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Full Length Research Paper

Histopathological responses of the intestinal tissue of lignose emperor "*Lethrinus elongates"* to crude oil exposure

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The histological effect of crude petroleum oil on the intestine of lignose emperor "*Lethrinus elongates"* was investigated. Exposing fish to 50 and 100 p.p.m of crude oil induced many histopathological alterations. The epithelium of the mucosal folds showed marked discontinuity with many eroded tips and the cell boundaries were ill-defined. The muscular layer exhibited severe fragmentation and degeneration. Moreover, the general mucosal epithelial layer showed apparent decrease in the treated fish. It is speculated that one or more of the crude oil hydrocarbons are responsible for the observed histopathological effects.

Keywords: Crude oil- Histopathological effects- Intestinal tissues- Lignose emperor

INTRODUCTION

The effects of crude oil on aquatic organisms have increased in recent years due to the incidence of accidental oil spills. The toxicity of crude oil or refined petroleum to fishes has received much attention by many investigators. Mitrovic (1972) found that oil and oil products at 0.001 ml /L accelerated the death of the fishes *Sargus annularis; Crenilabus tinca* and *Mugil saliens*. Anderson, et al. (1974) mentioned that the two crude oils, a Bunker C oil and No.2 feul oil were toxic to *Cyprindon variegatus, Fundulus similus* and *Menidia beryllina.* Ghatak and Konar (1990) reported that the petroleum product n-heptane was toxic to *Tilapia mossambica*. Moreover, oil and oil products in sublethal doses were reported to produce histopathological changes in the organs of different fishes (Vishnevetsku, 1961; Mitrovic, et al., 1968; Mazhar, et al., 1987; Hijji and Saleh , 1994). The present work was aimed to study the effect of crude petroleum oil on the intestinal tissue of lignose emperor "*Lethrinus elongates"*

MATERIAL AND METHODS

The lignose emperor "*Lethrinus elongates"* (300 ±5g each) were obtained from breeding station of fishing farm near Obhor, north Jeddah. They were transported to the laboratory and were kept in especially equipped aquaria which were continuously aerated by air pumps. Fish were provided twice daily with tropical standard commercial fish food. They were acclimated for one week in the aquaria before the beginning of the experiment.

The crude petroleum oil used in this study was taken from Jeddah field Red Sea Station, Saudi Arabia. Fish were divided into 3 groups each containing 25 fish. The first group was exposed to 50 p.p.m crude oil for 10 days while the second group was exposed to 100 p.p.m oil for

