

## **PROTECTIVE EFFECT OF DIFFERENT TYPES OF COFFEE EXTRACT ON RATS WITH INDUCED ACUTE LIVER TOXICITY**

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**Key Words:** green coffee, Arabic coffee, caffeine, liver toxicity, CCl<sub>4</sub>, rats.

### **Abstract**

Coffee (*Coffea* L.) is the world's beloved drink that is the most regularly consumed caffeine-containing beverage. It contains a complex mixture of chemicals that provide important amounts of chlorogenic acid and caffeine, which associated with many health benefits. The aim of the present study was to investigate the protective effects of conventional, decaffeinated coffee, green coffee and Arabic coffee extract on rats with induced acute liver toxicity. Thirty six adult male albino rats (Sprague-Dawley strain), weighing about (180±10 g) were divided randomly into two main groups as follow: the first group (-ve control= 6 rats) was fed on basal diet. The second group (30 rats) were divided into 5 subgroups from subgroup 1 to subgroup 5. Subgroup 2 (+ve control) fed on basal diet. Subgroups 2 and 5 were given the same dose of extracts 2ml/rat of Conventional, Decaffeinated, Arabic and Green coffee, respectively. After 6 weeks, subgroups from (1-5) were injected with one dose of CCl<sub>4</sub>. At the end of the experimental period (6 weeks), rats were scarified and serum was collected to determine biochemical analysis. The results showed that the administration of CCl<sub>4</sub> resulted in significant elevation in serum activities of aspartate aminotransferase (AST) alanine aminotransferase (ALT), alkaline phosphatase (ALP) and total bilirubin whereas serum total proteins albumin and globulin were significantly reduced, along with significant elevation of malondialdehyde level (MDA) and significant depletion in the level of reduced glutathione peroxidase (GP<sub>X</sub>) compared with negative control. Treatment with extracts of coffee prior to CCl<sub>4</sub> produced protective effects and attenuated these biochemical changes. The protective effects of extracts of coffee were more pronounced for the Arabic coffee. It be concluded that coffee beans exhibited hepatoprotective actions along with the restoration of lipid profile in acute liver injury animal models.

### **INTRODUCTION**

Liver is one of the largest organs in human body and the chief site for intense metabolism and excretion. So it has a surprising role in the maintenance, performance and regulating homeostasis of the body. It is

involved with almost all the biochemical pathways of growth, fight against disease, nutrient supply, energy provision and reproduction (Mroueh *et al.*, 2004). Liver damage is further characterized into hepatocellular predominantly (initial Alanine transferase elevation - initial alkaline phosphatase rise) and cholestatic type. Chemicals and drugs such as Carbon tetrachloride (CCl<sub>4</sub>) catabolized radicals induced lipid peroxidation, damage the membranes of liver cells and organelles, causing the swelling and necrosis of hepatocytes and result to the release of cytosolic enzymes in to the blood (Mumoli *et al.*, 2006).

Coffee (*Coffea* L.) is the world's beloved drink that is the most regularly consumed caffeine-containing beverage. It contains a complex mixture of chemicals that provide important amounts of chlorogenic acid and caffeine, which associated with many health benefits (Higdon and Frei, 2006). Coffee is appreciated for its aroma and flavour, and is a mixture of thousands of different compounds, such as carbohydrates, lipids, alkaloids, vitamins, nitrogenous molecules and phenolic compounds (Spiller, 1998). The roasting process causes a loss of water from the green bean and degradation of many of the compounds including the antioxidant polyphenols; however, there is very little difference in total antioxidants between the different roasts of a bean (Daglia *et al.*, 2000).

Green coffee beans contain 5–14% of the reported major components, chlorogenic acids (CGAs) are a family of esters formed between certain phenolic acids (trans-cinnamic acids) and quinic acid (Farah and Donangelo, 2006). The roasting process destroys CGAs; therefore, the unroasted beans like green coffee and Arabic coffee are used as the source for this nutritional supplement (Moon and Shibamoto, 2009).

