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Abstract

A reduction in renal function has a major effect on metabolism and nutritional status. It has been discovered that several plants have antioxidant effects and can defend against experimental kidney toxicity. This study examined the effects of powdered 5% horsetail, 5% hollyhock and 5% mixtures of it on nephrotoxic rats. In this experiment was used 25 adult male albino rats weighing 150±10g. The rats were divided into 5 groups. Each group contains 5 rats. Gentamicin was administered intravenously to the other groups once daily for ٧days while one was kept as the (-ve) group. The following data were determined glucose level, serum liver enzymes (AST, ALT, and ALP), markers of kidney functions (urea, creatinine, uric acid), lipid profile (triglycerides, total cholesterol, VIDL-c, HDL-c, LDL-c), serum electrolyte (sodium, chloride and calcium) and histopathology of the kidney. Also, it was was determined phenolic compounds of horsetail & hollyhock. The results of HPLC showed that the horsetail contained higher bioactive compounds than hollyhock leaves. According to the results, rats' kidney, liver and lipid profiles were all enhanced by the combination of horsetail and hollyhock leaves powder. The best results were shown with the 5% mixture, which is advised for use as a beverage drink to improve kidney functioning. In conclusion: In the treatment of rats with renal failure, Horsetail and hollyhock leaves can be considered as potential therapeutic feeding programs.

Keywords: Horsetail, Hollyhock, Kidney disorder, Gentamicin.

Introduction:

The kidney is an important organ in the human body due to its great importance in filtration, metabolism and excretion of compounds, The kidneys plays a large role in maintaining normal blood pressure regulation of base - acid balance **(Seely *et al.*, 2017)**. Also, the kidneys

works to get rid of the wastes of metabolism and absorption and have an effective role in excreting urine. Which include urea, phosphorus, ammonia, water, creatinine, potassium and sodium, deficiency of the hormone erythropoietin, which is produced by the kidneys, leads to severe anemia. Metabolism and nutritional status are greatly affected in the case of decreased kidney function **(Eknoyan *et al*., 2004).**

The common name for *Equisetum arvense* is horsetail, and it is a plant of the genus, characterized by regular vertical heads and branching stems, and a main stem of the plant is about 10 mm **(Costa *et al*., 2012)**. Horsetail contains tannin, phytosterols, alkaloids, flavonoids, silicic acid, phenolic, petrosins, saponins, sterols, volatile oils, minerals, ascorbic acid, triterpenoids and phenol. It has a medicinal properties which used it to treat wounds, it has a high content of silica this property, combined with including the Staphylococcus aureus **(Radulovic *et al* ., 2006)**, its antiseptic activity against several bacterial agents, also, horsetail has been used in the past to treat arthritis, bleeding ulcers, and as an anti-cancer, horsetail is used in European pharmacopoeias, along with many other plants **(Milovanovic *et al*., 2007)**. *Equisetum arvense* is used as an anti-hypoglycemic, diuretic, antiseptic, antioxidant, anti-inflammatory, vasorelaxant, hepatoprotective, and anti-nociceptive, further it helps improve bone disorders such as, bone wound healing & osteoporosis **(Stajner *et al*., 2009**). The studies have shown that horsetail has a protective effect on kidney disease **(Ülle *et al*., 2018).**

Pullaiah, (2006) *Alcea rosea* belongs to the family Malvaceae, the common name Hollyhock, all parts of this plant contain mucilage and are used in medicine . *Alcea rosea* has been used for many diseases, such as peptic ulceration, renal calculi, kidney disorders gastrointestinal disorders, skin cuts, ulcers, chest complaints, boils, abscesses, inflammatory conditions, asthma, and bronchitis. The flowers contain mucilage, starch and tannins **(Nazeem *et al*., 2016).** The purple portion of the flowers contains cyaniding, glucose and rhamnose, whereas the yellow portion has quercetin, kaempferol, isoquercitrin and kaempferol -3-glucoside, the fruits and leaves contain primary alcohols, cyclohexanol, limonene, phellandrene, and β-sitosterol, besides sucrose, glucose, galactose and mannose, also the leaves also contain p-tolualdehyde and α-terpenyl acetate, in addition to seeds, flowers and leaves of Egyptian plant contain palmitic, myristic, stearic, oleic, linoleic limonene,

phellandrene, citral **(Hirofumi *et al*., 2012).** Hollyhock flowers have a role in improving glucose and triglyceride levels and kidney function **(Zhang *et al*., 2015**), Hollyhock roots significantly reduced the number of kidney calcium oxalate deposits **(Ahmadi *et al*., 2012).** The objective of this study was to investigate the effect of Horsetail (*Equisetum arvense*) and Hollyhock (*Alcea rosea*) leaves in the treatment of kidney functions defects in gentamicin- induced rats.

