التأثير العلاجي المحتمل لمستويات مختلفة من مسحوق حرير الذرة على الفئران السمية الكلوية

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Potential treatment effect of different levels of corn silk powder on nephrotoxicity rats

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Abstract

"Nephrotoxicity" describes the harmful effects of chemicals and pharmaceuticals on the kidneys, specifically the quick loss of kidney function that results. The purpose of this study was to examine the effects of four different concentrations of corn silk on nephrotoxicity rat kidney function, liver enzymes, blood glucose, serum minerals, and antioxidant enzymes. In order to induce nephrotoxicity, five groups were given injections of gentamicin; the first group served as a negative control. The animals were divided into two groups: one that tested positive and the other that received a basal diet supplemented with corn silk level powder for a duration of 28 days. Six groups were formed from 36 healthy adult male albino rats of the Sprague-Dawley strain. the obtained results showed that the corn silk had high content of carbohydrates, dietary fiber, protein, potassium calcium and magnesium while it had low content of fat and moisture. The groups that were treated with nephritic corn silk showed a marked increase in Tp, Alb, GPX, SOD, CAT, GSTs, and TAC levels, and a significant decrease in AST, ALT, ALP, GGT, urea, uric acid, creatinine, MDA, and blood glucose levels. In the groups treated with nephritic acid, potassium and phosphorus levels fell while sodium and calcium levels rose, especially at 15%. Thus, it was determined that corn silk powder contains numerous essential components that significantly improve the prevention and treatment of kidney diseases.

Key words: Kidney functions- corn silk –- antioxidants enzymes- minerals

Introduction

The kidney plays a vital role in human body by performing many functions including controlling blood pressure, maintaining fluid homeostasis, acid-base balance, conserve bone density, hormonal balance, eliminating nitrogenous and xenobiotic toxicants (**Molaei *et al*., 2021).** Production of ROS and reactive nitrogen species (RNS) is associated with nephrotoxicity. This condition is defined as the rapid decline in renal function as a result of the toxic effects of metals such as lead, arsenic, and mercury, as well as chemotherapy medications such as cisplatin, antibiotics like gentamicin, and molds and fungi **(Perazella and Rosner, 2022).** Drug-induced nephrotoxicity represents approximately 19–26% of all hospital cases which can be mostly attributed to increased ROS production by the renal mitochondria, which harm cellular macromolecules like proteins, lipids, and DNA and eventually cause the death of kidney cells (**Ali *et al*.,2021).** Endocarditis, sepsis, pneumonia, pelvic inflammatory disease, meningitis, UTIs, and bone infections are some of the severe Gram-negative bacterial infections that gentamicin (GM), an aminoglycoside antibiotic, is used to treat. The adverse effect of using GMs appeared in oxidative stress, apoptosis, fibrosis, and inflammation crystal nephropathy, rhabdomyolysis, as well as thrombotic microangiopathy of kidney **(Althunibat *et al*., 2022 and Fitri *et al*., 2022)**.

In the maize plant, corn silk is the term used to describe the long, silken filaments of the stigma and styles. In traditional Chinese medicine, this demulcent and moderate diuretic is used to treat edema, cystitis, gout, rheumatism, RA, and rheumatoid arthritis, among other kidney-related ailments **(Chen *et al*., 2013)**. Minerals like magnesium, calcium, sodium, and potassium salts are just a few of the beneficial substances found in this herb. It also contains a plethora of bioactive substances like flavonoids, vitamins, phenolic compounds, alkaloids, steroids, carbs, amines, pigments, fixed oils, and resins (**Ayesha *et al*., 2022).** Because of its high antioxidant activity and abundance of beneficial bioactive chemicals, corn silk is a great source of ascorbate, flavonoids, and polyphenols **(Jyoti Singh *et al*., 2022).** Corn silk's strong antioxidant capabilities in both laboratory and living organisms suggest it may find use in food and medicine **(Liang Zhang *et al*., 2021).** Consequently, this study set out to assess the effect of different concentrations of maize silk powder on selected biochemical parameters in rats with the kidney damage.

Materials and Methods

Materials

Plant material

Corn silk was collected from corn field in Shebin-El kom City, Menoufia Governorate, Egypt and defined by Agriculture Crops Department, Agriculture Faculty, Menoufia University.

