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PHYTOCHEMICALS AND PHARMACOLOGICAL POTENTIALS OF CUCURBITA MAXIMA: A REVIEW

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ABSTRACT:

In ancient literature, we find references to the therapeutic use of about 500 plants; indigenous medical practices make use of about 800 plants. The pumpkin plant (*Cucurbita maxima*) is a creeper that is commonly seen growing on the rooftops of homes in India. Seeds, pulp, and fruit stalks are all put to good use. In addition to its potent antioxidant properties, pumpkin seed oil has been lauded for its ability to treat a variety of medical conditions, including but not limited to the prevention and reduction of prostate growth and size; the reduction of bladder and urethral pressure, the improvement of bladder compliance; the alleviation of diabetes by promoting hypoglycemic activity; and the reduction of gastric, breast, lung, and colorectal cancer. Chemical compounds can be extracted from seeds, including 24-ethyl-5-cholesta-7,22-trien-3-ol, 24-ethyl-5-cholesta-7,25-dien-3-ol, avenasterol, spinasterol, 24-dihydrospinasterol, 24-methyl lathosterol, and 25(27)-dehydrofungisterol. From the seeds, I extracted 25-(27) dehydroporiferasterol, clerosterol, isofucosterol, stigmasterol, sitosterol, campesterol, and codisterol. Traditionally, it has been utilized in headaches, nerve pain, inflammation, abscesses, and boils etc. Different parts of *C. maxima* have been evaluated for numerous pharmacological activities i.e., anticancer, anti-obesity, antidiabetic, hepatoprotective, diuretic, antioxidant, immunogenic, cardiotoxic, antidepressant, hypolipidemic, antiarthritic and antifungal. Seed extract from the Saw Palmetto plant is used to treat benign prostatic hyperplasia, sometimes in combination with other botanicals in order to cure prostate cancer. In conclusion, the pumpkin plant is highly promising in the coming era with diverse nutritional and pharmacological properties.

Keywords: *Cucurbita maxima*, pumpkin seeds, phytoconstituents, anti-inflammatory activity.



INTRODUCTION

In ancient literature, we find references to the therapeutic use of about 500 plants; indigenous medical practices make use of about 800 plants. India is home to an abundance of plants that can be used in alternative medicine [1]. Even though around 80% of the global population relies on traditional medicines for basic health care, WHO has not thoroughly reviewed them. However, in 1991, WHO established criteria for evaluating herbal medicines. The need for standardization in herbal medicine is discussed [2]. Some herbal constituents' safety has been questioned as of late due to reports of unwanted side effects and, more recently, evidence of clinically significant pharmacological interactions between herbs and pharmaceuticals [3]. However, interest in using herbs for therapeutic purposes has increased dramatically over the past few decades. Because of its all-natural origin and low risk of adverse consequences, it is gaining favour in both underdeveloped and industrialized nations [4].

The pumpkin plant (*Cucurbita maxima*) is a creeper that is commonly seen growing on the rooftops of homes in India. Seeds, pulp, and fruit stalks are all put to good use. Pumpkins can yield enormous fruits that weigh up to 20 pounds. The "Arka Chandan" cultivar, originally from the Indian institute of horticultural research at Hesaraghatta, produces medium-sized fruits that weigh between 2 and 3kg and have flesh that has an orangey colour. Many different plants have already been employed as nootropics. Some component in *Cucurbita maximus* may also be responsible for its memory-improving effects [4]. The seeds of the pumpkin, which are rich in medicinally useful compounds, have a long history of use in herbal, therapeutic, and even clinical contexts. The oil extracted from pumpkin seeds has been used as a nervine tonic and as a safe deworming agent [5].

In addition to its potent antioxidant properties, pumpkin seed oil has been lauded for its ability to treat a variety of medical conditions, including but not limited to the prevention and reduction of prostate growth and size; the reduction of bladder and urethral pressure; the improvement of bladder compliance; the alleviation of diabetes by promoting hypoglycemic activity; and the reduction of gastric, breast, lung, and colorectal cancer. The pumpkin is grown in almost every warm climate, including India [6].

Synonyms

English: Pumpkin red gourd, Red gourd pumpkin, Squash Gourd Squash melon, Winter squash

Malyalam: Mathan Mathanga

Plant Description

The leaves of a pumpkin are oval in shape, without any sharp points or numerous lobes, and they have a deep sinus at their stems. Pumpkin stems tend to be tougher, pricker, and more angular (at about a five-degree angle) than squash stems, which tend to be softer, rounder, and more flared at the point where they are attached to the fruit [7].

The pumpkin might be round, oblong, or anything in between. The rind is typically smooth and mildly ribbed. Pumpkins are typically orange or yellow, although other colors, including dark green, pale green, orange-yellow, white, red, and grey, have been spotted on some of the fruits.

