

Review on Pharmacological Activities of *Juglans Regia* (WALNUT)

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ABSTRACT: China boasts a large planting area, a wealth of walnut types, and world-class yields. Of the walnut fruit, the walnut kernel is the most useful component. A comprehensive investigation revealed that walnut by-products, like green husk and walnut shell, also have a wide range of potential applications and can be used as inexpensive raw materials to extract essential medicinal components and make industrial goods. Instead, while processing, the by-products are frequently burned or thrown away as waste, which pollutes the environment in addition to wasting resources. Every component of the walnut should be thoroughly processed in order to realize the high value-added application of the fruit. The important part is preliminary processing. The crucial step before walnuts are consumed and subjected to extensive processing is preliminary processing. The quality of the walnut items may be ascertained by looking at the sophisticated level of the necessary technical equipment. The six primary procedures of China's preliminarily processed walnuts are: removing the green husk, drying the walnuts, classifying the walnuts according to size, shattering the walnut shell, separating the walnut kernel from the shell, and removing the skin from the walnut kernel.

One of the earliest known food sources is the cultivated walnut species, *Juglans regia* L., which is used to produce nuts. Persian walnuts are produced all over the world in temperate climates; they are indigenous to the mountain slopes of Central Asia. Since 2012, the world has produced more than three million tons, with China, the United States, and Iran being the main suppliers. Breeding of walnut species (*Juglans* spp.) actually

began in the nineteenth century, despite their very ancient culture.^[1-5]

KEYWORDS: Walnut, Green husk, Walnut shell, Walnut Kernl, *Juglans regia* L.

I. INTRODUCTION:

The most prevalent names are akhrot in Hindi, doon in Kashmiri, and inunani in Gardgani. The origin of the unimportant name walnut is derived from the old wealhhnutu, which means "foreign nut" (wealhh is similar to the words Welsh and Vlach). The walnut got its name from its introduction from Italy and Gaul. The walnut was known by its Latin name, *Juglans regia*, or Gallic nut. *Jovis glans*, which translates to Jupiter's Acorn, is the source of the Latin name *Juglans regia*. According to legend, Jupiter and the other gods feasted on walnuts while common people lived on acorns during the classical golden period. The term "foreign nut" (German: Wallnuss) is where the contemporary name originates.

The walnut (genus *Juglans*) is a group of roughly 20 species of deciduous trees belonging to the Juglandaceae family that are indigenous to the West Indies, southern Europe, Asia, and North and South America.^[6-10]

Physical characteristics of the walnut:

The large compound leaves of walnut trees comprise five to twenty-three short-stalked leaflets. On the same tree, the male and female reproductive organs are carried in separate petal-less flower clusters called catkins. The twigs are characterized by a pith that has several chambers. The fruit is a drupe with an edible seed—often referred to as a nut—enclosed in a shell beneath a thick husk. It is not a true botanical nut. It is a

drupe whose edible seed—often referred to as a nut—is protected by a thick husk and a shell. From an ecological and economic standpoint, walnut trees rank among the most significant hardwood species in the northern hemisphere.

They are mostly grown for their nuts and lumber, but they also make lovely ornamental trees for parks. Because few walnut seedlings survive to be transplanted and because of their coarse root architecture, establishing walnut orchards is challenging. The architecture of the root system and the nutritional status of the seedlings are the primary factors that determine planting success, hence rhizosphere conditions are essential for plant performance. Obligate biotrophs known as arbuscular mycorrhizal fungus have the ability to form associations with walnut trees.

