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Seed to Wellness: The Therapeutic Potential of Pumpkin Seeds

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Abstract: ***Pumpkin (Cucurbita maxima), belonging to the family Cucurbitaceae, is a well-known edible plant, cultivated and abundantly used as herbal medicine and functional food. Pumpkins have long been used in traditional medicine to treat a wide range of conditions, including intestinal parasites, tumors, hypertension, arthritis, hyperglycemia, inflammation, dyslipidemia, and bacterial or fungal infections.***

This has led to increased interest in studying both the fruits and seeds of pumpkins Pumpkin is a well-known, nutrient-dense, versatile food that has recently allowed scientists to explore new possibilities for study. The flesh, seed, and peel of the pumpkin fruit are rich in primary and secondary metabolites, including proteins, carbohydrates, monounsaturated and polyunsaturated fatty acids, carotenoids, tocopherols, tryptophan, and delta-7-sterols, among many other phytochemicals. Rich sources of minerals, oils, proteins, and carbohydrates can be found in pumpkins. Pumpkin fractions have been found to contain certain classes of phytochemical compounds, such as phenolics, flavonoids, tocopherols, carotenoids, terpenoids, cucurbitacin, moschatin, and phytosterols.

To evaluate these medicinal properties, numerous investigations using cell cultures, animal models, and clinical trials have been conducted. Pumpkin is accepted due to its edible fruits, seeds, and greens. Nowadays, pumpkin seeds are frequently utilized as an herbal remedy and health enhancer for both humans and animals. Food scientists supply the food for healthcare sectors with pumpkin-infused goods. As a result, food producers have made an effort to increase the number of appetizers, baking, and snack applications for pumpkin seeds. This review article sheds light on the potential mechanisms that may lessen the likelihood of a variety of issues as well as the pharmacological properties of pumpkin seeds . The goal of this research is to compile evidence-based data from electronic databases about the possible use of pumpkin seeds as a functional food ingredient and related biological processes.

Keywords: Curcurbitaceae, Primary and Secondary Metabolites, Health Enhancer, Diseases.

I. INTRODUCTION

If you're looking to meet your protein needs while following a vegetarian diet, pumpkin-seed protein might be a valuable addition to your meals. Pumpkin-seed protein could be an excellent source of high-quality protein. It contains all the essential amino acids you need, making it a fantastic alternative to meat-based protein sources.

- Dr. Smita barode, B.A.M.S, M.S.

Cucurbita sp. is a fruit-vegetable hybrid native to the western hemisphere, this species of plant is easily grown in tropical Asia as a dietary supplement . Scientists have been researching the molecular-level impacts of different nutrients on several fatal and chronic illnesses over the past few years. People can adapt to various environments and habitat changes because a variety of nutrients can affect the molecular natural mode of many genes.

In another way, nutrients cause molecular modifications. Scientists research to treat and prevent illnesses by using appropriate foods instead of pharmaceuticals. Furthermore, research has shown that treating illnesses with a healthy diet is a sensible and affordable option. Scientists are becoming more interested in pumpkin seeds because of their nutritional profile of Cucurbita maxima Duchesne, and Cucurbita moschata Duchesne of pumpkin species. Because of its anti-inflammatory, antioxidant, antiviral, and antidiabetic characteristics pumpkin is used as medicine in many nations, including Austria, Hungary, Mexico, Slovenia, China, Spain, and several other European, Asian, and African nations.

Pumpkin is farmed for its peel, flesh, and seeds throughout the world. The seeds are often big and contain a lot of monounsaturated and polyunsaturated fatty acids. A lar matrix is composed of linoleic acid, oleic acid, palmitic acid, ECN-44, ECN-46, tocopherols, beta-sitosterol, and delta-7-sterols.