A deep sinus at the base and an almost round shape characterizes the leaves. Typically, the corolla will have a tube with parallel sides or a bulge at the base, and the peduncle will be short, spongy, and nearly cylindrical, without any expansion at the point of attachment to the fruit [8].

Taxonomy

Division: Spermatophyta

Sub-Division: Angiospermae

Class: Dicotyledonae

Sub-Class: Polypetalae

Series: Caliciflorae

Order: Passiflorales

Family: Cucurbitaceae

Genus: *Cucurbita*

Species: *maximus*



Leaves & flower



Fruit



Seeds

Fig 1. Depiction of diverse parts of *C. maxima*

Chemical Constituents

Chemical compounds can be extracted from seeds, including 24-ethyl-5-cholesta-7,22-trien-3-ol, 24-ethyl-5-cholesta-7,25-dien-3-ol, avenasterol, spinasterol, 24-dihydrospinasterol, 24-methyl lathosterol, and 25(27)-dehydrofungisterol. From the seeds, I extracted 25-(27) dehydroporiferasterol, clerosterol, isofucosterol, stigmasterol, sitosterol, campesterol, and codisterol. Two novel carotenoid pigments, cucubitanthins A and B, were isolated, and their structures were determined using ¹³C-NMR analysis of chondrillasterol. Saponin, fixed oil, resin, protein, sugar, and starch are all present in this plant, just like they are in other cucurbitaceous species [9]. Dried vegetable comprises ethereal extract of albuminoids 6.12% (including nitrogen 0.98%), soluble carbohydrates 77.33%, woody fiber 8.55%, and ash

7.00%, while fresh vegetable contains 89.50% moisture. Oil (39.1% yield) is produced from Pakistani seeds, and its fatty acid makeup is as follows: myristic, palmitic, stearic, oleic, and linoleic acid (30.3%). The anticancer effect of sterol glycosides and sterol fatty acid esters found in seeds has been demonstrated in mice. Seed ethanolic and etheric extracts were effective in vitro and in vivo against the worm *Fasciolopsis buski*. Seeds given orally had a 40.6% success rate in treating nematodiasis in calves younger than 6 months. In Brazil, the non-toxic seeds are reportedly employed as a vermifuge. The leaves include 85.9% water, 1.75 % fat, 4.58 % protein, and 1.82% ash [10].

Non-polar lipids account for 45.1% of the lipid fraction, followed by glycolipids at 24.4% and phospholipids at 30.5%. The lipid was predominately composed of linolenic acid. Calcium 36.38mg, magnesium 38.80mg, iron 2.04mg, zinc 0.76mg, and copper 0.42mg are all present in 100g of leaves. The fruits were used to isolate an esterase [11].

Traditional Uses

Diuretic, tonic, quenches thirst, heals kapha, indigestion and triggers biliousness and anorexia; these are just some of the Ayurvedic claims made about this fruit. As a taenicide, the seeds are put to good use. The oil is recommended as a tonic for the nervous system. The fruit's pulp is frequently applied topically as a poultice. The seeds have been used for centuries as a safe and efficient treatment for tapeworms in Malta. Anthelminitics, specifically taenicides, are made from the seeds [12].

The fruit has calming, soothing, and cooling properties. The pulp is used externally for a variety of ailments [13], including but not limited to:

- Headaches
- nerve pain
- inflammation
- abscesses
- boils

Pharmacological Properties

Anticancer

A medical condition called cancer involves the unchecked growth of tumour cells. The purpose of the study was to determine whether MECM (methanol extract of *Cucurbita maximus*) had any anticancer effects on mice having EAC (Ehrlich Ascites Carcinoma). EAC is a carcinoma that develops very quickly and acts aggressively. It can grow in practically all mouse strains. The implantation of an Ehrlich ascitic tumour causes an immediate local inflammatory response, increased vascular permeability, strong edoema development, cellular migration, and a gradual buildup of ascitic fluid. Since it provides tumour cells with a direct source of nutrition, ascitic fluid is crucial for the formation of tumours. The ascitic nutritive



fluid volume was likely decreased by MECM therapy, which considerably reduced tumour volume. Additionally, when compared to the tumour control group, the MECM-treated animals had considerably smaller packed cell volumes and fewer numbers of EAC tumour cells that were still alive in the peritoneum. These findings might point to a direct cytotoxic effect of MECM on tumour cells or a local indirect effect that would include macrophage activation and suppression of vascular permeability [14].

