

REVIEW ARTICLE

The Nutraceutical Role of Pumpkin Seed and its Health Effect: A Review

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ABSTRACT

Pumpkin seed also known as pepita in North America, is highly nutritious and beneficial for the body. It is also called as little seed of squash. They are included among the edible parts of the pumpkin. They belong to the family Cucurbitaceae as they are extracted from pumpkins. As nutritious as they are, they provide a lot of health benefits. It has an outer shell that is highly rich in fiber. They are highly nourishing and are packed full of antioxidants. The major components recognized to provide health benefits are omega-3, omega 6 fatty acids, fiber, antioxidants, vitamins and minerals. They provide a substantial quantity of healthy fats, magnesium and zinc. Eating small amounts of pumpkin seeds can provide substantial health benefits. They are known to improve heart and prostate health, and it protects against certain cancers. They are high in minerals, including manganese and vitamin K, both of which aid in wound healing. They are also high in zinc, which helps to increase immunity. They're high in protein and include a good amount of healthful fats. Omega 6 and omega 3 fatty acids are abundant in them. The fatty acids in the pumpkin seeds contain a range of beneficial nutrients, such as sterols, squalene and tocopherols. Sterols may help to reduce the risk of heart attack and heart stroke. Also they might help lower the cholesterol levels of the body by inhibiting the outer cholesterol to enter the body. Squalene mimics skin's natural oils. Also, it is a natural antioxidant. Provides certain conditions like eczema, psoriasis, dermatitis etc. Tocopherol promotes healthy skin. Since ages, pumpkin seeds have been used in folk medicine to treat kidney, bladder, and prostate problems.

As rich in antioxidants, they reduce inflammation and protects the cells from harmful free radicals. They promote healthy glowing skin. Diets rich in pumpkin seeds are related to reducing the risk of stomach, breast, lung, prostate and colon cancers. Lignans in pumpkin seeds may play key role in preventing breast cancers. According to the research, people who consume more lignans are less prone to cancer. Pumpkin seeds may help with benign prostate enlargement and overactive bladder symptoms. Pumpkin seeds can be eaten as usual because they have a mild flavor and a nutty, crunchy texture.

Keywords: Anti-cancerous, Antidiabetic, Antioxidants, Nutrients, Seeds.

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INTRODUCTION

Pumpkin seeds also known as '*Cucurbita pepo*' belonging to the family Cucurbitaceae, is believed to a herbaceous and piquant vine.¹ There are at least 200 varieties of pumpkin. Pumpkin itself is the best fruit for diabetes. Cultivation of pumpkin seeds is widely done in North America and Mexico. The practice of cultivation of pumpkin seeds is prevailing since 1400 BC.

Pumpkin is a member of the Cucurbitaceae family and belongs to the genus *Cucurbita*. *Cucurbita pepo*, *Cucurbita mixta*, *Cucurbita maxima*, and *Cucurbita moschata* are

examples of pumpkin plant species. These plants are grown for their decorative value. However, they are mostly vegetable plants. These plants only live for a brief time. They are vines that grow on a yearly or perpetual basis. They feature large lobed leaves with branching tendrils. Large orange and yellow flowers bloom on these plants. Pumpkins are the fruits of these flowers, which have a berry-like texture. These fruits are enormous compared to others, weighing up to 34 kg. Pumpkins are also called as 'squash'.^{2,3} The stem is green-colored and is known to be a peduncle i.e. it has flowering over the main stalk of the inflorescence. In dicots, the pumpkin stem is atypical.

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The leaves of the plant is large.⁴ They are greyish to dark green in color. They are mostly round in shape. They are said to be antidiabetic and antifungal.^{5,6} Flowers grow on the vines of the plant and ultimately bear fruit. The flowers are large and are orange and yellow in color. The blooming time of these flowers are mid-June till early July. These flowers are edible and are consumed widely in India and Mexico. The flower contains important fatty acids and phytonutrients, making it likely to be a nutritious food.⁵

Seeds

They are oval and flat-shaped seeds with a green layer known as outer shell. However, these seeds are being thrown away by some people being considered as scrap. But these seeds can be consumed either in cooked (roasted) form or uncooked as in their raw form. Even today, they are being sold in sprouted or roasted forms as healthy snacks. These seeds are derived from fruit vegetable pumpkin, also called as '*Cucurbita sp.* Pumpkin seeds (*pepita*) are a great powerhouse of nutrients. It consists of various elements and is a completely perfect source of nutrients. These are sterols, fatty acids, tocopherol, selenium, carotenoids, magnesium salts,⁴ cucurbitin, phytosterols, amino acids, β -tocopherol, squalene (1), phytoestrogens. Thus, they are known as phenolic compounds or secondary metabolites due to their capacity of being antioxidative and enormously nutritive and nutraceutical. They are easy to incorporate into our daily diet. They can be eaten as a snack. They can be roasted and seasoned. They can be added to the smoothies as well.