Materials and methods:

Plants:

Horsetail (*Equisetum arvense*) and hollyhock (*Alcea rosea*) were obtained from Agricultural Seed, Spices and Medicinal Plants Co (Harraz), Cairo, Egypt.

Gentamycin:

Gentamycin (amino-glycosides anti-biotics) was purchased from Technogen Chemical Company in Dokki, Giza, Egypt.

Rats:

Twenty-five (25) adult male albino rats of the Sprague Dawley strain, weighing (150±10g), were obtained from the Medical Insects Research Center in Doki, Cairo. In order to acclimatise, rats were fed a basal diet for one week at the animal research lab of Menoufia University in Egypt's College of Home Economics.

Methods

Plants preparation

Horsetail & hollyhock leaves were dried by air, the leaves were ground and made into a powder by using electric grinder and kept in dark, stoppered glass bottles in a cool, dry location and stored at 4°C until used according to **Russo(2001)**.

Phenolic compound identification:

A PDA model G1315B was used and an Agilent 1200 chromatograph, extracts from HPLC analysis were carried out, an RR Zorbax Eclipse Plus C18 column (1.8 µm, 150 mm× 4.6 mm), an auto-sampler with model number G1313A, and a Bin pump of the G1312A type. Formic acid at 0.2% in water served as the mobile phase A, and acetonitrile served as the mobile phase B. Elution was performed at 0.95 ml min-1 with the following gradient program of solvent B: 0–20 min, 5-16 %; 20–28 min, 16-40 %; 28–32 min, 40-70 %; 32-36 min, 70-99 %; 36-45 min, 99 % and 45-46, min. 99-95 %.30. The injection had a (10µl)

volume. The detection of the compounds was accomplished using calibration curves generated by HPLC of pure standards for the wavelengths of 280 nm (for flavan-3-ols and derivatives of benzoic acid) and 360 nm (for derivatives of cinnamic acid and flavonols).The of HPLC method by **Radovanovic *et al.*, (2010).**

Induction of rats with impaired kidney:

Gentamicin (amino-glycosides anti-biotics) has been used for impairing kidney by 7-days intra-peritoneal injection of about (100 mg/kg body weight), during which nephrotoxicity occurred, according to **Farombi and Ekor (2006)**.

Basal diet:

The basal diet is prepared according to the following formula as mentioned by **AIN (1993)** as follow: Protein (14%), corn oil (4%), vitamins mixture (1%), mineral mixture (3.5%), choline chloride (0.2%), methionine (0.3%), cellulose (5%), and the remained is corn starch (28%). The ingredient of the employed vitamin blend was suggested by **Campbell (1963)** while the combination of salts utilised was created in accordance with **Hegsted *et al.*, (1941)**.

Biological experimental design

Experimental Design :

In Shebin El-kom, Menoufia University's Faculty of Home Economics, the experiment was conducted. Rats were kept in sanitary conditions and kept in wire cages at room temperature. Biological experiments for this study were Ethically Approved by the Scientific Research Ethics Committee (Animal Care and Use).Approval#17- SREC-01-2022. After the adaptation period, rats were divided into the following groups:

Main group 1: The first main group (5 rats) Fed on a basal diet, as a negative control group.

The second main group: Gentamicin was injected (100 mg/ kg/ day) intravenously for 20 rats for 7 days. This group was subdivided into four groups (each five rats) to feed on the experimental diets for (4 weeks) according to; the following:

Group (2): Positive control group (untreated group fed on basal diet only).

Group (3): Fed on a diet containing 5% of horsetail.

Group (4): Fed on a diet containing 5% hollyhock.

Group (5): Fed on a diet containing 5% of mix of horsetail and hollyhock.

