

PHARMACOGNOSTICAL AND PHYTOCHEMICAL STUDY OF CORN SILK

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ABSTRACT: Corn silk, a by product of maize, consists of proteins, carbohydrates, vitamins, and minerals, with its composition fluctuating based on genotype and the stage of harvest. It is abundant in bioactive compounds such as flavonoids, tannins, saponins, and polyphenols, which offer various health advantages, including lipid reduction, lowering blood pressure, and possessing anti-inflammatory and antioxidant effects. Corn silk (*Zea mays* L.) holds promising potential as it is beneficial for kidney health, exhibits diuretic properties, and can help prevent the formation of urinary stones. The review research paper examines the extract of *Zea Mays* Silk, focusing on its chemical composition, pharmacological effects, and possible health benefits, including the bioactive components and pharmacological activities of corn silk (*Zea mays* L.). Observations were made regarding the color, shape, size, odor, and surface characteristics of corn silk hairs. The type of solvent used for extraction has also been noted.

KEYWORDS: pharmacological actions, kidney stones, phytochemicals, health advantages, and corn silk.

INTRODUCTION

- ❖ **Corn:** *zea Mays*, or corn, is a cereal crop having important agricultural and medical uses..
- ❖ **Silk:** Stigmas, the yellowish thread like strands from the female maize flower, are used to make silk.

Corn Silk

The foundation of contemporary medicine is largely composed of herbs, which have been used for ages to treat a wide range of ailments.^[1] Natural antioxidants, particularly phenolic chemicals, are responsible for the medicinal properties of many traditional plants^[2].

These substances have the capacity to scavenge reactive oxygen species (ROS), which can lead to a number of oxidative stress-related illnesses. molecules that cause cognitive impairment, cancer, and high blood pressure.

Corn silk (*Stigma maydis*) is one of these botanicals. Stigmas, which resemble yellow thread, are used to make corn silk (CS).^[3] It has been consumed for a long time as a therapeutic remedy for various illnesses and is important as an alternative natural-based treatment. It has been used as traditional medicine in many parts of the world such as China, Turkey, United States and France.^[4-5] Although not scientifically proven, CS tea has been claimed to have many benefits to human health such as lowering blood pressure, decrease prostate inflammation, diabetic and urinary tract infection, obesity and promote relaxation. Currently, a variety of commercially available CS products are available for medical use. ^[6] CS is rich in phenolic compounds, especially flavonoids.^[7] It also contains proteins, vitamins, carbohydrates, salts of calcium, potassium, magnesium, and sodium, volatile oils, steroids such as sitosterol and stigmasterol, alkaloids, and saponins. Due to its potential benefits, the pharmacological activity of CS has been reported in several studies. ^[8]

• Botanical Description

Corn (*Zea mays* Linnaeus), also known as maize.

Family = Ponceau or Gramineae.^[9]

Corn flowers are monoecious, with male and female flowers arranged in different inflorescences on the same stem.^[10] The male flowers (tassel) at the top of the plant produce yellow pollen. At the same time, female flowers produce CS and are located in the leaf axils.

Setae are elongated stigmas that resemble hair tufts. The color of CS is usually light green at first and then changes to red, yellow, or light brown. The function of CS is to capture pollen for pollination. Each silk pollinates and produces one kernel of corn.

For medical purposes, CS is harvested just before pollination occurs and can be used fresh or dried.^[11]

Zea Mace, commonly known as maize, is a grain with important agricultural and medicinal values. Maize silk, the stigma of the female flower, is traditionally used in various cultures for its medicinal properties. This review investigates the phytopharmacological aspects of corn silk extracts, focusing on bioactive compounds, pharmacological activities, and potential therapeutic applications. Zea Mays Corn silk, traditionally considered an agricultural by-product, has received significant attention due to its diverse health-promoting properties.

