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Antiurolithiatic Activity of Corn Oil on Ethylene Glycol-induced Renal Stone in Male Albino Rats

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Abstract

This study evaluated the effects of ethylene glycol (EG) and corn oil (CO) in male albino rats. Twenty-eight male albino rats (*Rattus norvegicus*) were randomly assigned into four equal groups (n = 7): (1) control group fed a basal diet with tap water *ad libitum*; (2) EG group fed a basal diet with drinking water containing 0.75% EG *ad libitum*; (3) EG + CO group fed a basal diet with 0.75% EG in drinking water *ad libitum* and received corn oil (0.3 mL/BW) orally by gavage; and (4) CO group fed a basal diet with tap water *ad libitum* and received CO by gavage. EG was administered for 28 days. The CO was given from day 14 to day 28. Results showed that EG significantly increased food intake during the third week and increased left kidney weight. EG caused non-significant increases in body weight, right kidney weight, and the weights of liver and heart. It also produced non-significant increases in red blood cells count, blood urea, and malondialdehyde (MDA). In contrast, EG reduced blood creatinine levels. Overall, the study suggests that CO is highly digestible and provides energy and essential fatty acids.

Keywords: Ethylene Glycol; Corn Oil; Urolithiasis; Kidney Tubules.

النشاط المضاد لتكوين حصوات المسالك البولية لزيت الذرة على حصوات الكلى الناتجة عن Ethylene Glycol في ذكور الجرذان البيضاء

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الخلاصة

هدفت هذه الدراسة إلى تقييم تأثيرات الإيثيلين غليكول (EG) وزيت الذرة (CO) في ذكور الجرذان البيضاء. استُخدم ثمانية وعشرون (28) من ذكور الجرذان البيضاء(*Rattus norvegicus*) ، وتم توزيعها عشوائياً وبالتساوي إلى أربع مجموعات (ن = 7): (1) مجموعة السيطرة التي تغذت على عليقة أساسية وماء حنفية ؛ (2) مجموعة EG التي تغذت على عليقة أساسية مع ماء شرب يحتوي على 0.75% من EG ؛ (3) مجموعة EG + CO التي تغذت على عليقة أساسية مع ماء شرب يحتوي على 0.75 % EG، وتلقت زيت الذرة (0.3 مل/وزن الجسم) فموياً بواسطة التغذية القسرية(Gavage) ؛ و(4) مجموعة CO التي تغذت على عليقة أساسية وماء حنفية وتلقت زيت الذرة فموياً بالتغذية القسرية. استمرت معاملة EG لمدة 28 يوماً، بينما أُعطي زيت الذرة من اليوم 14 حتى اليوم 28. أظهرت النتائج أن EG زاد بشكل معنوي من استهلاك الغذاء خلال الأسبوع الثالث، كما زاد وزن الكلية اليسرى. كما تسبب EG بزيادات غير معنوية في وزن الجسم، ووزن الكلية اليمنى، وأوزان الكبد والقلب. كذلك أحدث زيادات غير معنوية في عدد كريات الدم الحمراء(RBC) ، ويوريا الدم، والمالوندايالديهيد وعلى العكس من ذلك، خفّض EG مستوى الكرياتينين في الدم. وبصورة عامة، تشير الدراسة إلى أن زيت الذرة عالي القابلية للهضم ويوفر الطاقة والأحماض الدهنية الأساسية.

الكلمات المفتاحية: الإيثيلين غليكول; زيت الذرة; حصوات المسالك البولية ; أنابيب الكلى.

