

## Scientific Processing of Walnuts Necessary for Amazing Health Benefits

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### ABSTRACT

Optimum health is the prime concern in every human's life!" We all live and we try to live healthy, Nuts are a good source of nutrients which play an important role in the maintenance of overall health. The edible kernel known as the walnut is one of the best nutritious food one can take regularly for better health due to its highly rich nutritious content and because of its amazing health benefits essential for a disease free healthy life. Walnuts are rich in calorie, vitamin E, and fatty acids like the Omega 3 fatty acids. All these components present in walnut makes the tree nut a rich source of nutrient food with excellent nutritional benefits. Walnuts possess enormous health benefits provided the consumption is regular in controlled quantity and of course hygiene is utmost important which propounds processing of walnuts on modern scientific lines. Walnuts are probably one of the most nutritious nuts available that is why; they are often referred to as the 'Imperial nut'. Walnut is highly beneficial for skin, hair, healthy heart, type 2 diabetes, reducing obesity, fighting against cancer, stress relaxant and much more. Keeping all these facts in view, due consideration is demanded towards progression of Walnuts in market. This will not only keep rates stable in the market but will facilitate a common person to procure Walnuts as per desire for upkeep of health. For the hygienic processing of walnut kernels, automation of processing in Walnut Industries is highly required.

**Keywords:** Benefit, Consumption, Hygiene, Processing, Walnut.

### INTRODUCTION

There are a number of natural gifts in the world which help people keep them fit, fine and healthy in a natural way. Among all those natural gifts created by the nature for the

benefits of mankind, is an edible kernel from the tree belonging to the Juglandaceae family with the genus Juglan. Each nut is roughly spherical in its shape and its size is about a middle sized lemon (Figure 1) which weighs about 10-15 grams. It encloses a single bi-lobed edible kernel inside<sup>1</sup>. The walnut kernel consists of two uneven lobes which are off white in colour and are covered by a thin papery layer of light brown colour.

Apart from being great at taste, walnuts are rich in various nutrients and thus help greatly to the better health of human beings. The most important component present in walnuts is the omega 3- fatty acid.

Studies have found that around 38% of the walnuts are grown in United States and about 90% of those 38% walnuts are grown especially in California. Among all the health benefits walnuts provides, some of the most crucial benefits includes the benefits to heart health, anti-cancer benefits, benefits in fighting against type 2 diabetes, benefits to skin health etc<sup>2-4</sup>. However it is also mainly beneficial to the people who prefer a calorie rich diet. A comparative study between the tree-nut eaters and the non eaters of the tree nuts suggests that people who eat tree nuts are found with gaining 5 grams of more fiber, 73 milligrams of more calcium, 260 milligrams of more potassium, 95 milligrams of more magnesium, 3.7 mg of more vitamin E and 157 mg of less sodium.

Walnuts are round, single seeded fruits of the walnut tree growing in temperate regions. Each walnut is enclosed in a green, leathery fleshy husk which is inedible. When the husk is removed, it reveals the wrinkly walnut shell joined in two halves which are off white in color and covered by a paper-thin light brown skin<sup>5</sup>. This hard shell encloses the kernel which is edible. The seed kernels are enclosed in a brown seed coat which contains antioxidants. These antioxidants protect the seed from atmospheric oxygen, thus preventing rancidity.

Walnuts are usually ready for harvesting in the month of August when the thick green hull cracks open to reveal the light brown colored nut. There are generally two varieties of walnuts- Persian/English walnut and black walnut. The Persian or English walnut has its origin in Persia and is produced commercially. The black walnut has a high flavor but it has a smaller kernel and an extremely tough shell. Due to its poor hulling characteristics, it is not grown commercially for nut production. Since ancient times, walnut has been regarded as a symbol of intellectuality not only due to the resemblance of its shell to the human brain but also because of its health benefitting nutrients, particularly omega- 3 fatty acids. Ancient Romans used it as a delicacy as well as to dye wool and color hair. Oil extracted from walnuts is used in cooking and as a base or carrier oil in medicine and aromatherapy.



