ejpmr, 2025, 12(5), 714-722

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

SJIF Impact Factor 7.065

Review Article

ISSN 2394-3211

EJPMR

REVIEW STUDY ON PHYTOCHEMICAL COMPOSITION AND PHARMACOLOGICAL PROPERTIES AND MEDICINAL APPLICATION OF NATURAL NUTS

Yagini Sulakhiya and *Dr. Upendra Bhadoriya

Department of Pharmacology, IPS Academy College of Pharmacy, Rajendra Nagar A.B. Road Indore 452012 (M.P.).

***Corresponding Author: Dr. Upendra Bhadoriya**

Department of Pharmacology, IPS Academy College of Pharmacy, Rajendra Nagar A.B. Road Indore 452012 (M.P.).

Article Received on 22/03/2025 **Article Revised on 12/04/2025** **Article Accepted on 02/05/2025**

ABSTRACT

Natural nuts are a staple in diets worldwide, valued for their exceptional nutritional andqualities. This review examines the phytochemical composition, pharmacological activities, and medicinal uses of popular nuts like peanuts, cashews, pistachios, hazelnuts, walnuts, and almonds. Nuts, which are abundant in bioactive substances such as polyphenols, flavonoids, vitamins, minerals, and essential fatty acids, have strong cardioprotective, anti-inflammatory, and antioxidant properties. These bioactive ingredients have shown promise in the treatment and prevention of a number of illnesses, such as diabetes, heart disease, neurological disorders, and some forms of cancer. Natural nuts have also long been used to cure skin conditions, strengthen the immune system, and support digestive health. The bioactive ingredients in nuts are thoroughly examined in this review, which also identifies promising areas for further study and examines their modes of action, clinical relevance, and possible therapeutic uses.

KEYWORDS: Triterpenes, Minerals, Sugars, Phenolics, Tocopherols, and Tocotrienols Brazil nuts, cashews, macadamias, hazelnuts, pecans, pine nuts, pistachios, and walnuts are among the PCA Nuts food items.

INTRODUCTION

Nuts are highly recommended for consumption worldwide and are an essential part of the Mediterranean diet.[1] Nutrient-dense foods with distinctive nutritional profiles include legume seeds like peanuts and tree nuts including almonds, hazelnuts, cashews, Brazil nuts, macadamias, walnuts, and pistachios. Protein, both soluble and insoluble fibers, vitamins E and K, folate, thiamine, monounsaturated (MUFA) and polyunsaturated (PUFA) fatty acids, and other healthy nutrients are abundant in them. Additionally, they provide health-promoting compounds like antioxidants, phytosterols, and carotenoids, as well as vital minerals like potassium, copper, magnesium, and selenium, all of which improve overall wellbeing. They also supply essential minerals like potassium, copper, magnesium, and selenium, as well as health-promoting substances like antioxidants, phytosterols, and carotenoids, all of which enhance general wellbeing.[2,3] The complex structures of tree nuts and peanuts, which are rich in unsaturated fats and other bioactive compounds, provide high-quality plant-based protein, fiber, essential minerals, tocopherols, phytosterols, and phenolic compounds. Because of their unique composition, nuts are anticipated to have a positive impact on health outcomes.[4]

Along with important minerals like calcium, potassium, phosphorus, magnesium, iron, and zinc, as well as antioxidant minerals like manganese, copper, and selenium, nuts are also a great source of vitamins, including vitamin E and B-complex vitamins.

In addition, nuts contain beneficial phytochemicals like antioxidants and plant sterols. Their broad range of nutrients, nuts with support a variety of health functions, including improving heart, blood, brain, eye, skin, bone, and oral health. They also boost digestive health, enhance memory and metabolism, strengthen the immune system, aid in weight management, help control diabetes, reduce cancer risk, lower the likelihood of gallstone formation, and offer protection against viral and fungal infections. In short, nuts are a "complete package" of health benefits, making them a valuable addition to the diet. However, it's important to remember that moderation is key, as excessive consumption of nuts can have negative effects despite their many health benefits.[5] Almonds (Prunus amygdalus), hazelnuts (Corylus avellana), walnuts (Juglans regia), and pistachios (Pistacia vera) are the most widely consumed edible tree nuts. Pine nuts (Pinus pinea), cashews (Anacardium occidentale), pecans (Carya illinoiensis), macadamias (Macadamia integrifolia), and Brazil nuts (Bertholletia excelsa) are other nuts that are frequently eaten. Despite being classified as groundnuts or legumes, peanuts (Arachis hypogaea) are sometimes included in the category of nuts because of their comparable

nutritional makeup to tree nuts. Despite being categorized as tree nuts, chestnuts (Castanea sativa) are different from most other nuts because of their unique nutrient profile and starchier composition.[6]