Blood Samples

After 12 hours of fasting, blood samples were taken at the conclusion of the experiment utilising the abdominal aorta in which the rats were slaughtered while being ether anaesthetized. After allowing blood samples to coagulate at room temperature in clean, dry centrifuge tubes, the serum was separated by centrifuging the tubes for 10 minutes at 3000 rpm. For analysis, serum was properly extracted, put into cuvette tubes, and kept frozen at -20°C. The following variables were examined in all serum samples.

Determination of the activity of liver enzymes:

measurement of serum alkaline phosphates (Alp) by **Belfield and Goldberg (1971).** Glutamic pyruvic transaminase (ALT) & Glutamic oxaloacetic transaminases (AST) serums were determined by **Tietz (1976) and Yound (1975)** respectively.

Measurement of serum lipid:

Triglyceride was performed in accordance with **Fossati and Prencipe (1982)**. The measurement of total cholesterol was made by **Allen (1974)**. High-density lipoprotein (HDL-c) was measured by **Lopez (1977)**. Low-density lipoprotein-cholesterol (LDL-c) & very low- density lipoprotein-cholesterol (VLDL-c) were measured by **Lee and Nieman (1996)** following is:

VLDL-c (mg/ dl) = Triglycerdes /5

LDL-c (mg/ dl) = (TC – HDL-c) – VLDL-c.

Kidney functions parameters:

The enzymatic technique described for determining urea was used by **Patton and Crouch (1977)**. Creatinine was measured using the kinetic technique by **Henry (1974)**, and The method of measuring uric acid was used by **Schultz (1984).**

Determination of electrolyte:

Serum sodium, chloride and calcium:

Serum sodium, chloride and calcium were measured according to the colorimetric method described by **Henry (1974).**

Histopathological examination

The kidney was separated from each rat and examined histopathologically according to **Bancroft *et al*., (2012).**

Statistical analysis:

By employing a computerised costat software and a one-way ANOVA, the results were statistically examined. The results are presented as mean± SD. Differences between treatments at ($P \leq 0.05$) were considered significant. **Sendcor and Cocharn , (1979).**

Results

Identification of phenolics compounds in horsetail and hollyhock by HPLC

Data tabulated in Table (1) shows the identification of phenolic compounds of horsetail and hollyhock by using HPLC technique. It is obvious that the highest phenolic compounds identified in horsetail were recorded for chicoric acid, quercetin and caffeic acid. The values were 400.12, 320.80 and 290.00 mg/g, respectively. On the other hand, the lowest phenolic compounds identified in horsetail were recorded for gallic acid, 4-Hydroxybenzoic acid, and vanillic acid. The values were 0.95, 10.61 and 20.35 mg/g, respectively.

As for the hollyhock, data indicated that the highest phenolic compounds identified in hollyhock recorded for epicatechin, quercetin and gallic acid. The values were 31.16, 30.50 and 30.14 mg/g, respectively. On the other hand, the lowest phenolic compounds identified in hollyhock recorded for vanillin, vanillic acid and chlorogenic acid. The values were 0.56, 1.87 and 2.24 mg/g, respectively. While (kaempferol, vanillin, & chlorogenic acid), (caffeic acid, cinnamic acid, *P*-coumaric, rutin, chicoric acid and salicylic acid) did not detect at these conditions. These results agree with **Pallag *et al.*, (2016)** who reported that phenolics identified in these analyses were epicatechin, quercetin, catechin while the major phenolic acids were vanillic acid, caffeic acid, ferulic acid and p-coumaric acid. The results showed that extracts of *Equisetum arvense*, L. are rich sources of phenolic compounds.

Additionally, **Ammar *et al.*, (2013)** reported that the methanolic extracts of both aerial parts and flowers of *A. rosea*, Cav. are rich in phenolic compounds and have a prominent antioxidant activity. The antioxidant activity of both extracts may be attributed to their phenolic content.

Liver enzymes of rats fed on different experimental diets.

Table (2) indicated to significant increase in AST, ALT & ALP in the (+ve) control group as compared to the (-ve) control group, however,

all treated groups with herbs showed a significant decrease when compared with the (-ve) control group. Group 5 which was treated with 5% a mix of horsetail and hollyhock recorded the best results. These results agree with **Kim *et al.*, (2004)** who reported that hepatoprotective effect of the phenolic petrosins and flavonoids separated from *E. arvense* has been documented who suggested that using *E. arvense* would be useful for enhancing liver function. In addition, **Hussain *et al.*, (2014)** reported that *A. rosea's* traditional medicinal significance in liver damage is confirmed by the extract's potent hepatoprotective properties against acetaminophen-induced hepatotoxicity.

