

EFFECT OF SUBLETHAL CONCENTRATION OF SHEA BUTTER EFFLUENT ON THE ARCHITECTURAL LAYOUT OF SELECTED ORGANS OF *CLARIAS GARIEPINUS*

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ABSTRACT

Post Juvenile African catfish (*Clarias gariepinus*) were exposed to sublethal concentrations of shea butter effluent (0.003, 0.005, 0.007, 0.009 and 0.011 ppt) for 96 hours (acute) and 14 days (chronic). Control fish were maintained for the same periods in clean water devoid of shea butter effluent. Liver, Gill, Heart, Kidney and muscle samples from 3 fish were prepared for histological analysis and examined for alterations. Alterations in the Liver, Gill, Heart, Kidney and muscle of fish exposed to shea butter effluent were semi-quantitatively ranked based on the severity of tissue lesions and comparisons were made with fish in the control groups. Fish of the control groups exhibited functionally normal Liver, Gill, Heart, Kidney and muscle. Histopathology of the organs; Liver, Gill, Heart, Kidney and muscle after 14 days exposure revealed; congestion of central vein of varying degrees and distortion of hepatocytes in liver, inflamed and degenerated renal corpuscles in kidney, poor and degenerated gill filaments, distorted, irregular and fragmented muscle fibres coupled with distorted muscle fibres, irregular interfibre spaces and areas of inflammatory changes in the heart.

KEYWORDS: *Clarias gariepinus*, Shea Butter Effluent, Acclimatization of Fish

INTRODUCTION

Aquatic ecosystems are major recipients of pollutants, which, over time, can have serious consequences for the biota that might not become apparent until changes occur at the population or ecosystem level, a point at which it may be too late to take effective countermeasures (Khallaf et al., 2010). The contamination of fresh water with a wide range of pollutants has become a matter of great concern over the last few decades, not only because of the threats to public water supplies but also the damages caused to the aquatic life (Candi and Kalay, 1998).

The need to detect and assess the impact of pollutants, particularly at low, sub lethal concentrations, on environmental quality had led to development of a range of biological responses measured in number of different species (Fent, 2004; Linde-Arias et al., 2008).

Fish are generally considered to be the most feasible organisms for pollution monitoring in aquatic systems. Fish can be found virtually everywhere in the aquatic environment and they play a major ecological role in aquatic food-webs because of their function as carrier of energy from lower to higher trophic levels (Linde-Arias et al., 2008; Van-der Oost et al., 2003). Fish live in the closest possible contact with their environment, are extremely dependent upon it and are affected by changes in it.

Thus fish could be used as a “warning system” to indicate the presence of pollutants in natural water (Nussey et al., 1995). Prior to death or overt sickness, fish may respond to stress by changing molecular, physiological, histological or behavioral responses. This study was carried out to investigate the effects of shea butter effluent on selected organs (liver, kidney, Heart, gill and muscle) of *Clarias gariepinus* at different concentrations of the effluent.

METHODOLOGY

Post-juveniles of *C.gariepinus* used in this study were procured from Oyo State Ministry of Agriculture, Fishery Division, Ogbomoso. They were transported in a ventilated and aerated plastic container covered with mesh net to prevent being jumped out. The test organisms were transported to the fish laboratory of Department of Pure and Applied Biology of Ladoke Akintola University of Technology, Ogbomoso, Oyo State.

Acclimatization of Fish

The test organisms were held in 30cmx30cmx60cm plastic container containing non-chlorinated borehole water. The borehole water was dechlorinated prior exposure to fresh air for at least three days before usage. The organisms were fed once a day during acclimatization with pelleted vital fish feed to avoid the inherited problem that could result from starvation. This lasted for fourteen days (14 days). Feeding discontinued twenty four hours prior to the commencement of the experiments.

Five concentrations were used based in the result obtained in range finding test. The concentrations used were prepared arithmetically viz; 0.05, 0.06, 0.07, 0.08 and 0.09. Twenty four hour starved fish were exposed to each of the concentrations of for 96 hrs.

The behaviour and general conditions of the fish were observed before, during and after the experiment.

