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## **Study The Effect Of Chicory (*Cichorium Intybus, L.*) Leaves Powder On Some Biochemical And Biological Parameters Of Hepatotoxicity Induced By Ccl4 In Rats**

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### **Abstract**

The present study aimed to assess the effect of different concentrations (2.5 , 5 and 10 %) of Chicory (*Cichorium intybus*) leaves powder (Ch.L.P.) on impaired liver function of injected rats with Carbon Tetrachloride (CCl<sub>4</sub>,. Twenty five mature albino male rats weighing (140±10g) were randomly divided into five groups (n=5) and fed on the basal diet. The first group: negative control and the other four groups were injected by Carbon Tetrachloride (CCl<sub>4</sub>) in paraffin oil 50% V/V (2ml/Kg. B.W) twice in a week for two weeks to induce hepatotoxicity. The second group ( positive control) the third, fourth and fifth groups were fed on the basal diet containing 2.5%, 5% and 10% of Chicory leaves powder respectively for 28 days. Serum liver enzymes, lipid profile, total protein, albumin, glucose, antioxidant liver enzymes (SOD, GPX and CAT) and histopathological changes of liver tissues were examined and investigated, Also, phenolic compounds profile of (Ch.L.P.) was determined by HPLC. Obtain results of CCl<sub>4</sub> treated rats compared to control (+ve) groups revealed that rats fed on 10 % (Ch.L.P.)recorded the significant lowest glucose level (p≤0.05). Antioxidant liver enzymes (SOD, GPX and CAT), were increased significantly in all treatment fed on ChLP . The significant increase in albumin and total protein in 10% fed group .Total serum biliruben recoded the lowest significant in 10% group. For serum liver

enzymes (ALT, AST and ALP); the lowest significant values were noticed in 10% fed group . Lowest significant level of triglyceride and cholesterol were recorded in groups fed on 10% ChLP. The highest significant level of HDL-c was recorded for group fed on 10% ChLP. While, The lowest significant value of LDL-c and VLDL-c was recorded for rats fed on 10% ChLP .

**In conclusion,** chicory plant leaves could be considered as powerful nutraceutical therapeutic agent for the treatment of hepatotoxicity induced by CCl<sub>4</sub> in rats. All used concentrations in this study cause improvement in hepatotoxicity rats.

**Keywords:** Chicory , Hepatotoxicity, Rats, Liver function, Biochemical .

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### **Introduction**

Liver is the most important organ in terms of biochemical activity in the human body. The liver has a great capacity to detoxify and synthesize useful substances. There are several characteristic pathologies in the livers of patients with liver disease including fatty liver, hepatitis, hepatocirrhosis and liver cancer (**Al-Harbi et al., 2014**). Liver fibrosis is the common end stage of most chronic liver diseases regardless of the etiology the early stage of liver fibrosis can be reversed(**Bataller and Brenner, 2005**).Liver disease may be classed, as liver cirrhosis (cell destruction and increase in fibrous tissue), acute or chronic hepatitis (inflammatory disease) and hepatitis (non inflammatory condition) **Evans (1996)**.

It is well known that carbon tetrachloride (CCl<sub>4</sub>) has been widely used in animal models to investigate chemical toxin-induced liver injury. The most remarkable pathological characteristics of CCl<sub>4</sub> induced hepatotoxicity are steatosis, fatty liver cirrhosis and necrosis (**Lee et al., 2005**).CCl<sub>4</sub> produced damage to liver cells and was followed by the significant increase in serum alanine amino transferase (ALT) activity and hepatic lipid peroxidation after 24 h (**Al-Harbi et al., 2014**). Increased lipid peroxidation is a mechanism which is commonly suggested to explain the progression of liver damage and the development of fibrosis, and eventually cirrhosis in experimental animals and in alcoholic liver disease (**Goldani et al., 2007**).

*Cichorium intybus* (common name chicory) has a potent hepatoprotective, antioxidant, hypoglycemic, diuretic, anti-testicular toxicity and immune modulatory effects. Chicory has demonstrated antihepatotoxic potential in animal studies (**Krylova et al.,2006**).

Chicory can be used in several forms, leaves, flowers and roots. Leaves and flowers can be added to salads or vegetables but often have a rather bitter taste (**Corey and Whitney, 1987**). All parts of this plant possess as great medicinal importance due to the presence of a number of medicinally important compounds such as alkaloids, inulin, sesquiterpene lactones, coumarins, vitamins, chlorophyll pigments, unsaturated sterols, flavonoids, saponins and tannins (**Atta et al., 2010**).