Kidney functions of rats fed on different experimental diets.

Table (3) showed a considerable improvement in kidney function metrics; including (uric acid, urea & creatinine) in the (+ve) control group compared with the (-ve) control group. All treated groups showed a decrease in these parameters. The best improvement was recorded by the group which treated with 5% a mix of horsetail and hollyhock. These results in agreement with These results are in agreement with previous study by **Eman and Zaenah, (2020)** who concluded that there was a significant decrease in the level of serum creatinine, urea and uric acid by using horsetail ethanolic extract, because its contain numerous alkaloids, petrosins flavonoids, phenol, phenolic sterols, triterpenoids, phytosterols, tannin, saponins, volatile oils.

Ghavami *et al.*, (2022) reported that the comparison to the control group, the mean serum concentrations of creatinine, BUN, sodium, potassium, and uric acid all significantly decreased in all experimental groups ($P < 0.05$).

Ülle *et al.*, (2018) indicated that *E. arvense* showed a significant decrease in kidney function.

Determination of electrolyte:

Serum sodium, calcium and chloride:

Table (5) showed a significant decrease in serum sodium, calcium and chloride in the (+ve) group compared with the (-ve) control group. The best group was recorded for the treated with 5% a mix of horsetail and hollyhock. These results are in agree with **Mernosh *et al.*, (2022)** who reported that there was a significant increase in sodium and calcium, however, a considerable drop in rats receiving hollyhock therapy due to

the plant's antioxidant properties such as, stearic, oleic, linoleic limonene and flavonoid.

Lipid profile of rats fed on different experimental diets.

Table (6) indicated that ; T.C, T.G, VLDL and LDL levels increased in the (+ve) control group compared with the (-ve) control group. Therefore, these levels were restored in the treated group with 5% a mix of horsetail and hollyhock, on the other hand HDL level decreased in the (+ve) control group compared with the (-ve) control group, the best mean value of HDL-c recorded for the group which treated with 5% a mix of horsetail and hollyhock. These results agree with **Myers *et al.*, (2009)** because of polyphenols help metabolize cholesterol and lipoprotein in the liver to reduce dietary cholesterol absorption, thus, the level of cholesterol in the plasma decreases. In addition to the herbs used contain polyphenols that affect apolipoproteins (apo) A and B, which that reduce plasma triglyceride levels (TG), the risk of heart disease, modify very low-density lipoproteins (VLDL) particles because there may be an increase in lipoprotein lipase (LPL) activity that causes a reduction in the amount of LDL in the blood.

Table (1): Identification of phenolics compounds in horsetail and hollyhock by HPLC

Phenolic compounds of horsetail	Concentration (mg/g)	Phenolic compounds ofhollyhock	Concentration (mg/g)
Gallic acid	0.95	**Gallic acid**	30.50
Caffeic acid	290.00	**Caffeic acid**	ND
Cinnamic acid	100.68	**Cinnamic acid**	ND
Vanillic acid	20.35	**Vanillic acid**	1.87
***P*-coumaric**	60.31	***P*-coumaric**	ND
Quercetin	320.80	**Quercetin**	30.14
Chlorogenic acid	ND	**Chlorogenic acid**	2.24
4-Hydroxybenzoic acid	10.61	**4-ydroxybenzoic acid**	4.36
Ferulic acid	270.41	**Ferulic acid**	3.20
Epicatechin	250.02	**Epicatechin**	31.16
Rutin	60.43	**Rutin**	ND
Vanillin	ND	**Vanillin**	0.56
Chicoric acid	400.12	**Chicoric acid**	ND
Kaempferol	ND	**Kaempferol**	12.15
Salicylic acid	90.71	**Salicylic acid**	ND

ND= Not detectable

Table (2): Liver function of rats fed on different experimental diets.

