INTRODUCTION:

The liver is a large organ, being the largest gland and one of the most vital organs that functions as a centre for metabolism of nutrients and excretion of waste metabolites **(Ozougwu and Eyo, 2014).** Its primary function is to control the flow and safety of substances absorbed from the digestive system before distribution of these substances to the systemic circulatory system **(Allen, 2002).** A total loss of liver function could lead to death within minutes, demonstrating the liver‘s great importance **(Ozougwu, 2014).**

Enterolobium cyclocarpum is a tropical tree that has played a fundamental part in the development of rural man living from southern Mexico to the middle part of the South American subcontinent. The relevant biotechnological aspects of this benefactor and generous comrade in life, the taxonomic classification, geographical distribution and introduction to other continents, the basic aspects of their biology and ecology, the importance in the traditional agroforestry systems were described. Also, its role as material in the construction and manufacture of wooden utensils, in food and pharmaceutical biotechnology, in traditional medicine, in culinary regional folklore and its symbolic social importance were assessed **(Mauro *et al.,* 2012).**

Juan *et al.,* (2008) reported that chemical analyses were performed to quantify the protein (CP), fat (CF), fier (CF), ash, humidity, nitrogen free extract (NFE) and antinutritional factors in extracts from *Enterolobium cyclocarpum* seeds. *E. cyclocarpum* seeds have a great potential in pharmaceutical and chemical industries due to

the high content of minerals, carbohydrates and proteins. However, the seeds also contain cyanogenic glycosides such as trypsin inhibitory factor and cyanhidric acid, resulting in antinutritional effects, through enzymatic hydrolysis (ß-glycosidase), trypsin inhibition on an aqueous extract of the sample (0.1 N NaOH). By using a standard trypsin solution, the proteolytic activity in a synthetic substrate (benzoyl-arginine-p-nitroanilide) was studied. Analyses of the complete seeds showed; CP 26.13%, CF 2.85%, CF 4.95%, ash 2.95%, and nitrogen free extract (NFE) 63.1%. The dried almonds contained CP 34.5%, CF 7.6%, undetectable fier, ash 3.3%, and NFE 54.6%. No hemaglutinins were detected, whereas 4.82 units/mg of trypsin inhibition and 0.76 mg/100g of HCN were found. The low concentrations of trypsin inhibitor and hydrocyanic acid (HCN) will be reduced even more by the heat treatment previous consumption, which makes the seeds suitable for human beings or animals.

AIM OF THE STUDY:

This study aims to investigate the effect of elephant ear pods, leaves, and mixture on body weight gain, feed intake, feed efficiency ratio, antioxidant enzymes such as GPX, SOD and CAT, liver functions, kidney functions, blood glucose and lipids, as well as histological properties of liver and kidney in hepatointoxicated rats.

MATERIALS AND METHODS

Materials :

This study was carried out using elephant ear (*Enterolobium cyclocarpum*) pods & leaves which were obtained from the Ministry of Agriculture.

Carbon tetra chloride (CCl_4) was obtained from El-Gomhoria Company for chemicals, Cairo, Egypt, as a toxic chemical for liver poisoning according to **Passmore and Eastwood, (1986)**. At the same time, CCl_4 was mixed with paraffin oil by equal volumes and used for induction of liver disease.

Rats: Forty (40) adult male albino rats, Sprague Dawley strain, mean weight 159±10 g were obtained from Research Institute of Ophthalmology, Medical Analysis Department, Giza, Egypt. Rats were housed in wire cages under the normal laboratory conditions and fed on basal diet for 7 consecutive days as adaptation period. Diets were introduced to rat in a special non-scattering feeding cup to avoid loss of feed and contamination. Tap water was provided to rats by means of glass tubes projecting through wire cages from inverted bottles supported to one side of the cage.

Methods:

Experimental design: Forty (40) (Sprague - Dawley strain) male albino rats were distributed into 8 groups each of 5 rat in which means of rats weight for all groups were nearly equal. All rats were housed in wire cages and fed on the experimental diets for 4 weeks according to the following groups:

Group (1): Control negative group (-ve), in which normal rats were fed on basal diet for 28 days.

Group (2): Control positive (+ve), in which hepatotoxic rats were injected by CCL_4 and fed on basal diet for 28 days.

Group (3): CCl_4 hepatotoxic rats fed on basal diet containing 2.5% elephant ear pods for 28 days.

Group (4): CCl_4 hepatotoxic rats fed on basal diet containing 5% elephant ear pods for 28 days.

Group (5): CCl_4 hepatotoxic rats fed on basal diet containing 2.5% elephant ear leaves for 28 days.

Group (6): CCl_4 hepatotoxic rats fed on basal diet containing 5% elephant ear leaves for 28 days.

Group (7): CCl_4 hepatotoxic rats fed on basal diet containing 2.5% equalized combination of (leaves, pods) for 28 days.

Group (8): CCl_4 hepatotoxic rats fed on basal diet containing 5% equalized combination of (leaves, pods) for 28 days.

Rats were weighted at the beginning of the experimental then weekly and at the end of the experiment; consumed feed calculated each day.