Leaves of chicory are good sources of phenols, vitamins A and C as well as potassium, calcium, and phosphorus (**Mulabagal et al., 2009**). Furthermore, chicory is rich in cichoric acid which may stimulate the immune system as well as prevent inflammation and bacterial infections to a limited extent (**Nayeemunnisa, 2009**). *C. intybu* has been traditionally used for the treatment of fever, diarrhea, jaundice and gallstones (**Afzal et al., 2009; Abbasi et al., 2009**). The hepatoprotective activity of *C. intybus* has been correlated to its ability to inhibit the free radical mediated damage (**Sultana et al., 1995**). Herbal extracts of several plants like *Cardus aeanthoides*, *Cichorium natans*, *Cichorium intybus*, *Fumaria asepalae* and *F. vailantin*, *Gentiana olivieri* and *Plantago lanceeolata* have been studied for their hepatoprotective effects. *Cichorium intybus* were a perennial herb and has been investigated for its potent hepatoprotective activity (**Aktay et al., 2000**).

**Sadeghi et al., (2008)** used that The leaf extract at oral dosage of 200, 400 and 500 mg/kg exhibited significant ( $P \leq 0.05$ ) protective effect against CCl<sub>4</sub> induced hepatotoxicity. Level of serum markers such as aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP), total bilirubin (TB) were significantly increased in CCl<sub>4</sub> treated rats. Simultaneously, *C. intybus* extract significantly suppressed mainly the increase in plasma activities of AST, ALT, ALP and TB concentration, which are considered as markers of liver functional

state, this study confirmed the hepatoprotective activity effect of the hydroalcoholic extract of *C. intybus*.

### **Material & Methods**

#### **Materials:**

Chicory, (*Cichorium intybus*) was obtained from herbalist, Menoufia Governorate, Egypt. All other chemicals, kits and reagents were obtained from El-Gomhoreya Company, Cairo, Egypt.

#### **Experimental animals:**

Mature male albino rats of Sprague – Dawley strain (25 rats) weighing  $140\pm 10$ g. at age of 14 weeks were obtained from the medical insects research institute, Doki, Cairo, Giza, Egypt.

#### **Methods:**

##### **Preparation of hepatic rat (CCl<sub>4</sub>):**

Carbon tetrachloride (CCl<sub>4</sub>) was dispensed in white plastic bottles each containing one liter as a toxic chemical material for liver poisoning. In the same time, it was mixed with paraffin oil for dilution during the induction. Rats were subcutaneously injected with CCl<sub>4</sub> in paraffin oil (50% v/v) at 2 ml/kg B.Wt. twice in a week for two weeks to induce liver toxicity according to the method described by **Jayasekhar *et al.*, (1997)** .

##### **Chemical analysis of tested plant parts:**

Samples of chicory leaves were subjected to chemical analysis to estimate : moisture, protein, fat, fiber, ash and according to **AOAC (2000)**.

##### **Experimental design:**

Twenty five adult male white albino rats, Sprague Dawley Strain, 14 weeks age, weighing  $140\pm 10$ g were used in this experiment. All rats were fed on basal diet (casein diet) prepared according to **(AIN,1993)** for 7 consecutive days. Then divided into five groups (n=5) and fed on the basal diet. First group; negative control(-ve) and the other four groups were injected by Carbon Tetrachloride (CCl<sub>4</sub>) in paraffin oil 50% V/V (2ml/Kg. B.W) twice in a week for two weeks to induce hepatotoxicity. The second group was positive control (+ve), the third, fourth and fifth groups were fed on the basal diet containing 2.5%, 5% and 10% of Chicory leaves powder for 28 days.

**Chemical analysis of chicory leaves powder:**

Samples were subjected to chemical analysis in order to determine: moisture, protein, fat, fiber, ash and some minerals (Mg- K- Ca- Zn- Fe- Na) according to **AOAC (2000)**. Total phenols content also were determined by the folinciocalteu method of (**Meda et al., 2005**). Identification of phenolic compounds were assessed by HPLC according to the method outlined by **Radovanović et al., (2010)**.

**Blood sampling:**

At the end of the experiment after fasting for 12 hours, blood samples were collected from hepatic portal vein. Blood samples were collected into a dry clean centrifuge glass tubes and left to clot in water bath (37°C) for 28 minutes, then centrifuged for 10 minutes at 4000 rpm to separate serum, which were carefully aspirated and transferred into clean cuvette tube and stored in frozen at -20°C till analysis (**Schermer, 1967**).

**Organs Weight:**

After taking blood samples were collected from hepatic portal vein, each rat was rapidly sacrificed, Liver, kidneys, heart, spleen and pancreas were removed carefully, washed in saline solution and dried then weighed and fixed in formalin solution (10% V/V) according to the methods described by **Drury and Wallington (1980)**.

