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ORIGINAL ARTICLE

Acute and Chronic Toxicity of Pawpaw (*Carica papaya*) Seed Powder to Nile Tilapia *Oreochromis niloticus* (Linne 1757), Fingerlings

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ABSTRACT

The 96hrsLC_{50} of Pawpaw seed powder to fingerlings Tilapia *Oreochromis niloticus* is 1.8mg/l and the maximum admissible toxicant concentrations ranges between 0.018mg/l-0.81mg/l, while the total mortality occurred in the concentration of 8mg/l within 24hours exposure period. Toxic reaction exhibited by the fish includes erratic movement, air gulping, loss of reflex, discolouration, molting, loss of scale, and haemorrhage. There were no significant changes in the water quality during the experiment, the result obtained before the test, during the test and after the test were found closed to the physico- chemical parameters of the control. Results of the tests provided baseline information and established safe limits of using *Carica Papaya* seed powder as an antifertility agent in controlling excessive breeding of tilapia in fish farm.

Key words: -Toxicity, Pawpaw seed, Tilapia, Fingerlings, Tolerance limit, Haematology.

Introduction

Pawpaw (*Carica papaya*) seeds contain antifertility properties, particularly of the seeds,[17]. A complete loss of fertility has been reported in male rabbits, rats and monkeys fed an extract of papaya seeds[17,19,16]. suggesting that ingestion of papaya seeds may adversely affect the fertility of human males or other male mammals[1]. stated that Pawpaw (*Carica papaya*) seeds yield 660-760mg (bactericidal a glycone of glucotropaeolin benzyl isothiocyanate), a glycoside, sinigrin, the enzyme myrosin, and carpasemine. Papaya seeds even though have a deworming action, is not advisable to consume[1]. also recorded two important compounds called chymopapain and papain, which are supposed to aid in digestion. Papain also is used to treat arthritis. Papaya latex contains at least four proteolytically active components, including papain, chymopapains A and B, and papaya peptidase a[9].

A toxic substance called carpine is present in traces in black seeds of papaya. Carpine in large quantities is said to lower the pulse rate and depress the nervous system. This substance is only found in papaya seed and that too in very small quantity. The fleshy part of the fruit is completely free from this toxic substance. Externally the latex is irritant, dermatogenic, and vescicant. Internally it causes severe gastritis. Some people are allergic to the pollen, the fruit, and the latex. Papain can induce asthma and rhinitis. The acrid fresh latex can cause severe conjunctivitis and vesication.

A compound present in crushed papaya seed that is believed to have activity against helminthic intestinal parasites, benzyl isothiocyanate (BITC), has been shown to have an effect on vascular contraction using a canine carotid artery in vitro model[25]. Other studies have suggested possible purgative effects of root extracts[1]. and antihypertensive activity of fruit extracts[6]. The presence of cyanogenic compounds in papaya has also been reported[21].

The St. Peter's fish (Nile Tilapia) *Oreochromis niloticus* possesses characteristics such as, fast growth, and tolerance of poor water quality. Is common food fish in Nigeria and have been introduced to many countries around the World. Tilapia culture is, however fraught with the problem of prolific breeding,

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overpopulating any water they found themselves that resulted into stunted growth in Nigeria. Tilapia, *Oreochromis niloticus* sexually matures at about 20 g weights[18]. Uncontrolled reproduction of Tilapia *Oreochromis niloticus* in pond in Nigeria especially in Cross River State, as observed and complained by farmers lead to harvest of stunted fish with low nutritional and commercial value.

For profitable Tilapia culture, the prolific breeding and stunting problem associated with it have to be solved[1]. enumerated various methods and technique available for the control of prolific breeding in Tilapia and observed that each of them has it own shortcoming. As the search for a better solution to this problem continues the need to investigate the usefulness of natural resources in aquaculture become vital. Medicinal plants have successfully been used to induce sterility in laboratory animals[9,3,5,]. Pawpaw seed (*Carica papaya*)[23,7]. reported high success in using Pawpaw seed powder in inducing sterility in male Tilapia *Oreochromis* niloticus when administered through feed. They stated that the high dose of 9.8g/kg/of fish/day of the drug caused disintegrating of many more sperm cell cells. With the outcome of this result farmer in Nigeria has started to use Pawpaw seed powder indiscriminately in their farm to control prolific breeding of tilapia and it has resulted into high and regular death of fry, fingerling and adult Tilapia in pond.

