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CORN SILK (*STIGMA MAYDIS*) AS A HERBAL REMEDY: AN OVERVIEW

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ABSTRACT

Medicinal plants plays vital role in treatment of various diseases. In recent years, plant materials have been used as medicine for wide Varity of human ailments due to side effects of several allopathic drug and development of resistance to currently used drug for infectious disease. Medicinal effect of the plant is due to their phytochemical constituents. This review focuses on the available scientific evidence on potential uses of Corn Silk (CS) in healthcare including its phytochemical, pharmacological, and botanical description and its toxicological studies. Corn Silk (*Zea mays*) is yellowish thread-like strand found inside the husks of corn. Corn Stigma measure 4-8 in (10-20 cm) long and are collected for medicinal use before the plant is pollinated. Corn silk Chemically contains proteins, vitamins, carbohydrates, Ca^{2+}, K^{+}, Mg^{2+} and Na^{+} salts, volatile oils, and steroids such as sitosterol and stigmasterol, alkaloids, saponins, tannins, and flavonoids.[1]Corn silk has been claimed to have effect more particularly on renal diseases including chronic nephritis, benign prostate hyperplasia, gout and cystitis.[2,3,4] Corn silk also served as remedy for heart trouble, jaundice, malaria, and obesity. It work very effectively to treat urinary tract infections and kidney stone in adults. Corn silk also shows inhibitory effect on melanin production and act as whitening agent in cosmetic.

Other names : Stigma Maydis, Yu MiXiu, Maize silk, Purple corn, Barbedemais.

INTRODUCTION

Maize (*Zea mays*. L)is the third most planted food crop and one of the major energy sources among the people of the semiarid tropics.[5]*Zea mays*. L is most important edible grain in the world and it is also known as Corn, Maize, Indian corn, Mealie. The annual global production of corn is about 780 million metric tons, of which the United States and China produce more than 40% and 20%, respectively.[6]In addition to the grains other parts of maize plant are used for the treatments of several ailments. As maize plant contains the various components of therapeutic values , it have been used for centuries as remedy for human diseases. Corn silks are Scientifically referred to as Maydis Stigma which is made from stigmas, the yellowish thread like strands from the female flower of maize which measures about 4-8 in (10-20 cm). Corn silk is the waste material from corn cultivation and available in abundance. It has been used as traditional medicine in many parts of the world such as China, Turkey, United States, and France. It is used for treatment of kidney stone, urinary infection, prostate disorder, cystitis, edema, bedwetting and obesity. It soothes and relaxes the lining of the bladder and urinary tubules, hence reducing irritation and increasing urine secretion. The US food and Drug Administration has confirmed its safety and non-toxicity. Drugs made from its extract are non-prescription drugs.

Plant Description

Fig 1. Maize plant.

Columbus discovered maize in the New World in 1492 and brought it back to Spain, from where it spread throughout Europe, to North Africa, the Middle East, India and China. Maize (*Zea mays*, or Corn as it is known in some countries) is the only cereal crop that has an American origin and which is now a principal cereal crop in tropical and subtropical regions throughout the world.[7]*Zea mays*, the botanical name for corn comes from Greek, meaning to live. Mays comes from Spanish, the same word as a term in a native Mexican language meaning “mother”, or “mother of life”, reflecting the central importance of corn in the lives of early Americans.

Scientific classification:

Kingdom : Plantae

Family : Poaceae

Subfamily: Panicoideae

Genus : Zea.

Species : *Z. Mays*.

Synonyms : Maize, Corn, Mealie

Corn Silk[8,9,10]

Plants have been used for centuries as remedy for human diseases because they contain components of therapeutic values. Maize (Zeamays.L) is the third most planted food crop and one of the major energy sources among the people of the semiarid tropics. *Zea mays* L., also known as maize, Indian corn or corn is a cereal that is one of the most important edible grains in the world. In addition to the grains, leaves, corn silks, stalk and inflorescence of the maize plant are used for the treatment of several ailments. Corn silks are scientifically referred to as Maydis stigma or *Zea mays* as they reflect the soft, fibre-like growth which accompanies the ear of the corn. This yellowish thread-like strands or tassels called stigmas are found inside the husks of corn. They are relatively (4-8 inches) long with a mild sweetish taste. Corn silk has been used as diuretic, antilithiasic, uricosuric, and antiseptic. It is used for the treatment of edema as well as for cystitis, gout, kidney stones, nephritis, and prostatitis.

