

The Effect of Carob Pods and Fig Fruits Ether Extracts against Lead Induced Hematological and Biochemical Changes in *Oreochromis niloticus*

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Abstract

The current study aimed to investigate the possible effect of *Ceratonia siliqua* (carob) pods and *Ficus carica* (fig) fruits ether extracts against lead toxicity on hematological, biochemical parameters, growth performance and mortality % in Nile Tilapia (*Oreochromis niloticus*). One hundred and forty fish were divided into 7 groups. The first group was left as a control and fed a control diet, while, the second and third groups were exposed to 1/2 96 h LC₅₀ (77.5 mg/L) and 1/4 96 h LC₅₀ (38.7 mg/L) of Lead (Pb), respectively and provided with a control diet. The fourth and fifth groups were exposed to 1/2 96 h LC₅₀ and 1/4 96 h LC₅₀ of Pb, respectively and fed diet with 600 mg carob extract/kg diet. The sixth and seventh group were exposed to 1/2 96 h LC₅₀ and 1/4 96 h LC₅₀ of Pb, respectively and provided with diet contain 600 mg fig extract/kg diet. The hematological, biochemical parameters and growth performance was significantly decreased after exposure to 1/2 96 h LC₅₀ and 1/4 96 h LC₅₀ of Pb for 30, 60 and 90 days, while plasma glucose and mortality % were increased significantly. There were no significant changes in RBCs, Hb and PCV of *O. niloticus* exposed to 1/2 96 h LC₅₀ and 1/4 96 h LC₅₀ of Pb that fed diet enriched with carob extract 600 mg/kg diet for 90 days. The fish exposed to 1/2 96 h LC₅₀ and 1/4 96 h LC₅₀ of Pb and fed diet enriched with 600 mg/kg diet carob or fig for 90 days revealed no significant changes in plasma albumin, total protein, glucose and growth parameters with a reduction of mortality %. The current study highlighted the importance of carob and fig ether extract in the protection of Nile tilapia against the lead acetate toxicity.

Keywords: Carob, Fig, Lead, *Oreochromis niloticus*

Introduction

Lead is a persistent contaminant in the natural environment that can enter water through geologic weathering and volcanic action, or by various anthropogenic activities including burning of coal, effluents from storage battery industries, automobile exhausts, metal coating and finishing operations, fertilizers, pesticides and from additives in pigments and gasoline [1].

Exposure to lead is a major health problem; therefore, researchers give lead toxicity more attention. This heavy metal was found to induce a wide range of behavioral, biochemical and physiological effects. The target organs for lead toxicity is liver, kidneys and brain [2,3]. Plants act as store house for many safer and cheaper chemicals such as alkaloids, pigments, phenolic, steroids and essential oils. Which promote various

activities such as growth promotion, appetite stimulation, immunostimulant and antimicrobial in fish culture [4]. Herbal medicines were characterized by acceptable quality, safety and efficacy that became an integral part of health care science [5]. However, the continuing expansion of aquaculture requires converting from chemical drugs to natural plant. Medicinal plants that were once considered of no value are now being investigated, evaluated and developed into drugs with little or no hazard effects on animals [6]. Carob (*Ceratonia siliqua*) and fig (*Ficus carica*) contain active principles with curative characters against several diseases such as monoterpenes, carotinoids, glycosides, flavonoids, organic acids and xanthenes [7]. Carob interfered with the absorption of lead [8]. Also, fig is a chelating agent for lead ions [9].

Effects of *Ficus carica* extracts on hematological parameters were investigated in albino rats received a daily 200 mg/kg per os body weight of extract respectively for 14 days. Results showed that the hemoglobin concentration, hematocrit (PCV) and red blood cell count were increased in when compared with the control group. These results thus justify the ethnobotanical use of this plant as blood building herbs [10]. Hydro alcoholic seed extract of *Ceratonia siliqua* can bring about a decline in blood glucose and lipids levels in diabetic male rats [11].

The present study was designed to evaluate the possible positive impact of *Ceratonia siliqua* and *Ficus carica* ether extracts against lead induced toxicity via evaluation of hematological, biochemical parameters, growth performance indices and mortality % in *Oreochromis niloticus*.