Despite their widespread use, their toxicity and effectiveness to aquatic organisms, particularly fishes, have not been examined. Acute and chronic toxicity test was conducted using aqueous extract of Pawpaw seed seeds on a widely cultivated African freshwater fishes. Therefore, results expected from the toxicity test will provide baseline information and establish limit of using aquatic extract of Pawpaw seed seeds in freshwater fishpond. The effect on fingerlings and adult of Nile tilapia, *Oreochromis niloticus* will give information on the safe level on administration to aquatic environment.

The effect of Pawpaw seed on the target organ of the fish would also be determined as persistent usage of the chemical could build up in the organs of the fish, and the surrounding environment of the fish and this may be deleterious. This work is to determine the normal dosage of Pawpaw seed powder to fingerling tilapia and its effect on water quality, through the determination of toxicity and tolerance level of Pawpaw (*Carica papaya*) seed powder, which is lacking. Acute and chronic toxicity test will be conducted using aqueous extracts of Pawpaw seeds on widely cultivated African freshwater fish Tilapia *Oreochromis niloticus*.

Materials and Methods

200 live fingerlings, *Oreochromis niloticus,* identified using taxonomic key of[20]. for the experiment and was collected from Cross River University of Technology, fish farm at Obubra Campus, and was acclimated for 1 week in the laboratory, inside transparent rectangular glass tanks (75cm x 45cm x 45cm) container of 121.5 litres capacity, filled with 50 liters unchlorinated well water. The fish was fed to apparent satiation twice daily (0900h, 1600h) with a commercial pelleted fish diet containing 35% crude protein during the acclimation period. Feeding was discontinued 48 hours before the commencement of the experiment, to minimize the production of waste in the test container.

Preparation of Aqueous Extract of Pawpaw (Carica papaya) Seed Powder and Acclamation of Test Fish.

Large quantities of ripe Pawpaw seeds were purchased from the farmers and in gardens around Obubra village, in Cross River State, Nigeria. The seed powder was prepared by opening the mature fruit of Pawpaw and the fresh seeds extracted and were sun dried. The seeds was ground to a fine a powder, using the coffle mill attachment of a Moulinex domestic food bender and the powder was kept in a desiccators for later use in stock solutions.

Apparently healthy Nile Tilapia *Oreochromis niloticus* fingerlings weighing 7-5cm total length; 11.6g-17.6g weight was collected from Cross River University of Technology, fish farm at Obubra Campus, and was acclimated for 1 week in the laboratory, inside transparent rectangular glass tanks (75cm x 45cm x 45cm) container of 121.5 litres capacity, filled with 50 litres unchlorinated well water. The fish was fed with pelleted fish diet containing 35% crude protein, during the acclimation period. Feeding was discontinued 48 hours before the commencement of the experiment to minimize the production of waste in the test container.

Acute Toxicity Test

(1) Range Finding Test: - A preliminary range finding test was conducted to determine the toxicity level of Pawpaw, seed power using standard method/procedure. In the range finding test, one control and five tests in triplicates, was set up for the experiment. Pawpaw seed powder was introduced randomly, and test for 24hour, the behavior and mortality of the test fishes in each tank was monitored and recorded every 15 minutes for the first hour, once every hour for the next three hours and every four hours for the rest 24hours period.

Eighteen (60cm x 45cm x 45cm) glass tanks of 121.5 litres capacity each were filled with 50 litres aerated unchlorinated well water. Fingerlings *Oreochromis niloticus* was batch-weighed with a top-loading mettler balance (Mettler Toledo (K)), and distributed randomly in triplicate per treatment. The glass tanks were covered with mosquito net to prevent

fish from jumping out; there was no aeration, no water change nor feeding throughout the test. This was done prior to the introduction of the toxicant. The toxicant will be introduced at least concentration, 2mg/l, 4mg/l, 6mg/l, 8mg/l, & 10mg/l with a control of 0 mg/l in triplicate. The test will last for 24hr.

