

MUST EAT MUSKMELON AND SEEDS

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Abstract: Fruits are generally rich in vitamins, minerals and fibres along with phytochemical constituents in least amount. The by-products of any fruit include peel and seed possess certain benefits. Mostly people don't concern about the by-products containing functional benefits. The fruit enrich with phytochemicals besides other vitamins and minerals are Muskmelon (*Cucumis melo*). The most notable citizen of America, Benjamin Franklin, a printer by profession, scientist, and philosopher by renown, once said: "Women & melons are difficult to understand". It belongs to gourd family. Every part of this fruit has huge benefits. *Cucumis melo* seed are 5% by weight contain health enhancing compounds. Phytochemical constituents include flavonoids, phenolics, saponins, alkaloids and other secondary metabolites. The oils of this seed possess high Iodine value, saponification value, fatty acid profile revealing the presence of Poly Unsaturated Fatty acids including omega - 6 (linoleic acid) and Mono unsaturated fatty acids including omega- 9 (oleic acid) and also saturated fatty acids. The entire fruit possess pharmacological effects such as anti-inflammatory, antioxidants, anticancer, antidiabetic, antimicrobial, anthelmintic, immune modulator and so on. The seeds are used in value added products. It is evident that muskmelon contain abundant medicinal values and is easily available. The present review article contains phytochemical properties, nutritional properties, medicinal values and evaluation of muskmelon seed in value added products.

Keywords: musk melon seeds, pharmacological and medicinal value.

Introduction:

No other food category offers such a diverse range of pleasant and appealing tastes. Fruits' beautiful colour appeals to both the sight and the tongue. Modern transportation and refrigeration systems allow for the availability of fresh fruit almost all year. As a result, consumption of citrus fruit has expanded significantly during the last century. Increased consumption of fruit and vegetables is advised as part of a healthy diet since they are linked to a lower risk of chronic disease^{[23][17]}.

The nutritious and therapeutic benefits of musk melon make it a gorgeous, juicy, edible, and delectable fruit. Squash, pumpkins, cucumbers, musk melons, watermelons, and gourds are all members of the Cucurbitaceae family. Muskmelon is native to India and Africa. The natural habitats in India include Punjab and Rajasthan. Muskmelon is spread as feral from cultivation. It is grown in loamy soil made of sand, clay and silt so called Medium Textured Soils, as this soil exhibits good internal and surface drainage. Though it is seasonal fruit in the period from May to September, it is available in super market throughout the year. It is grown in tropical and subtropical areas but mostly prefers hot climate^[31].

Most melons have a water content of over 90%, are low in fat, and are a good source of carbohydrates, dietary fibre, and vitamins, particularly provitamins A and C. Flavonoids and phenolic chemicals are present in the flesh. Some of the wild and vegetable variants include the steroid cucurbitacin, which gives them a bitter flavour. Essential fatty acids, vitamin E, and antioxidants are present in large quantities in the seeds of musk melon, honeydew melon, and cantaloupe. Some melons' peels have significant levels of fibre, pectin, phenolics and flavonoids, making them better candidates for use as food supplements and cosmetic ingredients. Melon has been linked to biological processes that include the suppression of the growth of some cancer cells as well as anti-oxidative, anti-inflammatory, analgesic, antiglycation, antihyperlipidemic and antidiabetic effects^{[2][38]}.

History of Muskmelon:

Linné originally described the musk melon in the year 1753 in the planetarium species. More than 800 species and 120 genera that make up the family Cucurbitaceae. Melon domestication began throughout Asia and Africa^{[12][49]}. The seeds of the melon were first grown for their high protein and fat content. Wild melon flesh was extremely thin and bitter. Wide variations in melon germplasm were caused by the choice of plants depending on consumer preferences^{[26][35]}. Asia, from the Mediterranean Sea to East Asia, is the region where the melon has witnessed the most variety. Southwest and Central Asia are the main regions for melon diversity, with China, Korea, and the Iberian Peninsula serving as subsidiary regions. According to the literature, melons have been grown and eaten for over 4,000 years. Melon was first cultivated by the Persians and Egyptians around 2-3 BCE, according to historical and ethno - botanical data, and it later expanded to other areas of the world in the 14th and 15th centuries^{[48][13]}.