Material and Methods

Plants extraction

Ceratonia siliqua pods (carob) and *Ficus carica* (fig) fruits (one kg of each) were collected from market and then separately crushed with seeds removal. Consequently, they were dried and grinded to a fine powder. The powder was solved in two liters of ethyl alcohol (100%) for 48 h with periodical shaking and then the extract was filtered using gauze and funnel. Subsequently, the ethyl alcohol was evaporated by rotatory evaporator and then the extract was lyophilized. The lyophilized sample semisolid mass (10%) was collected, stored in airtight containers and kept in refrigerator at 4°C. The extraction process was done according to Mokhtari *et al.* [12].

Determination of 96 h LC₅₀

Determination of 96 h LC₅₀ was carried out according to Behreus and Karbeur [13]. Sixty apparently healthy *Oreochromis niloticus* (*O. niloticus*) (30±10 g) were collected from fish farm of Central Laboratory for fish research. Fish were acclimatized for two weeks and were fed on normal basal diet at rate of 3% of body weight daily. Fish were divided into 5 groups each group contain two aquaria each one contains 6 fish. Each group exposed to different dose of lead acetate for 96 h. Mortality was reported daily for calculation of 96 h LC₅₀.

Experimental design

One hundred and forty *O. niloticus* (30±10 g) free from diseases were collected from fish farm belonging to the Central Laboratory for Aquaculture Research. Fish were left two weeks for acclimatization before the beginning of the experimental study. Fish was fed on normal basal diet at 3% of body weight daily during the acclimation period. They were divided into 7 groups each contain two aquaria with 10 fish/aquarium. The first group was left as a control and fed a control diet, while the second and third groups were exposed to 1/2 96 h LC₅₀ (77.5 mg/L) and 1/4 96 h LC₅₀ (38.7 mg/L) of Pb, respectively and provided with a control diet. The fourth and fifth groups were exposed to 1/2 96 h LC₅₀ (77.5 mg/L) and 1/4 96 h LC₅₀ (38.7 mg/L) of Pb, respectively and fed diet with 600 mg carob extract/kg diet dose of carob [11]. The sixth and seventh groups were exposed to 1/2 96 h LC₅₀ (77.5 mg/L) and 1/4 96 h LC₅₀ (38.7 mg/L) of Pb, respectively and provided with diet contain 600 mg fig extract/kg diet dose of fig [14]. Feeding was performed one time daily for 90 days at rate of 3% of the total body weight each 15 days after taking the body weight of each group. The dose of carob and fig extracts 600 mg/kg applied in several studies in small rats and we used the same dose in this study for first time in *O. niloticus* due to nearly the same size of small rats and *O. niloticus* used in this study.

Hematological parameters and biochemical analysis

Blood samples were collected from caudal vein of fish using sterile syringe with EDTA solution (anticoagulant) at 30, 60 and 90 days post exposure for determining erythrocyte count (RBCs) [15], hemoglobin content (Hb) [16] and packed cell volume (PCV) [17]. Then the plasma was obtained by centrifugation at 3000 rpm/15min and stored in -20°C until the biochemical analysis. Glucose concentration [18], plasma total protein [19] and albumin [20] were determined using the kits.

Growth performance and mortality percent

The growth performance and mortality % were determined at 90 days as the follows:

Body weight gain (WG) = Final weight - Initial weight.

Specific growth rate (SGR) = $[(\ln \text{ final weight} - \ln \text{ initial weight}) / \text{number of experimental days}] \times 100$.

Mortality % = $(\text{No of dead fish at the end of experiment} / \text{Total number of fish at the beginning of the experiment}) \times 100$.

Statistical analysis

Statistical analysis was done using SPSS (version 22, IBM Corp., Armonk, NY, USA). One-way analysis of variance (ANOVA) was

used and followed by Tukey's Honestly Significant Difference test (Tukey's HSD), to clarify the significant differences among the experimental groups. Results were reported as means \pm SE (Standard Error of Mean). The value of $P < 0.05$ was used to indicate statistical significance.

Results

Lead 96 h LC₅₀ in Nile tilapia

The results showed that 96 h LC₅₀ of lead in Nile tilapia was 155 mg/L (Table, 1). Fish showed abnormal movements in aquarium, presence of dark and yellow spots on fish, severe congestion of dorsal area and caudal peduncle and severe congestion of all internal organs.