This review evaluates the chemical composition, pharmacological activity and potential health benefits of corn silk ethanol extract supported by recent scientific research.^[12]



Fig.No:1: Corn Silk

• **Plant profile**

For centuries, corn silk, harvested from the floral tops of maize (*Zea mays* L.), has been a trusted remedy across various medicinal systems. Belonging to the Gramineae family within the order Poales and the Plantae kingdom, maize is a tall, annual cereal plant that can reach heights of up to 2.5 meters. Its sturdy stalk supports long, broad leaves arranged alternately. At its apex, the plant develops male flower clusters resembling tassels, while the female inflorescences, appearing as ears of corn, emerge from the sides. The distinctive long, golden to brownish threads found at the tip of each ear are known as corn silk. These threads play a crucial role in pollination, carrying pollen to the ovule and remaining connected to each kernel. Historically, dried corn silk was employed as a medicinal agent, and its therapeutic potential continues to be a subject of extensive research.^[13-14] Corn silk is rich in a diverse array of bioactive compounds. It contains numerous flavonoids, such as maysin, luteolin, quercetin, and apigenin, as well as saponins, volatile oils, alkaloids, phytosterols, and essential minerals like potassium, calcium, and magnesium. Additionally, it features phenolic acids, including ferulic, caffeic, and gallic acids, all of which exert various beneficial effects on the body. Collectively, these components contribute to corn silk's antioxidant, anti-inflammatory, diuretic, and kidney-supporting properties.

Traditional medicinal practices in China, Native America, and South America have long recognized the therapeutic value of corn silk. Historically, it was employed to treat ailments such as urinary tract infections, kidney stones, cystitis, edema, prostatitis, and even hypertension. The diuretic and demulcent properties of marshmallow make it effective in alleviating urinary discomfort and facilitating urine excretion. This is particularly beneficial for individuals managing nephrolithiasis, or kidney stone disease.^[15]

Pharmacological research has confirmed many of these claims. Corn silk, in particular, has been extensively studied for its diuretic properties. Rich in potassium, it helps increase fluid volume in the kidneys, aiding in the flushing out of kidney stones.^[16] This increased urination is crucial for reducing the concentrations of calcium and oxalate in the urine, which are the primary contributors to calcium oxalate kidney stones.

Furthermore, corn silk contains flavonoids and phenolic compounds that neutralize harmful reactive oxygen species within kidney tissues. This helps maintain glomerular filtration and prevents toxic substances from entering the renal tubules, thus supporting normal kidney function.^[17-18]

So, corn silk is pretty good for your kidneys and can help with metabolic syndrome too. It often helps bring down blood pressure because it's packed with potassium and gently relaxes your blood vessels. Plus, it's linked to lower blood sugar, which is a big plus if you have kidney problems from diabetes. Basically, corn silk does a bunch of things: it helps your kidneys get rid of extra water, calms down inflammation, fights off damage from free radicals, and keeps your urine balanced so crystals don't form. Because of all these good points, it's a common part of plans to prevent or treat kidney issues. It's great that corn silk is considered super safe for use in health supplements. Studies on animals haven't shown any major bad side effects from people consuming a lot of it. There are no worries about it causing problems with long-term use, and it doesn't seem to harm DNA, your liver, or your kidneys. Because it's so safe and easy to work with, corn silk has been turned into teas, pills, liquid extracts, and now even gummy treats.^[19] The flavonoids in corn silk are also what give it its germ-fighting abilities, as they mess with the bacterial cell membrane, essentially destroying their proteins. Plus, the colorful corn varieties have a water-soluble pigment called anthocyanin, which not only packs a powerful antioxidant punch but also helps fight inflammation and may even prevent cancer.^[20] The compounds found in silk, like phenolic compounds, alkaloids, polyphenols, saponins, and steroids, give it antiseptic and antimicrobial properties that work against certain types of germs. The silk's ability to fight oxidation might help prevent long-term high-risk human papillomavirus (HR-HPV) infections, which are known to be a major factor in cervical cancer development.^[21]

Lots of research suggests that corn silk extract is good for lowering high blood sugar. Its flavonoid part, in particular, really helps bring down bad cholesterol (LDL-C), triglycerides, and overall cholesterol in the blood. The alcohol extract from corn silk has also been shown to lower blood pressure and act as a diuretic, meaning it helps you pee more. On top of that, corn silk can boost your body's antioxidant enzymes and prevent damage to fats in your cells.^[22]