In this connection, soil mineral nutrients obtained by fungi are exchanged for carbon molecules produced by plants. Arbuscular mycorrhizal symbiosis has long been known to improve hardwood seedling quality and field performance; nevertheless, an integrated The impact of arbuscular mycorrhizas on walnut cropping is not well understood. To give current information on the interactions between arbuscular mycorrhizas and walnut trees, we thus reviewed the literature that has been published during the previous 40 years^[11-15]



FIGURE:WALNUT TREE

LEAVES: Leaves In addition to treating skin conditions, eye irritations, eye discomfort, and conjunctivitis, the green leaves of walnuts are used to boost appetite in those who have poor appetites. To relieve irritation and treat conjunctivitis, an infusion is prepared from leaves that are used in eye wash. Moreover, cuts, acne, and skin allergies are treated with the same leaf infusion to cure skin conditions. Alkaloids, flavonoids, and terpenoids

are found in plants of the Juglandaceae family, according to the findings of many research.

This family of medicinal plants includes walnuts, which have been used to cure a wide range of illnesses in traditional medicine. Its various therapeutic benefits are attributed to the presence of monoterpenes, coumarin, flavonoids, tannins, saponins, alkaloids, and other constituents. It has been proposed that this ingredient lowers the risk of microbiological activity, cancer, diabetes mellitus, and hypertension.

Walnuts are a great source of essential nutrients that may also be advantageous to human health, according to findings from earlier research. Given its variety of components and pharmacological qualities, more research on this substance's unidentified beneficial qualities is required. Leaves in order for it to be utilized as a medication to treat illnesses in people.

To uncover chemicals, information routes, and relevant genes, additional study and clinical trials are advised. Evaluation of the therapeutic benefits of walnuts on conditions such as diabetes, hypertension, infectious disorders, and liver diseases—diseases that have to be studied in clinical trials—is a crucial topic for these investigations.



FIGURE:WALNUT LEAF

ACTIVITIES ON WALNUT LEAVES:

- 1. Antibacterial Activity:** Walnut leaf compounds may have the ability to either stop or eliminate the formation of germs, which may help treat bacterial infections.
- 2. Antifungal Activity:** Walnut leaves may have substances that, like their antibacterial counterparts, can prevent the growth of fungus, making them potentially helpful in the treatment of fungal illnesses.
- 3. Antiviral Activity:** Certain substances found in walnut leaves may have the ability to prevent viruses from replicating or acting as

agents, indicating a possible application in antiviral treatments.

4. **Antioxidant Activity:** Antioxidants included in walnut leaves may assist the body fight off dangerous free radicals, which may lessen oxidative stress and the chance of developing chronic illnesses.
5. **Antidiabetic Activity:** Walnut leaves contain some substances that may help control blood sugar levels, which may make them useful in the treatment of diabetes.
6. **Anthelmintic Activity:** This describes the capacity of some substances to inhibit parasitic worms, indicating that walnut leaves may have therapeutic qualities for helminthic illnesses.
7. **Hepatoprotective Activity:** Walnut leaf compounds may have hepatoprotective properties that help the liver fend off damage from illnesses or toxins.
8. **Anticancer Activity:** Research indicates that substances present in walnut leaves may be able to stop the spread of cancer cells or cause cancerous cells to undergo apoptosis, or programmed cell death.
9. **Memory Booster Activity:** Some data point to the possibility that certain substances in walnut leaves have cognitive-boosting properties that could enhance memory and cognitive performance.
10. **Immunity Booster Activity:** Walnut leaf compounds may have immune-stimulating qualities that aid in boosting the body's defenses against illnesses and infections.

It's crucial to remember that even though some studies may point to these activities, more investigation—including clinical trials—is frequently required to validate and completely comprehend the possible advantages and modes of action of these substances. Individual reactions to these kinds of activities can also differ.^[15-25]

BARK: The Russian State Pharmacopeia does not include walnut bark, which is currently little studied. The aim of the research was to examine the quality indicators of medicinal plants. Specifically, walnut crust and its extracts were examined. moisture content, total ash, and ash insoluble in walnut crust fed with 10% hydrochloric acid; tannin and juglone content in walnut crust; GC-mass spectrometric analysis of the composition petroleum extract from walnut bark

The walnut bark that was collected from young branches of plants growing in the Kursk area was utilized as the test material. When a plant's sap flow first begins, the bark is collected.