1. Almonds

The almond kernel, known scientifically as *Prunus dulcis*, is an individual belonging to the Prunus genus and Rosaceae family. It thrives in Mediterranean climates and is cultivated in regions such as Australia, Central Asia, California (USA), and the Mediterranean basin. Almonds are indigenous to south-central Asia.[7]

Various amounts of amygdalin, a diglucoside found in almond kernels, break down into benzaldehyde and hydrogen cyanide when the kernel is crushed and comes into contact with saliva or water.[8] The chemical composition of cultivated almond varieties is influenced by genetic makeup, environmental conditions, and processing methods. Regular almond consumption has been consistently linked to numerous health benefits, especially for managing cardiometabolic disorders.[9]

Research, including clinical trials and epidemiological studies, has demonstrated the advantages of nut consumption for a number of illnesses, including metabolic syndrome, diabetes, obesity, and hypertension.[10] Nutrients such as proteins, carbohydrates, calcium, lipids, iron, phosphorus, oxalic acid, thiamine, sulfur, copper, iodine, and chlorine are abundant in almonds (*Prunus amygdalus L.*)[11]

Phytochemical composition of almonds

Phenolic Compounds: Prunus dulcis has a wide variety of phytochemicals known as phenolic compounds. One or more hydroxyl groups that are directly joined to an aromatic ring define these substances. They are broadly categorized into flavonoids and non-flavonoids.

Flavonoids

The flavonoid category includes several subclasses

• Flavones (4b), Aurones (4a), and Flavanones (4c)
Flavonols (four d) and four e

• Chalcones (4g); anthocyanins (4f);
Phenolic acids, or non-flavonoids, are mostly phenolic acids, which include derivatives of benzoic acid and cinnamic acid.

Flavonoids

Water-soluble pigments called flavonoids are made up of two phenyl rings joined by three carbon atoms to form a heterocyclic structure that contains oxygen. The phenylpropanoid pathway is used to synthesize these compounds, starting with phenylalanine, which forms 4-coumaroyl-coenzyme A, a precursor that enters the flavonoid biosynthesis pathway.

Phenolic Acids

The aromatic, hydroxylated rings of phenolic acids set them apart as secondary metabolites. They fall into the categories of hydroxycinnamic acids and hydroxybenzoic acids, which are both produced by the phenylpropanoid pathway from shikimic acid. The biological actions of phenolic acids in trees are still poorly understood, despite a wealth of research on their chemical and biological characteristics. However, phenolic acids are recognized to be crucial for photosynthesis, protein synthesis, and nutrition absorption.[12]

Various Pharmacological and medicinal uses of Almonds

Antidepressant Activity

Almond oil therapy, either by itself or in conjunction with lavender oil inhalation, decreased swimming ability in the forced swim test, according to a study examining the antidepressant effects of PA in rats. Nevertheless, in the passive avoidance test, it lengthened the delay duration.[13]

Anti-aging Activity

A preclinical study demonstrated the anti-aging effects of PA in mice treated with PA extract for 15 days. The treatment exhibited strong antioxidant activity and enhanced levels of malondialdehyde (MDA) and glutathione (GSH) in the prepared formulation as opposed to the group that was exposed to radiation.[14]

Hepatoprotective Activity

Rats were used to test PA oil's hepatoprotective properties. Alkaline phosphatase (ALP), lactate dehydrogenase (LDH), aspartate aminotransferase (AST), alanine aminotransferase (ALT), total cholesterol (TC), triglycerides (TG), malondialdehyde (MDA), and low-density lipoprotein (LDL) were all markedly decreased by the treatment. Furthermore, it raised superoxide dismutase (SOD) and glutathione peroxidase (GPx) concentrations.[15]

2. Hazelnut

Hazelnuts, like other nuts like almonds and cashews, are a great way to get good fats. Hazelnuts contain a substantial amount of lipid, which is composed of both polar and nonpolar components. Nearly all of the nonpolar lipids in hazelnut oil are triacylglycerols, which are the main nonpolar lipids. Monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA), such as palmitic acid, stearic acid, linoleic acid, and

linolenic acid, are especially abundant in hazelnuts. Omega-3 fatty acids must be received from diet because the human body is unable to manufacture them. Hazelnuts are a valuable dietary source of omega-3 fatty acids because they are high in α-Linolenic acid, a precursor to these fatty acids.[16]

Phytochemical Hazelnut composition

Tocopherol analysis

The α- and γ-tocopherol analysis in hazelnut skins was carried out utilizing electrochemical detection (ECD) in conjunction with high-performance liquid chromatography (HPLC) according to the To sum up, 1 mL of aqueous ascorbic acid (1 g/100 mL), 2 mL of ethanol, and 1 g of powdered sample were combined. Following that, the mixture was saponified for one hour at 70 °C using 0.3 mL of saturated potassium hydroxide solution. Prior to injection, tocopherols were extracted using hexane, dried under nitrogen, reconstituted in methanol, and diluted.

