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Effect of Turmeric and Arabic Gum Supplementation on Liver Enzymes and Liver Antioxidant Enzymes in Rats Suffering from Glycerol Toxicity

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ABSTRACT

This study aimed to investigate the effects of turmeric and gum Arabic supplementation on feed intake, some organ weight/ body weight%, liver enzymes, and liver antioxidant enzymes in 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 toxicity and acute renal failure. The results indicated that glycerol decreased feed intake, and increased liver &kidney weight/body weight%. Serum results revealed that aspartate amino transferase (AST), alanine amino transferase (ALT),

and alkaline phosphates (ALP) were increased by injection of rats with glycerol, as compared to non-injected rats. Liver 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, as compared to non-treated rats, especially the groups that were fed a diet containing a mixture of gum Arabic and turmeric with high level. Conclusion: gum Arabic, turmeric and their combination can be used to reduce the side effects of liver problems causing by kidney diseases. Therefore, intake of gum Arabic and turmeric may be beneficial for kidney and liver diseases patients.

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

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INTRODUCTION

Human kidneys filter over 140 liters of plasma, reabsorb all important nutrients, excrete water, and 53 electrolytes and eliminate toxins to maintain the internal milieu **(Gueutin et al., 2012)**. Kidney disease is defined by a decline in glomerular filtration. Chronic kidney disease (CKD) is the 9th 54 leading cause of 55 deaths **(Yinusa et al., 2022)** in the United States, affecting 14% of the population. Diabetes and hypertension are 56 responsible for more than 75% of all CKD **(Kakitapalli et al., 2020)**. The kidney has an important role in removing wastes and toxins from the blood circulation (like creatinine and urea), regulating the balance of electrolytes, controlling the fluid balance, blood pressure, and hormone secretions **(Wu et al. 2017)**.

Glycerol injection is used to induce kidney and liver injury. Glycerol-caused acute renal failure (ARF) is one of the most used models of experimental ARF in rats and is assumed as an experimental analog of myoglobinuric ARF in humans induced by transfusion incidents or injury **(Abugomaa & Elbadawy, 2020)**.

Turmeric is an Indian rhizomatous herbal plant (Curcuma longa) of the ginger family (Zingiberaceae) of well-known medical benefits **(Pawar et al., 2014)**. Curcuma longa (Turmeric) is a popular

and widely used Indian rhizomatous medicinal plant from the family Zingiberaceae. Curcumin, Demethoxycurcumin (DMC), and Bisdemethoxycurcumin (BDMC) are the constituents of the turmeric and are collectively known as curcuminoids **(Rathore et al., 2020)**.

Curcumin has been used in tradition as a medical herb due to its various advantages such as: antioxidant **(Rheim et al., 2015)**, anti-inflammatory **(Gomez-Estaca et al., 2017)**, antimutagenic **(Noorafshan and Ashkani-Esfahani, 2013)**, antimicrobial **(Prasad et al., 2014)**, and several therapeutic properties **(Gupta et al., 2013).**

Gum Arabic (GA) is a natural gummy exudate gained from the trees of Acacia species (*Acacia senegal* and *Acacia seyal*), family Fabaceae. GA is considered a dietary fiber with a high percentage of carbohydrates and a low protein content. The sugars arabinose and ribose were originally discovered and isolated from gum Arabic, which represents the original source of these sugars. Mainly, GA is produced in the belt region of Africa, mainly in Sudan, Chad, and Nigeria. Traditionally, the gum was used for chronic renal failure, digestive discomfort, and others. Although gum Arabic is considered an inert substance, recent information revealed multiple pharmacological and medical effects, such as weight reduction, antihypertensive, antihyperlipidemic, anticoagulant, antibacterial, antidiabetic, anti-inflammatory, nephroprotective, and other effects **(Jaafar, 2019)**.