The aim of the present study was to investigate the protective effects of conventional, decaffeinated coffee, green coffee and Arabic coffee extract on rats with CCl<sub>4</sub>-induced acute liver toxicity, also to evaluate on body weight, feed intake, lipid profile and liver functions that may occur on hepatotoxic rats.

## MATERIALS AND METHODS

### Materials:

Beans of (Conventional coffee and green coffee), and decaffeinated coffee were obtained from Agriculture Research Center, Giza, Egypt. Beans were convert to powder and Arabic coffee were prepared from green coffee with add some flavors with common doses. Carbon tetrachloride and chemical kits were obtained from Sigma-Aldrich Group., Cairo, Egypt. Casein, cellulose, sucrose, choline chloride, D-L methionine, vitamins and minerals constituents were purchased from El- Gomhoriya Company Cairo, Egypt. Thirty six adult

male albino rats (Sprague-Dawley strain), weighing about (180±10 g) were purchased from the Animal House of the National Research Center, Dokki, Egypt.

**Methods:**

**1. Preparation of Water Extract of Conventional Coffee, Decaffeinated Coffee, Green Coffee and Arabic Coffee:**

Twenty gram of conventional coffee, decaffeinated coffee, green coffee and Arabic coffee powder were submerged in 100 ml of distilled water and were boiled before being given to the rats, then filtered to obtain a liquid extract. A dose of 2 ml /rat of conventional coffee, decaffeinated coffee, green coffee, caffeine and Arabic coffee extract were given orally respectively by stomach tube.

**2. Induction of Acute Liver Toxicity:**

Carbon tetrachloride (CCl<sub>4</sub>)-induced acute hepatotoxicity in rats at the end of the experiment. Intraperitoneal injection of male albino rats with CCl<sub>4</sub> 1 mL/kg/BW, (1:1) mixture with paraffin oil according to (karthikeyan and deepa, 2010).

**3. Diet Composition and Experimental Animal Design:**

The basal diet was formulated according to AIN-93M diet (Reeves *et al.*, 1993). Animals (36 rats) were housed in well conditions in biological studies lab of Faculty of Home Economics. They were left for seven days as adaptation period and they were allowed to feed standard laboratory food and water. After the period of adaptation, animals were divided into two main groups, as follows: - **the first main group** (6 rats) was fed on basal diet and served as a negative control group (-ve), **the second main group** (30 rats) were divided as follow:-

- Subgroup (1):** Rats were fed on basal diet and given only distilled water daily as were kept as positive control group.
- Subgroup (2):** Rats were given 2 ml/ rat of Conventional Coffee extract.
- Subgroup (3):** Rats were given 2 ml/ rat of Decaffeinated Coffee extract.
- Subgroup (4):** Rats were given 2 ml/ rat of Arabic Coffee extract.
- Subgroup (5):** Rats were given 2 ml/ rat of Green Coffee extract.

After 6 weeks, subgroups from (1-5) were injected with one dose of CCl<sub>4</sub> (Karthikeyan and Deepa, 2010).

**4. Biological Evaluation:**

Feed intake will be recorded daily and animals will be weighed at the beginning and twice a week throughout the experimental period.

Body weight gain% and feed efficiency ratio will be calculated at the end of the experiment according to the method of **Chapman *et al.*, (1959)**.

#### **5. Blood Collection And Serum Separation:**

At the end of the experimental period (6 weeks), rats were fasted overnight before scarifying and blood samples were collected from each rat and were centrifuged at 3000 rpm for 15 min to obtain the serum for biochemical analysis.