Definitive Test

The definitive test was conducted using concentration of, 4.0mg/l, 4.2mg/l, 4.4mg/l, 4.6mg/l, 4.8mg/l, 5.0mg/l, of Pawpaw seed powder earlier determined for the range finding test. This test comprised one sub lethal toxicity test according to the standard method/procedures.

Biological Data

Fish mortality was monitored and recorded hourly for the first four hours, 4hrs for the next 24hrs, and subsequently every 24 hours, for the next 96hrs. The inability of fish to respond to external stimuli was used as an index of death. Apart from monitoring and recording fish mortality the fish behaviour such as erratic swimming, air gulping, loss of reflex, discolouration, and molting was monitored.

Determination of Lethal Concentration

LC_{50}, which is the concentration of Pawpaw seed powder, estimated to be lethal to 50% of test organism after exposure time of 96 hr, was determined graphically using probit transformation[11,24].

Haematological Examination of Fish

One test organism was removed, from each tank for blood analysis. 5 - 10 ml blood per fish was collected from cardiac puncture in fingerlings fish using 2ml disposable heparinized syringes, treated with tetra acetic acid (EDTA) as anti-coagulant. The blood was stored at -4^0C in deep freezer prior to analysis. The blood analysis follows the method described by [22].

Blood Cell Counts

Haemocytometer was used in blood cell counts. The apparatus consists of a counting chamber, a cover slip, white and red blood pipette for the blood and a plastic mouthpiece for drawing the fluid into pipette. The blood diluting fluid was prepared as described by [22]. The blood cells were counted on the counting chamber of haemocytometer with the aid of compound microscope.

RBC = No of cells counted X 5 X 10 X 200 ($10^6 mm^3$)

WBC = No of cells counted X 0.25 X 10 X 20 ($10^4 mm^3$)[22].

Haemoglobin Estimation

Haemoglobinometer was used for haemoglobin estimation. The apparatus and the reagents include, Shali graduated tube, standard (SHILONOMETER), N/10 HCL, 0.02 ml pipette. The graduated tube was filled to 20 ml marked with N/10 HCL; 0.02 ml blood was added and mixed thoroughly. It was allowed to stay for 5 minutes, and distilled water was added drop by drop and each addition will be mixed thoroughly, until colour matches the standard. The amount of solution in the graduated tube gives the haemoglobin concentration as percentage.

Haemoglobin =Value obtained / 100 X 17.2 (gm/100ml)[22].

Packed Cells Volume (PCV)

Non-clotted blood was drawn by capillary action into microhaematocrit tubes; one end of the tubes was sealed with synthetic sealant. The sealed tube was centrifuged in a microhaematocrit centrifuge. Centrifugation was for 5 minutes at 10500 rpm. The packed cell volume was measured using microhaematocrit reader and expressed as percentage.

Erythrocyte Sedimentation Rate (ESR)

Non-clotted blood are was drawn by capillary action into microhaematocrit tube, one end of the tube was sealed, by a synthetic sealant, and placed, onto a special metal holder consisting of two plate slanting at an angle of 45°c. The rate at which erythrocyte spontaneously settled, determined the erythrocyte sedimentation rate. It was allowed to stand for 40 minute. The value of erythrocyte sedimentation rate is determined by means of the haematocrit reader. The erythrocytes column is determined as percentage of the total column of the blood. The value of erythrocyte sedimentation rate with the given time interval is the difference 100% and the percentage part represented by the corpuscle column[22].

Mean Cell Haemoglobin Concentration

This refers to the percentage of haemoglobin in 100ml of red blood cell. This was calculated by divided the haemoglobin content in g/100ml by the pcv/100mlof red blood according to the formulae: -
MCHC = HB/PCV*1000 T/l^{-1}[22].

Mean Corpuscular Volume (MCV)

The value of the mean corpuscular volume was calculated from the haematocrit value (pcv) (%) and the erythrocyte count (Er.) ($10^6/mm^3$) according to [22].
MCV= PCV *1000/Er (u^3)

Mean Corpuscular Haemoglobin (MCH)

Mean corpuscular haemoglobin concentration, expresses the concentration of haemoglobin in unit volume of erythrocyte. It was calculated from the haemoglobin value (Hb) and from the erythrocyte count (Er) according to the following formular
MCV= Hb/Er (Picogramme)(pg)[22].