Sub Lethal Tests

Fish utilized for the sub lethal tests were subjected to similar experimental conditions but fed once daily in weighing 5% of their body weight and monitored for 2weeks. After two weeks fish were sacrificed and dissected, selected organs; liver, gill, kidney, heart and tissues were removed from eachs concentration, they were then washed in saline water, fixed with 10% formalin for 24 hours. The washed tissues were dehydrated through a series of graded alcohol, cleared in xylene, infiltrated with paraffin in a vacuum oven at 56⁰C and embedded in 40% paraffin wax for 5 hours (Luna, 1968).The embedded samples were sectioned to 5mm thickness, mounted on slides with neutral Canada balsam, stained with haematoxylin and eosin for 5 minutes (Anon, 1969) and examined under a microscope at x200 and x400 magnifications in order to describe the normal histological structures, appearance, arrangement and their physiological conditions. The photomicrographic impressions of the slides for each tissue at 0.003, 0.005,, 0.007, 0.009, 0..011 water taken.

RESULTS AND DISCUSSIONS

The histological alterations in the liver, kidney, Heart, gill and muscle *C. gariepinus* atsublethal concentrations is shown figures 1 to 25

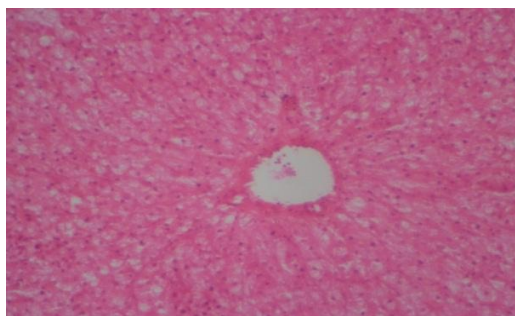


Figure 1: Photomicrograph of the Liver Showing Well Preserved Architecture of Liver Cells (Control) with No Areas of Inflammatory Changes

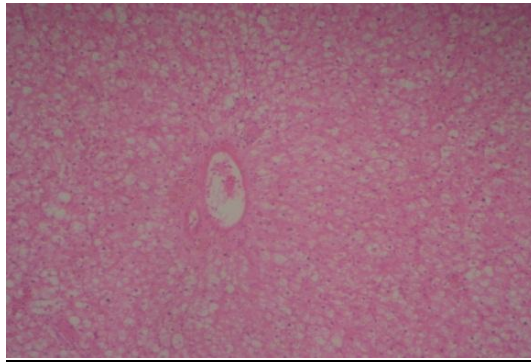


Figure 2: Photomicrograph of the Liver Showing Mild Congestion of Central Vein when Compare with the Control

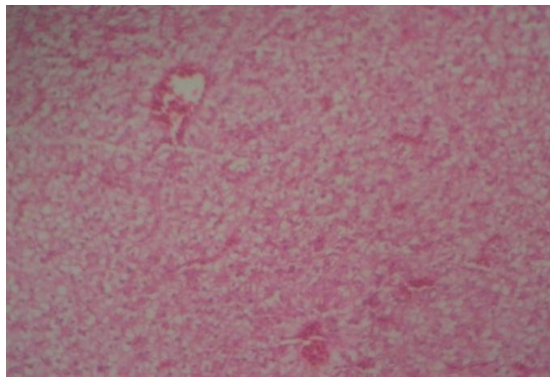


Figure 3: Photomicrograph of the Liver Showing Pronounced Distortion of Hepatocytes Architecture when Compare with the Control

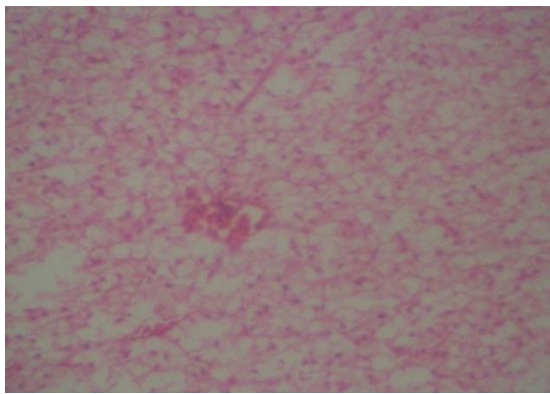


Figure 4: Photomicrograph of the Liver Showing Pronounced Distortion of Liver Hepatocytes Architecture with Highly Congested Central Vein when Compare with Control