Animals

The study utilized 36 male albino rats of the Sprague-Dawley strain, which were acquired from the Animal House Department of the Research Institute of Ophthalmology in Giza, Egypt, and weighed 150±10 g.

Chemicals

From El-Gomhoria Company for Trading Drugs, Chemicals and Medical Instruments in Cairo, Egypt, we procured choline chloride, methionine, vitamins, minerals, casein, cellulose chemical kits, and gentamicin, which are aminoglycoside antibiotics. The Mostorod Factory in Qalyubia, Egypt, which is known as the Egyptian Starch and Glucose, was supplied with corn starch.

Methods

Preparation of corn silk powders

After removing it from the corn, the corn silk was finely chopped using a sharp knife. Following a thorough washing with clean water to eliminate any impurities, the pieces were subjected to 48 hours of drying at 50±5°C until their moisture content reached 6%. The dehydrated parts were subsequently powdered using a Braun AG Frankfurt Type: KM 32 laboratory disc mill from Germany and kept at 4°C until further examination **(Russo, 2001)**.

Determination the chemical constitutes of corn silk

Chemical constitutes (Triplicate sample) were determined to identify their contents from moisture, protein, fat, ash and dietary fiber which were regarding to **A.O.A.C. (2018)** and total carbohydrates were determined by difference**.**

Analysis of minerals content

Following the protocols of atomic absorption spectroscopy, the concentration of minerals was measured using a German-made PerKin-Elmer Instrument Model 2380 **A.O.A.C. (2012).**

Assessment of some vitamins

Carotene was determined by the method described by **Okwu and Josiah (2006).** Spectrophotometric methods were used to determine the levels of ascorbic acid (vitamin C), thiamine (B1), riboflavin (B2), niacin (B3), and pyridoxine (B6) **Onwuka (2005).**

Evaluation of Total flavonoid, total phenols, DPPH and APTS

Total flavonoids and total phenols were determined according the methods of **Park *et al.* (1997) and Singleton & Rossi (1965) respectively**.

The 1,1-diphenyl-2-picrylhydrazyl (DPPH) and ABTS assays were used in conjunction, with the procedures following those of **Brand-Williams *et al.* (1995) and Re *et al.* (1995)** respectively.

Biological experiments

The following formula, as stated by, is used to prepare the basic diet (BD) **Reeve *et al.* (1993)** All of the parts are listed below: A 10% protein-corn oil combination includes all of the following: An assortment of vitamins and minerals (4%), choline chloride (0.2%), methionine (0.3%), cellulose (5%), and corn starch (99%) make up the whole. In place of corn starch, rats were given corn silk powder in different concentrations as a dietary supplement.

For the adaptation period, a well-ventilated laboratory was used to house 36 healthy adult male Sprague-Dawley rats in individual wire cages. The weight of each rat was 150±10 g. Glass tubes ran through the wire cage, supplying the rats with water from inverted bottles that were positioned on one side and watched over every day. The rats' diets were introduced into these cups in a specific way to prevent feed loss and contamination.

Following the one-week adaptation period on the basal diet, the rats (n=36) were split into two groups. One group, consisting of six rats, served as a control group that did not receive any experimental food. Injecting 10 mg of gentamicin (an aminoglycoside antibiotic) per

kilogram of body weight once daily for 10 days in a row was administered to the second main group of rats (n=30) **(Farombi and Ekor, 2006)** We aimed to induce nephrotoxicity by doing this. The next step was to sort the rats into five groups of six. There was a control group and the other groups got a basic diet plus2.5,5,10, and 15% of the recommended daily allowance, respectively.

Blood samples

For the last part of the experiment, rats were fasted for 24 hours and given water for two hours. After that, they were put to sleep under anesthesia and sacrificed. Centrifuged at 3000 r.p.m. for 10 minutes, blood samples were extracted from the aorta. Drying the tubes and placing them in fresh Eppendorf tubes allowed the serum to separate. Afterwards, the tubes were kept at -20°C until they were required. (**Schemer,1967)**.

This study was approved by the Research Ethics Committee (REC) at National Hematology and Tropical Medicine research Institute (NHTMRI)- Cario-Egypt (Approval protocol number:(**A5-2024).**

Serum biochemical parameters measurements

Creatinine, urea, and uric acid were evaluated in accordance with the methodologies of **Patton& Crouch(1977); Fossati *et al*.(1980) and Larsen, (1972)** respectively.