Water Quality

Water quality monitoring was done prior to the experiment, during the experiment and after the experiment. Water quality parameters determined include pH, dissolved oxygen concentration, and temperature. Ph was determined using a digital pH meter (Mettle Toledo 320). The electrode was inserted into the bottle containing the water sample after standardization in different buffer, after which the reading was taken. Dissolved Oxygen Concentration was measured using a digital, dissolved oxygen meter (Jenway 9071) once in a day at 8.00 a.m. Temperature was measured using a mercury in-glass thermometer, which was placed in the medium inside the test container until reading was be made. The reading was taken at 10.00 a.m. on each day of the experiment.

StatisticaL Analysis

All results were collated and analysed using computerized, probit and logit analysis[15]. The median lethal concentration LC_{50} at selected period of exposure, and an associated 95% confidence interval for each replicate toxicity test was subjected to logit and probit analysis[8]. using Statistical Package for Social Sciences (SPSS) 11.0 for Windows XP on Pc.

Result and discussions

Table 1 and 2 shows the percentage cumulative mortality of toxicity of Pawpaw seed powder to Fingerling Tilapia *Oreochromis niloticus*. The 96hours LC_{50} of an aqueous Pawpaw seed powder to fingerlings Tilapia *Oreochromis niloticus* is presented in Table 3 and Figure 1-4. This value is the concentrations of the treatments required to bring about, 50% mortality of *Oreochromis niloticus* fingerlings within 96hours periods.

The acute toxicity of Pawpaw seed decreased with increase in time. Total mortality resulted at concentration of 8mg/l and the 96hrs LC_{50} is 1.8mg/l of Pawpaw seed to fingerlings tilapia. The maximum admissible toxicant concentration of 0.018mg/l - 0.18mg/l established for fingerling tilapia was derived by multiplied a constant 0.01-0.1 by 96hours LC_{50}. The fish were observed swimming erratically, they exhibited loss of reflex, molting, Discouloration, air gulping, loss of scale (Table 4).

Increase of loss of scale and haemorrhage were observed to be directly proportional to increase aqueous extract of pawpaw seed powder concentration level and duration of exposure. Table 7: showed the results of the physico-chemical parameters of on fingerling Tilapia *Oreochromis niloticus*. The Ph, Temperature, and Dissolved oxygen concentration determined at different time interval. The result obtained for the 96hours were found closed to the physico- chemical parameter of the control.

Conclusion

The result of toxicity of Pawpaw *Carica papaya* seed powder to fingerling tilapia *Oreochromis niloticus* presented in Table 1 and figure 1-5, show that 20, 24, 48, 72, 96hrsLc50 of *Carica papaya* to fingerlings tilapia *Oreochromis niloticus* were 4.8mg/l, 32.mg/l, 2.6mg/l, 2.1mg/l, 1.8mg/l and the maximum toxicant admissible concentrations were 0.018mg/l-0.18mg/l. reported lower concentration of Ringworm plant *Senna alata*, used in poising water bodies for fish capture in Benue State of Nigeria, the 96hrLc50 for juvenile tilapia *Oreochromis niloticus* was 13.93mg/l, Indicated that the extract causes sub acute effect.

The toxicity of *Carica papaya* to *Oreochromis niloticus* is higher than the result of who reported that the 96hLc50 of $0.19mg/l^{-1}$, for the Nile tilapia *Oreochromis niloticus*, exposed to the toxicity of cassava (*Manihot esculenta*), the reason may be as a result of higher toxicant concentration in cassava effluent. stated that the acute toxicity of an organophosphorus insecticide monocrotophus to the fresh water fish *Anabas testudineus.* The 24h, 48h, 72h, and 96hLc50 were found to be 22.65, 21.2, 9.75, and 19ppm respectively. The safe concentration of monocrotophos was 0.19ppm.