**Biochemical analysis:**

Serum glucose was determined according to **Trinder (1969)**. Determination of antioxidant status in liver: superoxide dismutase (SOD), Catalase (CAT) and Glutathion peroxidase (GPX) were assayed according to the method of **Sun et al., (1988)**, **Diego (2011)**, and **Zhao et al., (2001)**, respectively. Determination of Liver enzymes: Glutamate Oxaloacetate Transaminase (AST), Alanine Amino transferase (ALT) and Alkaline Phosphatase (ALP) assayed by the methods of **Chawla (2003)**, **Srivastava et al., (2002)** and **Haussament (1977)**, respectively. Determination of serum total bilirubin was assessed by **Doumas et al., (1973)**. Determination of total protein was carried out according to the colorimetric method of **Henry (1974)**. Determination of serum albumin was

assessed by **Doumas *et al.*, (1971)**. Serum levels of total cholesterol (TC), triglyceride (TG) and high density lipoprotein (HDL.c) were determined by using the methods of **Thomas (1992)** and **Fossati and Principe (1982)** and **Grodon & Amer (1977)**, respectively.

The determination of low density lipoprotein cholesterol (LDL-c) and very low density lipoprotein cholesterol (VLDL-c) were carried out according to the methods of **Lee and Nieman (1996)** as follows:

$$\text{VLDL-c (mg/dl)} = \text{Triglycerides} / 5$$

$$\text{LDL-c (mg/dl)} = \text{Total cholesterol} - \text{HDL-c} - \text{VLDL-c.}$$

#### **Histological examination**

Livers of the sacrificed rats were dissected, removed, and fixed in 10% formalin solution. The fixed specimens were then trimmed, washed, and dehydrated in ascending grades of alcohol. These specimens were cleared in xylene, embedded in paraffin, sectioned at 4-6  $\mu$  of thickness and stained with Hematoxylin and Eosin, then examined microscopically (**Carleton, 1980**).

#### **Statistical Analysis**

The results recorded as mean  $\pm$  SD and were subjected to an analysis of variance (ANOVA) for a completely randomized design using a statistical analysis system by **SAS (2000)**. Duncan's multiple range tests were used to determine the differences among means at the level of 95%.

#### **Results and discussion :**

Table (1) show the some minerals and chemical composition of dried chicory leaves powder (ChLP.). Fiber, carbohydrate and protein level were values 4.01, 4.70 and 1.70 (g/100g), respectively. And show the content of important minerals in chicory leaves which it was rich in Calcium, Phosphorus, Sodium and Magnesium values were 100, 47.0, 45.0 and 30.0 (g/100g), respectively. These results are in agreement with those reported by **Schittenhelm (2001)**. **Abbas *et al.*, (2015)** found that the extracts of chicory leaves were found to contain high amount of mineral elements especially Mg and Zn.

Data in Table (2) evident that a phenolic compounds in chicory leaves powder (*Cichorium intybus*). It is clear to notice that the highest phenolics compounds of dried chicory leaves recorded for Chicoric acid, Caffeic acid, Chlorogenic acid and p-Hydroxybenzoic acid. The values were 37.2, 35.22, 17.84 and 11.04 mg/100g, respectively. All of these play an important role to improving the human health by participating in the antioxidant defense system against free radical generation. These results are in agreement with **Abbas et al., (2015)**, who found that the leaves were to possess comparatively higher values of total flavonoids, total phenolic acids. **Jurgonbski, et al., (2011)** indicated that the leaf and seed extracts had decidedly lower mass fractions of inulin (1.7 and 3.2 g per 100 g of fresh mass, respectively) and higher mass fractions of phenolic compounds were 9.6 and 4.22 g per 100 g of fresh mass, respectively, which recognized as caffeoylquinic acids, chicoric acid and quercetin glucuronide. **Innocenti et al., (2005)**, reported that these phenolic compounds appeared to be responsible mainly for the strong antioxidant activities. In chicory leaves, caffeic acid was the major phenolic compound presented, followed by chlorogenic, p.hydroxybenzoic, p. coumaric acids, protocatechuic, gallic and iso- vanillic acids in descending order.

Table (3) showed the effect of chicory leaves powder (ChLP) on relative organ weight (ROW) (g/100g) of hepatotoxicated rats. From this data it found that induced by CCl<sub>4</sub> led to hugeness and thicken in liver weight, and it was clear in (+) group  $4.5 \pm 0.42$  g/100g. Feeding on ChLP the organ weight decreased significantly ( $p \leq 0.05$ ). The best group was ( $4.0 \pm 0.24$  g/100g) 10% concentration. These results are in agreement with **Mohammed (2017)** who reported that liver weight of positive control group was higher than negative control group with highly significant difference of hepatic rats. The mean values were  $5.07 \pm 0.4$  and  $3.85 \pm 0.2$  g, respectively.