Diet: The basal diet was prepared according to **Reeves *et al*., (1993).**The vitamin mixture was prepared according to **AIN (1977**). The salt mixture was prepared according to **AIN (1977**).

Organ weights: The internal organs (liver – heart- kidney –spleen – and lungs) were excised, rinsed in chilled saline solution, then blotted on filter paper, and weighed separately to calculate the absolute organs weight.

Biochemical analysis:

At the end of the experiment (4 weeks), the animals were anesthetized with diethyl ether. Incisions were made into the abdomen and blood samples were obtained from the

portal vein into (EDTA) centrifuge tubes. Plasma was separated by centrifugation at 4000 r .p. m for 10 minutes. The collected samples were analyzed for the biochemical parameters. Enzymatic colorimetric method used to determine, aspartate aminotransferase GOT (AST) alanine aminotransferase and alkaline phosphate GPT (ALT) activities were measured according to method described by **Henry (1974) and Yound (1975)**. Alanine phosphatase determination (ALP) procedure based on colorimetric determination was preformed according to the method of **IFCC (1983).** Serum total protein (TP) assessed according to **Henry, (1974),** serum albumin (Alb) according to **Doumas *et al.* (1971),** serum total bilirubin (T.Bil) according to **Doumas *et al.*, (1973),** serum direct bilirubin (D.Bil) according to **Chary and Sharma (2004).** Serum indirect bilirubin (Ind.Bil) according to **Chary and Sharma (2004)**. Determination of SOD carried out according to **Sun *et al.* (1988),** GPX according to **Zhao, (2001)** and CAT according to **Diego (2011)**. Determination of Cholesterol performed according to **Allain (1974),** triglycerides according to **Fossati and Prencipe (1982),** high density lipoprotein (HDL) cholesterol according to **Lopez (1977)**. Low density lipoprotein (LDL-c) and very low density lipoprotein (VLDL-c) calculated according to **Lee and Nieman (1996).**Creatinine was determined according to the method described by **Bohmer (1971).** Urea according to the method described by **Patton and Crouch (1977)** and serum glucose according to **Yound (1975) and Tietz (1976)**.

Histological examination: Specimens of the internal organs (Liver and kidney) were taken immediately after sacrificing rats and immersed in 10% neutral buffered formalin. The fixed specimens were then trimmed and

dehydrated in ascending grades of alcohol, cleared in xylene, embedded in paraffin, sectioned (4-6 Mm thickness), stained with hematoxylin & eosin and examined microscopically **(Carleton, 1979)**.

Statistical analysis: The data were statically analyzed using a computerized Costat Program by one way ANOVA. The results are presented as mean ± SD. Differences between treatments at $p \leq 0.05$ were considered significant **(S.A.S, 1985)**.

RESULTS AND DISCUSSION:

The effect elephant ear (*Enterolobium cyclocarpum*) pods & leaves, and the mixture on body weight gain (BWG g), feed intake (FI g) and feed efficiency ratio (FER) of CCl4 injected rats is shown in table (1). Data illustrated in hepatic rats a gradual increase in relative BWG, FI, & FER when feeding on elephant ear (*Enterolobium cyclocarpum*) seeds & leaves, and the mixture at levels of CCl_4 (2.5%,7.5%). The statistical analysis showed significant positive relations between treatments for BWG, FI, & FER. These results are in agreement with those reported by **Bakr (2009); Nazeah (2012) and Shehata, (2012)** on hepatic rats.

Table (2) show that effect of elephant ear (*Enterolobium Cyclocarpum*) pods & leaves, and the mixture on organs weight (g) of carbon tetrachloride (CCl4) injected rats. Data illustrated that a gradual increase took place in relative organs weight for control (+) group. Elephant ear (*Enterolobium cyclocarpum*) pods & leaves, and the mixture at level of (2.5, 5%) diets lowered such weights. The statistical analysis showed a significant negative correlation between treatments plant concentrations and organs weight. These results are in agreement with those

reported by **Bakr (2009); Nazeah (2012) and Shehata (2012)** on hepatic rats.

Table (3) reflects the effect of elephant ear (*Enterolobium Cyclocarpum*) pods & leaves, and the mixture on (GPT,ALP, AST/ALT), total protein (g/dl), albumin (g/dl), globulin (g/dl), albumin (mg/dl) / globulin (mg/dl), total bilirubin (mg/dl), direct bilirubin (mg/dl) and indirect bilirubin (mg/dl) of CCl_4 injected rats. AST level of hepatic rats fed control diet was 87.60±2.93 U/L. The decreases in aspartame amino transferase (AST) level (mixture 5%), also alanine amino transferase (ALT) level were recorded. Alkaline phosphates (ALP), total protein (g/dl) and albumin (mg/dl), total bilirubin, direct bilirubin and indirect bilirubin improved when rats fed on (pods & laves), but the best transactions when rats fed (mixture 5%). **Nawirska *et al.,* (2013); Badr *et al.,* (2011), Umadevi *et al.,* (2011)** reported that the Zucchini seeds contained b-carotene, caffeic acid trihexoside, phenolic acids, Vit.E. Apparently, the abovementioned compounds seem to have distinct effect on Liver protection. These results are in agreement with those reported by **Madhavi *et al.,* (2012)**, they found that the significant decrease in serum ALT, AST and ALP levels treated groups which increased due to CCl4 induced liver damage are comparable with standard drug. Histopathological study of liver tissue ravealed the favourable hepatoprotective activity of *Citrullus lanatus* seed oil. This was also found for hepatointoicated rats by CCL4. **Muthupillai *et al.,* (2014)** found that oral supplementation of *Mangifera indica* extract remarkably reduces hepatotoxicity in mice possibly through its antioxidant potentials.

