Egyptian Journal of Nutrition
Official journal of the Egyptian Nutrition Society
Print ISSN: 1687-1235
Online ISSN: 2090-2514
Vol. 38 No. 2(2023)
https://ejn.journals.ekb.eg/

Effect of Turmeric and Gum Arabic Supplementation on the Kidney Alteration Caused by Glycerol Toxicity in Rats

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ABSTRACT

This study aimed to investigate the effects of turmeric and gum Arabic supplementation on protein status, kidney functions, kidney antioxidant enzymes, and histopathological changes in the kidneys of rats suffering from glycerol toxicity. Sixty-six male albino rats of the Sprague-Dawley strain, weighing 150 ± 10g, were used in this study. The rats in this study were divided into two main groups. ***The first main group*** (6 rats) was fed a basal diet (BD) as a control negative group (-ve). ***The second main group*** (60 rats) was divided into ten subgroups (6 rats each). The rats in the second main group were fed as follows: **Subgroup (1):** fed on a basal diet (BD) only as a control positive group (+ve). **Subgroups (2, 3, and 4)** were fed BD containing 1, 2, and 4 g of gum Arabic (GA) per100 g of diet, respectively. **Subgroups (5, 6, and 7)** were fed BD containing 1, 2, and 4 g of turmeric per 100 g of diet, respectively. **Subgroup (8)** was fed BD containing 1 g of GA and 1g of turmeric per 100 g of diet. **Subgroup (9)** was fed BD containing 2 g of GA and 2g of turmeric per 100 g of diet. **Subgroup (10)** was fed BD containing 4 g of GA and 4g of turmeric per100 g of diet. Rats were fed on these diets for 28 days before and after 3 days' injection with glycerol to induce acute renal failure. The results indicated that glycerol decreased feed intake and body weight percent, and serum results revealed that protein and globulin decreased while albumin, uric acid, and

creatinine increased. Kidney results revealed that glutathione (GSH), and glutathione peroxidase (GPX) activities decreased, while malondialdehyde (MDA) activity increased, as compared to the negative control group. Treating rats that were suffering from kidney alteration induced by glycerol with tested diets improved all of these parameters and ameliorated histopathological lesions seen in the kidney as compared to non-treated rats, especially the groups that were fed a diet containing a mixture of gum Arabic and turmeric at level 4%. Conclusion: gum Arabic, turmeric and their combination can be used to reduce the side effects of kidney diseases. Therefore, intake of gum Arabic and turmeric may be beneficial for kidney disease patients.

Keywords: Glycerol toxicity, Kidney diseases, Rats, Turmeric, Gum Arabic, Biochemical analysis, Histopathology.

Received: ***Accepted:*** ***Published:***

INTRODUCTION

The kidney plays a critical role in maintaining fluid balance, blood pressure, hormone secretion, and the removal of wastes and toxins from the blood circulation, including creatinine and urea **(Javaid et al., 2012 and Wu et al. 2017).,** Glycerol injections are used to induce acute renal failure (ARF) in rats due to rhabdomyolysis and myoglobin release, resulting in ischemic injury and nephrotoxicity **(Aydogdu et al., 2006 and Giannoglou et al., 2007).** Through the development of rhabdomyolysis, a single intramuscular injection of glycerol in rats causes Acute kidney injury AKI (**Ustundag et al., 2008)**.

After skeletal muscle injury caused by physical, thermal, ischemic, infectious, metabolic, or toxic causes, rhabdomyolysis-induced AKI develops, releasing deadly amounts of myoglobin and other intracellular proteins into the circulation (**Vanholder et al., 2000 and Bagley et al., 2007)**. Most patients with heart failure HF and CKD share several risk factors, including hypertension, diabetes, obesity and metabolic alterations **(kjeldsen, 2018)**.

Turmeric has been utilized in Indian traditional medicine for a number of diseases. The spice known as turmeric is made from the root of the *Curcuma longa* plant by first drying and powdering it **(Ravindranath and Chandrasekhara 1981)**. Curcumin is safe and could be tolerated, even at very high doses. **Lao, (2006)** found that Curcumin is a biofunctional antioxidant that has been used in traditional medicine to protect against kidney damage. In this respect **Mahmoud et al., (2014)** reported that Curcumin attenuates gentamicin-induced nephrotoxicity by protecting glutathione and increasing antioxidant enzyme activities.

In a thesis examining the impact of GA on healthy mice's renal functions, **Nasir, (2007)** stated that GA not only increased feces weight in line with the action of dietary fibers, but also showed binding of free water, which decreased intestinal fluid absorption and, therefore, urine volume. Antidiuretic hormone secretion increased in parallel with this. Decreased kidney excretion was again represented by the fact that GA also joined intestinal Na+. These results are in contrast to past research showing that GA enhances oral rehydration and improves water and sodium absorption in a rat model of chronic osmotic diarrhea **(Teichberg et al., 1999)**.

According to recent studies, GA has anti-inflammatory, anti-oxidant, and anti-apoptotic effects in reducing acute renal injury in a variety of animal models **(Shafeek et al., 2019).** Furthermore, there is increasing evidence that oral GA administration decreases renal injury in models of chronic renal illness by pathways that are comparable to those that reduce inflammation and antioxidant activity **(Al Za'abi et al., 2018).**

The purpose of this study was to investigate effect of turmeric and gum Arabic supplementation on kidney functions, kidney antioxidant enzymes, and histopathological changes in kidney of rats suffering from glycerol toxicity.

MATERIALS AND METHODS

Materials:

- Casein, vitamins, minerals, cellulose, and choline chloride were obtained from El Gomhoriya Company, Cairo, Egypt.
- Starch and corn oil were obtained from the local market.
- Gum Arabic GA (*Acacia Senegail* L.) and turmeric were purchased from the national center for agricultural research.

Kits:

- Kits for biochemical analysis were purchased from Gamma Trade Company for Pharmaceuticals and Chemicals, Dokki, Egypt.

Rats:

- Sixty-six male albino rats of the Sprague Dawley strain, weighing 150 $\pm$ 10g, were purchased from the laboratory of the animal colony, Ministry of Health and Population, Helwan, Cairo, Egypt.

Methods:

Experimental Design:

Sixty-six male albino rats of the Sprague Dawley strain weighing 150 $\pm$ 10g, were housed in well-aerated cages under hygienic conditions in the biological studies lab of the Faculty of Home Economics, Helwan University. Rats were left for seven days as an adaptation period, and they fed on a basal diet. The rats in this study were divided into two main groups. The first main group (6 rats) was fed a basal diet (BD) as a control negative group (-ve). The second main group (60 rats) was divided into ten subgroups (6 rats each). The animals were fed as follows:

Subgroup (1): fed on a basal diet (BD) only as a control positive group (+ve). **Subgroups (2, 3, and 4)** were fed on BD containing 1, 2, and 4 g of gum arabic (GA) per 100 g of diet, respectively. **Subgroups (5, 6, and 7)** were fed BD containing 1, 2, and 4 g of turmeric per 100 g of diet, respectively. **Subgroup (8)** was fed BD containing 1 g of GA and 1g of turmeric per 100 g of diet. **Subgroup (9)** was fed BD containing 2 g of GA and 2g of turmeric

per 100 g of diet. **Subgroup (10)** was fed BD containing 4 g of GA and 4g of turmeric per 100 g of diet.