Analysis of Condensed Tannins in Hazelnut Skins

A modified vanillin assay was used to determine the amount of condensed tannin (CT) present in hazelnut skin extracts. Aliquots of hazelnut skin extracts from each cultivar were run over a Sephadex LH-20 column (about 4 g) that had been equilibrated with 30% methanol in order to provide a pure CT standard for calibration. In order to get rid of sugars and non-tannin phenolics, the column was first cleaned with two volumes of 30% methanol. The CT fraction was then eluted using a single volume of 70% acetone in water (v/v), and it was subsequently vacuum-dried.[17]

Various Pharmacological and medicinal uses of Hazelnut

Anticonvulsant Properties

The dry aqueous extract of *Corylus avellana* (hazelnut) leaves collected in Ukraine has demonstrated significant anticonvulsant effects, likely due to the synergistic action of its biologically active compounds.[18] In a study involving mice with pentylenetetrazol-induced seizures, the aqueous extract exhibited the strongest anticonvulsant activity among the tested hydroalcoholic extracts, performing comparably to the reference drug, sodium valproate. The aqueous extract notably delayed the onset of the first seizure, reduced mortality rates, and shortened the duration of convulsive episodes. Conversely, both 50% and 96% ethanol extracts displayed similar anticonvulsant effects but showed diminished efficacy as the ethanol concentration increased.[19]

3. Walnut

Among the most significant hard-shelled nut species in the world are walnuts (Juglans regia L.), which belong to the Juglandaceae family within the Plantae kingdom, the Fagales order, and the genus Juglans. The walnut tree is a deciduous plant with wind-pollinated, monoecious, unisexual flowers and aromatic, odd-pinnate leaves; male flowers develop as drooping catkins on last year's shoots, while female flowers grow on the stems of the current year.[20]

Walnuts are versatile and can be enjoyed in various forms, including salted, fresh, and dried. They are frequently dried with air or sunlight and are used extensively in the food sector, especially in ice cream and baked goods. Additionally, green walnut kernels are used to make liqueurs. Walnuts have long been prized for their health advantages, and scientists now acknowledge their anti-inflammatory, antidiabetic, and antioxidant properties promoting properties.

Walnut species are raised worldwide, with The English or Persian walnut being the most widely grown. Persian walnuts rank highly three most consumed nuts globally. Traditionally propagated through seeds, walnut plants exhibit notable diversity in morphological traits, including shell size, shape, thickness, and color, in addition to the look and quality of the seed.[21]

Phytochemical composition of walnut

Phenolics

One or more aromatic rings with hydroxyl groups are what distinguish phenolic compounds from other types of chemicals. Subclasses of these phytochemicals, which are often found in fruits, include phenolic acids, flavonoids, stilbenes, coumarins, and tannins. The complex and varied mixture of phenolic chemicals found in walnuts includes flavonoids, gallotannins, phenolic acids, and ellagitannins. High-resolution mass spectrometry has made it possible to identify more than 100 phenolic compounds in walnuts, many of which were previously undocumented.[22]

Fatty acids

walnut kernels contain approximately 40–70% oil, varying by variety. This oil comprises a mix of fatty acids, including forms that are polyunsaturated (PUFA), monounsaturated (MUFA), and saturated (SFA). Walnut

oil is particularly high in PUFAs, in contrast to the majority of nut oils, which are primarily made up of MUFAs. More than 86% of the total fatty acid content in EW walnut oil is made up of unsaturated fatty acids (MUFA and PUFA), which include palmitoleic (16:1), oleic (18:1), linoleic (18:2), α-linolenic (18:3), 11-eicosenoic (20:1), and eicosatetraenoic (20:5) acids.[23]

Pharmacological and medicinal uses of walnut

Antimicrobial effect

Products made from walnuts, such as their husks, bark, leaves, fruits, and the substance juglone, are known for their antimicrobial properties. Numerous studies have highlighted that, in addition to their antioxidant effects, phenols and phenolic extracts exhibit significant antimicrobial activity. This has prompted researchers to explore their potential as alternatives to antibiotics and chemical preservatives.[24]

Antihypertensive effect

The aqueous extract of walnut leaf demonstrated anti-hypertensive effects by lowering mean arterial pressure, diastolic pressure, and systolic pressure. Flavonoids, particularly It is well known that quercetin can lower blood pressure. Furthermore, plant flavonoids help control excessive blood pressure and reduce the in vitro activity of ACE.[25]