Traditional Uses

In history, pumpkins were used as functional food and medicine. In countries like Bulgaria, Turkey, China, Ukraine, Argentina, Mexico, India, and Brazil, pumpkins were used as medicine. Even today, they are being used to treat enlarged prostates.² pumpkin seeds are also known to be diuretic and antihelminthic.^{2,7} They treat intestinal worms, motion sickness, nausea, impotency, swollen prostate, and dribbling urination. These seeds are also useful in the treatment of urinary tract infections. In children, these seeds have been approved for treating irritable bladder and the problem of bedwetting in children.² Addition of pumpkin seeds in daily diet has proved to be very beneficial for those suffering specially from diabetes¹¹ and certain cancers.⁸⁻¹² According to research by Gossel-Williams (2008), extracts of these seeds have been noticed to increase uterine weight, mammary gland, bone density and even they are believed to prevent hyperlipidemia. These seeds play vital role in boosting immunity. As it contains zinc, zinc is known to improve fertility in men and in pregnancy, it leads to the baby's healthy growth. They are rich sources of unsaturated acids like palmitic, stearic, oleic and linoleic acid.

Phytonutrients in Pumpkin Seeds

Phytosterols, saponins, phenolics, and soluble fibres are present in pumpkin seeds. Phytosterols have the hormone mocking property.¹³ So also they are used in benign hypertrophic prostate disease in which they stop testosterone to convert into dihydroxytestosterone.¹³ Pumpkin seeds also have carotenoids

which are very beneficial for eye diseases, heart diseases and cancer.¹³ In addition, pumpkin seeds contain phenolic acids hydroxybenzoic, caffeic, coumaric, ferulic, sinapic, protocatechuic, vanillic, and syringic acid; and the lignans pinosresinol, medioresinol, and lariciresinol.¹⁴ Some supportive-health phytosterols, such as beta-sitosterol, sitostanol, and avenasterol are also present in pumpkin seeds.¹⁴ Minerals like phosphorus, magnesium, manganese, and copper are present in rich amount in pumpkin seeds.¹⁴ Other minerals like zinc and iron are also present.¹⁴ Pumpkin seeds are also a very good source of protein. Widely covered nutrients in pumpkin seeds are phytoestrogens, topocopherol and fatty acids. All of these nutrients have ample amount of health benefits on the body.

Physiochemical Properties

These are the chemical properties of a substance that can not be changed without changing the chemical identity. These properties play important role in benefiting health. As per the findings, the seeds contained 41.59 oil and 25.4% protein.¹⁵ The seeds' moisture, crude fiber, total ash, and carbohydrate contents are 5.2, 5.34, 2.49, and 25.19%, respectively.¹⁵ Considering every species/varietal of the pumpkin seeds, fatty acids, topocopherol, sterol and phytoestrogen were found to be similar, not ignoring the other contents like protein, minerals and the estrogenic effect it has on the body.

Omega fatty acids are polyunsaturated fatty acids characterized by the presence of double bond, n atoms away from the terminal methyl group in their chemical structure. Pumpkin seeds contain omega 3 and omega 6 fatty acids. They themselves have very powerful health benefits.

The most famous species of pumpkin seeds having wide number of research is *C. pepo* L. The second most popular species of pumpkin is *Cucurbita maxima*.¹⁶ They are rich in antioxidants and vitamin E like α -tocopherols, γ -tocopherols and carotenoids, and also are rich source of polyunsaturated fatty acids. Palmitic acid, stearic acid, oleic acid, linoleic acid, and phytoestrogens and phytosterols such as daidzein, genistein, secoisolariciresinol and some of the trace components. According to researches over the different varieties of *Cucurbita* seeds, the studies shows that it has great number of health benefits over human body.¹⁷⁻²⁰

High Fibre Content

Pumpkin seeds are good source of dietary fibre 28 gm of pumpkin seeds provides 1.1 gm of dietary fibre. They are known to promote good digestive health and are associated with reduced risk of obesity. Obesity is a condition where there is an excessive amount of body fat. As high fibre diets help in maintaining obesity.²⁰

Rich In Omega Fatty Acids

Fatty acids abound in pumpkin seeds. The presence of a double bond n atoms distant from the terminal methyl group in the molecular structure of omega fatty acids distinguishes them from other polyunsaturated fatty acids. Omega 3 and omega 6 fatty acids are found in pumpkin seeds. They have a lot of health benefits on their own.²¹