The experimental diets were prepared according to the method of **Reeves et al. (1993).** The diet composition consists of protein (14%), fat (4%), salt mixture (3.5%), vitamin mixture (1%), choline chloride (0.25%), cellulose (5%), sucrose (10%), and L-cystein (0.18%), and the remainder is corn starch. Rats fed on these diets and tested diets for 28 days before and 3 days after injection with glycerol (50 % weight /volume glycerol in 0.9 % saline at 5 ml/ kg to induce acute renal failure according to the methods described by **Maree et al. (1994)**

During the experimental period (4 weeks), the diets consumed and body weights were recorded every week. At the end of the experiment, the rats were fasted overnight, and then the rats were anaesthetized by pentobarbital sodium, 40 mg/kg, and sacrificed. Blood samples were collected from the aorta of all rats. The blood samples were centrifuged, and serum was separated to estimate some biochemical parameters, i.e., serum protein (**Gomal et al., 1949),** serum albumin **(Doumas and Biggs, 1971),** estimation of serum globulin, serum urea nitrogen **(Patton and Crouch, 1977)**, serum creatinine **(Bartels and Bohmer, 1971),** serum uric acid **(Fossati et al., 1980),** and glutathione peroxidase (Gpx), malondialde (MDA), and reduced glutathione (GSH) activities were measured in the kidney according to the methods described by **(Tamas and Andras, 2017; Sushil et al., 1989; Paglia & Valentine, 1967),** respectively**.**

The kidneys of sacrificed rats were taken and immersed in a 10% formalin solution. The fixed specimens were then trimmed, washed, and dehydrated in ascending grades of alcohol (from 70% to 100%). They were then cleared in xylol, embedded in paraffin, sectioned at 4-6 microns' thickness, and stained with hematoxylin and eosin according to **(Sheehan and Hrapchak, 1980).**

Results of the biological evaluation of each group were statistically analyzed (mean ± standard deviation and one-way ANOVA test) by using the SPSS package and compared with each other using the suitable test ($P< 0.05$) is considered significant according to (**Sendecor and Cochran, 1979)**.

RESULTS AND DISCUSSION

Table 1 illustrates the effect of a basal diet supplemented with different levels (1, 2, and 4%) of Arabic gum, turmeric and mixed between them (1:1, 2:2, and 4:4 w/w) for 4 weeks on daily feed intake (FI) and body weight gain percentage (BW%) in normal rats (control-ve) fed on a basal diet and groups of rats suffering from kidney toxicity.

The mean values of daily feed intake and body weight percentage in normal rats (control-ve) and the positive group fed on basal diet (BD) were 17.97 ± 0.361, 32.964 ± 1.148 g/day and 14.50 ± 0.308, 8.588 ± 1.052, respectively. Feed intake and body weight gain% decreased significantly $P \leq 0.05$ in the positive control group, as compared to the negative control group.

Concerning (FI), statistically, our results revealed a significant decrease ($P \leq 0.05$) in the positive group fed a diet containing 4% mixed (AG) and 4% (TUR), as well as the group fed on a diet containing 4% AG, as compared to the (+ve) control group fed only on (BD). Our results are in agreement with **Azaab et al., (2015)**, who reported that a significant reduction in food intake has been observed by AG, which could be attributed to the high dietary fiber content of AG, which promotes satiety and satiation. Concerning the effect on feed intake, our results are in agreement with **Zanzer et al., (2019)**, who reported that turmeric TUR lowered desire to eat and prospective consumption in a postprandial setting compared to control.

Concerning BWG%, Table(1) illustrates the effect of BD supplemented with different levels of (AG), (TUR), and the combination between them on BWG% in rats suffering from kidney alteration (KA). Results showed that the control (+ve) group recorded BWG% (8.588 ± 1.052) while the (-ve) group recorded BWG% (32.964 ± 1.148). There is a significant decrease $P \leq 0.05$ in BWG% in the (+ve) control group fed on (BD). The (+ve) groups that fed on (BD) supplemented with different levels of (AG), (TUR) and mixed between them (1, 2, and 4%), showed that all treated groups recorded a significant increase ($P \leq 0.05$) in (BWG%) as compared to the (C+ve group) fed on (BD) only. Results showed no significant

difference ($P \leq 0.05$) between BWG% of (+ve) groups that fed on (1, 2, and 4 % mixed AG and TUR).

The obtained results are in agreement with **Hajavi et al., (2017)** who reported that curcumin down-regulates the differentiation of pre-adipocytes to adipocytes, up-regulates adipocyte energy metabolism, induces apoptosis, and suppresses angiogenesis in adipose tissue. Curcumin administration has been shown to result in the reduction of leptin, resistin, and visfatin, while simultaneously increasing the expression of adiponectin.

Table (2) illustrate the effect of basal diet supplemented with different levels (1, 2, and 4 %) from AG, TUR, and mixed between them (1:1, 2:2, and 4:4 w/w) for 4 weeks on total protein, albumin (Alb), and globulin (Glu) status in the normal (control –ve) group that fed only on basal diet and (+ve) groups of rats suffering from kidney alteration toxicity that fed on BD supplemented with (1, 2, and 4% from AG, TUR, and mixed between them). Results showed a significant decrease in total protein, Glu, and Alb for the positive group compared to the negative group.

Groups that fed on BD supplemented with AG plus TUR had a significant increase in total protein level compared to the positive (+ve) control group that only fed on BD. The best results were recorded by groups that fed on BD supplemented with (4%:4% w/w) AG plus TUR, followed by (2%:2% w/w) AG plus TUR. On the other hand, there is no significant difference between the two levels from AG and TUR (2:2 w/w) and 4% from AG.

Statistical results revealed that all treated groups had a significant decrease ($P<0.5$) in (Alb) levels while recording a significant increase in (Glu) levels. The best results of (Alb) was recorded by the positive groups that fed on (BD) supplemented with (4%:4% w/w and 2%:2% w/w) from mixed (AG) and (TUR), followed by 4% (AG) and 4% (TUR), while the best results for (Glu) level were recorded by the (+ve) groups that fed on (BD) supplemented with (4%: 4% w/w) AG plus TUR followed by 2% from the mixture and 4% (AG). The results are in agreement with **Chiu et al., (2009)**, who reported that curcumin treatment reduced chronic diabetic kidney complications.

Sharma et al., (2006) cleared that administration of streptozotocin-induced diabetic Sprague-Dawley rats with curcumin (15 and 30 mg / kg b.w/ day) for 2 weeks resulted in significantly improved renal dysfunction and oxidative stress. **Tikoo et al., (2008)** suggested that curcumin's regulation of diabetic nephropathy may involve changes in post-translational modification. **Asoum et al., (2013)** clarified that curcuminoids are a rich source of phenolic compounds, and curcumin, as the major component of turmeric, has been shown to have antimicrobial, anti-inflammatory, and antimutagenic activities. As (AG) is an edible biopolymer, its effective biological role has been confirmed, including an antioxidant effect with a protective role against hepatic and cardiac toxicities. In addition to that, it has been claimed that AG alleviates the effects of chronic renal failure in humans **(Glover et al., 2009).**

Table (3) illustrate the effect of BD supplemented with different levels (1, 2, and 4 %) of AG, TUR and mixed between them (1:1%, 2:2%, and 4:4% w/w) for 4 weeks on kidney function including, uric acid (UA), urea nitrogen (UN) and creatinine (CR) in the normal (control –ve) group that fed on BD and (+ve) groups of rats suffering from kidney alteration toxicity. Results revealed that the mean values of UA, UN, and Cr levels decreased significantly in the (-ve) control group compared to the (+ve) control group.