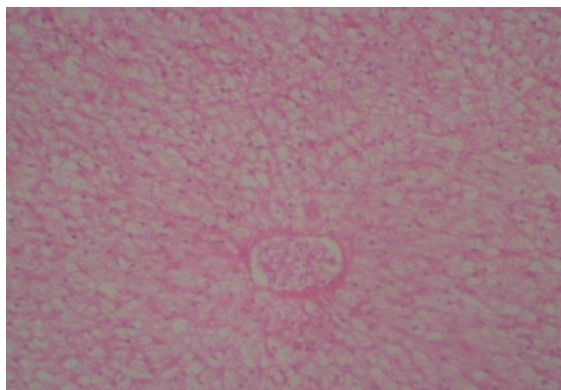


Figure 5: Photomicrograph of the Liver Showing Pronounced Distortion of Hepatocytes Architecture with Wider and Highly Congested Central Vein when Compare with Control

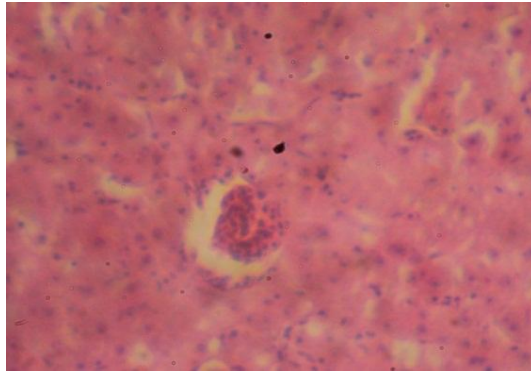


Figure 6: Photomicrograph of the Kidney Showing Well Preserved Architecture of the Renal Corpuscle with a Wide Bowman's Space. (Control)

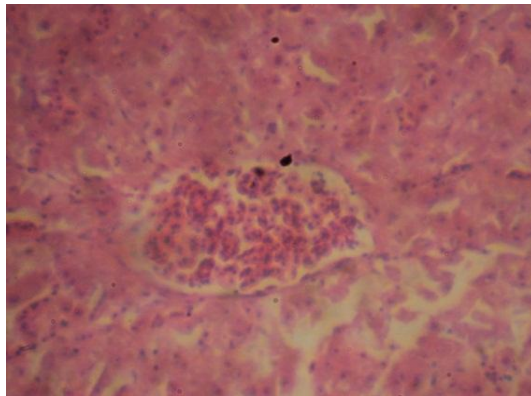


Figure 7: Photomicrograph of the Kidney Showing Inflamed Renal Corpuscles with Narrow Bowman's Space when Compare with the Control

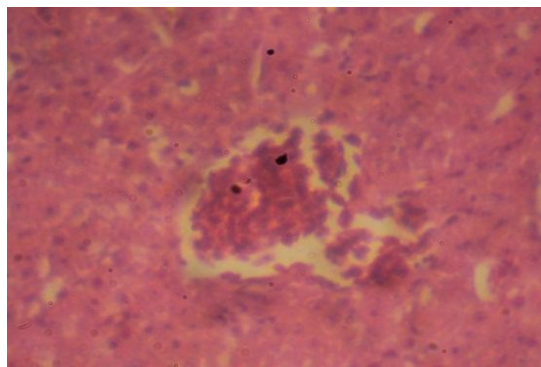


Figure 8: Photomicrograph of the Kidney Showing Degenerated Renal Corpuscles when Compare with the Control

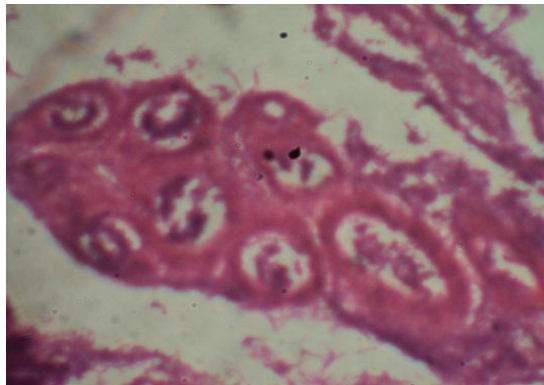


Figure 9: Photomicrograph of the Kidney Showing Group of Degenerated Renal Corpuscles with when Compare with the Control