Omega 3: They fight depression, anxiety, improve mental disorders,²² and improve eye health.²³ Brain health is promoted during pregnancy and early life,²⁴ heart diseases are prevented and risk's reduced.²⁵ Seen that asthma and symptoms of ADHD in children is also reduced.²⁶ Reduce symptoms of metabolic syndrome.²⁷ Omega 3s can also fight inflammation.²⁸ They can fight autoimmune diseases.²⁹ Helps fighting age related mental disorders and Alzheimer's disease.³⁰ Liver fat is reduced.³¹ They may improve bone and joint health. They also may alleviate menstrual pain. They improve sleep and are good for skin.

Omega 6: They play an effective part in brain function and the normal growth and development of the body and brain. They also help stimulate skin and hair growth. Bone health is being maintained. Also, they maintain the reproductive system.

Health Benefits

known to be the power house of nutrients, pumpkin seeds have ample health benefits on our body. They have various positive traits, from lowering blood sugar levels to reducing the risk of certain cancers. They are rich in omega fatty acids, and minerals like zinc, potassium, magnesium etc. They also have phytoestrogen and possess estrogen like properties. The benefits are as followed:

Antidiabetic

Diabetes occurs when blood sugar levels are very high. It is of two types- insulin-dependent diabetes mellitus- also known as juvenile diabetes. Here insulin production is either in negligible amount or no production at all and in non insulin-dependent diabetes mellitus either the product is zero or the insulin is being rejected by the cells, due to which glycogen reservoirs are being broken down to make glucose causing bad effects over health. In both of cases, sugar levels will go high in the blood. Due to rise in glucose levels, body undergoes many issues. Pumpkin seeds reduce down blood sugar levels in body.¹¹ They have high amounts of magnesium, which helps control blood sugar levels.^{17,18} So pumpkin seeds help in preventing diabetes, thus lowering down the risk of being diabetic.^{11,18} So including them in diet will be very beneficial for those suffering from diabetes.

They are known to have a beneficial effect on diabetes due to their high magnesium content. Magnesium-rich diets were linked to a 33% lower incidence of T2D in males and a 34% lower risk in women in observational research of over 127,000 adults.

Managing Hypertension

Hypertension is defined as the rise in blood pressure, leading to further diseases. So, it is very important to control this. Due to the presence of high content of magnesium, pumpkin seeds control blood pressure levels, thus preventing hypertension.^{19,20} High magnesium intake leads to control of BP.²¹

Estrogen-Like Behaviour

Pumpkin seeds contain phytoestrogen. Phytoestrogen are those compounds that have estrogenic-like effects over the body.

Estrogen is derived from plant sources. Due to its ability to bind with the estrogen receptors, the estrogen hormone plays a key role in maintaining the cycles in the female body. It is one of the main hormones of female body. Estrogen regulates the menstrual cycle, reproduction and secondary sexual characteristics of the female body. Moreover, it also affects bone density and transports cholesterol in the body.³² Estrogen also regulates lipid metabolism.³³ They balance the HDL, LDL and plasma lipids by stopping cardiovascular outcomes. Also it regulates the development of the mammary gland and epithelial cells of uterus. Thus, these phytoestrogens and tocopherols present in pumpkin seeds, especially in the oil, have proven to be very beneficial for the females. They are the natural source of estrogen.

Anti-Cancerous

Pumpkin seeds are known to treat and reduce the risk of certain cancers such as stomach, lungs, breast, prostate and colon cancer.³⁴

Prostate cancer: due to the change of DNA, cells in the prostate develop, especially in women, it has been found that in postmenopausal women, they tend to reduce risk of breast cancer³⁵ and also in the treatment.³⁶ It has been said so because the phytoestrogens present in the seeds stimulate estrogen-like behavior, which impacts the proliferation of the cells, contradicting the statement. Still, it helps to prevent breast cancer due to the estrogenic-like effect only. Moreover, the lignans found in these seeds are also held responsible for preventing and treating breast cancer in women.¹⁰

Furthermore, they also help treat prostate cancer as they can slow down the growth of these cancer cells.^{36,37} According to the research, people who consume more lignans are less prone to cancer. They help by blocking those enzymes involved in hormone metabolism and tumor cell growth and spreading. Studies have also shown that supplements containing pumpkin seeds can slow down prostate cancer cells.