Anti-Obesity

Beta vulgaris, Smilax regelii, and Cucurbita maxima root extracts. Through many mechanisms, seeds are useful for both individual and combined efforts to reduce fat. The first one removes lipids from the body, and the second and third one's control thyroxine. Cucurbita maxima. seed sample reach of manganese having tendency to generate thyroxine become potentiated with Smilax regelii extract sample iodine reach, produce thyroxine to control fat in body, is also benefited with Beta vulgaris which flushes out fat from tissue and blood corpuscle [15].

Anti-Diabetic

Streptozocin, a glucose analogue and strong diabetogenic drug, selectively causes the death and necrosis of pancreatic cells in mice to cause diabetes. According to the study, MECM considerably lowered the high fasting blood glucose levels compared to diabetic control mice [16].

Hepatoprotective

The goal of the study was to determine whether the methanol extract of *Cucurbita maxima* Duchesne (Cucurbitaceae) has any hepatoprotective effects against hepatotoxicity caused by carbon tetrachloride (CCl₄). CCl₄-induced liver injury is a frequently employed model for the evaluation of hepatoprotective medications. The cytochrome P-450 system converts CCl₄ into the trichloromethyl free radical (CCl₃), which then quickly interacts with oxygen to create the highly reactive trichloromethyl peroxy radical (CCl₃OO). This free radical then causes lipid peroxidation by covalently attaching to cell membranes and organelles, upsetting Ca²⁺ homeostasis, and ultimately leading to cell death. Assessment of liver function can be done by estimating the activity of blood marker enzymes such SGOT, SGPT, and ALP. Several enzymes that are typically found in the cytoplasm of the liver cell are released into the bloodstream when the plasma membrane of the liver cell is disrupted. A helpful quantitative indicator of the degree and type of hepatocellular damage, their quantification in the serum [17].



Diuretic

Traditional uses for the seeds of *Cucurbita maxima* Duchesne include treating urinary disorders and diuretics. The flame photometer was used to measure the levels of Na⁺ and K⁺ in the urine. The test group's urine volume and Na⁺ and K⁺ concentration were compared to those of the control group. According to the findings, there was a substantial rise in urine volume in the *Cucurbita maxima* seeds' aqueous extract as compared to the control group. However, compared to the control group, there was no appreciable increase in the excretion of Na⁺ and K⁺ in urine in the drug-treated group. *Cucurbita maxima*'s aqueous extract demonstrated substantial diuretic efficacy [18].

Antioxidant

The goal of the study was to assess the *in vitro* antioxidant properties of the pericarp of *C. maxima* extracted in petroleum ether, chloroform, and methanol. the presence of elements such as steroid/terpinoids, flavonoids, glycosides, tannins, alkaloids, and polyphenolic substances 13 demonstrates the action [19].

Immunogenic

By using solvent partitioning and repeated vacuum liquid chromatography, the antigenotoxic component of squash flowers was identified. Several sterols found in the *Cucurbita maximus* flower are what give the plant its antinogenic properties [20].

Cardiotonic

According to preliminary pharmacological testing using crude extract from *Cucurbita maxima* seeds, it has a positive inotropic impact on the heart of frogs and causes a mild, momentary elevation in the mean arterial blood pressure of dogs. These effects were not dose dependent. The analysis of a dog's ECG showed an increase in the "QRS" complex and a drop in heart rate. *Cucurbita maxima* has cardiotonic effect as a result of the extract's beta-adrenergic stimulating activity [21].

Antidepressant

Using both normal and depressed rats as subjects, researchers were able to demonstrate that a powder extract of raw, autoclaved, boiled, germinated, and roasted pumpkin seeds was as effective as the gold standard antidepressant, Imipramine. The duration of immobility time in the Force Swimming Test and the Tail Suspension Test was significantly reduced in the treated group of experimental rats compared to the depressed control group. Pumpkin seed contains the important amino acid tryptophan, and the metabolite 5-hydroxytryptophan (5-HTP) is a precursor to the neurotransmitter serotonin. For depression, many people turn to either tryptophan or 5-HTP [22].



Antifungal

Using batch-wise chromatography on carboxymethylcellulose (CM52) and reverse-phase HPLC, the antifungal activity of pumpkin (*Cucurbita maxima*) seeds was separated. Electrospray ionisation mass spectrometry (ESMS) was used to calculate the molecular weights of various polypeptides. Antifungal activity against multiple fungal species was observed in this fraction's components [23]. Because of their high zinc content, pumpkin seeds can protect against acrodermatitis enteropathica an autosomal recessive metabolic disorder affecting zinc uptake that causes periorificial and acral dermatitis, alopecia, and diarrhoea [24].

