

The Benefits of Walnuts Consumption on Human Health

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Abstract: The oldest writings about walnuts attest that they were consumed thousands of years before Christ in Persia, where they were specially cultivated for the royal family. Following the Silk Road, traders brought walnuts from Central Asia, China, to ancient Greece. Nowadays, the countries that can be proud of the impressive production of walnuts are China, the United States of America takes the second place, and Iran is the third largest producer of walnuts. Walnuts are a food that can be used in drinks and salty and sweet dishes and are also the basis of many cosmetic products. In addition, it is suitable for people of all ages. There are no restrictions in this regard. Due to the composition rich in minerals and vitamins, walnuts offer a generous series of external and internal benefits to the body. The studies undertaken in recent years have highlighted the positive effects that the consumption of nuts has on human health, such as: in brain functions, heart health, and reducing the risk of cancer.

Keywords: amino acids, diseases, human health, *Juglans regia*, walnuts.

Introduction

The *Juglans* genus (family *Juglandaceae*) comprises 7 to 45 species, depending on the taxonomic study. The genus is mainly distributed in the temperate and subtropical regions of the Northern Hemisphere, with many species also found in Central America and along the Andes Mountains of western South America (Wani et al., 2016). The English walnut (*Juglans regia*) is native to Eurasia, extending from the Near East to the Himalayas and Western China. This single species is known by different names: Persian, Turkish, Italian, French, Circassian, and Carpathian walnut. Walnuts must

have been harvested from ancient times, but the earliest records of growing walnut orchards date back to classical Roman and Greek times. In addition to walnuts, the trees are also a source of high-quality wood used for furniture. Walnut cultivation in Europe began in the 16th century, but by the end of the 17th century, walnut had been replaced by mahogany as the preferred wood for furniture. It is now grown all over the world. Black walnut and other nuts are used the same way as European walnut (Rogers, 2004).

Countries by nut production. Worldwide 4,498,442 tons of walnuts are produced per year. The largest producer of walnuts in the world is China (figure 1), with an annual production of 2,521,504 tons. China alone produces more than 50% of the world's walnuts. The United States of America ranks second with an annual production of 592,390 tons. With 321,074 tons of production per year, Iran is the third largest walnut producer (<https://www.atlasbig.com/en-us/countries-walnut-production>.)

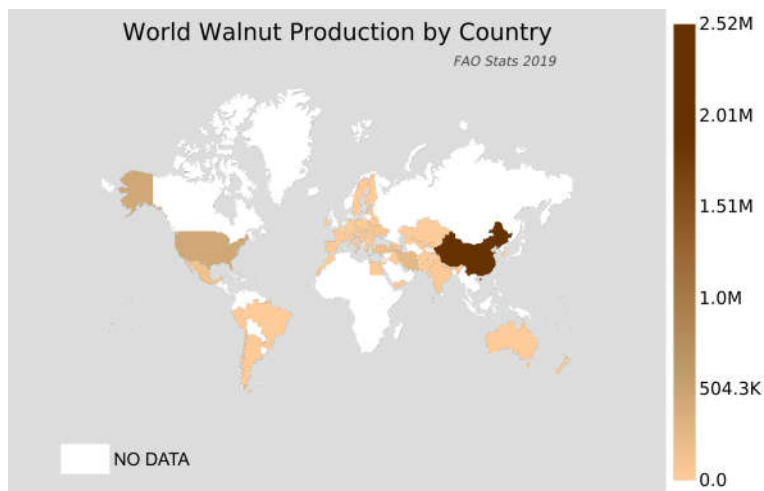


Figure 1. World walnut production by country (<https://www.atlasbig.com/images/en/countries-walnut-production.png>)

Ecology

Temperature acts on the walnut throughout the year. It requires heat during the growing season, at least six months with an average temperature $> 10^{\circ}\text{C}$ (Becquey, 1997), with hot summers where the warmest month registers an average temperature of $20\text{--}22^{\circ}\text{C}$, mild winters with an average temperature of the coldest month

of $-1...-3^{\circ}\text{C}$ (Cociu, 2006). The walnut behaves better at high temperatures than at low ones. However, temperatures higher than 35°C followed by drought, dry soil, and air cause burns on shoots, leaves, and fruits, and if this phenomenon occurs in the warmer months (June and July), production may be compromised. Hereditary characteristics can influence the walnut's resistance to frost during the rest period. Applied agricultural techniques, phytosanitary status, age, climatic conditions during vegetation, and winter preparation of trees can also influence the walnut's resistance (Cociu, 2006). The plant is sensitive to winter and late spring frosts (Bernetti, 1995). After entering the vegetation, negative temperatures (below 0°C) affect the vegetative organs of the walnut as follows: -17°C in the buds, if the negative temperatures suddenly return after coming out of dormancy, $-25...-27^{\circ}\text{C}$ in the buds and small female buds, $-28...-29^{\circ}\text{C}$ for annual branches, $-30...-36^{\circ}\text{C}$ for perennial branches. Daily temperature fluctuations (around 0°) also harm the walnut; when the cambium freezes, cracks occur on the branches and trunk. Temperatures below 0°C destroy the stigmas during flowering. Female and male flowers, leaves, and shoots are compromised at -3°C . The optimal temperature during flowering is between $15-20^{\circ}\text{C}$ and the minimum temperature of 15°C (Cociu, 2006).