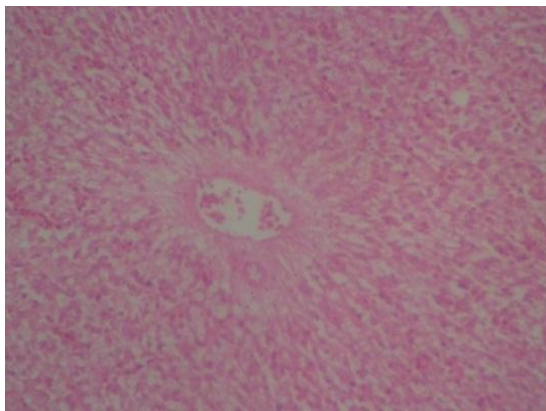


Figure 10: Photomicrograph of the Kidney Showing Completely Degenerated Renal Corpuscles when Compare with the Control

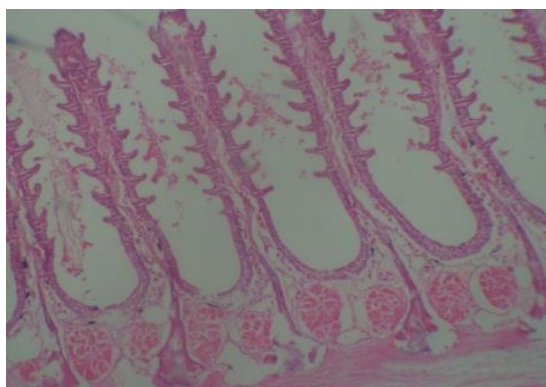


Figure 11: A Photomicrograph of Gill Showing Normal and Well Vascularised Gill Filaments. Gill Filaments Architecture is Well Preserved

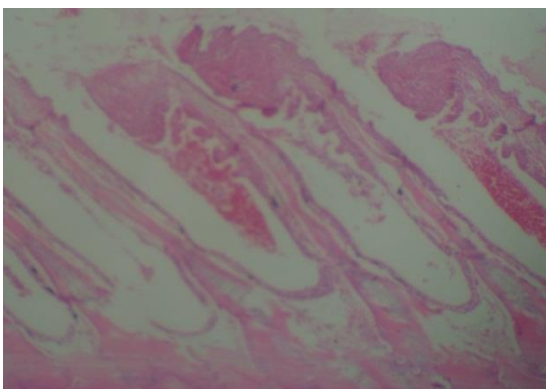


Figure 12: A Photomicrograph of Gill Showing Poorly Vascularised Gill Filaments

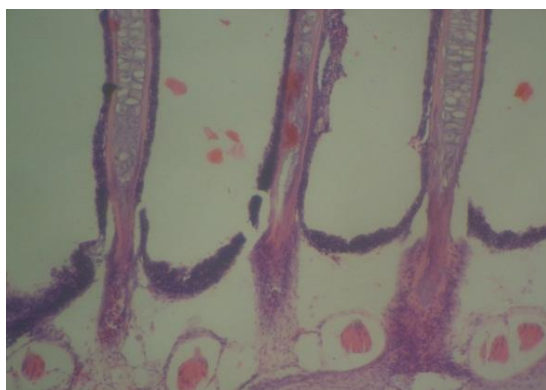


Figure 13: A Photomicrograph of Gill Showing Poorly Vascularised and Gradually degenerating Gill Filaments