Fig. 2 Corn silk from maize plant.

All parts of corn are utilized, including the silks. The flowers of corn are monoecious in which the male and female flowers are located in different inflorescences on the same stalk.[11]The male flowers (tassel) at the top of the plant produce yellow pollen. Meanwhile, the female flowers produce CS and are situated in the leaf axils. The silks are elongated stigmas which look like a tuft of hairs. The colors of the CS, at first are usually light green

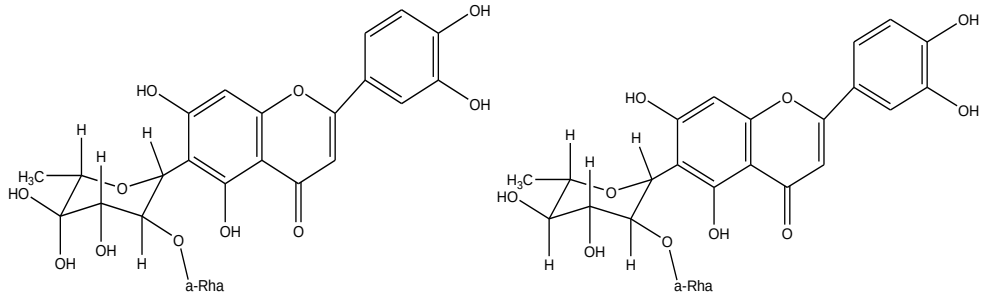
and later turn into red, yellow or light brown. The function of CS is to trap the pollen for pollination. Each silk may be pollinated to produce one kernel of corn. The CS can be 30 cm long or longer with a faintly sweetish taste. For medicinal purpose CS is harvested just before pollination occurs and can be used in fresh or dried form.

Phytochemical Compositions

Scholars from various countries have carried out large number of studies on corn silks chemical constituents, contents and biological activities, and found out that main constituents of *stigma maydis* are crude fiber,[12] polysaccharides,[13]β-sitosterol[14]alkaloids, flavonoids, allantoin, organic acids, saponins, minerals, tannins thathave convergence activity, zeaxanthin that have vitamin A activity and other nutrient substances and effective constituents, which can be used in the treatment of hypertension, nephritis, gallstone, diabetes, jaundice, measles, etc.Flavonoids, saponin, tannins, phenols, alkaloids and cardiac glycosidecan be extracted in both aqueous and methanolic extract. It also contains Terpenoid compounds which is isolated only in methanolic extract. Corn silk also contains fats, volatile oil, gums, resin, glycosides, vitamins C and K, sterols, plant acids, potassium and calcium.