Table 1: Actual estimation of 96 h LC₅₀ in Nile tilapia exposed to different levels of lead acetate

Groups (n=6)	Concentration (mg/L)	No of dead fish at 96 hours	b	a	axb	Σaxb
1	60mg/L	1		60 mg/L		
2	120mg/L	2	1.5	60 mg/L	90	
3	180mg/L	4	3	60 mg/L	180	
4	240mg/L	4	4	60 mg/L	240	510

The formula of calculation was: 96 h LC₅₀=highest dose- $\Sigma \text{ axb} / \text{n}$ (a=Constant factors between two successive dose, b=the mean of dead fish in each group, $\Sigma \text{ axb}$ =sum of axb, n=Number of fish in each groups)= $240 - 510/6 = 155 \text{ mg/L}$.

Hematological parameters

Erythrocyte count, hemoglobin content and packed cell volume of *O. niloticus* in all groups are illustrated in Table 2. It shows that *O. niloticus* of the second and third groups revealed a significant decrease ($p < 0.05$) in erythrocyte count, Hb and PCV when compared with the control group at the day 30, 60 and 90. On the other hand, RBCs count, Hb and PCV of *O. niloticus* in the fourth and fifth

groups showed non-significant changes ($p < 0.05$) when compared with the control group at the day 30, 60 and 90. While, erythrocyte count, Hb and PCV in blood of *O. niloticus* in the six and seventh groups was decreased significantly except the seventh group at the day 60 revealed no significant changes ($p < 0.05$) when compared with the control group.

Biochemical parameters

The plasma glucose concentration in *O. niloticus* of the control group was 24.57 ± 1.25 , 23.38 ± 2.74 and 28.55 ± 2.82 mg/dL, respectively for the day 30, 60 and 90. *O. niloticus* of the second and third groups revealed a significant increase in plasma glucose concentration when compared with the control group at the day 30, 60 and 90. On the other hand, groups 4, 5, 6 and 7 showed non-significant changes ($p < 0.05$) in plasma glucose level when compared with the control group at the day 30, 60 and 90. In the current study the values of albumin and total protein content in the plasma of *O. niloticus* were significantly decreased ($p < 0.05$) after exposure to 1/2 and 1/4 96 h LC₅₀ of Pb and fed a control diet when compared with the control group at the day 30, 60 and 90. However, the plasma albumin and total protein content of *O. niloticus* exposed to 1/2 and 1/4 96 h LC₅₀ of Pb and fed a diet contain 600 mg of carob or fig extract/kg diet showed no significant changes ($p < 0.05$) when compared with the control group for the day 60 and 90, respectively (Table 3).

Growth parameters and mortality (%)

The weight gain of *O. niloticus* in the control group was 17.7 ± 2.30 g/fish. The

weight gain of *O. niloticus* in the second and third groups were significantly decreased ($p < 0.05$) to 11.3 ± 4.01 and 12.8 ± 3.33 g/fish, respectively when compared with the control group. While, groups 4, 5, 6 and 7 revealed no significant changes ($p < 0.05$) when compared with the control group (Table 3). Specific growth rate of Nile tilapia in control group was 1.3 ± 0.08 . *O. niloticus* of the second and third groups revealed a significant decrease ($p < 0.05$) in specific growth rate (0.84 ± 0.05 and 0.95 ± 0.05 , respectively) when compared with the control group. Also, this value of *O. niloticus* exposed to 1/2 and 1/4 96h LC₅₀ of lead acetate and fed a diet enriched with 600 mg carob or fig extract/kg diet was no significant changes ($p < 0.05$) when compared with the control group (Table 3).

The mortality was 10% in *O. niloticus* of the control group at the day 90. Mortality recorded 50% and 45% in *O. niloticus* of groups two and three at the day 90, respectively. *O. niloticus* of the fourth and fifth groups recorded mortality of 40% and 30% at the day 90, respectively. Fish in the six and seventh groups recorded 10% mortality at the day 90 (Table 4).

