

WALNUT: NOT A HARD NUT TO CRACK

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ABSTRACT

Walnuts grow on large trees, known for their beauty, timber and tasty edible nuts. There are many varieties of walnuts that vary in hardness, nut size and thickness of the nut shell. When it comes to their health benefits, Walnuts definitely are not hard nuts to crack. They contain free radical scavenging compounds like ellagic acid, juglone and certain phytosterols that support the immune system and appear to have anti-cancer properties. Walnuts have higher contents of polyunsaturated fatty acids including α -Linolenic acid, than do other nuts which may give walnuts additional anti-atherogenic and cosmetic value. It was found in clinical trials that walnut consumption in the amount of two to three servings per day consistently decreased total cholesterol and LDL cholesterol. Linolenic acid and Linoleic acids present abundantly in walnuts are crucial for maintaining skin functions such as regulation of transepidermal water loss and anti-inflammatory action. The beneficial action of walnut oil on skin is known for centuries and is widely used in cosmetic industry. The walnut oil is a component of dry skin creams, anti-wrinkle and anti-ageing products as it possesses moisturizing property as well as free radical scavenging capacity. Besides, they also exhibit anti-microbial, anti-diabetic, anti-stress, anti-ageing and Hepatoprotective activities. “Walnuts are better than cookies, french fries or potato chips, when you need a snack” as they provide rich nutrients. In the light of above, we thought it worthwhile to compile an up-to-date review article on Walnuts covering its synonyms, phytoconstituents, phytopharmacology and medicinal uses.

KEYWORDS: Walnut, Akhrot, *Juglan regia*, Aphrodisiac, Nutrient

INTRODUCTION

Walnuts are delicious way to add extra flavor, nutrition and crunch to a meal. It is no surprise that the regal and delicious walnut comes from an ornamental tree that is highly prized for its beauty and belongs to a relatively small family *Juglandaceae*. Walnut is unquestionably the finest wood in the World, as it is easy to work with, yet durable. The nuts are the rounded, single-seeded stone fruits of the walnut tree. They are enclosed in a green, leathery, fleshy husk, which is inedible. Removal of the husk reveals the wrinkly walnut shell, which is in two halves, and encloses the kernel, which is likewise in two halves separated by a partition. The walnut kernel consists of two bumpy lobes that look like abstract butterflies. There are 15 different varieties of Walnut, but the main types are English/Persian walnut (*Juglan regia*), Black walnut (*Juglan nigra*) and White walnut/Butternut (*Juglans cinerea*). The familiar Persian walnuts, often called English walnuts, can be cracked easily, often by holding two of them in the palm of the hand and squeezing but the black walnut and the butternut requires the utmost of "S" and "S"- (Strength and Strategy). These natives of North America sport the

toughest husks that cling firmly to their tough shells. Walnuts were well protected from light, heat, moisture and water because of their hard shells. Walnuts make the perfect food for a long journey across many oceans throughout the globe, since their shelf life is high.

NAMING THE WALNUT

The word Walnut is derived from Old English word, Wealh meaning “strange” or foreign” and wealhnutu, literally meaning foreign nut. The origin of the word nut is derived from the Latin *nux or nucleus* referring to the fruit inside the shell, the nut kernel itself. The walnut tree's formal botanical name, *Juglans regia*, comes from the Romans. The word *juglans*, from the Latin, means "the acorn of Jupiter," while *regia* refers to royalty. Walnut is termed as “Jupiter’s acorn”: figuratively, a nut fit for God. Another Roman version, **Jovis glans**, though not its botanical name, is translated as the royal nut of Jove, another name for Jupiter who is the highest god in Roman mythology. Yet another Roman name for the walnut, **Nux juglandes**, translates as "the nut of Jupiter". The walnut shell has an appearance reminiscent of the human brain; the Afghanistani word for walnut is **charmargh** or "four brains".

SCIENTIFIC CLASSIFICATION

Kingdom	Plantae	Family	Juglandaceae
Sub kingdom	Tracheobionta	Sub family	Juglandoideae
Super division	Spermatophyta	Tribe	Juglandae
Division	Magnoliophyta	Subtribe	Juglandinae
Class	Magnoliopsida	Genus	Juglans L.
Subclass	Hamamelididae	Species	<i>Juglan regia</i> ,
Order	Fagales		

COMMON NAMES

Mockernut hickory, Carya, Jupiter's Nuts, Kurup, ramakrot

AYURVEDIC NAMES

Akshoda, Akshodaka, Akshota, Shailbhava, Pilu, Karparaal, Vrantphala.