1. Introduction

Urinary system stone is a frequent that can adversely affect the quality of human life. Various factors, such as genetic background, have a 25% effect on individuals, including metabolites, dietary habits, smocking, alcohol use, air pollution, and stress, which are considered to trigger stone formation [1]. Epidemiological studies showed that urolithiasis is more prone to men (12%) than women (6%), and although it can be seen at any age, its frequency developed with age, and it is most commonly seen in individuals between the ages of 30 and 60 [2]. The formation of renal stones is mainly developed by different factors involved in urinary supersaturation, crystal nucleation, growth, aggregation, and migration to renal epithelial cell surfaces [3]. An imbalance between the promoters such as low urine volume, calcium, oxalate, uric acid, phosphate, and inhibitors may represent a potential factor in lithogenesis [4]. The EG is commonly used in automotive products, such as brake fluids, anti-freeze, windscreen de-ices, coolants, and sweet taste [5]. It has been suggested that EG is oxidised to glycollic acid, which, in turn, is oxidised to the toxic compound oxalic acid [6]. Glycollic acid causes severe acidosis, and oxalate precipitates as calcium oxalate in the kidneys, which leads to the storage of calcium oxalate crystals and the formation of kidney stones [7]. It was associated with proximal tubule cell necrosis, leading to the production of several metabolites (glycolaldehyde, glycolate, glyoxylate, and oxalate, in order) and the accumulation of large calcium oxalate crystals in the tubular lumen [8]. Medicinal plants are still the alternative choice of disease [9]. Corn is the small hard seed of any of the cereal grasses; it is edible, and therefore it is used in the preparation of food items. It can be used as an antidote to prevent some oxidative stress-related diseases and a complication is advocated [10]. It has been reported that CO is highly digestible and provides energy and essential fatty acids. Linoleic acid is a dietary essential that is necessary for the integrity of the skin, cell membranes, the immune system, and the synthesis of eicosanoids. The fatty acids found in their structure are palmitic acid, stearic acid, oleic acid, linoleic acid, and linolenic acid [11]. This study is aimed to investigate the protective effect of CO against EG induced renal stone underlying mechanisms using in male albino rats.

2.Materials and Methods

2.1 Animals housing

Twenty-eight adult male albino rats weighing about 150-350 g were housed at the animal house at the Department of Biology, Faculty of Science, Soran University, Iraq. They were kept in standard environmental laboratory conditions under natural light and dark cycles of temperature (22°C ± 2°C, relative humidity 55% ± 5%, and 12 h light/dark cycles). Animals were fed a normal diet and water ad libitum during the experiment. The bedded with wooden chips.

2.2 Preparation of the diet

The constituents of diet were determined according to Pico Lab. Rodent diet 20, with the assistance of experts from the Erbil poultry project and Erbil animal diet factory in Erbil, Iraq, as follows: 66.6% wheat, 25.6% soya, 1.5% lime stone, 0.63% salt, 0.156% methionine, 0.244% lysine, 0.062% choline chloride, 0.058% vitamin C, 0.642% dicalcium phosphate, 0.080% AZ/1200, and 0.050% trace elements.

2.3 Renal stone induction

Ethylene glycol -induced urolithiasis model was used to assess the antiurolithiatic activity in male albino rats. Urolithiasis was induced by administration of EG (0.75% w/v) in drinking water for 28 days *ad libitum* [12-14].

2.4 Preparation of corn oil dose

The CO was obtained from a local market, which is used daily by our people. The dose was prepared at about 1 ml/kg/BW, then the dose would be 0.3 ml/rat /BW that you used in this experiment as a final dose was applied from the 14th day of the experiment until the 28th day through the oral gavage.

2.5 Experimental design

This experiment was designed to study curative effects of CO on EG induced kidney stone in male albino rats. Hyperoxaluria and calcium oxalate deposition in the kidney was induced by adding EG to the drinking water to a final concentration of 0.75% for two groups (group II&III). Animals were divided randomly and equally into four groups to four groups the experiment was continued for 28 days as following. Group I: Control rats (n= 7) were supplied with normal basal diet and normal water *ad libitum* water and diet. Group II: EG (n=7) Were received normal basal diet and water supplemented with EG 0.75% *ad libitum* for 28 days. Drinking water supplemented with EG 0.75% for 28 days. Group III: EG and CO (N=7) Were received normal basal diet and water supplemented with EG 0.75% *ad libitum* for 28 days and CO (0.3 ml/rat) for 14 days started from 14^{th} to 28^{th} days orally by gavage. Group IV: CO (N=7) Were received normal basal diet and water *ad libitum* with CO (0.3 ml/rat) for 14 days started from 14^{th} to 28^{th} days orally by gavage.

2.6 Body weight and food intake measurement

At the beginning of the experiment and the end of each week, the weight of rats was recorded in gm. Also, the food intake of each group was recorded at the end of the 3^{rd} and 4^{th} weeks in gm/rat.

2.7 Collection of blood samples

At the end of the experiment, the rats were anaesthetised by a combination of ketamine hydrochloride (90 mg/kg) and xylazine (10 mg/BW). Blood samples were taken by cardiac puncture into chilled tubes with or without ethylene diamine tetra acetic acid (EDTA) (1.5 ml) as an anticoagulant tube and used for haematological and further serological parameters.