Table 2: Erythrocyte count ($10^6/\text{mm}^3$), hemoglobin content (g/dL) and packed cell volume (%) of *Oreochromis niloticus* blood exposed to two doses of lead acetate and fed on a diet enriched with carob or fig ether extract for 90 days (n = 4)

Group	Erythrocyte count			Hemoglobin content			Packed cell volume		
	Experimental days								
	30d	60d	90d	30d	60d	90d	30d	60d	90d
G1	3.78±0.22 ^a	3.89±0.36 ^a	3.92±0.29 ^a	4.6±0.35 ^a	3.58±0.37 ^a	3.6±0.44 ^a	25.5±1.44 ^a	27.75±2.27 ^a	27.25±2.85 ^a
G2	1.11±0.34 ^b	1.7±0.25 ^b	1.62±0.22 ^b	2.13±0.49 ^b	1.91±0.53 ^b	0.71±0.19 ^b	17.5±1.33 ^b	18.1±3.85 ^b	17.15±2.39 ^b
G3	1.42±0.44 ^b	1.6±0.18 ^b	1.97±0.20 ^b	2.5±0.56 ^b	1.33±0.7 ^b	0.75±0.24 ^b	19.75±1.37 ^b	20±1.87 ^b	18.25±2.19 ^b
G4	2.88±1.07 ^a	3.05±0.32 ^a	3.58±0.25 ^a	3.75±0.67 ^a	2.96±0.55 ^a	3.35±0.2 ^a	21.25±3.07 ^a	23.25±1.07 ^a	24.5±3.07 ^a
G5	2.91±1.02 ^a	3.17±0.28 ^a	3.38±0.39 ^a	4.45±0.58 ^a	3.15±0.64 ^a	3.93±0.3 ^a	24.75±4.53 ^a	25.5±1.22 ^a	26.5±3.75 ^a
G6	1.03±0.66 ^b	1.41±0.19 ^b	1.57±0.11 ^b	1.23±0.37 ^b	1.5±0.79 ^b	0.5±0.1 ^b	19.0±1.58 ^b	17.05±2.22 ^b	18.44±1.01 ^b
G7	1.62±0.23 ^b	2.88±0.32 ^a	1.69±0.21 ^b	1.58±0.55 ^b	2.89±0.45 ^a	0.58±0.11 ^b	16.5±1.66 ^b	26.8±2.61 ^a	16.75±4.03 ^b

G1: Control; G2: 1/2LC₅₀ Pb; G3: 1/4LC₅₀ Pb; G4: 1/2LC₅₀+C; G5: 1/4LC₅₀+C; G6: 1/2LC₅₀+F and G7: 1/4LC₅₀+F. (Pb: lead, C: Carob and F: Fig). Means within the same column carrying different superscripts were significantly different at P < 0.05.

Table 3: Glucose (mg/dL), albumin (g/dL) and total protein levels (g/dL) in the plasma of *Oreochromis niloticus* exposed to two doses of lead acetate and fed on a diet enriched with carob or fig ether extract for 90 days (n = 4)

Group	Glucose			Albumin			Total protein		
	Experimental days								
	30d	60d	90d	30d	60d	90d	30d	60d	90d
G1	24.57±1.25 ^b	23.38±2.74 ^b	28.55±2.82 ^b	0.44±0.04 ^a	0.42±0.03 ^a	0.37±0.08 ^a	2.82±0.49 ^a	2.63±0.17 ^a	2.66±0.11 ^a
G2	40.29±0.88 ^a	58.06±4.08 ^a	73.01±2.46 ^a	0.29±0.06 ^b	0.28±0.06 ^b	0.15±0.07 ^b	1.7±0.19 ^b	1.42±0.18 ^b	1.19±0.11 ^b
G3	38.92±4.32 ^a	50.52±3.24 ^a	67.64±3.49 ^a	0.33±0.01 ^b	0.25±0.04 ^b	0.22±0.05 ^b	1.48±0.22 ^b	1.39±0.15 ^b	1.12±0.37 ^b
G4	21.93±2.2 ^b	27.9±1.48 ^b	55.05±1.75 ^b	0.34±0.04 ^a	0.42±0.01 ^a	0.41±0.01 ^a	2.61±0.27 ^a	2.22±0.26 ^a	2.76±0.23 ^a
G5	27.97±2.27 ^b	28.28±3.99 ^b	29.33±2.62 ^b	0.34±0.02 ^a	0.45±0.01 ^a	0.38±0.09 ^a	2.55±0.28 ^a	2.62±0.18 ^a	2.72±0.17 ^a
G6	27.12±3.4 ^b	28.39±0.92 ^b	31.03±1.49 ^b	0.19±0.03 ^c	0.40±0.01 ^a	0.39±0.07 ^a	1.45±0.24 ^b	2.48±0.23 ^a	1.95±0.34 ^a
G7	27.04±10.2 ^b	25.91±4.31 ^b	26±0.33 ^b	0.40±0.09 ^a	0.41±0.06 ^a	0.42±0.08 ^a	2.65±0.12 ^a	2.83±0.06 ^a	1.97±0.18 ^a