INDIAN NAMES

Hindi	Akhrot
Sanskrit	Akschota
Siddha	Akrottu
Tamil	Akrottu, Akroot kai
Telgu	Nattua Krot Vitthu, Akroot kaya
Guajarati	Akrot, Akharot
Bengali	Akrot, Bosnian
Urdu	Akhhroot
Kannada	Acrota
Malayalam	Akrothandi, Buah keras
Marathi	Akrod
Oriya	Akhoot

INTERNATIONAL NAMES

Afghani	Charmaz, Charmarghz
African	Okkerneut
Albanian	Wolnat arre, Dru arre, Arra
Bulgarian	Opexob, Opex
Chinese	Hu tao, Noz
Croatian	Orasi
Czech	Vlassky, Orech
Danish	Valnod
Dutch	Walnoot, Vannote hout
Finnish	Saksanpahkina, Jalopahkinat
French	Noix, Noyer, Cacahouete
German	Wallnuss, Walnufs, Welsche Nuss
Greek	Caryapersica, Caryabasilike, karithis
Hungarian	Dio
Indonesian	Buahkinari
Irish	Gallchno
Italian	Noce, Legonodinoce
Latvian	Valrieksts
Latin	Aleurities moluccana, A. Triloba, Iuglans
Norwegian	Valnott

Persian	Gerdo
Polish	Orzech
Portuguese	Noz, Nogueira, Imbuia
Romanian	Nux persica. Nux regia, Lemn de nuc, Nuca
Russian	Gretskiy/orekh, Opex
Serbian	Orah, Orgah
Slovak	Oreh
Spanish	Nuez, Nogel
Swedish	Valnot, Valnot strad, Valnotsslaktet
Turkish	Ceviz, Ceviz agaci, Ceviz tahtari
Unani	Akhrot
Vietnamese	Danh tu, Quaoccho

HISTORY

The Walnut is one of the World's most venerable fruits. The Romans associated the walnut with the Juno, the Roman goddess of women and the wife of Jupiter. This association led to the unique wedding practice of throwing walnuts at the bride and groom as a symbol of fertility. Women often carried walnuts to promote fertility. The French went nuts over the walnut. Early cultivation began there during the fourth century. In the French countryside, it was tradition to hang a bag of walnuts from the ceiling beam in the kitchen to represent abundance. Walnuts also represented longevity. Some young men believed the walnut tree to possess aphrodisiac powers and attempted to sneak a leaf into the shoe of a young woman they admired. One custom in Poitou, France is to have the bride and groom dance around the city's gigantic walnut tree. The villagers believe that by participating in this dance the bride will produce an abundance of milk for her baby. Charlemagne, during eighth to ninth century, ordered his gardeners to plant walnut trees on his extensive properties. The Walnut appears in the Greek mythology in the story of Carya, with whom the God Dionysus fell in love. When she died, Dionysus transformed her in to Walnut tree. The first cultivation of walnuts is attributed to the ancient Greeks, but it may have actually been the Persians, who first cultivated a superior variety. The walnuts growing in Greece were small and didn't produce a significant quantity of oil. When the Greeks encountered the larger Persian walnuts, they began to improve their variety by cultivation. The ancient Greeks utilized the walnut not only for food, but also as a medicine and a dye for the hair, wool, and cloth. The Romans discovered the merits of walnut around one hundred years after the Greeks usage and were willing to pay dearly for the luxury of serving them along with fruits for dessert. In the Old Testament, King of Solomon speaks with delight of visiting his Walnut grove. The

mention of walnut also appears in the Song of Solomon. Mesopotamia, the area that is now modern Iraq boasted of walnut groves in the famed Hanging Gardens of Babylon about 2,000 B.C. As testimony, Chaldeans left clay tablet inscriptions that accounted for these orchards. These were the earliest written records mentioning walnuts. Though written records of the walnut's arrival in Kashmir are absent, walnuts were an established presence from where they may have journeyed to China during the Han dynasty, sometime between 206 B.C. and 220 B.C.

The first mention of the walnut's arrival in the British Isles appeared in the Encyclopedia Britannica dated 1567. However, walnuts were only acceptably served at the end of a meal along with port and Stilton cheese. Though many historians pinpoint Persia as the country of the walnut's origin, confusion persists because archeological remains of walnuts were found spread from the Himalayas through Persia into Turkey, Italy, and Switzerland as well.

DESCRIPTION

William Cole, an exponent of the doctrine of signatures, said in Adam in Eden, 1657 that **Walnuts have the perfect Signature of the Head**: The outer husk of green covering, represents the Pericranium, or outward skin of the skull, upon which the hairs grow, and therefore salt made of these husks or barks, may help in healing wounds of the head. The inner woody shell resembles the Signature of the Skull, and the little yellow skin, or peel, that covers the Kernel, corresponds to hard Meninga and Pia-mater, which are thin scarves that envelope the brain. The kernel has the same appearance as the brain and therefore may be beneficial to the brain and provides resistance against poisons.

Plant

The trees are deciduous, 10-40 meters tall (30-130 ft), with spreading crown and thick massive stem. They grow vigorously and abundantly, when not injured by late frost of spring.