Concerning all positive control groups that were treated with AG, TUR, and mixed between them (1, 2, and 4 %). Results revealed a significant decrease ($P<0.05$) in (UA, UN, and Cr) as compared to the (+ve) control group. Our results revealed that the best improvement was recorded by positive groups that fed on BD supplemented with 4% mixed (AG) and (TUR), followed by 2% mixed, then 4% (AG), and lastly 4% (TUR).

The results are in agreement with **Moghadamtousi et al., (2014)** who reported that turmeric powder contains a high concentration of the potent biologically active phytochemical compound curcumin (diferutoyl methane), a substance believed to have health benefits as it gives a specific flavor and yellow colour to

curry. Besides, it possesses anti-inflammatory properties **(Srimal and Dhawan, 1973)**. Anti-inflammatory **(Joe and Lokesh, 1994)** and anticarcinogenic properties. Bicyc 10, 3-heptene, 2-isopropenyl-5-isopropyl 1-7, 7-dimethyl possesses antiprotozoal, antimicrobial, anti-inflammatory, antitumor, and chemo preventive activity **(Jurenka et al,2009)**.Xylopropamine has antipyretic, analgesic, anti-inflammatory, antitumor, and chemopreventive properties **(Ahn et al, 2010)**.

The kidney is susceptible to damage induced by reactive oxygen species. One of the intrinsic functions of kidney is to filter waste products from blood stream. Chronic renal failure is gradual, resulting in end-stage kidney disease **(Small et al., 2012)**. Oxidative stress is developed from an interaction between free radical production and antioxidant defense reduction. Antioxidants, therefore, are effective in ameliorating chronic renal failure and deteruration of kidney function caused by oxidative stress.

Concerning gum Arabic, our results are in agreement with **Ali et al., (2008)** who reported that when GA was given at an oral dose of 50 g/day for 3 months, serum creatinine, urea, phosphate, and uric acid concentrations were reported to be significantly reduced by GA, while the treatment significantly increased that of serum calcium. GA could alleviate the adverse effects of CRF.

The results are in agreement with **(Suliman et al., 2000)** who reported that GA has been tried in patients with chronic renal failure, and it was claimed that it helps to reduce urea and creatinine plasma concentrations and reduce the need for dialysis from 3 to 2 times per week.

Table (4) illustrated the effect of BD supplemented with different levels (1, 2, and 4%) of turmeric, AG and mixed between them (1:1, 2:2, and 4:4 w/w) for 4 weeks on antioxidant enzymes in kidney glutathione peroxidase enzymes (GPX), malondialdehyde enzyme (MDA), and glutathione enzyme (GSH) in the normal control (-ve) group and (+ve) control groups of rats suffering from kidney alteration toxicity by glycerol.

Results revealed that the mean values of (GPX, MDA, and GSH) in normal control (C –ve) vs. (C +ve) groups recorded (0.293 ± 0.013, 63.587 ± 2.072, and 0.526 ± 0.022 vs. 1.180 ± 0.007, 105.134 ± 5.463, and 0.212 ± 0.012, respectively). Statistical results revealed that

the (+ve) control group recorded a significant ($p < 0.05$) decrease in GPX and GSH levels, while recording a significant ($p < 0.05$) increase in (MDA) levels as compared to the control (-ve) group.

Statistical results revealed that there is a significant ($p<0.05$) increase in GPX and GSH levels in (+ve) all treated groups, while there is a significant decrease ($p<0.05$) in MDA levels in all treated groups as compared to the (+ve) control group, which fed only on (BD). The best results of (GPX and GSH) were recorded by the positive groups that fed on BD supplemented with (4:4% w/w) turmeric and Arabic gum, followed by (2:2% w/w), then 4% turmeric. Concerning MDA level results, they revealed that at level 4%, mixed Arabic gum and turmeric recorded the best decrease in MDA level, followed by 4% turmeric, then 2% turmeric.

Our results are in agreement with **Ghule et al., (2009)** who clarified the effect of antioxidants on kidney oxidative stress-induced kidney damage is associated with ROS/RNS production. Moreover, oxidative stress induced kidney damage is significantly reduced by antioxidants.

Our results are at the same line with **(Rafieian-Kopaei, 2013)** who clarified that oxidative stress (OS) is an important factor contributing to kidney damage by increasing the production of oxidants, in the absence of an endogenous antioxidant defense system. Medicinal plant antioxidants have been shown to ameliorate oxidative-induced kidney damage by reducing lipid peroxidation and enhancing the scavenging ability of the antioxidant defense system.

Our results are also in agreement with **Yuliani et al., (2018)** who indicated that ethanoic turmeric extract prevented trimethyltin (TMT)-induced oxidative stress at a dose of 200 mg/kg bw by decreasing plasma and brain MDA levels and increasing SOD, CAT, and GPX enzyme activities as well as GSH levels in the brain.

Histopathological Examination:

Kidneys of rats from the control negative group revealed the normal histological structure of renal parenchyma, as shown in photos

(1). The kidneys of rats from the control positive group suffering from kidney alteration induced by glycerol which fed on BD only showed cytoplasmic vacuolization of epithelial lining renal tubules and endothelial lining glomerular tuft (photo 2), cystic dilatation and renal tubules (photo 3), coagulative necrosis of epithelial lining renal tubules (photos 4) and mononuclear inflammatory cells infiltration (photo 5). On the other hand, kidneys of rats from groups suffering from kidney alteration induced by glycerol fed on BD containing 1% Arabic gum (AG) showed cytoplasmic vacuolization of epithelial lining renal tubules (Photos 6) and endothelial lining glomerular tufts in kidneys group fed on BD containing 2% AG (Photos 7), as well as necrosis of epithelial lining some renal tubules (Photo 8). Meanwhile, kidneys from the group fed on BD containing 4% AG showed necrosis of the epithelial lining of small focal renal tubules and renal cast in the lumen of other renal tubules (Photo 9).

On the other hand, examined sections from group fed on (BD) containing 1% turmeric (T) revealed necrosis of epithelial lining some renal tubules (Photo 10) and slight vacuolization of epithelial lining some renal tubules (Photo 11). Moreover, kidney from the group which fed on (BD) containing 2% (T) revealed vacuolization of epithelial lining some renal tubules (Photos 12) and congestion of glomerular tuft (Photo 13). However, kidney of rats from the group which fed on (BD) containing 4% (T) showed vacuolization of epithelial lining renal tubules and endothelial- lining glomerular tuft (Photos 14, and 15) as well as coagulative necrosis of focal renal tubular epithelium (Photo 15).