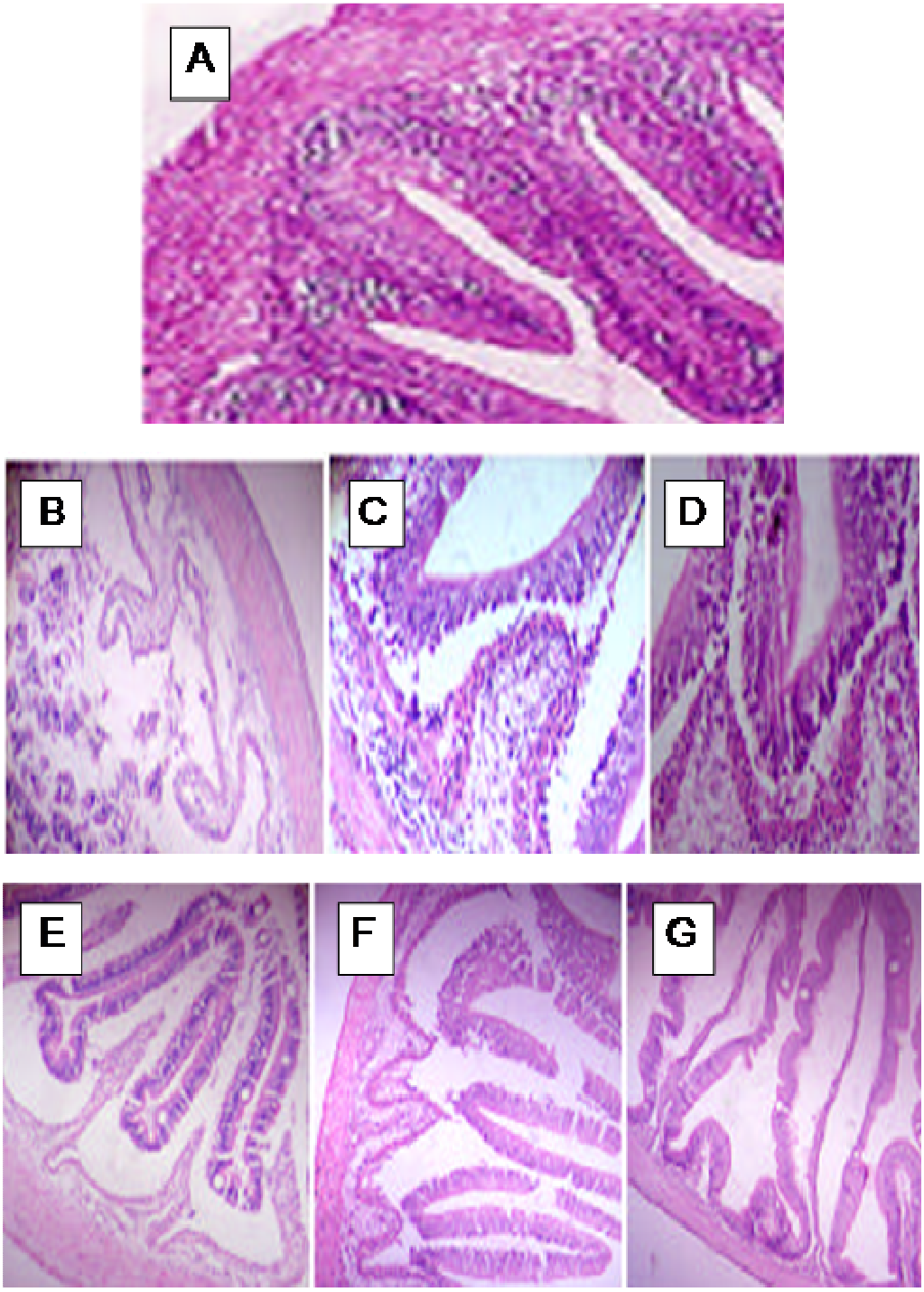

Figure 1. Intestine of control fish showing the normal structure (A), Section of intestine of a fish exposed to 50 p.p.m crude oil showing enlarged mucosal core (B) and degenerated mucosa with eroded tips atrophy in the muscularis (C) with severe degenerative and necrotic changes in the intestinal mucosa and submucosa (D), Section of intestine of a fish exposed to 100 p.p.m crude oil showing large and deteriorated core, broken epithelium and large vacuoles in the muscularis (E), haemorrhage in the submucosa with edema between the intestinal dilation in the blood vessels of serosa (G) X400 (H&E stain).

5 days. The third group was used as control. For histological study, specimens were taken from control and experimental groups and dissected. After dissection, small pieces of the intestine were removed and fixed in

Bruin's fluid. The tissue was then embedded in paraffin wax, sectioned and stained with haematoxylin and eosin.

RESULTS

The normal intestine of *Lethrinus elongates* is a long coiled tube histologically; it consists of two layers, mucosa and muscularis. The mucosa is thrown into numerous folds which protruding into the lumen. The intestinal mucosal epithelium composed of two layer cell types: the columnar cells and goblet cells which are interspersed between the columnar cells. The crypts or glands of Lieberkuhn were not observed. The columnar cells showed a striated apical border with a basophilic cytoplasm and a basal nucleus. At the base of the mucosal folds, an irregular layer of smooth muscle was found surrounding the epithelium and extends into the connective tissue core of the mucosal folds. The muscularis composed of circular and longitudinal muscle fibers followed by the lamina propria layer which contain blood capillaries (Figure1A).