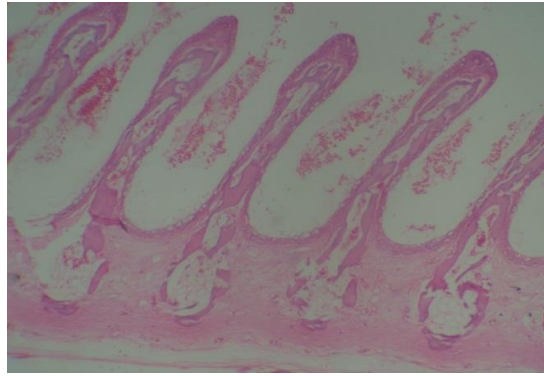


Figure 14: A Photomicrograph of Gill Showing Poorly Vascularised and Distorted Gill Filaments

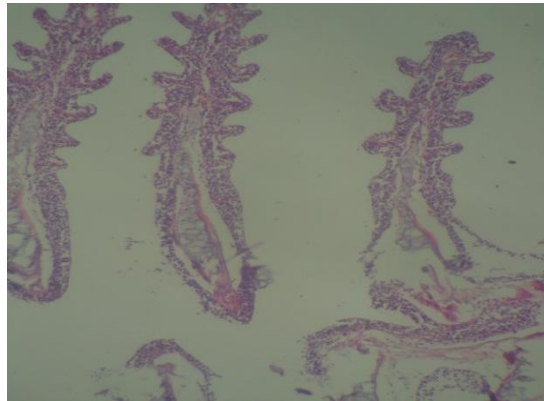


Figure 15: A Photomicrograph of Gill (E) Showing Poorly Vascularised and Grossly Degenerated Gill Filaments

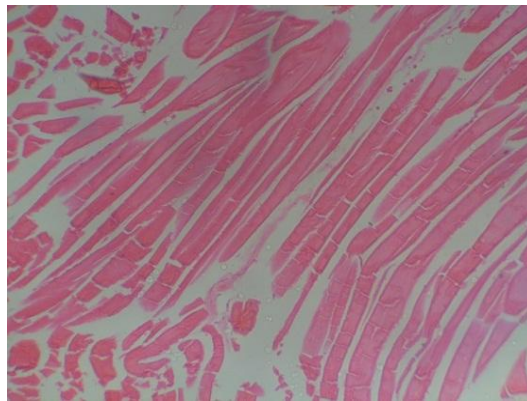


Figure 16: A Photomicrograph Showing Normal Histology of the Muscle Fibres (Control)

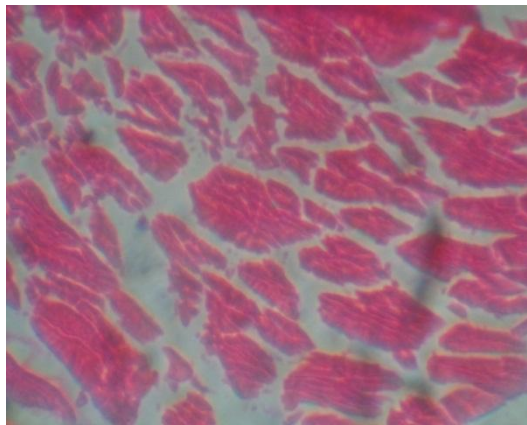


Figure 17: A Photomicrograph Showing Slightly Distorted and Irregular Muscle Fibres

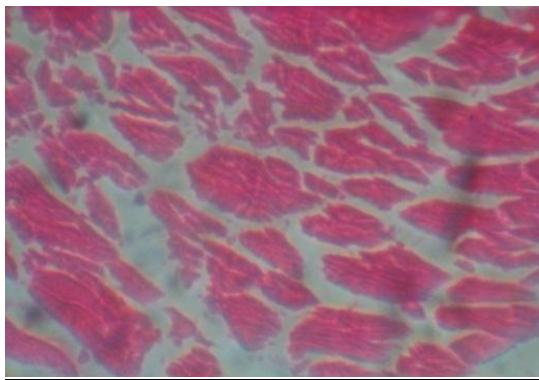


Figure 18: A Photomicrograph Showing Distorted, Irregular and Fragmented Muscle Fibres

