SRYAHWA PUBLICATIONS

Journal of Aquatic Science and Marine Biology
ISSN: 2638-5481 | Volume 5, Issue 1, 2024
https://doi.org/10.22259/2638-5481.0501001

RESEARCH ARTICLE

Assessment of the Toxicity and Histo-Morphological Effects of Clint Car Wash Liquid Soap on African Catfish *(Clarias gariepinus)* Fingerlings

George, U. U[1], Essien-Ibok[2], M. A., Ajayi, O. O[3], Abiaobo, N. O[4], Mbong, E. O[5]

[1]*Department of Fisheries and Aquaculture, Faculty of Agriculture, Akwa Ibom State University, Obio Akpa Campus, Akwa Ibom State, Nigeria.*
[2]*Department of Fisheries and Aquatic Environmental Management, University of Uyo, Nigeria.*
[3]*Department of Pathology, Faculty of Basic Clinical Sciences, University of Uyo, Akwa Ibom State.*
[4]*Department of Zoology, Akwa Ibom State University, Ikot Akpaden, Nigeria.*
[5]*Department of Environmental Biology, School of Science and Technology, Heritage Polytechnic-Eket, Akwa Ibom State, Nigeria.*

Received: 11 April 2024 Accepted: 22 April 2024 Published: 29 April 2024
Corresponding Author: George, U. U, Department of Fisheries and Aquaculture, Faculty of Agriculture, Akwa Ibom State University, Obio Akpa Campus, Akwa Ibom State, Nigeria.

Abstract

The effect of clint car wash liquid soap on the histopathology of the gills of *Clarias gariepinus* fingerling was investigated in the present study. The fish specimens were exposed to graded acute concentrations of the water-soluble fraction of clint liquid soap (0.0, 10.0, 12.0, 14.0, and 16.0 mg/l) for 96 h, during which time-dependent (24 h, 48 h, 72 h, 96 h) lethal concentrations of the toxicant were monitored for mortality, behavioral changes, histopathological changes in the gill of the grouped specimens were evaluated. Based on the findings, the 96-h median lethal concentrations of the water-soluble fraction of clint liquid soap to *C. gariepinus* fingerlings was established to be at 8.0 mg/l representing a log transformed concentration of 0.90 mg/l. The study further indicate that the toxicant affected water quality conditions of the test media in a concentration-dependent manner. Consequently, WSF of clint liquid soap elicited prominent behavioral aberrations (excessive mucus secretion, air gulping, respiratory distress, erratic swimming and vertical erection) and induced histopathological lesions in the gills of *C. gariepinus* fingerlings after 96-h exposure duration. The use of clint car wash liquid soap for washing car should be applied with caution in order to avert catastrophic events in the aquatic ecosystems.

Keywords: Clint Car Wash Liquid Soap, African Catfish, Toxicity, histomorphological Effects, Fingerlings, Aquatic Environment.

1. Introduction

The discharge of carwash effluents containing detergents residues into freshwater ecosystems can lead to adverse effects on aquatic organisms, disrupting the balance of aquatic ecosystems and potentially causing long term harm. *Clarias gariepinus* is a commercially important freshwater fish species in many regions, contributing significantly to aquaculture and local economies. Assessing the toxicity of clints liquid soap on its fingerlings is crucial for safeguarding this economic resource. *C. gariepinus* plays a vital role in maintaining the ecological balance of freshwater ecosystem by controlling pest populations and serving as prey for larger predators. Any decline in its population due to toxic contamination can have cascading effects on the entire ecosystem. Regulatory

Citation: George, U. U, Essien-Ibok, M. A., Ajayi, O. O., *et al* . Assessment of the Toxicity and Histo-Morphological Effects of Clint Car Wash Liquid Soap on African Catfish *(Clarias gariepinus)* Fingerlings. Journal of Aquatic Science and Marine Biology. 2024;5(1): 01-10.

Agencies often set limits on the discharge of pollutants into water bodies to protect aquatic life and human health.

Aquatic ecosystem worldwide faces numerous threats from anthropogenic activities, including pollution from various sources (Ekpo, *et. al*., 2015; George and Atakpa, 2015a, b). Among these, the discharge of carwash liquid soap into water bodies represents a significant but often overlooked contributor to environmental degradation (George, *et. al*., 2015 c). Carwash liquid soaps like many, like many household detergents, contain a mixture of surfactants, solvents, fragrances and other chemical designed to removed dirt and grime from vehicles. While these products are effective at their intended purpose, their indiscriminate use and improper disposal can have detrimental effects on aquatic ecosystems and the organisms within them (George, *et. al*., 2015; George and Effiom, 2017; George and Effiom, 2018).

The impacts of carwash liquid soap on aquatic ecosystem stem from its chemical composition and mode of action. Surfactants, the primary active ingredients in these products, reduce surface tension and facilitate the dispersion of oils and particulate matter (George, *et. al*., 2015). When discharge into water bodies through runoff or drainage, these surfactants can persist in the environment and accumulate over time. This persistence can lead to formation of foam, which interferes with natural processes such as gas exchange and sunlight penetration, affecting the health and productivity of aquatic ecosystems (George, *et. al*., 2015)

Furthermore, the chemicals present in carwash liquid soaps can exert toxic effects on aquatic organisms, ranging from fish and invertebrates to algae and aquatic plants. Surfactants, in particular can disrupt the integrity of cell membranes, interfere with respiratory functions and impair the osmoregulatory mechanisms of aquatic organisms. Additionally, some ingredients found in carwash liquid soaps, such as phosphate and heavy metals, can contribute to eutrophication, algal blooms and bioaccumulation in aquatic food webs, further exacerbating ecological imbalances (George, *et. al*., 2015).

