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# CUCURBITA MOSCHATA: A BRIEF STUDY ON PHYTOCHEMICAL AND PHARMACOLOGICAL PROFILE

**Manjima Santhosh*[1], Dr. R. Xavier Arulappa[2], Anila Kumari V. S[3]**

*[1]Student, Seventh Semester B Pharm, Sree Krishna College of pharmacy and Research Centre, Parassala, Thiruvananthapuram, Kerala, India -695502., [2]HOD and Professor, Department of Pharmaceutical Chemistry, Sree Krishna College of Pharmacy and Research Centre, Parassala, Thiruvananthapuram., [3]Assistant Professor, Department of Pharmaceutical Chemistry and Analysis, Sree Krishna College of Pharmacy and Research Centre, Parassala, Thiruvananthapuram.

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**Abstract:**

*Medicinal plants, containing bioactive compounds that offer therapeutic benefits, have been used across cultures for centuries to treat various health conditions. Historical records from ancient civilizations like the India, Egyptians, Greeks, and Chinese document their early medicinal use. Today, these plants remain vital in global healthcare, blending ancient wisdom with modern science to treat diseases and promote well-being, highlighting their enduring role in health and healing. Cucurbita moschata is highly valued for its dual role in both culinary and medicinal applications. Its elongated fruits are characterized by smooth skin and a sweet, nutty flavour making them popular in various dishes such as soups, stews, roasts and as a nutritious side dish. Rich in essential nutrients like vitamins A, C and E as well as dietary fibre and antioxidants including beta-carotene, it also supports immune health, aids in digestion and promotes heart health by lowering cholesterol levels. Medicinally, extracts derived from Cucurbita moschata such as cucurmosin, are known for their anti-inflammatory, antioxidant and potential anticancer properties contributing to overall wellness. This versatile plant is cultivated globally, contributing significantly to both culinary diversity and traditional health practices, offering a wide array of nutritional benefits and therapeutic uses.*

**Keywords:** *Cucurbita moschata, cucurmosin, beta-carotene, antioxidant, anticancer*

**Corresponding author:**

**Manjima Santhosh,**

*Seventh semester B Pharm,*

*Sree Krishna College of pharmacy and Research Centre,*

*Parassala, Thiruvananthapuram, Kerala, India -695502*

*E-mail: manjimasanthosh02@gmail.com*

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## INTRODUCTION:

Medicinal herbs, have been discovered and used in traditional medicines practices since prehistoric times [1]. They represent a rich source of natural compounds with therapeutic properties. These plants produce a diverse array of phytochemicals, such as alkaloids, flavonoids, terpenoids, and phenolic compounds, which possess pharmacological effects beneficial to human health. The use of medicinal plants spans across different cultures and traditions, with each society having its own unique herbal remedies and healing practices. These plants have historically played a significant role in traditional medicine systems like Ayurveda, Traditional Chinese Medicine (TCM), and Indigenous healing practices [2].

*Cucurbita moschata*, commonly known as butternut squash or winter squash, is a species of squash belonging to the Cucurbitaceae family. Native to the Americas, particularly Central and South America. It possesses various pharmacological actions like anthelmintic, anti-allergen, antibacterial, wound healing, antidiabetic, anti-inflammatory, antifungal, anti-hyperlipidaemic, anti-oxidant, immunomodulatory, hypotensive, anti-cancer, analgesic, hepatoprotective, anti-obesity, and anti-ulcer [3].