Groups	ALT (U/L) Mean ± SD	AST (U/L) Mean ± SD	ALP (U/L) Mean ± SD
Control -ve (G١)	44.31^{e} ± 1.53	70.96^{e} ± 1.44	105.48^{e} ±1.39
Control +ve (G2)	161.03^{a} ± 0.73	252.72^{a} ± 2.36	251.55^{a}± 2.00
5% of horsetail (G3)	103.50^{c} ± 1.55	147.35^{c} ± 1.50	168.24^{c} ±2.35
5% hollyhock (G4)	120.63^{b} ± 1.57	188.49^{b} ± 1.73	176.70^{b} ± 2.15
Mix of horsetail and hollyhock 5% (G5)	60.14^{d} ± 1.06	144.03^{d} ± 1.42	160.65^{d} ± 1.42
LSD (p≤ 0.05)	**1.78**	**2.29**	**2.62**

Means from separate litters in the same column are substantially different (p≤ 0.05) Different.

Table (3): Kidney functions of rats fed on different experimental diets.

Groups	Creatinine (mg/dl) Mean ± SD	Urea (mg/dl) Mean ± SD	Uric acid (mg/dl) Mean ± SD
Control –ve (G1)	0.48^{e} ± 0.02	31.33^{e} ± 1.11	3.٢٢^{e} ± 0.٣٣
Control +ve (G2)	1.42^{a} ± 0.01	91.38^{a} ± 1.07	٩.٠٨^{a} ± ١.66
5%horsetail (G3)	0.99^{b} ± 0.05	64.91^{b} ±1.40	7.34^{b} ± 0.37
5%hollyhock (G4)	0.85^{c} ± 0.0٢	58.14^{c} ± 1.64	6.12^{c} ± 0.57
Mix of horsetail and hollyhock 5% (G5)	0.٦٧^{d} ± 0.01	44.40^{d} ± 1.68	4.78^{d} ± 0.35
LSD (p≤ 0.05)	**0.04**	**1.87**	**1.15**

Means from separate litters in the same column are substantially different (p≤ 0.05) Different.

Table (5): Serum sodium, calcium and chloride

Groups	Sodium (mg/dl) Mean ± SD	calcium (mg/dl) Mean ± SD	chloride (mg/dl) Mean ± SD
Control -ve (G1)	145.05^{b} ± 0.61	9.27^{a} ± 0.35	128.01^{a} ± 2.48
Control +ve (G2)	128.01^{d} ± 1.74	7.39^{b} ± 1.01	103.66^{c} ± 2.15
5%horsetail (G3)	139.38^{c} ± 1.13	9.26^{a} ± 0.67	110.27^{b} ± 1.12
5%hollyhock (G4)	147.72^{a} ± 1.62	9.49^{a} ± 0.54	105.83^{c} ± 1.21
Mix of horsetail and hollyhock 5% (G5)	149.06^{a} ± 2.11	10.12^{a} ± 0.56	103.36^{c} ± 1.99
LSD (p≤ 0.05)	**1.80**	**0.94**	**2.42**

Means from separate litters in the same column are substantially different (p≤ 0.05) Different.

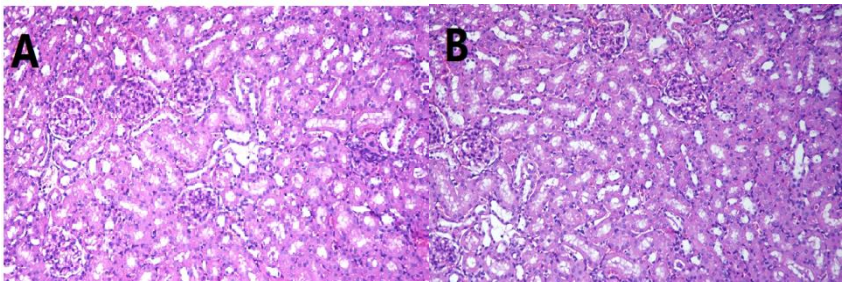
Table (6): Lipid profile of rats fed on different experimental diets