The organisms most vulnerable to the effects of carwash liquid soap in aquatic ecosystems include fish, amphibians and macroinvertebrates. Fish, in particular, are highly sensitive to changes in water quality, as their respiratory systems rely on efficient gas exchange and dissolved oxygen levels (Jonah and George, 2019; Jonah *et. al*., 2019; Jonah *et. al*., 2020; George *et. al*., 2020a, b). Exposure to elevated concentrations of surfactants and other chemicals can lead to physiological stress, reduced growth rates, reproductive abnormalities and even mortality in fish populations.

Similarly, amphibians which often serve as indicators of environmental health due to their permeable skin and semiaquatic lifestyles, can suffer from dermal exposure to carwash liquid soap residues. The absorption of chemicals through their skin can disrupt hormone function, weaken immune defenses, and impair reproductive success in amphibian populations, contributing to population declines and local extinctions (George, *et. al*., 2020a).

Macroinvertebrates, including insects, crustaceans and mollusk play crucial roles in nutrient cycling, organic matter decomposition and food webs within aquatic ecosystems. However, these organisms are also susceptible to the toxic effects of carwash liquid soap, which can impair their locomotion, feeding behaviour and overall fitness (George, *et. al*., 2015). As key components of freshwater food webs, declines in macroinvertebrates populations can have cascading effects on higher trophic levels, including fish and aquatic birds. The effects of carwash liquid soap on aquatic ecosystems and their resident organisms are multifaceted.

Understanding the toxicological impacts of clints liquid soap on *C. gariepinus* fingerlings can inform regulatory measures and ensure compliance with environmental standards. Contaminants present in carwash effluents can bioaccumulate in aquatic organisms and eventually enter the human food chain, posing risks to human health. Assessing the toxicity of clints liquid soap on *C. gariepinus* fingerlings is essential for evaluating potential risks to human consumers.

2. Materials and Methods

2.1 Purchase of Toxicant

Clint liquid soap (carwash) was bought from a supermarket in Uyo metropolis.

2.2 Collection of Test Organism

Fingerling of *Clarias gariepinus* were collected from Akwa Ibom State University fish farm, Obio Akpa Akwa Ibom State, Nigeria located within latitude 5°17′N and 7°27′N, Longitude 7°27′E and 7°58′E.

The climate of the area is tropical and is characterized by distinct wet and dry seasons (George *et.al*., 2023a, b). The vegetation of the study area is generally rainforest close to the mangrove belt. Human activities in the area include farming, hunting, boat building and sand mining. A total of two hundred (200) fingerling were collected and used for the study.

2.3 Acclimatization of Specimen's

The fingerlings were acclimated in a re-circulatory plastic aquarium measuring 25 ×10 × 15 containing hatchery water for 24hours in the fisheries and aquaculture laboratory of Akwa Ibom State fish farm. This enhanced the stability of the fingerlings from stress of collection and transportation (Udo *et al*, 2006).

2.4 Preparation of Experimental Aquaria

Ten (10) rectangular plastic aquaria measuring 25 ×10 × 15 cm were thoroughly washed with tap water and properly rinsed with fresh water of similar salinity and allowed to drain dry for 24 hours on the laboratory bench based on Dede and Kagbo (2001).

2.5 Stocking of Specimen

Prior to commencement of actual experiment, a preliminary test or range finding test with varying concentration (0, 5, 10, 15, 20) was conducted to give the actual variations in concentration to be used for the bioassay. Each of the aquarium had a replicate to ensure accuracy. Each of the Ten (10) plastic aquaria was filled with two liters of hatchery water and 10 *Clarias gariepinus* fingerlings was stocked in each aquarium. The ethanolic extract of *Costus afer* with varying concentrations (0,10, 12, 14, 16) was added to each stocked aquaria and allowed to stand for 96 hours for mortality examination.

2.6 Monitoring of Water Quality

Water Quality Parameters was monitored prior to commencement of the experiment and also periodically according to Standard Method (APHA,1998). Parameters that were monitored include dissolve Oxygen (DO), pH, And Temperature (^{0}C). Temperature and pH were measured using portable pH /Ec/ TDs/ Temperature HANNA, H1 991301 Model instrument while oxygen was measured using digital portable analyser JPB - 607A from "Search Tech Instrument".

2.7 Monitoring of Specimen for Mortality

The effects of the various concentration of Clint liquid soap (carwash) on the fingerlings was monitored on a 24 hours' basis for 96 hours as recommended by Udo *et. al.,* (2006) and Ekanem and Ekpo (2008).

2.7.1 Determination of Mortality and Survival Rates of Fingerlings

The percentage mortality and survival rates of the fingerlings in the different concentrations of Clint liquid soap (carwash) during the period of study was determine using the formula;

% mortality =n/N × 100 (Chan, 1977).

Where;

n = number of dead fish per aquarium per concentration

N = Total Individual Stocked

The difference between dead fish and survivors will give the percentage survival of the fingerlings at the end of the experiment (96 hours) (Udo *et. al*., 2006).

2.7.2 Determination of Mortality Lethal Median Concentration (96 hours LC_{50})

The effects of the various concentrations of Clint liquid soap (carwash) on the fingerlings of *C. gariepinus* was determined by graphical method (Probit Level Determination as recommended by Omoregie (2002), Omoregie and Ufodike (2000), Ekanem and Ekpo (2008) and Udo *et.al*. (2006). At Lethal Median Concentration LC_{50}, after 96 hours of test, the number of fingerlings that are expected to die was determined from the graph. Similarly, the concentration that will kill 50% of the stocked fingerlings at the end of the test (96 hours) was determined at the probit level (Omoregie, (2002) Omoregie and Ufodike (2000), Udo *et. al*., (2006); Ekanem and Ekpo (2008).