G1: Control; G2: 1/2LC₅₀ Pb; G3: 1/4LC₅₀ Pb; G4: 1/2LC₅₀+C; G5: 1/4LC₅₀+C; G6: 1/2LC₅₀+F and G7: 1/4LC₅₀+F (Pb: lead, C: Carob and F: Fig). Means within the same column carrying different superscripts were significantly different at P < 0.05.

Table 4: Body weight gain (g), specific growth rate (%) and mortality % of *Oreochromis niloticus* exposed to two doses of lead acetate and fed on a diet enriched with carob or fig ether extract for 90 days (n = 4)

Group	Initial weight (g/fish)	Final weight (g/fish)	Body weight gain (g/fish)	Specific growth rate (% day)	Mortality %
G1	29.8±11.1 ^a	47.5±04.01 ^a	17.7±2.30 ^a	1.3±0.08 ^a	10%
G2	31.7±10.31 ^a	43.0±06.1 ^b	11.3±4.01 ^d	0.84±0.05 ^d	50%
G3	30.8±13.22 ^a	43.6±04.1 ^b	12.8±3.33 ^c	0.95±0.05 ^c	45%
G4	31.8±11.01 ^a	46.7±04.05 ^a	14.9±3.01 ^a	1.1±0.05 ^a	40%
G5	29.6±9.11 ^a	47.4±5.05 ^a	17.8±04.57 ^a	1.3±0.09 ^a	30%
G6	29.4±10.13 ^a	43.9±06.33 ^a	14.5±02.72 ^a	1.1±0.06 ^a	10%
G7	29.9±9.55 ^a	44.2±07.1 ^a	14.3±01.6 ^a	1.1±0.05 ^a	10%

G1: Control; G2: 1/2LC₅₀ Pb; G3: 1/4LC₅₀ Pb; G4: 1/2LC₅₀+C; G5: 1/4LC₅₀+C; G6: 1/2LC₅₀+F and G7: 1/4LC₅₀+F(Pb: lead, C: Carob and F: Fig). Means within the same column carrying different superscripts were significantly different at P < 0.05.

Discussion

Phytochemicals in the form of herbal medicine play an important role in treatment of infectious fish diseases, enhancing fish health and food safety and quality while conserving aquatic environment and considered a promising source for therapeutics in fish culture [21]. Our study in *O. niloticus* fed diet enriched with carob or fig at 600 mg/kg diet and exposed to 1/2 and 1/4 96h LC₅₀ of Pb for 90 days showed an improvement in some hematological parameters, glucose level, albumin, total protein, growth parameters and mortality %.