Alkaline phosphatase (ALP), serum gamma-glutamyl transferase (GGT), aspartate aminotransferase (AST), alanine aminotransferase (ALT), total protein (Tp), albumin (Alb), AND globulin (Glb) were included in the methods used to evaluate liver functions **Henry(1974); Titez(1976)** ; **Kind and King(1954);Gowenlock *et al.*(1988) ; Spencer &Price(1977)** and **Srivastava *et al.*(2002)** respectively. Serum glucose was measured in the serum according to **Trinder, (1969).**

By **Nicoli and Diana(2003)** Sodium (Na), potassium (K), calcium (Ca), and phosphorus (P) were quantified using the following procedures.

Catalase (CAT), malondialdehyde (MDA), glutathione peroxidase (GPX), superoxide dismutase (SOD), and total antioxidant capacity (TAC) were all measured in this study **Zhao(2001); Sun *et al*.(1988); Aebi, (1983); Koracevic(2001) and Ohkawa *et al.*(1979)** respectively.

Statistical analysis

All data collected from the study was submitted for statistical analysis using SPSS ver. 11, specifically evaluating divergence ANOVA and the associated test LSD **AboAllam, (2003).**

Results and discussion

Data in Table (1) presented the chemical constitutes of dried corn silk. It was noted that it had low content of fat while the carbohydrates recorded the highest constitute. Ash and moisture recorded nearly values. Also, it had high content of dietary fiber and protein. For minerals contents, potassium was the highest followed by calcium and magnesium. The lowest content was detected in zinc followed selenium and iron.

From previous studies, it could be noticed that the finding of **EL Kewawy (2018)** nearly matched with the obtained results. In dry weight corn silk, the components that were determined to be present were moisture (7.04%), fiber (6.13), ash (20.1), protein (13.57%), carbohydrates (51.35%), and 1.91 (1.01).

Another study was nearly to the obtained results was carried out by **Nuntaporn *et al.*** (**2015**) Within 100 grams, the following compositions were determined: 51.37 grams of carbohydrates, 17.94 grams of protein, 16.11 grams of crude fiber, 9.06 grams of moisture, 4.60 grams of ash, and 0.91 grams of fat.

Also, **Singh *et al. (*2022)** found that the maize silk powder that was prepared had a moisture content of 7.89 ± 0.49 g/100 g, which made it easier to manage its shelf life. According to the chemical composition of the maize silk granules, corn silk has a high carbohydrate content of 56.16 ± 0.66 g/100, which is higher than the other nutrients.A total of 14.82 ± 0.84 grams of fiber per 100 grams of maize silk powder was found in the samples. Corn silk, which contains an average of 5.29% ash and 15.29% protein, is among the most effective sources of both nutrients. Roughly half of that amount was lipid in the variant in question.

For minerals contents, **EL Kewawy(2018)** The following elements were found to have specific concentrations: 2.77 εg/g for zinc, 1.96 εg/g for iron, 4.7.3 εg/g for copper, 0.65 εg/g for magnesium, and 8.16 εg/100 g for calcium. Also, **Nuntaporn *et al.* (2015**) mature corn

silk contained 35671.67 and 266.67 l g/g of K and Na, respectively **Singh *et al.(* 2022)** proved that atmospheric conditions, soil type, irrigation, and fertigation-introduced nutrients are among the variables that affect the mineral content of maize silk. The study's authors found that corn silk is an excellent food source for several minerals, including sodium, magnesium, potassium, and calcium. They also found trace amounts of iron(41.77 ± 2.67 µg/g), manganese(11.10 ± 2.15 µg/g),, and zinc(83.75 ± 1.80 µg/g).