Leaves

The leaves are pinnate having 200-900 millimeter length (7-35 in) with 5-25 ovate-lance-shaped leaflets, which are attached to a stout, downy rachis. The leaflets are 2 to 4 inches long and yellowish-green in color with a paler and often fuzzy underside. In hot weather, or when bruised, they give out a powerful aromatic smell, which produces drowsiness or even nausea. They have bitter and astringent taste. On long standing, the leaves become brown and lose their characteristic, aromatic odor.

Wood

The common walnut and its allies are important for their attractive timber, which is hard, dense, tight-grained and

has a very smooth finish polishes. The color ranges from creamy white in the sapwood to a dark chocolate color in the heartwood. When kiln-dried, walnut wood tends toward a dull brown color, but when air-dried can become a rich purplish-brown.

Flowers

Walnuts are monoecious, (male and female flowers produced on the same tree). The male flowers are produced in long catkins and the inconspicuous, greenish female flowers are borne in clusters. Male and female flowers are not open at the same time, so in order to pollinate, two or three trees should be planted near each other.

Fruit

Nuts (fruits) are borne singly or in clusters of 2-3 on shoot tips. The walnuts are round and 1½ to 2 inches in diameter with a sculptured bony shell. They are surrounded by a slightly fleshy, greenish husk during the summer. The tree's roots tend to secrete juglone, a poisonous substance, into the soil that actually poisons some plants growing nearby. Horticulturists therefore, recommend not planting tomatoes, rhododendrons and azaleas within 80 feet of any walnut tree

CULTIVATION

Soil

Walnut trees will flourish in a well-drained, loamy soil. The walnut should be grown on deep, fertile, light (sandy) ground, which is free from alkali. It needs to be moist all the time. The pH of the soil should be 6-8.

Climatic Conditions

Walnuts are light-demanding species. The best locations for walnut trees are sunny, relatively sheltered sites with deep, well drained loam. They need protection from wind. Walnuts are also very hardy against drought. Walnuts are quite intolerant of wet climates, and may not fruit successfully in locations, where the annual rainfall exceeds 40 inches. The main problem associated with growing walnuts in high rainfall areas is walnut blight (*Xanthomonas campestris pv.juglandis*) due to which young shoots die, number of male flowers are reduced and nuts are spoiled. Walnut blight can be controlled to some degree by maintaining the soil pH above 6, cutting out affected shoots, sterilizing tools, avoiding excessive feeds of nitrogen, and spraying with copper based fungicides.

Potting

They should be planted in fall or early spring. The young plants need to be pruned to encourage the formation of a single, central shoot. All pruning should be done between June and December because if they are pruned in late winter or spring, they "bleed" profusely.

Propagation

Seeds should be used to propagate the wild species whenever possible. They should be placed in moist sand during winter months so as to prevent their drying out, and be sown in well-drained, light, loamy soil in the spring. They should be given protection from vermin by covering them with a wire netting or some other covering. It would be beneficial if the seeds could be sown, where they are to grow permanently, because transplanting could seriously stunt their growth. If they are started in a nursery bed, the seedlings should be lifted at the end of the season and the roots carefully trimmed. They should then be replanted. Other common methods are Whip grafting and Ring budding. Varieties and hybrids should be increased by grafting. Interplanting walnut plantations with a nitrogen fixing plant such as *Elaeagnus ebbingei* or *Elaeagnus umbellata*, and various *Alnus* species results in a 30% increase in tree height and girth

Harvesting

Before the age of mechanization, the traditional September harvesting of walnuts consisted of shaking the trees by hand using long hooked poles to knock the nuts to the ground, from where they could be easily collected. This breaks off many of their points, thereby causing the production of new spurs, which will probably bear fruit-bearing flowers. Today, the trees are shaken by a machine, while another machine uses vacuum suction to collect the fallen nuts. Commercial hot-air dehydrators with blower fans circulate warm air to reduce the moisture of the walnuts between 12 and 20% to preserve their shelf life. In past centuries, walnuts were simply left on drying racks away from the sun, until they were properly dried.

Storage

Dried nuts last for about 4 months at room temperature before becoming rancid, and 1-2 years, when stored in the freezer.

NUTRITIONAL COMPONENTS OF WALNUT

For many years, Walnut has been regarded as a health food that is nutritious and delicious as well. Both the preventive and therapeutic effects of Walnut are documented in the Indian system of medicine, Chinese medicine and the Western folklore medicine. Consequently, many scientists have long been engaged in the study of phytoconstituents of the walnut. Though scientific studies have not completely verified the mysterious healing effects of walnut, most of them are positive and affirmative. There may be nutritional variation from location to location and among individual cultivars of walnut. The nutritional values of Black

walnut i.e. *Juglans nigra*, are summarized in Table 1. The Values are for edible portion.