2.8 Collection of Samples for Histopathological Examinations

The gill's tissues were isolated from the test animal and fixed in formalin -saline for 48 hours. The fixed tissue was processed manually through graded ethanol, cleared in xylene impregnated and embedded in paraffin wax, sections of the tissue sample were cut with a rotary microtome, stained by hematoxylin and eosin technique, prepared tissues were finally observed using a microscope for pathological changes at x100 and x400 magnification.

2.9 Data Analysis

The results of the respective concentration effects of Clint liquid soap (carwash) were presented in tables. One-way analysis of variance (ANOVA) was used to test for significant difference between the varying concentrations in both batches (batch A and batch B) at the probability level of ($P>0.05$). Probit analysis was done using SPSS version 20.0.

3. Results

3.1 Initial Water Quality Parameters

Physicochemical parameters of the test water were tested and the values recorded before commencement of the actual experiment. The values of the basic water quality parameters prior to stocking were, dissolved oxygen (5.8 mg/l), temperature (29.5°C) and pH (6.40) (Table 1).

Table 1. *Initial Physico-chemical parameters of the test water prior to stocking of test organism*

Fish Species	Initial physico-chemical parameters prior to stocking		
	DO (mg/l)	Temp (°C)	pH
Clarias gariepinus	5.8	29.5	6.40

3.2 Variation of in Physico chemical Parameters of Test Media

The effect of water-soluble fraction of clint liquid soap on the physico-chemical properties of the culture medium was assessed in the study (Table 2). Based on the findings of this study, values for temperature and hydrogen ion concentration (pH) recorded revealed no substantial different ($p > 0.05$) among treatments with reference to the control, but considerable changes ($p < 0.05$) were observed for dissolved oxygen.

Table 2. *Mean Physico-chemical properties of the test media across treatments*

Conc. (mg/l)	Parameters		
	Dissolved Oxygen (mg/l)	Temperature (^{0}C)	pH
0 (control)	4.90±0.90^a	27.90±0.7^a	6.27±0.1^a
10	3.68±2.2^b	27.58±0.6^a	6.25±0.06^a
12	3.50±2.2^b	27.45±0.3^a	6.22±0.08^a
14	3.03±2.2^b	27.30±0.2^a	6.20±0.09^a
16	2.88±2.00^c	27.20±0.4^a	6.15±0.05^a

Mean with different superscripts along the same column are significantly different at p

3.3 Summary of the Percentage Mortality and survivors of *C. gariepinus* Fingerlings in the in the different concentrations of Water-Soluble Fraction of Clint Liquid Soap (Car Wash) at the end of the experiment (96 hrs.).

The percentage mortality and survivors of *C. gariepinus* fingerlings at the end of the test period in each of the concentrations are shown in Table 3 for the two batches of the experiment.

In the 0 mg/l concentration of the extract, no mortality was recorded throughout the test period in both batches A and B. In the 10, 12 and 14 mg/l concentration of the toxicant, 80 % mortality was recorded leaving behind 20 % survivors in both bathes respectively.

At the end of the 96-hour bioassay 100 % mortality was observed in the 16 mg/l concentration of the toxicant leaving behind no test organisms in the test media for both batches (Table 3). Statistical Analysis using one-way Anova (SPSS 20.0) showed that there was no significant difference ($p>0.05$) in mortality between the two batches.

Table 3. *Summary of the Percentage Mortality and survivors of C. gariepinus Fingerlings in the different concentrations of Water-Soluble Fraction of Clint Liquid Soap (Car Wash) at the end of the experiment (96 hrs.).*

Conc. of extract (mg/l)	BATCH A				BATCH B			
	Mortality (M)	% M	Survivors (S)	% S	Mortality (M)	% M	Survivors (S)	% S
0	0	0	10	100	0	0	10	100
10	8	80	2	20	8	80	2	20
12	8	80	2	20	8	80	2	20
14	8	80	2	20	8	80	2	20
16	10	100	0	0	10	100	0	0

3.4 96 Hours LC_{50} Determination

The 96 hours LC_{50} for *C. gariepinus* fingerlings exposed to the different concentrations of Water-Soluble Fraction of Clint Liquid Soap (Car Wash) **was** determine using probit analysis. The concentrations were first transformed into log for the probit analysis (Table 4). The 96 hours LC_{50} is given at 8.0 mg/l representing a log transformed concentration of 0.90 mg/l a point where 50 % of the test organisms would be killed at the end of the experiment (Fig. 1).

Table 4. *LC50 determination for C. gariepinus Fingerlings at the end of the 96-hours bioassay.*

Concentration (mg/l)	Log Transformation	Mortality (M)	% Mortality	Survivor (S)	% Survivor
0	**0**	0	0	10	100
10	**1.00**	8	80	2	20
12	**1.08**	8	80	2	20
14	**1.15**	8	80	2	20
16	**1.20**	10	100	0	0