Table (4): results reflect the effect of elephant ear (*Enterolobium cyclocarpum*) pods & leaves, and the mixture on SOD (U/L), CAT enzyme (mmol/L) and GPX (Ng/ml.) of hepatointoxicated rats. Serum SOD of the control (+) group was 111.84±5.44 (U/L). In hepatic rats fed different (pods, leaves, mixture 5%) pronounced improvement was revealed. The table illustrates maximum improves of serum CAT, GPX, and SOD when rats fed mixture (5 %) diet. **Nazima *et al.*, (2018)** noted that active constituents present in stem bark, leaves, heartwood, roots and fruit of *Mangifera indica* (*Mango*) and have antioxidant, anti-inflammatory, radioprotective, antitumor, immunemodulatory, anti-allergic, anti-diabetic, anti-bone resorption, mono-amine oxidase inhibiting, anti-viral, anti-fungal, anti-bacterial, anti-spasmodic, antidiarrheal, anti-malarial, antiparasitic as well as lipolytic properties. *M. indica* active components and their application in pharmaceutical industry.

Table (5) results show the effect of elephant ear (*Enterolobium cyclocarpum*) pods & leaves, and the mixture on serum total cholesterol & triglycerides (TG), high density lipoprotein cholesterol (HDL-c), low density lipoprotein cholesterol (LDL-c), very Low density lipoprotein cholesterol (VLDL-c) and atherogenic index (AI) of CCl4 injected rats. Data revealed Pronounced decreases of serum (TC), (TG), (LDL-c), (VLDL-c) & (AI) when rat feed (mixture 5%), while HDL was raised. **Kossori *et al.*, (1998); Sawaya & Khan (2006) ; Ozcan and Al–Juhaimi (2011)and Ghazi et al., (2013)** reported that the seeds of prickly pear contained linoleic acid, palmitic acid, stearic acid, oliec acid, sterols, Vit. E, minerals of Ca, K, Mg & P, and these components may be of hypocholesterolemic effects. **Ramadan and Mörsel**

(2003) showed that cactus pear reduces cholesterol levels in human and modify LDL composition. **Rahbar and Nabipour (2010)** showed that powdered seeds of *Citrullus colocynthis* can lower the triglyceride and cholesterol concentration significantly in nondiabetic hyperlipidemic patients.

These results (table 5) are in agreement with those found by **Zamani *et al.* (2007)** reported that the pulp and the seeds of *Citrullus colocynthis* were assessed for their effects on the lipid profile of hyperlipidemic New Zealand rabbits. In the experimental groups that received the pulp of *C. colocynthis* or 100 mg/kg of seeds, the lipid profiles were significantly reduced when compared to the control group ($P<0.05$). **Talabani and Tofiq (2012),** showed that significant drop in serum total cholesterol and triglyceride observed at 120 h after first administration of colocynth seeds oil. They suggested *Citrullus colocynthis* oil as a treatment for hyperlipidemia.

Table (6) The effect of elephant ear (*Enterolobium cyclocarpum*) pods & leaves, and the mixture on urea (mg/dl), creatinine (mg/dl) and uric acid of hepato-intoxicated rats is shown in table (6). Serum creatinine level for rats fed control (+) diet was 1.63±0.005 mg/dl. A marked decrease of serum creatinine was observed, along with feeding of hepatic rats on elephant ear (*Enterolobium cyclocarpum*) pods & leaves, and the mixture. Urea and Uric acid showed a paralled decreases when rats fed on plant parts mixture (2.5 & 5%). But the best transactions recoreded when rat fed the mixture (5%). However these results (Ttable 6) disagree with that reported by **Soufane *et al.* (2013)** that the intake of extract of ripe *Citrullus colocynthis* fruit presented some adverse effects on the

functions of the liver, kidney and bone marrow in rats. **Abor (2014**), lowever found that administration of celery powder, juice, seed and extract has improvement effects against cisplatin induced nephrotoxicity in rats.

Table (7) results indicate the effect of elephant ear (*Enterolobium cyclocarpum*) pods & leaves, and the mixture on serum glucose in CCl_4 injected rats. Results illustrated a pronounced decrease of blood glucose level followed feeding on elephant ear (*Enterolobium cyclocarpum*) seeds & leaves, and the mixture. Data proved the desirable effect of feed (pods, leaves) on blood glucose. Blood glucose was lower in the all supplemented diets compared to control (+ve). Group G8 (mixture 5%) revealed lowest values compared to others groups.