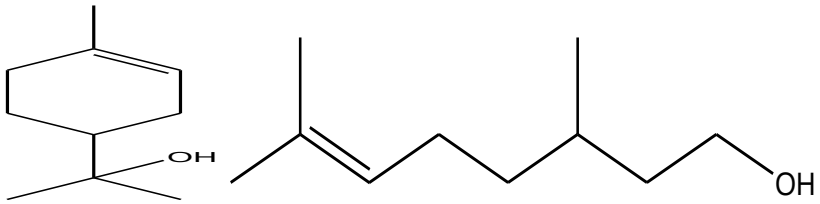
A recent study showed that the total flavonoids (TFC) content of the butanol fraction of CS extract is in good correlation with the total phenolic content (TFC).[15]Butanol fraction of CS is significantly higher in TFC [164.1 ug Gallic Acid Equivalent (GAE)/g DCS] and TFC [69.4 ug Rutin Equivalent (RE)/g DCS]. The upper (dark brown) parts of CS had higher amount of total phenolics (180 ug GAE/g F.W.), total anthraquinones (17.22 ug/g F.W.) and total flavonoids (119.47 ug/g F.W.) than the lower parts of CS (151.33 ug GAE/g F.W.,8.61ug/g F.W. and 101.66 ug/g F.W. respectively).[16]A flavonoid, 3'-methoxymaysin and reduced derivatives of mayasin have been isolated and identified from CS of several corn inbreeds. The compounds isolated include 2"-O-α-L-rhamnosyl-6-C-quinovosylluteolin, 2"-O-α-L-rhamnosyl-6-C-fucosylluteolin, and 2"-O-α-L-rhamnosyl-6-C-fucosyl-3'-methoxyluteolin.[17] Five other flavonoid derivatives were isolated from CS ethanol extract (80%) and identified as 2"-O-α-L-rhamnosyl-6-C-3"-deoxyglucosyl-3'-methoxyluteolin, 6,4'-dihydroxy-3'-methoxyflavone-7-O-glucosides, ax-5'-methane-3'-methoxymaysin, ax-4"-OH-3'-methoxymaysin and 7,4'-dihydroxy-3'-methoxyflavone-2"-O-α-L-rhamnosyl-6-C-fucoside.[18] Phytochemicals can be extracted from corn silk using various solvents such as benzene, chloroform, ethanol, ethyl acetate, methanol and petroleum ether. Screening of phytochemicals shows positive results for the presence of flavonoids, alkaloids, phenols, steroids, glycosides, carbohydrates, terpenoids and tannins.

Fig. 3 Structures of flavonoid derivatives

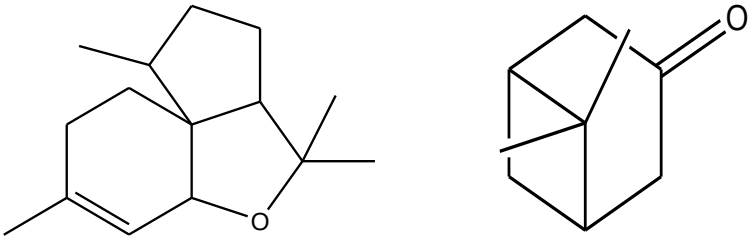


2''-O-α-L-rhamnosyl-6-C-fucosyl-3'-methoxyluteolin 2''-O-α-L-rhamnosyl-6-c-quinovosylluteolin

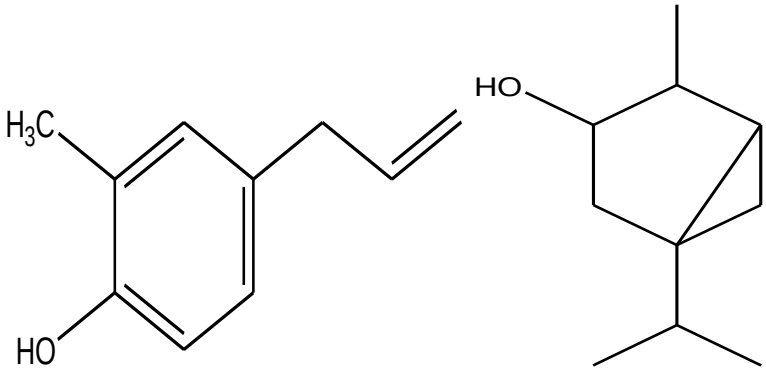
Fig. 4 Structures of some terpenoid compounds.



α-terpineolcitronellol



6,11-oxidoacor-4-ene trans-pinocamphone



Eugenol neo-iso-3-thujanol

Phenolic compounds: These are the class of chemical compounds consisting of hydroxyl group (-OH) attached directly to an aromatic hydrocarbon moiety. Corn is the major sources of polyphenolic compounds. especially corn bran, a main dietary fiber, is shows to be the most abundant source of polyphenolic compound However, the content and types of phenolic compounds in corn are affected by varieties and the cultivation conditions. The dominant phenolic compounds found in corn and there health benefits are shown in Table 1.