**Figure 1** Shape of walnut stone

The list providing the nutritional information of walnuts as per the best possible facts available are as under.

- It provides about 654 kilocalorie of energy
- It has about 13.71 grams of carbohydrates
- It has a principle nutrient value of 15.23 grams proteins
- It has a total fat of about 65.21 grams
- It has about 6.7 diet fiber
- It must be noted there are no cholesterol
- It has about 441 mg of potassium and only 2 mg of sodium
- It is a good source of vitamins, Vitamin C lists about 1.3 mg, Vitamin A content includes 20 IU, vitamin E list 20.83 mg
- It is rich in minerals like calcium (98 mg), magnesium (158 mg), phosphorous (346 mg) etc.
- It has iron content of around 2.9 mg.
- They contain some percentage of phyto-nutrients essential for human health and nutrition

## **HEALTH BENEFITS OF WALNUTS**

### **1. Anti-ageing Benefits**

Most nuts are good for skin and walnut is no exception. The wide array of nutrients in this nut, particularly omega-3 fatty acids and Vitamin E helps to maintain a nourished and smooth complexion. Walnuts are rich in antioxidants which counter the action of free radicals that can harm your cells and accelerate the ageing process<sup>6,7</sup>. Walnut oil has been used since the 17th century as a remedy for wrinkles, thanks to its high levels of essential nutrients and rich minerals. Though this oil is greasy and rich, applying it on your face helps treat wrinkles and fine lines, thus making your skin look younger.

### **2. Improves Skin Quality**

Both walnuts and their oil contain abundant amounts of vitamins B1, B2 and B3 as well as vitamin E and B complex. The phytonutrients and fatty acids present in walnut oil improve the texture and quality of your skin.

### **3. Treatment of Psoriasis**

Psoriasis is a persistent, painful skin ailment that can be alleviated by using walnut oil. You can add this oil to your bath or apply it topically on your skin for an hour to soothe the inflammation caused by psoriasis.

### **4. Treatment of Skin Infection**

The anti-fungal properties of walnut oil make it great for the treatment of fungal infections like athlete's foot and candida. This oil can be applied topically on the affected

areas or mixed with other herbal anti-fungal ingredients such as garlic to enhance its effectiveness.

### **5. Treatment of Eczema**

Omega-3 fatty acids contained in walnut oil help in treating eczema. All you need to do is mix some garlic juice with walnut oil and apply it on the eczema affected area. Do this regularly to experience beneficial results within 10 days.

### **6. Healing Qualities**

Walnuts contain amino acids which are naturally found in healthy skin. Thus, eating walnuts is a natural way of making your skin beautiful, healthy and damage resistant. They also contain Vitamin E which is a skin friendly antioxidant. Taking it internally makes your skin softer and accelerates healing of injured skin.

### **7. Walnut: Hair Benefits**

Walnuts are considered the most hair friendly among all nuts, primarily due to their high content of omega-3 fatty acids as well as zinc, iron, B vitamins (B1, B6 and B9) and abundant amounts of protein. These nuts offer the following benefits for your hair. Omega-3 fatty acids in walnut oil form a vital part of cell structure as they stop dehydration of cells and maintain the physical property. In this way, walnut oil hydrates your scalp, thus preventing dry scalp which is a cause of hair loss.

### **8. Prevents Dandruff**

Dandruff is a common problem these days, which if left unattended can lead to severe hair loss. Walnuts contain alpha linolenic acid, an omega-3 fatty acid that helps condition your hair. Walnut oil moisturizes your scalp region to ensure that the skin does not become flaky. Thus, topical application of this oil helps in preventing dandruff.

### **9. Promotes Hair Growth**

Walnut oil also contains minerals like potassium and copper which play an important role in promoting hair growth. Deficiency of potassium can disable the cells to repair and regenerate which might cause hair loss and even balding. Copper, on the other hand, is required for the synthesis of the melanin pigment, deficiency of which can cause stained and lack luster hair. Thus, topical application of this oil can invigorate hair growth.

