

## The Effect of Gum Arabic in Treatment of Kidney Dysfunction in Chickens

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### ABSTRACT

Gum arabic is a polysaccharides obtained from the stems and branches of *Acacia senegal* tree. In folk medicine Gum arabic has been reported to have anti-oxidant and nephroprotectant effects.

This study aimed to evaluate the Gum arabic effect on kidney dysfunction in chickens which induced by cadmium nitrate.

Healthy chickens were divided into three groups, 5 chickens in each group; group 1: Normal group fed on basal diet, group 2: Control group feed on basal diet mixed with (100 ml/kg b. w.) cadmium nitrate, Group 3: Treated group, chickens feed on basal diet mixed with cadmium nitrate (100 ml/kg b. w.) then treated with Gum Arabic extract (500 g/kg body weight). Blood samples were collected at the beginning of the experiment (group 1: normal), after 5 days blood samples collected from (group 2: control) and after 10 days of Gum Arabic treatment blood samples collected from (group 3: treated), creatinine and uric acid were estimated as a kidney function parameters. The results demonstrated that oral administration of cadmium nitrate (control group) recorded a significant increase at ( $p < 0.05$ ) in serum creatinine levels and serum uric acid levels compared with those levels of the normal group. The results in this study illustrated that oral administration of Gum Arabic extract (treated group) showed a significant decrease at ( $p < 0.05$ ) in serum creatinine level and serum uric acid level compared with those levels of the normal group

Furthermore, the results obtained from this study suggested that oral administration of Gum Arabic extract may be helpful in the prevention of kidney dysfunction and may represent an effective therapy that normalizes serum creatinine and serum uric acid levels in chickens.

### INTRODUCTION

Gum Arabic is a dried exudate obtained from the stems and branches of *Acacia Senegal* tree, consists mainly of polysaccharides and it is a pale white to orange-brown solid. Gum Arabic has wide industrial uses as a stabilizer, thickening agent and emulsifier, mainly in the food industry (e.g. in soft drinks syrup, gummy candies, and marshmallows), but also in cosmetics and pharmaceutical industries (Verbeken *et al.*, 2003).

In folk medicine, Gum Arabic has been reported to be used internally for the treatment of inflammation of the intestinal mucosa (Gamal el-din *et al.*, 2003). Some recent reports have claimed that Gum Arabic possesses anti-oxidant and nephroprotectant effects (Rehman *et al.*, 2001 and Ali *et al.*, 2008).

Clinically, it has been tried in patients with chronic renal failure, and it was claimed that it helps reduce urea and creatinine plasma concentrations (Suliman *et al.*, 2000). These findings are not universally accepted and their confirmation, reliability, and mode of action await further studies.

Cadmium is a toxic heavy metal; it is water-soluble and is easily transferred from soil to plants that may affect many species if there is an intake of feed from a contaminated plant source (Satarug *et al.*, 2003)(

Accumulation of cadmium in tissues may lead to a decreased rate of growth. Akyolcu *et al.*, 2003 observed that cadmium administration resulted in lower body weights and higher tissue cadmium concentrations. Uyanik *et al.*, 2001 also reported that cadmium administration at the rate of 100 ppm resulted in damage in the kidney and liver.

The present study investigates the effect of Gum Arabic on kidney dysfunction in chickens caused by cadmium nitrate as a chicken is a major source of protein to the population and is widely consumed. The main source of heavy metals in chicken arises from the contamination of feed and drinking water. Contamination is transferred through direct sewage water and industrial effluent (Akan *et al.*, 2010)

## **MATERIALS AND METHODS**

### **Collection of Plant Material:**

Gum Arabic (*Acacia Senegal*) were obtained from Sudan.

### **Gum Arabic Extraction (Aqueous Extraction):**

About 500 mg of Gum Arabic was added to 100 ml of warm tap water and used as a daily treatment dose for 10 days (Amani *et al.*, 2013).