#### **6. Biochemical Analysis of Serum:**

Aspartate aminotransaminase (AST) and Alanine aminotransaminases (ALT) were determined according to the method described by **Young, (2001)**, and Alkaline phosphates (ALP) was determined according to **Roy, (1970)**. Total bilirubin, Malondialdehyde (MDA) and Glutathione peroxidase (GPx) were determined according to **Young, (2001); Draper and Hadley, (1990)** and **Hissin and Hilf, (1970)**, respectively. Serum total cholesterol (TC), triglyceride (TG), high density lipoprotein cholesterol (HDL-C) were determined according to **Richmond, (1973); Wahlefeld, (1974)** and **Albers *et al.*, (1983)**, respectively. Regarding to serum low density lipoprotein cholesterol (LDL-C) and very low density lipoprotein cholesterol (VLDL-C) were calculated according to **Fridewald *et al.*, (1972)**. Total protein, albumin and globulin were determined in the serum according to method describe by **Burtis and Ashwood, (1999); Young, (2001)** and **Goldenberg and Drewes, (1971)**, respectively. The biochemical determinations were conducted at the National Research Center, Giza, Egypt.

#### **7. Statistical Analysis:**

Results were expressed as the mean standard error  $\pm$  SE. Data were statistically analyzed for variance "ANOVA" test at  $P \leq (0.05)$  using SPSS statistical software, version 20 was used for these calculations (**Armitage and Berry, 1987**).

### **RESULTS AND DISCUSSION**

Results recorded in **Table 1** showed the effect of diet supplemented with extracts of Conventional, Decaffeinated, Arabic and Green Coffee on FI, BWG % and FER of Hepatotoxic Rats. Feed intake was decreased in positive control group compared to negative control group, while groups treated with extracts of Conventional, Decaffeinated, Arabic and Green Coffee were reduced in feed intake compared to negative control group. There were significantly decreased ( $P < 0.05$ ) in BWG and FER for the positive control group compared to the negative control group, it was also showed that all treatment groups with extracts of Conventional, Decaffeinated, Arabic and Green Coffee significantly increased ( $P < 0.05$ ) in BWG and FER compared with positive control group expect BWG in

group treated with Conventional Coffee non significantly compared to positive control group.

**Table (1): Effect of Conventional, Decaffeinated, Arabic and Green Coffee Extract on Feed Intake (FI), Body Weight Gain% (BWG %) and Feed Efficiency Ratio (FER) in Rats with CCl<sub>4</sub>-Induced Acute Liver Toxicity**

Parameters Groups	FI (g/d)	BWG%	FER
Negative Control	15.00	34.05±0.05 <sup>a</sup>	0.136±0.004 <sup>a</sup>
Positive Control	14.00	17.16±0.84 <sup>c</sup>	0.070±0.001 <sup>c</sup>
Conventional Coffee	13.50	23.53±0.83 <sup>cd</sup>	0.122±0.002 <sup>b</sup>
Decaffeinated Coffee	12.00	21.53±0.53 <sup>de</sup>	0.124±0.024 <sup>b</sup>
Arabic Coffee	13.00	31.94±0.78 <sup>ab</sup>	0.138±0.037 <sup>a</sup>
Green Coffee	14.00	27.51±0.83 <sup>bc</sup>	0.130±0.001 <sup>ab</sup>

\*Mean values are expressed as means ± SE.

\*Mean values at the same column with the same superscript letters are not statistically significant at P<0.05.

Results in Table 1 indicated that CCl<sub>4</sub> administration significantly lowered FI, BWG and FER compared to negative control group, these results were in the same line with **Shaker *et al.*, (2010) and Wang *et al.*, (2018). Mahmoud *et al.*, (2013)** found that the feeding on different doses of Arabic coffee for 30 days lowered body weight in rats fed on basal diet. The possible mechanism by which coffee prevented higher body weight gain in the present study could be by increasing lipolysis via catecholamines (**Kobayashi-Hattori *et al.*, 2005 and Lopez-Garcia *et al.*, 2006**). Caffeine might also have caused body weight loss by increasing physical activity. It is known that green coffee effects the body weight, green coffee extract has a hypotensive effect in mice, decreases visceral fat and body weight (**Jeszka-Skowron *et al.* 2016**).