**Fig 1: *Cucurbita moschata* plant**

**TAXONOMICAL CLASSIFICATION [4]**

| | |
|---|---|
| **KINGDOM** | **Plantae** |
| **PHYLUM** | Tracheophyta |
| **CLASS** | Magnoliopsida |
| **ORDER** | Cucurbitales |
| **FAMILY** | Cucurbitaceae |
| **GENUS** | Cucurbita |
| **SPECIES** | *Cucurbita moschata* |

**VERNACULAR NAMES [4]**

| SL NO | LANGUAGES | VERNACULAR NAMES |
|---|---|---|
| 1 | English | Butternut pumpkin, Butternut squash |
| 2 | Malayalam | Kumpalam, Matanga |
| 3 | Tamil | Poosanikaai |
| 4 | Hindi | Halwa Kadu, petha, Kashi phal |
| 5 | Kannada | Sihi kumbala kaayi |
| 6 | Bengali | kumara |
| 7 | Assamese | Mishti-kumari, Mith-lao, Raonga-lao |
| 8 | Punjabi | Halwa kaddu, Mitha kaddu |
| 9 | Telugu | Gummadi |
| 10 | Urdu | kaddu |

**Geographical distribution:**
Butternut squash is also popularly called pumpkin in western countries. Originally native to Central America, including regions of southern Mexico, it has spread widely due to its agricultural value. In North America, it is extensively cultivated in the United States and Canada. In South America, it is grown in countries such as Argentina, Brazil, and Peru. European cultivation is prominent in southern countries like Italy, Spain, and France. It is also cultivated in Africa, particularly in countries like South Africa, Egypt, and Morocco. In Asia, major producers include China, Japan, and India, and it is also grown in Southeast Asian countries. Additionally, Cucurbita moschata is cultivated in Oceania, notably in Australia and New Zealand. The plant thrives in warm, temperate, and subtropical climates, requiring a long growing season with ample sunlight, well-drained fertile soils, and moderate to high rainfall [5].

**BOTANICAL DISTRIBUTION [6-10]**

| | |
|---|---|
| Flower | Yellow in colour; very tubular with petal 3-ribbed. Sepals acicular, deeply 5 - lobed, about 4.5-6.0cm long |
| Stem | The stem is nearly cylindrical or slightly 5-sided, and oftentimes shows rather dark spots at the insertion of the petiole. The petioles are cylindrical, with alternate light green and dark green stripes, uniformly hispid, but hardly ever with spiny and prickly hairs. |
| Leaves | The leaves are circular, kidney-shaped, heart-shaped, or triangular, often deeply indented at the base, weakly lobed, wavy and toothed, more or less white spotted, up to 20 cm long and 30 cm wide. The leaves are velvety, or comparatively soft to the touch, round, reniform, denticulate notched at the margin, ordinarily with five or sometimes six sharp lobes, seldom obtuse or rounded, separated by the equally sharp sinus. |
| Fruit | 15 - 20cm by 10 - 12cm; round and of three colours: green, green with white, smooth patches and green with punctate blotches; 5-angled stalk, enlarged at fruit attachment and sunken. |
| Seed | The seeds are oval, flat, white to brown, thin-shelled, irregularly margined, with a meaty kernel. |
| Ovary | Oblong or discoid, unilocular; style thick, with 3 two-lobed stigmas |

**Microscopic features:**
The stem epidermis of Cucurbits is regular, with thin cells and scattered collenchyma cells in most species except *Cucurbita moschata*, which lacks scattered collenchyma. In a transverse section of the stem of *Cucurbita moschata*, the stem cortex collenchyma is 4-6 cells thick and consists of a narrow band of sclerenchyma cells. While most species have stem vascular bundles arranged in two rings, *Cucurbita moschata* has them in one ring, with ten bundles arranged in cycles of five. The stem vascular bundles are bicollateral [10].

Transverse section of fruit pericarp and seed coat which reveals that the transverse section of fruit consists of Epicarp layer followed by Mesocarp of 5-6 layers then the region of Endocarp. Lignified Vascular Bundles were embedded in Endocarp region [11].

The seed coats have four tissue layers: epidermis, hypodermis, sclerenchyma, and chlorenchyma. The hypodermal and chlorenchymatous parenchyma layers of the seed coat increase from the centre towards the margin. In *Cucurbita moschata*, the hypodermis and chlorenchyma are both 3-4 layers each but increase to 6-7 and 4-7 layers, respectively [8].

