of the health effects of peanuts. Despite their numerous health benefits, it is important to consume peanuts in moderation. Due to their high energy and fat content, excessive consumption can lead to undesirable weight gain or obesity. Additionally, as an allergenic food with the potential risk of aflatoxin contamination, peanuts should be consumed with caution.

AUTHOR CONTRIBUTION

Idea/Concept: DNK, İGY; Supervision: İGY; Data collection and/or data processing: DNK; Analysis/Comment: DNK, İGY; Article Writing; DNK.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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