Microscopically, kidney from group fed on (BD) containing mixture from (1% AG plus 1% T) revealed vacuolization of epithelial lining renal tubules and endothelial lining glomerular tuft (Photo 16, and 17) as well as coagulative necrosis focal renal tubular epithelium (Photo 17). On the other hand, some examined sections from group which fed on (BD) containing (2% AG plus 2% T) and the group fed on (BD) containing mixture from (4% AG plus 4% T) showed no histopathological alterations (Photo 18, 19, and 21), whereas other Sections from those groups revealed vacuolization of epithelial lining renal tubules and endothelial lining glomerular tuft (Photo 20 & 22).

Results of the histopathological examination of kidneys of rats suffering from kidney alteration toxicity by glycerol fed on BD containing 4% mixture between (2% AG plus 2% T) revealed a dose

dependent reduction of degenerative changes caused by glycerol in kidneys of rats. The histopathological findings may confirm the various biochemical changes in some serum constituents. These findings agreed with that obtained by **(Rafieian-Kopaei, 2013)** who reported that medicinal plant antioxidants are able to ameliorate oxidative induced kidney damage by reduction of lipid peroxidation and enhancement of scavenging ability of antioxidant defense system.

Figures and Tables

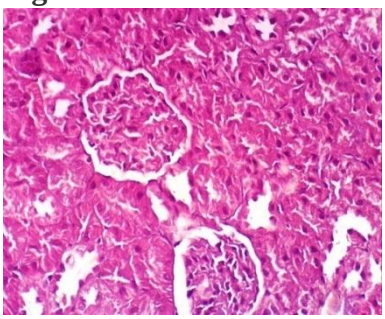

Photo (1): Kidney of a rat from the control negative group showing the normal histological structure of renal parenchyma (H & E X 400).

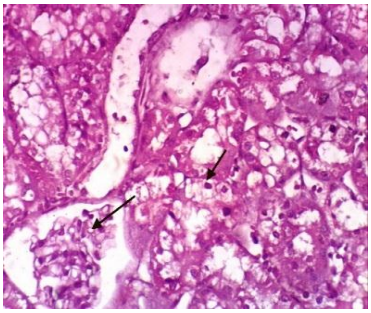

Photo (2): Kidney of a rat from the control positive group showing cytoplasmic vacuolization of epithelial lining renal tubules and endothelial lining glomerular tuft (H & E X 400).

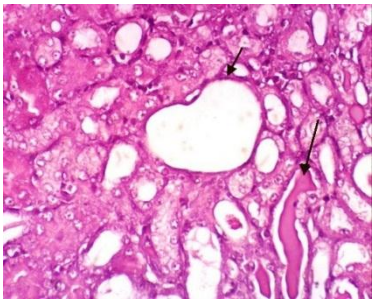

Photo (3): Kidney of rat from control positive group showing cystic dilatation of renal tubules and renal cast in the lumen of renal tubules (H & E X 400).

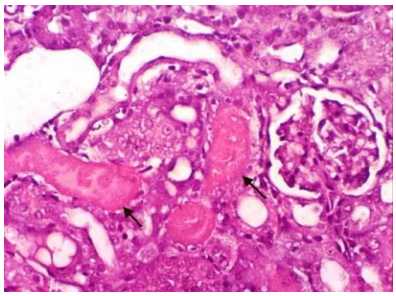

Photo (4): Kidney of rat from control positive group showing coagulative necrosis of epithelial lining renal tubules (H & E X 400).

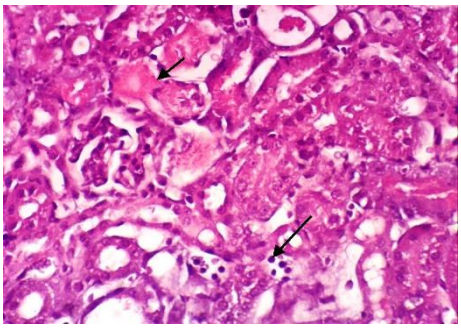

Photo (5): Kidney of rat from control positive group showing coagulative necrosis of epithelial lining renal tubules and mononuclear inflammatory cells infiltration (H & E X 400).

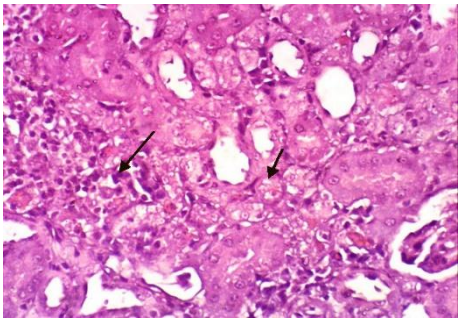

Photo (6): Kidney of rat from group fed on diet containing 1% Arabic gum showing vacuolar degeneration of epithelial lining renal tubules and focal necrosis of renal tubules associated with inflammatory cells infiltration (H & E X 400).

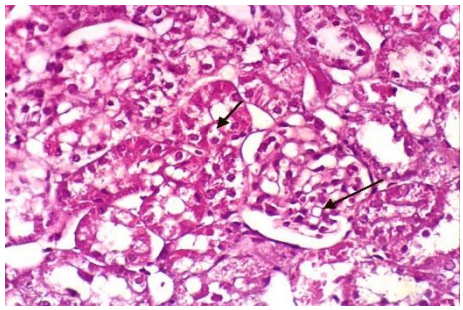

Photo (7): Kidney of rat from group fed on diet containing 2 % Arabic gum showing cytoplasmic vacuolization of epithelial lining renal tubules and endothelial lining glomerular tuft (H & E X 400)

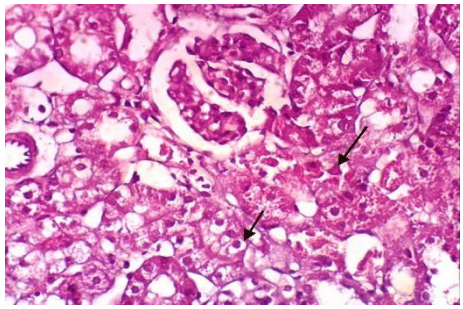

Photo (8): Kidney of rat from group fed on diet containing 2 % Arabic gum showing cytoplasmic vacuolization of epithelial lining renal tubules and necrosis of epithelial lining some renal tubules (H & E X 400).

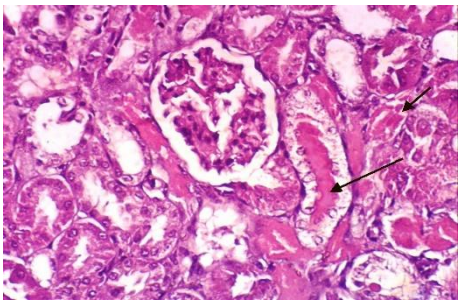

Photo. **(9):** Kidney of rat from the group fed on diet containing 4% Arabic gum showing necrosis of epithelial lining small focal renal tubules and renal cast in the lumen of other renal tubules (H & E X 400).

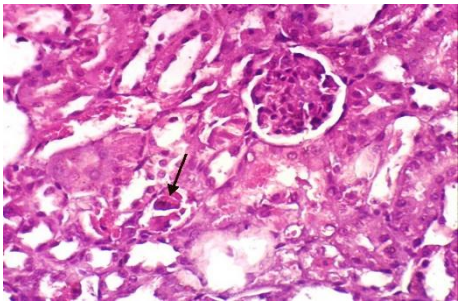

Photo. (10): Kidney of rat from the group fed on diet containing 1% Turmeric showing necrosis of epithelial lining some renal tubules (H & E X 400).