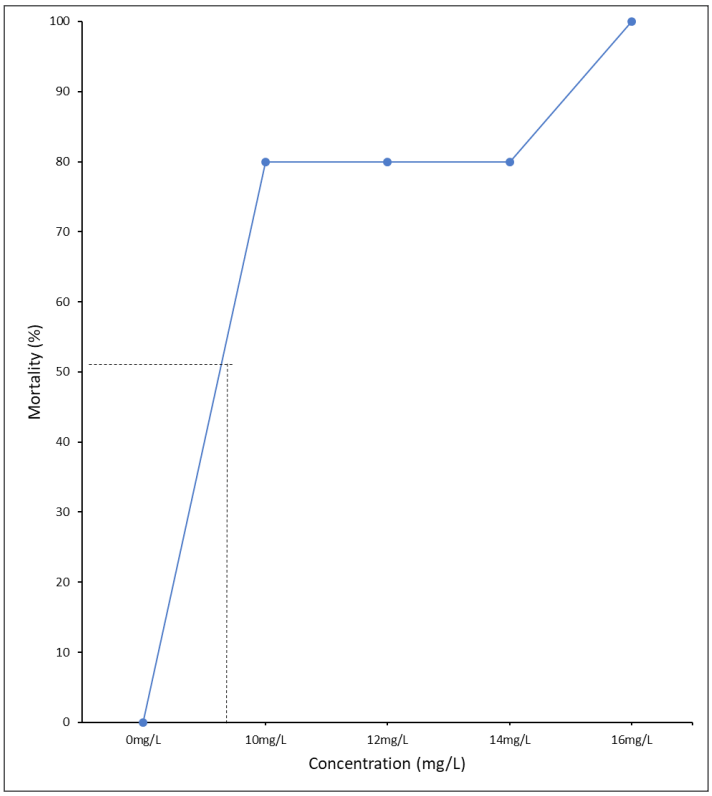

Figure 1. *Probit Graph of mortality (%) against concentration*

3.5 Histopathology of the gill of *C. gariepinus* Exposed to the different concentrations of Water-Soluble Fraction of Clint Liquid Soap (Car Wash) at the end of the experiment (96 hrs.).

The histological analysis was conducted on the gills of *Clarias gariepinus* exposed to varying concentrations of the Water-Soluble Fraction of Clint Liquid Soap to assess histopathological changes. The results of the histological analysis (Figure 1) revealed notable histological alterations among the experimental groups exposed to different concentrations of the Water-Soluble Fraction, compared to the control group.

Gills from the control group exhibited normal histological features, characterized by a well-vascularized gill arch with intact lining epithelium covering the lamellae, primary, and secondary filaments. Gill tissue from the experimental groups predominantly displayed supporting cartilage epithelial tissue, indicative of increased loss of epithelial cells from the filaments. Diffuse and severe epithelial degeneration was observed across all experimental groups, ranging from the low dose to the highest concentration.

While the extent of epithelial degeneration varied across the experimental groups, the difference in the level of severity between the groups was found to be unremarkable.

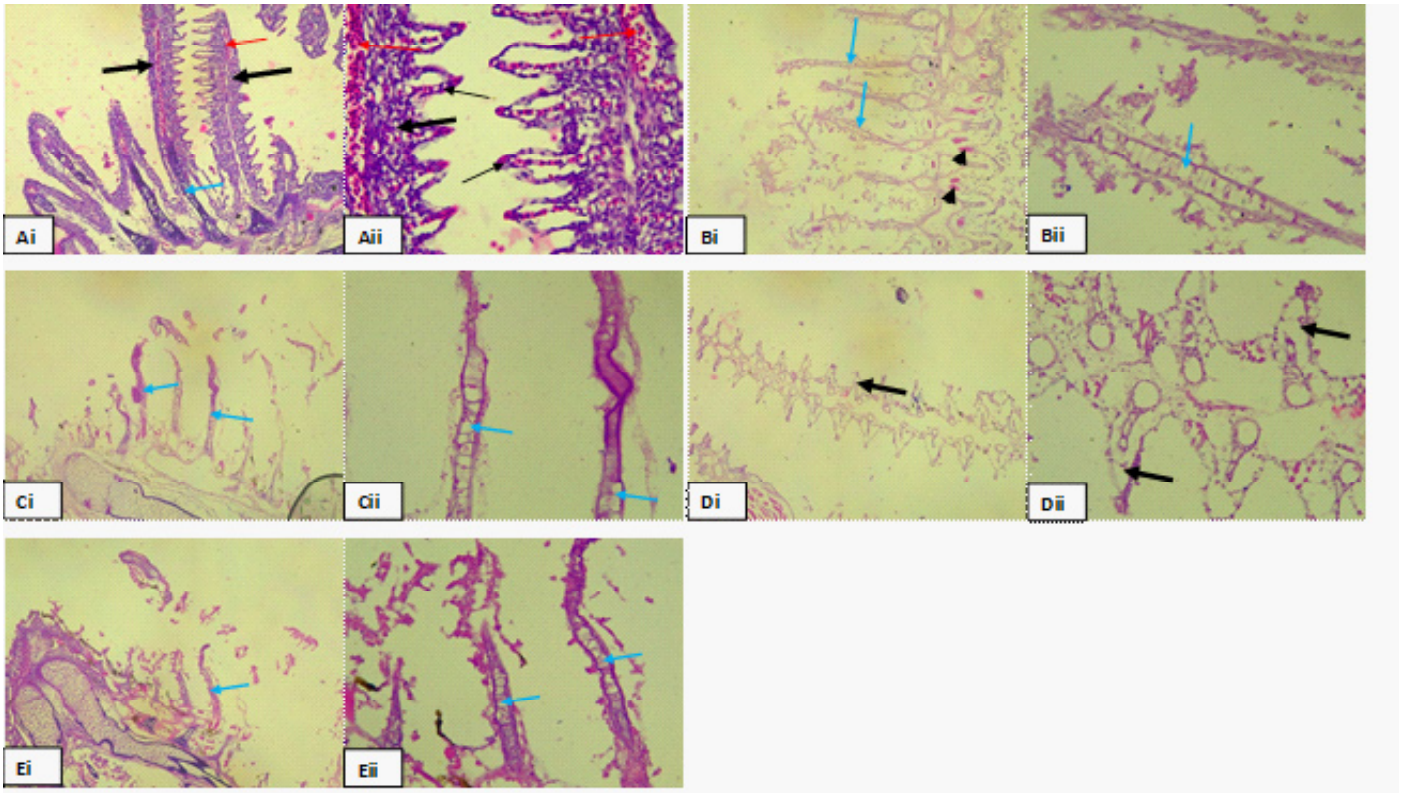

Figure 1. *Photomicrograph of gill arch, A (i&ii), the control group at 0mg/l showed normal histology of the gill arch showing the primary filament (Thick black arrow), its processes secondary filament (thin black arrow), the blood capillaries (thin red arrow) the supporting catillage (blue arrow) and the skeletal muscle (arrowhead). The experimental groups B, C, D and E for 10 mg/l, 12mg/l, 14 mg/l and 16 mg/l toxicant concentration respectively showed severe epithelial cell loss in the lamella, Primary (Thick black arrow) and secondary (thin black arrow). The severe epithelial loss revealed the middle supporting cartilage (blue arrow). Haematoxylin and Eosin Stain, Magnification at x100 and x400.*