Tannic content, moisture content, total ash, and ash insoluble in 10% hydrochloric acid were all calculated using the fourteenth edition of the Russian Federation's State Pharmacopoeia.

Using spectrophotometry, the amount of juglone in the diet was quantitatively determined.

The quantity of glycosides in *Juglans regia* cortex was analyzed in terms of glycolglone glucoside using C. Daglish's technique, which called for an exact weight of roughly 1.0 g. After RL was crushed and put through a 1 mm screen, it was put in a flask with a 100 ml capacity and a lapping stopper. 50 ml of an alcoholic hydrochloric acid solution (0.27 mol/l) was then added, and the mixture was agitated for 30 minutes using a magnetic stirrer. In 2019, Vieira V. et al. A 100 ml paper filter called "red tape" was used to filter the extract into a volumetric flask. An alcoholic solution of hydrochloric acid (0.27 mol/l) was added to correct the volume and the mixture was swirled. A volumetric flask with a capacity of 25 ml was filled with 2 ml of the resultant solution and adjusted to the mark with the same solution, agitated, and the absorbance was measured at a wavelength of 341 nm using an SF-2000 spectrophotometer.

Petroleum extract tested for Agilent Technologies, USA equipment. A standard injection volume of 1 ml was employed in the analysis. Temperature of the injector: 250 °C. 280 °C was the interface temperature. Helium was the carrier gas; the flow rate was one milliliter per minute. ChemStationE 02.00 software. Qualitative examination of the identification component composition was performed on the whole NIST-05 mass spectra collection.



FIGURE: WALNUT BARK

ACTIVITY ON WALNUT BARK:

1. Anti-plaque Activity: The compounds included in walnut bark have the potential to stop dental plaque from forming, which can aggravate gum disease and cause tooth decay.

2. Anti-fungal Activity: Walnut bark, like walnut leaves, may include substances that prevent the growth of fungi, which makes it effective in treating fungal diseases.

3. Anti-bacterial Activity: Walnut bark contains compounds that may be able to stop the growth of germs or eliminate them, which may help treat bacterial illnesses.

4. Anti-cariogenic and Tooth Whitening Material: This implies that walnut bark may have cariogenic activity, which is the ability to cause tooth decay, and it may also be utilized in tooth whitening solutions.

5. Anti-inflammatory Activity: Walnut bark compounds may have the ability to lessen inflammation, which is advantageous for the treatment of a number of inflammatory diseases.

6. Anti-viral Activity: A few of the substances in walnut bark may have the ability to stop viruses from replicating or acting as they do, which could make them useful in antiviral treatments.

7. Anti-parasitic Activity: Compounds in walnut bark may contain qualities that are helpful in preventing parasitic infections, much like the previously described anti-helminthic activity.

8. Anti-cancerous Properties: Some research points to the possibility that substances in walnut bark contain qualities that stop the spread of cancer cells or have other anti-cancer benefits.

It's crucial to remember that even if these exercises are advised, further study is frequently required to verify their efficacy and comprehend the underlying mechanics. Furthermore, using walnut bark for these objectives would need careful thought and perhaps more research into developing targeted therapies or goods.^[26-30]

HUSK: Plant-based materials, and nuts in particular, have drawn a lot of attention and study in recent years. Because these chemicals include valuable compounds that may be favorable for acquiring different beneficial compounds, their usage is a significant concern today. Agricultural waste products have been the subject of much research due to their abundance and careless disposal, which results in degradation of the environment. The primary purpose of growing walnuts is for their kernels; other fruit components,

such the husk and shell, are generated as waste crops when fruit is harvested and processed. The distinctive by-products of the fruit produced in walnut growing centers are the hard shell and green husk. These two agricultural waste products are produced as a byproduct of the nut and are closely related to one other. The biomass properties of walnut husk and shell differ in terms of composition, application, dispersion, and accessibility.