Muniyan and Veeraraghavan (1999) reported the effect of insecticide, ethofenprox to Nile Tilapia *Oreochromis mossambicus*, using a static bioassay method, the median lethal concentration for 3, 6, 12, 24, 48, and 96h were 2.03, 1.95, 1.90, 1.85, 1.79, 1.76, and 1.74ppm respectively. It was observed that fingerlings of Tilapia *Oreochromis niloticus* showed variations in their tolerance to aqueous extracts of *Carica papaya* Table 4 & 5: upon addition of the toxicant, the fish showed various toxic reactions such as erratic movements, air gulping, molting, while increase in concentration and exposure time resulted in loss of scale and haemorhage. This report agree with the work of many authours who work on the toxicity of different freshwater fishes.

There is significant difference in the value of blood parameters; of fingerlings O. niloticus after exposure to 96hours aqueous extract of *Carica papaya* seed powder Table 6. The result of haematological parameters of fingerlings tilapia showed significant difference in higher concentrations. The pack cell volume increased

Table 1: Percentage Cumulative Mortality of *Carica papaya* to Tilapia *Oreochromis niloticus* Fngerlings (Range Finding Test)

S/N	CONC.	15min	30min	45min	60min	2hr.	3hrs	4hrs	8hr	12hr	16hr	20hr	24hr
1	0mg/l	0	0	0	0	0	0	0	0	0	0	0	0
2	2mg/l	0	0	0	3.3	6.7	10	13.3	23.3	23.3	30	30	30
3	4mg/l	0	0	3.3	10	20	26.7	30	30	30	46.7	46.7	50
4	6mg/l	0	3.3	6.7	23.3	23.3	33.3	40	40	43.3	46.7	60	66.7
5	8mg/l	0	3.3	16.7	26.7	40	46.7	53.3	63.3	66.7	73.3	90	100
6	10mg/l	0	6.7	10	30	53.3	56.7	70	70	83.3	93.3	100	100

Table 2: Percentage Cumulative Mortality of *Carica papaya* to Tilapia *Oreochromis niloticus* Fingerlings (Definitive Test)

S/N	CONC.	1hr	2hr	3hr	4hr	8hr	12hr	16hr	20hr	24hr	48hr	72hr	96hrs.
1	4.0mg/l	0	0	0	3.3	13.3	16.7	16.7	33.3	33.3	36.7	36.7	36.7
2	4.2mg/l	0	0	0	6.7	10	26.7	30.	43.3	43.3	43.3	43.3	53.3
3	4.4mg/l	0	0	3.3	10	10	13.3	30.	30	46.7	46.3	50	50
4	4.6mg/l	0	0	0	3.3	16.7	16.7	23.3	36.7	46.7	56.7	56.7	56.7
5	4.8mg/l	0	0	3.3	6.7	13.3	20.0	38.3	39.3	46.7	46.7	63.3	83.3
6	5.0mg/l	0	0	13.3	21.2	40	46.7	46.4	53.3	60	80	93.3	100

Table 3: The LC_{50} value for Fingerlings Tilapia Oreochromis niloticus.

TIME (Hours)	LC50 (mg/l)
20	4.8
24s	3.2
48	2.6
72	2.1
96	1.8

from 13.6±1.2% in the control to 6.58.0±3.4% in concentration of 5.0mg/l *Carica papaya* / litre of water. Erythrocyte Sedimentation Rate increases from 9.33±0.5% in control to 14.5±1.6% in higher concentration of 5mg/l White blood cell, Mean Cell Heamoglobin increase from 3.3±0.3 $10^4 mm^3$, 3.3±0.3, to 5.4±0.2, and 4.8±0.9 in higher concentration of 5.0mg/l.

Table 4: Behavioral Monitoring for fingerling Tilapia (Range finding test)

Behavior/Exposure Time	12hrs.						16hrs.						20hrs.						24hrs.					
Concentrations	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10
Loss of reflex	-	-	-	-	+	+	-	-	-	-	+	+	-	-	-	-	+	+	-	-	-	-	+	+
Molting	-	-	-	-	+	+	-	-	-	-	+	+	-	-	-	-	+	+	-	-	-	-	+	+
Discoloration	-	-	-	-	+	+	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-
Air gulping	-	+	+	+	+	+	-	+	+	+	+	+	-	+	+	+	+	-	-	+	+	+	+	-
Erratic swimming	-	-	-	-	+	+	-	-	-	-	+	+	-	-	-	-	+	+	-	-	-	-	+	+
Loss of scale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Haemorrhage	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+