Table (4) demonstrated the effect of (ChLP) on liver enzymes (AST, ALT and ALP) (U/L) of hepatotoxicated rats. In present study, CCl<sub>4</sub> caused histopathological damage to rats liver and increased serum level of AST, ALT and also ALP. ChLP at concentration of 2.5, 5 and 10% decreased

significantly ( $p \leq 0.05$ ) of serum AST, ALT and ALP as compared with +ve group. The best results were at concentration of 5 and 10% groups. The mean values were 222.2, 95.5 and 228 (U/L) at 5%, respectively; and 212, 96.0 and 220 (U/L) at 10%, respectively. These results are in agreement with **Ahmed *et al.*, (2003)** who found that different fractions of alcoholic extract and one phenolic compound AB-IV of seeds of *Cichorium intybus L.* were screened for antihepatotoxic activity on carbon tetrachloride  $\text{CCl}_4$  induced liver damage in albino rats. And also **Zafar & Mujahid (1998)** reported that serum levels of the hepatic enzymes AST and ALT were increased, reflecting the hepatocellular damage in the  $\text{CCl}_4$  induced injury model. However, treatment with chicory lowered AST and ALT levels of  $\text{CCl}_4$  exposed animals. **Atta *et al.*, (2010)** identified hepatoprotective effect of ginger, chicory and their mixture against carbon tetrachloride intoxication was in rats. Carbon tetrachloride treatment significantly elevated alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase, gamma glutamyltransferase activities, serum triglycerides and cholesterol level as compared to control group.

Table (5) showed the effect of chicory leaves powder (ChLP) on GPX, CAT and SOD of hepatotoxicated rats. It is clear that in rats injected by  $\text{CCl}_4$  without curing diet (+ve) group the mean value of GPX, CAT and SOD were low it being 16 ng/ml, 15.4 mmol/l and 12.0 u/l, respectively. Feeding on diet containing different concentration of chicory leaves (ChLP) (2.5, 5 and 10%), significant increases of these antioxidant enzymes was noted compared to (+ve) group. At 10% groups, achieved higher improvement was significant ( $p \leq 0.05$ ) for GPX and SOD which were 25.4 (ng/ml) & 22.0 (u/l), respectively, as compared to (+ve) group but in CAT higher group was 5% which was 23.4 (mmol/l) comparing to (+ve) group. These results are in agreement with **Abdel-Rahim *et al.*, (2016)**. They reported that the decreased activities of SOD and catalase of diabetic animals were significantly ( $P < 0.05$ ) reversed by the feeding on diets containing either chicory leaves or psyllium seeds.



Table (6) showed the effect of chicory leaves powder on Glucose of hepatotoxicated rats. It could be observed that the highest serum glucose recorded for positive control group, while the lowest glucose recorded for negative control group with significant ( $p \leq 0.05$ ) differences. The mean values were 170.5 and 97.3 mg/dl, respectively. On the other hand, the highest serum glucose level of treated groups was recorded for 2.5%, while the lowest glucose recorded for 10% group with insignificant differences. The mean values were 130.3 and 118.3mg/dl, respectively. These results are in agreement with **Ghamarian et al., (2012)**, they reported that one and three weeks' treatment of streptozotocin (STZ) diabetic rats with the methanol extract of *C. intybus* resulted in significant decrease of blood glucose levels in treated animals.

Also, **Pushparaj et al., (2007)** investigated the ethanolic extract of *Cichorium intybus* for its anti-diabetic activity on male Sprague Dawley rats treated with streptozotocin. A dose of 125 mg/kg body weight influenced oral glucose tolerance test and the same amount given orally for 14 days had reduced serum glucose by 20%, triglycerides by 91% and cholesterol by 16%. No changes in the insulin secretion were observed during the experiment, whereas hepatic Glc-6-Pase activity was markedly reduced.