As seen in **Table 2**, serum concentrations of aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP) and total bilirubin were significantly (P< 0.05) elevated by CCl<sub>4</sub> administration (positive control group) compared with negative control group. It was observed significant (P< 0.05) reduce in serum AST, ALT, ALP and total bilirubin levels for all groups treated with extracts of Conventional, Decaffeinated, Arabic and Green Coffee compared to positive control group, group treated with Arabic Coffee was close to the negative control group.

**Mahmoud *et al.*, (2013)** evaluated the effect of consumption of different levels of Arabic coffee on blood parameters concentration. Blood samples were collected and used for determination of ALT, and AST. These parameters were found to be significantly lower in group treated with coffee than control group. These results are in accordance to other studies in which coffee consumption displayed reduction of liver

functioning enzymes such as, AST, ALT and ALP as prevention from cirrhosis and fibrosis (Sadiq *et al.*, 2019).

**Table (2): Effect of Conventional, Decaffeinated, Arabic and Green Coffee Extract on Serum AST, ALT, ALP and Total Bilirubin in Rats with CCl<sub>4</sub>-Induced Acute Liver Toxicity**

Parameters Groups	AST	ALT	ALP	Total Bilirubin
	U/L			mg/dL
Negative Control	91.96±0.83 <sup>f</sup>	29.64±0.54 <sup>d</sup>	88.84±0.48 <sup>c</sup>	0.39±0.014 <sup>d</sup>
Positive Control	140.79±0.42 <sup>a</sup>	48.01±0.52 <sup>a</sup>	150.26±0.32 <sup>a</sup>	0.91±0.010 <sup>a</sup>
Conventional coffee	129.65±0.30 <sup>b</sup>	34.62±0.98 <sup>c</sup>	108.97±0.58 <sup>bc</sup>	0.58±0.016 <sup>c</sup>
Decaffeinated coffee	124.33±0.89 <sup>c</sup>	38.45±0.90 <sup>b</sup>	114.35±0.98 <sup>b</sup>	0.69±0.017 <sup>b</sup>
Arabic coffee	97.09±0.98 <sup>e</sup>	30.42±0.90 <sup>d</sup>	98.09±0.99 <sup>d</sup>	0.40±0.006 <sup>d</sup>
Green coffee	101.36±0.71 <sup>d</sup>	32.44±0.44 <sup>cd</sup>	103.69±0.95 <sup>cd</sup>	0.43±0.007 <sup>d</sup>

\*Mean values are expressed as means ± SE.

\*Mean values at the same column with the same superscript letters are not statistically significant at P<0.05.

Green coffee bean extract contains chlorogenic acid (CGA) as the principal constituent, and most of the health benefits of decaffeinated coffee and its by-product have been attributed to chlorogenic acid (Stoos and Badmaev, 2016). The effects induced by repeated CCl<sub>4</sub> administration were attenuated by conventional and decaffeinated, arabica and green coffee intake. These findings confirm the beneficial effects of coffee and against liver injury induced by other hepatotoxicants (Ozercan *et al.*, 2006; Lee *et al.*, 2007; Shi *et al.*, 2010 and Moreno *et al.*, 2011). However, a suitable evaluation of the protective efficacy of coffee beverages and caffeine against different stages of carcinogenesis might be better warranted in other models of rat liver carcinogenesis (Okano *et al.*, 2008 and Silva- Oliveira *et al.*, 2010).

Results in Table 3 showed a significant decrease (P< 0.05) in serum glutathione peroxidase (GP<sub>X</sub>) activity of the positive control group compared with the negative control group. It was clear that, there was significant (P< 0.05) increase in serum GP<sub>X</sub> activity for all treated groups with Coffee compared to the positive control group. Concerning to serum malondialdehyde (MDA) level, results showed that serum MDA level was significantly increased (P< 0.05) in the positive control group compared with the negative control group whereas all treated groups with Coffee significantly decreased (P< 0.05) compared to the positive control group. It was also observed that rats were fed on Arabic coffee reextract

considered the best group for enhancing the serum GP<sub>X</sub> and reducing serum MDA levels.