4.Pistachio

The *Pistacia* genus is part of the Anacardiaceae family, which comprises poison ivy, cashew, mango, and sumac. The only species in this genus that yields edible nuts big enough is Pistacia vera L., or pistachio for commercial use.[26] Other species, such as Mainly used as rootstocks or for applications such as oil production, agroforestry, lumber, carpentry, *P. atlantica, P. cabulica, P. chinensis, P. falcata, P. integerrima, P. kinjuk, P. kurdica, P. lentiscus, P. mutica, P. palaestina*, and *P. terebinthus*. The origin of the word "pistachio" is debated, but it is thought to come from the ancient Persian word “pistak” in Avestan. Pistachios are indigenous to western Asia, but traders brought them to the Middle East, Mediterranean nations, and Europe. Pistachio consumption by Neanderthals dates back 300,000 years, according to archeological data, with charred remnants discovered in the Mousterian strata of Israel's Kebara Cave.[27]

Phytochemical composition of pistachio

Pistachios (*Pistacia vera*) are rich in phytochemicals, which contribute to their potential health benefits. These bioactive compounds include a range of polyphenols, flavonoids, carotenoids, and other phytochemicals with antioxidant, anti-inflammatory, & other health-promoting qualities.

Phenolic Compounds

Flavonoids: Pistachios contain various flavonoids, including quercetin, kaempferol, luteolin, and isorhamnetin, which have potent anti-inflammatory and antioxidant qualities.

Anthocyanins: Found mainly in the outer skin (pericarp) of pistachios, these compounds are pigments with high antioxidant potential.

Phenolic Acids: Gallic acid, caffeic acid, and p-coumaric acid are common phenolic acids found in pistachios, which contribute to their antioxidant profile.

Carotenoids

Zeaxanthin and Lutein: These are pistachios main carotenoids, which are known for their role in supporting eye health by protecting against oxidative damage in the retina.

Beta-Carotene: Another carotenoid presents in lower amounts, which acts as a precursor to vitamin A and has antioxidant properties.[28]

Pharmacological properties of pistachios: The effects of pistachios on gut microbiota composition are closely linked to their high dietary fiber content and specific bioactive compounds. Here’s a summary of their impact.

1. **Rich in Dietary Fiber**: Pistachios provide about 2.8 grams of fiber per ounce, with approximately 80% being insoluble fiber. Insoluble fiber plays a crucial role in gut health by serving as a substrate for microbial fermentation.[29]
2. **Promoting Healthy Microbiota**: A balanced gut microbiota includes a diverse range of bacteria, viruses, and fungi. The fermentation of fiber from pistachios contributes to this balance, leading to the synthesis of advantageous short-chain fatty acids (SCFAs), such as butyric acid. These SCFAs are essential for gut health and have anti-inflammatory and immunomodulatory effects.
3. **Prebiotic Properties of Pistachio Hull Polysaccharides (PHP)**: Research has shown that PHP exhibits significant prebiotic capabilities, comparable to those of inulin. PHP enhances the development of good gut flora and boosts the synthesis of SCFAs such as butyrate, propionate, and acetate, which are crucial for maintaining gut integrity and systemic health.[30]

5. Cashewnut

Cashew (Anacardium occidentale L.) is a nutrient-rich crop from the Anacardiaceae family that is grown as a commodity worldwide. Originally from Brazil, cashew is now grown in tropical climates worldwide, and over the past five years, its production has steadily increased due to market demand for cashew nuts.

Cashew nuts, the primary commercial product, are kidney-shaped and comprise a mere 10% of the total weight of the harvested crop. It is valuable due to its many biological qualities, tasty flavor, and high nutrient content. The nut's surroundings are the Because of their hard, inedible shell, cashew nuts are protected against environmental damage (CNS). The fruit's CNS, which contains cashew nut shell liquid (CNSL), is incredibly resistant to deterioration even though it only makes up 3% of its weight. This dark brown liquid contains a lot of phenolic compounds.[31]

Phytochemical composition of Cashewnut

Phenol Substances

The main phenolic components of cashew nut shell liquid made from commercial Anacardium occidentale are anacardic acid, cardol, and cardanol. Each of these structurally varied compounds has a side chain with fifteen carbons that can be saturated or have one, two, or three double bonds.

Various methods have been developed for isolating Cardol, anacardic acid, and cardanol for industrial use purposes. One approach involves using calcium anacardate to selectively extract anacardic acid. In this method, Ammonia is used to treat cashew nut shell liquid that is acid-free. solution and then subjected to an extraction using hexane/ethyl acetate (98:2) to separate cardanol, the monohydroxy phenolic element. Subsequently, the A solution of ammonia is extracted using a Hexane/ethyl acetate mixture (80:20) to isolate cardol.[32]

Flavonoids

The genus Anacardium contains a variety of flavonoids. For example, occidentoside, sometimes called (-)-salipurposide, and β-sitosterol have been identified in Anacardium occidentale (cashew) nut shells. Occidentoside structure as tetrahydroninokiflavone-C-glucoside (III) has been verified by spectroscopic and chemical investigations. Notably, this chemical is the first C-glycoside in the bioflavonoid category and the first bioflavonoid to contain a combination of one flavanone and one chalcone unit. Additionally, it has been reported that cashew nut shells contain (-)-salipurposide.[33]