Table (7) elucidated the effect of chicory leaves powder on albumine, total bilirubin and total protein of hepatotoxicated rats. It is clear to mention that the serum albumin levels and total protein levels of control negative recorded the higher value as compared with control positive with significant difference ( $p \leq 0.05$ ). The mean values were 5 , 9.5 g/dl and 3.8 , 8.3 g/dl, respectively. On the contrary, Serum total bilirubin levels of control negative rat group recorded to has lower value compared with control positive with significant difference ( $p \leq 0.05$ ). The mean values were 0.5 and 0.9 mg/dl, respectively. When adding the different concentration of ChLP (2.5 , 5 and 10%) to the diet the results improved significantly compared with +ve groups but with no significant differences between concentrations. These results are in agreement with **Al-Malki and Abo-Golayel, (2013)**. They reported that insignificant improvement in serum albumin level of chicory fed rats compared with nitrosamine

precursors treated rats. **Hassan and Yousef, (2010)**, reported that the administration of chicory supplemented diet resulted in an improvement of protein pattern by preventing protein oxidation and improves liver and other organs functions which synthesized plasma protein.

Table (8) concluded the effect of chicory leaves powder on lipids profile(T.C, T.G , HDL, VLDL and LDL of hepatotoxicated rats. Ch L P – free diet had the highest significant ( $P \leq 0.05$ ) effect against TC, TG, LDL and VLDL values while HDL had opposite trend. The mean values were 127.3 , 170.0 , 72.3 , 34.0 mg/dl, and 20.0 mg/dl , respectively. When adding different concentration of ChLP (2.5 , 5 and 10%) to the diet it resulted in significant improvement compared with +ve groups. The significant decreased in TC, TG, LDL and VLDL levels, whereas HDL had significantly increased .The best group were 10% where mean values were (74.5, 130.3 , 20.3 , 26.1 mg/dl and 28.2 mg/dl ) respectively. These results are in agreement with **Yunyan et al .,(1999)** who found the effects of different chicory extracts on the blood glucose, total cholesterol (TC) and triglycerides (TG) was studied in hyperglycemic mouse model. It was found that chicory alcohol soluble extract can decrease the blood glucose, TC and TG, which is more effective than the chicory alcohol deposit extracts. Also it was agree with **Abdel-Rahim et al., (2016)**,who found that administration of chicory leaves or psyllium seeds to diabetic rats produced asignificant reduction in cholesterol, triglyceride and low density lipoprotein cholesterol (LDL -C) levels. **Also , Kim (2000)** reported that chicory root extract decreased in cholesterol absorption by 30% ( $p \leq 0.05$ ) in the jejunum and by 41% ( $p \leq 0.05$ ) in the perfused ileum. And reported antioxidative effects of *Cichorium intybus* root extract on LDL (low density lipoprotein) oxidation. The water extract of *Cichorium intybus* showed an antioxidative effect on LDL and inhibitory effects on the production of thiobarbituric acid reactive substance and the degradation of fatty acids in LDL.

#### **HISTOPATHOLOGICAL RESULTS**

Microscopically, liver of rats from group 1(- ve) (fig 1) revealed the normal histological structure of hepatic lobule . On the other hand, liver of

rats from group 2 (+ ve) (fig2) showed steatosis of hepatocytes, activation of Kupffer cells , apoptosis of hepatocytes, collagen fibers deposition in the portal triad and encircled the hepatic lobules.

However, liver of rats from group 3 (2.5%) (fig 3) showed very slight hydropic degeneration of hepatocytes, slight Kupffer cells activation. Liver of rats from group 4 & 5 (5 &10%) (figs 4&5) revealed no histopathological changes of hepatocytes.

**Conclusion:**

Dietary intake of chicory leaves at 5 or 10 % for four weeks could be beneficial for patients suffering from liver disease as it lowers elevated serum liver enzymes, total cholesterol, and triglycerides, and improves lipid profile. Moreover, diet supplementation with this plant produces an excellent effect on the histology of liver as it ameliorates the hepatic damage seen in the liver of hepatotoxicity rats.

**Table (1): Some minerals and chemical composition of chicory leaves powder (ChLP).**

Compounds	Quantity
<b>Dry matter</b>	<b>81.7 g/100g</b>
<b>Fiber</b>	<b>4.01 g/ 100g</b>
<b>Protein</b>	<b>1.70 g/ 100g</b>
<b>Carbohydrates</b>	<b>4.70 g/100g</b>
<b>Energy Kcal</b>	<b>23.0</b>
<b>Magnesium</b>	<b>6.944 mg / 100g</b>
<b>Potassium</b>	<b>166.57 mg / 100g</b>
<b>Calcium</b>	<b>292.61 mg / 100g</b>
<b>Zink</b>	<b>0.91 mg / 100g</b>
<b>Iron</b>	<b>9.178 mg / 100g</b>
<b>Sodium</b>	<b>88.84 mg / 100g</b>