The produced hard shell biomass from walnut fruit is more favorable in terms of use when compared to the green husk, despite the fact that the green husk of the walnut fruit is widely employed in traditional medicine and is now being utilized in the business.



FIGURE: WALNUT HUSKS

ACTIVITY ON WALNUT HUSK:

1. Antioxidant Content and Radical Scavenging Activity: Rich in antioxidants, walnut husk aids in the body's defense against dangerous free radicals. This scavenging action lowers the risk of chronic illnesses and shields cells from oxidative damage.

2. antibacterial Activities: Walnut husk constituents may have antibacterial qualities that prevent the growth of fungus, bacteria, and other microbes. This may support its possible application in the management or prevention of microbial illnesses.

3. Anti-Platelet Activities: Research indicates that components in walnut husk might have antiplatelet properties, which means they could prevent blood

platelets from clumping together. Engaging in this activity can help lower the risk of cardiovascular problems and prevent the production of abnormal blood clots.

4. Cytotoxic Activities: Certain types of cells may be able to die as a result of compounds in walnut husk exhibiting cytotoxicity. This characteristic may be investigated for possible medicinal uses, such as targeted cell death in cancer therapy.

All of these actions point to walnut husk's possible health advantages. To properly comprehend and use these qualities for useful purposes, more study is required, just as it is with other walnut tree sections.^[31-35]

STEM: Stem diameter fluctuations were continually measured in the field and during different trials using LVDT devices (models DF 2.5 and DF 5, Solartron Metrology, Massy, France) with a $\pm 1 \mu\text{m}$ sensitivity. Copper-constantan thermocouples were used to measure the temperatures of the stem, air, and occasionally the soil. Data loggers (DL2e, Delta T devices, UK) were used to record the temperatures as well as the LVDT data. While data for laboratory cooling studies were recorded as 5-min averages and averaged at 1-min intervals, data for longer-term field observations were recorded as 1-h averages and averaged at 10-min intervals.

Measurements of temperature and diameter fluctuations were conducted in the winters of 1997–1998 and 1999–2000 on excised stems of orchard walnut trees (*Juglans regia* L. cv. Franquette scions on wild walnut root stocks). The trees, which were 17 years old in 1998, were cultivated outdoors at the INRA PIAF station close to Clermont-Ferrand in south-central France. Twig stem pieces underwent many freeze-thaw cycles in a temperature-controlled container equipped with LVDT sensors, called "Gelista™" (INRA, France).

Ten excised stem segments, each measuring 5 cm in length and 1 cm in diameter, with an LVDT device were intended to fit inside the chamber. Utilizing a circulator bath (Ministat Huber: -25°C to $+120^\circ\text{C}$) with an external Pt100 into the chamber, the cooling and warming cycles were computer-controlled with a linear rate of warming and chilling of 5°C per hour and up to ten repeats of the freeze-thaw cycle ($0, -10^\circ\text{C}, 0^\circ\text{C}$).

In several instances, the bark was perfectly intact and peeled off the stem all the way down to the vascular cambium. As a result,

diameter changes for the following tissues could be compared: (1) stem segments with bark still attached, (2) isolated bark strips measuring one centimeter broad by two centimeters long, and (3) stem segments where the bark had been removed. In several instances, the separated bark and/or stem section were autoclaved to eradicate any live cells. For every example, at least 10 duplicates were examined in terms of how the diameter fluctuated over freeze-thaw cycles.

As an example, during the winter of 1997–1998 for one of the previously stated orchard trees, temperature and diameter fluctuations were monitored in the field on the trunk, branches, and smaller stems, in tandem with temperature readings of the stem, branch, air, and trunk.

Apart from the orchard tree trials, freezing tests were conducted from October 1998 to May 1999 using 5-year-old potted walnut plants (*Juglans regia* L. cv. Franquette scions on wild walnut root stocks). The individual 33-liter well-drained pots with a mixture of 67% clay soil and 33% peat were used to grow the grafted plants.