Pharmacological and medicinal properties of Cashewnut

Using Cashew Nuts to Treat Rhinitis

Vitamin B, an antioxidant that occurs naturally and has potent immune-boosting qualities, is abundant in cashew nuts. Eating cashew nuts in the winter or other colder months can boost a person's immunity.[34]

Cashew Nuts for Obesity

Healthy foods strong in fats like olive oil and tree nuts are good for controlling weight, according to Harvard University. When included in a balanced diet, these nuts are low in calories and help people lose weight.[35] Compared to other snacks, cashews are lower in calories and higher in fiber and minerals, which helps suppress hunger.[36] Furthermore, it has been demonstrated that cashew extract dramatically lowers levels of LDL, VLDL, triglycerides, and total cholesterol.[37]

6. Pinenut

The major source of commercial pine nuts is the evergreen conifer Pinus pinea L., also referred to as the stone pine. Its seeds, which are native to the Mediterranean Basin, have been a mainstay of the Mediterranean diet for more than 200 years. It is commonly known that this diet lowers risk factors linked to metabolic syndrome. As a result, there is a steady increase in demand for pine nuts worldwide. However, the pest Leptoglossus occidentalis has destroyed P. pinea woodlands in main producing nations, severely affecting production. Pine nuts are known for their healthy fatty acid composition, even though they are heavy in fat and energy density.[38]

Phytochemical composition of pinenut

Phenolic and flavonoid

When included in the diet, phenolic and flavonoid compounds—essential bioactive molecules—provide a number of health advantages. In this study, the average phenolic content of pine nuts from Pinus cembroides was 5.5%.[39] Although there is no previous data for this species, the measured levels were lower than those for Pinus sibirica (266 mg/g), Pinus koraiensis (264 mg/g), Pinus pinea (7.99 mg/g), Pinus pinaster (9.23 mg/g), and Pinus canariensis (9.67 mg/g). They were more than those in Pinus halepensis seeds (3.71 mg/g), though. At an average of 3.1%, the flavonoid concentration was below that of Pinus pinea (2.17 mg/g) but higher than that of Pinus canariensis (0.75 mg/g), Pinus halepensis (0.80 mg/g), and Pinus pinaster (1.42 mg/g).[40]

Pharmacological and medicinal properties of pine nut activity that prevents asthma

Both in-vitro and in-vivo experiments were conducted to examine the antiasthmatic effects of Pinus roxburghii alcoholic extract. Guinea pig ileum preparation was used for the in-vitro assessment, and histamine-induced bronchospasm in guinea pigs and catalepsy in mice were used for the in-vivo investigations. Additionally, passive paw anaphylaxis in rats and milk-induced leukocytosis in mice were used to evaluate the plant's anti-allergic capabilities.[41]

Anticonvulsant Activity

At 100, 300, and 500 mg/kg, the alcoholic extract of Pinus roxburghii showed anticonvulsant properties. The maximal electroshock-induced seizure paradigm was used to assess its effectiveness against generalized tonic-clonic and partial seizures in rats.[42]

7. Chestnut

Chestnuts *(Castanea spp.)* are deciduous trees, sometimes shrubs, that are members of the Fagaceae family. They are indigenous to the Northern Hemisphere's temperate zones. Chestnuts are grown at elevations between 2,000 and 3,000 meters in India's Himalayan region, which includes Assam and Meghalaya. The Himalayan foothills, especially the valleys of Jammu and Kashmir, Kullu, Kangra, and Shimla, as well as the northwest regions of Uttar Pradesh, are home to the trees, which have grown naturalized in India.[43]

Phytochemical composition of chest nut

Water Chestnut's Phenolic Compound Content: This study used a C18 column and an aqueous acetic acid-acetonitrile gradient to isolate phenolic chemicals with excellent resolution. There were no interfering peaks in the phenolic extract from CWC (water chestnut) according to the high-performance liquid chromatography (HPLC) profile. Based on their retention durations and spectral characteristics in comparison to commercially available pure standards, peaks 1, 2, and 3 were determined to be (-)-gallocatechin gallate, (-)-epicatechin gallate, and (+)-catechin gallate, respectively. More than 60% of the overall phenolic content, which was determined to be 2.53 mg/g on a fresh weight basis, was made up of these main phenolic compounds.[44]

Pharmacological and medicinal properties of chest nut

Wistar rats were used in a study to examine the water chestnut fruits' antiulcer properties. Pyloric ligation and aspirin-induced pyloric ligation were the conditions under which a 50% ethanolic extract of the fruit was tested at two dosing levels.[45] The higher sugar concentration and its function in modifying the stomach's mucosal barrier through increased carbohydrate content are probably the reasons for the extract's notable antiulcer activity. These results imply that water chestnut ethanolic extracts might have antiulcer potential.[46]

8. Brazilnut

Brazil nuts, the biggest of the widely consumed nuts, are produced by the enormous, South American native Brazil nut tree (Bertholletia excelsa). This tree, which grows in Brazil, Peru, Colombia, Venezuela, and Ecuador, does well in hard, well-drained soil along the Amazon River. A tropical evergreen that may reach heights of over 150 feet, the Brazil nut tree is a member of the Lecythidaceae family and frequently rises above the thick forest canopy close to the Amazon and Rio Negro Rivers.