Rich calorie nut

Walnuts, like other nuts, are rich in calories. The calories in walnut come mainly from its abundant fat and protein. In the past, people living in some areas of the world relied heavily on walnuts to supplement energy needed for life. Black Walnuts provide more energy (3318 kJ/100g) than English walnuts (2730 kJ/100g).

Rich in essential fatty acid

Every 100 grams of edible portion of walnut contains as much as 68 grams of fat, in which a majority is the polyunsaturated fatty acid, such as Linoleic Acid and Linolenic Acid, accounting for 70% of the total fatty acid. The rest are the monounsaturated fatty acids (18%) and the saturated fatty acids (12%). Therefore, though walnuts are rich in calories, its fatty acid is mainly the unsaturated acid that would not cause harm to human cardiovascular system. Monounsaturated fats have favorable effects on high cholesterol levels and other cardiovascular risk factors. It is worth mentioning that walnuts contain rich Linoleic Acid (58%) and Linolenic Acid (12%), both are essential fatty acids in sustaining a healthy body. Alpha -Linoleic acid (ALA) lowers levels of C-reactive protein a marker of inflammation strongly associated with atherosclerosis and heart disease. Especially, Linolenic Acid is an omega-3 type of fatty acid. Eicosapentaenoic acid (EPA) and Docosahexaenoic acid (DHA) that becomes popular in recent years also belongs to this omega-3 type, which is known for its significant effect of lowering blood lipid and cholesterol. Omega-3 fatty acid has many potential health benefits ranging from cardiovascular protection, through the promotion of cognitive function, to anti-inflammatory benefits helpful in asthma, rheumatoid arthritis and inflammatory skin diseases like eczema and psoriasis

The source of quality protein

People usually weigh the quality over the quantity of protein. Walnuts however, are excellent both in quality and quantity of proteins. Walnut kernel contains about 14.5-24% of protein and rises to 61-66% in dry, defatted cake. Every 100 grams of edible walnut contains 14.4 grams of protein, of which most are of good quality and are therefore easy to digest. Furthermore, walnuts have a considerable variety of amino acids (Table 1). Walnut cake contains more arginine and lysine than soya bean meal. Moreover, walnuts also contain a sulphur amino acid, taurine (2-aminoethanesulphonic acid) in concentration of 15-46 nmol/g. In humans, taurine deficiency may lead to a decreased electroretinogram and to pigmentary degeneration of the retina. Walnut kernels have the potential to replace meat as a source of dietary

taurine. In addition to several essential amino acids that the human body cannot synthesize, walnut also contains many amino acids that are difficult to obtain from other vegetarian foods. Therefore, vegetarians are able to obtain all the proteins, the body needs with walnut diet.

Rich in fiber

Walnut is rich in fiber. 9.7 grams of fiber is present in every 100 grams of edible walnuts. Besides, fibers ingested help the stomach and bowel movement, digestion and excretion, preventing constipation. Some researches point out that fiber-rich foods help lower serum cholesterol and prevent cardiovascular diseases, such as heart diseases and stroke.

Pectic Substances

Walnuts contain about 2% on the dry matter basis pectic substances. These make up a component of dietary fiber and have nutritional value such as hypocholesterolemic effects, increased excretion of faecal sterols and the capacity to bind bile salts. Pectic substances also slow down the absorption of soluble carbohydrates, causing a smaller increase in postprandial level of blood sugar.

Other vitamins and minerals

Walnuts contain a variety of vitamins and minerals. As for vitamins, the abundant fat in walnut carries fat-soluble vitamins, such as vitamin A and E, and water-soluble vitamins, such as vitamin C, B1, B2, folic acid, pantothenic acid, and niacin. English walnuts contain more vitamin A (380 iu/100g) than black walnut (30-140 iu/100g), while the latter is a richer source of thiamin than English walnuts. The contents of nicotinic acid and riboflavin are same in almost all varieties of walnut. As for minerals, walnut has iron, zinc, copper, magnesium, phosphorus, manganese, etc. Black walnut is a rich source of trace mineral chromium and is also high in iodine but it contains moderate amount of calcium. Among minerals, walnut has very low sodium content with only 10 milligrams of sodium in every 100 grams of edible walnut, meeting the prevailing low sodium health concept. Manganese and copper are two minerals that are essential cofactors in a number of enzymes important in antioxidant defenses. Besides, the above-mentioned nutrients, there are several hundred micronutrients, including several pigments, phenolic compounds, etc., which still remain to be studied scientifically.