Table 1. The major health compounds in corn and their health benefits

Compounds in Corn	Health Benefits	Corn genotype
Carotenoids (lutein, zeaxanthin, β-cryptoxantin, β-carotene)	Cancer preventive activity, protective against age-related mascular degeneration; inhibitory effect against promotion of hepatocarcinogenesis.	Yellow, Red Corn
Ferulic acid	Anti- inflammatory anti-coloncarcinogenesis, and anti-diabetic effect through stimulating insulin secretion.	Yellow, Orange, and White Corn
Anthocyanins	Inhibit colorectal carcinogenesis; antimutagenic and antioxidant; prevents obesity and ameliorates hyperglycemia; antimicrobial; gastroprotection.	Red, Blue, Purple, Black Corn.
Phytosterols	Decrease serum total LDL-Cholesterol; inhibit adsorption of dietary cholesterol and biosynthesis of cholesterol.	Whole Corn Kernel (no specific color)

Preliminary phytochemical screening of corn silk

Phytochemical screening can be done by taking five grams of fresh corn silk sample then this sample is mesh and homogenize with 50ml of alcohol, acid(1% HCl) and water separately. These mixtures are boiled for one hour, cooled, filtered and used for analysis of phytochemicals such as flavonoids, phenols, anthocyanins, tannins, saponins, steroids, alkaloids and terpenoids . Phytochemicals were extracted best in methanol.[19]

1.1 Corn Silk In Healthcare

Corn silk (CS) is made from stigmas, the yellowish thread like strands from the female flower of maize. As it is a waste material from corn cultivation it available in abundance. 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. It is used for the treatment of cystitis, edema, kidney stones, diuretic, prostate disorder, and urinary infections as well as bedwetting and obesity. It soothes and relaxes the lining of the bladder and urinary tubules, hence reducing irritation and increasing urine secretion. Other beneficial treatments of CS include anti-fatigue activity, anti-depressant activity and kaliuretic. In addition, it possesses excellent antioxidant capacity and demonstrated protective effects in radiation and

nephrotoxicity. In China, it is considered very important medicinal plant in the treatment of prostate problems. Meanwhile, the Native Americans used CS to treat urinary tract infections, malaria and heart problems. 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, edema, obesity and promote relaxation. To date, there are various CS commercial products for medicinal uses are available in the market. CS is rich in phenolic compounds, particularly flavonoids. It also consists of proteins, vitamins, carbohydrates, calcium, potassium, magnesium and sodium salts, volatiles oils and steroids such as sitosterol and stigmasterol, alkaloids, and saponins. Due to its potential benefits, there are several studies reported the pharmacological activities of CS.

Antioxidant activity

Oxidation can cause a number of diseases including atherosclerosis, neurodegenerative disorder, cancer, diabetes, inflammatory and aging.[20]Antioxidants are used by aerobic organisms to prevent oxidation that can damage the cell during oxygen metabolism. Natural antioxidants extract from fruits, teas, vegetables, cereals and medicinal plants have been investigated extensively due to their effectiveness in eliminating free radical and claimed to be less toxic than synthetic antioxidants such as butylatedhydroxyanisole (BHA) andbutylatedhydroxytoluene (BHT).[21,22]Secondary metabolite from medicinal plants function as small molecular weight antioxidant, but their particular mechanism of action are variable, and depends both on the structure and environment.[23]Free radical scavenging activity is determine by using 1,1-diphenyl-2-picryl hydrazyl radical (DPPH) assay, as DPPH is a stable antioxidant.Methanolic extract shows maximum DPPH scavenging activity and total antioxidant activity.These activities may be due to the presence of flavonoids, alkaloids, phenols, steroids, glycosides and tannins in corn silk.