Table (1): Chemical constitutes of dried corn silk powder per100g

Constitutes	**Corn silk powder (CSP)**
Moisture (g)	6.72±0.87
Protein(g)	12.16±1.96
Fat(g)	0.97±0.004
Dietary fiber(g)	26.86±1.67
Ash(g)	5.72±0.72
Carbohydrates(g)	49.57±3.81
Calories kcal	255.65±6.92
Calcium (mg)	81.55±2.34
Phosphorous (mg)	45.09±4.77
Sodium (mg)	12.81±6.71
Magnesium(mg)	67.05±2.64
Iron (mg)	1.87±0.008
Potassium (mg)	323.17±4.52
Zinc (mg)	0.78±0.002
Selenium(mg)	0.48±0.001

Values are expressed as mean ± SD; n = 3, Values in the same column having different superscripts letters are significantly ($p \leq 0.05$)

Table (2) show the content of vitamins C, thiamin, riboflavin, beta carotene, niacin, and pyridoxine in dried corn silk. It was found corn silk had the highest content in vitamin C followed by beta-carotene . The other vitamins were detected but in small amount under the value of one . A water-soluble vitamin known as ascorbic acid is essential for a variety of physiological processes and serves as a potent antioxidant in the fight against diseases caused by free radicals (**Alam, 2011**). There was a notable increase in

the vitamin C content of the maize silk powder, with 270.55 mg/100 g being reported, compared to 9.72 mg/100 g being reported by **EL Kewawy (2018)** which very nearly to the current study.

Table (2): Vitamins content of dried corn silk powder per 100g

Vitamins	Content /100g
Vit.C(mg)	263.04±5.82
Thiamine mg	0.09±0.008
Riboflavin mg	0.23±0.003
Carotene (provitamin A) mg	123.08±10.76
Niacin mg	0.53±0.06
Pyridoxine mg	0.08±0.001

Values are expressed as mean ± SD; n = 3, Values in the same column having different superscripts letters are significantly ($p \leq 0.05$)

Table (3) reveal that the total phenols and total flavonoids were 98.67±2.24 mg GAE/g and 157.92±2.45 mg QE/100 g respectively . This corn silk powder was tested for total antioxidant activity using the DPPH radical scavenging activities test and the ABTS activity. The results are shown in the same table; the ABTS activity for corn silk powder was 55.15± 1.83 TEAC mg/gdw, and the DPPH percentage was 84.0̲ 5.32%. These findings corroborated with **EL Kewawy (2018)** who discovered that CS contained total flavonoids (ranging from 30.1 to 88.8 mg RE/g) and total phenolics (ranging from 80.8 to 117.1 mg GAE/g). **Xizhu *et al*. (2021)** proved that the quantity of phenol and flavonoid in maize silk fluctuates in response to varying growth conditions. Antioxidant content is frequently regarded as a beneficial characteristic of corn silk. They include ascorbates, flavonoids, and polyphenolic compounds. Because of their high nutritional value, anti-inflammatory, anti-diabetic, antiviral, and antioxidant capabilities, these elements are vital to human fitness. The action mechanisms of medicinal plant secondary metabolites, which are antioxidants with small molecular weights, depend on their structure and environment **(Haslina *et al*., 2017). Singh *et al.* (2022)** revealed that the upper regions of corn silk contained significantly more phenolics and flavonoids than the lower regions. Nevertheless, the compounds were determined using a homogenized sample in the present analysis.

Table (3): Total phenols, total flavonoids and DPPH of dried corn silk

Compounds	Content
Total phenols mg GAE/g	98.67±2.24
Total flavonoid mg QE/100 g	157.92±2.45
DPPH (%)	83.02± 5.32
ABTS TEAC mg/gdw	55.15± 1.83

Values are expressed as mean ± SD; n = 3, Values in the same column having different superscripts letters are significantly ($p \leq 0.05$

Nephrotoxicity rats were studied by measuring the levels of corn silk on average for creatinine, urea, and uric acid. The results were published in

table (4). Compared to the negative control group, the nephritic positive group had significantly higher levels of creatinine, urea, and uric acid (P0.05). Rats with nephritis who were given different amounts of maize silk had their levels of creatinine, urea, and uric acid reduced gradually but significantly, in comparison to the control group.The positive control group and the group that received 2.5% maize silk showed no statistically significant difference. A corn silk concentration of 15% was found to be the most effective in reducing the tested kidney functions compared to the positive control. There was a decrease of around 13% for creatinine, 46% for urea, and 47% for uric acid. Previous studies proved that maize silk reduced urea and creatinine levels in the kidneys of mice. **Marijana *et al.(* 2016)** .Also, **Aewha *et al*.(2018)** showed that corn silk extract is effective in the treatment of kidney-related diseases as a diuretic agent due to its high concentration of phytochemicals that can induce diuresis **Naeem(2022)** discovered that the parameters of kidney function were significantly reduced after consuming maize silk extract in comparison to the positive control. The diuretic compounds' toxic effects, which help reduce inflammation and renal problems, were the reason for this.**Xizhu *et al.*, (2021)** and **Ayesha *et al.*, (2022)**, Serum urea and serum creatinine levels were reported to have decreased significantly by corn silk extract, indicating the presence of polysaccharide. Influenced by harmful compounds that harm kidney cells and cause nephrotoxicity when inhaled, consumed, or injected, this polysaccharide decreased renal injury and increased uric acid excretion.