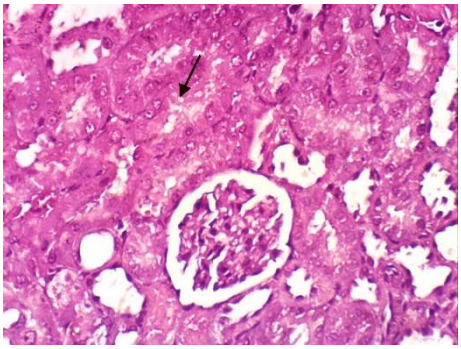

Photo. (11): Kidney of rat from the group fed on diet containing 1% Turmeric showing slight vacuolization of epithelial lining some renal tubules (H & E X 400).

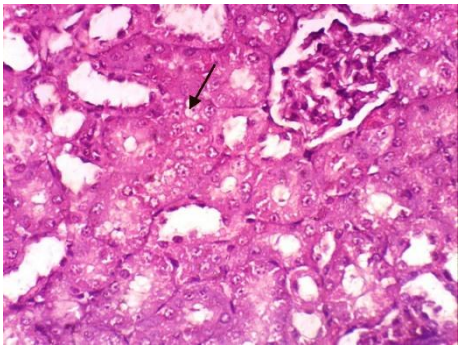

Photo. (12): Kidney of rat from the group fed on diet containing 2% Turmeric showing vacuolization of epithelial lining some renal tubules (H & E X 400).

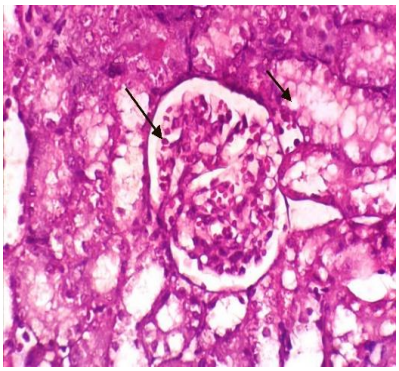

Photo. (13): Kidney of rat from the group fed on diet containing 2% Turmeric showing vacuolization of epithelial lining some renal tubules and congestion of glomerular tuft (H & E X 400).

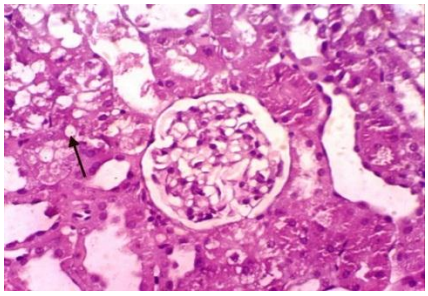

Photo. (14): Kidney of rat from the group fed on diet containing 4% Turmeric showing vacuolization of epithelial lining renal tubules (H & E X 400).

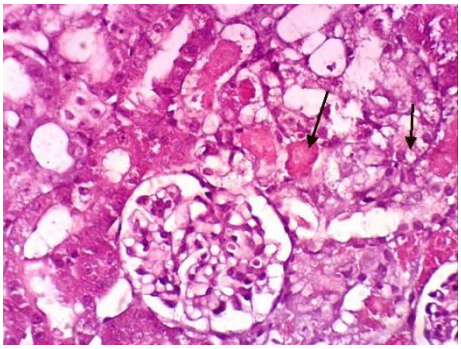

Photo. (15): Kidney of rat from the group fed on diet containing 4% Turmeric showing vacuolization of epithelial lining renal tubules and coagulative necrosis of focal renal tubular epithelium (H & E X 400).

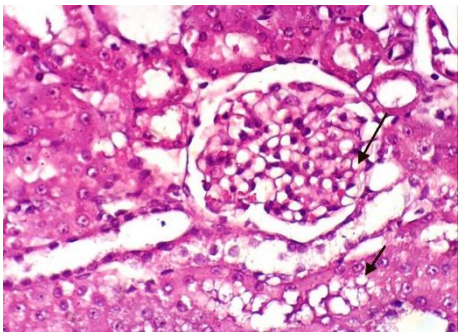

Photo. (16): Kidney of rat from the group fed on diet containing 1% Arabic gum and 1% Turmeric showing vacuolization of epithelial lining renal tubules and endothelial lining glomerular tuft (H & E X 400).

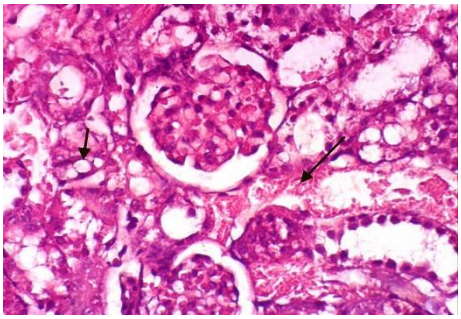

Photo. (17): Kidney of rat from Kidney of rat from the group fed on diet containing 1% Arabic gum and 1% Turmeric showing vacuolization of epithelial lining renal tubules and coagulative necrosis of focal renal tubular epithelium (H & E X 400).

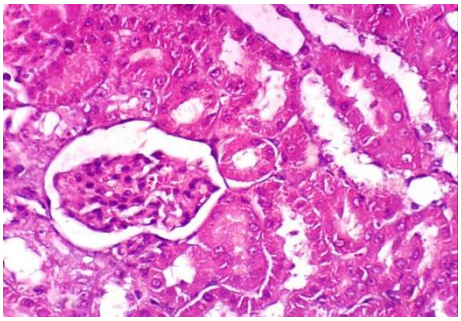

Photo. (18): Kidney of rat from the group fed on diet containing 2% Arabic gum and 2% Turmeric showing no histopathological alterations (H & E X 400).

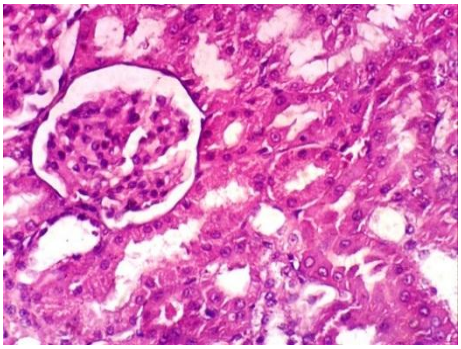

Photo. (19): Kidney of rat from the group fed on diet containing 2% Arabic gum and 2% Turmeric showing no histopathological alterations (H & E X 400).

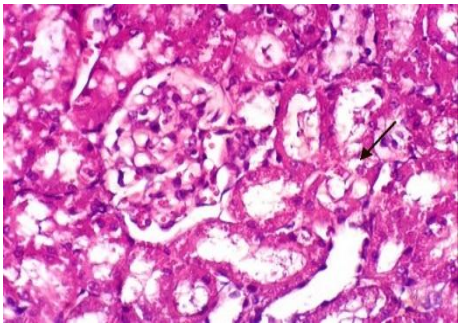

Photo. (20): Kidney of rat from the group fed on diet containing 2% Arabic gum and 2% Turmeric showing vacuolization of epithelial lining renal tubules and endothelial lining glomerular tuft (H & E X 400).