2.8 Measurement of some organ weight

After withdrawal of blood samples, animals were dissected, the liver, spleen, heart, left and right kidney were removed, and their weights were recorded by high-precision electronic balances (BL-220H, Shimadzu, Japan).

2.*9 Measurement of hematological parameters*

Hematological parameters including hemoglobin (Hb), packed cell volume (PCV), red blood cells (RBC), white blood cells (WBC), platelets (PLT), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), Mean corpuscular hemoglobin concentration (MCHC), lymphocytes [15], monocytes (MO) and Granulocytes (GR) were measured for each group by coulter counter (Nihon Kohden, MEK-6410K, Japan).

2.10 Serum separation

Blood was collected. Serum was separated by centrifugation at 3,000 rpm for 10 minutes (min) and stored at -20 °C until analysis. Various serum parameters of the kidney function test, including creatinine (CR) and urea (UA), in the blood were determined by using the Kenza instrument.

2.11 Determination of serum malondialdehyde

Serum MDA concentration, was determined spectrophotometrically, 150 µL serum sample the followings were added: 1ml of 17.5% trichloroacetic acid (TCA) and 1ml of 0.66% thiobarbituric acid (TBA), mixed well by vortex, incubated in boiling water for 15 min, and then allowed to cool. One ml of 70% TCA was added and the mixture was allowed to stand at room temperature for 20 min, and then centrifuged at 2000 rpm for 15 min, and the supernatant was taken for scanning spectrophotometrically at 532 nm.

2.12 Statistical analysis

Post hoc tests are used to uncover specific differences between three or more group means when an analysis of variance (ANOVA). Data were analysed using one-way ANOVA by the statistical package of social science (SPSS). With Duncan's Multiple and they presented as mean plus mines standard error, the same letters mean non-significant while different letters mean statistical values less than 0.05 ($P<0.05$) significant.

3. Result

3.1 Effect of ethylene glycol and corn oil on body weight in male albino rats

The influence of EG and CO on rats BW is showed in table 1. The rats treated with EG showed non-significant change in their BW as compared to control rats, also the administration of rats with both EG and CO showed non-significant changes in all weeks except the third one which decreased significantly ($p<0.05$) as compared to EG groups rats. Furthermore, rats administrated with CO alone produced non-significant change in all weeks except third which also decreased significantly ($p<0.05$) as compared to control rats.

Table 1- Body weight under effect of ethylene glycol and corn oil in male albino rats

Groups	1st week (gm)	2nd week (gm)	3th week (gm)	4th week (gm)
Control	268.571± 23.129 a	259.428± 25.217 a	312.000± 14.612 bc	332.857± 13.668 bc
Ethylene Glycol	293.428± 15.040 a	307.428± 14.187 a	326.571± 12.541 c	338.857± 10.363 c
Ethylene Glycol with Corn Oil	285.000± 16.889 a	300.333± 14.618 a	266.333± 23.491 ab	286.000± 26.417 ab
Corn Oil	285.142± 11.717 a	296.285± 11.771 a	247.428± 20.107 a	266.857± 15.825 a

The difference in letters indicates significant differences.

3.2 Effect of ethylene glycol and corn oil n food intake in male albino rats

The influence of EG and CO on food intake is showed in table 2. rats treated with EG showed a significant ($p<0.005$) decrease in food intake in third week, while in fourth week of study EG group showed non-significant decrease as compared to the control group. Also, rats treated with EG and CO showed decreased food intake significantly ($p<0.05$) as compared to EG supplemented group while rats treated with CO produced significant ($p<0.05$) decrease in third week, in contrast, the fourth week it increased significantly ($p<0.05$) as compared to control group. Data presented as mean ± S.E the same letters mean non-significant differences while the different letters mean significant differences *= p< 0.05

Table 2- Effect of ethylene glycol and corn oil on food intake in male albino rats

Groups	3^{th} week (gm)	4^{th} week (gm)
Control	210.000± 0.816 ^{d}	99.857± 0.760 ^{b}
Ethylene Glycol	164.000± 1.046 ^{c}	98.571± 0.447 ^{b}
Ethylene Glycol with Corn Oil	158.571± 0.947 ^{b}	82.428± 0.423 ^{a}
Corn Oil	142.000± 0.816 ^{a}	118.285± 0.423 ^{c}

The difference in letters indicates significant differences.