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A. Taxonomy Classification

KINGDOM	PLANTAE
DIVISION	Tracheophyta
CLASS	Magnoliopsida
ORDER	Curcurbitales
FAMILY	Curcurbitaceae
GENUS	*Curcurbita L.*
	Argyrosperma
	Digitata
	Ficifolia
	Foetidissima
SPECIES	*Maxima*
	Moschata
	Okeechobeensis
	Palmata
	Pepo

II. VARIETIES OF PUMPKIN

1) Ficifolia (chilacayote squash and Malabar gourd)
2) Maxima (Hubbard, buttercup, and winter squashes)
3) Argyrosperma (cushaw squash)
4) Moschata (Shaker town Field and Long Island Cheese pumpkins)
5) Pepo (jack-o'-lantern varieties, delicata squashes, ornamental gourds

III. MEDICINAL USES OF PUMPKIN.

a) Nutritional important
b) Antioxidant activity
c) Anti-inflammatory
d) Prevent Chronic diseases such as type 2 diabetes and heart disease
e) Anti-cancer property

Pumpkin seeds are an excellent source of iron, magnesium, healthy lipids, and other minerals to enhance the heart and bone health. Also, they contain high levels of antioxidants like beta carotene and selenium as well as polyunsaturated fatty acids. Iron content in one cup of pumpkin seeds is 9.52 mg, which is a postmenopausal women and 18 mg for premenopausal women. Also, pumpkin seeds include zinc, phosphorus, manganese, protein, and fiber.

The pumpkin seed oil has a relatively low fatty acid content, mostly consisting of the essential fatty acids: Oleic, palmitic, stearic, and linoleic acids, which together account for approximately (98 ± 0.13%) of the total amount of fatty acids. Additionally, phytoestrogens, and phytosterols including daidin, genistein, secoisol, ariciresinol, and β-sitosterol are included. Increased concentrations of certain non-triacylglycerol components, such as tocopherols, which are essential in preventing the production of free radicals in biological systems, are also present in pumpkin seed oil. The procedures used for processing pumpkin seed oil extraction have a significant impact on tocopherol.

Pumpkins are commonly eaten in the US for Thanksgiving feasts, they are often packed into pie mixes or canned pumpkins, but the large, flat, oval seeds were once thrown away as organic matter. Follow pumpkins are annual creepers or trailing plants that grow from sea level to the highest peaks; their cultivation has spread from northern Mexico to Chile and Argentina and eventually to Europe, Asia, especially China and India, and Western America.

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IV. ANTI-CANCER PROPERTIES

There is a strong correlation between cancer and a diet high in oxidants and antioxidants. Given that oxidative stress is linked to cancer, diet has the potential to either enhance or aggravate the illness. According to a GLOBOCAN report, The PMC website provides information on the nutritional value, phytochemical potential, and therapeutic benefits of pumpkin (Cucurbita sp.).

There were 18.1 million cases of cancer in 2018 and 9.6 million deaths from the disease are expected in 2019. While breast, lung, and prostate cancer are more prevalent in industrialized nations, stomach, cervical, and liver cancer rates are higher in less developed nations.

Numerous studies have investigated the anti-cancer potential of pumpkin. According to reports, eating pumpkin seeds inversely correlates with the chance of developing many cancers, including lung, breast, and rectal cancer. According to reports, prostate cancer is the most common cause of death in America among all cancers. A randomized, double-blind investigation on the relationship between saw palmetto and pumpkin seed oil and prostate cancer was carried out in 2009. 47 patients, average age of 53.3, were split up into groups for this study. It was determined after three months that the blood prostate-specific antigen was lowered when palmetto oil and pumpkin seed oil were combined. To prevent testosterone-induced hyperplasia of the prostate, an oral dose of 20–40 mg/kg of pumpkin seed oil is thought to be effective for treating hyperplastic prostate glands for 20 days. It has been observed that terpenoids and triterpenoids possess cytotoxic properties that are anti-tumor. Cucurbitacin B (CuB) and cucurbitacin 163 E (CuE) are two subclasses of cucurbitacin, a class of tetracyclic triterpenes. CuE is said to possess both antitumor and anticancer effects. CuE inhibits prostate cancer cells through actin and vimentin structural disruption. Using the JAK/STAT, PARP, and MAPK pathways to induce apoptosis, curcumin demonstrates anticancer effects.

A. Role in Breast Cancer

The effect of phytoestrogens on hormone-dependent cancers is debatable. Previous investigations using rat models of breast cancer have demonstrated that treatment with pumpkin seed extract can increase the production of estradiol and improve the condition of the estrogen receptor (ER)-α/ER-β/progesterone receptor (PR) on MCF7, BeWo, and JEG3 breast cancer cells. Richter et al. [28] found that MCF7, BeWo, and Jeg3 cells produced more estradiol in a dose-dependent manner during this search. A significant downregulation in ER-α and an overexpression in PR were seen, especially in MCF7 cells. These findings suggest a possible use of pumpkin seeds in the therapy or prevention of breast cancer.