Botanical Description:

Based on the amount of hair on the hypanthium, melons were separated into two subspecies: subspecies *melo*, which has hair on the hypanthium, and subspecies *agrestis*, which lacks hair. Eastern Asia, from India to Japan, is home to botanical groups that belong to the subsp. *agrestis*, while the subsp. *melo* is found in Europe and the New World^[18]. In addition to the nonsweet varieties

of chito (mango melon), flexuosus (snake melon), tibish, acidulous, conomon (oriental pickling melon), kachri, and memordica (snampmelon or Phut), sweet varieties include adana, Ameri, cantaloupe, reticulates (muskmelon), chandalak, inodorus (winter melon), casaba, ibericus, indicus, makuwa, and chinensis are sweet types and dudaim (Queen Anne's Pocket melon) has fragrance in their skin^{[20][42]}. As a result of the intermediate forms created by the hybridization between these two groups, the groups cantalupensis (cantaloupe) and reticulates (muskmelon) are combined among them since the difference between them is continuous for fruit netting^{[36][37][9]}.

Table 1: Botanical Description of Musk melon

Kingdom	Plantae
Sub Kingdom	Tracheotritonta
Super Division	Spermtophyta
Division	Magnoliophyta
Class	Magnoliophyta
Subclass	Dilleniidae
Order	Viollos
Family	Cucurbitaceae
Genus	<i>Cucumis L</i>
Species	<i>Cucumis melo L</i>

* [31]

Antioxidant Phytochemicals in Musk Melon:

It is well known that muskmelon and other melons contain a variety of compounds with antioxidant and radical-scavenging properties. Ascorbic acid, carotenoids, phenolic acids and flavonoids are a few of the powerful antioxidants. Radical scavenging activity is further aided by minute amounts of vitamin E, selenium, and fatty acids. Fruits that are frozen, air-dried, freeze-dried, and fresh have all had their antioxidant activity evaluated. Radical scavenging activity in fruit peel, pectin and seed has also been researched in addition to the edible fruit portions. When muskmelon is freeze dried, antioxidant molecules are relatively stable. According to a study on the measurement of antioxidant phytochemicals and activity after freeze-drying particular tropical fruits, there were substantial differences in antioxidant activity and content between the different fruits investigated, with the exception of muskmelon. *Averrhoa carambola L.*, *Mangifera indica L.*, *Carica papaya L.*, *C. melo L.*, and *Citrullus lanatus* (watermelon) were the fruits examined. Phenolics, ascorbic acid, and beta-carotene concentration were examined^[30].

Due to the inclusion of phenolics, flavonoids and tocopherols, muskmelon seeds are a good source of antioxidants in addition to the fruit flesh^[25]. Pectin is a complex heteropolysaccharide that was extracted from the muskmelon peel and is well-known for its antioxidant potential, among other health advantages^[27]. The pectin was identified as high methoxy pectin, which is also known for its anti-inflammatory and proliferation-inhibitory effects on a variety of cancer cells^{[44][16][14]}.

Nutritive Value of Muskmelon Seed:

The seeds are a good source of energy, carbohydrates, fat, proteins and minerals such as calcium, iron, magnesium, phosphorus and potassium^{[19][25]}. The proximate analysis (in terms of % w/w) of seed shows that it contains Carbohydrate 22.94%, protein 14.91%, Lipid 30.83%, Moisture 7.78%, Ash 4.20%, Fibre 19%^[8] compared to the proximate analysis done by Mehra et al., (2015)^[25] shows that seed contains 22.874% of carbohydrate, 32.80% of protein, 37.167% of Fat, 0.2% of Fibre, 4.801%, of Ash and 2.358% of Moisture. From this it is evident that musk melon seed acts as an instant Energy provider as it contains high source of fat, protein and carbohydrate. The majority of fatty acids nearly 84.4% were unsaturated. The contribution of mono- and poly-unsaturated fatty acids to the total fatty acids was 20.2% and 64.3%, respectively. The Iodine value is 112 and the saponification value is 210.62. Melon seed protein is loaded with aspartic and glutamic acids, similar to other oil seed proteins. Also rich in minerals namely calcium 55.392mg, magnesium 101.715mg, potassium 509.804mg, sodium 41.176mg, manganese 1.593mg, iron 4.901mg, copper 0.833mg and zinc 4.656mg^[4].