Hematological parameters

The present study on *O. niloticus* of the second and third groups showed a significant decrease in erythrocyte count, hemoglobin content and PCV after the 30, 60 and 90 days of exposure. The reduction of these parameters might be attributable to the destruction of mature RBCs and inhibition of erythrocyte production as a result of reducing the haem synthesis that affected by pollutants [22] and the haematopathology or acute hemolytic crisis that resulted in severe anemia in most vertebrates including fish species when exposed to different environmental pollutants [23]. The current results were in agreement with Mahmoud *et al.* [24] who stated that lead (Pb) toxicity on fish caused significantly decline in hemoglobin content, RBCs count and PCV. Results of this study clearly showed an improvement in activities of erythrocyte count, hemoglobin content and PCV in fish exposed to 1/2 and 1/4 96h LC₅₀ of Pb and fed diet supplemented with 600 mg of carob /kg diet after 30, 60 and 90 days of exposure. Moreover, showed an improvement in activities of erythrocyte count, hemoglobin content and PCV in fish exposed to 1/4 96h LC₅₀ of Pb and fed diet supplemented with 600 mg of fig /kg diet after 60 days of exposure only. The current study was comparable with Carolina and Mestrado [25] who reported that carob meal contains flavonoids and 45 to 50% protein similar to soybean meal to meagre fish diets with graded levels augmented the RBCs counts. Our study supported by the study of Nebedum *et al.* [10] who investigated the effect of the ethanolic extracts of *Ficus carica* on albino rats that received a daily extract dose

of 200 mg/kg for 14 days. They detected an increase in the hemoglobin content, RBCs count and PCV compared with the control group. These results justified the ethnobotanical use of fig as blood building herbs due to the presence of huge amounts of flavonoids, protein and small amounts of iron.

Biochemical parameters

This study revealed a significant increase in plasma glucose level in *O. niloticus* of the second and third group after 30, 60 and 90 days of exposure. This increase may be resulted from an increase in plasma catecholamine and corticosteroid hormones [26,27]. Moreover, the stress caused by Pb led to hypersecretion of adrenaline, which stimulated the breakdown of glycogen to glucose [27,28]. Results of this study clearly showed an improvement in plasma glucose in *O. niloticus* exposed to lead 1/2 and 1/4 96 h LC₅₀ and fed diet enriched with carob or fig ether extract 600 mg/kg diet after 30, 60 and 90 days of exposure. The present study supported by Mokhtari *et al.* [11] who stated that ether extract of carob (*Ceratonia siliqua*) caused a decline in blood glucose level of diabetic male rats. Perez *et al.* [29] mentioned that the extract of *Ficus carica* has an obvious hypoglycemic activity in oral diabetic rats. The presence of fiber, phytosterols and tocopherol in the extract of carob and fig probably cause reduction in blood glucose level and stimulated the pancreatic beta cells to secrete more insulin in blood circulation.

The liver synthesizes not only the protein but also produces serum albumin the most important one. In this study, *O. niloticus* of the second and third group showed a significant decrease in plasma albumin and total protein after 30, 60 and 90 days of exposure. This is a damage marker for hepatic cells and synthetic function of liver cell. The current reduction resulted from deleterious effect of the toxin on the hepatic synthesis of these proteins. This study supported by Elgaml *et al.* [30] who found decrease in the levels of the total protein, Ca, P and Mg due to hepatic toxicity of lead acetate in *O. niloticus*. Mahmoud *et al.* [24] who reported that lead toxicity on fish exposed for 15 and 30 days significantly caused a decline in serum total protein and albumin. Results of this study clearly showed

an improvement in plasma albumin and total protein in *O. niloticus* exposed to 1/2 and 1/4 96h LC₅₀ of Pb and fed a diet enriched with carob or fig ether extract 600 mg/kg diet after 60 and 90 days of exposure.

Growth parameters and mortality (%)

In this study, *O. niloticus* of the second and third groups revealed a significant decrease in body weight gain after 90 days of exposure. This decrease may be attributed to reduction of food intake, poor food conversion efficiency and inhibition of digestive enzymes. Similarly, lead exposure at all concentrations reduced body weight gain in fish [31]. The current results clearly showed an improvement in body weight gain of *O. niloticus* exposed to 1/2 and 1/4 96h LC₅₀ of Pb and fed diet enriched with carob or fig extract 600 mg/kg diet when compared with the control group after 90 days. *O. niloticus* in the groups 2 and 3 showed a significant decrease in specific growth rate after 90 days of exposure. Very low concentrations of heavy metals like lead caused an effect on growth of fresh water fish meant for human consumption [32]. *O. niloticus* in this study that exposed to 1/2 and 1/4 96h LC₅₀ of Pb and fed diet enriched with carob or fig extract 600 mg/kg diet revealed an improvement of specific growth rate. The improvement in growth parameters may be due to the presence of fiber in carob and fig extract which improved the feed digestion and stimulated the digestive enzymes that reduced by lead toxicity.