The purpose of this study was to investigate effect of turmeric and gum Arabic supplementation on liver enzymes and liver antioxidant enzymes in rats suffering from glycerol toxicity 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 ± 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 ± 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 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 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 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 was 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., Aspartate Aminotransferase (AST) & Alanin Aminotransferase (ALT) according to **Henry (1974),** Alkaline phosphates (ALP) **(Belfield and Goldberg 1971),** and glutathione peroxidase (Gpx), malondialde (MDA), and reduced glutathione (GSH) activities were measured in the liver according to the methods described by **(Tamas and Andras, 2017; Sushil et al., 1989; Paglia & Valentine, 1967),** respectively**.**

The kidneys and liver of sacrificed rats were taken and weighted to calculated organs weight/body weight % 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 (least significant differences at $P< 0.05$) 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 (liver and kidneys weights / body weight %) 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 in normal rats (control-ve) and the positive group fed on basal diet (BD) were 17.97 ± 0.361, and 14.50 ± 0.308 g/day of each rat), respectively. Feed intake decreased significantly $P\leq0.05$ in the positive control group, as compared to the negative control group.

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 liver and kidney weight / body weight % results revealed a significant increase ($P \leq 0.05$) in liver and kidney weight of the C +ve group fed on a basal diet only as compared to the negative control group that fed on a basal diet only was observed, while all positive groups that were treated with BD supplemented with different levels (1,2, and 4%) of (AG, TUR, and AG plus TUR) recorded a significant decrease ($P < 0.05$) in liver and kidney weight as compared to the (+ve) control group. The best results in decreasing liver and kidney weight were recorded by the mixed combination of (AG and TUR) at level 4% followed by 2 and 1 % and lastly 4 % (TUR) then 4% (AG).

Our results are in agreement with **Azaab, (2015)** who reported that the relative weight of kidneys significantly increased on adenine administration, and supplementation with AG significantly diminished that increase. Concerning the effect of different treatments our results are in harmony with **(Michael et al.; 1999)** who cleared the effect of (AG) to reduce the damage of hepatic tissue take place due to its ability to scavenge nitric oxide in order block oxidative stress. Concerning the effect of (TUR) on hepatoprotective **(Sadashiva et al.; 2019),** they reported that a significant activity was used to stimulate hydrogen peroxide, and a dose dependent suppression of the toxic nature of AG on liver weight of hydrogen peroxide confirmed the hepatoprotective potential of (TUR).

Table (2) 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 liver enzymes aspartate amino transferase (AST), alanine amino transferase (ALT), and alkaline phosphates (ALP) in the normal (–ve) group that fed on BD and (+ve) groups of rats suffering from kidney alteration toxicity.

Results revealed that the mean values of (AST, ALT, and ALP) in normal control (C-ve) vs. (C+ve) groups that fed on (BD) only were (57.160 ± 4.253, 18.089 ± 1.035 and 84.284 ± 3.168) vs. (93.790 ± 4.069, 36.320 ± 2.441, and 162.822 ± 5.312 U/l, respectively). Statistical results revealed a significant decrease ($P \leq 0.05$) in (AST, ALT, and ALP) in (-ve) control group as compared to the (+ve) control group.

Statistically, all treated groups recorded a significant decrease in AST, ALT & ALP values as compared with the (+ve) control group. The best results for all parameters were recorded by the (+ve) groups that fed on BD supplemented with mixed (AG) plus (TUR) at levels (4% followed by 2%), 4% turmeric, and 4% AG, respectively, these treatments decreased the mean value of (AST, ALT, and ALP) by about (33.692, 41.588, and 27.366%), (27.894, 37.767, and 20.501%), (28.475, 34.884, and 19.375%), and (24.534, 32.356, and 16.382%), respectively.

Our results are in harmony with **Shapiro et al (2006)**, who reported that curcumin showed a hepatoprotective effect and decreased levels of thiobarbituric acid reactive substances (TBARS), minimized oxidative stress, and inhibited inducible nitric oxide (INOS) protein and NF-KP in acute thioacetamide hepatotoxicity rats supplemented with 200 and 400 mg/kg per day of curcumin.

Curcumin treatment shows hepatoprotective activity induced by E.histolytica, decreasing serum activities of ALT, ALP, and Y-GTP, which were consistent with macroscopic and microscopic observation, suggesting that curcumin protects in both the early and late stages of liver infection **(Deng. 2016).**

Concerning the effect of (AG) on (AST, ALT, and ALP), the present study showed a significant decrease and improvement in enzymatic levels (AST, ALT, and ALP) after treatment with 4% (AG) or a mixture of 4% (AG) and (TUR). Our results are in agreement with **(Al-Kenanny et al., 2012)** who noted that elevated ALT and AST mean a marked risk of liver injury. Mice treated with AG showed amelioration in enzymatic levels (ALT and AST) but did not reach the normal level as in the control group; these results indicated that AG has the ability as a protective factor to decrease liver damage.