However, corn silk is usually discarded as waste during the processing but it can be used for the formulation of various products. This will not only increase the income off farmers but can also add nutritional density and diversity to the diet of people. For example, it can be commercially used as a major ingredient for the production of value-added products like corn silk tea, snacks, cosmetics and medicines. At present, there are more than 1000 kinds of corn by-products that are being used in chemical, fermentation, food and other industries.^[23] Additionally, corn silk is a major by-product of the corn processing industry that is traditionally discarded as eco-friendly agricultural waste or used as animal feed. However, corn silk is a good source of vital nutrients, including carbohydrates, proteins, vitamins, and minerals, as well as resins, mucilage, and fibres.^[24] In addition, it also contains a wide range of bioactive compounds in the form of volatile oils, steroids, and other natural antioxidants, such as polyphenols and flavonoids. According to the traditional Chinese medicine system, these bioactive and fibrous compounds possess various health benefits and help to avoid numerous chronic diseases, including oedema, cystitis, gout, rheumatism, and rheumatoid arthritis.^[25-26]

In addition, several in vivo and clinical studies reported corn silk safe for human consumption. Given these benefits, corn silk is now being utilized in the development of value-added foods, such as beverages and patties.^[27] Furthermore, earlier studies of 10 different cornsilk genotypes showed a significant number of bioactive components, including flavonoids and phenolics, and also revealed the antioxidant activities of cornsilk polysaccharides; however, this characterization based on various techniques is not studied for cornsilk powder. As corn silk nutrients and bioactive are mostly subject to large variations owing to soil conditions, environmental variations, and different cultivars, the current study aims to investigate the nutritional composition, bioactive composition and characterization of a selected variety of cornsilk (G5417) that is most commonly grown in the northern region of India, owing to its high yield and acceptability.^[28]

Production of corn silk: Corn is a starchy cereal plant that is widely used as human food, biofuel and live stock feed around the world. It is extensively grown in many countries including the USA, China, Brazil and India. According to the United States Department of Agriculture 2020, USA, China, Argentina and Brazil

account for 64.63% of total production and a large fraction of it is consumed domestically. The processing of corn results in a production of a high amount of cornsilk but a new and efficient method should be opted for its valorisation.^[29] It has been reported in the literature that the communal yield of different corn silk varieties lies between 123 to 283 kg per hectare. North America and Latin America hold the first position in the production of corn silk followed by the European countries. China is also progressing to become the producer and consumer of corn silk extract. According to the Global Corn Silk Market Report 2022, higher corn production will lead to easy accessibility of cornsilk extract.^[30] Due to the growth of several diseases and the increase in health awareness among consumers, there has been an increase in the demand for health products and dietary supplements which will lead to the growth of the pharmaceutical industry in the future.^[31]

Pharmacological Activities:

Antioxidant Activity

Corn silk demonstrates potent antioxidant abilities attributed to its polyphenol levels. These substances neutralize free radicals, safeguarding cells from oxidative strain and possibly lowering the chance of chronic illnesses.^[32]

Anti-inflammatory and Analgesic Effects

The anti-inflammatory properties of corn silk can be credited to its bioactive elements, which block inflammatory mechanism. Tannins and polyphenols enhance its analgesic effects, making it a potent aid for alleviating pain

Antidiabetic Properties

Corn silk has demonstrated its ability to lower blood glucose levels by inhibiting xanthine oxidase and promoting insulin activation. This positions it as a valuable natural solution for diabetes management^[33]

Anti-obesity Effects

Corn silk extract suppresses adipogenesis and lipid metabolism, helping in weight management. It inhibits the expression of adipogenic transcription factors, thus preventing fat accumulation.^[34]

Cardiovascular Health

The extract has been found to improve blood lipid profiles by reducing total cholesterol, triglycerides, and LDL cholesterol, while increasing HDL cholesterol. This contributes to its potential in managing conditions like angina pectoris.