Table (4): Effect of corn silk levels on creatinine, urea, and uric acid of nephrotoxicity rats (mg/dl)

Groups	Creatinine	Urea	Uric acid
G_1	0.76±0.001 ^{e}	11.34±1.82 ^{e}	1.58±0.34 ^{e}
G2	1.75±0.04 ^{a}	38.61±1.32 ^{a}	4.71±0.04 ^{a}
G3	1.72±0.03 ^{a}	36.45±1.12 ^{a}	4.21±0.02 ^{a}
G4	1.66±0.012 ^{b}	31.26±0.82 ^{b}	3.52±0.07 ^{b}
G5	1.60±0.032 ^{c}	25.55±0.43 ^{c}	3.01±0.11 ^{c}
G6	1.52±0.01 ^{d}	20.64±1.72 ^{d}	2.49±0.19 ^{d}
LSD	0.04	2.03	0.50

Values are expressed as mean ± SD; n = 6, Values in the same column having different superscripts letters are significantly ($p \leq 0.05$)

Data in table (5) showed that serum total protein, albumin and globulin of nephrotoxicity rats as affecting the feeding on corn silk powder levels .It was found that the values of the tested parameters significantly improved by increasing the corn silk levels. The level 15% recorded the highest value as compared to the other tested levels . In case of globulin , the third group gave value nearly to the positive control group with nonsignificant changes. The improvement percentage for the serum protein was about 43% when the corn

silk level was 15%. An increase in serum concentration of total protein, globulin, and albumin is caused by the antioxidant activity of corn silk, which is attributed to its total phenolic and flavonoid content **(Tanideh et al., 2018).** Moreover, CS is a source of proteins, sugars, vitamins (particularly riboflavin), and minerals. The anti-inflammatory characteristics of corn silk have made it a popular remedy for inflammatory pain syndromes like gout and arthritis. Its antioxidant properties and ability to stifle free radicals are due to the many components and flavonoids it contains **(Ayesha et al.(2022).**

Table (5): Total protein (Tp), albumin (Alb), and globulin (Glb) of gentamicin-induced nephrotoxicity rats as affecting by corn silk powder levels.

Groups	Total protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)
G_1	9.06±0.32 [a]	5.67±0.25 [a]	3.39±0.003 [a]
G2	5.24±0.20 [f]	3.07±0.18 [f]	2.17±0.09 [e]
G3	5.72±0.22 [e]	3.43±0.23 [e]	2.29±0.17 [e]
G4	6.35±0.41 [d]	3.81±0.09 [d]	2.54±0.11 [d]
G5	6.96±0.18 [c]	4.09±0.15 [c]	2.87±0.20 [c]
G6	7.50±0.32 [b]	4.39±0.24 [b]	3.11±0.04 [b]
LSD	0.41	0.26	0.20

Values are expressed as mean ± SD; n = 6, Values in the same column having different superscripts letters are significantly ($p \leq 0.05$)

The mean values of liver enzymes of nephrotoxicity rats were markedly decreased by adding the corn silk powder in rat's diet at the levels 2.5, 5, 10 and 15% with significant differences($P \leq 0.05$) as compared to untreated group (nephrotoxicity rats) (table 6). 15% gave the highest effect. Only in case of GGT, there is no significant differences between group fed 2.5% powder and positive control group . AST was the most enzyme affected by the levels of corn silk especially at the level 15% , the reduction percentage was about 33% followed by ALT enzyme which had about 32% as reduction percentage whereas the other enzymes have 25 and 21 % for GGT and ALP respectively . Potassium, a wonderful natural electrolyte that aids in regulating the action of the body's nerves and muscles, is responsible, according to earlier research, for the corn silk effect **(Tuty and Muchlisyam , 2018).** Also, it has high vitamin C and polyphenols content which can combat inflammation ,required for healthy metabolic functioning and protect the liver from damage(**Arba *et al.*, (2020).** Also, **El-Seedy *et al.*, (2022)** A study was conducted to determine that corn silk enhanced serum liver functions in rodents. These enhancements were further enhanced as the concentration of corn silk increased, which was attributed to its phytochemical content and antioxidant agents, including phenolic compounds, vitamins, and minerals.

