EFFECT OF WATER SOLUIBLE FRACTION (WSF) OF CRUDE OIL ON SOME BIOCHEMICAL CHARACTERS OF JUVENILES COMMON CARP, *Cyprinus carpio* L.

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ABSTRACT

This study was carried out juveniles common carp, *Cyprinus carpio* to determined the effect of (WSF) of crude oil on blood glucose and hemoglobin of blood values and glycogen of liver and muscles exposed to sub lethal effects for using different concentration. Study showed lower levels of blood hemoglobin and glycogen of liver and muscles, while blood glucose values have risen when exposed to concentrations of crude oil used.

INTRODUCTION

Crude oil, a complex mixture of hydrocarbons, is constantly present in aquatic environment in varying amount and below threshold level upon species but increase levels of crude oil in aquatic ecosystem of industrialized area (1 , 2).

Petroleum hydrocarbons which entered to the aquatic environment from various sources and is transmitted to the different fish tissues through the water from gills or the food chain. Petroleum hydrocarbons can act as a mediator in free radical generation in fish.

It has been reported that the uptake and translocation of crude oil compounds in fish might be through the gills, the gut or the intestinal walls (3) where the parent compounds solublize in the cell membrane and are carried via the erythrocytes to the general circulation of the blood.

Environmental and physiological factors are known to affect many parameters in the blood. Exposure to different concentrations of crude oil caused various physiological, behavioral, biochemical response, hematological in fish (4 , 5) and sometimes leading to large scale mortality. Larval and juvenile stages of herring exposed to hydrocarbons also show genetic damage as well as histopathological and morphological effects (6). Some studies have also shown structural damage to organs and tissues related to the exposure of fish to petroleum derivatives. The fraction of oil that is most bioavailability to marine biota such as

teleosts is the dissolved hydrocarbons, which include the polycyclic aromatic hydrocarbons (PAHs).

(7) showed that an immunotoxicity and carcinogenicity are both hallmarks of PAH toxicity in teleosts. Moreover, individual PAHs have distinct and specific developmental consequences when fish are exposed at early life-history stages. Hematological and histopathological changes in fish exposed to pollutants have been proposed and used as sensitive biomarkers for assessing the effects of several environmental contaminants, including petroleum hydrocarbons (8). An extensive literature such as (9 ,10 ,11) concerning the acute toxicity of oil and its components exists for various teleosts species. The multifaceted acute and chronic toxicities presented by organisms exposed to petroleum hydrocarbons are a unique challenge in assessing sub lethal toxicity with performance indicators that rely on the optimum functioning and integration of several key physiological systems, any or all of which may be targets for toxicity (10). The aim of this study was to determine the effect of WSF of crude oil on some biochemical composition exposed to sub lethal effects.

MATERIALS AND METHODS

Common carp *Cyprinus carpio* juveniles were collected by cast net from Marine Science Centre ponds belongs to the University of Basrah-Iraq during May 2008. The specimens were nearly uniform in weight at 25.0 ± 1.9 gm, and placed in a glass tank capacity of 40 liters for period of 7 days for adaptation, and 10 fish at each tank. Three volumes (200, 400 and 600) ml of regular Basrah crude oil were added to 20 liters of tap water for each concentration. The solutions were mixed by the shaker for 24 hours at speed of 230 rpm. Solutions were left to settle for 2 hours. Three concentrations of water soluble fractions (WSF) for 10 fish exposure were taken in triplicate and analyzed, according to the method described by (12). Glycogen content in liver and muscles was determined according to the (13). Blood glucose analysis was carried out according to the method described by (14), while the most accurate method of determining blood hemoglobin content was Drabkin's method (15).

RESULTS AND DISCUSSION

(16) observed that petroleum pollution could range from diffused chronic exposure to considerably large single doses. These sub-lethal concentrations may not necessarily lead to outright mortality but may have significant effects which can lead to physiological stress and dysfunctions in animals (17). Hematological parameters are very sensitive to WSF of crude oil.

Table (1 , 2) showed the results of liver and muscle glycogen content after exposure to different concentrations of WSF of crude oil. The lower values of glycogen content were recorded with high concentration of WSF of crude oil (600 ml) during 72 hours 0.41 mg/g in liver and 0.033 mg/g in muscles. While the higher values of its content were recorded with low concentration of WSF of crude oil (200 ml) during 48 hours 0.76 mg/g in liver and 0.062 mg/g in muscles.

A negative correlation appeared with the liver and muscles glycogen in fish when exposed to different concentrations of crude oil used (9, 18).

Exposing fish to crude oil, in the present work, induced depletion of general carbohydrate contents of the intestinal epithelium. Similarly, glycogen and lipid depletion has been reported in *Fundulus heteroclitus* collected near an oil spill (19).

The significantly dose-dependent reduction in the muscle and liver glycogen contents of the catfish *clarias garieoinus* exposed to the WSF of petrol indicated that metabolism of carbohydrates was impaired, fish usually increase their metabolic rates to metabolize and excrete aromatic hydrocarbons to allocate greater amount of energy to homeostatic maintenance than its storage, leading to a reduction in stored energy food reserves (11).

The effect of different concentrations of WSF of crude oil on blood glucose was obtained in Table 3. The higher values of blood glucose were found with high concentration of WSF of crude oil (600 ml) during 72 hours 31.05 mg/100 cm^3 of blood, while the lower values of blood glucose were recorded with low concentration of WSF of crude oil (200 ml) during 48 hours 22.09 mg/100 cm^3 of blood.