3.3 Effect of ethylene glycol and corn oil on some organs weight in male albino rats

The influence of EG and CO on some organs weight is showed in table 3. Rats were treated with EG produced non-significant change in organs weight except in left kidney which increased significantly ($p<0.05$) as compared to control group. On the other hand, the administration of rats with both EG and CO also showed non-significant changes as compared to EG group. Furthermore, treated rats with CO produced non-significant changes in organs weigh except in liver which decreased significantly ($p<0.05$) as compared to the control group.

Table 3- Effect of ethylene glycol and corn oil on organ weights in male albino rats

Groups	Right Kidney (gm)	Left Kidney (gm)	Liver (gm)	Heart (gm)	Spleen (gm)
Control	1.408± 0.028^{ab}	1.297 ± 0.034^{a}	9.011± 0.208^{b}	1.190± 0.038^{ab}	1.453± 0.111^{a}
Ethylene Glycol	1.565± 0.047^{b}	1.471± 0.075^{b}	9.443± 0.347^{b}	1.300± 0.057^{b}	1.303± 0.104^{a}
Ethylene Glycol with Corn Oil	1.550± 0.085^{b}	1.552± 0.077^{b}	9.015± 0.431^{b}	1.229± 0.089^{ab}	1.640± 0.278^{a}
Corn Oil	1.279± 0.061^{a}	1.199± 0.047^{a}	7.589± 0.132^{a}	1.084± 0.030^{a}	1.442± 0.082^{a}

The difference in letters indicates significant differences.

3.4 Effect of ethylene glycol and corn oil on some hematological parameters in male albino rats

The influence of EG and CO some hematological parameters is showed in table 4. on some hematological parameters. The administration of rats with EG showed non-significant of measured parameters included WBC, RBC, Hb, PLT and HCT as compared to the control group. Also, EG and CO group showed non-significant increase in all hematological parameters as compared to the EG group. On the other hand, rats were treated with CO showed non-significant change on same parameters as compared to control rats.

Table 4- Effect of ethylene glycol and corn oil on hematological parameters in male albino rats

Groups	WBC (10^9/ L)	RBC (10^{12}/ L)	Hgb (g/ dL)	PLT (10^9/L)	HCT (%)
Control	7.185± 1.117[a]	6.977± 0.338[a]	14.228± 0.515[a]	505± 80.615[a]	42.671± 1.797[a]
Ethylene Glycol	6.966± 0.993[a]	7.041± 0.657[a]	13.733± 1.250[a]	482± 77.493[a]	40.916± 4.096[a]
Ethylene Glycol with Corn Oil	9.460± 1.315[a]	7.602± 0.266[a]	15.320± 0.432[a]	489± 48.586[a]	45.020± 1.634[a]
Corn Oil	8.5143± 1.503[a]	6.565± 0.330[a]	13.557± 0.657[a]	545± 38.649[a]	40.185± 2.091[a]

The difference in letters indicates significant differences.

3.5 Effect of ethylene glycol and corn oil on some kidney function tests in albino rats

The influence of EG and CO on kidney function tests included blood urea and creatinine is showed in table 5. rats treated with EG showed non-significant increase in urea, and non-significant decrease in creatinine level as compared to the control group. On the other hand, rats treated with both EG and CO group showed non-significant increase as compared to the EG group. On the other hand, rats treated with both EG and CO non-significant increase in urea and creatinine as compared to the control group.

Table 5- Effect of ethylene glycol and corn oil on kidney function tests in male albino rats

Groups	Blood urea (mg/dL)	Blood creatinine (mg/dL)
Control	35.857± 1.518[a]	0.425± 0.009[a]
Ethylene Glycol	37.666± 2.304[ab]	0.421± 0.010[a]
Ethylene Glycol with Corn Oil	43.600± 3.009[b]	0.450± 0.014[a]
Corn Oil	38.750± 1.555[ab]	0.436± 0.007[a]

The difference in letters indicates significant differences.

3.6 Effect of ethylene glycol and corn oil on malondialdehyde in male albino rats

The influence of EG and CO on MDA level is showed in table 6. Rats were treated with EG produced non-significant increase in (MDA level as compared to the control. Meanwhile rats were treated with both EG and CO showed non-significant change in MDA level as compared to the EG group. In addition, the administration of rats with CO produced non-significant change in MDA level as compared to control group.

Table 6- Effect of ethylene glycol and corn oil on malondialdehyde levels in male albino rats

Groups	MDA (μmol/L)
Control	2.6730± 0.4625[a]
Ethylene Glycol	6.3593± 1.0534[a]
Ethylene Glycol with Corn Oil	3.8820± 1.1820[a]
Corn Oil	3.9366± 0.5384[a]

The difference in letters indicates significant differences.