Table (6): Aspartate amino transaminase (AST), alanine aminotransferase (ALT), (AST/ALT ratio), alkaline phosphatase(ALP), and gamma-glutamyltransferase (GGT) of gentamicin-induced nephrotoxicity rats as affecting by corn silk powder levels (U/L).

Groups	AST	ALT	ALP	GGT
G1	32.86±2.11 f	34.78±1.87 f	87.45±0.04 f	3.23±0.21 e
G2	65.83±1.09 a	59.65± 1.04 a	120.76±0.56 a	5.12±0.08 a
G3	60.08±2.05 b	55.32±2.12b	114.34±4.11 b	5.05±0.20 a
G4	55.12±1.34 c	50.66±0.56 c	108.65±1.78 c	4.65±0.18 b
G5	49.54±0.76 d	44.87±1.28 d	100.04±3.45 d	4.22±0.14 c
G6	43.86±1.76 e	40.55±1.04 e	94.81±2.72e	3.82±0.04 d
LSD	4.02	2.99	4.76	0.31

Values are expressed as mean ± SD; n = 6, Values in the same column having different superscripts letters are significantly ($p \leq 0.05$)

Here we summarize the mean serum glucose values for the negative control group, the positive control group, and the groups treated with 3, 5, 10, and 15% corn silk. Table (7). The negative control group's mean serum glucose value was lower than that of the positive control group, which was statistically significant ($p \leq 0.05$). In comparison to the negative control group, the positive control group's serum glucose levels rose by about 73%.The results showed that nephritic rats' blood glucose levels were significantly lowered by a basal diet with different amounts of maize silk, and then increased by the effects of gentamicin. The reduction percentage was about 28% at the 15% powder level when compared to the positive control group. Consistent with the findings made by **Dika *et al.* (2020)** Maize silk contained fitosterol, alkaloids, flavonoids, phenols, saponins, and tannins; when administered to diabetic rats, it significantly reduced blood glucose levels. Flavonoids can potentially stimulate insulin secretion by repairing pancreatic β cells.Also, **Carla *et al* .(2019)** Research has shown that the phenolics found in corn silk make it a popular anti-diabetic medication. These phenolics inhibit the action of enzymes that break down carbohydrates, like the intestinal α-glucosidase. Apymaysin, molecular maysin, and methoxymaysin are three maize silk compounds that may primarily inhibit α glycosidase.

Table (7):Blood glucose of gentamicin-induced nephrotoxicity rats as affecting by corn silk powder levels

Groups	Blood glucose
G_1	88.93±3.76 [f]
G2	153.78±4.98 [a]
G3	140.56±5.81 [b]
G4	136.43±2.65 [c]
G5	123.78±3.06 [d]
G6	110.12±4.56[e]
LSD	6.92

Values are expressed as mean ± SD; n = 6, Values in the same column having different superscripts letters are significantly ($p \leq 0.05$)

SOD, CAT, MDA, TAC, and GPX activities were used to measure the antioxidant activity in nephritic rats treated by different levels of corn silk (Table 8) . Results showed that positive control group levels of MDA were much higher than negative control levels, whereas levels of TAC, SOD, CAT, and GPx were much lower. In comparison to the positive control group, the group given the basal diet supplemented with 15% corn silk powder showed improvements of approximately 40% in CAT, 60% in TAC, 59% in SOD, and 51% in GPX. The changes in antioxidant enzyme values were primarily impacted by the nutritional composition and antioxidant capacity of corn silk, according to the results.**Hu and Deng, (2011)** scientists found that polyphenol and flavonoid-containing corn silk extracts greatly enhanced levels of antioxidant enzymes like catalase and superoxide dismutase (SOD and SOD, respectively), in addition to volatile oxygen-containing compounds **Mallikarjuna *et al.*, (2008)** effects of maize silk, an antioxidant and free-radical scavenger, on Gentamycin-induced oxidative and renal damage. As was stated. One of the most important defense mechanisms against oxidative stress and its potentially harmful O2 free radicals is superoxide dismutase (SOD). The findings are in line with **Fahmy, (2020)** compared to the control group that received an injection of CCL4, found that all groups given the experimental diets containing 7.5% maize silk had significantly higher levels of antioxidant enzymes (SOD and CAT). However, when compared to the positive control group, the serum MDA levels of the groups treated with cornsilk decreased significantly.