Chemical Constituents

Walnut contains flavonoids, phospholipids, sphingolipids hydrocarbons, sterols, triterpenes, quinones, oils, tannins, essential fatty acids including, ellagic acid, gallic acid, methyl gallate, serotonin, cis- linoleic acid and alpha-linolenic acid. It contains α -tocopherol, mucilage, albumin, mineral matter, cellulose and water. Ellagic acid and gallic acid supports the immune system and

appears to have several anti-cancer properties. The active principal is nucin or juglon (quinone). Defatted kernels of walnut are found to contain some phenolic acids, namely phenyl acetic acid, syringic acid, caffeic and ferulic acid in very small quantities. Phenolic compounds such as pyrogallol, *p*-hydroxybenzoic acid, vanillic acid, ethyl gallate, protocatechuic acid, gallic acid and 3,4,8,9,10-pentahydroxydibenzo[*b,d*]pyran-6-one are also isolated from walnuts. Walnuts have about 16 polyphenols, with anti-oxidant activity so protective that it is described as "remarkable". Hydrolysable tannins in walnuts consist of a glucose core, esterified with hexahydroxydiphenic acid and gallic acids. Strictinin is major simple tannin present in walnut. The major constituents of oil are triglycerides. Free fatty acids, diglycerides, sterols, sterol esters, phosphatides and vitamins are present in minor quantities. Seed oil contains fatty acids such as olein, myristin, palmitin, stearin, acrid resin. Walnut oil has been found to contain at least 29 volatile components, such as terpenes, alcohols and carbonyls and the characteristic odor of oil is attributed to the collective effect of a number of constituents. The phytochemical investigation of stem bark of *juglan regia* represented five new chemical constituents 4'-(*o*-methoxyphenyl) butyric acid, 1-methoxy-2-*n*-octanyl naphthalene-9-carboxylic acid, *o*-undecanyloxy-*n*-heptacosanyloxy-benzoate, *n*-heneicosanyl-9-octadecanoate and *n*-heptatriacont-12'-enyl hexadecanoate along with the known compounds stigmasta-5-en-3- β -ol, stigmasta-5,22-dien-3 β -ol-3 β -D-glucopyranosyl, stigmasta-5-en-3 β -ol- β -D-glucopyranoside and stigmast-5-en-3-ol-O- β -D-glucuronopyranoside¹. Siaresinolic acid, betulinic acid, daucosterin, 4, 5-O-isopropylidene- α -tetralone, 4-methoxy- α -tetralone-5-O α -glucopyranoside, 4-ethoxy-8-hydroxy- α -tetralone, 2, 3-dihydroxy-1-(4-hydroxy-phenyl)-propan-1-one and dihydrophaseic acid are the chemical constituents extracted from green husk of the walnut.

MEDICINAL USES

- Walnuts show anti-atherogenic properties².
- Walnuts show anti-cancer activity. It prevents colon, breast and prostate cancer^{3,4}.
- Walnuts show potent anti-microbial activity⁵.
- Walnuts give better night sleep due to melatonin.
- Walnuts help to cure obstinate ulcers.
- Walnut diet improves motor and behavioral skills.
- The leaves of walnut tree are anti-inflammatory and depurative.
- Walnut leaf washes "shrink" sweat glands, reducing perspiration.

- The leaves, bark and root bark are astringent.
- Leaves, barks, roots and oil from seeds are anthelmintic.
- The powdered bark of walnut tree is laxative and purgative.
- Walnut has been called the "vegetable arsenic" because of its curative powers in skin diseases. Leaves are specific in treatment of strumous sores. Seeds are made into paste and applied as a poultice to area of dermatitis and eczema.
- Oil from seeds is also used in the treatment of menstrual problems and dry skin conditions.
- Walnut Seeds are antilithic, diuretic and stimulant. They are used internally in the treatment of low back pain, weakness of legs, chronic cough, asthma, constipation and stones in the urinary tract.
- Walnut seeds prevent coagulation, facilitate blood circulation and reduce serum cholesterol.
- Walnut seeds prevent immune dysfunction and inhibit the formation of abnormal antibodies.
- Walnut seeds promote protein synthesis.
- Walnut seeds are used as vermifuge.
- The juice of the green husks, boiled with honey is a good gargle for soar mouth and inflamed throat.
- The thin yellow skin which cloth the inner nut and oil extracted from ripe kernel is remedy for colic.
- Male inflorescences are used to treat cough and vertigo.
- Piece of green husk of walnut eases the pain of hollow tooth.

CUISINE USES

- Walnuts are better than cookies, French fries or potato chips, when you need a snack. Creative cooks and chefs of many countries have eagerly adopted walnuts and incorporated them into a multitude of dishes from soups to desserts.
- In American cuisine, walnuts are preserved in sugar syrup and eaten as such.
- In Italy, liqueurs called Nocino and Nocello are flavoured with walnuts.
- Salsa di Noci ("Walnut Sauce") is a pasta sauce originating from Liguria.
- Walnut oil is used sparingly in Salad dressings.
- Baklava, a well-known delicacy served throughout the Middle East, is a rich dessert made of alternate layers of buttered filo dough and ground walnuts.