4. Discussion, Conclusion, Reccommendations

4.1 Discussion

4.1.1 Initial Values of the Physico-chemical parameters of the Experimental water

In aquaculture operations, there are recommended values for basic water quality parameters. For dissolved oxygen a range of between 4.0 – 6.0 mg/l is suitable, 6.7 – 8.6 for pH and 25.0 – 30.0 ^{o}C for temperature are recommended values for standard operation of aquaculture (Udo, 2007, Ajah 2007, George *et.al*., 2013a; George *et.al*., 2013b; George *et.al*., 2014a; George *et.al*., 2015a). Prior to commencement of the experiment, three basic physicochemical parameters were measured which conformed with recommended values. The ranges of the physico-chemical parameters of the experimental water were found to fall within the acceptable limits prior to the commencement of the experiment as previously reported by the authors under reference.

Ensuring that water quality is within recommended standards for aquaculture prior to test ensures that the baseline conditions are suitable for the organisms being studied. It also provides a controlled environment for assessing the effects of specific substances or stressors on aquatic life without confounding factors from poor water quality. Also, ensuring that water quality meets recommended standards before conducting toxicity tests is essential for obtaining reliable data and protecting the health of aquatic ecosystems.

4.1.2 Variations in Water Quality in the Test Media During the Experimental Period

Variations in water quality during bioassay using clint liquid soap as the toxicant could stem from a combination of chemical, biological and environmental factors interacting with the test system over time. Clint liquid soap may undergo chemical reactions in water leading to changes in pH, dissolved oxygen levels or other chemical parameters. The breakdown or degradation of clint liquid soap in the water could results in changes in water quality. This could occur through processes such as, hydrolysis, photolysis or microbial degradation. Finally, the presence of clint liquid soap may affect the physiology or behaviour of the test organisms, leading to variations in water quality indicators such as oxygen consumption,

ammonia, excretion or pH regulation (Ogundiran *et.al*., 2010; Adewoye, 2010a).

This phenomenon has been previously documented in previous studies by George *et. al.,* (2023 a) when reporting dose-response toxicity for *Clarias gariepinus* fingerlings exposed to ethanolic extract of *Latana camara*, George, *et. al.,* (2023 b) when investigating toxicity of *Phragmenthera capitata* (Mistletoes) on mortality and histopathological indices of *Clarias gariepinus* fingerlings in aquarium, George, *et. al*., (2023 c) during their studies on mortality and histopathological alteration on the Gills of *Oreochromis niloticus* juveniles following exposure to ethanolic extract of *Phramenthera capitata* under laboratory conditions, and George, *et.al.*, (2023 d) when evaluating dose-response relationship and histo-morphological alterations on *Oreochromis niloticus* juveniles following exposure to ethanolic extract of *Latana camara*.

4.1.3 *Preliminary Test of Water-Soluble Fraction of Clint Liquid Soap on C. gariepnus Fingerlings*

Range findings test prior to commencement of the experiment is important in toxicity studies because it will help to determine the range of doses to be used in the main toxicity study. By administering a range of doses, it can help identify the highest dose that does not cause significant toxicity (NOAEL – No Observed Adverse Effect Level) and the lowest dose that does not cause toxicity (LOAEL- Lowest Observed Adverse Effect Level).

Toxicity range values are usually found to be different for each toxicant and organisms (George, *et.al*., 2013a, 2013b; George, *et. al*., 2014a; George, *et. al*., 2015 a; 2015 b), the procedure is generally acceptable in eco-toxicity experiments (APHA, 1998).

No mortality was recorded in the 0 mg/l (control) concentration of the toxicant used for the bioassay. However, 20 % mortality was recorded in the 5mg/l concentration of the toxicant, 60 % mortality recorded against 10 mg/l and 100 % mortalities recorded each for 15 mg/l and 20 mg/l concentration of the toxicant respectively. This gave an insight to the final concentration which was used for the toxicity test.

4.1.4 Percentage Mortality and Survivors of C. gariepnus Exposed to Different Concentrations of Water-Soluble Fraction of Clint Liquid Soap

The percentage mortality of *C. gariepinus* in the water-soluble fraction of clint liquid soap ranged from 0 – 100 % in both batches A and B at the end of the 96-hours bioassay. No mortality was recorded in the 0 mg/l concentration of the toxicant. However, 80 % mortalities were recorded in the 10, 12 and 14 mg/l concentration in each of the batches while 100 % mortality was recorded in 16 mg/l concentration of the toxicant. The results of the present findings are in consonance with the earlier reports by George *et.al*., (2013a) when reporting on the laboratory bioassay of the potential effect of rubber extract (*Hevea Brasiliensis*) on the Survival of fingerlings of *Oreochromis niloticus*; George *et.al*., (2013b) during their studies on the effect of lethal concentrations of rubber extract (*Hevea Brasiliensis*) on the survival on fingerlings of *Clarias gariepinus* under laboratory condition; George *et.al*., (2015a) when working on the toxic effect of crude oil on hatchery reared *Oreochromis niloticus* fingerlings and earlier assertion made by George *et.al*., (2014a) when investigating on the acute toxic effect of qua iboe light crude oil on the gills of *Clarias gariepinus* juveniles.