The root typically consists of the epidermis, cortex, endodermis, and vascular bundles. The epidermis is one cell thick, with the root cortex collenchyma being 2-4 cells thick and cortex parenchyma 5-7 cells thick. The endodermal and pericyclic layers are inconspicuous. Root vascular bundles have four radial arms of primary xylem alternating with four zones of primary phloem, arranged in a ring. The meristem has about seven layers of cambium-like cells, decreasing towards the root apex periphery. The central tissue forms the vascular cylinder, with adjacent cells forming the cortical region. The cortex and vascular cylinder can be approximately delimited, as the innermost cortex cells divide tangentially longer than adjacent vascular cylinder cells [10].

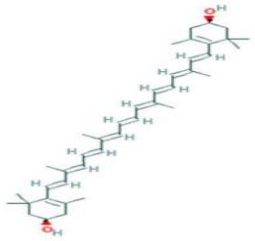
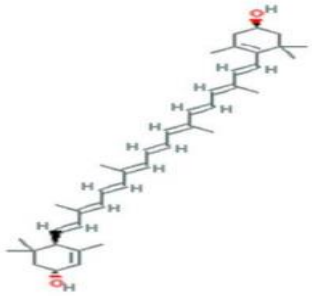
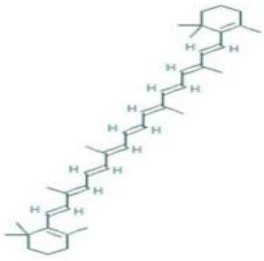
**Propagation and Planting:**
Propagation of *Cucurbita moschata* involves starting seeds indoors in a warm environment about 2-4 weeks

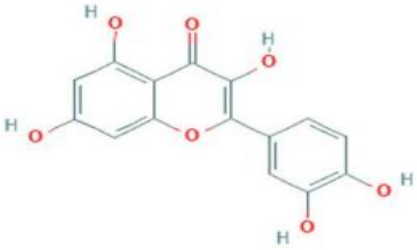
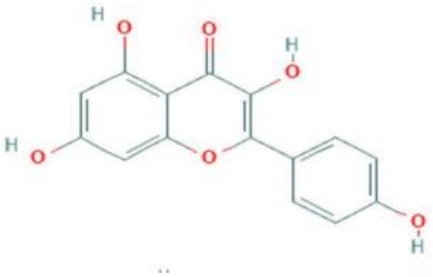
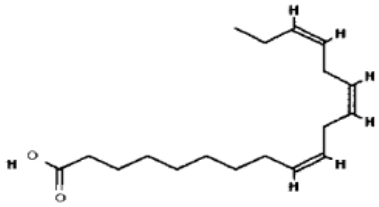
before the last frost date. Transplant seedlings outdoors once all danger of frost has passed, spacing them 18-36 inches apart in rows 6-12 feet apart. Provide well-draining, fertile soil with a pH of 6.0-6.8, amended with compost. Water regularly at the base of plants, and apply balanced fertilizer during the growing season. Harvest butternut squash when fully matured, and cure them in a warm, dry place before storing in a cool, dry area for extended shelflife [12].

**PYTOCHEMICAL SCREENING [13]**

| Compounds | Skin | Mesocarp | Seeds |
|---|---|---|---|
| Carbohydrate | - | - | - |
| Saponins | + | + | - |
| Sterols | - | + | - |
| Flavonoids | + | + | + |

**CHEMICAL CONSTITUENTS [14]**

| Sl. No. | Chemical constituents | Structure |
|---|---|---|
| 1 | Zeaxanthin ($C_{40}H_{56}O_2$) |  |
| 2 | Lutein ($C_{40}H_{56}O_2$) |  |
| 3 | β-carotene ($C_{40}H_{56}$) |  |

| | | |
|---|---|---|
| 4 | Quercetin ($C_{15}H_{10}O_7$) |  |
| 5 | Kaempferol ($C_{15}H_{10}O_6$) |  |
| 6 | Linoleic acid ($C_{18}H_{30}O_2$) |  |