Table 5: Behavioral Monitoring for fingerling Tilapia (Definitive Test)

Behavior/Exposure Time	24hrs					48hrs					72hrs					96hrs				
Concentrations	4.0	4.2	4.6	4.8	5.0	4.0	4.2	4.6	4.8	5.0	4.0	4.2	4.6	4.8	5.0	4.0	4.2	4.6	4.8	5.0
Loss of reflex	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molting	-	-	-	-	+	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Discoloration	-	-	-	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+
Air gulping	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Erratic swimming	-	-	+	+	+	+	-	-	-	-	+	-	-	+	-	-	-	-	+	-
Loss of scale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	+
Haemorrhage	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+

Key: - = not present
+ = Present

Table 6: The Summary of Effect of *Carica papaya* on Haematological Parameters of Fingerlings Tilapia *Oreochromis niloticus*.

CONC./ PARAMETERS	PCV (%)	Hb (g/dl)	ESR (%)	WBC $10^4 mm^3$	RBC $10^6 mm^3$	MCH(pg)	MCHC (T/L)	MCV (μ^3)
$T_{0\ (0mg/l)}$	13.6±1.2	4.6±0.44	9.33±0.6	3.3±1.3	1.4±0.3	3.3±0.3	336.4±5.0	98856.2±1009.8
T_1 (4.0mg/l)	7.67±3.8	2.63±1.3	12.7±2.3	4.2±1.4	0.6±0.4	4.3±0.6	343.9±5.4	12398.3±1723.2
T_2 (4.2mg/l)	15±4.36	5.17±1.3	10±2.65	2.8±1.0	9.3±0.3	4.2±0.5	348.1±2.1	34310.6±4674.3
T_3 (4.4mg/l)	12.7±0.6	4.23±0.2	10.7±0.6	2.7±0.5	1.2±0.2	2.6±0.3	334.2±4.0	10342.7±916.17
T_4 (4.6mg/l)	13.3±4.0	4.49±1.3	10.7±2.1	3.6±1.0	1.3±0.5	3.5±0.3	330.3±3.6	10065.8±1152.7
T_5 (4.8mg/l)	6.33±1.5	2.13±0.5	14±1.0	5.0±0.3	0.5±0.2	3.4±0.5	336.5±7.6	10536.5±846.18
T_6 (5.0mg/l)	6.58±3.4	2.02±0.4	14.5±1.6	5.4±0.2	0.3±0.2	4.8±0.9	336.9±3.4	14365.08±268.14

Table 7: The summary result of Physico-Chemical Parameter during the test.

Parameter	Range Finding Test			Definitive Test		
	Before test	During test	After Test	Before test	During test	After Test
Tem. (°C)	26.5	27	27	26.2	26.5	27.2
DO^2 (mg/l)	5.6	5.8	5.5	6.2	5.8	6.2
pH	7.2	6.9	6.8	6.8	7.1	7.5

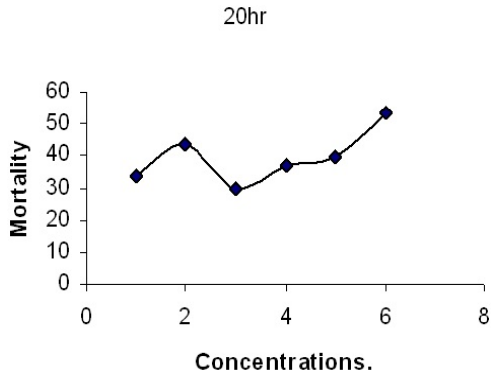

Fig. 1: Graph Showing the Determination of 20Hrs. Lc50 For Fingerlings Tilapia O.