Hypolipidemic

Animal studies suggest that supplementation with pumpkin seed oil (PSO), which is rich in phytochemicals, may be beneficial in hyperlipidemic situations. Changes in plasma lipids and blood pressure due to low oestrogen availability after menopause were found to be counteracted by PSO supplementation. Most notable was an increase in good (HDL) cholesterol, which is known to reduce the danger of cardiovascular problems. The atherogenic index, which is strongly connected to the likelihood of atheroma formation decreased generally. An increased risk of coronary heart disease is associated with the raised serum lipid level seen in diabetes mellitus. For the purpose of avoiding heart disease in a diabetic population, a reduction in total cholesterol and an increase in HDL-C are highly desirable. In animal studies, *Cucurbita maxima* alcoholic extract was found to significantly lower total cholesterol, low-density lipoprotein cholesterol, very low-density lipoprotein cholesterol, and total cholesterol while significantly increasing HDL-cholesterol. Flavanoids, phenols, or saponins in the extract were thought to be responsible for the finding. Pumpkin-seed oil (PSO) is a dietary supplement that has been shown to increase levels of beneficial fatty acids and antioxidants in the body [25].

Anti-Inflammatory

A high nutrient composition, pumpkin seeds are thought to be helpful in lowering the incidence of bladder stone illness by increasing the level of inhibitors of crystal formation or aggregation. The bladder pressure, bladder compliance, and urethral pressure are all significantly lowered by a pumpkin seed oil formulation. The anti-cancer and anti-inflammatory properties of pumpkin-seed-extract cucurbitacin E have been demonstrated. Since cucurbitacin E inhibits the expression of cyclooxygenase-2, an inflammatory protein, it not only has an apoptotic effect on prostate and lung cancer cells, but it also has anti-inflammatory activity [26][27].



Anti-Arthritic

Recent studies have looked into the potential anti-arthritic benefits of pumpkin seeds. The chronic phase of inflammation was significantly suppressed in arthritic rats after treatment with pumpkin-seed oil, as measured by a reduction in paw oedema. Researchers showed that pumpkin seed oil improved some biochemical indicators seen in patients with chronic arthritis. The high content of unsaturated fatty acids in pumpkinseed oil may contribute to this enhancement. This impact may be amplified by the antioxidant tocopherols and selenium found in pumpkinseed oil. Pumpkin-seed oil contains carotenoids, which have been identified as cellular antioxidants. The anti-inflammatory action of pumpkin seed oil during arthritis may be due to its ability to scavenge free radicals, which prevents lipid peroxidation of cell membranes [28].

INDUSTRIAL USES

Pumpkin (*Cucurbita maxima*) seeds are often disposed of as agro-industrial wastes. Raw, roasted, or boiled seeds are consumed on a small scale in several parts of the world. It has just come to light that these seeds have a lot to offer the food sector due to their high protein, fibre, mineral, polyunsaturated fatty acid, and phytosterol content. Their recent rise to prominence among food technologists has led to their widespread adoption in the food industry. Companies in the food industry are experimenting with using them in new products, and consumers are taking notice. Researchers are looking into their potential benefits for a variety of other conditions, including as diabetes, immunity, cholesterol, the liver, the prostate gland, the bladder, depression, learning difficulties, and parasite inhibition. More research should be done to see if turning these agricultural byproducts into valuable ingredients might help solve the world's food scarcity problems. This article reviews a new type of dietary supplement [29].

CONCLUSION

The pumpkin seeds had a crude protein content of 39.25%, a crude oil content of 27.83%, an ash content of 4.59%, and a crude fibre content of 16.84%, while the comparable values for the kernels were 39.22%, 43.69%, 5.14%, and 2.13%. The mineral content of pumpkin seed kernels was relatively high, notably in terms of phosphorus, magnesium, and potassium. Methionine and tryptophan were as trace, whereas arginine, glutamic, and aspartic acids were the most abundant, as shown by the amino acid profiles. Considering its high oil and protein content, the seed could be used to produce commercial vegetable oil and protein. As an anthelmintic, particularly effective against *Ascaris*, *Taenia*, and *Oxiuris* worms. Heterophyiasis is treated with areca nut and pumpkin seed water extracts. Pumpkin seeds are used to treat enuresis in children and as a mild diuretic. Seed extract from the Saw Palmetto plant is used to treat benign prostatic hyperplasia, sometimes in combination with other



botanicals. In order to cure prostate cancer. To keep stomach cancer at bay. fights cadmium's harmful effects. Use as a gentle laxative as a remedy for respiratory illnesses. Kava (*Piper methysticum*) has been used to calm an irritated bladder, and pumpkin seed oil has also been tried. Seeds have a lot of useful nutrients and can be added to food or utilized to extract bioactive compounds. Because of their many positive effects on human health, these seeds deserve recognition as a functional food.

In conclusion, the pumpkin plant is highly promising in the coming era with diverse nutritional and pharmacological properties.

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Nil.

CONFLICT OF INTEREST

None.

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