The water-soluble vitamin, ascorbic acid can also give fruits a sour flavour. Four wild types have high levels of ascorbic acid, indicating that they could be good sources of antioxidants. Melons are also renowned for having high levels of pro-vitamin A, which is found in them mostly as carotenoids. A crucial marker of fruits and vegetables' beneficial characteristics is their total polyphenol content. These phenolic substances include complex phenols, phenolic acids, flavonoids, and tannins^[11]. Ascorbic acid, flavonoids, anthocyanin, coumarins, tannins, and other polyphenols are examples of natural substances with increased DPPH scavenging action^{[43][21]}. From this it is evident that muskmelon seeds are not only rich in macronutrients but also in micronutrients and can nourish body to the fullest.

Medicinal Benefits of Muskmelon:

Melon has huge medicinal benefits as it is evidenced by its nutritional properties. Melon has the ability of ACE inhibition, NO induction and radical scavenging. It inhibits or prevents the initiation of many chronic diseases such as cardiovascular disease and cancer^[24]. Fruits with high radical-scavenging activity may reduce the risk of these diseases since free radicals start the breakdown of cellular components that results in a number of chronic diseases.

On investigating with the seed of oriental melon on suppression of alpha amylase and alpha glucosidase, the result showed that hexane extract inhibits alpha amylase and alpha glucosidase by 61.8% and 35.5% respectively to prove the effectiveness of melon

in anti-diabetic activity [6]. For better postprandial blood glucose control, the inhibition of these two enzymes could delay the release of oligosaccharides from starch. This would slow down the absorption of glucose in the small intestine [3]. In addition to that Unsaturated fatty acids that inhibit -glucosidase and -amylase include palmitic acid, oleic acid, and linoleic acid [6][34]. The levels of tissue lipid peroxidation, blood lipids, glucose, and creatinine kinase-MB were increased by the CCT diet (supplemented with 4% cholesterol, 1% cholic acid, and 0.5% 2-thiouracil), but this effect was mitigated by the fruit peel extracts of *Cucumis melo*. Additionally, musk melon boosted thyroid hormone and insulin levels, suggesting that they may be able to reduce the effects of diet-related changes in serum lipids, thyroid dysfunction, and hyperglycaemia/diabetes mellitus. The high concentration of polyphenols and ascorbic acid in the extracts may be the cause of these beneficial benefits.

The cantaloupe melon extract known as Oxykine is protected by polymeric films made of wheat matrix gliadin and is high in vegetal superoxide dismutase (SOD). In type 2 diabetic rodents, oxykine therapy reduced the acceleration and development of diabetic nephropathy. The oxykine lessened the damage to renal mesangial cells and oxidative stress brought on by diabetes. A potential strategy for preventing diabetic nephropathy may involve oxykine [29][32]. In the in vivo study conducted to test anti hypothyroidism on normal healthy and propylthiouracil induced hypothyroid Wistar albino male rat, result shows significant increase in thyroid hormones namely T3 and T4 [33].

Antioxidants are essential for lowering pain and enhancing its analgesic impact because free radicals have the potential to stimulate the pain response [28]. By preventing the production of free radicals, which can also cause inflammation, *Cucumis melo* L. demonstrated its analgesic impact. This was accomplished through a rise in the gene activity that produces pro-inflammatory cytokines such interleukin-6, tumour necrosis factor, and interferons [10]. Following inflammatory stimulation, carrageenan enhanced the concentration of leukocytes in the pleural space and raised the level of leukotriene B4 (LKB4) in the pleural exudate. Toxic oxygen free radicals would be released into extracellular space as a result of neutrophil migration to the damaged location, contributing to the pro-inflammatory situation. *Cucumis melo* L. may also enhance LTB4 levels while decreasing leukocyte inflow [28].