### **Kidney Dysfunction:**

The dose of 100 mg/kg of cadmium as cadmium nitrate was used to induce kidney dysfunction which selected according to Uyaniket *al.*, 2001. Cadmium nitrate obtained from the chemistry department at college of science and humanities in Al Quwai'iyah

### **Experimental Animals:**

Healthy adult chickens weighing 1000 g were obtained from the local market in Al Quwai'iyah, chickens were housed in metal cages with free access to standard feed and water.

### **Experimental Design:**

Experimental animals were separated into three groups consisting of 5 chickens in each group.

**Group 1:** Normal group, chickens fed on basal diet.

**Group 2:** Control group, chickens feed on basal diet mixed with. (100 ml/kg b. w.)Cadmium nitrate

**Group 3:** Treated group, chickens feed on basal diet mixed with (100 ml/kg b. w.) cadmium nitrate then treated with Gum Arabic extract (500 g/kg body weight).

### **Blood Collection:**

Chickens were sacrificed at the end of the experiment and samples of blood were collected.

### **Kidney Functions Estimation:**

Serum creatinine and uric acid were estimated as kidney functions.

### **Statistics:**

The results expressed as means  $\pm$  S.E. and made by one-way analysis of variance (ANOVA) using SPSS version 12.0 (SPSS Inc., Chicago, IL, USA); Statistical significance was set at  $p < (0.05)$ .

Microsoft Excel 2000 (Microsoft Corporation, Redmond, WA, USA) was applied for curves including glucose levels and groups.

**RESULTS**

**1- Serum Creatinine Levels:**

**Effect of Cadmium Nitrate (100 ml/kg body weight) on Serum Creatinine Levels:**

As recorded in table 1 and illustrated in Fig. 1, serum creatinine level of chickens received (100 ml/kg b. w.) cadmium nitrate, control group (G2) showed a significant increase at ( $p < 0.05$ ) when compared with the normal group (G1).

**Effect of Daily Doses Orally Administrated of Gum Arabic**

**Extract (500 g/kg body weight) after 10 Days of Treatment on Serum Creatinine Level of Chickens Received Cadmium Nitrate (100 ml/kg body weight):**

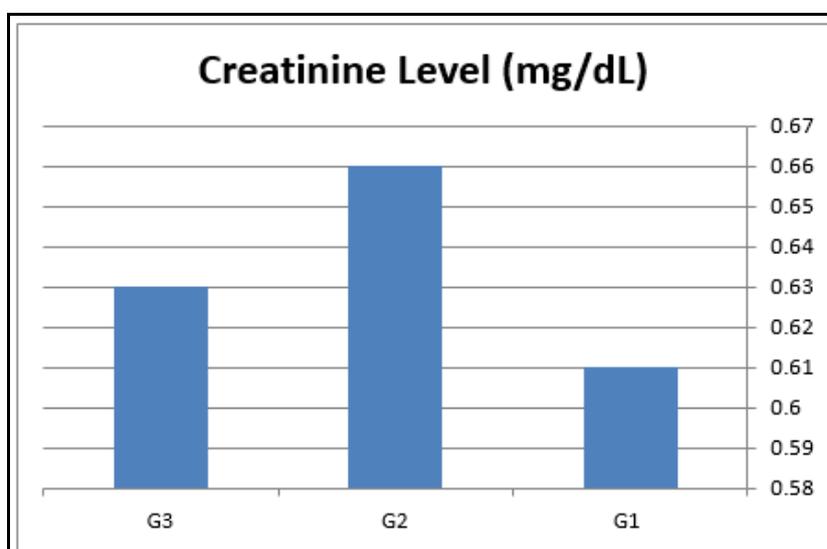
Chickens treated with Gum Arabic extract (500 g/kg body weight) after 10 days of treatment (G3), serum creatinine level showed a significant decrease at ( $p < 0.05$ ) when compared with a serum creatinine of control group (G2). This result is recorded in table 1 and illustrated in Figure 1.