**Table (3): Effect of Conventional, Decaffeinated, Arabic and Green Coffee Extract on Serum GP<sub>X</sub> and MDA in Rats with CCl<sub>4</sub>-Induced Acute Liver Toxicity**

Parameters Groups	GP <sub>X</sub> (U/mg)	MDA ( $\mu$ mol/dL)
Negative Control	64.03 $\pm$ 0.61 <sup>a</sup>	9.80 $\pm$ 0.19 <sup>c</sup>
Positive Control	29.10 $\pm$ 0.98 <sup>c</sup>	22.11 $\pm$ 0.51 <sup>a</sup>
Conventional coffee	46.71 $\pm$ 0.93 <sup>c</sup>	15.02 $\pm$ 0.40 <sup>bc</sup>
Decaffeinated coffee	40.72 $\pm$ 0.29 <sup>d</sup>	17.02 $\pm$ 0.34 <sup>b</sup>
Arabic coffee	63.62 $\pm$ 0.91 <sup>a</sup>	12.74 $\pm$ 0.41 <sup>d</sup>
Green coffee	54.62 $\pm$ 0.72 <sup>b</sup>	13.28 $\pm$ 0.73 <sup>cd</sup>

\*Mean values are expressed as means  $\pm$  SE.

\*Mean values at the same column with the same superscript letters are not statistically significant at P<0.05.

Demirtaş *et al.*, (2012) reported that caffeine doses decreased lipid peroxidation (MDA) in liver. Antioxidant enzyme activities in the rat liver, like GPx, showed a statistically significant increase with caffeine intake. Chlorogenic acid, a phenolic compound found in green coffee, has antioxidant activity and has the ability to trap superoxide anions or hydroxyl radicals (Castro *et al.*, 2018). Chlorogenic acids are strong reactive oxygen species (ROS) scavengers. ROS are produced physiologically during various cellular processes such as aerobic metabolism and should be harmful when the amount is high. Even though ROS are known to be harmful, in order to sustain cellular homeostasis through redox cell signalling, they must be at a certain level (Priftis *et al.*, 2018).

Data revealed in Table 4 that serum TC, TG, LDL-C and VLDL-C were significantly (P< 0.05) increased in the positive control group compared with the negative control group. Results also illustrated that all groups that were treated with coffee decreased significantly (P< 0.05) in serum TC, TG and VLDL-C levels compared to the positive control group. Regarding serum HDL-C level, results showed a significant (P< 0.05) decrease in serum HDL-C level of the positive control group compared to the negative control group. There was a significant change in serum HDL-C level for all treated groups with coffee compared to negative control group. The highest improvement for

lipid profile was observed at the groups treated with by the extracts of Arabic and Green coffee.

**Table (4): Effect of Conventional, Decaffeinated, Arabic and Green Coffee Extract on Serum TG, TC, HDL-C, LDL-C and VLDL-C in Rats with CCl<sub>4</sub>-Induced Acute Liver Toxicity**

Parameters	TG	TC	HDL	LDL	VLDL
Groups	mg/dl				
Negative Control	45.03±0.38 <sup>f</sup>	89.19±0.38 <sup>d</sup>	44.37±0.63 <sup>a</sup>	35.46±0.48 <sup>d</sup>	9.00±0.76 <sup>f</sup>
Positive Control	112.62±0.83 <sup>a</sup>	146.64±0.65 <sup>a</sup>	25.03±0.24 <sup>f</sup>	99.09±0.57 <sup>a</sup>	22.52±0.16 <sup>a</sup>
Conventional coffee	98.08±0.98 <sup>c</sup>	124.47±0.98 <sup>b</sup>	31.85±0.72 <sup>d</sup>	73.00±0.89 <sup>b</sup>	19.61±0.43 <sup>c</sup>
Decaffeinated coffee	103.00±0.92 <sup>b</sup>	130.47±0.36 <sup>b</sup>	27.68±0.59 <sup>e</sup>	82.02±0.65 <sup>b</sup>	20.75±0.18 <sup>b</sup>
Arabic coffee	67.38±0.73 <sup>e</sup>	93.83±0.99 <sup>d</sup>	36.04±0.43 <sup>c</sup>	44.31±0.89 <sup>c</sup>	13.70±0.14 <sup>e</sup>
Green coffee	73.53±0.60 <sup>d</sup>	105.43±0.97 <sup>c</sup>	39.44±0.35 <sup>b</sup>	51.28±0.97 <sup>c</sup>	14.70±0.12 <sup>d</sup>