In the present study, the severity of toxic effects increases as concentration increases. This phenomenon occurs due to a higher concentration of the toxicant overwhelming the detoxification and defense mechanisms of organisms, leading to greater damage at cellular, tissue or organisms' levels. Essentially, higher concentrations result in a greater number of toxic molecules interacting with biological systems, leading to more pronounced toxic effects. Similar results have been reported by different authors; Ogundiran *et.al.,* (2010) when investigating toxicological impacts of detergents effluents in juveniles of African catfish (*Clarias gariepinus*), Calta, *et.al.*, (2004) when studying the acute toxicity of the synthetic pyrethroid deltamethrin to young minnow carp (*cyprinus carpio*), Ayuba *et. al*., (2002) when investigating on the acute toxicity of the root of Jimson's weed (*Datura innoxia*) to the African catfish (*Clarias gariepinus*) fingerlings and Adedeji *et.al*., (2008) when investigating acute toxicity of diazinion to African catfish (*Clarias gariepinus*) fingerlings. The observed mortalities in the present studies were attributed to various factors such as ingredients in the soap formulation, concentration levels, potential allergens or irritants and route of exposure.

The presence of clint liquid soap resulted in variations observed in the water quality which could stimulate stress in the test organism. Such environmental stress may facilitate tolerance to increase concentrations of contaminants (Ayotunde *et.al*., 2011).

4.1.5 96 Hours LC_{50} Determination for Clint Liquid Soap

The 96 hours LC_{50} of any toxicant is the dose or concentration which kills 50 % of the stocked organisms at the end of the experimental period of 96 hours (4 days) (Udo et.al., 2006; George *et.al*., 2013a; 2013b, 2014a and 2015a). LC_{50} values help in assessing the potential risks posed by substances to aquatic ecosystems and human health, allowing for informed decision-making regarding their use and management

The 96 hours LC_{50} is known to vary with respect to different toxicants and concentrations due to various factors such as mode of action of the toxicant, the sensitivity of the organisms being tested and the specific environmental conditions under which the test is conducted. Different toxicants may have different mechanisms of actions, affecting organisms in distinct ways. Therefore, the variability in LC_{50} values reflects the complexity of interactions between toxicants and organisms in different conditions.

The 96 hours LC_{50} of toxicants are known to vary as previously reported by the authors earlier sited above. For instance, Ogundiran, *et. al*., (2010) reported 96 hours LC_{50} of 0.0166 mg/l and 0.0038 mg/l for batch A and B *Clarias gariepinus* fingerlings under the toxicity effects of detergent effluents, 96 hours LC_{50} of 0.1 mg/l and 0.03 mg/l was reported by Adewoye, (2010b) when working on the effects of soap and detergent effluents on *Clarias gariepinus* fingerlings. Again, Ayotunde *et. al*., (2011) reported the 96 hours LC_{50} of 0,033 – 0.33 mg/l on *Clarias gariepinus* adults using Carica papaya extract. The varied 96 hours LC_{50} values usually obtained from different toxicants and test organisms is again reported by Ekanem *et. al*., (2011), when they reported a 96 hours LC_{50} of 5.0 ± 1.76 and 4.0 ± 1.76 mg/l for *Macrobrachium macrobrachion* and *Macrobrachium vollenhovenii*.

In this study the 96 hours LC_{50} of 8 (0.90) mg/l obtained for both batch A and B might have depended on the ranges of the toxicant finally used for the bioassay after conducting a preliminary test.

4.1.6 Effects of the Water-soluble Fraction of Clint Liquid Soap on the gills of the test Organisms

The effects of the water-soluble fraction of clint liquid soap showed pathological effects on the gill lamellae of *Clarias gariepinus* fingerlings. However, the gill lamellae in the control (0 mg/l) were not affected. Pathological effects were pronounced at 10 mg/l, 12 mg/l, 14 mg/l and 16 mg/l concentration of the toxicant which shows evidence of diffused epithelial degeneration of the gill lamella.

The observed pathological changes in the gills of *Clarias gariepinus* fingerlings following exposure to clint liquid soap at concentrations of 10, 12, 14 and 16 mg/l suggest that the liquid soap may be toxic to the fish at these concentrations. The absence of pathological changes in the control group indicates that the changes observed in the experimental groups were likely caused by the exposure to the clint liquid soap rather than other factors. These changes could be due to the chemical composition of the soap, which may have adverse effects on the gills of the fish, potentially disrupting their normal physiological functions.

The results of this findings are similar to earlier assertion reported by George *et. al*., (2015a) when reporting on the acute toxic effects of *Hevea brasiliensis* on the gills of hatchery reared *Oreochromis niloticus* fingerlings and observed histological changes in the gills of the exposed organisms which were concentration dependent, George *et.al*., (2014a) when investigating on the acute toxic effect of qua iboe light crude oil on the gills of *Clarias gariepinus* juveniles; Idowu *et. al*., (2019) when studying the effect of *Euphorbia hirta* leaf extract on histopathology of juveniles *Clarias gariepinus* and George *et.al*., (2014b) when reporting on the histopathological alterations in gills of fingerlings of *Clarias gariepinus* following sub-lethal acute exposure to *Hevea brasiliensis.*

4.2 Summary and Conclusion

Studies on exposure of *Clarias gariepinus* fingerlings to water soluble fraction of clint liquid soap on the survival and histopathology of the gills were investigated using static bioassay under laboratory condition. The control group (0mg/l) showed no mortality and no pathological changes in the gills. However, in groups exposed to concentrations of 10, 12, 14 and 16 mg/l of the toxicant, mortality rates of 80% and 100% were observed respectively. Additionally, pathological changes were observed in the gills of the fish exposed to these concentrations, indicating potential toxicity of clint liquid soap to *Clarias gariepinus* fingerlings, particularly at higher concentrations.