The containers were regularly drip-irrigated to field capacity and 10 grams of NH_4NO_3 was applied yearly to nourish the plants. Twelve potted trees were grown outside until September 1998, when they were moved inside a greenhouse that was designated as "cool," where the temperature was typically maintained at the same level as it was outside. Nonetheless, a heating system was immediately activated and the air temperatures in the greenhouses were regularly monitored.

When the weather plummeted to 0°C , I turned on to raise the temperature in the greenhouse to as high as 3°C . So, in the fall and winter of 1998–1999, before the freezing trials, the trees were exposed to low temperatures, but not subzero ones. Because of this, the cool greenhouse's typical winter temperatures were only marginally higher than those outside, which may have allowed for some cold adaptation. Up to four potted trees, each measuring up to two meters in height, might fit inside the spacious cooling chamber. Temperature readings were taken of the trunk, stem, air, and soil during computer-controlled cooling and warming cycles.



FIGURE: WALNUT STEM

ACTIVITY ON WALNUT STEM:

The leaves, bark, and nuts of the walnut tree have all been investigated for possible medical benefits, even though walnut stems themselves are not frequently used in medicine. The stems might still contain substances, though, that have the potential to improve general health. The following are some possible uses for substances discovered in walnut stems:

- 1. Antioxidant Properties:** Similar to other walnut tree parts, walnut stems may include antioxidants that assist in scavenging damaging free radicals from the body, hence lowering oxidative stress and the chance of developing chronic illnesses.
- 2. Anti-inflammatory Effects:** Walnut stem compounds may have anti-inflammatory qualities that help lessen inflammation and ease the symptoms of inflammatory diseases.
- 3. Antimicrobial Activity:** It's possible that the compounds in walnut stems have antimicrobial qualities. These compounds could hinder the growth of bacteria, fungus, or other pathogens and help treat or prevent microbial diseases.
- 4. Neuroprotective Effects:** A few of the substances in walnut stems may have neuroprotective properties that help shield nerve cells from harm and promote the general health of the brain.

Although these possible uses point to potential health advantages of walnut stems, more investigation is required to completely comprehend the impacts and composition of these stems. Any practical applications would also need to be carefully thought through and maybe developed further into targeted treatments or products.^[35-42]

FRUIT: The green husk, walnut shell, skinless walnut kernel, and skin on the walnut kernel make up the walnut fruit. Walnut kernels, being the edible portion, have been the focus of much research. Within the food industry, walnut kernels may be processed into three different types of goods: dry fruit, intermediate products like walnut milk, and deep-processed products with significant added value like protein powder and walnut oil. With advancements in pharmaceutical expertise and extraction technology, the active ingredients found in walnut kernels have been carefully investigated and employed in the medical profession.



FIGURE: WALNUT FRUIT

Walnut kernels now play significant roles in the medical industry. However, because they are difficult to collect and process, the by-products of walnut (*Juglans regia*) production and processing—green husks, walnut shells, and skins on walnut kernels—are burned, buried, or abandoned, resulting in significant resource waste and pollution of the environment. As technology advances, several

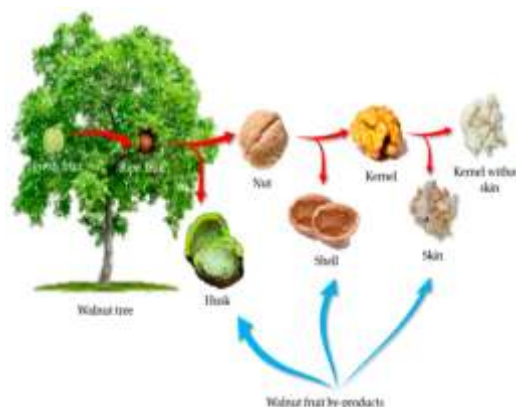


FIGURE: OVERVIEW ON WALNUT FRUIT

ACTIVITY ON WALNUT FRUIT:

1.Cardiovascular Health: Discuss how the omega-3 fatty acids, antioxidants, and other nutrients in walnuts support heart health by reducing inflammation, improving cholesterol levels, and enhancing blood vessel function.