\*Mean values are expressed as means ± SE.

\*Mean values at the same column with the same superscript letters are not statistically significant at P<0.05.

Liver is the major site for the synthesis and metabolism of cholesterol (Yang *et al.*, 2011). Distinct alterations in lipid metabolism have been reported in CCl<sub>4</sub> induced hepatotoxicity in rats (Singhal and Gupta, 2012). The present results expressed the significant increasing in levels of serum TG, TC, LDL-C and VLDL-C, while decreasing in HDL-C level in CCl<sub>4</sub> induced rats. Treatment of coffee also attenuated these changes of lipid profile of rats treated previously with CCl<sub>4</sub>. These results were in the same line with Sadiq *et al.*, (2019) who reported that Arabica coffee decreased the levels of TG, TC and LDL in co-treated group, while an elevation in HDL levels is also there. This could also be attributed to the various bioactive molecules identified, along with various fat-soluble compounds (Lee, 2000). It is suggested that, both, the type and mode of coffee preparation strongly affect the lipid profile modulation (Corrêa *et al.*, 2013). The bioactive molecules, cafestol and kahewol are found in considerable amounts in unfiltered boiled coffee, that enhance TG, TC and LDL (Heckers *et al.*, 1994; Weusten-Van der Wouw *et al.*, 1994; Urgert *et al.*, 1997).

Green coffee directly affects all the parameters of the lipid profile (Shimoda *et al.*, 2006). The phytoconstituent of green coffee beans was reported to significantly improve the levels of HDL and VLDL (Meng *et al.*, 2013). Additionally, green coffee was reported to decrease the levels of cholesterol, triglyceride, and LDL (Yukawa *et al.*, 2004).

In **Table 5**, CCl<sub>4</sub> treatment significantly ( $p < 0.05$ ) reduced serum total proteins, albumin and globulin as compared to negative control. Groups treated with extracts of Conventional, Decaffeinated, Arabic and Green Coffee have a significant increase compared to positive control group. The best improvement of serum total proteins, albumin and globulin was observed in the group treated with Arabic coffee.

Results in **Table 5** were in agreement with **Hussein et al., (2020)**, who reported that the treatment with green coffee significantly increased levels of total protein, albumin and globulin compared to positive control group. On the other hand, **Birkner et al., (2006)** showed that the level of total protein increased after treatment with caffeine.

**Table (5): Effect of Conventional, Decaffeinated, Arabic and Green Coffee Extract on Serum Total Protein, Albumin and Globulin in Rats with CCl<sub>4</sub>-Induced Acute Liver Toxicity**

Parameters Groups	Total Protein	Albumin	Globulin
	g/dL		
Negative Control	5.02±0.06 <sup>a</sup>	3.65±0.13 <sup>a</sup>	2.18±0.88 <sup>a</sup>
Positive Control	2.43±0.15 <sup>c</sup>	0.98±0.13 <sup>d</sup>	1.17±0.27 <sup>d</sup>
Conventional coffee	2.63±0.13 <sup>c</sup>	2.29±0.11 <sup>c</sup>	1.24±0.24 <sup>d</sup>
Decaffeinated coffee	3.76±0.09 <sup>b</sup>	1.97±0.58 <sup>c</sup>	1.40±0.10 <sup>cd</sup>
Arabic coffee	4.75±0.11 <sup>a</sup>	2.89±0.40 <sup>b</sup>	1.99±0.11 <sup>ab</sup>
Green coffee	4.00±0.10 <sup>b</sup>	3.31±0.97 <sup>a</sup>	1.73±0.14 <sup>bc</sup>

\*Mean values are expressed as means ± SE.