**Table( 2): Phenolic compounds in chicory leaves powder (ChLP).**

Phenolic compounds	mg/100g
Protocatechuic acid	2.50 ±1.10
Gallic acid	1.96 ± 1.2
Chlorogenic acid	17.84 ± 1.0
p-Hydroxybenzoic acid	11.04 ± 0.02
Caffeic acid	35.22 ± 1.10
Isovanillic acid	1.97 ±1.0
p-Coumaric acid	9.65± 0.10
Chicoric acid	37.2 ± 0.10
<b>Totalphenolic content</b>	<b>26.4 ± 1.05</b>

Values expressed as mg GAE g-1 dry extract (mean of three replicates ± standard deviation) GAE = Gallic acid equilibrium

**Table( 3): Effect of chicory leaves powder (ChLP) on relative organ weight (ROW) of hepatotoxicated rats.**

Groups / Parameters	Negative Control	positive Control	2.5% ChLP	5% ChLP	10% ChLP
<b>ROW of liver (g/100g)</b>	3.8± 0.25 <sup>b</sup>	4.5± 0.42 <sup>a</sup>	4.2± 0.29 <sup>ab</sup>	4.2± 0.15 <sup>ab</sup>	4.0± 0.24 <sup>b</sup>

Values are expressed as means ± SD; means in the same raw with different letter are significantly different (P ≤0.05) ChLP= chicory leaves powder

**Table ( 4): Effect of chicory leaves powder (ChLP) on liver enzymes of hepatotoxicated rats.**

<b>Groups / Parameters</b>	<b>Negative Control</b>	<b>positive Control</b>	<b>2.5% ChLP</b>	<b>5% ChLP</b>	<b>10% ChLP</b>
<b>ALT(U/L)</b>	85.8± 4.3 <sup>c</sup>	199.5 ± 16.0 <sup>a</sup>	106.8 ± 5.6 <sup>b</sup>	95.5± 2.0b <sup>c</sup>	96.0 ±2.4 <sup>bc</sup>
<b>AST(U/L)</b>	169 ± 4.5 <sup>c</sup>	306.3 ± 35 <sup>a</sup>	224 ± 5.4 <sup>b</sup>	222.2 ± 3.6 <sup>b</sup>	212 ± 8.5 <sup>b</sup>
<b>ALP(U/L)</b>	179 ± 9.5 <sup>c</sup>	313.3 ± 20.7 <sup>a</sup>	236 ± 6.1 <sup>b</sup>	228 ± 8.1 <sup>b</sup>	220 ± 8.0 <sup>b</sup>

Values are expressed as means ± SD; means in the same raw with different letter are significantly different (P ≤ 0.05)

ChLP= chicory leaves powder . ALT= Alanine Amino transferase  
AST= Glutamate Oxaloacelate Transaminase ALP= Alkaline Phosphatase

**Table( 5): Effect of chicory leaves powder (ChLP) on GPX , CAT and SOD activities in serum of hepatotoxicated rats.**

<b>Groups / Parameters</b>	<b>Negative Control</b>	<b>positive Control</b>	<b>2.5% ChLP</b>	<b>5% ChLP</b>	<b>10% ChLP</b>
<b>SOD (u/l)</b>	27.8± 2.0 <sup>a</sup>	12.0± 1.0 <sup>d</sup>	16.9± 2.0 <sup>c</sup>	20.0± 0.2 <sup>b</sup>	22.0± 2.3 <sup>b</sup>
<b>GPX(ng/ml)</b>	29.4± 3.7 <sup>a</sup>	16± 1.5 <sup>d</sup>	22.5± 0.7 <sup>c</sup>	22.0± 0.3 <sup>c</sup>	25.4± 0.9 <sup>b</sup>
<b>CAT(mmol/l)</b>	25.3± 1.8 <sup>a</sup>	15.4± 2.0 <sup>c</sup>	21.6± 0.4 <sup>b</sup>	23.4± 0.9 <sup>ab</sup>	22.5± 0.7 <sup>b</sup>

Values are expressed as means ± SD; means in the same raw with different letter are significantly different (P ≤ 0.05 )

ChLP= chicory leaves powder . SOD= superoxide dismutase  
GPX= Glutathion peroxidase CAT= Catalase

**Table (6): Effect of chicory leaves powder (ChLP) on glucose level in hepatotoxicated rats**

Groups / Parameters	Negative Control	positive Control	2.5% ChLP	5% ChLP	10% ChLP
Glucose (mg/dl)	97.3± 1.5 <sup>d</sup>	170.5± 4.7 <sup>a</sup>	130.3 ± 3.8 <sup>b</sup>	121.3 ± 2.5 <sup>c</sup>	118.3± 2.4 <sup>c</sup>

Values are expressed as means ± SD; means in the same raw with different letter are significantly different ( $P \leq 0.05$ )

ChLP= chicory leaves powder .