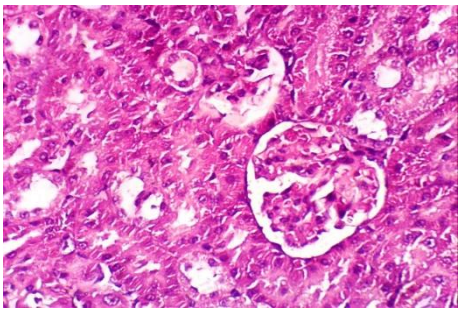

Photo. (21): Kidney of rat from the group fed on diet containing 4% Arabic gum and 4% Turmeric showing no histopathological alterations (H & E X 400).

Table (1): Effect of Supplementation with Turmeric and Arabic Gum on Feed Intake and Body Weight Gain% in Rats Suffering from Kidney Alteration Induced by Glycerol Toxicity.

Parameters / Groups	Feed Intake (g/day/each rat)	BWG%
Control (-)	17.97 [a] ± 0.361	32.964 [a] ± 1.148
Control (+)	14.50 [c] ± 0.308	8.588 [f] ± 1.052
1% AG	14.897 [b c d] ± 0.409	12.526 [e] ± 0.711
2% AG	14.955 [b c d] ± 0.748	14.808 [b c] ± 0.689
4% AG	14.00 [d] ± 0.833	14.000 [c d] ± 0.607
1% TUR	15.043 [b c] ± 0.975	13.677 [d] ± 0.788
2% TUR	15.349 [b c] ± 0.536	15.010 [b] ± 0.809
4% TUR	15.659 [b] ± 0.551	15.157 [b] ± 0.652
1% AG and 1% TUR	14.850 [b c d] ± 0. 807	13.724 [d] ± 0.328
2% AG and 2% TUR	14.576 [c d] ± 0.845	13.595 [d] ± 0.617
4% AG and 4% TUR	14.00 [d] ± 0.764	13.672 [d] ± 0.254

AG: Arabic GumTUR: Turmeric

Means in the same column with different letters are significantly different at ($p \leq 0.05$).

Table (2): Effect of Supplementation with Turmeric and Arabic Gum on Protein Status in Rats Suffering from Kidney Alteration Induced by Glycerol.

Parameters / Groups	Protein	Alb.	Glu.
	g/dl		
Control (-)	6.887 [a] ± 0.140	3.626 [f] ± 0.123	3.260 [a] ± 0.134
Control (+)	5.607 [i] ± 0.073	4.373 [a] ± 0.061	1.234 [h] ± 0.038
1% AG	5.993 [g] ± 0.079	3.957 [c] ± 0.072	2.036 [f] ± 0.040
2% AG	6.367 [d] ± 0.080	3.814 [d e] ± 0.130	2.553 [d] ± 0.176
4% AG	6.563 [c] ± 0.015	3.762 [d e] ± 0.048	2.800 [c] ± 0.050
1% TUR	5.860 [h] ± 0.100	4.113 [b] ± 0.066	1.747 [g] ± 0.091
2% TUR	6.196 [e f] ± 0.087	3.957 [c] ± 0.123	2.239 [e] ± 0.162
4% TUR	6.298 [d e] ± 0.051	3.858 [c d] ± 0.012	2.439 [d] ± 0.061
1% AG and 1% TUR	6.105 [f] ± 0.092	3.827 [d e] ± 0.085	2.278 [e] ± 0.123
2% AG and 2% TUR	6.539 [c] ± 0.047	3.732 [e f] ± 0.078	2.807 [c] ± 0.065
4% AG and 4% TUR	6.721 [b] ± 0.052	3.722 [e f] ± 0.059	2.999 [b] ± 0.094

AG: Arabic Gum TUR: Turmeric

Means in the same column with different letters are significantly different at ($p \leq 0.05$).

Table (3): Effect of Supplementation with Turmeric and Arabic Gum on Kidney Functions in Rats Suffering from Kidney Alteration Induced by Glycerol.

Parameters / Groups	Uric Acid	Urea Nitrogen	Creatinine
	mg/dl		
Control (-)	1.414 ^{g} ± 0.053	24.467 ^{h} ± 0.849	0.589 ^{h} ± 0.021
Control (+)	2.886 ^{a} ± 0.104	71.101 ^{a} ± 4.055	2.711 ^{a} ± 0.131
1% AG	2.158 ^{c} ± 0.115	60.389 ^{b} ± 2.221	2.027 ^{c} ± 0.073
2% AG	1.847 ^{d} ± 0.066	50.559 ^{d} ± 2.408	1.589 ^{e} ± 0.084
4% AG	1.720 ^{e} ± 0.060	42.079 ^{f} ± 2.220	1.262 ^{f} ± 0.055
1% TUR	2.394 ^{b} ± 0.118	63.052 ^{b} ± 2.766	2.200 ^{b} ± 0.078
2% TUR	2.074 ^{c} ± 0.069	54.531 ^{c} ± 2.832	1.789 ^{d} ± 0.060
4% TUR	1.900 ^{d} ± 0.060	45.733 ^{e} ± 1.996	1.482 ^{e} ± 0.262
1% AG and 1% TUR	1.906 ^{d} ± 0.127	54.677 ^{c} ± 2.991	1.811 ^{d} ± 0.074
2% AG and 2% TUR	1.699 $^{e\,f}$ ± 0.031	42.349 ^{f} ± 2.252	1.264 ^{f} ± 0.047
4% AG and 4% TUR	1.593 ^{f} ± 0.058	33.744 ^{g} ± 2.393	1.029 ^{g} ± 0.072

AG: Arabic Gum TUR: Turmeric

Means in the same column with different letters are significantly different at ($p \leq 0.05$).

Table (4): Effect of Supplementation with Turmeric and Arabic Gum on Antioxidant Enzymes in Kidney Rats Suffering from Kidney Alteration Induced by Glycerol.

Parameters / Groups	GPX U/mg protein	MDA nmol/g	GSH ng/g
Control (-)	0.293 [a] ± 0.013	63.587 [f] ± 2.072	0.526 [a] ± 0.022
Control (+)	0.180 [h] ± 0.007	105.134 [a] ± 5.463	0.212 [i] ± 0.012
1% AG	0.199 [g] ± 0.003	96.468 [b] ± 5.802	0.255 [h] ± 0.010
2% AG	0.216 [f] ± 0.005	91.054 [b c] ± 4.640	0.315 [f] ± 0.014
4% AG	0.240 [e] ± 0.007	84.841 [c d] ± 4.072	0.377 [d] ± 0.010
1% TUR	0.221 [f] ± 0.009	91.568 [b c] ± 3.771	0.283 [g] ± 0.010
2% TUR	0.239 [e] ± 0.006	84.865 [c d] ± 3.531	0.340 [e] ± 0.011
4% TUR	0.255 [c d] ± 0.003	80.583 [d e] ± 3.531	0.411 [c] ± 0.014
1% AG and 1% TUR	0.251 [d e] ± 0.002	87.140 [c d] ± 4.956	0.320 [e f] ± 0.009
2% AG and 2% TUR	0.264 [c] ± 0.005	80.400 [d e] ± 0.527	0.382 [d] ± 0.009
4% AG and 4% TUR	0.280 [b] ± 0.004	77.472 [e] ± 2.471	0.454 [b] ± 0.017

AG: Arabic Gum TUR: Turmeric
Means in the same column with different letters are significantly different at ($p \leq 0.05$).