The tree has big, leathery leaves that are up to two feet long and six inches wide. Its strong, spherical shells, about 0.5 inches thick, encase its nuts. Further covering these shells are thick, woody, spherical or pear-shaped outer fruits. Usually, there are 12 to 24 angular, three-sided nuts per fruit.[47]

Phytochemical composition of brazilnut

Total amount of bound and soluble phenolics (TPC)

With the use of lyophilized extracts, the total soluble and bound phenolic contents (TPC) of Brazil nuts were determined. Separately, these extracts were diluted and dissolved in methanol. Utilizing a modified Folin-Ciocalteu phenol reagent method, TPC was determined. Gallic acid equivalents (GAE) were measured using a standard curve made with gallic acid, and the results were reported as milligrams of GAE per gram of defatted meal or per 100 grams of sample.[48]

Pharmacological and medicinal properties of brazilnut

Antioxidant and Anti-inflammatory Properties

Although regular consumption of Brazil nuts has been strongly linked to increased GPx activity, there was no significant increase in plasma GPx activity after participants consumed three to five Brazil nuts for 16 weeks. This lack of effect may have been caused by the

participants' baseline plasma selenium levels (~110 µg/L), which exceeded the minimum threshold (84–100 µg/L) required for plateau activity. Selenium is already known for its antioxidant properties, with approximately one-third of selenoproteins acting to inhibit free radical reactions.[49]

CONCLUSION

In addition to their nutritional worth, natural nuts are prized for their remarkable phytochemical makeup and pharmacological advantages, which support their many therapeutic applications. Nuts, which are abundant in bioactive substances including polyphenols, flavonoids, alkaloids, and essential fatty acids, are vital for maintaining good health and averting a number of diseases. They are significant ingredients in functional meals and natural treatment choices because of their qualities, which include anti-inflammatory, cardioprotective, antidiabetic, neuroprotective, antioxidant, and anticancer activities.

Even though a lot of data suggests that they have therapeutic potential, more research is required to fully comprehend the bioavailability, long-term safety, and synergistic interactions of the phytochemicals in whole nuts. Standardized procedures and clinical trials are also essential for determining how well they work to treat particular medical disorders. Including natural nuts in daily meals presents a viable option to enhance health and wellbeing worldwide and offers sustainable and natural substitutes for traditional.

ACKNOWLEDGE

The director and principal of the IPS Academy College of Pharmacy in Indore, Madhya Pradesh, are thanked by the author for granting permission to conduct this review.