These results (Table 7) are in agreement with those reported by **Oryan *et al.* (2014),** that *C. colocynthis* was able to reduce blood glucose significantly compared with the control diabetic group ($P<0.05$). **Jia *et al.*, (2003)** reported that the marrow seeds exert hypoglycemic activities.

Histopathologically (Photos1-16), show pronounced changes took place in liver & kidneys structures due to injection with CCl_4. **Oryan *et al.* (2014),** found that injection with alloxan resulted in severe necrotic changes in the pancreatic islets, especially in the central area of the islets. Liver of the treated diabetic rats revealed significant changes due to diabetes mellitus meanwhile, improvement of the hepatic tissue compared to those of the untreated diabetic rats recorded when inflicted rats recerived extract of colocynth.

In present work (Photos 1-16) supplementing diet with (pods, leaves) improved liver and kidneys structures

such improvements were achieved by feeding hepatic rats with (2.5, 5%) pods, leaves & mixture. Anyhow microscopically, liver, kidney of rat from control (-ve) group showed normal structures (Photos 1& 9).While, hepatic rat from control (+ve) group showed atrophy and vacuolations in liver and kidney .Meanwhile, liver and kidney of rat fed on elephant ear plant diets no or slight histopathological changes indicating regaining more or less restoration of the original structure.

Table (1): Effect of elephant ear (*Enterolobium cyclocarpum*) pods & leaves, and the mixture on body weight gain (BWGg), feed intake (FI) and feed efficiency ratio (FER) of CCl4 rats

Groups \ Parameter			BWG (g) M±SD	FI (g) M±SD	FER M±SD
Basal diet		(G1) Control (-)	1.63^{b} ± 0.0563	19.28^{a} ± 1.23	0.085^{d} ± 0.0004
		(G2) Control (+)	1.02^{e} ± 0.742	15.54^{f} ± 1.34	0.066^{h} ± 0.0002
Elephant ear diet	Pods	(G3) 2.5%	1.20^{de} ± 0.523	16.44^{e} ± 1.75	0.073^{g} ± 0.0008
		(G4) 5%	1.57^{bc} ± 0.872	17.64^{c} ± 1.38	0.089^{c} ± 0.0006
	Leaves	(G5) 2.5%	1.26^{d} ± 0.655	16.85d ± 1.66	0.075^{f} ± 0.0003
		(G6) 5%	1.85^{a} ± 0.733	18.00^{bc} ± 1.78	0.103^{b} ± 0.0004
	Mixture	(G7) 2.5%	1.41^{cd} ± 0.563	17.95^{bc} ± 1.73	0.079^{e} ± 0.0001
		(G8) 5%	1.95^{a} ± 0.644	18.25^{b} ± 1.34	0.107^{a} ± 0.0002
---------		LSD	0.203	0.392	4
Means in the same row with different litters are significantly different at ($P \leq 0.05$).					

Table (2): Effect of elephant ear (*Enterolobium cyclocarpum*) pods & leaves, and the mixture on organ weight (g) of carbon tetrachloride (CCl4) injected rats

Groups \ parameter			Liver Weight mean± SD	Kidneys Weight Mean± SD	Spleen Weight Mean± SD	Heart Weight Mean± SD	Lungs Weight Mean± SD
Basal diet	(G1) Control (-ve)		3.60^{g} ± 0.002	0.90^{e} ± 0.001	0.31^{g} ± 0.007	0.71^{g} ± 0.003	1.10^{d} ± 0.006
	(G2) Control (+ve)		6.10^{a} ± 0.004	1.21^{a} ± 0.003	0.72^{a} ± 0.008	1.00^{a} ± 0.004	1.25^{a} ± 0.005
Elephant ear diet	Pods	(G3) 2.5%	5.00^{b} ± 0.001	1.10^{b} ± 0.005	0.68^{b} ± 0.009	0.88^{b} ± 0.001	1.13^{c} ± 0.004
		(G4) 5%	4.90^{c} ± 0.007	0.99^{c} ± 0.007	0.62^{c} ± 0.004	0.83^{d} ± 0.003	1.10^{d} ± 0.003
	Leaves	(G5) 2.5%	4.70^{d} ± 0.006	0.99^{c} ± 0.006	0.45^{d} ± 0.003	0.84^{c} ± 0.008	1.14^{b} ± 0.005
		(G6) 5%	4.30^{e} ± 0.005	0.95^{d} ± 0.002	0.40^{e} ± 0.004	0.80^{e} ± 0.007	0.99^{e} ± 0.003
	Mixture	(G7) 2.5%	3.80^{f} ± 0.001	0.89^{f} ± 0.007	0.36^{f} ± 0.009	0.76^{f} ± 0.003	0.96^{f} ± 0.003
		(G8) 5%	3.50^{h} ± 0.008	0.86^{g} ± 0.005	0.30^{h} ± 0.007	0.71^{g} ± 0.007	0.90^{g} ± 0.007
	LSD		0.0047	0.0039	0.0041	0.004	0.0026
Means in the same row with different litters are significantly different at ($P \leq 0.05$).							