- Green walnuts are completely edible but are bit sour. They form an ideal ingredient for pickles, jams, and marmalades.
- The French enjoy their Walnut Soup and relish sauces made of walnuts, garlic and oil, while the Persians favor a dish called Fesenjen made of poultry/ meat, pomegranate juice and walnuts.
- To prevent bread from sticking, bakers spread powdered walnut shells on the base of their ovens

WALNUTS AS WILD LIFE PLANTS

Walnuts are used as food plants by the larvae of some Lepidoptera species. These include:

- Brown tail (*Euproctis chrysorrhoea*)
- The Coleophora case-bearers *C. laticornella* (recorded on *J. nigra*) and *C. pruniella*
- Common Emerald (*Hemithea aestivaria*)
- Emperor Moth (*Pavonia pavonia*)
- The Engrailed (*Ectropis crepuscularia*)
- Walnut Sphinx (*Amorpha juglandis*)

The nuts are consumed by other animals, such as mice and squirrels. In California and Geneva (Switzerland), ravens have been witnessed taking walnuts into their beaks, flying up to 60 feet in the air, and dropping them to the ground in order to crack the shells so as to eat the inside nut.

MISCELLANEOUS USES

- ❖ Finely powdered walnut shells are used in many commercial industries. The powder was employed as a polish for metals in the aeronautical industry.
- ❖ It is used for cleaning automobile and jet engines, electronic circuit boards, for paint and graffiti removal.
- ❖ Oil riggers use the powdered walnut shells to sharpen their drills.
- ❖ NASA has even put powdered walnut shells in thermal insulation in rocket nose cones.
- ❖ It is occasionally used in soap, face powder and exfoliating cleanser.
- ❖ Cleansing and polishing: Walnut shells are mostly used to clean soft metals, fiberglass, plastics, wood and stone. This environmentally friendly and recyclable soft grit abrasive is well suited for air blasting, de-burring, de-scaling, and polishing operations because of its elasticity and resilience.
- ❖ The shell is used widely in oil well drilling in making and maintaining seals in fracture zones.
- ❖ Flour made from walnut shells is widely used in the plastics industry.
- ❖ Used as a filler in dynamite.

- ❖ Furniture makers and finishers use the husks to create a rich walnut stain.
- ❖ Women developed hair dye made from the walnut hulls a beauty secret to enhance their appearance, Scribes made a rich brown ink from walnut hulls. Since prehistoric times weavers extracted a rich dark brown dye from walnut juice, while they used the green husks to make a yellow dye. They also boiled the bark to extract a deep brown dye used for coloring wool.
- ❖ Walnut shells are added to paint to give it a thicker consistency for "plaster effect" ranges.
- ❖ Walnut burls (or 'burrs' in Europe) are commonly used to create bowls. Veneer sliced from walnut burl is one of the most valuable and highly prized by cabinet makers and prestige car manufacturers.
- ❖ Walnut is also used in lutherie, i.e. making stringed musical instruments.
- ❖ The ancient Egyptians used the walnut oil in the embalming of their mummies.
- ❖ In nineteenth century in France walnut oil was used in the church as holy oil.
- ❖ The oil yielded by the kernel of the fruit is used to polish the wood.
- ❖ In Jammu (India) it is used widely as a Prasad (offering) of Mother Goddess Vaisnav Devi and, generally, as a dry fruits in the season of festivals such as Diwali.
- ❖ Leaves contain iodine and are a powerful insect repellent. The liquid made by macerating the husk and leaves in warm water can be poured on lawns, which will destroy all the worms without injuring the grass itself.
- ❖ King Louis XI' barber preferred to shave with the edge of heated walnut shells instead of a razor, because he thought, this would prevent cuts.

PHARMACOLOGICAL ACTIVITIES

Anti-microbial activity

The antimicrobial activity was studied in green husk aqueous extracts of six walnut (*Juglans regia L.*) cultivars against gram positive (*Bacillus cereus*, *Bacillus subtilis*, *Staphylococcus aureus*) and gram negative bacteria (*Pseudomonas aeruginosa*, *Escherichia coli*, *Klebsiella pneumoniae*) and fungi (*Candida albicans*, *Cryptococcus neoformans*)⁶. Ethyl acetate *J. regia L.* extract of walnut showed potent anti-fungal activity against all candida strains⁵. Pyroligneous acid collected by pyrolyzing walnut tree branches showed powerful antimicrobial activity⁷. Dry extracts of whole nuts of *Juglans regia* and *Prunus communis* showed anti-fungal activity against *Aspergillus* species⁸.