(5) showed that the reason of the increase in blood glucose content in flounder fishes *Pleuronectes flesus* after the exposure to 50 % of WSF of crude oil was to the stress of this species, also he obtained that the reason of the decrease in blood hemoglobin after the impact of petroleum compounds was due to the damage of gills and anemia (breaking of red blood cells).

Studies have shown that oil pollution affects the increase in blood glucose and decrease in blood hemoglobin (20, 21, 22). The decreasing in values of liver and muscle's glycogen and the increasing in blood glucose values agree with both (9) who studied on tilapia fish *Oreochromis niloticus* and (2) on *Carassius auratus*.

Table 4 showed the effect of different concentrations of WSF of crude oil on blood hemoglobin. The value 0f blood hemoglobin was decreased with high concentration of WSF of crude oil (600 ml) during 72 hours (3.93 gm/100 cm^3 of blood), while it was increased with low concentration of WSF of crude oil (200 ml) during 48 hours (6.52 gm/100 cm^3 of blood).

The observed linear reduction in hemoglobin, demonstrate and suggest an anemic condition in the crude oil treated fishes. The toxic components especially those in crude oil change blood chemistry and induce anaemia by causing bone marrow hypoplasia and interfered with platelet production in the animals, hence the reduced values (23).

The degree of ecosystem contamination by toxic organic chemicals can be estimated by the analysis of biochemical changes. From the results of this study, it is hereby suggested that crude oil is an environmental stressor which causes damage to hematological parameters in fishes.

Table 1. Liver glycogen in *C. carpio* juveniles after the exposure to different concentrations of crude oil.

Volumes of crude oil in Tank (ml)	Conc. of Dissolved Hydrocarbons in Tank (µg / l)	Liver glycogen values (mg/g)		
		Control	48 hours	72 hours
Control	5.63 ± 0.40	0.80 ± 0.006	0.78 ± 0.020	0.78 ± 0.010
200	5590.90 ± 4.30	-	0.76 ± 0. 009	0.71 ± 0. 040
400	7975.70 ± 12.30	-	0.72 ± 0.010	0.63 ± 0. 030
600	11035.60 ± 20.20	-	0.65 ± 0.010	0.41 ± 0. 090

Table 2. Muscles glycogen in *C. carpio* juveniles after the exposure to different concentrations of crude oil.

Volumes of crude oil in Tank (ml)	Conc. of Dissolved Hydrocarbons in Tank (µg / l)	Muscles glycogen values (mg/g)		
		Control	48 hours	72 hours
Control	5.63 ± 0.40	0. 07 ± 0. 001	0.070 ± 0.003	0.068 ± 0.004
200	5590.90 ± 4.30	-	0.062 ± 0.003	0.058 ± 0.008
400	7975.70 ± 12.30	-	0.060 ± 0.002	0.052 ± 0.010
600	11035.60 ± 20.20	-	0.055 ± 0.005	0.033 ± 0.008

Table 3. Blood glucose in *C. carpio* juveniles after the exposure to different concentrations of crude oil.

Volumes of crude oil in Tank (ml)	Conc. of Dissolved Hydrocarbons in Tank (µg / l)	Blood glucose values (mg/100 cm^3 Blood)		
		Control	48 hours	72 hours
Control	5.63 ± 0.40	22.50 ± 1.81	22.16 ± 0.98	21.96 ± 1.20
200	5590.90 ± 4.30	-	22.09 ± 0.66	24.26 ± 1.02
400	7975.70 ± 12.30	-	23.21 ± 1.20	28.10 ± 0.09
600	11035.60 ± 20.20	-	27.92 ± 1.26	31.05 ± 1.41

Table 4. Blood hemoglobin in *C. carpio* juveniles after the exposure to different concentrations of crude oil.

Volumes of crude oil in Tank (ml)	Conc. of Dissolved Hydrocarbons in Tank (µg / l)	Blood hemoglobin values (gm/100 cm^3 Blood)		
		Control	48 hours	72 hours
Control	5.63 ± 0.40	7.96 ± 0.29	7.68 ± 0.13	7.77 ± 0.17
200	5590.90 ± 4.30	-	6.52 ± 0.31	6.11 ± 0.25
400	7975.70 ± 12.30	-	4.44 ± 0.11	4.63 ± 0.11
600	11035.60 ± 20.20	-	4.12 ± 0. 09	3.93 ± 0. 08

تأثير الجزء الذائب بالماء من النفط الخام على بعض الصفات الكيموحيوية ليافعات أسماك الكارب الاعتيادي *Cyprinus carpio*, L.

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الخلاصة

أجريت هذه الدراسة على يافعات أسماك الكارب الاعتيادي *Cyprinus carpio* لغرض معرفة تأثير الجزء الذائب بالماء من النفط الخام على قيم كلوكوز وهيموغلوبين الدم وكلايكوجين الكبد والعضلات عند تعرض الأسماك لتأثيرات تحت مميتة وباستعمال تراكيز مختلفة. أظهرت الدراسة انخفاض في قيم هيموغلوبين الدم وكلايكوجين الكبد والعضلات، في حين ارتفعت قيم كلوكوز الدم عند تعرضها لتراكيز النفط الخام المستخدمة.

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