Ample of Antioxidants

Pumpkin seeds are rich in antioxidants like carotenoids like beta carotene and vitamin E.³⁸⁻⁴⁰ Carotenoids are pigments produced by some plants and algae, but they act as antioxidants in humans. They have ample amount of health benefits on the human body. They enhance our immune system too. Some free radicals harm the human body. Antioxidants are known to prevent this harm. Thus, they protect us from different diseases especially certain cancers and eye diseases.⁴¹ Carotenoids get converted into carotene. Carotene is very essential for our eye health. It keeps our eye health and protects from eye diseases like cataracts etc.. Also they reduce inflammation. According to a study, pumpkin seed oil reduced inflammation in rats suffering from arthritis.⁴²

Enhances Bladder And Prostate Health

Benign prostatic hyperplasia is a condition where prostate gland enlarges. According to the studies, pumpkin seeds have been proven useful in reducing the symptoms of BPH.^{38,43} Pumpkin seeds also improve bladder health. According to

studies, they have improved urinary function in both men and women.⁴⁴ Though the oil extracted from pumpkin seeds have been proven essential for managing benign prostatic hyperplasia. The effect was directly proportional to the dose of the seed oil.

Keeps Heart Healthy

Pumpkin seeds have ample omega fatty acids, magnesium, zinc and antioxidants.⁴⁸ They provide good cholesterol to the body. They lower the high blood pressure and high cholesterol levels, reducing the risks of heart disease. Other research suggests that pumpkins' potential to enhance nitric oxide production in the body may be responsible for their heart-health benefits. Nitric oxide aids in the expansion of blood vessels, boosting blood flow and lowering the risk of plaque formation in the arteries.

Improves Sleep

Pumpkin seeds are the natural source of tryptophan. Tryptophan is an amino acid that promotes sleep. Studies suggest that eating around 1 gm of tryptophan daily improves sleep.⁴⁹ In addition, pumpkin seeds are an excellent source of magnesium. And it has been said that magnesium levels affect sleep.⁵⁰

Nutraceutical Role

Pumpkin seeds are consumed widely as both food and medicine. They have bioactive compounds with promising benefits like antidiabetic, anti-cancerous, antitumor, antidepressant, antioxidant, and more. They show the potential of both traditional and functional food. Pumpkin seeds contain a significant amount of vitamins and minerals. Pumpkin seeds' low sodium and high potassium concentration gradient improves cardiovascular health. Pumpkin seeds contain a phenyl hydroxyl group which prevents the oxidation of some harmful radicals. Pumpkin seed oil can be used in baking. Also, its flour can be used in baking. Also the nutrients from the oil can be used in capsules for those who cannot eat them. Moreover, as it has minerals and vitamins, the oil can be used in cosmetic products to promote good skin and hair.

CONCLUSION

The conclusion we derive through all of this is that pumpkin seeds are the great power house of nutrients. They have ample amounts of health benefits. They act as pharma and nutraceutical product in the treatment and reducing risks of certain diseases. They are a great reserve of antioxidants, vitamins, minerals, protein, omega fatty acids and other valuable nutrients. Antioxidants reduce inflammation and provides protection against certain diseases and improve eye health. Although they are small, they are little powerhouse of nutrients and health benefits. They are a great source of protein and unsaturated fats. They also have ample of iron, calcium, B2, folate and beta-carotene, which the body converts to vitamin A. They are rich in omega 6 and omega 3 fatty acids. The fatty acids in the pumpkin seeds contain a range of beneficial nutrients, such as sterols, squalene and tocopherols. Sterols may help to reduce the risk of heart

attack and heart stroke. Also, it lowers down the levels of bad cholesterol. Pumpkin seeds reduce the risks of certain cancers such as stomach, breast, lung, colon and prostate cancers. It has been seen that it reduces the chances of breast cancer in postmenopausal women. They are rich in protein. Studies suggest that pumpkin seeds are known to balance blood sugar levels. Also, they are very helpful in obesity and improve bladder health. People with urinary bladder diseases have found positive results after consuming pumpkin seeds. People with health issues like obesity, diabetes, and hypertension find it difficult to have a healthy way of snacking. Whereas pumpkin seeds completely fits in. Summing up their benefits-they are antidiabetic, anti-cancerous, fights depression and anxiety, improve heart health, have ample amount of antioxidants and vitamin E that promotes healthy skin and improves eye health. They help treat prostate cancer and keep the urinary bladder healthy. It improves sleep and contains ample minerals like phosphorous and zinc, strengthening the immune system. They also have nutraceutical potential and were used as a traditional herb to treat diseases and improve health. Nonetheless, pumpkin research gives little evidence to support ethnomedical practice's conventional views.

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