Hamid et al. (2021) reported that dietary administration of GA has a beneficial effect on hepatic apoptosis, oxidative stress, and the inflammatory response in experimentally-induced hepatotoxicity in rats. GA is reported to have robust anti-oxidant effects; it has been able to ameliorate cardiac, renal, and hepatic lipid peroxidation and toxicity, besides its anti-inflammatory, antimicrobial, antidiarrheal, anti-obesity, and antihypertensive effects **(Ali et al., 2009 and Elshama, 2018).**

Ahmed et al. (2015) reported that gum Arabic (GA) has strong antioxidant properties; therefore, it could be one of the mechanisms of hepatoprotection. **Ashraf et al., (2022)** reported that, feeding rats with hyperuricemia on a standard diet or low protein diet containing (5% and 10% gum Arabic) improved the lipid profile and the liver enzymes (AST, ALT and ALP), as compared to the positive control groups.

Scannell et al., (2012) reported that curcumin has a protective effect on experimentally induced hepatotoxicity and cardiotoxicity in rats, reducing increased serum marker enzymes and decreasing lipid peroxidation. In this respect, **Panahi et al., (2017)** reported that after 8 weeks of curcumin (phytosomal form, at daily dose of 1 g), a reduction in body mass index and waist circumference and an improvement in ultrasonographic liver findings were observed, with a significant reduction of ALT and AST.

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 antioxidant enzymes in the liver glutathione peroxidase enzymes (GPX), malondialdehyde enzyme (MDA), and glutathione enzyme (GSH) in the normal control (-ve) group and (+ve) groups of rats suffering from kidney alteration toxicity.

Results revealed that the mean values of (GPX, MDA, and GSH) in normal control (C –ve) vs. (C +ve) groups recorded (0.210 ± 0.010 U/mg protein, 129.865 ± 3.907 nmol/g, and 0.321 ± 0.017 ng/g) vs. (0.117 ± 0.010 U/mg protein, 179.092 ± 4.960 nmol/g, and 0.173 ± 0.012 ng/g), respectively. Statistical results revealed that the control (+ve) group recorded a significant decrease ($P \leq 0.05$) in GPX and GSH levels while recording a significant increase ($P \leq 0.05$) in MDA levels as compared to the control (-ve) group.

Statistical results revealed a significant (P≤0.05) increase in GPX and GSH levels in all treated groups, while there is a significant decrease (P<0.05) in MDA levels in all treated groups as compared to the positive +ve control group, which only fed on a basal diet. The best results were recorded by the positive groups that fed on BD supplemented with 4% mixed (AG) and (TUR) followed by 2% them 4% TUR, and finally 4% (AG).

Our results are in agreement with **Jeong et al., (2006)** who reported that curcumin enhances the activity of many antioxidant enzymes such as catalase, superoxide dismutase (SOD), glutathione peroxidase (GPX), and heme oxygenase-1 (COH-1). These activities reduce the lipid peroxidation, decreasing hepatic damage **(Balasubashini et al., 2004)**.

Scannell et al., (2012) investigate the protective effects of curcumin on experimentally induced hepatotoxicity, and cardio toxicity using various animal models with biochemical parameters like serum marker enzymes and antioxidants in target tissues. The increased relative weight of liver and heart in CCl4 induced liver injury and isoproterenol induced cardiac necrosis were also reduced by Curcumin treatment. Elevated serum marker enzymes, aspartate aminotransferase (AST), alanine aminotransferase (ALT) and alkaline phosphatase (ALP) increased lipid peroxidation, decreased gluthione (GSH), glutathione peroxidase (GPx) and superoxide dismutase (SOD) in edematous, granulomatus, liver and heart tissues during liver injury and cardiac necrosis, respectively. The study demonstrated the invitro and in-vivo protective effect of curcumin on experimentally induced hepatotoxicity and cardio- toxicity in rats.

On the other side **(Kocaadam and Sanlier, 2017)** cleared that curcumin can upregulate other enzymes like glutathione transferase and their mRNAs and scavenge free radicals. Moreover, our results are in line with **Liu et al., (2017)** who reported that curcumin can increase the levels of reduced glutathione (GSH) and moderate the malondialdehyde levels in a lung carcinogenesis model induced by benzo (a) pyrene (a major carcinogenic pollutant) in mice.