Assay of free radical scavenging activity (DPPH): DPPH is use for determination of free radical scavenging activity of various extracts. Different concentrations (10-100 µg) of eachof the extract of corn silk will add with an equal volume of methanolic DPPH solution (0.5 mM) and incubate at 37^{o}C for 30 min. In this assay DPPH solution with methanol is use as positive control and methanol act as negative control. When DPPH reacts with antioxidant, it get reduced which is visualize by change in colourfrom deep violet to light yellow. Absorbance is measure against blank at 517 nm using spectrophotometer The percentage of DPPH radical scavenging activity (%) of sample is calculated as:[19]

Percent Scavenging activity= Absorbance of the sample/ Absorbance of the control *100

Anti-Urolithiatic activity

The different calculi are painful urinary, disorders that starts as salt/chemical crystals which precipitate out from urine. Under normal circumstances, the urine contains substances that prevent crystallization but for patients with kidney stone problem, these inhibitory substances are ineffective. Kidney stone is one of the most important problems in different countries over the world. Locally corn silk used as decompose of stones. Corn silk is playing an important physical role in treatment by increasing the contraction of smooth muscles a led to increase the urinary output and increased percentage the passage of urinary stone through the urinary tracts. Corn silk used as decompose of stones. Current study proved that aqueous extracts of corn silk of *Zea mays* executed on generated calcium oxalate crystals by homogenous precipitation method for *in-vitro* anti-lithiatic activity.[2]

Antimicrobial activity

Phytochemical studies on corn silk revealed that it contained a number of flavonoids. Phytochemical analysis on corn silk resultant the isolation of two flavonoid glycosides Maysin and Maysin-3'-methyl ether, from the n-butanol fraction of methanol extract of corn silk. These two flavonoid glycosides showed wider range of activity towards gram-positive and gram-negative bacteria. Comparatively Maysin shows highest antimicrobial activity towards gram positive bacteria than Maysin-3'-methyl ether, it seems the presence of methoxyl substitution on C-3' position slightly decreases the sensitivity towards bacteria. reported that the presence of phenolic hydroxyl groups was essential for higher antibacterial activity. In comparison with the antibacterial activity of Maysin-3'-methyl ether. Recent study reveals that in comparison with Gentamycin, Maysin showed significantly higher activity against *Bacillus cereus, Bacillus subtilis, Staphylococcus aureus, Salmonella typhi, Shigellasonnei, Shigellaflexneri, Proteus vulgaris* and similar activity against *Enterobacteraerogenes, Salmonella paratyphi, and Proteus mirabilis*.From the different solvent extracts of corn silk, it can be seen that extracts exhibited wider range of antimicrobial activity, petroleum ether and methanol extracts were more active than chloroform extracts.[25]

Anti-diabetic

Corn silk contains proteins, vitamins, carbohydrates, Ca, K, Mg, and Na salts, fixed and volatile oils, steroids such as sitosterol and stigmasterol, alkaloids, saponins, tannins, and flavonoids. Based on folk remedies, corn silk has been used as an oral antidiabetic agent in china for decades. From experimental study it was found that corn silk extracts markedly

reduced hyperglycemia in alloxan-induced diabetic mice. The action of corn silk extract on glycaemic metabolism is not via increasing glycogen and inhibiting gluconeogenesis but through increasing insulin level as well as recovering the injured β-cells.[26]recent experimental study shows that methanolic extract of corn silk enhanced the uptake of glucose by isolated rat hemi-diaphragm significantly ($p<0.001$) and was found to be more effective than insulin. The glucose uptake by corn silk extract and insulin together was found to be less than corn silk extract alone, but significantly higher than insulin treated group. This result appears that drug interaction could have occurred between Corn silk extract and insulin when given together

Urinary Tract Infection

Urinary tract infection are infections of the urethra, bladder, ureters, or the kidneys, which comprise the urinary tract. Corn silk extract helps to soothe and coat irritated, inflamed tissue.Corn silk also helps to stimulate the kidney and bladder and increase the flow of urine.Cornsilk is used to treat urinary tract infections and kidney stones in adults. Corn silk is regarded as a soothing diuretic and useful for irritation in the urinary system. This gives it added importance, since today, physicians are more concerned about the increased use of antibiotics to treat infections, especially in children. Eventually, overuse can lead to drug-resistant bacteria. Also, these drugs can cause complications in children. Furthermore, corn silk is used in combination with other herbs to treat conditions such as cystitis (inflammation of the urinary bladder), urethritis (inflammation of the urethra), and parostitis (mumps). Corn silk is said to prevent and remedy infections of the bladder and kidney. The tea is also believed to diminish prostate inflammation and the accompanying pain when urinating.[28,29]