Light is vital in the walnut tree's development. Walnut is a tree species that require high light needs, which, if it is not assured, can negatively influence: annual growth, differentiation, and binding of female flowers, small productions and of poor quality, low percentage of core, low resistance of trees to diseases and frost. The optimal requirements of the walnut are if the duration of sunshine falls between 800-1000 hours during the differentiation of female flowers, and in the phenophase of growth and ripening of the fruits, it requires 1100-1800 hours (Popescu et al., 1982).

Water. For optimal growth, the walnut tree needs 700–800 mm of rainfall each year and is well distributed throughout the year (Bergougoux & GrosPierre, 1981). It can tolerate drought, although rainfall should never fall below 100 –150 mm during the growing season (Giannini și Mercurio, 1997). During the rest period, the walnut is not picky about water. However, long periods of drought can negatively influence the synthesis of complex substances and the hydrolysis of starch, determining the low resistance to frost. The phenophases of nut budding and flowering have higher water demands, but the large excess of water also negatively influences

pollination and favors the manifestation of diseases, especially bacteriosis. In the flowering and copulation phenophases, the relative humidity of the air must be 60-70%, low humidity can cause drying of the stigmas, and high humidity blocks the opening of the flowers. The phenophases of intensive growth of shoots and fruits have high demands for water (100-200 l/sqm/month, in the phenophase of fruit ripening, the demands of the walnut for water are lower (60-70 l/sqm/month) (Cociu, 2006).

Soil is not a limiting factor for walnut. Walnut is a tree species with modest soil requirements, and it can grow on a wide range of soils. Inadequate conditions meet them in clayey, compact, cold, heavy, impermeable, and poorly fertile soils. On these soils, walnuts grow poorly and are debilitated. Walnut grows and bears well on light to medium-textured, nutrient-rich, permeable soils with a loose, high water-holding capacity and drainable subsoil. The skeletal content of more than 20% is considered a limiting factor for the walnut, the root system of the walnut being forced to move into the shallow horizons of the soil, where it is exposed to various thermal and hydric effects, where they find poor nutritional conditions. In these conditions, the root system can be distributed incorrectly, and the tree is forced to modify part of its root and reduce the trunk's thickness. The walnut has good growing and fruiting conditions on hills and plateaus with an altitude of 350-450 m., and where the altitude is higher, the fruits obtained are of lower quality, and the production is poor, although the growths are typical (Cociu, 2006). From the point of view of soil pH, its values vary between 6.5 - 7.5 (Becquey, 1997; Șofletea & Curtu, 2007) or 6-7.5 (Giannini and Mercurio, 1997).

In order to establish a productive plantation, a complete analysis must be done based on a previous study in which three factors will be taken into account: the choice of suitable land for the development of the plantation in good conditions, the selection of valuable planting material for the plantation, the application of superior technology and suitable for walnut culture. Walnuts must benefit from the best conditions to produce superior quality and early harvests. The recommended climate is temperate, and cold areas will be avoided without risks of frost, strategies to minimize this risk factor are taken into account. An elevation study of the area and a topographical study will be done to establish the microclimates in the area (Iannamico, 2014). The establishment of walnut plantations in exposed and open areas can cause poor growth and development of

walnut seedlings, especially black walnut (*Juglans nigra*). By installing artificial wooden barriers in fences, there is a tremendous increase in diameter by more than 60% and an increase in height by more than 70% in walnut seedlings. After removing the protective barriers, significant growth is observed over the next seven years in the crown and other elements of the walnut crown. The use of existing natural barriers: forest edges, hedgerows, land topography, and tall herbaceous vegetation, should be considered when planting walnut, especially in exposed and open areas (Heiligman, 2006).

The uses of the walnut

A fruit tree, the walnut has fruits whose core can be used as a complex food, with a content of 52-77% lipids, 12-25% proteins, 5-24% carbohydrates, 1.3-2.5% mineral salts (represented by mineral elements such as Zn, Cu, K, Mg, P, S, Fe, Ca), vitamins A, B1, B2, P and vitamin C, 40-50 mg% (4 times more than rose hips and 40 times more than orange juice). The essential aminoacids from the walnut kernel are presented in table 1.