Our results are in line with **Lukitaningsih et al., (2020)** who demonstrated that turmeric has been known as an herbs and spice with antioxidant activities due to curcuminoid content. An antioxidant can

be defined as any substance or sample capable of inhibiting free radical reactions in the oxidation reaction. Antioxidant activities in vivo can be measured by determining antioxidant enzymes, which include catalase, glutathione reductase, superoxide dismutase, glutathione peroxidase, and glutathione S- transferase. The antioxidant enzymes increased while the lipid peroxidation decreased for both curcuma species.

In this respect, **(Babiker et al., 2017)** reported that, Daily gum Arabic dose for twelve weeks significantly affected the liver antioxidant activity of Sprague-Dawley rats.

Najla et al., (2017) and **Elshama (2018)** who reported that Arabic gum has significant antioxidant properties which has an effective protective in hepatotoxicity. Also, previous studies confirmed the antioxidant effect of Arabic gum by the significant reduction in MDA and increase in glutathione, total antioxidant capacity, and antioxidant enzyme activities in tissues of rats suffering from hepatotoxicity by using trichloroacetate TCA.

Figures and Tables

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

Parameters / Groups	Feed Intake (g/day/each rat)	Organs Weight/Body Weight%	
		Liver	Kidney
Control (-)	17.97 ^{a} ± 0.361	2.910 ^{g} ± 0.102	0.422 ^{e} ± 0.017
Control (+)	14.50 ^{c} ± 0.308	5.300 ^{a} ± 0.153	0.647 ^{a} ± 0.017
1% AG	14.897 $^{b\,c\,d}$ ± 0.409	4.862 ^{b} ± 0.178	0.584 ^{b} ± 0.015
2% AG	14.955 $^{b\,c\,d}$ ± 0.748	4.395 ^{c} ± 0.248	0.507 ^{c} ± 0.036
4% AG	14.00 ^{d} ± 0.833	3.903 ^{d} ± 0.243	0.485 ^{c} ± 0.030
1% TUR	15.043 $^{b\,c}$ ± 0.975	4.761 ^{b} ± 0.246	0.568 ^{b} ± 0.016
2% TUR	15.349 $^{b\,c}$ ± 0.536	4.303 ^{c} ± 0.202	0.489 ^{c} ± 0.033
4% TUR	15.659 ^{b} ± 0.551	3.441 ^{e} ± 0.231	0.453 ^{d} ± 0.019
1% AG and 1% TUR	14.850 $^{b\,c\,d}$ ± 0. 807	3.180 ^{f} ± 0.200	0.436 $^{d\,e}$ ± 0.015
2% AG and 2% TUR	14.576 $^{c\,d}$ ± 0.845	3.020 $^{f\,g}$ ± 0.093	0.424 $^{d\,e}$ ± 0.014
4% AG and 4% TUR	14.00 ^{d} ± 0.764	2.955 $^{f\,g}$ ± 0.111	0.415 ^{e} ± 0.013

AG: Arabic Gum TUR: 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 Liver Enzymes in Rats Suffering from Kidney Alteration Induced by Glycerol.

Parameters / Groups	AST	ALT	ALP
	U/l		
Control (-)	57.160 ^{i} ± 4.253	18.089 ^{g} ± 1.035	84.284 ^{h} ± 3.168
Control (+)	93.790 ^{a} ± 4.069	36.320 ^{a} ± 2.441	162.822 ^{a} ± 5.312
1% AG	86.123 ^{b} ± 2.643	31.278 ^{b} ± 1.939	153.552 ^{b} ± 2.081
2% AG	78.478 $^{c d}$ ± 2.327	26.772 $^{c d}$ ± 2.228	144.301 ^{c} ± 2.173
4% AG	70.779 $^{f g}$ ± 2.421	24.568 $^{d e}$ ± 2.255	136.147 ^{e} ± 1.795
1% TUR	81.771 ^{c} ± 2.612	28.424 ^{c} ± 2.119	151.493 ^{b} ± 2.053
2% TUR	74.038 $^{e f}$ ± 2.870	25.153 $^{d e}$ ± 1.938	141.171 $^{c d}$ ± 2.015
4% TUR	67.083 ^{g} ± 2.139	23.650 $^{e f}$ ± 1.563	131.275 ^{f} ± 1.620
1% AG and 1% TUR	75.785 $^{d e}$ ± 2.124	25.166 $^{d e}$ ± 2.134	138.837 $^{d e}$ ± 3.079
2% AG and 2% TUR	67.628 ^{g} ± 2.533	22.603 $^{e f}$ ± 1.778	129.441 ^{f} ± 1.956
4% AG and 4% TUR	62.190 ^{h} ± 1.803	21.215 ^{f} ± 0.669	118.264 ^{g} ± 2.178

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 Antioxidant Enzymes in Liver Rats Suffering from Kidney Alteration Induced by Glycerol.