### **10. Anti-ageing Property**

The anti-ageing property of walnuts can be attributed to the presence of omega-3 fatty acids. This property enables it to work at the cellular level to prevent cell damage or cell death resulting in hairless patterns or hair loss.

### **11. Anti-fungal Properties**

The anti-fungal properties of walnut oil prevent fungal infections, thus stimulating hair growth and providing you with a clean and healthy scalp.

## **12. Walnut For heart health**

Walnuts are greatly beneficial for the heart. The presence of a larger quantity of antioxidants and also due to the presence of these antioxidants in a mixed manner; walnuts are known to be effective in greater cardiovascular functioning<sup>8-10</sup>. The presence of omega 3 fatty acids in walnuts assists in lowering of blood pressure and reduces the risk of heart strokes.

## **13. Walnut Benefits in Fight against Cancer**

A study at Marshall University School of Medicine in West Virginia found that taking around 28 walnuts everyday helps in reducing the risk in breast cancer because of the antioxidants and phytosterols provided by it<sup>11</sup>. So, walnuts are helpful in reducing breast cancers, prostate cancers and various other cancer developments mainly due to the antioxidants. The presence of omega 3 fatty acids which are known for their anti-oxidant properties, aids in cancer prevention.

## **14. Walnut Helps in Treating Type 2 Diabetes**

There is presence of mono and polyunsaturated fats in walnuts. Due to the presence of such unsaturated fats, it is known that walnuts are highly essential in reducing the type 2 diabetes<sup>12,13</sup>. These mono and polyunsaturated fats helps in insulin sensitivity.

## **15. Benefits in Providing Relaxation and Managing Stress**

Walnuts and walnut oils are essential in reducing or managing stress in a wonderful way. Some other health benefits of walnuts includes its ability in reducing obesity or prevention of excessive weight gain, better mental health benefits like benefits in reducing depression, Alzheimer's etc., helps in bone health and also the MLT or melatonin component present in walnut help in good sleep<sup>14</sup>. Walnuts are beneficial for patients diagnosed with metabolic syndromes. It is recommended that one ounce of walnuts everyday for about three months can help in treating or reducing metabolic syndrome greatly.

## **WALNUT PROCESSING REQUIREMENTS**

### **Harvesting**

Walnuts are mostly harvested by traditional methods by beating the walnut bunches lying on the branches of walnut tree. Leaning and stretching towards walnuts lying on extreme branches puts the labour at risk and in many cases results in slipping from the huge tree. The falling from tree mostly results in damage in spinal cord disabling the person for entire life and in some cases resulting in on spot death. Thus extreme care is needed to be exercised during harvesting of walnuts, it is better to use mechanical shakers which agitate the branches of walnut tree providing the desired force for dislodging walnuts, or otherwise dwarf walnut trees are to be propagated for less risk.

### **Dehulling**

The walnuts obtained after harvest are covered in black cover which needs to be removed. Most of the growers dehull walnuts by hands or foot thereby causing many skin diseases and damaging their clothes with unwanted stains. This process is time consuming and laborious. The mechanical dehuller is a better alternative for this process and is available around Rs 20000.

### **Drying**

Sometimes in order to improve the appearance of nuts, these are bleached with either alkali or acid solution. After removal of the husks, cleaning and drying, they should be stored and marketed separately to fetch a higher price. Delay in drying causes rapid loss in nut quality and makes walnuts susceptible to the mould. Drying of nuts stabilises the product's weight and prolongs storage life. Walnuts are stored in gunny bags in a small ventilated room free from excess humidity. For export purpose, these are packed in double gunny bags.

### **Grading**

Grading of any agricultural produce enhances its market value, so grading of walnut stones are necessarily to be graded. Mostly growers grade their walnuts by traditional methods of handpicking, which is cumbersome and inefficient. Low cost mechanical graders are also available for grading of walnuts at around Rs 25000. Since marginal farmers can not normally afford these mechanical gadgets, but they can approach related Government agencies for subsidy purpose so that they can have these gadgets. Different multipurpose graders have been designed at Division of Agricultural Engineering, SKUAST-K, which are suitable progressive farmers and for Industrial level.