Groups	T.C (mg/dl) Mean ± SD	T.G (mg/dl) Mean ± SD	HDL-c (mg/dl) Mean ± SD	LDL-c (mg/dl) Mean ± SD	VLDL-c (mg/dl) Mean ± SD
Control -ve (G1)	$107.06^{d} \pm 1.29$	$85.33^{d} \pm 2.06$	$49.68^{a} \pm 1.83$	$40.31^{e} \pm 1.98$	$17.07^{d} \pm 0.42$
Control +ve (G2)	$232.40^{a} \pm 1.56$	$195.16^{a} \pm 1.51$	$45.60^{b} \pm 1.34$	$147.77^{a} \pm 1.51$	$39.03^{a} \pm 0.30$
5%horsetail (G3)	$183.13^{b} \pm 1.68$	$121.40^{c} \pm 1.73$	$48.29^{ab} \pm 1.88$	$109.53^{c} \pm 3.01$	$24.28^{c} \pm 0.34$
5%hollyhock (G4)	$184.52^{b} \pm 0.93$	$138.86^{b} \pm 1.62$	$46.19^{b} \pm 1.97$	$114.31^{b} \pm 1.78$	$27.77^{b} \pm 0.32$
Mix of horsetail and hollyhock 5% (G5)	$153.72^{c} \pm 1.56$	$120.12^{c} \pm 1.27$	$49.31^{a} \pm 1.98$	$77.66^{d} \pm 1.90$	$24.02^{c} \pm 0.25$
LSD (p≤ 0.05)	**1.99**	**0.84**	**2.23**	**2.87**	**0.37**

Means from separate litters in the same column are substantially different (p≤ 0.05) Different.

Histopathological examination of kidneys:

Examination of kidney sections of the control negative group revealed the normal histological structure of both organs without any histological alterations (Photos1Aand1B). Kidneys of the control positive group rats showed interstitial mononuclear inflammatory cells infiltration, congested interstitial vessels, perivascular edema, perivasculitis and glomerular hypercellularity and cast formation in the Bowman's space (Photo1Cand1D). Kidneys of rats from the group3 showed marked congestion of the inter-tubular vessels multiple foci of inflammatory cells infiltration, and hypercellularity of the glomerular tuft (Photo1Eand1F) these, results were in agreement with **(Kour *et al.*, 2017)** who showed necrotic changes with few focal areas of interstitial inflammatory cells by using *E. arvense* . Rats from the group4 indicated mild tubular epithelial cells degenerative and few necrotic changes (Photo1Gand1H) **(Niloofar *et al.*, 2022)** reported that there was scattered necrosis & mild tubular epithelial cells. While kidneys of rats from the group (5) indicated a mild degenerative and necrosis (Photo1Iand1J) these, results were in agreement with **(Marzieh *et al.*, 2012)** who reported that mild degenerative and necrosis were nearly normal .