2.Brain Health: Explore the cognitive benefits of walnuts, including their potential to improve memory, concentration, and overall brain function.

3.Antioxidant Properties: Explain the role of antioxidants in protecting cells from oxidative damage and reducing the risk of chronic diseases such as cancer and diabetes.

4.Weight Management: Discuss how the protein, fiber, and healthy fats in walnuts contribute to feelings of fullness and may aid in weight management by reducing overall calorie intake.

5.Diabetes Management: Explore research on the effects of walnuts on blood sugar control, insulin sensitivity, and other markers of diabetes management.

6.Cancer Prevention: Review studies suggesting that walnuts may have anticancer properties due to their bioactive compounds and ability to inhibit the growth of cancer cells.

7.Gut Health: Discuss the role of walnuts as a source of fiber and prebiotics, which promote digestive health and support a healthy gut microbiome.

8.Skin Health: Explain how the omega-3 fatty acids and antioxidants in walnuts benefit skin health by protecting against UV damage, reducing inflammation, and promoting a healthy complexion.^[43-45]

SHELL:The term "shell" refers to the central portion of the walnut fruit that encircles the kernel. It is regarded as a nontoxic, hard organic abrasive that degrades naturally and is chemically inert. Its many benefits include exceptional durability, flexibility, and cost-effectiveness. It is also eco-friendly and doesn't leave any pitting or scratches after washing. Another benefit is that it's a renewable resource, making it easily accessible.

The lignocellulosic agricultural waste found in the walnut fruit's shell is made up of cellulose (17.74%), hemicellulose (36.06%), and lignin (36.90%).

With few uses, WS is the principal waste product that is left over after the edible portion of the walnut is consumed.⁵³ Nevertheless, it may be utilized as a medium in abrasive blasting to polish and clean soft surfaces after being powdered and sized.

It may also be used for effective deburring of electrical components, casting, moldings, and other materials, as well as pre-treating various parts and devices prior to painting. Moreover, WS may be utilized as a filler in casting, as a filtration medium in hydration systems, as an extender for adhesive products, as a lost circulation material in the oil sector, and for cleaning and polishing via barrel tumbling. After processing, WS may be used as an abrasive to polish metal items, jewelry, and gun casings. It can also be used as a scrub in the soap and cosmetic industries.

Excellent adsorbency and reinforcing properties have also been reported for WS powder, enabling its application as a very effective biosorbent. In addition to producing ACs and eliminating HM ions and oils, WS has also been utilized because of its special mechanical qualities, low ash content, and bulk density.

Given that WS is regarded as an agricultural waste product, its market value is zero. This cellulose-rich agricultural waste can therefore be used to create packaging sheets that are commercially biodegradable. WS is an effective carbonaceous sorbent for managing different heavy metals (HMs) in industrial liquid streams.



FIGURE:WALNUT SHELL

ACTIVITY ON WALNUT SHELL:

1.Cleaning and Polishing: Because of its inherent abrasiveness, crushed walnut shells are frequently used in exfoliating scrubs and cleansers. They aid in cleaning the skin of debris, pollutants, and dead skin cells, leaving it feeling renewed and silky.

2.Ground walnut shells are occasionally used to drilling fluids in the oil and gas sector. This is known as oil well drilling. During drilling operations, they aid in filtration improvement, fluid loss control, and wellbore stability enhancement.

3.Paint Thickener: Water-based paints and coatings can benefit from the thickening properties of walnut shell flour, a finely ground powder derived from walnut shells. Enhancing texture and viscosity aids in improved application and coverage.