Table (3): Effect of Effect of elephant ear (*Enterolobium cyclocarpum*) pods & leaves, and the mixture on (AST), (ALT), (ALP) and (AST/ALT), total protein (g/), Albumin (mg/dl), globulin (mg/dl), albumin (mg/dl) / globulin (mg/dl), total bilirubin (mg/dl), direct bilirubin (mg/dl) and indirect bilirubin (mg/dl) of CCl_4 injected rats

parameter / Groups			AST (U/L) Mean ± SD	ALT (U/L) Mean ± SD	AST(U/L) / ALT(U/L) Mean ± SD	Alkaline Phosphatase ALP (U/L) Mean ± SD	Total Protein (g/L) Mean ± SD	Albumin (g/dl) Mean ± SD	Globulin (g/dl) Mean ± SD	Alb/Glb Mean ± SD	Total Bilirubin (mg/dl) Mean ± SD	Direct Bilirubin (mg/dl) Mean ± SD	Indirect Bilirubin (mg/dl) Mean ± SD
Basal diet	(G1) Control (-ve)		33.50^{e} ± 1.98	25.40^{e} ± 1.18	1.32^{b} ± 0.43	62.60^{h} ± 3.32	7.75^{a} ± 0.523	5.61^{a} ± 0.324	2.14^{f} ± 0.324	2.62^{a} ± 0.132	0.51^{g} ± 0.008	0.12^{a} ± 0.014	0.39^{de} ± 0.010
	(G2) Control (+ve)		87.60^{a}± 2.93	45.20^{a} ± 2.03	1.94^{a} ± 0.132	170.10^{a}± 3.42	4.22^{d} ± 0.673	0.62^{e} ± 0.123	3.60^{a} ± 0.211	0.17^{e} ± 0.121	0.78^{a} ± 0.004	0.17^{a} ± 0.017	0.62^{a} ± 0.013
Elephant ear diet	Pods	(G3) 2.5%	59.50^{b}± 2.12	39.20^{b} ± 1.95	1.52^{ab} ± 0.24	83.60^{b} ± 2.56	7.23^{c} ± 0.972	4.35^{d} ± 0.332	2.88^{b} ± 0.432	1.51^{d} ± 0.170	0.68^{b} ± 0.003	0.15^{a} ± 0.013	0.53^{b} ± 0.014
		(G4) 5%	48.60^{e} ± 1.97	36.40^{c} ± 2.32	1.34^{b} ± 0.34	80.00^{c} ± 3.44	7.41^{b} ± 0.832	4.60^{c} ± 0.4 20	2.81b^{c} ± 0.240	1.64^{d} ± 0.340	0.61^{c} ± 0.001	0.15^{a} ± 0.004	0.46^{c} ± 0.018
	Leaves	(G5) 2.5%	46.10^{c} ± 1.88	35.5^{e}± 2.65	1.30^{b} ± 0.25	78.60^{d} ± 2.99	7.50^{a} ^{bc} ± 0.937	4.85^{b} ± 0.320	2.65^{cd} ± 0.423	1.83^{c} ± 0.230	0.59^{d} ± 0.007	0.14^{a} ± 0.016	0.45^{cd} ± 0.089
		(G6) 5%	43.50^{d}± 2.24	34.1^{d}± 2.35	1.28^{b} ± 0.21	75.10^{e} ± 2.89	7.56^{a} ^{bc} ± 0.723	4.90^{b} ± 0.432	2.66^{cd} ± 0.123	1.84^{c} ± 0.320	0.56^{e} ± 0.006	0.13^{a} ± 0.018	0.43^{cde} ± 0.079
	Mixture	(G7) 2.5%	32.20^{e} ± 2.25	25.85^{e} ±1.92	1.25^{b} ± 0.27	70.30^{f} ± 3.01	7.62^{a} ^{b} ± 0.432	5.08^{b} ± 0.426	2.54^{de} ± 0.320	2.00^{b} ± 0.212	0.55^{f} ± 0.006	0.13^{a} ± 0.019	0.40^{cde} ± 0.071
		(G8) 5%	31.40^{e} ± 1.99	25.12^{e} ±1.32	1.25b ± 0.15	67.80^{g} ± 3.11	7.84^{a} ± 0.724	5.41^{a} ± 0.563	2.43^{e} ± 0.360	2.06^{b} ± 0.120	0.50^{h} ± 0.005	0.12^{a} ± 0.098	0.38^{e} ± 0.063
	LSD		2.591	0.9136	0.4639	0.5219	0.328	0.223	0.187	0.152	0.0039	0.052	0.0593

Means in the same row with different litters are significantly different at (P≤ 0.05).