\*Mean values at the same column with the same superscript letters are not statistically significant at  $P < 0.05$ .

### CONCLUSION:

Coffee is beneficial for health in general and particularly for patients with liver disease. Consumption of coffee protects against progression of almost all forms of liver disease. Usual mechanisms involved are prevention of fibrosis, carcinogenesis, and antioxidant effect. The incidence of advanced fibrosis and cirrhosis is lower among coffee drinkers. The risk of hepatocellular carcinoma also is lower in coffee drinkers compared to the non-coffee consuming population. However, in view of retrospective nature of data, more interventional trials are required before coffee finds its way in the regular prescription in liver disease patients.

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## التأثير الوقائي لمستخلص أنواع مختلفة من القهوة في الفئران المحدث لها

### التسمم الكبدي الحاد

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القهوة هي المشروب المحبوب في العالم وهي أكثر المشروبات التي تحتوي على الكافيين استهلاكاً بانتظام. يحتوي على مزيج معقد من المواد الكيميائية التي توفر كميات مهمة من حمض الكلوروجينيك والكافيين، والتي ترتبط بالعديد من الفوائد الصحية. كان الهدف من هذه الدراسة هو دراسة التأثيرات الوقائية للقهوة التقليدية ومنزوعة الكافيين والقهوة الخضراء ومستخلص البن العربي على الفئران المصابة بسمية كبدية حادة. تم تقسيم ستة وثلاثين من ذكور الفئران البيضاء البالغة (سلالة Sprague-Dawley)، التي تزن حوالي  $10 \pm 180$  جم) بشكل عشوائي إلى مجموعتين رئيسيتين على النحو التالي: المجموعة الأولى (المجموعة الضابطة = 6 فئران) تم تغذيتها على النظام الغذائي الأساسي. تم تقسيم المجموعة الثانية (30 فئران) إلى 5 مجموعات فرعية من المجموعة الفرعية 1 إلى المجموعة الفرعية 5. المجموعة الفرعية 2 (مجموعة ضابطة موجبة) تم تغذيتها على النظام الغذائي الأساسي. تم إعطاء المجموعات 2 إلى 5 نفس جرعة المستخلصات 2 مل / فأر من القهوة التقليدية، منزوعة الكافيين، العربية والقهوة الخضراء، على التوالي. بعد 6 أسابيع تم حقن مجموعات فرعية من (5-1) بجرعة واحدة من CCl<sub>4</sub>. في نهاية فترة التجربة (6 أسابيع) تم تشريح الفئران وجمع السيرم لإجراء التحاليل الكيميائية. أظهرت النتائج أن الحقن برابع كلوريد الكربون أدى إلى ارتفاع كبير في سيرم AST، ALT، ALP والبليروبين الكلي، بينما انخفض بشكل كبير البروتين الكلي في الدم، الألبومين والجلوبيولين، مع ارتفاع من مستوى MDA وانخفاض كبير في مستوى GPX مقارنة بالمجموعة الضابطة السالبة. أدى العلاج بمستخلصات القهوة قبل CCl<sub>4</sub> إلى تأثيرات وقائية وقلل من هذه التغيرات البيوكيميائية. كانت التأثيرات الوقائية لمستخلصات القهوة أكثر وضوحاً للقهوة العربية. نستنتج أن حبوب البن أظهرت تأثيرات وقائية للكبد مع استعادة المظهر الدهني في نماذج حيوانية المصابة بالتسمم الكبدي الحاد.