**Table (7): Effect of chicory leaves powder (ChLP) on albumine and total protein of hepatotoxicated rats.**

Groups / Parameters	Negative Control	positive Control	2.5% ChLP	5% ChLP	10% ChLP
Alb(g/dl)	5± 0.3 <sup>a</sup>	3.8± 0.4 <sup>b</sup>	4.8 ± 0.3 <sup>a</sup>	4.8 ± 0.2 <sup>a</sup>	4.8± 0.2 <sup>a</sup>
T.P(g/dl)	9.5± 0.7 <sup>a</sup>	8.3± 4.0 <sup>b</sup>	10.4± 1.1 <sup>a</sup>	9.9 ± 0.3 <sup>a</sup>	9.6 ± 0.4 <sup>a</sup>
T.BIL(mg/dl)	0.5± 0.1 <sup>b</sup>	0.9± 1.0 <sup>a</sup>	0.5± 0.1 <sup>b</sup>	0.5± 0.1 <sup>b</sup>	0.5± 0.1 <sup>b</sup>

Values are expressed as means ± SD; means in the same raw with different letter are significantly different ( $P \leq 0.05$ )

ChLP= chicory leaves powder .

Alb = Albumin T.P = Total Protein T.BIL = Total Billiurubin

**Table (8): Effect of chicory leaves powder (ChLP) on lipids profile of hepatotoxicated rats.**

Groups / Parameters	Negative Control	positive Control	2.5% ChLP	5% ChLP	10% ChLP
T.C (mg/dl)	72.0± 3.5 <sup>c</sup>	127.3± 7.4 <sup>a</sup>	86.5± 3.7 <sup>b</sup>	91.7± 3.3 <sup>b</sup>	74.5± 3.7 <sup>c</sup>
T.G (mg/dl)	121.3± 3.0 <sup>e</sup>	170.0± 7.4 <sup>a</sup>	147.0± 4.8 <sup>b</sup>	138.0± 4.7 <sup>c</sup>	130.3± 5.9 <sup>d</sup>
HDL (mg/dl)	35.0± 4.0 <sup>a</sup>	21.0± 1.0 <sup>c</sup>	26.2± 1.2 <sup>b</sup>	24.7± 2.6 <sup>b</sup>	28.2± 0.7 <sup>b</sup>
VLDL (mg/dl)	24.3± 0.6 <sup>e</sup>	34.0± 1.5 <sup>a</sup>	29.4± 1.0 <sup>b</sup>	27.7± 0.9 <sup>c</sup>	26.1± 1.2 <sup>d</sup>
LDL (mg/dl)	13.0± 1.3 <sup>e</sup>	72.3± 6.4 <sup>a</sup>	31.0± 4.6 <sup>c</sup>	39.4± 3.9 <sup>b</sup>	20.3± 4.7 <sup>d</sup>

Values are expressed as means ± SD; means in the same raw with different letter are significantly different ( $P \leq 0.05$ )

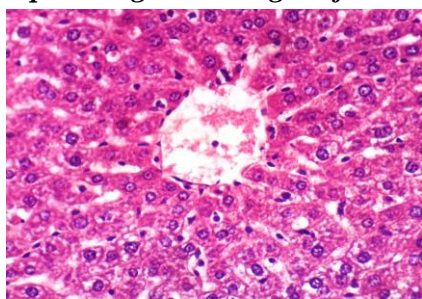
ChLP= chicory leaves powder .

T.C = total cholesterol T.G = triglyceride

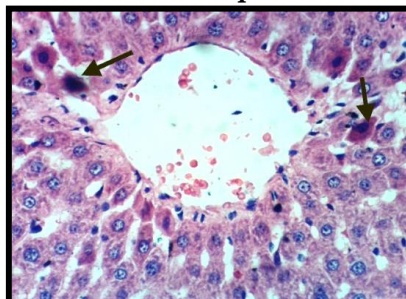
HDL = high density lipoprotein VLDL = very low density lipoprotein

LDL = low density lipoprotein

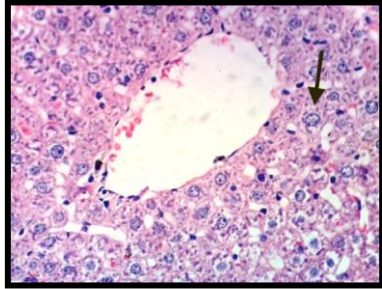
***Histopathological changes of liver tissues in normal and hepatotoxicated rats***



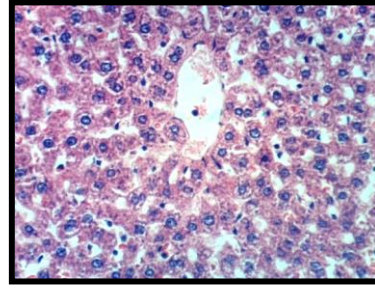
**Fig. (1):** Liver of control (-) healthy rat, basal diet showing no histopathological changes (H & E X 400).