REFERENCES

1. Ros, E.; Martínez-González, M.A.; Estruch, R.; Salas-salvadó, J.; Martínez, J.A.; Corella, D. Mediterranean Diet and Cardiovascular Health: Teachings of the Predimed Study. Adv. Nutr, 2014; 5: 1–3.
2. Souza, R.G.M.; Gomes, A.C.; Naves, M.M.V.; Mota, J.F. Nuts and Legume Seeds for Cardiovascular Risk Reduction: Scientific Evidence and Mechanisms of Action. Nutr. Rev, 2015; 73: 335–347.
3. De Souza RG, Schincaglia RM, Pimentel GD, Mota JF. Nuts and human health outcomes: a systematic review. Nutrients, 2017 Dec 2; 9(12): 1311.
4. Dubey S. A brief review on utility of nuts consumption. IP J Nutr Metab Health Sci, 2023; 6(3): 102-105.
5. Kumawat KL, Raja WH, Chand L, Rai KM. Nutritional value and health benefits of nuts. Indian Farmer. 2017; 4(8): 627-37.
6. Ros E. Health benefits of nut consumption. Nutrients, 2010 Jul; 2(7): 652-82.
7. Yada S, Lapsley K, Huang G. A review of composition studies of cultivated almonds: Macronutrients and micronutrients. Journal of Food Composition and Analysis, 2011; 24(4-5): 469-480.
8. Wirthensohn M, Chin W, Franks T, Baldock G, Ford C, Sedgley M. Characterising the flavour phenotypes of almond (Prunus dulcis Mill.) kernels. The Journal of Horticultural Science and Biotechnology, 2008; 83(4): 462-468.
9. De Souza Rgm, Schincaglia Rm, Pimentel Gd, Mota Jf. Nuts and human health outcomes: A systematic review. Nutrients, 2017; 9(12): 1311.
10. Siddiqua A, Hussain S, Syed SK. Phytochemistry, nutritional and medicinal importance of almond. Postepy Biologii Komorki, 2021 Jan 1; 48(2): 167-80.
11. Abdullah Mk, Hussain Mk. Badam (Prunus amygdalus Bail.): A Fruit with Medicinal Properties. International Journal of Herbal Medicine, 2017; 5(5): 114-117.
12. Rao H. Therapeutic applications of almonds (Prunus amygdalus L.): a review. Journal of clinical and diagnostic research, 2012; 6(1): 130-5.
13. Al-Sayari A, Ghazwani M, Alhamhoom Y, Almaghaslah D, Louis JV, Gurusamy N. The antidepressant-like effect of almond oil: An additive effect with lavender oil. Biomedical Research, 2018; 29: 3402-3407.
14. Sachdeva, M. K., and T. Katyal. "Abatement of detrimental effects of photoaging by Prunus amygdalus skin extract." International Journal of Current Pharmaceutical Research, 2011; 3(1): 57-59.
15. Jia, Xiao-Yan, et al. "Hepatoprotective effects of almond oil against carbon tetrachloride induced liver injury in rats." Food chemistry, 2011; 125(2): 673-678.
16. Dobhal K, Singh N, Semwal A, Negi A. A brief review on: Hazelnuts. Int. J. Recent Sci. Res, 2018; 9(1): 23680-4.
17. Pfeil JA, Zhao Y, McGorrin RJ. Chemical composition, phytochemical content, and antioxidant activity of hazelnut (Corylus avellana L.) skins from Oregon. LWT, 2024 Jun 1; 201: 116204.
18. Bliznyuk NA, Prokopenko YS, Georgians VA, Tayvion VV. A comparative phytochemical and pharmacological analysis of the extracts from leaves of the Ukrainian flora shrubs. News of Pharmacy, 2016 Mar 11(1 (85): 29-32.
19. Bottone A, Cerulli A, D'Urso G, Masullo M, Montoro P, Napolitano A, Piacente S. Plant specialized metabolites in hazelnut (Corylus avellana) kernel and byproducts: an update on chemistry, biological activity, and analytical aspects. Planta medica, 2019 Aug; 85(11/12): 840-55.
20. Hayes D, Angove MJ, Tucci J, Dennis C. Walnuts (Juglans regia) chemical composition and research in human health. Critical reviews in food science and nutrition, 2016 Jun 10; 56(8): 1231-41.
21. Ali G, Zeb A. Walnuts ameliorated hepatic inflammation and toxicity induced by thermally oxidized high-fat diet in mice. Journal of Functional Foods, 2024 Mar 1; 114: 106080.