**Table (1):** Effect of daily oral administrated doses of Gum Arabic extract (500 mg/kg body weight) after 10 days of treatment on serum creatinine level:

Groups	Creatinine level (mg/dL) Mean ± S. E.
Normal group (G1)	0.61 ± 0.2
Control group (G2)	0.66 <sup>+a</sup> ± 0.5
Treated group (G3)	0.63 <sup>-b</sup> ± 0.3

+a = Significant increase compared with normal at  $p < 0.05$

-b = Significant decreased compared with control at  $p < 0.05$



**Fig.1:** Effect of daily oral administrated doses of Gum Arabic extract (500 mg/kg body weight) after 10 days of treatment on serum creatinine level:

**2- Serum Uric Acid Levels:  
Effect of Cadmium Nitrate (100 ml/kg body weight) on Serum Uric Acid Levels:**

As recorded in table 2 and illustrated in Fig. 2, serum uric acid level of chickens received (100 ml/kg b. w.) cadmium nitrate, control group (G2) showed a significant increase at ( $p < 0.05$ ) when compared with the normal group (G1).

**Effect of Daily Doses Orally Administrated of Gum Arabic Extract (500 g/kg body weight) after**

**10 Days of Treatment on Serum Uric Acid Level of Chickens Received Cadmium Nitrate (100 ml/kg body weight):**

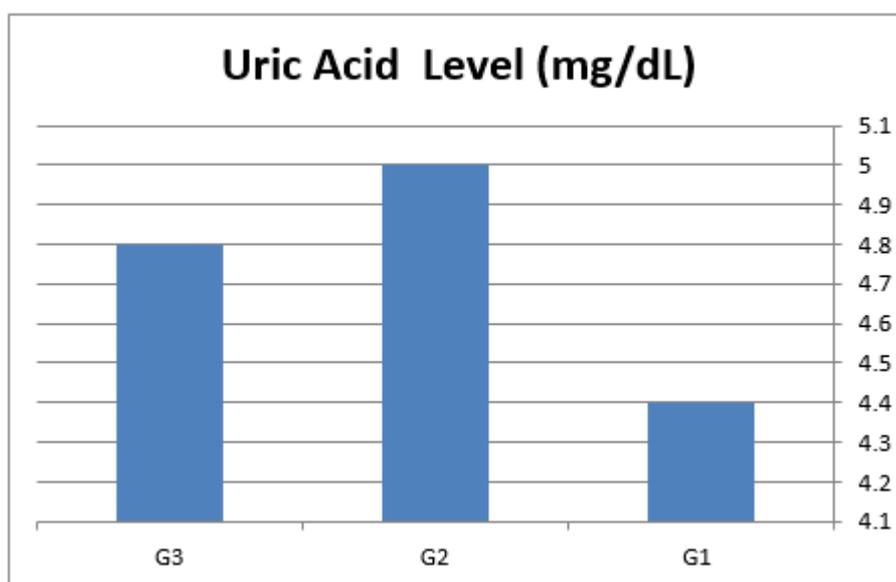
Chickens treated with Gum Arabic extract (500 g/kg body weight) after 10 days of treatment (G3), serum uric acid level showed a significant decrease at ( $p < 0.05$ ) when compared with serum uric acid level of the control group (G2). This result is recorded in table 2 and illustrated in Figure 2.

**Table (2):** Effect of daily oral administrated doses of Gum Arabic extract (500 mg/kg body weight) after 10 days of treatment on serum uric acid level:

Groups	Uric acid level (mg/dL) Mean $\pm$ S. E.
Normal group (G1)	4.4 $\pm$ 0.3
Control group (G2)	5.0 <sup>+a</sup> $\pm$ 0.5
Treated group (G3)	4.8 <sup>-b</sup> $\pm$ 0.7

+a = Significant increase compared with normal at  $p < 0.05$

-b = Significant decreased compared with control at  $p < 0.05$



**Fig.2:** Effect of daily oral administrated doses of Gum Arabic extract (500 mg/kg body weight) after 10 days of treatment on serum uric acid level:

## DISCUSSION

Kidney function tests in the present study illustrated that chickens exposed to cadmium nitrate 100 mg/kg body weight showed an increase in serum creatinine and serum uric acid levels as shown in tables (1&2) and figs (1&2). The results obtained from this study in agreement with that reported by (Deepti *et al.*, 2011) who recorded an increase of urea and creatinine concentration in the animals receiving cadmium chloride .