## PHARMACOLOGICAL ACTIVITIES:

**Anti-obesity:**

The potential anti-obesity properties of fermented *Cucurbita moschata* extract, and the results showed that the extract inhibited the mRNA expression of fat genes in mice. They concluded that the fermented *Cucurbita moschata* could be used as a potential drug to control obesity [15]. Dehydrodiconiferyl alcohol (DHCA) is isolated from a water-soluble extract of *Cucurbita moschata*. DHCA can inhibit the DNA binding activity of enhancer binding-protein, thus inhibiting the proliferation of mitotic clones, and can also directly inhibit the expression of fat production regulators and primordial embryonic fibroblasts [16].

**Depression:**

β-carotene benefits in baked *Cucurbita moschata*, which is used to treat patients with depression in Korea [17].

**Anti-diabetic:**

In recent years, many studies have shown that *Cucurbita moschata* has a variety of health effects; among them, the research on its effect on diabetes has attracted much attention. The pulp and seed of *Cucurbita moschata* showed hypoglycaemic activity in both normal animals and tetraoxopyrine-induced diabetic rats. Two novel tetrasaccharide glyceroglycolipids were extracted from *Cucurbita moschata* and found to reduce the blood sugar level of diabetic mice significantly. These glyceroglycolipids could be used as a candidate drug for the treatment of type II diabetes [18].

**Antihelmintic:**

The seeds of *Cucurbita moschata* can be used as an insect repellent and can be eaten fresh or roasted, which can relieve the symptoms of abdominal cramps and bloating caused by intestinal worms. In the clinical study, it was reported that pumpkin seeds have a minimum inhibitory when ingested at a concentration of 23 g of pumpkin seeds to 100 g of distilled water can produce an anthelmintic effect [19].

**Anti-cancer activity:**

Cancer treatment remains challenging due to cancer's characteristics of unlimited growth and spreading. Research suggests that consuming more vegetables

and fruits, like pumpkins, can lower cancer risk [20]. Components in *Cucurbita moschata*, such as proteins and polysaccharides, show potential anticancer effects against melanoma and leukaemia. Studies indicate that regular pumpkin consumption and exercise can reduce the risk of stomach, intestine, lung, and breast cancers [21]. Moschatin, a type 1 ribosome-inactivating protein (RIP) is extracted from mature Cucurbita moschata seeds. Their research showed that Moschatin effectively inhibits the growth of M21 melanoma cells, highlighting its potential in cancer treatment [22]. Also, compounds like lycopene and beta-carotene from vegetables can lower prostate cancer risk [23].

**Anti-bacterial activity:**

Bacteria, viruses, fungi, and other parasites can cause many diseases and can also affect economic development. A new type of antifungal peptide with a molecular weight of 8 kDa was isolated from *Cucurbita moschata* seeds. At a dose of 375 mg, it inhibited Botrytis cinerea, Fusarium oxysporum, and Mycosphaerella oxysporum [24]. Three basic proteins isolated from *Cucurbita moschata* seeds: MAP2, MAP4, and MAP11 can inhibit the growth of yeast cells. Among them, MAP11 is the most effective inhibitor, but MAP2 and MAP4 did not inhibit the growth of Escherichia coli [25,26].

## CONCLUSION:

*Cucurbita moschata*, a valuable source of bioactive compounds, shows promise for various therapeutic applications. Researchers have isolated phytochemicals like cucurbitacin, phenolic compounds, flavonoids, and carotenoids from its fruit, seeds, and leaves. These compounds exhibit antioxidant, anti-inflammatory, antidiabetic, antimicrobial, and anticancer properties. Current research suggests *Cucurbita moschata*'s potential in developing novel therapeutic agents or combination therapies that could enhance treatment outcomes and reduce side effects. The medicinal chemistry of *Cucurbita moschata* highlights the need for interdisciplinary research to fully explore its pharmacological benefits.

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