Antimicrobial and Anticancer Properties:

The presence of flavonoids and phenolic acids in corn silk contributes to its antimicrobial activity. Additionally, quercetin, a flavonoid, exhibits anticancer properties by inducing apoptosis in cancer cells.^[35]

Traditional Uses

Traditionally, corn silk has been used to treat urinary disorders, hypertension, and diabetes. It is consumed as a decoction or tea, leveraging its diuretic and anti-inflammatory properties.

Safety and Toxicological Studies

While corn silk is generally safe, limited studies on its toxicological profile exist. Moderate consumption is recommended, as excessive use may cause allergic reactions or interact with medications.^[36]

Potential Health Benefits

The ethanolic extract offers numerous health benefits, supported by its bioactive components, Diabetes Management, Helps regulate blood glucose and improve insulin function.

Nutritional value and health benefits

According to the USDA National Nutrient Database, corn not only provides the necessary calories for healthy, daily metabolism but can also be a rich source of vitamins A, B, E, K, and many minerals. Its high dietary fibre content may ensure that it plays a significant role in the prevention of digestive ailments like constipation.

The antioxidants present in it might act as anti-carcinogenic agents and may help in preventing Alzheimer's diseases.

Provides antioxidants

Plant substances known as antioxidants save your body's cells from oxidative stress and damage caused by free radicals. One of the main causes of many chronic illnesses, such as diabetes, heart disease, cancer, and inflammation, is oxidative stress. Flavonoid antioxidants are abundant in corn silk by nature. Its flavonoids lower oxidative stress and guard against damage from free radicals, according to several research conducted in test tubes and on animals. Many of the advantages of corn silk may be attributed to these substances.

Manage blood sugar

Corn silk may help control the symptoms of diabetes and reduce blood sugar, according to some research. In comparison to a control group, diabetic mice administered corn silk flavonoids showed considerably lower blood sugar levels, according to one animal study. A recent test-tube study also revealed that antioxidants in this corn product might help prevent diabetic kidney disease.^[38]

Reduce cholesterol

Additionally, corn silk may reduce cholesterol. Mice fed maize silk extract showed notable increases in HDL (good) cholesterol and decreases in total and LDL (bad) cholesterol, according to one animal research. In another study, mice given a high-fat diet had far lower overall cholesterol than mice not given corn silk.^[39]

Nutritional and Bioactive Composition of Corn Silk

Proximate Nutrients:

Comprises water, ash, crude fat, proteins, fibers, and carbohydrates, creating a robust nutritional base.

Polysaccharides:

Exhibited benefits in managing diabetes, reducing lipids, and lowering blood pressure.

Dietary Fiber:

Soluble and insoluble fibre types help manage weight and lower cholesterol levels.

Minerals:

Comprises vital minerals, including potassium, calcium, magnesium, sodium, and iron. Potassium assists in reducing blood pressure and has diuretic properties that benefit kidney and urinary health.

Vitamins:

Abundant in vitamins C, E, and K, which support immune function and have antioxidant properties.

Phenolic Compounds:

Offer advantages in reducing blood pressure and fatigue while also improving stamina during physical activity.

Flavonoids:

Contains maysin, luteolin, apigenin, and formononetin, which provide antioxidant, anti-obesity, and anti-cancer properties, particularly against prostate cancer.

Antioxidant Capacity:

Assessed with DPPH, ABTS, and FRAP techniques, showing considerable ability to neutralize free radicals.

Carotenoids:

Including β -carotene and zeaxanthin, promote eye health, boost immunity, and raise serum vitamin A levels.

Phytosterols:

Stigmasterol and β -sitosterol provide anti-inflammatory, antioxidant, and heart-protective benefits.^[40]

Who Should Limit or Avoid Corn Silk

- Pregnant and Breastfeeding Women Corn silk should not be consumed during pregnancy due to its mild diuretic and possible uterine-stimulating effects. It needs to be consulted by a doctor because its safety during breastfeeding is not well established.