4.3 Recommendations

Based on the results of the study which showed high percentage mortalities when exposed to water

soluble fraction of clint liquid soap, it is important to raise public awareness about the potential harm of improperly disposing of household chemicals, encouraging proper disposal methods to prevent contamination of water bodies. It is important to advocate for regulations or guidelines governing the use and disposal of household chemicals like liquid soap to prevent their entry into aquatic ecosystems.

Further research is recommended on monitoring the impacts of household chemicals on aquatic ecosystems, including their effects on fish populations and overall ecosystem health. Finally, incorporate education about the importance of protecting aquatic ecosystems into school curricular and community outreach programs, fostering a sense of responsibility and stewardship among individuals.

By implementing these measures, we can help mitigate the impacts of toxicity from household chemicals like clint liquid soap on aquatic ecosystems and ensure the health and sustainability of these vital environment.

5. References

1. Adedeji, B. A., Adedeji, A. O., Adeyemo, O. K. and Agbede, S. A. (2008). Acute toxicity of diaziam to the African catfish *Clarias gariepinus*. *African Journal of Biotechnology*, 7(5): 651-654.
2. Adewoye, S. O. (2010a). A Comparative study on the behavioural responses of *Clarias gariepinus* on exposure to Soap and detergent effluents. *Advances in Applied Research*, 1(1):89-95.
3. Adewoye, S.O. (2010b). Haematological and biochemical changes in *Clarias gariepinus* exposed to *Trephosia vogelii* extract. *Adv. Appl. Sci. Res*., 1(1): 74 – 79.
4. Ajah, P. O. (2007). Fish feeding and hatchery management. Calabar, Nigeria. Jerry Commercial Productions, 178Pp.
5. APHA (American Public Health Association) (1998). Standard Methods for the examination of water and waste waters. 20th Edn. New York, 314 Pp.
6. Ayotunde, E. O., Offem, B. O. and Bekeh, A. F. (2011). Toxicity of Carica papaya Lim: Haematological and piscicidal effect on adult catfish (*Clarias gariepinus*). *Journal of Fisheries and Aquatic Science*, 6(3): 291 – 308.
7. Ayuba, J. O. and Ofojekwu, P. C. (2002). Acute toxicity of the root of Jimson weed (D*atura innoxia*) to the African catfish (*Clarias gariepinus*) fingerlings. *Journal of Aquatic science*; 17:131-133.
8. Calta, M. and Ural, M. S. (2004). Acute toxicity of the synthetic pyrethroid deltamethrin to young mirror carp, Cyprinus carpio. *Fresen Environmental Bulletin*; 13(11a):1179–1183.
9. Chan, E. I. (1977). Oil pollution and tropical littoral communities. Biological effects of the 1975 Floride key oiul spills. Pp 187-192. In: Procedures of oil spill Conference. Api publication, Washington DC.
10. Dede, E. B. and Kagbo, H. D. (200!1). Aqua toxicological effects of water-soluble fraction (WSF) of diesel fuel on *Oreochromis niloticus* fingerlings. *Journal of Applied Science and Environmental Management*, 5(1): 93-96.
11. Ekanem, A. P and Ekpo, I. A. (2008). Effects of commercial detergents on the juvenile of *Herterobranchus longifilis* (Curvier and Valiennies). *African Journal of Environmental Pollution and Health*, 6(1): 18 – 23.
12. Ekanem, A. P, Asuquo, F. E. and Ndiok, E. J. (2011). Toxicity of crude oil to freshwater shrimp *Macrobrachium macrobrachion* and *Macrobrachium Vollenhovenii* from Nigeria Coastal water. *Bulletin Environmental Contaminant and Toxicology*, 86:394 – 397.
13. Ekpo, E. A., **George, U. U**. and Edet, M. (2015). Impacts of Water Pollution with Heavy Metal on the Tissue of *Egeria radiata* (Bivalvia: Tellinacea: Donacidae) (Lammark, 1804) Obtained from Calabar River, Cross River State, Nigeria. *Nature and Science*, 13(8):36-39.
14. **George U. U.,** Etim, I. N., Ekanim, M. P. and Akpan, M. K. (2015 c). Toxic Effect of Crude Oil on Hatchery Reared *Oreochromis niloticus* Fingerlings. *Journal of Academia and Industrial Research,* 3 (11): 573-576.
15. George U. U., Etim, I. N., Ekanim, M. P. and Akpan, M. K. (2015a). Acute Toxic Effects of *Hevea brasiliensis* on the Gills of Hatchery Reared *Oreochromis niloticus* Fingerlings. *Journal of Academia and Industrial Research,* 3 (11): 562-566.
16. **George, U. U.** and Efiom, Edak (2018). Physical and Chemical Variations in Water Quality of Imo River Owing to Human Perturbations in the System. *Researche*r, 10(6): 47 – 54.
17. **George, U.** and Effiom, E. (2017). Impacts of Coastal Activities on Benthic Sediments from Qua Iboe River Estuary, South-South, Nigeria using Multivariate Statistical Techniques. *International Journal of Applied Research*, 3(7): 39-50.
18. **George, U. U**. and Atakpa, E. O. (2015 b). Seasonal Variation in Physico-Chemical Characteristics of Cross River Estuary, South Eastern Nigeria. *Nature and Science*, 13(12):86-93.