The mortality % in this study decreased in *O. niloticus* exposed to 1/2 and 1/4 96h LC₅₀ of Pb and fed diet enriched with carob or fig extract 600 mg/kg diet for 90 days. Carolina and Mestrado [24] found no mortality as a result of adding the carob meal which provided about 45 - 50% of protein similar to soybean meal to meagre fish diets with graded levels during the course of the study, which attributable to the hepatoprotective, hypoglycemic and ethnobotanical effect of those extracts.

Conclusion

The results of this study supported the idea that carob (*Ceratonia siliqua*) pods and fig (*Ficus carica*) fruits ether extracts have possible positive impact against lead toxicity

in Nile tilapia (*Oreochromis niloticus*). Summing up our observation, carob (*Ceratonia siliqua*) improved hematological parameters, keep the protein synthetic function of liver and improved growth performance. While, fig (*Ficus Carica*) improved growth performance and decreased the mortality %. Therefore, our study recommended addition of carob and fig ether extracts to fish diet as herbal medicine to keep and improve their physiological processes.

Conflict of interest

The authors have no conflict of interest to declare.

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الملخص العربي

تأثير الخلاصة الكحولية لقرون الخروب وثمره التين البرشومي ضد التغيرات الدمويه والبيوكيميائيه المحدثه بخلات الرصاص في اسماك البلطي النيلي

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تهدف الدراسة الحالية الي التعرف على تأثير المستخلص الكحولي لقرون الخروب وثمره التين البرشومي بجرعة 600 مجم / كجم في عليقه ضد جرعتين من التسمم بالرصاص على قياسات الدم، البروتين الكلي، الألبومين ، الجلوكوز ، قياسات النمو ، معدل النفوق في اسماك البلطي النيلي. مائة وأربعين من اسماك البلطي النيلي تم تركها لمدة أسبوعين لتتأقلم قبل بدء التجربة ثم تم تقسيمها إلى سبعة مجموعات كل مجموعة تحتوي على اثنين من الاحواض الزجاجية يحتوي كلا منهما على 10 اسماك. تم ترك المجموعة الأولى بدون معاملات (مجموعة ضابطة) بينما المجموعة الثانية والثالثة من الأسماك تعرضت ل 2/1 (77.5 مجم/لتر) و 4/1 (38.7 مجم/لتر) الجرعة النصف المميته من خلات الرصاص لمدة 90 يوما وتم تغذيتها بالعليقة بدون اضافات. أما المجموعتين الرابعة والخامسة فقد تعرضتا الي 77.5 مجم/لتر (2/1 الجرعة المميته) ، 38.7 مجم/لتر (4/1 الجرعة المميته) من الرصاص على التوالي مع إضافة 600 مجم من مستخلص الخروب لكل كجم من العليقة. وقد تم معاملة المجموعتين السابعة والثامنة بنصف وربع الجرعة النصف مميته من الرصاص مع 600 مجم من التين البرشومي لكل كجم من العليقة. وكانت النتائج أن اسماك البلطي النيلي التي تغذت على عليقه خاليه من المستخلصين والمعرضتين لخلات الرصاص بنصف وربع الجرعة نصف المميته لمدة ثلاثين و ستين وتسعين يوما اظهرت انخفاضاً معنوياً في قياسات النمو وقياسات الدم والقياسات البيوكيميائية بينما زادت قياسات كلا من الجلوكوز في الدم ومعدل النفوق. بينما اسماك البلطي النيلي التي تغذت على عليقه مدعمه بمستخلص الخروب أو التين بجرعة 600 مجم / كجم والمعرض لخلات الرصاص بنصف وربع الجرعة نصف المميته لمدة ثلاثين و ستين وتسعين يوما اظهرت تحسناً في الألبومين ، البروتين الكلي وبعض قياسات الدم مثل عدد كرات الدم والهيموجلوبين وحجم الخلايا الدمويه ، معايير النمو وانخفاض مستوى الجلوكوز ونسبة النفوق. ونخلص من هذا البحث الي اهمية استخدام خلاصة الخروب والتين البرشومي في الوقاية من التسمم بخلات الرصاص في البلطي النيلي.