Table (8):Glutathione pyroxidase (GPX), superoxide dismutase (SOD), total antioxidant capacity (TAC) and oxidant enzymatic malondialdehyde (MDA) and catalase (CAT) of gentamicin-induced nephrotoxicity rats as affecting by corn silk levels

Groups	GPX (ng/dl)	SOD (U/L)	TAC(nmoL/L)	CAT(mmoL/L)	MDA(nmoL/L)
G_1	79.13±3.07 [a]	50.22±0.99 [a]	1.92±0.01 [a]	67.45±0.97 [a]	16.03±2.11 [f]
G2	43.87±1.95 [f]	29.45±2.1 1 [f]	0.89±0.11 [f]	26.61±2.06 [f]	34.42[a]±0.89 [a]
G3	49.78±1.33 [e]	32.98±1.01 [e]	0.97±0.15 [e]	29.87±1.64 [e]	31.34±0.67 [b]
G4	54.17±2.22 [d]	37.34±1.88 [d]	1.04±0.12 [d]	33.87±2.04 [d]	28.96±1.46 [c]
G5	60.43±3.07 [c]	41.02±2.75 [c]	1.28±0.07 [c]	38.23±1.24 [c]	24.02±0.75 [d]
G6	66.09±0.85 [b]	46.79±2.17[b]	1.42±0.07 [b]	42.64±0.34[b]	20.65±1.23 [e]
LSD	4.75	2.09	0.05	1.46	2.74

Values are expressed as mean ± SD; n = 6, Values in the same column having different superscripts letters are significantly ($p \leq 0.05$)

Data in table (9) indicate that the nephritic positive control group exhibited high mean values of potassium and phosphorous and low values of calcium, iron, and sodium. The nephritic positive control group exhibited significant differences in serum elements when contrasted with the negative control group. A significant increase ($P \leq 0.05$) in sodium, iron, and calcium was observed in the nephritic rodents who were fed a diet containing maize silk. Additionally, potassium and phosphorus levels were significantly reduced ($P \leq 0.05$). Corn silk contained a greater quantity of macro-elements, which are regarded as the most critical minerals, including calcium, magnesium, and phosphorus. Chronic kidney disease is known to be associated with chronic inflammation and low antioxidant activity. Potassium is an essential component of the cells that aid in the monitoring of blood pressure and cardiac rate, as well as of body fluids. The consumption of potassium can help prevent seizures and coronary heart disease (**Fahmy, 2020). Mersha and Gebrail (2018)** indicate that the nephritic positive control group exhibited high mean values of potassium and phosphorous and low values of calcium, iron, and sodium. The nephritic positive control group exhibited significant differences in serum elements when contrasted with the negative control group. A significant increase ($P \leq 0.05$) in sodium, iron, and calcium was observed in the nephritic rodents who were fed a diet containing maize silk. Additionally, potassium and phosphorus levels were significantly reduced ($P \leq 0.05$). Corn silk contained a greater quantity of macro-elements, which are regarded as the most critical minerals, including calcium, magnesium, and phosphorus.

Chronic kidney disease is known to be associated with chronic inflammation and low antioxidant activity. Potassium is an essential component of the cells that aid in the monitoring of blood pressure and cardiac rate, as well as of body fluids. The consumption of potassium can help prevent seizures and coronary heart disease **Nuntaporn *et al.*, (2015) and Naeem (2022)** found that corn silk have zinc (Zn), iron (Fe), copper (Cu), magnesium (Mg), calcium (Ca) K and Na which effect on the serum content from these elements.