### **Cracking**

The walnuts are then set for cracking, normally walnut cracking machines are not available in India as yet so traditional cracking is employed. The labours usually women are employed to crack by hammering walnuts and remove kernels in Walnut Industrial units. The kernels are then graded sieve based mechanical graders wherein different sieves are agitated and kernels are obtained underneath each sieve. This eliminates/removes the fine broken parts left after cracking. This broken part is used in confectionary items. The graded kernels are then graded on the basis of colour, and are finally separated by hand picking. The light colour with lesser broken parts forms the highest grade similarly other grades are identified.

### **Drying**

Walnut kernels are then set for drying; growers normally put kernels on mats in open sunshine for few days and then sell in the market. The desired moisture level is never being achieved, so these kernels usually develop fungus with time. In walnut processing Industries

the kernels are put in vertical racks heated by electrical heating system and blowing out moisture by circulating air. The moisture content is not maintained at the desired level, because they don't have that mechanism to have automation based measuring system. So the excess moisture content in kernels usually results in development of fungus, even if not visible to naked eye. This fungus deteriorates the taste and may result in health hazards if fungus level is high. So automatic moisture content measuring needs to be established, which may be achieved by a load cell put under the drying rack, and sample checked for the present and required moisture level.

### **Packing**

The dried kernels are then vacuum packed in different measures by weight as demanded by the market. These packets can preserve kernels for longer use if all the steps of processing are based on scientific methods.

### **How to Select Walnut Stones for Purchase**

In the markets, they are displayed for sale all the year round in several forms such as shelled, unshelled, salted, sweetened and ground walnuts. While buying shelled walnuts, look for plump, crisp nutmeats. Shelled nuts should be brittle, compact, and uniform in size, plus heavy in hand.

The nuts that grow on the sunnier side of the tree generally have a darker brown color and richer flavor. They should be free from cracks, molds, spots and rancid smell. While buying shelled walnuts, ensure that the shells are not cracked, pierced or stained which often indicates mold development in the nutmeat, rendering it unfit for consumption. Shelled nuts are also available in pre-packaged containers and bulk bins. While buying them, ensure that the bins containing them are covered and the store has a good product turnover to ensure their freshness. Avoid the nuts that look rubbery and shriveled as this is an indication of age. Smell the nuts, if possible, to ensure that they are not rancid.

It is advisable to buy whole unshelled nuts rather than processed ones, as the latter are often treated with ethylene gas, fumigated with methyl bromide, and dipped in a solution of glycerin and sodium carbonate to loosen their skins and then rinsed in citric acid.

### **Storage of Walnuts**

The high content of polyunsaturated fats in walnuts makes them highly perishable and hence, they should be stored with immense care. Unshelled walnuts should be kept in a cool, dark and dry place where they can last up to 6 months. Shelled kernels should be placed in an airtight container and kept in a refrigerator for up to 6 months or placed in the freezer where they will last for a year. Walnuts should be used as soon as possible as they turn rancid quickly.

### **Scientific Processing and Possible Outcome**

The quality of food products is very important for human health and must not be compromised at any cost. Healthy food makes healthy society, so this demands scientific

processing of food products. Walnuts' being considered as an important food supplement for good health, so considerable attention is needed towards the processing of walnuts and its products. The two processes that is Grading and drying are very important amongst all other processes, because these two processes are highly required for market attraction and good health consideration. So these two processes will be discussed in detail.

**Sorting/Grading:** The vision based sorting system consists of different subsystems. Fig.1 shows the different components of the sorting system. Fast single camera or multiple cameras are used to capture the image of the products. Single camera with mirrors can be used to check the different sides of the product, while multiple cameras fixed in different directions get more clear images. Usually, isolated box with lighting is used to overcome lighting variation problems and get better images. The captured images are sent to the computer to be processed and analyzed in real time. The decision, "pass" or "fail", is sent as an electronic signal to interfacing circuits. These circuits drive an electronic valve to open or close the path of the products. By closing the path, the product is pushed to "bad product" store. Finally, the high quality products only will continue to the "pass" store. Sometimes, products are classified into more than two classes. The different classes represent different degrees of quality. The vision system consists of many modules, and it is required to finish all processing in real time.