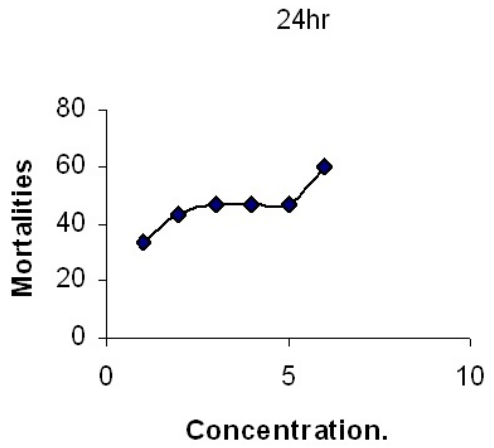

Fig. 2: Graph Showing the Determination of 24Hrs. Lc50 for.

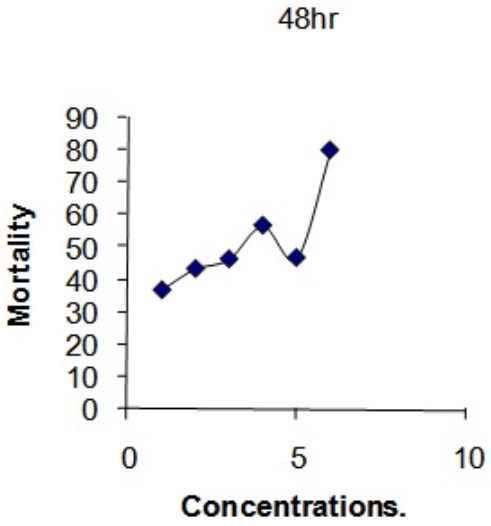

Fig. 3: Graph Showing the 48Hrs Lc50 For Fingerling Tilapia O. Niloticus.

While there is a decrease in the value of heamoglobin concentration, Haemoglobin, Mean Cell Volume, decreases from 4.6±0.4g/dl, 98856.2±10098m^3 in control to 2.02±0.4, 14365±268.14 in higher concentration of 5mg/l respectively. There is no significant difference in change in mean cell haemoglobin. This result is similar to the work of who studied the effect of inhalation of the pyrethroid insecticide, tetramethrin on hematological and biochemical parameters in albino rats. They recorded no significant changes in RBC count, haematocrit value, hemoglobin content and the blood indices MCHC, MCV and MCH. On the other hand, the WBC counts and lymphocytes percentage showed significant increase whereas the blood platelets decreased significantly in the treated rats. Serum triglycerides were significantly raised after 3, 6 and 9 days of treatment while cholesterol values showed significant increase after 15 days. Total proteins and albumin had not been changed significantly in tetramethrin treated animals during the experimental period.

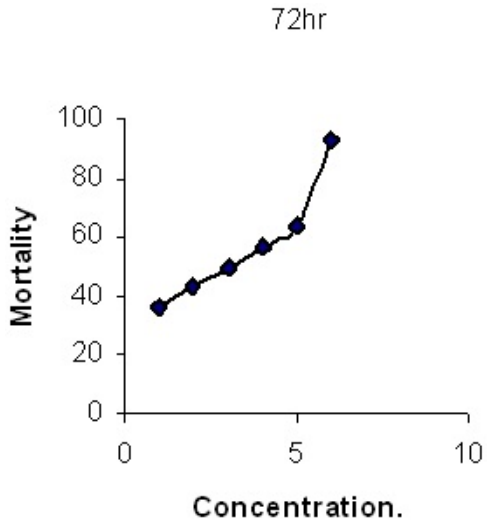

Fig.4 : Graph Showing the Determination of 72Hrs. Lc50 for Fingerlings tilapia O.Niloticus.

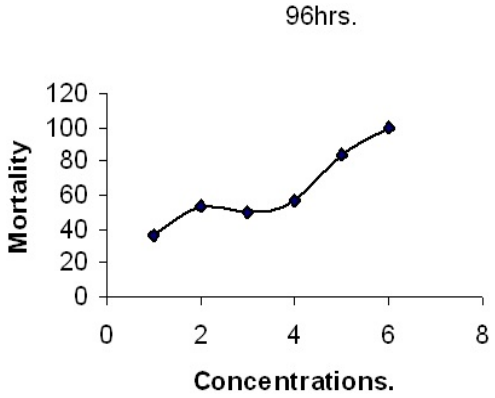

Fig. 5: Graph Showing the Determination of 96Hrs. Lc50 For fingerlings Tilapia.

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