CONCLUSION

gum Arabic, turmeric and their combination can be used to reduce the side effects of kidney diseases. Therefore, intake of gum Arabic and turmeric may be beneficial for kidney disease patien

REFERENCES

Ahn, J.; Lee, H.; Kim, S. and Ha, T. (2010).
Curcumin-induced suppression of adipogenic differentiation is Accompanied by activation of Wnt/β-catenin signaling. Am. J. Physiol Cell Physiol., 298, \ C1510–C1516.

Ali, A.A, Ali, K.E., Fadlalla, A. and Khalid, K.E. (2008).
The effects of G.A. oral treatment on the metabolic profile of Chronic renal failure patients under regular haemodialysis in Central Sudan. Nat. Prod. Res. 22: 12-21.

Al Za'abi, M, M, M.; Al Salam, S.; Al Suleimani, Y.; Manoj, P.; Nemmar, A. and Ali B.H. (2018).
Gum Acacia Improves Renal Function and Ameliorates Systemic Inflammation, Oxidative and Nitrosamine Stress in Streptozotocin-Induced Diabetes in Rats with Adenine-Induced Chronic Kidney Disease. Cell Physiol Biochem, 45 (6): 2293-2304.

Asoum, M.; Ataee, R.; Ahmad; A.A. and Amini, A. (2013):
Antioxidant and free radical scavenging activates of curcumin. Asian J Chem., 23: 7593-7595.

Aydogdu, N.; Atmaca, G.; Yalcin, O.; Taskiran, R.; Tastekin, E. and Kaymak, K. (2006)
Protective effects of L-carnitine on myoglobinuric acute renal Failure in rats. Clin Exp Pharmacol Physiol 33:119–124.

Azaab, M., AlBusadi, M. yes. J ; yas: J. Scupp and N, Nemmar. A. (2015):
Development of a new model for the induction of chronic kidney Disease via intraperitoneal adenine administration and the effect of Treatment with gum acacia thereon. Am. J Transl Res, 7 (1): 28-38.

Bagley, W.H.; Yang, H. and Shah, K.H. (2007)
"Rhabdomyolysis." Intern Emerge Med 2: 210–218.

Bartels, H. and Bohmer, M. (1971):
Creatinine standard and measurement of serum creatinine with Picric acid. Clin. Chem.; Acta, 32: 81.

Chiu, J.; Khan Zia, A.; Farhangkhoee, H. and Chakrabarti, S. (2009).
"Curcumin prevents diabetes-associated abnormalities in the Kidneys by inhibiting p300 and nuclear factor-B", Nutrition 25: 964–972.

Doumas, B.T. and Biggs, H.G. (1971):
Albumin standard and measurement of serum albumin with Bromocresol green. Clin. Chem. Acta., 31 : 78.

Fossati, P.; Penciple, L. and Berti, G. (1980):
Egyptian colorimetric method of determination of uric acid in Serum. Clin. Chem., 26: 227.

Ghule, A.E.; Jadhav, S.S. and Bodhankar, S.L. (2011).
Reno protective effect of Linum usitatissimum seeds through Hemodynamic changes and conservation of antioxidant enzymes in renal ischemia-reperfusion injury in rats**.** Arab Journal of Urology, 9:215-221.

Giannoglou, G.D.; Chatzizisis, Y.S. and Misirli, G. (2007)
The syndrome of rhabdomyolysis: pathophysiology and Diagnosis. Ear J Intern Med 18: 90–100.

Glover, D.A.O. Phillips and Riley, S.G. (2009):
An evaluation of potential health benefits in human subjects. Food Hydrocolloids**,** 23, (8): 2410-2415.

Gomal, A.C.; Bard will, C.J. and David, M.M. (1949):
Determination of serum protein. J. Bio. Chem.., 177:715.
Hajavi, J.; Momtazi, A.A.; Johnston, T.P.; Banach, M.

Javaid, R.; Aslam, M.; Nizami, Q. and Javaid, R. (2012)
Role of antioxidant herbal drugs in renal disorders: an overview. Free Rad Antiox 2:2–5.Joe, B. and Lokesh, B. R. (1994). Role of Capsaicin, curcumin and dietary n-3 fatty acids in lowering the Generation of reactive oxygen species in rat peritoneal Macrophages. Biochim Biophys Acta;1224(2):255-63.
Jurenka, J.S. (2009). Anti-inflammatory properties of curcumin, a Major constituent of Curcima longa: A review of preclinical and Clinical research. Altern Med Rev.; 14:141–153.

Kjeldsen, S.E. (2018):
Hypertension and cardiovascular risk: general aspects

Pharmacological research, 129: 95-99.

Lao, C.D. (2006)
Dose escalation of a curcuminoid fromulation, BMC complement Altern. Med. 6 (1): 10.

Majored, M. and Sahebkar, A. (2017).
Curcumin: A Naturally Occurring Modulator of Adipokinesin Diabetes. Journal of Cellular Biochemistry 118:4170–4182

Mahmoud, A.M.; Ahmed, O.M. and Galaly, S.R. (2014)
The moquinone and curcumin attenuate gentamicin-induced renal Oxidative stress, inflammation and apoptosis in rats Excli J. 2014; 13:98-110.

Maree, A.; Peer, G.; Schwartz, D.; Serban, I.; Blum, M.; Wollman, Y.; Cabili, S. and Iaina, A. (1994):
Role of nitric oxide in glycerol induced acute renal failure in rats. Euro. Ren. Assoc.; 9 (4): 78-81.

Moghadamtousi, S.Z.; Kadir, H.A.; Hassandarvish P.; Tajik, H.; Abubakar, S. and Zandi, k. (2014).
A Review on Antibacterial, Antiviral, and Antifungal Activity of Curcumin. Medicinal Chemistry. 2014;11(11):1451–1460**.**

Nasir, O.D.S. (2007).
Physiological effects of kinases, pioglitazone and G.A. on renal function. Doctor of Philosophy in Zoology. University of Khartoum.

Paglia, D.E. and Valentine, W.N. (1967)
Studies on the quantitative and qualitative characterization of Erythrocyte glutathione peroxidase. J. Lab. Clin. Med. 70:158-169.

Patton, C.J. and Crouch, S.R. (1977):
Enzymatic colorimetric method to determine urea in serum Anal. Chem., 49:464.

Rafieian-Kopaei, M. (2013).
Medicinal plants for renal injury prevention. J Renal Inj Prev; 2(2):63-5.

Ravindranath, V., and Chandrasekhara, N. (1981).
Metabolism of curcumin–studies with [3H]curcumin. Toxicology 22, 337–344.

Reeves, P.G.; Nileson, F.H, and Fahmy, G.C. (1993):
Reported of the American institute of Nutrition adho wring committee on the formulation of the AIN 76 A-Rodent diet. J. Nutr., 123: 1939-1951.

Sendecor, G. and Cochran, W. (1979):
Statistical methods. 6 Th, ED. Lowa state collage. U.S.A.: 871.

Shafeek, F.; Abu-Elsaad, N.; El-Karef, A. and Ibrahim, T. (2019).
Gum Acacia mitigates diclofenac nephrotoxicity by targeting monocyte chemo attractant protein-1, complement receptor-1 and Pro-apoptotic pathways Food Chem. Toxically., 129: 162-168.