Table(9): **Sodium (Na), potassium (K), calcium (Ca) and phosphorus (P) of gentamicin-induced nephrotoxicity rats as affecting by corn silk levels**

Groups	Sodium mg/dl	Potassium mg/dl	Calcium mg/dl	Phosphorus mg/dl	Iron mg/dL
G_1	130.46±1.76 [a]	5.03±0.08 [f]	8.54±0.20 [a]	4.52±1.95 [f]	50.03±3.44 [a]
G2	89.23±2.76 [f]	9.76±0.12 [a]	1.12±0.21 [f]	9.21±0.28 [a]	21.65±1.92 [f]
G3	95.25±1.45 [e]	9.09±0.05 [b]	1.91±0.23 [e]	8.93±0.07 [b]	26.61±2.04 [e]
G4	108.29±3.71 [d]	8.22±0.22 [c]	2.37±0.06 [d]	7.62±0.31 [c]	31.71±3.12 [d]
G5	114.34±1.05 [c]	7.54±0.02 [d]	3.92±0.18 [c]	6.84±0.07 [d]	37.21±0.87 [c]
G6	120.28±2.65 [b]	6.64±0.15 [e]	4.56±0.03 [b]	5.04±0.35 [e]	42.65±0.34 [b]
LSD	3.99	0.29	0.25	0.36	3.76

Values are expressed as mean ± SD; n = 6, Values in the same column having different superscripts letters are significantly ($p \leq 0.05$).

Conclusion

Based on the results acquired, maize silk contains a significant amount of protein, a high concentration of total phenolic compounds, flavonoids, and a highly active antioxidant. Rodents with nephrotoxicity had their serum glucose levels, liver functions, and kidney functions improved by using maize silk. As the concentration of maize silk increased, these improvements were even more pronounced. Corn silk is an excellent agent for the prevention and treatment of renal injury.

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التأثير العلاجي المحتمل لمستويات مختلفة من مسحوق حرير الذرة على الفئران السمية الكلوية

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تعرف السمية الكلوية على أنها تدهور سريع في وظائف الكلى بسبب التأثير السام للأدوية والمواد الكيميائية. لذلك أجريت هذه الدراسة لمعرفة التأثير العلاجي لحرير الذرة بأربعة مستويات (2.5%، 5%، 10، 15%) على وظائف الكلى وأنزيمات الكبد وبعض معادن المصل وجلوكوز الدم وأنزيمات مضادات الأكسدة في الجرذان المصابة بالسمية الكلوية. . تم تقسيم ستة وثلاثين ذكراً بالغاً من فئران الالبينو السليمة إلى ست مجموعات، كانت المجموعة الأولى مجموعة مراقبة سلبية بينما تم حقن المجموعات الخمس الأخرى بالمضاد الحيوى الجينتاميسين بتركيز 10 مليجرام / كجم وزن الجسم لتحفيز السمية الكلوية، وكانت إحداها مجموعة إيجابية،. تم تغذية المجموعات الأخرى على علائق أساسية تحتوي على مسحوق حرير الذرة المختبر لمدة 28 يوما. أظهرت النتائج التي تم الحصول عليها أن حرير الذرة يحتوي على نسبة عالية من الكربوهيدرات والألياف الغذائية والبروتين والبوتاسيوم والكالسيوم والمغنيسيوم بينما يحتوي على نسبة منخفضة من الدهون والرطوبة. بالنسبة للتجربة البيولوجية، انخفضت مستويات AST، ALT، ALP، GGT، اليوريا، حمض اليوريك، الكرياتينين، MDA، وجلوكوز الدم بشكل ملحوظ في المجموعات المعالجة بحرير الذرة الكلوية وزادت بشكل ملحوظ في مستويات Tp، Alb، GPX، SOD، TAC،CAT. كما انخفضت مستويات البوتاسيوم والفوسفور بينما ارتفعت مستويات الكالسيوم والصوديوم في المجموعات المصابة المعالجة بحرير الذرة خاصة بنسبة 15%. وقد اشارت البيانات إلى أن مسحوق حرير الذرة يحتوي على العديد من المركبات الحيوية التي لها فعالية كبيرة في الوقاية من أمراض الكلى وعلاجها.

الكلمات المفتاحية: وظائف الكلى – حرير الذرة ـــ مضادات الأكسدة الإنزيمات – المعادن