Antidepressant Activity

Studies have shown that increasing levels of flavonoids in the diet could decrease certain human diseases. Corn silk extract shows high level of total phenol and flavonoids contents. The swimming test has been widely employed to evaluate the effect of various agent on the central nervous system (CNS), such as CNS depressants, antidepressants, sedative-hypnotics, psychostimulants, euphorics, nootropics, adaptogens, etc. The immobility seen in rodent during swimming reflects behavioral despair as seen in human depression. Antidepressant activity of corn silk can be evaluated by Forced swimming (FST) and Tail suspension tests (TST). Hydro alcoholic extract of corn silk (125, 250, 500, and 1000 mg kg^{-1}) used to study antidepressant activity by FST and TST. Extract at 1500 mg/kg shows similar activity as imipramine 10 mg/kg(tricyclic antidepressant) in TST.

Forced Swimming Test: Drop the mouse into a glass cylinder (20 cm in height and 12 cm in diameter) containing 8-cm-deep water at 24-25^{o}C and left there for 6 min. the duration of immobility during the final 4-min interval of the Swimming test is measure (2-4). Control group is treated with solvent. The other groups of mice receive an interperitoneal (i.p.) injection of extract (125, 250, 500, and 1000 mg kg^{-1}) in tween 80 plus 0.9 % (w/v) saline solution and Antidepressant drug (5 and 10 mg kg^{-1}), 1 h before the experiment. Antidepressant drug (e.g. Imipramine) was utilized as positive control of the test.[30]

Corn silk in cosmetic as Whitening agent

The skin color of the human body is determined by melanin, carotenoids, hemoglobin, and bilirubin, among which melanin is the most important factor. Melanin is produced to protect the skin against damage due to UV radiation. The biosynthesis of melanin starts with the oxidation of tyrosine by tyrosinase; DOPA and dopachrome are then produced, followed by DHI-eumelanin, DHICA-eumelanin, and pheomelanin. Researchers carried out experiment to investigate the inhibitory effect of corn silk on melanin production in Melan-A cells by measuring melanin production and protein expression. Experimental finding shows that the corn silk extract applied on Melan-A cells at a concentration of 100 ppm decreases melanin production by 37.2% without cytotoxicity. This is better result than arbutin, a positive whitening agent, which exhibit a 26.8% melanin production inhibitory effect at the same concentration. The corn silk extract not suppress tyrosinase activity but greatly reduced the expression of tyrosinase in Mela-A cells. Corn silk extract activity of depigmentation can be measured by applying the extract to human face with hyperpigmentation, and skin color is measure to examine the degree of skin pigment reduction. The application of corn silk extract on faces with hyperpigmentation significantly reduced skin pigmentation without abnormal reactions. Corn silk has good prospects for suppressing skin pigmentation.[31]

Corn silk in Nutrition

Presently, the incidences of chronic diseases such as heart disease, stroke, cancer, chronic respiratory diseases and diabetes are undoubtedly increasing and becoming a major problem. In order to prevent the incidence of any chronic diseases, intake of dietary fibres from fruit, vegetables and whole grains should be promoted.Dietary fibre has its benefit effects in preventing obesity, cardiovascular disease, type 2 diabetes mellitus, colon cancer, colonic diverticulitis and constipation. So, it is crucial to add dietary fibre in our diets to prevent those diseases. It is suggested that populations that consume more dietary fibre have less chances to get those chronic diseases. Cornsilk which is rich in antioxidants and dietary fibres

has grown in the current decade and led to the development of a large market for antioxidant and fibre rich ingredients and products. Cornsilk has already been incorporated into beef and chicken patties to improve nutritional composition. [32,33]