Anti-oxidant activity

The anti oxidant activity of walnut was assessed by its ability to quench the stable free radical 2,2'-diphenyl-1-picrylhydrazyl (DPPH) and to inhibit the 2,2'-Azobis (2-amidinopropane) dihydrochloride (APHH)-induced oxidative hemolysis of human erythrocytes. Methanolic seed extract of walnut presented highest DPPH and APHH scavenging activity^{9,10}. Two phenolic compounds isolated from the stem bark of walnut exhibited strong scavenging activities against 1,1'-diphenyl-1-picrylhydrazyl (DPPH), 2,2'-azino-bis-(3-ethylbenzenethiazoline-6-sulphonic) acid (ABTS) and superoxide radicals, and also showed inhibitory effect on lipid peroxidation and low density lipoprotein (LDL) oxidation¹¹. Walnut green husk aqueous extract showed anti-oxidant potential against cyclophosphamide (CP) induced urotoxicity in mice. CP treatment cause decrease in the activities of catalase (CAT), glutathione peroxidase (GP), glutathione reductase (GR), glutathione S-transferase (GST) and in the glutathione (GSH) content and increase in the lipid peroxidation (LPO). Walnut extract restored all the above antioxidants significantly and lowered the elevated LPO in the bladder¹². Melatonin is present in Walnut, when eaten, increases blood melatonin concentrations. The increase in blood melatonin levels correlates with an increased anti-oxidant capacity of this fluid¹³.

Anti-mutagenic activity

Aqueous and acetone extracts of walnuts are effective in inhibiting 2-aminofluorene (2AF) induced mutagenicity in TA100 tester strains of *Salmonella*¹⁴.

Anti-Cancer activity

What is good for the heart may be good for the prostate as well. Walnuts due to their tocopherol contents help favorably men who were at the risk for prostate cancer³. Juglone, a naphthoquinone from walnuts, exerts cytotoxic and genotoxic effects against cultured melanoma tumor cells¹⁵. Studies revealed that ellagic acid, juglone and the "strong acids" fraction from walnut depressed the tumor cell proliferation significantly. Walnut consumption may provide the body with essential omega-3 fatty acids, antioxidants and phytosterols that reduce the risk of breast cancer^{16,4}.

Cholesterol lowering activity

The first studies indicated that controlled diet containing walnut reduced LDL cholesterol significantly¹⁷. Consuming high amount of walnuts reduced the risk of stroke and clogging of arteries up to 70 percent¹⁸. Endothelial dysfunctions associated with cardiovascular diseases are restored by various food components. Compared with Mediterranean diet, walnut diet had shown improved endothelial function in

hypercholesterolemic patients. Walnut diet improved endothelium-dependent vasodilation in hypercholesterolemic subjects. It significantly reduced total cholesterol and LDL cholesterol levels¹⁹. Studies showed that in addition to lowering LDL cholesterol Walnut rich alpha -linoleic acid (ALA) diet decreased the levels of ICAM-1, VCAM -1 and E-selectin, all of which are involved in cholesterol's adhesion to the endothelium (the lining of arteries). It increased the level of the protective omega -3 fatty acids, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Incorporating walnuts and fatty fish in a human diet lowered serum cholesterol and triglyceride concentrations, respectively, thereby reducing CHD risk^{20,21}.

Anti-inflammatory activity

Studies showed that Walnut rich alpha -linoleic acid (ALA) diet lowered the levels of C-reactive protein, a marker of inflammation strongly associated with atherosclerosis and heart disease. Microglial activation can result in the generation of cytotoxic intermediates and is associated with a variety of age-related and neurodegenerative conditions. Walnut extract inhibited LPS-induced Activation of Bv-2 Microglia. Walnut extract also induced a decrease in tumor necrosis-alpha (TNF α) production²².

Anti-diabetic activity

Studies revealed that structural dietary advice incorporating walnuts achieves optimal fat and energy balance in patients with type 2 diabetes mellitus²³. Dietary fat can be manipulated with whole foods such as walnuts, producing reductions in fasting insulin levels.

Anti-ageing effect

The walnut oil is a component of dry skin creams, anti-wrinkle and anti-ageing products as it possesses moisturizing property as well as free radical scavenging capacity²⁴.

Anti-stress activity

A diet rich in walnuts helps the body to combat stress more effectively and lowers stress induced blood pressure.

Hepato-protective activity

Walnut kernel extract showed protective action against cigarette smoke (CSE) induced acute lung toxicity in rats. It significantly decreased the levels of lactate dehydrogenase (LDH), total cell count, total protein and increased the glutathione level in bronchoalveolar lavage fluid (BALF). It restored the levels of glutathione reductase (GR), catalase and reduced the xanthine oxidase (XO) activity in lung tissue¹⁰.

Anti- Alzheimer's activity

Walnut extract inhibited and defibrillized the β - amyloid plaques in the brains of patient suffering with Alzheimer

disease²⁵. Walnut supplementation can improve cognitive and motor performance in aged rats²⁶.

Insecticidal activity

Walnut, *Juglan regia* L. was reported to possess useful insecticidal activities against herbivores and microbes²⁷.