Intestine of treated fish which exposed to 50 p.p.m of crude oil showed certain histopathological changes. The connective tissue core of the mucosal folds became enlarged in comparison with that in the control fish (Figure 1B). The lining epithelium of the mucosal folds has exhibited marked discontinuity with many eroded tips. The cell boundaries were will-defined being almost undetectable in many parts (Figure 1C). Moreover, the muscularis was found to contain large vacuoles separating the circular muscle fibers from the longitudinal one (Figure 1D).

These signs of deterioration appeared to have been more enhanced in fish exposed to 100 p.p.m crude oil. The core of mucosal fold became very large, deteriorated and structureless. The lining epithelium showed distinct signs of destruction. Considerable parts of the epithelium have broken off and the great majority of the mucosal cells were no more having distinct boundaries being mostly replaced by a syncytial structure (1E). The rest of the cells showed clear symptoms of necrosis (Figure 1F). The muscle fibers manifested severe fragmentation degeneration and became highly separated from each other with reduction submucosa with atrophy in the submucosa dilation in the blood vessels of serosa (Figure 1G).

DISCUSSION

The present results revealed that exposing the lignose emperor "*Lethrinus elongates"* to crude oil induced histopathological changes in the intestine. The lining epithelium of the mucosal folds was degenerated with many eroded tips and the muscle fibers became highly separated from each other leaving large vacuoles in the muscularis layer. Similar results were observed in the intestine of *Clarias lazera* exposed to crude oil from Balayim field, Sinai, Egypt (Mazhar, et al., 1987). Anderson et al (1974) reported that naphthalene, a component of many petroleum mixtures, has been shown to induce extensive necrosis of the gut mucosa in marine fishes. Reichenbach- Klinke (1965) studied the effect of low phenol concentration (0.02 to 0.07mg /L) on 14 fish species caught a live in the Rhine and Elbe. He found serious lesions in the gills and inflammatory and destructive changes in the skin, intestine and liver. Several other investigators gave reported histopathological changes in various fish organs exposed to oil and oil derivatives. Hepatic damage, local hematomas and occluded blood vessels were produced in fish exposed to crude oil (Vishnevetsku, 1961). Mitrovic, et al (1968) observed that in subacute poisoning by phenol, a general intoxication of fish organism occurs followed by inflammatory and necrotic changes of vital organs, gills, brain, liver, kidneys, spleen and gonads. Exposing fish *Oreochromis nilotica* to crude oil was found to induce many histopathological changes in the liver and gills (Hijji and Saleh, 1994). Recently, exposing fish *Dicentrarchus labrax* to crude oil was also found to induce many histopathological changes in the liver, kidney and gills (Shaikh Omar, 2012). Exposing fish to crude oil, in the present work, induced disturbance of general intestinal epithelium which may be due to depletion in carbohydrate contents. Similarly, glycogen and lipid depletion has been reported in *Fundulus heteroclitus* collected near an oil spill (Sabo, et al., 1975). Hawkes (1977) observed depletion of glycogen in the liver of rainbow trout that received Prudhoe Bay crude oil in their diets.

In fact, carbohydrate depletion observed in the intestinal epithelium under the effect of crude oil in different fishes is similar to those observed by treating with different pesticides. El-banhawy, et al. (1986) reported a decrease of carbohydrate contents in the ideal epithelial cells of *Clarias lazera* exposed to the insecticide cyolane. The same results were obtained by Sastry and Malik (1979) in the fish *Channa punctatus* exposed to dimecron. Exposure of the catfish *Macrones keletius* to gradual sublethal concentrations of dimethoate induce inhibition of amylase activity in the intestine (Hameed and Vadamali , 1986). Asztalos, et al. (1990) showed that treatment with copper sulphate, paraquate and methidation caused tissue damage and stress in fish *Cyprinus carpio* indicated by the increase of LDH and GOT enzyme activity and elevated blood sugar level. It is well known that the effect of crude oil on marine life is attributed to the presence of hydrocarbons (Blumer, 1969). In the present work, it is speculated that one or more hydracarbons or its metabolites may responsible for the histopathological effects recorded in the intestine of the lignose emperor "*Lethrinus elongates"*

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