Table 1

The essential amino acid composition in walnut kernel protein

No.	Essential aminoacid	Content g/1g
1.	Threonine	29
2.	Valine	66
3.	Methionine	19
4.	Isoleucine	54
5.	Leucine	116
6.	Phenylalanine	64
7.	Tryptophan	6
8.	Lysine	48
9.	Histidine	39
10.	Arginine	176

(Grosu et al., 2013)

One kilogram of the walnut kernel is equivalent to 6500-7000 calories. Fats contain mainly unsaturated fatty acids, and proteins contain essential amino acids, important substances in the human body's metabolism (Mitre and Fițiu, 2014).

A technical plant. Due to its decorative and physical-mechanical properties, walnut is a raw material for industrial branches (furniture, airplanes, automobiles). In addition, the walnut

kernel is used to extract a refined oil, with multiple uses in food, manufacturing ink, varnishes, and paints used in painting. Walnut cakes, resulting from obtaining walnut oils, are used to obtain halva and other confectionery products and in animal feed. Green nuts are used before the endocarp hardens when making jam or nut liquor. In order to extract tannin and vegetable dyes, the following are used: the mesocarp, the bark, and the leaves. Activated carbon, abrasive mixtures, and fine linoleums are obtained from the endocarp (Mitre and Fițiu, 2014).

As a **medicinal plant**, it has been used since ancient times. Green walnuts and walnut leaves extract iodine and other pharmaceutical products recommended against chronic dyspepsia, avitaminosis, disorders of the digestive system, conjunctivitis, and rickets (Mitre and Fițiu, 2014).

Decorative plant. It is used in alignment plantings, solitary or in clumps, where it is appreciated for its pleasant smell and rich foliage. It is also essential in agroforestry improvements for land fixation and as a leading species in protective curtains. Unfortunately, the assortment of walnut varieties used worldwide is quite limited compared to other fruit species, with each area having a specific assortment acclimatized to it (Mitre and Fițiu, 2014).

The benefits of walnuts consumption

Brain function support. The omega-3 fatty acids in walnuts are suitable for the brain. Eating foods rich in essential fatty acids) may slow cognitive decline (Willis et al., 2009). Oxidative stress and inflammation are essential in the aging process, dementia, and many age-related diseases. Walnuts consumption may have additive or synergistic effects in suppressing inflammation, and oxidative damage due to its multiple components with anti-inflammatory and antioxidant effects. Studies have shown that walnuts reduce oxidative stress by lowering free radical levels and increasing antioxidant defenses, thus reducing oxidative damage to lipids and proteins (Chauhan and Chauhan, 2020). Early and long-term nutritional intervention with walnuts may have beneficial effects in maintaining cognitive function and protecting against age-related cognitive decline and reducing the risk, delaying the onset or slowing the progression of cognitive impairment and dementia (Chauhan and Chauhan, 2020).

Immunity increasing. Nuts contain antioxidants that keep an immune system healthy and prevent disease. Add some nuts to the diet every day. Walnuts are rich in vitamins and minerals, such as copper and vitamin B6, which can boost immunity (Nath, 1997; Cheng et al., 2006).

Increase heart health. Walnuts benefit the cardiovascular system due to their high omega-3 fatty acids. Eating a few walnuts a day can also help lower blood pressure. Omega-3 fatty acids are known to reduce bad cholesterol in the body, encourage the production of good cholesterol, and help reduce inflammation and increase blood vessel function (Rajaram et al., 2009; Banel & Hu, 2009; Katz et al., 2012)

They are reducing the cancer risk. Walnuts are rich in plant compounds such as omega-3 fatty acids, polyphenols, and urolithins. These bioactive components may have anti-cancer properties. As a result, walnuts may reduce the risk of certain types of cancer, such as breast, colon, and prostate (Jahanbani et al., 2016). For example, the American Association for Cancer Research has stated that eating a few walnuts daily may help reduce breast cancer risk (Heuvel et al., 2012).

Reduction of inflammations. People with inflammatory diseases such as asthma, arthritis, and eczema can benefit from walnuts due to the presence of essential fatty acids (Jiménez-Gómez et al., 2009). In addition, nuts can fight inflammation and reduce the risk of coronary heart disease (Wu et al., 2014).

They are improving bone health. Walnuts contain an essential fatty acid called alpha-linolenic acid associated with more robust, healthier bones. The omega-3 fatty acids in walnuts can also help. They help fight inflammation and decrease subsequent bone resorption in humans (Griel et al., 2007).

Heals fungal infections. Research suggests that black walnuts can help treat fungal infections. Candidiasis, either in the digestive system or on the skin, can be severe. These infections create some uncomfortable symptoms, including itching and other allergies. Black walnuts may be as effective as specific treatments against fungal infections (Ho et al., 2018).

In conclusion, consuming nuts is beneficial for human health, but they must be consumed balanced. Otherwise, by abusing them, the effects we are looking for will take on a completely different meaning.

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