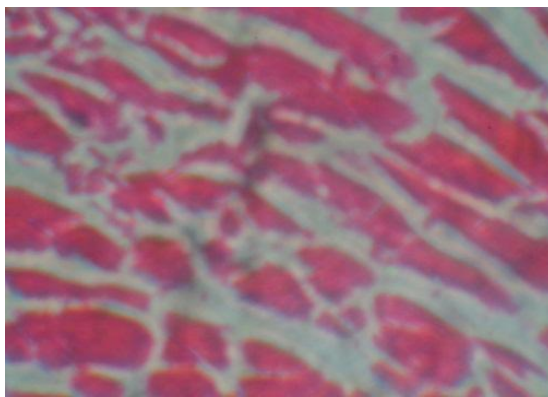


Figure 19: A Photomicrograph Showing Pronounced Distortion of Irregular and Fragmented Muscle Fibres

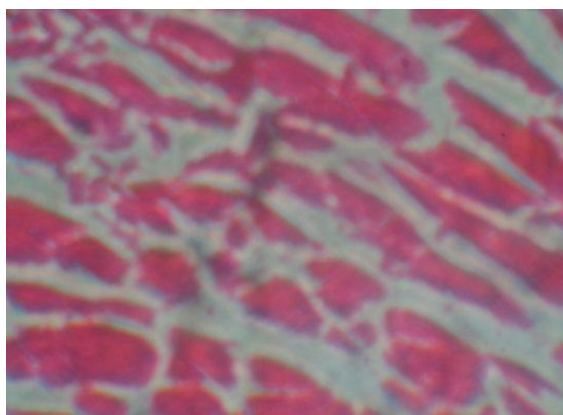


Figure 20: A Photomicrograph Showing Pronounced Distortion and Degeneration of Muscle Fibres

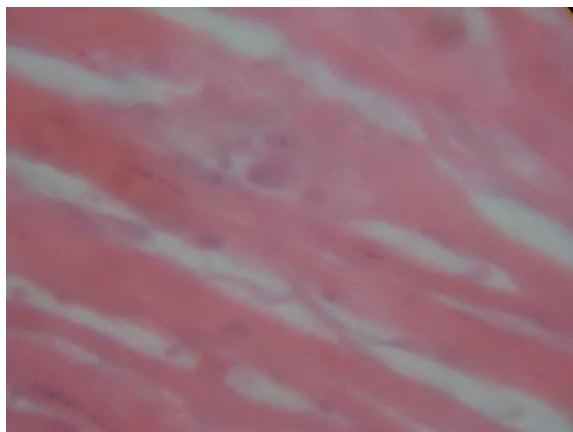


Figure 21: A Photomicrograph of the Heart Showing Normal Histology of the Muscle Fibres

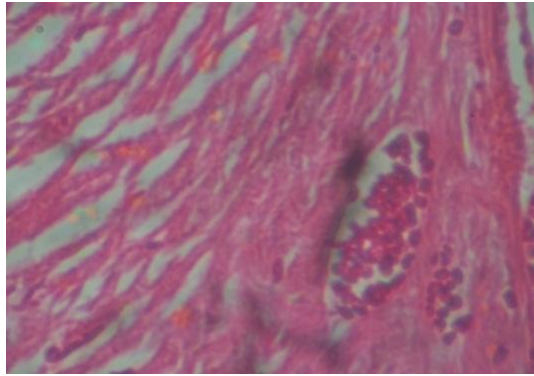


Figure 22: A Photomicrograph of the Heart Showing Distorted Muscle Fibres, Irregular Interfibrous Spaces and Areas of Inflammatory Changes

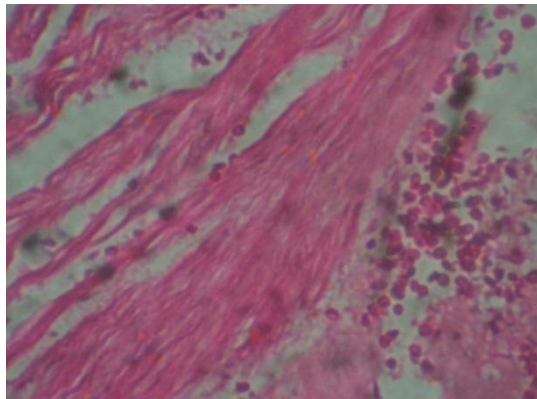


Figure 23: A Photomicrograph of the Heart Showing Distorted Muscle Fibres, with Areas of Inflammatory Changes