The proximate compositions, total dietary fibre (TDF) content, textural properties and sensory acceptability of yeast breads formulated with 0%, 2%, 4% and 6% of cornsilk powder (CSP) were studied. The protein, ash and TDF contents of yeast breads were increased in line with the CSP level added whereas moisture content was decreased. Yeast bread added with 6% CSP recorded the highest content of TDF (5.91%), protein (9.76%) and ash (1.03%) compared to other formulation of yeast breads containing lower percentage of CSP. Besides, texture profile analysis (TPA) reported that the firmness, gumminess and chewiness of yeast breads increased directly proportional to the level of CSP added mainly due to higher content of TDF and lower content of moisture. However, for the yeast bread added with 2%CSP, there were no significant differences compared with control yeast bread. Among all cornsilk-based yeast bread, formulation containing 2% CSP had the highest scores for all attributes including overall acceptance and there were no significant differences with control yeast bread. This study indicated that the addition of 2% CSP could be an effective way to produce functional yeast bread without changing negatively its desirable textural and sensory acceptability.[34]

Table 2:*In vivo* study for pharmacological activities of corn silk.

***IN VIVO* STUDY**			
Pharmacological activities	**Methods**	**Results**	**Referances**
Antioxidant activity	γ-Radiation induced oxidative stress in micetreated for 10 days.	Antioxidant activity against γ -radiation.	35
	Exercise induced oxidative stress in mice treated for 28 days.	Antioxidant activity against oxidative stress during acute exercise.	36
Diuresis and kaliuresis effect	Wistar rats were administered with CS extract by orogastriccatherer and continuous urine collection for 3 and 5 h.	Exhibition of diuresis and kaliuresis effect.	37
	Wistar rats were treated intragastrically with CSextract for 90 min and urine collection and urinary flow were measured by cannulated to the urinary bladder.	Shows a diuresis effect.	38
Hyperglycemia reduction	Adrenaline-inducedhyperglycemic mice treated orally with CS extract for 45 and 14 days.	Reduction of blood glucose levels.	39
Nephrotoxicity reduction	GM-induced nephrotoxicity mice administered with CS extract for 8 days.	Ameliorate nephropathy.	40

Renal protective activity	Activity of CS by Isolated Rat Renal Perfusion System (IRRP)	Histo-pathological studies using a light microscope showed significant renal damage including necrosis and infiltration, due to hydro alcoholic extract of corn silk when compared to negative & positive control groups.	41
Anti-fatigueactivity	Swimming exercise carried out by 10 mice afteradministration of flavonoid CS for 14 days and loaded with 5% of its body wt. of galvanized wire.	Strong anti-fatigueactivity.	42
Anti-depressant activity	FST and TST carried out on 10 male Swiss mice for 6 and 5 min, respectively, 1h after treated with CS extract.	Strong anti-depressant activity.	43
	Activity times of CS treated mice (normal and diabetic mice) in a black box were observed.	Good anti-depressant activity.	44
Antihyperlipidemic effect	Hyperlipidemic rats were treated with CS extract for 20 days.	Shows anti-hyperlipidemiceffect.	45
Anti-diabetic effect	Streptozotocin-induced diabetic rats were treated intragastrically with polysaccharides from CS for 4 weeks.	Shows anti-diabetic effect.	44
Anti-inflammatory effects	Carragenin-induced pleurisy rats were administered orally with CS for 6 h.	Inhibit inflammatory response.	46

Table 3: *In vitro* study for pharmacological activities of corn silk.