B. Estrogenic Effects

Effects similar to those of estrogen ,a polyphenolic component known as phytoestrogen possesses estrogenic-like qualities due to its binding capacity to the estrogen receptor. It has been established that pumpkin seed oil contains significant amounts of phytoestrogens and sterols, such as lariciresinol and secoisolariciresinol. Giving hypercholesterolemic rats pumpkin seed oil has significant hepatoprotective and anti-atherogenic effects. Additional research revealed that pumpkin seeds maintain their estrogenic-like properties, including bone remodeling, regulation of lipid metabolism, and improvement of uterine and mammary gland epithelial cells. This is because phytoestrogen compounds play a critical role in suppressing cardiovascular issues and regulating blood lipid levels.

C. Enhances Sleep Quality

Tryptophan, an amino acid found in pumpkin seeds, aids with sleep. It comes before melatonin and serotonin. Melatonin and serotonin both contribute to sleep induction.

D. Beneficial for Strong Bones

Magnesium is abundant in pumpkin seeds. Magnesium promotes bone strength and growth. People who consume large levels of magnesium in their diet have been found to have higher mineral densities in their bones. By doing this, dangers like osteoporosis and bone fractures are reduced. Increased inflammation has also been connected to low magnesium levels. Low blood levels of calcium are another consequence of magnesium insufficiency. Up to 262 milligrams of magnesium can be found in every 100 grams of pumpkin seeds. This is sufficient to meet 65% of your daily magnesium needs.

E. Enhances the Sperm Quality

Zinc content is high in pumpkin seeds. Men's fertility is enhanced by zinc. Both the number and quality of sperm are increased, along with the levels of testosterone.

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F. Beneficial for Pregnant

Because pumpkin seeds have a high zinc content, they can be beneficial during pregnancy. Zinc strengthens immunity and promotes a baby's healthy growth. Eating meals high in zinc is good during pregnancy.

G. Reduces Anxiety and Depression

Pumpkin seeds contain magnesium, which lowers tension and anxiety. Also, it relaxes our minds.

H. Antimicrobial

Studies using cell cultures have shown that pumpkin seed extract has promising antibacterial action against a variety of microbiological species. Effective antibacterial activity of the seed extract has been shown against Escherichia coli, Klebsiella pneumonia, Pseudomonas putida, Pseudomonas aeruginosa, Bacillus subtilis, Staphylococcus werneri, and Pseudomonas aureus. Moreover, the mycelial growth of the fungus Botrytis cinerea, Fusarium oxysporum, Mycosphaerella arachidicola, and Mycosphaerella, oxysporum is inhibited by cucurmoschin, an isolate of pumpkin seed protein. Antifungal proteins' ability to block translation most certainly contributes to at least some of their antifungal properties. It is clear from the results that the protein from pumpkin seeds appears to be efficient against the tested gram-positive. Reference for Model Dosage Significance. The potential of pumpkin seeds as a useful component in food: An analysis - microorganisms and is less effective against gram-negative bacteria. El-Aziz and others found that because of their cell wall lipopolysaccharides, which may keep these active substances from penetrating gram-negative bacteria's cytoplasmic membrane, gram-ve bacteria are more resistant to the antibacterial effects of oil and protein than gram +ve bacteria.

I. Liver Disease Preventive Properties

Pumpkin has been proven to protect the liver by multiple groups of researchers in the past. A low-protein diet was given to male Sprague Dawley rats for five days to induce liver failure as part of a 2005 study. After receiving CCl4 injections, the four liver enzymes aspartate transaminase (AST), alkaline phosphatase (ALP), alanine transaminase (ALT), and lactate dehydrogenase (LD) all showed significantly increased levels. When pumpkin seed protein isolate was given to one group, the levels of the two aforementioned enzymes decreased, indicating that pumpkin may help treat liver dysregulation. The same outcomes as well as antioxidant effects were observed in a similar trial conducted a year later (2006).