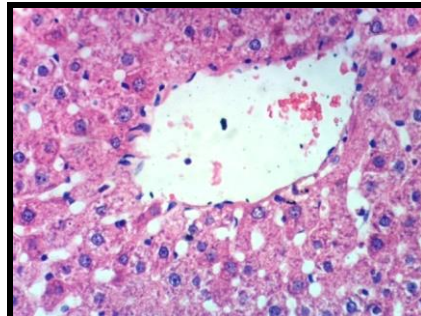
**Fig. (2):** Liver of control (+) hepatic rat, basal diet showing necrosis of sporadic hepatocytes (H & E X 400).



**Fig. (3):**Liver of hepatic rat, 2.5%(ChLP) diet showing very slight hydropic degeneration of hepatocytes (H & E X 400).



**Fig. (4):**Liver of hepatic rat, 5 %(ChLP) diet showing no histopathological changes (H & E X 400).



**Fig. (5):**Liver of hepatic rat, 10 %(ChLP) diet showing No histopathological changes (H & E X 400).



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### الملخص العربي

هدفت الدراسة الحالية الي تقييم التركيزات المختلفة (2.5- 5- 10 %) من مسحوق أوراق الشيكوريا وذلك لتحسين وظائف الكبد لدي الفئران المحقونه برابع كلوريد الكربون . تم استخدام 25 فأر من النوع الالبينو تتراوح أوزانهم من  $140 \pm 10$  جم وتم تقسيمهم الي 5 مجاميع , واحد منهم استخدمت كما هي وهي المجموعة الضابطة (-) السليمة بقيه المجاميع حقنت برابع كلوريد الكربون المخلوط مع زيت البرافين 50% بالحجم بنسبه 2 مل /كجم من وزن الجسم مرتين أسبوعيا لمدة أسبوعين واستخدمت مجموعهم كمجموعه ضابطه (+) مصابه وبقية المجاميع المصابه تغذت علي عليقه أساسيه بالاضافه الي التركيزات محل الدراسة لمدته 28 يوم . ثم تم قياس إنزيمات الكبد- والبروتين الكلى – الالبيومين- البيلوروبين الكلى - الكوليستيرول الكلى - الجليسيريدات الثلاثية - الليبوبروتينات – الجلوكوز- وإنزيمات الكبد المضادة للاكسده وتم قياس وزن عضو الكبد وعمل التحاليل الهستوباثولوجيه له – كما تم تحليل المركبات الفينولية بأوراق الشيكوريا المجففة . وكانت النتائج جميعها مقارنة بالمجموعه الضابطة الموجبة ( المريضة ) حيث أوضحت النتائج ان المجموعه التي تغذت علي غذاء محتوي علي تركيز 10% خفضت نسبه جلوكوز الدم بشكل معنوي. وفي حاله قياس مستوي انزيمات الكبد المضاده للاكسده ارتفعت المعنويه بشكل ملحوظ لهذه المجموعه 10% , وكذلك في حاله قياس مستوي البروتين الكلي والالبيومين بالسيرم , اما في حاله البيلوروبين الكلي انخفضت المعنويه لهذه المجموعه 10% و ليس هناك فرق معنوي بينها وبين بقية التركيزات الاخرى 2.5- 5 % , وفي حاله تقديرات أنزيمات الكبد انخفضت المعنويه بشكل ملحوظ ايضا لهذه المجموعه 10% كذلك عند تقدير نسبه الكولسترول والجليسريدات الثلاثيه, والليبوبروتينات المنخفضة الكثافه والمنخفضة جدا فالكثافه انخفضت معنويه هذه المجموعه 10% وأعطت نتائج مقبولة اما بالنسبه لليبوبروتينات عاليه الكثافه ارتفعت المعنويه بشكل جيد لهذه المجموعه 10%

**الخلاصه :** تعتبر اوراق نبات الشيكوريا مفيد جدا في تحسن حاله الفئران المصابه بخلل وسميه فالكبد وكل التركيزات التي استخدمت في هذه الدراسة أدت الي تحسن حالات الفئران وبالاخص تركيزي 5-10% .

**الكلمات الداله :** الشيكوريا – تسمم الكبد – الفئران – وظائف الكبد – التحاليل البيوكيميائية