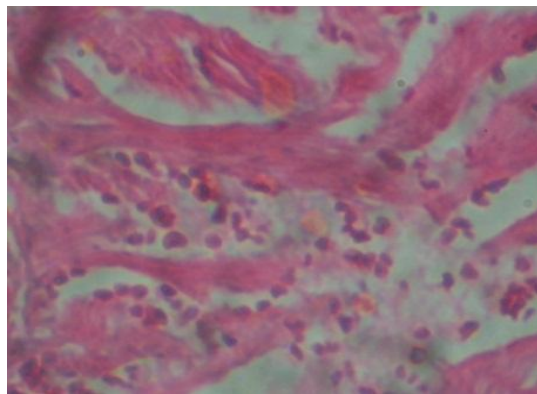


Figure 24: A Photomicrograph of the Heart Showing Distorted Muscle Fibres, with Pronounced Areas of Inflammatory Changes

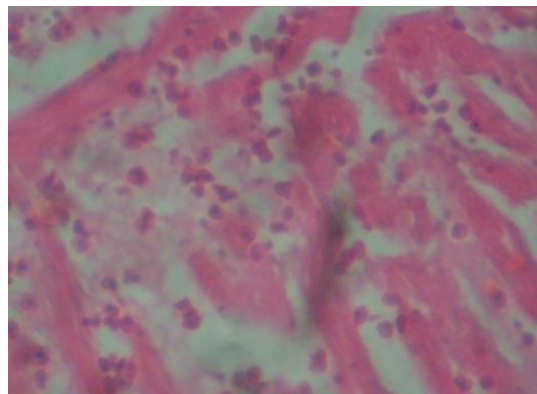


Figure 25: A Photomicrograph of the Heart Showing Grossly Distorted Muscle Fibres with Pronounced Areas of Inflammatory Changes

DISCUSSIONS

In this study histopathological examination revealed absolute degeneration of liver, heart, kidney, gill and muscle as the concentration increases, indicating that the shea butter effluent is highly toxic to the test organisms. This observation corroborate the report of Luna(1968) that the higher the concentration of pollutants the more severe the degree of damages to fish gill and liver tissues. Many studies have reported that the exposure of fish to pollutants (agricultural industrial and sewage) can cause several pathological alterations in different tissues of fish. (Saki and Gabr, 1991; Abo and Amer, 1995; Das and Mukherjee, 2000; Elnemaki and Abuzinadah, 2003; Abbas and Ali, 2004). The liver, as the major organ of metabolism, comes into close contact with xenobiotics absorbed from the environment and liver lesions are often associated with aquatic pollution. Several histopathological alterations were observed in the liver of *Gymnocephalus cernu* collected from Elbe Estuary contaminated by domestic, industrial and agricultural pollutants (Heidemarie and Peters, 1985) *Oreochromis niloticus* collected from the southern region of Lake Manzalah contaminated with domestic, industrial and agricultural pollutants (Mohammed, 2001), Histopathological changes have been reported in the gills of many fish as a result of exposure to different toxicants (Kakuta and Murachi, 1997; Olurin et al., 2006; Camargo and Martinez, 2007; Triebskorn et al., 2008).

Several pathological alterations have been reported in the kidney of *Cyprinus carpio* exposed to sewage (Kakuta and Murachi, 1997), trichlorfon (Veiga et al., 2002) *Latescalcarifer* exposed to cadmium (Thophon et al., 2003). *Channa punctata* exposed to zinc (Gupta and Srivastava, 2006) and *Prochilodus lineatus* caged in Cambé stream, Brazil, polluted by industrial, domestic and agricultural wastes (Camargo and Martinez, 2007).

CONCLUSIONS AND RECOMMENDATION

Investigations into the effects of Shea butter effluent revealed that it is toxic to aquatic organisms and causes histopathological changes in gills, heart, Liver, kidney and muscle. Therefore, indiscriminate discharge of shea butter effluent into water bodies should be vehemently discouraged and the recipient stream and rivers/dam should be maintained to conform to the international standard for water quality.

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