Table (4): Effect of elephant ear (*Enterolobium cyclocarpum*) pods & leaves, and the mixture on SOD (U/L) & CAT (mmol/L) and GPX (Ng/ml) on hepatointoxicated rats

Groups / Parameter			SOD (U/L)	Catalase enzyme (Mmol/L) Mean ± SD)	GPX (Ng/ml)
Basal diet		(G1) Control (-ve)	328.95^{a} ± 6.23	791.31^{a} ± 6.34	12.22^{a} ± 1.97
		(G2) Control (+ve)	111.84^{h} ± 5.44	413.12^{h} ± 5.46	0.64^{e} ± 0.01
Elephant ear diet	Pods	(G3) 2.5%	250.60^{g}± 4.34	561.30^{g} ± 5.32	6.79^{d} ± 1.03
		(G4) 5%	267.10^{f} ± 3.63	580.50^{f} ± 4.22	7.46^{d} ± 1.07
	Leaves	(G5) 2.5%	286.40^{e} ± 4.42	622.40^{e} ± 4.13	8.68^{c} ± 1.23
		(G6) 5%	290.50^{d} ± 6.55	690.60^{d} ± 5.43	9.35^{c} ± 1.33
	Mixture	(G7) 2.5%	312.40^{c} ± 4.34	774.30^{c} ± 6.67	10.50^{b} ± 1.89
		(G8) 5%	315.80^{b} ± 5.54	780.50^{b} ± 6.87	11.67^{a} ± 1.40
		LSD	1.792	1.810	1.62

Means in the same row with different litters are significantly different at ($P \leq 0.05$).

Table (5): Effect of elephant ear (*Enterolobium cyclocarpum*) pods & leaves, and the mixture on serum total cholesterol (TC) and triglycerides (TG), high density lipoprotein cholesterol (HDL-c), low density lipoprotein cholesterol (LDL-c), very low density lipoprotein cholesterol (VLDL-c) and atherogenic index (AI) of CCl4 injected rats

Groups \ Parameter			Serum Cholesterol (mg/dl) Mean± SD	Serum Triglycerides (mg/dl) Mean± SD	Serum high density lipoprotein cholesterol (HDL-c) (mg/dl) Mean± SD	Serum Low density lipoprotein cholesterol (LDL-c) (mg/dl) Mean± SD	Serum very Low density lipoprotein cholesterol (VLDL-c) (mg/dl) Mean± SD	AI Mean ± SD
Basal diet	(G1) Control (-ve)		98.20^{g} ± 1.93	54.40^{h} ± 1.64	48.20^{a} ± 1.77	39.10^{f} ± 1.83	10.90^{g} ± 1.05	0.83^{e} ± 0.13
	(G2) Control (+ve)		220.60^{a} ± 2.69	91.60^{a} ± 1.67	25.00^{g} ± 1.89	177.30^{a} ± 1.97	18.30^{a} ± 1.03	7.82^{a} ± 0.97
Elephant ear diet	Pods	(G3) 2.5%	123.40^{b} ± 2.35	79.40^{b} ± 1.87	35.60^{f} ± 1.23	71.90^{b} ± 1.56	15.90^{b} ± 1.08	2.47^{b} ± 0.83
		(G4) 5%	110.20^{d} ± 2.28	76.20^{c} ± 1.88	39.80^{e} ± 1.88	55.20^{c} ± 1.43	15.20^{c} ± 1.12	1.77^{c} ± 0.74
	Leaves	(G5) 2.5%	111.40^{c} ± 2.44	65.40^{d} ± 1.24	43.00^{d} ± 1.05	55.30^{c} ± 1.87	13.10^{d} ± 1.20	1.59^{cd} ± 0.86
		(G6) 5%	100.60^{e} ± 1.67	60.80^{e} ± 1.56	43.60^{cd} ± 1.07	44.80^{d} ± 1.56	12.20^{e} ± 1.04	1.31^{cde} ± 0.84
	Mixture	(G7) 2.5%	99.40^{f} ± 1.97	57.60^{f} ± 1.80	44.20^{c} ± 1.08	43.70^{e} ± 1.68	11.50^{f} ± 1.13	1.25^{de} ± 0.63
		(G8) 5%	95.10^{h} ± 2.01	55.20^{g} ± 1.76	45.60^{b} ± 1.44	38.50^{g} ± 1.87	11.00^{g} ± 1.18	1.09^{e} ± 0.66
		LSD	0.577	0.366	0.650	0.335	0.1126	0.452
Means in the same row with different litters are significantly different at ($P \leq 0.05$).								

Table (6): Effect of elephant ear (*Enterolobium cyclocarpum*) pods & leaves, and the mixture on urea (mg/dl), creatinine (mg/dl) and uric acid (mg/dl) of hepatointoxicated rats

Groups \ Parameter			Urea (mg/dl) Mean ± SD	Creatinine (mg/dl) Mean ± SD	Uric Acid (mg/dl) Mean ± SD
Basal diet	(G1) Control (-ve)		30.40^{f} ± 3.69	0.79^{e} ± 0.004	2.32^{g} ± 0.048
	(G2) Control (+ve)		51.20^{a} ± 2.332	1.63^{a} ± 0.005	4.85^{a} ± 0.048
Elephant ear diet	pods	(G3) 2.5%	48.40^{b} ± 3.420	0.93^{b} ± 0.003	3.90^{b} ± 0.048
		(G4) 5%	44.60^{c} ± 2.704	0.86^{c} ± 0.007	3.71^{c} ± 0.048
	leaves	(G5) 2.5%	45.30^{c} ± 2.782	0.84^{d} ± 0.003	2.86^{d} ± 0.048
		(G6) 5%	42.00^{d} ± 1.935	0.72^{f} ± 0.006	2.65^{e} ± 0.048
	Mixture	(G7) 2.5%	41.50^{d} ± 1.977	0.65^{g} ± 0.007	2.60^{f} ± 0.048
		(G8) 5%	38.40^{e} ± 1.820	0.58^{h} ± 0.008	2.35^{g} ± 0.048
		LSD	1.222	0.0033	0.0362
Means in the same row with different litters are significantly different at (P≤ 0.05).					