Hassan *et al.*, (2011) mentioned that the toxic effect of cadmium on the renal tissues was clear as the level of creatinine in serum increased. The elevation in the creatinine was due to the nephrotoxic effect of cadmium on renal tubules and glomeruli..Also, Shalaby (1997) described a significantly increased creatinine level in cadmium-treated chickens. The similar result demonstrated by (Khaled and Huda 2013) where they recorded that the plasma creatinine increased significantly in chickens exposed to cadmium for one month.

Results recorded in tables (1&2) and figs (1&2) showed a significant decrease in serum creatinine and serum uric acids levels in chickens treated with Gum Arabic extract (500 mg/kg body weight) for 10 days, the mechanism by which Gum Arabic ameliorates cadmium nephrotoxicity may include anti-oxidant and anti-inflammatory actions. Ali *et al.* (2009) mentioned that the antioxidant properties of Gum Arabic have been suggested to be involved in the amelioration of the toxicities of several agents, including acetaminophen hepatotoxicity, doxorubicin cardiotoxicity, and cisplatin nephrotoxicity.

The results observed in this study in agreement with (Ali *et al.*, 2013) who recorded that treated rats with the three types of Gum Arabic significantly reduced this effect of

adenine on creatinine and urea levels to a broadly similar extent.

ALSuleimani *et al.*, (2015) showed that treatment with Gum Arabic provides experimental evidence for the usefulness of Gum Arabic in the amelioration of chronic kidney disease, this in the line with the results observed in our study.

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## ARABIC SUMMARY

### أثر إستخدام الصمغ العربي في علاج إختلال وظائف الكلي في الدجاج.

راندا عبده عبد الرحمن، نوال عبد الله القحطاني، هيا محمد السهلي، هيا سعد القحطاني ونجود سعد الزنيتان  
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تهدف تلك الدراسة إلي دراسة الأثر العلاجي للصمغ العربي علي إختلال الكلي في الدجاج. ولذا فقد تم تقسيم الحيوانات الي ثلاث مجموعات من الدجاج (٥دجاج لكل مجموعة). المجموعة ١: تم اعطاء الدجاج وجبة غذائية طبيعية عن طريق الفم كمجموعة طبيعية. المجموعة ٢: تغذت على وجبة غذائية مختلطة معنترات الكادميوم (100 ml/kg b. w.) كمجموعة ضابطة أما المجموعة ٣: تغذت على وجبة غذائية مختلطة مع نترات الكادميوم (100 ml/kg b. w.) ثم تم علاجها بواسطة مستخلص الصمغ العربي (500 g/kg body weight)

ولقد أظهرت نتائج التحاليل الإحصائية أن المجموعة المصابة بإختلال وظائف الكلي والتي تم إصابتها بواسطة نترات الكادميوم (المجموعة الضابطة) قد أظهرت زيادة معنوية ملحوظ في قياس الكرياتينين وحمض اليوريك في الدم عند مقارنتها مع قياسات المجموعة الطبيعية. أما المجموعة المصابة بنترات الكادميوم والمعالجة بواسطة مستخلص الصمغ العربي قد أظهرت إنخفاضا معنويا في مستوي الكرياتينين وحمض اليوريك في الدم عند مقارنتها مع المجموعة الضابطة. ومن تلك النتائج نستطيع أن نستنتج أن تناول مستخلص الصمغ العربي عن طريق الفم قد يكون مفيدا في الوقاية من إختلال وظائف الكلي ويمكن ان يمثل علاجاً فعالاً لما له من دور تحسيني ضد تلف الخلايا الناتج من الشوارد الحرة.