***IN VITRO* STUDY**			
Pharmacological activities	**Methods**	**Results**	**Referances**
Antioxidant activity	Total antioxidant capacity, DPPH radical scavenging activity, reducing power, and iron-chelating capacity were evaluated in ethanol extract (EF), petroleum ether (PF), aceticether (AF), n-butanol(BF), and water (WF).	BF exhibited the strongest antioxidant activity.	47
	Total antioxidant capacity by DPPH radical scavenging activity was evaluated in CS ethanolic extract.	Upper parts of CS showed higher antioxidant activity than the lower parts of CS.	48
	50% ethanolic extract were tested in DPPH radical scavenging activity, metal chelating activity, nitric oxide-scavenging activity, reducing power determination and ferric thiocyanate (FTC) method.	Ethanol extract showed a comparable antioxidant activity to the standard compounds (BHA, BHT, Vitami C, quercetin, EDTA).	49
	Dichloromethane extract, petroleum ether extract, 95% ethanol extract, water extract were evaluated for theirantioxidant activity in DPPH and β-carotene bleaching assay.	Ethanol extract exhibited the strongest antioxidant activity.	50

	70% aqueous acetone extract were tested for ferric reducing antioxidant power (FRAP) assay using different type of hybrid.	The acetone extract of NS 640 hybrid showed a highest antioxidant activity.	51
	Metaholic extract of CS were evaluated for antioxidant capacity by lipid peroxidation inhibition in liposomes induced by Fe2+/ascorbate system.	Antioxidant activity from matured CS is higher than immature CS.	52
	DPPH radical scavenging activity, superoxide (SO) scavenging activity, iron chelating capacity, ferric reducing antioxidant power (FRAP) assay were carried out in ethyl acetate extract and ethanol extract.	All extracts exhibited low DPPH radical scavenging activity. Ethanol extract of *Z. mays* var. *indurate* exhibited the highest iron chelating capacity. Higher antioxidant activity by FRAP assay in Ethyl acetate extract.	53
Anti-glycation effect	Inhibition of AGE formation assay in 80% methanolicextract.	Inhibit non-enzymatic glycation.	54
Anti-inflammatory effect	Endothelial-monocyte adhesion assay, molecule expression, treatment of TNF-mediated cytotoxicity, LPS-induced TNF released were evaluated in chloroform, ethyl acetate, butanol and water extract.	Ethanol extract inhibits the expression of ICAM-1 and adhesiveness of endothelial cells.	55
	COX-2 determination was conducted on macrophages treated with CS and PGE2 production was measured with PGE2 enzyme immunoassay kit.	CS stimulated COX-2 and secretion of PGE_2.	56
Neuroprotective effect	Acetylcholinesterase (AChE) and butrylcholinesterase (BChE) inhibitions assay were carried out in ethyl acetate extract and ethanol extract.	Ethyl acetate extract of *Z. mays* var. *intendata*strongly inhibitAChE and ethyl acetate extractof *Z. mays* var. *everta*stronglyinhibit BChE.	53
Anti-urolithiatic activity.	Calcium oxalate crystals were generated and treated with the corn silk extract	Corn silk extracts has shown significant and better action in dissolving the crystals.	24

Interactions with medication

- Corn silk might decrease blood sugar. Diabetes medications are also used to lower blood sugar. Taking corn silk along with diabetes medications might cause blood sugar level to go too low. Monitor the blood sugar closely. And the dose of diabetes medication might need to be changed.
- Large amounts of corn silk seem to decrease blood pressure. Taking corn silk along with medications for high blood pressure might causes blood pressure to go too low.
- Some medications for inflammation such as corticosteroids can decrease potassium in the body. Corn silk might also decrease potassium in the body. Taking corn silk along with some medications for inflammation might decrease potassium in the body too much.

- Corn silk contains large amounts of vitamin K. Vitamin K is used by the body to help blood clot. Warfarin (Coumadin) is used to slow blood clotting. By helping the blood clot, corn silk might decrease the effectiveness of warfarin (Coumadin).
- Corn silk seems to work like "water pills." Corn silk and "water pills" might cause the body to get rid of potassium along with water. Taking corn silk along with "water pills" might decrease potassium in the body too much.

CONCLUSION

This review highlights the potential of Corn Silk as a herbal drug for healthcare applications. Pharmacological studies (*in vitro* and *in vivo*) have shown its remarkable bioactivities as antioxidant, hyperglycemia reduction, anti-depressant, anti-fatigue and effective diuretic agent. Some of the studies have confirmed the earlier findings and new research discoveries have proven that Corn Silk is safe and non-toxic.

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