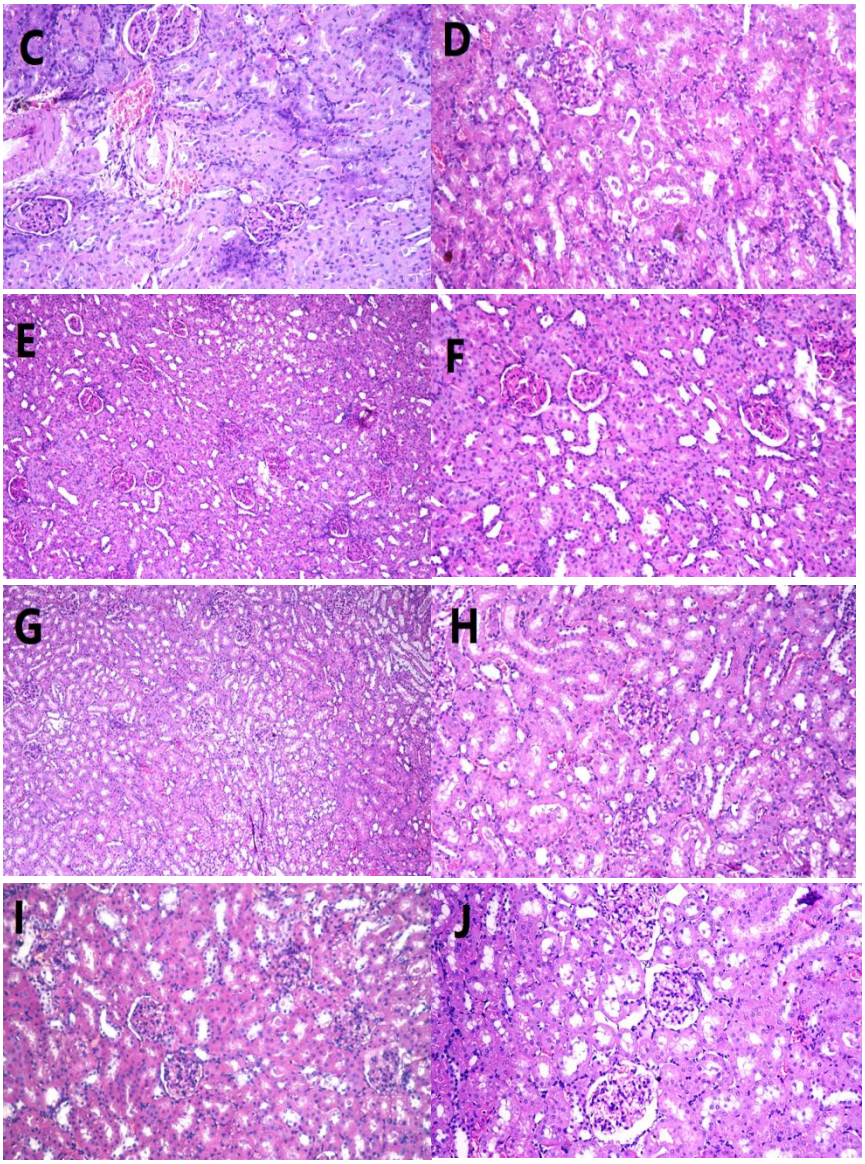


Photo 1: Rats' kidney histopathology was altered as a result of the plants' effects; (a & b) the group (-ve); (c & d) the group (+ve); (e and f) rats fed on diet containing 5% horsetail for (4 weeks); (g & h) rats fed on diet containing 5% hollyhock for 4 weeks; (i & j) rats fed on diet containing mix of horsetail and hollyhock 5% for (4 weeks).

Conclusion

In conclusion, it can be said that horsetail and hollyhock contain many antioxidants and polyphenols, so both of them are considered an alternative treatment for kidney diseases because of their ability to improve kidney function. The results of this study supported that plants to protect the kidney.

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تأثير أوراق زيل الحصان والخطمية لعلاج الخلل الحادث في وظائف الكلى في الفئران المصابة بالجنتاميسين

الملخص العربي

انخفاض وظائف الكلى له تأثير كبير على التمثيل الغذائي والحالة التغذوية. تم اكتشاف أن العديد من النباتات لها تأثيرات مضادة للأكسدة ويمكن أن تحمي من التسمم الكلوي .تناولت هذه الدراسة تأثير مسحوق أوراق زيل الحصان بنسبة ٥٪ والخطمية بنسبة ٥٪ ومخلوطهم معا بنسبة ٥٪ على الفئران المصابة بخلل في الكلي. في هذه التجربة تم استخدام٢٥ من ذكور الفئران البيضاء، وزنها ١٠±١٥٠جرام في هذه الدراسة. تم تقسيم الفئران إلى٥ مجموعات. كل مجموعة تحتوي على ٥ فئران. تم حقن المجموعات الأخرى بالجنتاميسين (١٠ مجم / كجم من وزن الجسم) مرة واحدة يوميًا لمدة ٧ أيام عن طريق الوريد بينما تم الاحتفاظ بإحداهما كمجموعة ضابطة سالبة. تم تقدير التحاليل التالى ظائف الكبد في سيرم الدم (ALP, AST, ALT) ووظائف الكلى (الكرياتينين، واليوريا، وحمض البوليك) وصورة دهون الدم (الكوليسترول الكلي، والدهون الثلاثية ، HDL–c، LDL–c ، VIDL–c) وتحليل العناصرفى سيرم الدم (الصوديوم, الكلور, الكالسيوم) . وتم التعرف على المركبات الفينولية باستخدام جهاز الكروماتوجرافى الغازي عالي الأداء.كذلك اظهرت نتائج الكروماتوجرافى الغازي عالي الأداء أن أوراق زيل الحصان تحتوي على تركيزات عالية من كل المركبات النشطة الفعالة بالمقارنة بأوراق الخطمية. وفقًا للنتائج، تم تحسين وظائف الكلى والكبد والدهون في الفئران عن طريق مخلوط أوراق زيل الحصان والخطمية. تم الحصول على أفضل النتائج مع المخلوط بتركيز ٥٪، والذي ينصح باستخدامه كمشروب لتحسين وظائف الكلى. في الختام: في علاج الفئران المصابة بالفشل الكلوي، يمكن اعتبار أوراق زيل الحصان والخطمية من برامج التغذية العلاجية الفعالة.

الكلمات الكاشفة: ذيل الحصان ،الخطمية ، الفشل الكلوي، الجنتاميسين.