Parameters / Groups	GPX U/mg protein	MDA nmol/g	GSH ng/g
Control (-)	0.210 [a] ± 0.010	129.865 [h] ± 3.907	0.321 [a] ± 0.017
Control (+)	0.117 [g] ± 0.010	179.092 [a] ± 4.960	0.173 [f] ± 0.012
1% AG	0.136 [f] ± 0.005	169.804 [b] ± 3.757	0.187 [f] ± 0.009
2% AG	0.152 [e] ± 0.005	163.175 [c d] ± 2.577	0.205 [e] ± 0.011
4% AG	0.164 [c d] ± 0.004	152.947 [e f] ± 2.488	0.232 [d] ± 0.007
1% TUR	0.141 [f] ± 0.004	165.553 [b c] ± 3.931	0.204 [e] ± 0.006
2% TUR	0.158 [d e] ± 0.003	157.807 [d e] ± 2.566	0.232 [d] ± 0.004
4% TUR	0.172 [c] ± 0.006	149.506 [f] ± 2.056	0.257 [c] ± 0.003
1% AG and 1% TUR	0.156 [d e] ± 0.004	156.791 [e] ± 4.961	0.231 [d] ± 0.006
2% AG and 2% TUR	0.173 [c] ± 0.005	150.492 [f] ± 1.812	0.269 [c] ± 0.004
4% AG and 4% TUR	0.186 [b] ± 0.004	141.222 [g] ± 2.056	0.294 [b] ± 0.005

AG: Arabic Gum TUR: Turmeric

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

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تأثير التدعيم بالكركم والصمغ العربي على إنزيمات الكبد والأنزيمات المضادة للاكسدة في كبد الفئران التي تعاني من سمية الجلسرين

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تهدف هذه الدراسة إلى معرفة تأثير التدعيم بالكركم والصمغ العربي على المتناول من الطعام ووزن بعض الأعضاء منسوبا كنسبة مئوية لوزن الجسم وانزيمات الكبد والانزيمات المضادة للأكسدة في الكبد في الفئران التي تعاني من سمية الجليسرول. استخدمت في هذه الدراسة عدد (66) فأرا من نوع الالبينو، اوزانهم 150 ± 10 جم. تم تقسم فئران هذه الدراسة إلى مجموعتان رئيسيتان. المجموعة الرئيسية الاولى (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 الاولى تم تغذيتها على غذاء أساسي واستخدمت كمجموعة ضابطة إيجابية "مصابة". المجموعات الفرعية (2و 3 و 4) تم تغذيتهم على غذاء أساسي يحتوى 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 والتهاب كلوي حاد. أشارت النتائج إلى أن الجليسرول احدث تناقصا في المتناول من الطعام كما احدث زيادة في وزن الكبد والكلى منسوبا كنسبة مئوية لوزن الجسم. كما اشارت نتائج تحليل مصل الدم إلى ان حقن الفئران بالجليسرول أدى إلى حدوث ارتفاعا في مستويات الاسبرتات ALP ، و الالكالين فوسفاتيز ALT و الالانين امين ترانسفيراز ASTامين ترانسفيريز مقارنة بالفئران الغير محقونة. اشارت نتائج تحليل الكبد 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، مقارنة بالفئران الغير معاملة، وخاصة المجموعات التي تم تغذيتها على غذاء يحتوي على خليط الصمغ العربي والكركم بالمستوى المرتفعة. **الخلاصة:** يمكن إستخدام الصمغ العربي والكركم ومزيجهما لتقليل الآثار الجانبية لمشاكل الكبد الناتجة عن أمراض الكلى . لذلك فإن تناول الصمغ العربي والكركم قد يفيد مرضى الكلى والكبد.

الكلمات المفتاحية: التسمم بالجليسرول – أمراض الكبد – فئران – كركم – صمغ عربي – التحاليل الحيوية