Furthermore, to become widely utilized as a sweetener in over 60 nations around the world, aspartame has also been linked to hepatotoxicity, which impairs liver function. An investigation into the impact of pumpkin seed oil (PSO) on aspartame was carried out. It has been reported that supplementing PSO with water at a dose of 4 mL/kg for four weeks may reduce aspartame's harmful effects and safeguard the liver. Albumin, globulin, ALP, ALT, AST, bilirubin, and PSO were all maintained by this PSO supplementation. Furthermore, compared to bound polyphenols, free polyphenols from pumpkin are recognized to have the most hepatoprotective qualities.

J. Cardiovascular Disease

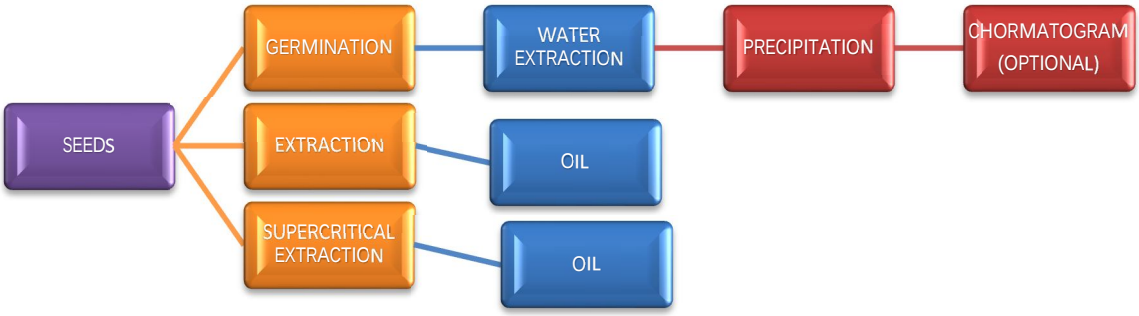
A lot of studies have been done on the Cucurbitaceae species, which is part of the Mediterranean diet, to better understand its relationship to CVD. According to reports, saturated fats increase the risk of heart disease, but unsaturated fats reduce it (Demaison and Moreau 2002). Based on these findings, a study was carried out wherein an increase in HDL and a decrease in LDL were associated with a diet rich in mono and polyunsaturated fatty acids. Based on the available data, a follow-up study was carried out in 2011 to evaluate the impact of olive and pumpkin oils on serum lipoprotein levels because of their high MUFA and PUFA contents.

V. NUTRITION COMPOSITION OF PUMPKIN SEEDS

Constituents	Health benefits
Tryptophan	Act as natural sleeping pills
Omega-3 Fatty Acid	Support heart health and lowers LDL levels
Cucurbitacin	Helps in prostate health
Cucrbitin	Eliminate intestinal worms

Seeds Oil	Broad spectrum antimicrobial activities & Prevention of arthritis
Moschatin	Anti-carcinogenic
Vit A and E	Prevent prostate cancer
Potassium	Prevent kidney stones
Essential Fatty Acid	Promotes collagen formation
Peptide	Antifungal

Fig:- Extraction of Bioactive Components from Pumpkin Seeds.



VI. PUMPKIN SEEDS SIDE EFFECTS

1) Allergies
2) Gastro-Intestinal Issue
3) Weight Gain
4) High Oxalate Content
5) Potential For Contamination
6) Blood Thinning

A. Allergic Responses

A pumpkin seed allergy is quite uncommon. Only a small number of cases involving individuals aged 3 to 70 have been documented. Reactions range in severity from minor to severe.

B. Potential drug Interactions

Pumpkin seeds are high in vitamin K, omega-3 fatty acids, and magnesium, and they also have diuretic effects.

VII. CONCLUSION

Pumpkin (Cucurbita maxima), belonging to the family Cucurbitaceae, is a well-known edible plant, cultivated and abundantly used as herbal medicine and functional food.

The cultivation of pumpkin seeds is practiced in tropical and subtropical regions. Three major varieties, Cucurbita pepo, Cucurbita maxima, and Cucurbita moschata are produced in larger quantities. Previous studies indicate the significant function of pumpkins in the management and treatment of anxiety, diabetes, cancer, liver illnesses, and cardiovascular diseases.

Researchers have also reported the medicinal use of cucurbit species for their anti-inflammatory, antibacterial, antioxidant, and anti-ulcerative activities.