4. Discussion

The action of EG causes renal toxicity in rats through the metabolism of EG to oxalic acid and the precipitation of oxalic acid with calcium [16]. The non-significant increment of body weight in the all week experiment (Table 1) by EG administration is supported the result [17]. On the other hand, the declined BW with EG administration is in accordance with the result of studies by [18] These differences were frequently associated with increased incidences of liver tumor and it is the reduced incidence of mononuclear cell leukemia (generally considered a lethal neoplasm) in corn oil gavage control male rats. The decrement of food intake in third and fourth weeks (Table 2) by the EG consumption in the drinking water is confirmed by previous study [19] who reported that food intake was severely reduced between day 6 and 9 at the 800 part per million (ppm), causing a severe loss of body weight in these dams, No major external or skeletal malformations were found in fetus from dams exposed to concentrations of EG as high as 800 ppm. Internal soft tissue examinations revealed two fetuses, each from different dams, exposed to 800 ppm of EG and one control fetus with persistent right aortic arches. Cardiovascular anomalies have been reported to occur spontaneously in this strain of rat, albeit at a very low rat. Our the result is agree with the finding of [20] who reported that the female Wistar rats caused A significant loss in body weight correlates with the decrease in feed consumption was also observed when treated with EG at three different doses (0.4%, 0.75% and 1.0%, v/v) for 28 days. On the other hand, the significant decrement in food intake in third week of rats treated with CO is agree with finding of [21] who showed that female sprague-dawlery rats were administrated (10ml/kg) corn oil for 1-8 days was reduced food consumption have been reported to be involved in the rewarding effect of brain stimulation in rats. While the significant increase in food intake in fourth week treated with CO is confirmed by previous study [22] who reported that Female Albino Rats were fed CO (0.3 ml/rat) for 28 days their diet increased their food intake. Our the result, it is agree with finding of [1] who suggested that rats fed the CO diet (10 ml/kg) during 4 weeks increased their food intake and also agreed with finding of [23]. The increment in organ weight of Right and left kidney in (Table 3) by the EG consumption in the drinking water is supported by previous study [20] who reported that The administration of EG at three different doses (0.4%, 0.75% and 1.0%, v/v) for 28 days in female Wistar rats caused efficient in kidney weight in rats was also observed when treated with EG in drinking water. Many earlier reports have confirmed that kidney weights of wistar rats administered diets containing EG for 16 weeks increased absolute and relative kidney weights in both strains of rats treated at 500 and 1000 mg/kg/day [18]. While the non-significant increase in liver and heart weight in (Table 3) treated with the EG consumption in the drinking water is agree with finding of [17] who showed that the male rats caused raise in liver and heart weight in rats was also observed when treated with EG((1.0 and 0.2 g/kg/day) in drinking water at 2 years. However, the non-significant decrease in spleen weight in (Table 3) treated with EG consumption in the drinking water is confirmed by study [24] who reported that male f344 rats caused reduced relative weights (g/ 100 g BW) of spleen was seen in EG(100 or 500 mg/kg/day) treated rats on day 1. On the other hand, the non-significant decrease in weight of R. and L. kidney in (Table 3) treated with CO is confirmed by previous study [25] who showed that male albino rats fed CO orally (1 ml/kg) for one week caused deficient in kidney weight. While the non-significant decrease in weight of spleen treated with CO is supported by previous study [26] who reported that male Fischer rats treated with CO (5 ml /kg body wt/day) for 12 weeks loss spleen weight relative to non-gavaged or water-gavaged rats. However, the significant decrease in weight of liver treated with CO is supported by previous study [27] who reported that male albino rats reduce in liver weight treated with 0.3 ml /rat /day of CO for four weeks, It has been reported that the hepatotoxicity ranks one the most frequent causes of acute liver failure and combination of poly and mono-unsaturated fatty acids in CO is protective against alcohol and iron induced liver injury. While the non-significant decrease in weight of heart treated with CO is disagree with the finding of [28] who reported that Male Wistar albino rats were fed for 21 days on a diet in which fat (12%) was included either as fresh corn oil was higher than the mean relative heart weights of the control rats. The non-significant decrease in WBC and Hgb in (Table 4) by the EG consumption in the drinking water is supported by previous study [29] who showed that female Fischer 344 rats were treated with EG (100 ppm) 6 hr/day for a total of 9 days during an 11-day interval was decrease in WBC and Hgb parameters. While The non-significant decrease in PLT and HCT treated with the EG consumption is agree with finding of [30] who administrated that male