Table (7): Effect of elephant ear (*Enterolobium cyclocarpum*) pods & leaves, and the mixture on serum glucose in CCl_4 injected rats

Groups \ Parameter			Serum Glucose (mg/dl) Mean± SD
Basal diet	(G1) Control (-ve)		45.60^{g} ± 2.23
	(G2) Control (+ve)		83.40^{a} ± 3.35
Elephant ear diet	Pods	(G3) 2.5%	70.10^{b} ± 1.98
		(G4) 5%	66.60^{c} ± 1.99
	Leaves	(G5) 2.5%	58.60^{d} ± 2.01

		(G6) 5%	51.80^{e} ± 2.35
	Mixture	(G7) 2.5%	50.20^{f} ± 2.70
		(G8) 5%	46.20^{g} ± 2.63
		LSD	0.830
Means in the same row with different litters are significantly different at (P≤ 0.05).			

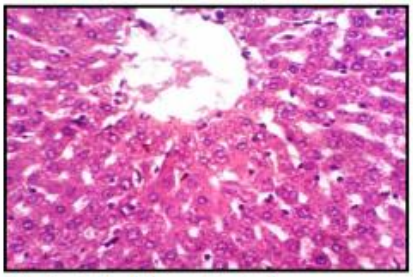

Photo (1): Liver of rat from group 1 control (−) showing the normal histological structure of hepatic lobule **(H & E X 400).**

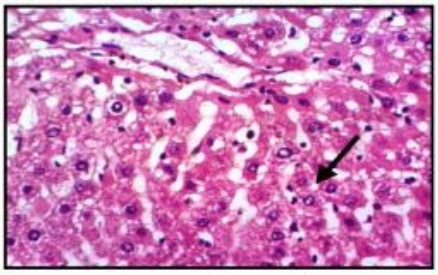

Photo (2): Liver of rat from group 2 control (+) showing cytoplasmic vacuolation of hepatocytes **(H & E X 400).**

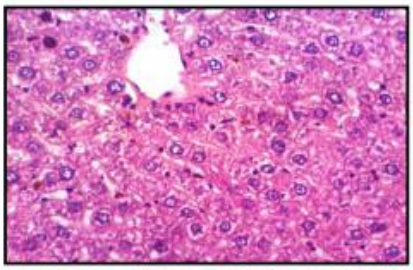

Photo (3): Liver of rat from group 3 (pods diet 2.5%) showing no histopathological changes **(H & E X 400).**

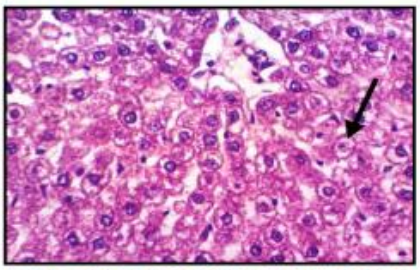

Photo (4): Liver of rat from group 4 (pods diet 5%) showing slight hydropic degeneration of hepatocytes **(H & E X 400).**

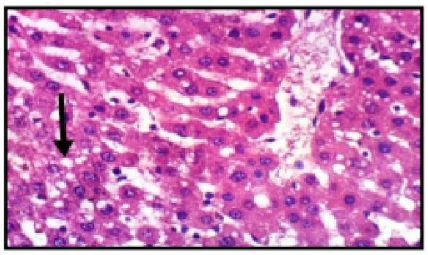

Photo (5): Liver of rat from group 5 (leaves diet 2.5%) showing cytoplasmic vacuolation of hepatocytes (**H & E X 400**).

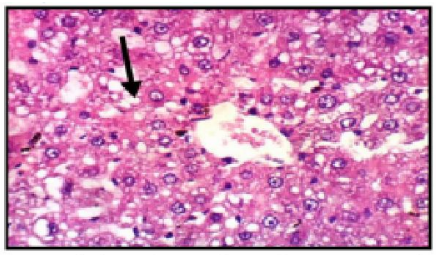

Photo (6): Liver of rat from group 6 (leaves diet 5%) showing cytoplasmic vacuolation of hepatocytes (**H & E X 400**).

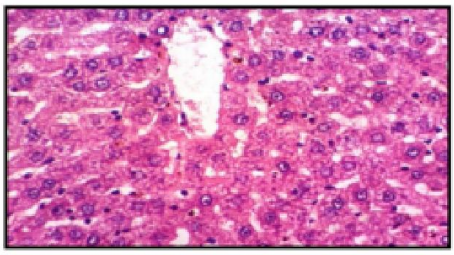

Photo (7): Liver of rat from group 7 (mix diet 2.5%) showing no histopathological changes (H & E X 400).