Sharma, S.; Kulkarni, S-K., and Chopra, K (2006):
Curcumin, the Active Principle of Turmeric (Curcuma Longa), Ameliorates Diabetic Nephropathy In Rats. Chan-Exp. Pharmacol. Physiol, 33, 940-945.

Sheehan, D. and Harpchak, B. (1980):
Phory and bractec histotechnology. 2nd Ed. Battle Press; Ohio.
Small, D.M.; Coombes, J.S.; Bennett, N.; Johnson, D.W. And Gobi, G.C. (2012). Oxidative stress, anti-oxidant therapies And chronic kidney disease. Nephrology, 17 (4): 311-321.
Srimal, R. C. and Dhawan, B. N. (1973). Pharmacology of Diferutoyl methane (curcumin), a non-steroidal anti inflammatory Agent. Pharmacy and Pharmacology, 25 (6): 447-452.

Suliman, S. M., Hamdouk, M. I. and Elfaki, M. B. (2000).
G.A. fiber as a supplement to low protein diet in chronic renal Failure patients. In: Sudan Association of Physicians, 17th Conference, Friendship Hall, Khartoum, Sudan, 21-23 March.

Sushil, J.K.; Mcvie, R.; Duett, J. and Herbst, J.J. (1989).
Erythrocyte membrane lipid peroxidation and glycosylated Hemoglobin in diabetes. Diabetes, 38: 1539-1543.

Tamas, L. and Andras , S. (2017)
The determination of hepatic glutathione at tissue and subcellular Level. Journal of Pharmacological and Toxicological Methods, 88 : 32-39.

Teichberg, S.; Wingertzahn, M.A.; Moyse, J. and Wapnir, R.A., (1999).
Effect of G.A. in an oral rehydration solution on recovery from Diarrhea in rats. J. Pediatric. Gastroenterology. Nutr. 29, 411–417.

Tikoo, K.; Meena, R.L; and Kabra, D.G. (2008):
Change in post-translational modifications of histone H3, heat-Shock protein-27 and MAP kinase p38 expression by curcumin in Streptozotocin-induced type I diabetic nephropathy. Br. J. Pharm, 153, 1225-1231.

Ustundag, S.; Yalcin, O.; Sen, S. and Cukur, Z. (2008)
"Experimental Myoglobinuric Acute Renal Failure: The Effect of Vitamin C." Ren Fail 30: 727–735.

Vanholder, R.; Sever, M.S.; Erek, E. and Lameire, N. (2000)
"Rhabdomyolysis." J Am SocNephrol 11: 1553–1561

Wu, J.; Pan, X.; Fu, H.; Zheng, Y.; Dai, Y.; Yin, Y.; Chen, Q.; Hao, Q.; Bao, D. and Hou, D. (2017)
Effect of curcumin on glycerol-induced acute kidney injury in rats. Sci Rep 7:10114.

Yuliani, S.; Mustafa and Partadiredja, G. (2018)
Turmeric (Curcuma longa L.) extract may prevent the Deterioration of spatial memory and the deficit of estimated total Number of hippocampal pyramidal cells of trimethyltin-exposed Rats. Drug Chem Toxically; 41(1):62-71.

Zanzer, C, Y., Batista, G. A, Dougkas, A. (2019):
Difficulties in Translating Appetite Sensations Effect of Turmeric-Based Beverage When Giver Prior to Is energetic Medium- or High-Fat Meals in Healthy Subjects.

تأثير التدعيم بالكركم والصمغ العربي على التغيرات الكلوية التي تسببها سمية الجلسرين في الفئران

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تهدف هذه الدراسة إلى معرفة تأثير التدعيم بالكركم والصمغ العربي على حالة البروتين ووظائف الكلى والانزيمات المضادة للأكسدة في الكلى والتغيرات الهستوباثولوجية في الكلى في الفئران التي تعاني من سمية الجليسرول. استخدمت في هذه الدراسة عدد (66) فأرا من نوع الالبينو، أوزانهم 150 ± 10 جم. تم تقسم فئران هذه الدراسة إلى مجموعتان رئيسيتان. المجموعة الرئيسية الأولى (6 فئران) تم تغذيتها على غذاء أساسي واستخدمت كمجموعة ضابطة سالبة "سليمة". المجموعة الرئيسية الثانية (66 فأرا) تم تقسيمها الي 10 مجموعات فرعية (6 فئران في كل مجموعة). تم تغذية فئران المجموعة الرئيسية الثانية كالتالي:
المجموعة الأولى تم تغذيتها على غذاء أساسي واستخدمت كمجموعة ضابطة إيجابية "مصابة". المجموعات الفرعية (2و 3 و 4) تم تغذيتهم على غذاء أساسي يحتوي على (1 و 2 و 4 جم صمغ عربي) لكل 100 جم غذاء، على التوالي. المجموعات الفرعية (5 و 6 و 7) تم تغذيتهم على غذاء أساسي يحتوي على (1 و 2 و 4 جم كركم) لكل 100 جم غذاء، على التوالي. المجموعة الفرعية الثامنة تم تغذيتها على غذاء أساسي يحتوي على (1 جم صمغ عربي و 1 جم كركم) لكل 100 جم غذاء. المجموعة الفرعية التاسعة تم تغذيتها على غذاء أساسي يحتوي على (2 جم صمغ عربي و 2 جم كركم) لكل 100 جم غذاء.
المجموعة الفرعية العاشرة تم تغذيتها على غذاء أساسي يحتوي على (4 جم صمغ عربي و 4 جم كركم) لكل 100 جم غذاء. تم تغذية الفئران لمدة 28 يوم و ثلاثة أيام اخرى بعد الحقن بالجليسرول لاحداث السمية. أشارت النتائج إلى أن الجليسرول احدثت تناقصا في المتناول من الطعام والنسبة المئوية للزيادة في الوزن. كما أشارت نتائج تحليل مصل الدم ان الجليسرول أدى إلى حدوث تناقصا في مستويات البروتين والجلوبيولين في حين أحدثت إرتفاع في مستويات الالبيومين و حامض اليوريك والكرياتينين. أشارت نتائج تحليل الكلى إلى حدوث تناقص في مستوى الجلوتاثيون و الجلوتاثيون بيروكسيديز في حين ارتفع مستوى المالونديالديهيد، مقارنة بالمجموعة الضابطة السالبة "السليمة". أدت معاملة الفئران التي تعاني من تغير في الكلى الناتج عن الجلسرين بالوجبات المختبرة إلى تحسين كل هذه التقديرات وتحسن في التغيرات الهستوباثولوجية التي لوحظت في الكلى مقارنة بالفئران غير المعاملة ، وخاصة المجموعات التي تم تغذيتها على نظام غذائي يحتوي على خليط من الصمغ العربي و كركم. **الخلاصة:** يمكن إستخدام الصمغ العربي والكركم ومزيجهما لتقليل الآثار الجانبية لأمراض الكلى. لذلك فإن تناول الصمغ العربي والكركم قد يفيد مرضى الكلى.

الكلمات المفتاحية: التسمم بالجليسرول – أمراض الكلى – فئران – كركم – صمغ عربي – التحاليل الحيوية – التغيرات النسيجية