19. George, U. U., Ajayi, O. O., George, I. E. and Vincent, U. E. (2023a). Establishing a Dose-Response Toxicity for *Clarias gariepinus* Fingerlings Exposed to Ethanolic Extract of *Latana camara*. *Asia Journal of Fisheries and Aquatic Research*; 24(1):1-10.

20. George, U. U., Akpan, E. R. and Akpan, M. M. (2020 a). Assessing the Impacts of Coastal Activities on the Water Quality of Qua Iboe River Estuary, South-South, Nigeria. New York Science Journal; 13(3):1-15.

21. George, U. U., Asuquo, F. E., Idung, J. U. and Andem, A. B. (2013a). Effects of Lethal Concentration of Rubber Extract (*Hevea brasiliensis)* on the survival on fingerlings of *Clarias gariepinus* Under Laboratory Conditions. *Journal of Natural Sciences Research*, 3 (9): 56-60.

22. George, U. U., Asuquo, F. E., Idung, J. U. and Andem, A. B. (2013b). A Laboratory Bioassay of the Potential Effects of Rubber Extract (*Hevea brasiliensis)* on the survival of fingerlings of *Oreochromis niloticus. Journal of Biology, Agriculture and Health Care,* 3 (11): 70-74.

23. George, U. U., Atakpa, E. O. (2015 a). Impacts of Human Perturbations on the Physico-chemistry and Biological Parameters on the Water Quality of Cross River Estuary, South Eastern Nigeria. *Report and Opinion*, 7(11): 49-55.

24. George, U. U., Etim, I. N., Ekanim, M. P and Otu, U. (2015b). Acute Toxicity of Ariel Detergent on the Survival of **Fingerlings** of Nile Tilapia **(***Oreochromis niloticus***)**. *International Journal of Current Research*. 7 (4): 14825-14828.

25. George, U. U., Jonah, U. E., Nkpondion, N. N. and Akpan, M. M. (2020 b). Assessment of Water Quality and Benthic Macroinvertebrates Assemblage of Etim Ekpo River, Niger Delta, Nigeria. *World Rural Observation*;12(1):16 – 24.

26. George, U. U., Joseph A. and Andy, J. A. (2014a). Histopathological Alterations in Gills of Fingerlings of *Clarias gariepinus* (Burchell, 1822) Following Sublethal Acute Exposure to *Hevea brasiliensis. International Journal of Scientific & Technology Research,* 3(9):252- 255.

27. George, U. U., Mbong, E. O., Abiaobo, N. O. and Akpan, I. I. (2023b). *In Vivo* Studies on Mortality and Histopathological Indices of *Phragmenthera capitata* (Mistletoes) on *Clarias gariepinus* Fingerlings in Aquarium. *Mathews Journal of Cytology and Histology*; 7(2):1-10.

28. George, U. U., Otoh, A. J., Ajayi, O. O and George, I. E. (2023c). Studies on mortality and Histopathological Alteration on the Gills of *Oreochromis niloticus* Juveniles Following Exposure to Ethanolic Extract of *Phramenthera capitata* Under Laboratory Conditions. *Asian Journal of Fisheries and Aquatic Research*, 24(3):23-34.

29. George, U. U., Otoh, A. J., Ajayi, O. O and George, I. E. (2023d). Dose-Response Relationship and Histo-Morphological Alterations on *Oreochromis niloticus* Juveniles following Exposure to Ethanolic Extract of *Latana camara*. *Asian Journal of Research in Zoology*;6(4):71-83.

30. George, U. U**.,** Urom, S. E. and Etanketuk, N. (2014 b**).** Acute Toxic Effect of Qua Iboe Light Crude Oil on the Gills of *Clarias gariepinus* Juveniles. *International Journal of Environment and Pollution Research,* 2(2):16-30.

31. Jonah, U. E. and **George, U. U.** (2019). Influence of Water Quality on Zooplankton Community Structure of Etim Ekpo River, Akwa Ibom State, South-South, Nigeria. *World Rural Observation*; 11(3):49-57.

32. Jonah, U. E., **George, U. U.** and Avoaja, D. A. (2019). Impacts of Anthropogenic Perturbation on Water Quality Characteristics of Ikpe Ikot Nkon River, Southern Nigeria. *New York Science Journal*; 12(9):70-77.

33. Jonah, U. E., **George, U. U.** and Avoaja, D. A. (2020). Impacts of Agrochemical on Water Quality and Macroinvertebrates Abundance and Distribution in Ikpe Ikot Nkon River, South-South, Nigeria. Researcher; 12(1):36-43.

34. Ogundiran, M. A., Fawole, O. O., Aderoye, S. D. and Ayandiran, T. A. (2010). Toxicological impacts of detergents effluent on juveniles of African catfish (*Clarias gariepinus*) (Burchell, 1822). *Agriculture and Biology Journal of North America*, 1(3): 330 – 342.

35. Omoregie, E. (2002). Acute Toxicity of Water-Soluble Fraction of Crude Oil to the Nile Tilapia (*Oreochromis niloticus*). *Bulletin of Environmental Contamination and toxicity*, 68: 623 – 629.

36. Omoregie, E. and Ufodike, B. C. (2000). Effects of water-soluble fraction of crude oil on growth of the Nile Tilapia (*Oreochromis niloticus*) (L). *Bulletin of Environmental Contamination and toxicity*, 64: 601 – 605.

37. Udo, P. J. (2007). Techniques in Fish farming (Practice and Management). Wusen Publishers, Calabar, Nigeria, 100 Pp.

38. Udo, P.J., Ekanem, A P. and Eze, E E. (2006). Toxicity of crude oil to early life stages of *Heterobranchus longifilis* (Cruveier and Valiennces) Pisces: Bagridae). *Tropical Environmental Research*, 1:450-459.