Sprague–Dawley rats were slightly decrease in PLT and HCT levels treated the EG administration (150 mg/kg) during six times per week for 4 weeks. However, The non-significant increase in RBC treated with EG consumption is in accordance with the result of studies of [29] who showed that male Fischer 344 rats were treated with EG (100, 300, 1000 ppm) 6hr/day for a total of 9 days during 11 days interval was increase in RBC parameters. Our the results it is agree with finding of [30] who reported that male Sprague–Dawley rats were increase in RBC treated the EG administration (150 mg/kg/BW) during six times per week for 4 weeks. Meanwhile, the increment in WBC administrated with CO is attempt with finding of [31] who said that Male rats fed corn oil (0.5 mL) daily for one month was increase in WBC parameters. On the other hands, the non-significant increase in PLT level by the C.O consumption is confirmed by previous study [22] who reported that Female Albino Rats were increase in PLT parameter when treated with the corn oil given (0.3 ml) for 4 weeks present 24 rats. While, the non-significant decrement in HCT level administrated with CO is supported with the result of study [31] who reported that Male rats weighing 218-234 g fed corn oil (0.5 mL) daily for 30 days was decrease in HCT parameters. Meanwhile, the non-significant decrease in RBC and Hgb levels administrated with C.O is supported with the result of study [22] who showed that Female Rats were decrease in RBC and Hgb levels when treated with the corn oil given (0.3 ml) for 28 days that's present 24 rats. The influence of EG on some renal function test caused an increase in the uric acid and creatinine level. The renal parameters are highly responsive sensitive to the action of poison because of its intensive metabolic activity. The non-significant increase in urea in (Table 4) by the EG consumption in the drinking water is confirmed by previous study [32] who showed that Wistar albino rats fed EG (75% v/v) in drinking water during 28 days was increased risk of urolithiasis by increasing urea levels of stone constituents. Our the results is agree with the finding of [17] who reported that the male rats were fed high dose of EG (1g/kg/day) during 12 months increase the urea compared with control groups. On the other hand, the non-significant change in creatinine during the experiment in (Table 4) by treated EG consumption in the drinking water is supported by [17] who reported that the male rats were fed low dose of EG (0.2, 0.04 g/kg/day) during 12 months No changes were observed at the lower dose levels or in any other clinical chemistry measurement at any dose level at any time. On the other hand, the non-significant increase in urea in (Table 2) by treated with CO administration is agree with the finding of [25] who reported that male albino rats fed CO orally 1 ml/kg for one week that's raise urea level. On the other hand, the non-significant increase in creatinine in (table 2) by treated with CO administration is agree with the finding of[33] who showed that the level of serum glucose was significantly increased in male rats were treated CO (50 mg/kg /BW) daily for 3 weeks. A number of renal pathological diseases, including calcium oxalate kidney stones, have resulted due to the oxalate-induced damage to the renal cells. Elevated levels of oxalate are responsible for the toxic effects on the renal epithelial cells via alteration in membrane integrity, generation of reactive oxygen species, and depleted source of antioxidant enzymes. The non-significant increase in MDA (Table 6) by the EG consumption in the drinking water is confirmed by previous study [34] who showed that Male Wistar albino rats weighing 150–200 g were treated with EG (0.75%) in drinking water was fed to Groups II–IX for induction of renal calculi for 28 days, This study also revealed the increased lipid peroxidation and decreased levels of antioxidant potential in the kidneys of rats supplemented with EG. Our the result is agree with the finding of [32] who demonstrated in the present study that administration of EG (0.75% v/v) to drinking water for 28 days that is increased MDA content of kidneys and decreased activity of the antioxidant enzymes in the kidneys. On the other hands, the non-significant increase in MDA (Table 6) by treated with CO administration is agree with the finding of [35] who observed that Fischer 344 rats chronically consuming (3 and 5%) CO diets yielded significantly higher levels of MDA, as analysed by high-performance liquid chromatography, starting at 57 days of age, for a duration of 2, 10, or 20 weeks.

Conclusions

In present study EG increased the body weight, food intake, and kidney weight and MDA. Also, it declined the creatinine level and produced many serological toxicities in the rats include liver and kidney function tests. On the other hand, rats' administration with CO showed some recovery against the demonstrations of EG such as recovery of weight of whole body and absolute organ weight. The CO produced beneficial properties against EG toxicity.

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Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication and/or funding of this manuscript.

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