Anaesthetic/ Depressant activity

It dilates the ear vessels of the intact rabbit and coronary arteries of the isolated rabbit heart. It depresses the activity of isolated smooth muscle of rat intestine and uterus²⁸.

Bone health

Walnut, promotes bone health. Alpha-linoleic acid, the omega-3 fat found in walnuts significantly lowered the concentration of serum N-telopeptides (NT $_x$), a marker of bone breakdown and positively correlated with the pro-inflammatory cytokine TNF alpha²⁹. Walnut extract has a high anti-atherogenic potential and a remarkable osteoblastic activity²¹.

Effect on body weight

Studies showed that the fear of gaining the weight after consumption of nut is baseless. On the other hand, "Frequent nut consumption was associated with a reduced risk of weight gain³⁰. Regular walnut intake resulted in weight gain much lower than the expected and this became non significant after controlling the energy intake³¹.

CONCLUSION

Walnut has been regarded as a health food that is nutritious and delicious as well. Walnuts are better than cookies, french fries or potato chips, when you need a snack" as they provide rich nutrients and pharmacological activities. The walnut shell has an appearance reminiscent of the human brain. Furthermore, walnut possesses several useful medicinal properties such as aphrodisiac, anti-hyperlipidemic, anti-tumor, anti-diabetic and free radical scavenging activity. The preventive and therapeutic effects of walnut are documented in the Indian system of medicine, Chinese medicine and the Western folklore medicine. People usually weigh the quality over the quantity of protein content. Walnuts however, are excellent both in quality and quantity of proteins. Walnut kernels have the potential to replace meat as a source of dietary taurine (sulphur amino acid). In humans, taurine deficiency may lead to pigmentary degeneration of the retina. Walnut consumption in the amount of two to three servings per day consistently decreases total cholesterol and LDL cholesterol. Walnuts have higher contents of polyunsaturated fatty acids including α -Linolenic acid, than do other nuts, which give walnuts additional anti-atherogenic property and cosmetic value. The walnut oil is an ingredient of dry skin creams, anti-wrinkle and anti-

ageing products, since it possesses moisturizing property as well as free radical scavenging capacity. Walnuts make the perfect food for a long journey across many oceans, since their shelf life is high.

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Table 1: NUTRITIONAL VALUE OF BLACK WALNUT FOR EDIBLE PORTION

Nutrients	Units	Value per 100 grams
Water	g	4.56
Energy	Kcal	618
Energy	Kj	2584
Proteins	g	24.06
Total lipids (fat)	g	59.00
Ash	g	2.47
Carbohydrates	g	9.91
Fiber total dietary	g	6.8
Sugar total	g	1.10
Sucrose	g	1.00
Glucose (dextrose)	g	0.05
Fructose	g	0.05
Starch	g	0.24
Minerals		
Calcium	mg	61
Iron	mg	3.12
Magnesium	mg	201
Phosphorus	mg	513
Potassium	mg	523
Sodium	mg	2
Zinc	mg	3.37
Copper	mg	1.360
Manganese	mg	3.896
Selenium	mcg	17
Vitamins		
Vitamin C	mg	1.7
Thiamine	mg	0.057
Riboflavin	mg	0.130
Niacin	mg	0.470
Pantothenic acid	mg	16.60
Vitamin B ₆	mg	0.583
Folate total	mcg	31
Choline total	mg	32.1
Betaine	mg	0.5
Vitamin A	IU	40
Vitamin E (alpha toopherol)	mg	1.80
Toopherol gamma	mg	28.48
Toopherol delta	mg	1.44
Vitamin K (Phylloquinone)	mcg	2.7
Lipids		
Fatty acid, total saturated	g	3.368
Fatty acid total monosaturated	g	15.004
Fatty acid total polyunsaturated	g	35.077
Cholesterol	mg	0
Stigmasterol	mg	0
Phytosterol	mg	108
Campesterol	mg	5
Beta-sitosterol	mg	103
Amino Acids		
Tryptophan	g	0.318
Threonine	g	0.721
Iso leucine	g	0.966
Leucine	g	1.684
Lysine	g	0.713
Methionin	g	0.467
Cystine	g	0.462
Phenyl alanine	g	1.094
Tyrosine	g	0.740
Valine	g	1.271
Arginine	g	3.618
Histidine	g	0.672
Alanine	g	1.048
Aspartic acid	g	2.433
Glutamic acid	g	5.512
Glycine	g	1.189
Proline	g	0.926
Serine	g	1.225
Others		
Alchol, ethyl	g	0
Caffeine	mg	0
Theobromine	mg	0

Carotene, alpha	mcg	24
Carotene, beta	mcg	0
Cryptoxanthin ,beta	mcg	0
Lycopene	mcg	0
Leutin + Zeaxnthin	mcg	9