These pharmacological actions have been correlated with phytochemicals found in pumpkin peel, flesh, and seeds, such as phenols, flavonoids, carotenoids, terpenoids, peptides, polysaccharides, vitamins, and minerals.

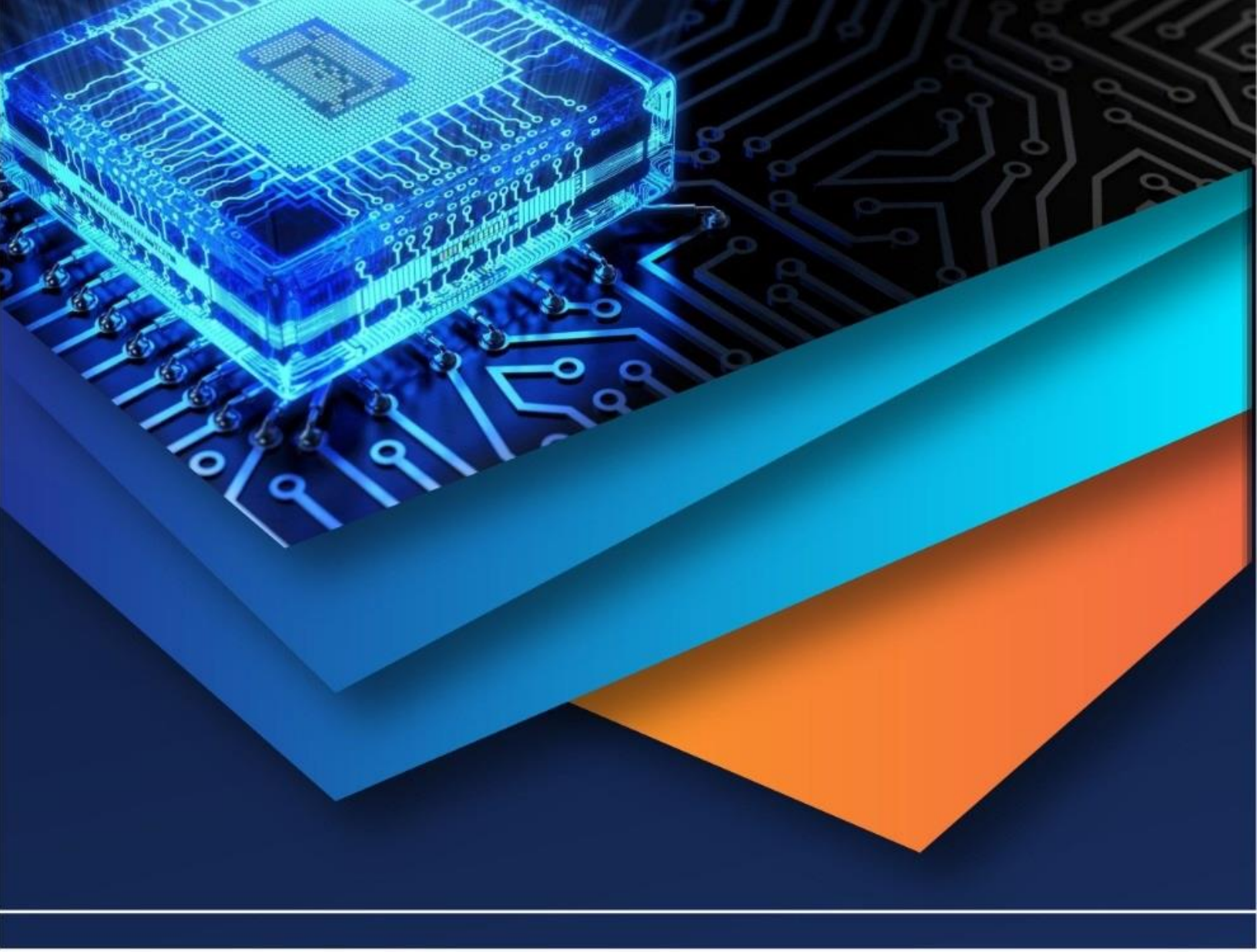
To encourage individuals to include these in their regular diet, further research and education on their therapeutic and nutritional benefits is essential.

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