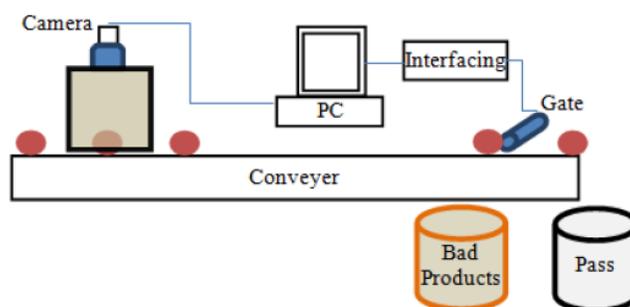


Figure 1 Sorting system

**Drying:** Maintaining moisture content in Walnuts is necessary because excess moisture content leads to the development of fungi and renders Walnuts useless thus wastage of resources. Figure 2 and Figure 3 shows vertical electrical dryers used for drying of kernels wherein temperature can be set and maintained at any desired level. But this is not going to help for reducing moisture of kernels to the recommended level of 8-10%, unless some mechanism is involved for checking the moisture level of kernels. As of now Industrial unit holders just guess about the moisture level, which can never be correct and it has been observed that the final moisture content of the dried kernels is around 20-25%, which is prone to the development of fungi. The solution to this problem can be obtained by analyzing a sample for weight basis detection of moisture content and applying same to the loaded kernels. A load cell kept under the rack for final desired moisture level. Figure 4

shows a frame containing load cell with digital display. The vertical rack can be installed over this load cell system and it can be reset when rack is empty, and then Walnut kernels will be loaded in rack which will give us the weight of loaded kernels. The display will indicate the real time loss of weight in kernels as moisture is reduced with time. The heating is continued till desired calculated weight is obtained. These kernels will be then removed and cooled before set for vacuum packing.



**Figure 2 Vertical electrical dryer**



**Figure 3 Vertical electrical dryer**



**Figure 4 Load cell with display**

## **RESULTS**

The simulation results obtained by using Mamdani Inference Engine is shown in Figure 5 and Figure 6. Triangular membership functions have been used for evaluation purpose where three classes low, medium and high have been used. The three dimensional view giving relationship between various variables obtained clearly shows that; Low moisture content and High grading results in High market value and Low moisture content and High grading results in High health benefit.

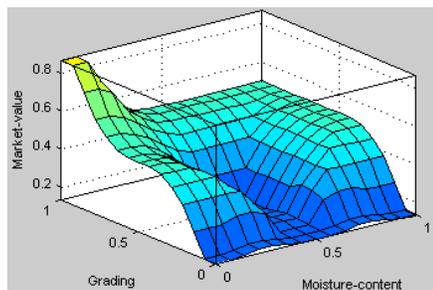


Figure 5 Grading, Moisture content Vrs Market value

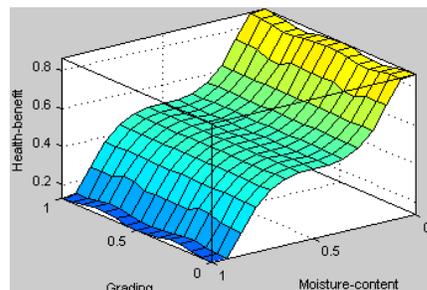


Figure 6 Grading, Moisture content Vrs Health benefit

## CONCLUSION

In order to compete at the high standard of the world level market trade our states have also to be uplifted with modern technological interventions. This can be achieved by due consideration from Governmental organizations, various schemes of the central Government, and general awareness about the benefits of post harvest processing for value addition and proportionate benefits. Since walnuts have a good demand now because of the health conscience of public, and About 7 shelled walnuts are recommended to intake everyday for optimum health benefits.

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