Cucurbitacin are tetracyclic triterpenes with high oxygen content that are mostly found in the Cucurbitaceae family. A natural anti-cancer substance called cucurbitacin B was discovered in the stems of the *Cucumis melo* plant. It has been documented that cucurbitacin B inhibits the growth of human leukaemia cells. In the leukaemia cell line K562, cucurbitacin B prevents STAT3 activation and the Raf/MEK/ERK pathway. Significant anti-tumour action is also present in cucurbitacin A and cucurbitacin E [46][5]. It has been noted that the dried pedicel of *Cucumis melo* L. enhances liver function and boosts gluconeogenesis. It offers defense against CCl4 intoxication. Jaundice, cirrhosis of the liver, and toxic and chronic hepatitis is all treated with it [46].

In dogs under anaesthesia, the diuretic properties of *Cucumis melo* L. were examined. The volume of the urine and its chloride content were both markedly elevated by an ether extract of the seeds. The higher glomerular filtration rate and reduced tubular reabsorption may be the cause of this rise in chloride concentration [47]. Juice from Musk melons can be consumed regularly to avoid hepatic steatosis and atherosclerosis. Human platelet aggregation caused by epinephrine, ADP, collagen, thrombin, sodium arachidonate, prostaglandin endoperoxide analogue U-46619, and PAF-acether was reduced by adenosine extracted from an aqueous melon extract. Musk melon's ability to do this may be useful in the treatment of cardiovascular disorders [7][1].

Bhat community uses musk melon plant for fertility treatment [22]. The seeds of *Cucumis melo* L. have demonstrated strong antibacterial and anthelmintic action when extracted with n-hexane and methanol. Another usage for cucumber melo is as a vermifuge [15][50]. SOD-rich melon extract and wheat gliadin (Glisodin®) together boosted the expression of INFgamma and IL-4 as well as type 1 helper T lymphocyte (Th1) production. However, the level of IgE (allergic) production remained low, and the level of IgA did not alter, supporting the idea that Glisodin® has immunomodulatory effects. The stimulation of antigen-presenting cells (APC) by the gliadin-SOD combination may be the cause of this reaction. Nitric oxide and H₂O₂ are released as a result of this activation, which then activates catalase and GPx and causes the development of the cytokines INF-gamma and IL-4. Then, the activated APC modifies the immune response to produce a Th1 response [45].

Muskmelon In Products:

Numerous elements, such as the production environment and the ingredients utilized, have an impact on bakery goods. Analyzing the nutritional value of seeds (including muskmelon, flax, and pumpkin seeds), these seeds were used to create the muffin and vermicelli, which was then taste-tested. The shelf life of the muffin, vermicelli, and the most acceptable product—the muffin—were the subjects of the proximate analysis. On sensory evaluation, muskmelon seed flour and oats flour in the ratio (40:20) volume was most acceptable [41]. Development of value-added product from muskmelon was done with development of muskmelon nectar by extracting pulp and prepared product according to different treatments and subjected to heat for 5 minutes and preservative of KMS at 70ppm added to finished product and filled in sterilized bottles and pasteurize for 30 minutes and cooled. The shelf life was found to be 90 days and shows good result on TSS, pH, Acidity. Nectar prepared with 15% pulp, 10° brix TSS was rated superior for overall acceptability [40].

Hamid Salari et al., (2012) [39] carried an experiment to develop squash and syrup beverage from muskmelon by blending with pomegranate. The squash prepared with 35% blended juice of composition 80% muskmelon and 20% pomegranate juice and the syrup prepared with 50% muskmelon juice and 50% pomegranate juice recorded highest scores for sensory quality with storage

period of 4 months. There is an increase in TSS, pH, viscosity, reducing sugar, total sugar with decrease in ascorbic acid and the product proved to be free from spoilage during storage.

Conclusion:

As said by the most notable citizen of America, Benjamin Franklin, a printer by profession, scientist, and philosopher by renown, "Women & melons are difficult to understand". It is no wonder to say that 'Muskmelon is a gift by nature' as it exhibits a wide range of pharmacological effect, cheapest source abundant with phytochemical properties and enriched with nutrients in all parts of the plant. Melons are locally available and due its various properties, the muskmelon can be used in various value-added products and enjoy eating Musk melon.

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