4.Cosmetic Cleaner: Due to its mild abrasive qualities, walnut shell powder is often used in cosmetic items like toothpaste and hand cleaners. It works well to remove surface stains from teeth and leaves the skin clean without irritating it. These uses highlight walnut shells' adaptability and value across a range of sectors, from industrial manufacturing to personal hygiene.^[46-48]

KERNEL: Due to the walnut's (*Juglans regia*) high protein, unsaturated fatty acid, phospholipid, vitamin, and mineral content as well as other nutrients, walnut kernels are regarded as a food of the highest caliber that has health benefits for humans. Walnuts play a significant role in the prevention and treatment of obesity, diabetes, and cardiovascular disease.

The common walnut (*Juglans regia* L.), when grown for its nuts and high-quality wood, is one of the world's most economically significant species.

The kernel of a walnut refers to the edible part found inside the hard shell of the walnut fruit. It's the meaty, crescent-shaped portion that you commonly find when you crack open a walnut shell. Walnut kernels are highly nutritious, containing protein, healthy fats, vitamins, minerals, and antioxidants. They are particularly rich in omega-3 fatty acids, specifically alpha-linolenic acid (ALA), which is essential for heart and brain health.

Walnut kernels have a distinct texture and flavor. They are crunchy and slightly oily, with a rich, nutty taste that is both savory and slightly sweet. This flavor profile makes them a popular ingredient in a variety of dishes, including salads, baked goods, and savory dishes.

Consuming walnut kernels regularly has been associated with numerous health benefits. They can help improve heart health by reducing cholesterol levels, lowering blood pressure, and decreasing inflammation. Additionally, the omega-3 fatty acids and antioxidants in walnut kernels support brain function, reduce the risk of cognitive decline, and promote overall well-being.

Walnut kernels are incredibly versatile and can be used in a wide range of culinary applications. They can be eaten raw as a snack,

roasted and seasoned for added flavor, chopped and sprinkled over salads or oatmeal, or used as a key ingredient in recipes for baked goods, such as cakes, cookies, and bread. Getting to the walnut kernel requires cracking open the hard shell of the walnut fruit. This can be done using a nutcracker or by applying pressure with a sturdy object, such as a hammer. Once cracked open, the kernel can be easily removed and enjoyed.



ACTIVITY ON WALNUT KERNEL:

1.Cardiovascular Health: Investigate the impact of walnut kernels on heart health, including their effects on cholesterol levels, blood pressure, and overall cardiovascular risk.

2.Brain Health: Explore the potential cognitive benefits of walnut kernels, including their effects on memory, cognitive function, and age-related cognitive decline.

3.Antioxidant Properties: Research the antioxidant compounds found in walnut kernels and their role in reducing oxidative stress and inflammation.

4.Weight Management: Examine studies on the relationship between walnut kernel consumption and weight management, including appetite control and metabolic health.

5.Diabetes Management: Investigate the effects of walnut kernels on blood sugar levels, insulin sensitivity, and other markers of diabetes management.^[49-50]

II. CONCLUSION:

Alkaloids, flavonoids, and terpenoids are found in plants in the Juglandaceae family, according to the findings of multiple studies. This family of medicinal plants includes walnuts, which have been used to cure a wide range of illnesses in traditional medicine. Its various therapeutic benefits are attributed to the presence of

monoterpenes, coumarin, flavonoids, tannins, saponins, alkaloids, and other constituents. It has been proposed that this ingredient lowers the risk of microbiological activity, cancer, diabetes mellitus, and hypertension. Walnuts are a great source of essential nutrients that may also be advantageous to human health, according to findings from earlier studies. Given its variety of components and pharmacological qualities, more research on this substance's unidentified beneficial qualities is required plant in order to make it into a medication to cure illnesses in people. In order to uncover chemicals, information routes, and relevant genes, more study and clinical trials are advised. Evaluating walnuts' potential therapeutic benefits for conditions like diabetes, hypertension, infectious diseases, and liver diseases—diseases that ought to be the subject of clinical trials—is a crucial question for these investigations.^[51-55]

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