22. Regueiro J, Sánchez-González C, Vallverdú-Queralt A, Simal-Gándara J, Lamuela-Raventós R, Izquierdo-Pulido M. Comprehensive identification of walnut polyphenols by liquid chromatography coupled to linear ion trap–Orbitrap mass spectrometry. Food chemistry, 2014 Jun 1; 152: 340-8.
23. Nguyen TH, Vu DC. A review on phytochemical composition and potential health-promoting properties of walnuts. Food Reviews International, 2023 Jan 2; 39(1): 397-423.
24. Mohammadi J, Chatrroz B, Delaviz H. The effect of hydroalcoholic extract of Capparis spinosa on quality of sperm and rate of testosterone following induction of diabetes in rats. J Isfahan Med Sch, 2014; 31: 1-11.
25. Delaviz H, Mohammadi J, Ghalamfarsa G, Mohammadi B, Farhadi N. A review study on phytochemistry and pharmacology applications of Juglans regia plant. Pharmacognosy reviews, 2017 Jul; 11(22): 145.
26. Ferguson L, Polito V, Kallsen C. The pistachio tree; botany and physiology and factors that affect yield. Pistachio production manual, 4th ed. Davis, CA, USA, University of California Fruit & Nut Research Information Center, 2005; 31-9.
27. Mandalari G, Barreca D, Gervasi T, Roussell MA, Klein B, Feeney MJ, Carughi A. Pistachio nuts (Pistacia vera L.): Production, nutrients, bioactives and novel health effects. Plants, 2021 Dec 22; 11(1): 18.
28. Mandalari G, Barreca D, Gervasi T, Roussell MA, Klein B, Feeney MJ, Carughi A. Pistachio nuts (Pistacia vera L.): Production, nutrients, bioactives and novel health effects. Plants, 2021 Dec 22; 11(1): 18.
29. Ukhanova, M., Wang, X., Baer, D.J., Novotny, J.A., Fredborg, M., & Mai, V. (2014) Effects of almond and pistachio consumption on gut microbiota composition in a randomized cross-over human feeding study. Br J Nutr, 111: 2146–2152.
30. Nadimi AE, Ahmadi Z, Falahati-Pour SK, Mohamadi M, Nazari A, Hassanshahi G, Ekramzadeh M. Physicochemical properties and health benefits of pistachio nuts. International journal for vitamin and nutrition research. 2019 Feb 12.
31. Sruthi P, Naidu MM. Cashew nut (Anacardium occidentale L.) testa as a potential source of bioactive compounds: A review on its functional properties and valorization. Food Chemistry Advances, 2023 Jul 16: 100390.
32. Paramashivappa, R.; Phain, K.; Vithay, A.; Rao, A. Method for isolation of major phenolic constituents from cashew (anacardium occidentale l.) nutshell liquid. J. Agric. Food Chem, 2001; 49: 2548–2551.
33. Salehi B, Gültekin-Özgüven M, Kırkın C, Özçelik B, Flaviana Bezerra Morais-Braga M, Nalyda Pereira Carneiro J, Fonseca Bezerra C, Gonçalves da Silva T, Douglas Melo Coutinho H, Amina B, Armstrong L. Anacardium plants: chemical, nutritional composition and biotechnological applications. Biomolecules, 2019 Sep 9; 9(9): 465.
34. Cardoso, B. R., G. B. S. Duarte, et al. (2017). "Brazil nuts: Nutritional composition, health benefits and safety aspects." Food Research International, 100: 9-18.
35. Cordeiro, T. A. "A Review on The Nutritional Aspects and Health Benefits of Cashew (Anacardiumoccidentale).
36. . Davis, C. D. (2003). "Low dietary copper increases fecal free radical production, fecal water alkaline phosphatase activity and cytotoxicity in healthy men." The Journal of nutrition, 133(2): 522-527.
37. Fetuga, B., G. Babatunde, et al. (1975). feeding stuff potential of Cashewnut scrap kernel meal. Proceedings of the Conference on Animal Feeds of Tropical and Subtropical Origin.
38. Lutz M, Álvarez K, Loewe V. Chemical composition of pine nut (Pinus pinea L.) grown in three geographical macrozones in Chile. CyTA-Journal of Food, 2017 Apr 3; 15(2): 284-90.
39. Su, X.Y.; Wang, Z.Y.; Liu, J.L. In vitro and in vivo antioxidant activity of Pinus koraiensis seed extract containing phenolic compounds. Food Chem, 2009; 117: 681–686.
40. Valero-Galván J, Reyna-González M, Chico-Romero PA, Martínez-Ruiz ND, Núñez-Gastélum JA, Monroy-Sosa A, Ruiz-May E, Gonzalez Fernandez R. Seed characteristics and nutritional composition of pine nut from five populations of P. cembroides from the states of Hidalgo and Chihuahua, Mexico. Molecules, 2019 May 30; 24(11): 2057.
41. Kaushik P, Kaushik D. Ethnobotany and phytopharmacology of Pinus roxburghii Sargent: A plant review. Journal of integrative medicine, 2013; 11(6): 371-6.
42. Sharma A, Sharma L, Goyal R. A review on Himalayan pine species: Ethnopharmacological, phytochemical and pharmacological aspects. Pharmacognosy Journal, 2018; 10(4).
43. Shilpa R, Lata S, Yadav A, Sood A. Chestnut (Castanea spp.): An Overview on Importance and its Cultivation.
44. Boopathi T, Gopalasatheeskumar K, Parthiban S, Sangeetha G, Thang Kokila M, Manimaran T. Evaluation of Antimicrobial Activity of TecomaStans and Muntingia Calabura, 2007; 6(3): 617-627.
45. Poerschmann J, Trommler U, Biedermann W, Truyen U, Lucker E. Sequential pressurized liquid extraction to determine brain-originating fatty acids in meat products as encephalopathy risk markers in bovine spongiform assessment studies. J Chromatogram A., 2006; 1127: 26-33.
46. Rajkumar P, Rajitha Sri M. Water chestnut: Growing conditions, nutritional and phytochemical composition, novel extraction methods and health properties. Pharma Innov. Inl. J., 2022; 11(7): 599.

47. Yang J. Brazil nuts and associated health benefits: A review. LWT-Food science and technology, 2009 Dec 1; 42(10): 1573-80.
48. John JA, Shahidi F. Phenolic compounds and antioxidant activity of Brazil nut (Bertholletia excelsa). Journal of functional foods, 2010 Jul 1; 2(3): 196-209.
49. Cardoso BR, Duarte GB, Reis BZ, Cozzolino SM. Brazil nuts: Nutritional composition, health benefits and safety aspects. Food Research International, 2017 Oct 1; 100: 9-18.