- Those taking blood pressure or diuretics: Corn silk may intensify the effects of antihypertensive or diuretic medications, which could result in hypotension or electrolyte imbalance.
- Patients with Kidney Disorders or Hypokalaemia: The diuretic action of corn silk increases potassium excretion, which can exacerbate conditions like hypokalaemia or negatively impact people with chronic kidney disease.
- Those on anticoagulant therapy or those with bleeding disorders should use corn silk with caution because it contains vitamin K and some flavonoids that may interfere with blood clotting (e.g. The g. warfarin) or people who suffer from bleeding disorders.^[41]

Factors influencing the antioxidant potential

As shown in the figure, a number of characteristics have been found to affect the antioxidant competence of corn silk extracts.^[42]



Fig No:02 Factors that influence the antioxidant activity of corn silk

Because of variations in their genetic composition and profiles of bioactive compounds, different types of corn have different levels of antioxidant activity. The antioxidant content is greatly influenced by the maturity stage at harvest; corn silk at the silking stage typically has higher phenolic and flavonoid contents than corn silk at later stages.^[43] The yield and makeup of antioxidant compounds are influenced by the extraction technique and solvent selection. Methanol and ethanol extracts frequently exhibit higher antioxidant activity than aqueous extracts. The recovery of bound phenolic compounds can be improved by optimal extraction conditions, such as those attained by alkaline hydrolysis.^[44]

The phytochemical makeup and antioxidant activity of corn silk can be influenced by environmental factors such as soil type, climate, and agricultural practices. Nutrient profiles are significantly influenced by variables like soil quality, climate, altitude, and farming methods. The levels of flavonoids and phenolic acids, which are essential for their antioxidant qualities, are influenced by variations in temperature, sunlight exposure, and precipitation. Stronger ABTS radical scavenging activity can be obtained by extending the extraction time.^[45] A number of additional factors, such as drying methods, storage conditions, and processing techniques, have been found to affect antioxidant activity and stability.^[46]

Bioactive compounds present in corn silk:

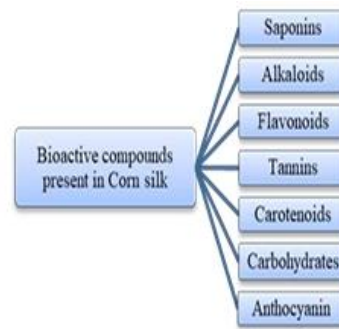


Fig No:03 Bioactive compound present in corn silk

APPLICATIONS:

- It is used in the treatment of:
 - Cystitis
 - Oedema
 - Kidney stones
 - Diuretic
 - Prostate disorder and

Obesity, bedwetting, and urinary infections all calm and relax the lining of the bladder and urinary tubules, which lessens irritation and increases urine secretion.^[47]

MATERIALS AND METHOD

➤ Materials

Corn silk was obtained from mature maize ears cultivated in controlled agro-climatic conditions at an organic farm in Mandleshwar, India. All reagents and chemicals used in the study—including ethanol and distilled water.

➤ Method

Extraction of Corn Silk

Collection and cleaning

Collection and cleaning to ensure that the phytochemicals were at their peak, corn silk was extracted from mature corn. To get rid of anything that could contaminate it, like soil, agricultural chemicals, and microbes, it was cleaned with distilled water.

Drying process

There were two stages to the drying of corn silk. The flavourful and fragrant phytochemicals were preserved by shade drying at room temperature for seven days. After that, it was baked for six hours at 45 to 50 degrees Celsius to guarantee the products' safety and extended shelf life. This procedure helps enhance extraction and guarantees that the wort's enzymes do not degrade.

Grinding and sieving

Grinding and sieving Using a grinder, corn silk was reduced to a coarse powder. A 60-mesh sieve was used to separate the powder so that every particle had the same size.

Cold Maceration Extraction

The cold maceration method was used to extract 40% ethanol (6:4 w/v). The material was left at room temperature for 72 hours.

Filtration:

Whatman No. The plant materials were separated using one filter paper, leaving the extract pure and transparent.

Concentration:

To prevent the loss of volatile bioactive components, the filtrate was concentrated by immersing it in a water bath at 40°C. This method preserves the chemical integrity of active phytochemicals while guaranteeing their enrichment. **Final Drying and Storage:**

A desiccator was used to dry the damp semisolid extract. After that, the extract was kept at 4°C in amber glass bottles to prevent it from being impacted by light or oxygen.