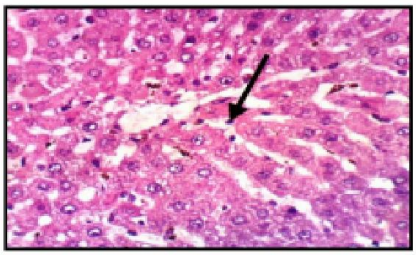

Photo (8): Liver of rat from group 8 (mix diet 5%) showing slight activation of Kupffer cells (H & E X 400).

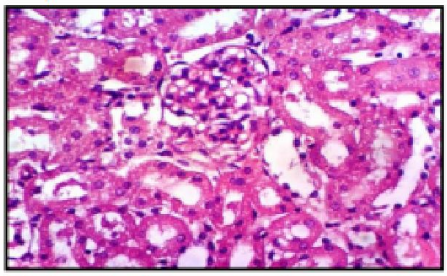

Photo (9): Kidney of rat from control normal group1 (control negative) showing the normal histological structure of renal parenchyma (H & E X 400).

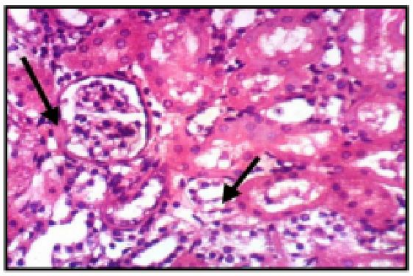

Photo (10): Kidney of rat from group 2 (control positive) showing vacuolation of epithelial lining renal tubules and thickening of the parietal layer of Bowman's capsule (H & E X 400).

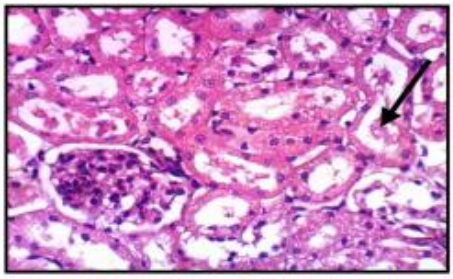

Photo (11): Kidney of rat from group 3 (pods diet 2.5%) showing proteinaceous material in the lumen of some renal tubules (H & E X 400).

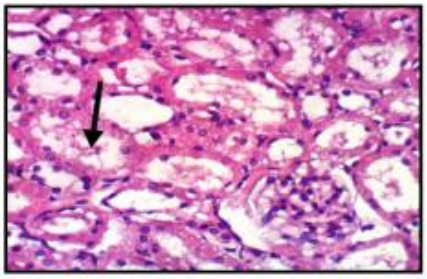

Photo (12): Kidney of rat from group 4 (pods diet 5%) showing proteinaceous material in the lumen of some renal tubules (H & E X 400).

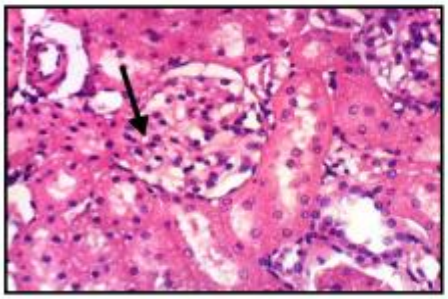

Photo (13): Kidney of rat from group 5 (leaves diet 2.5%) showing slight vacuolation of endothelial lining glomerular tuft (**H & E X 400**).

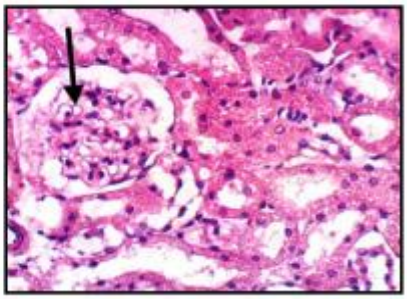

Photo (14): Kidney of rat from group 6 (leaves diet 5%) showing slight vacuolation of endothelial lining glomerular tuft (**H & E X 400**).

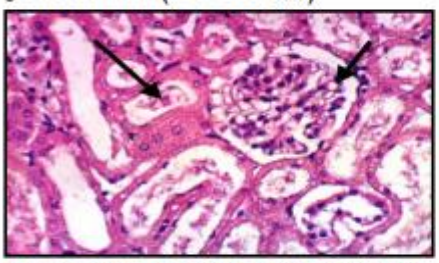

Photo (15): Kidney of rat from group 7 (mix diet 2.5%) showing slight vacuolation of glomerular tuft and proteinaceous material in the lumen of some renal tubules (H & E X 400).

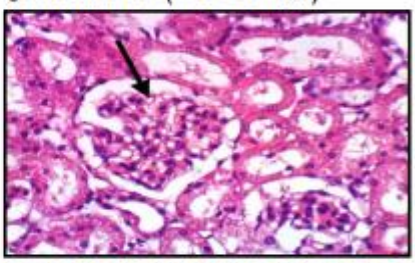

Photo (16): Kidney of rat from group 8 (mix diet 5%) showing slight vacuolation of endothelial lining glomerular tuft (**H & E X 400**).

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