Fig No: 04 Dry corn silk



Fig No: 05

Drying in hot air oven Corn silk powder



Fig No: 06 Cold Maceration Filtration

➤ **Pharmacognostical Evaluation:**

In accordance with WHO Quality Control methods for herbal medicine, an organoleptic evaluation of corn silk and sour orange has been conducted with regard to colour, size, odour, shape, taste, surface, and fracture. The impression on a person's five senses—eyes, nose, tongue, ears, and touch—is referred to as organoleptic. Organoleptic evaluation is a qualitative technique in which the worker (pharmacognosy) examines the distinctive characteristics of crude drugs, particularly those derived from plants, using his sense organs. Using the senses of sight, smell, taste, hearing, and feeling, the worker examines the crude drugs and documents information about their size, shape, internal and external colours, markings, fractures, texture, taste, odour, and so forth. The study's methodology is known as organoleptic in general, and the information gathered is specifically referred to as sensory characters.

Qualitative analysis

• Phytochemical investigation

➤ **Tests for flavonoids:** Each extract was subjected to phytochemical analysis for chemical components using methods that yielded valuable reports. Every test was completed in triplicate.

➤ **Tests for tannins:** Include acid and vigorous shaking. Steroids and terpenoids are indicated by the appearance of green and reddish-brown hues, respectively. Salkowski test: After adding each extract solution to chloroform, concentrated sulfuric acid was carefully added to the mixture. Steroids and terpenoids were confirmed to be present at the interface by the development of reddish purple and reddish brown, respectively.

➤ Tests for alkaloids:

➤ **Dragendroff's test:** Which involves treating the extract solution with bismuth potassium iodide. The presence of alkaloids is indicated by the formation of orange-red precipitates.

➤ **Wagner's test:** The extract solution was mixed with the Wagner's reagent (iodine in potassium iodide). The presence of reddish-brown precipitates is indicated by their appearance.

➤ **Test for reducing sugars:** Ehling's reagent was added in small amounts to the aqueous extract, and the mixture was boiled for two minutes to test for reducing sugars. The presence of glycosides was indicated by a brick red colour.

➤ **Test for saponins:** 0.5 grams of ethanolic extract, then filter the mixture. Ten millilitres of distilled water were added to two and a half millilitres of the filtrate in a test tube. After a few minutes of vigorous shaking, it was left to stand for a while. Saponins were detected by frothing and the development of honey comb.

RESULT AND DISCUSSION

➤ Organoleptic Evaluation

Microscopic Characteristics of Corn Silk:

S.NO.	Organoleptic Characters	Observation
1	Colour	Pale yellow brown
2	odour	unpleasant
3	taste	Slightly sweet
4	shape	Thread like
5	texture	Silky fiber

phytochemical analysis

The results of qualitative phytochemical analysis of corn silk Qualitative analysis of the phytochemicals of baby corn silk extracts.

S.NO.	Phytochemical	Test Performed	Corn Silk
1	Carbohydrate	Molisch's reagent	+
2	Tannins	Salkowski test	+
3	Alkaloids	Dragendroff's test	+
4	Reducing sugar	Fehling's reagent	+

SUMMARY

Traditional medicine makes extensive use of corn silk, a significant herbal medication. Pharmacognostical evaluation aids in accurate crude drug identification, authentication, and quality control.

Among the macroscopic features are:

- A long, smooth, thread-like structure.
- The colour ranges from yellow to brown.
- Soft texture with a distinct smell.

CONCLUSION:

The Pharmacognostical analysis of corn silk offer crucial diagnostic for accurate identification and aids in adulteration prevention. The presence of multiple bioactive compounds that contribute to its therapeutic potential is confirmed by phytochemical analysis. All things considered, corn silk has important pharmacological qualities and is a valuable natural medication. Its application in contemporary medicine can be improved by appropriate standardization and additional research, which can also aid in the creation of safe and efficient herbal formulations.

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