Mintage Journal of Pharmaceutical & Medical Sciences

Vol 6, Issue 2, 2017 ISSN: 2320-3315

MINTAGE JOURNALS™

Original Article

EVALUATION OF THE EFFECT OF BENZENE-CONTAMINATED WATER ON THE GRAVIMETRY, SERUM CHOLESTEROL AND TRIGLYCERIDE CONCENTRATIONS OF AFRICAN CATFISH (*CLARIAS GARIEPINUS*)

OGUNBIYI, OLUWAGBENGA JOHN

Department of Biochemistry, Faculty of Science, Adekunle Ajasin University, P.M.B. 01, Akungba Akoko, Ondo State, Nigeria
Email: 2rayacoa@gmail.com

Received - 07.02.2017; Reviewed and accepted -31.03.2017

ABSTRACT

Objective: The biochemistry of *Clarias gariepinus* cultivated in benzene-contaminated water for a period of 8 weeks was studied. **Methods**: Twenty African catfish were divided into two groups of ten fish each and cultivated in water contaminated with 10µg/ml of benzene while the appropriate control does not contain this contaminant. **Results:** The results show that there was significant decrease ($p<0.05$) in the heart-body ratio of benzene-contaminated water (0.13±0.01) when compared to control (0.28±0.04). However, the body weight gain of the test fish was found to be significantly higher ($p<0.05$) than that of control. The serum cholesterol concentration was significantly decrease while that of triglyceride concentration was significantly elevated when compared to that of control (cholesterol for benzene= 25.38±0.18 mg/dl; cholesterol for control= 42.21±0.02 mg/dl and triglyceride for benzene= 37.74±0.24 mg/dl; triglyceride for control= 12.80±0.30 mg/dl). **Conclusion:** The findings suggest that there is likely to be imbalance in the lipid metabolism of the fish which if consumed by man will, perhaps, alter the proper functionality of some of their organ.

Keywords: serum cholesterol, triglycerides, *C. gariepinus*, benzene, contaminants.

INTRODUCTION

Human life, as with all animal and plant life on the planet, is dependent upon water. Not only do we need water for agricultural purposes, generate our power and run our industries, but we need it as a basic part of our daily lives. Pollution from industrial and oil-related activities is common in many parts of the world. Many industrial and urban areas in Nigeria are contaminated with a variety of pollutants that are harmful to aquatic organisms [1]. Contaminants carried in water are dependent on solid waste composition and on the simultaneously occurring physical, chemical and biological activities within landfill [2]; [3].

Sewage pollution harms fish and other aquatic life by degrading and destroying aquatic habitat. In addition to destroying fish spawning zones, the accumulation of excessive organic matter contributes to a reduction of plant growth and productivity, thus adversely affecting the aquatic organisms feeding on these plants [4]. Also, excessive organic matter can rob water of its dissolved oxygen content, adding stress to the system and resulting sometimes in the death of aquatic organisms [4].

Available reports show that cultivating *Clarias gariepinus* in contaminated water may promote fish growth [5], compromise fish liver integrity [6] and impair lipid metabolism in fish [7] depending on bioavailability of contaminants. A contaminant can have toxic effects only if it occurs in a bioavailable form [8]. This contaminant can find their way into the animal cell and influence the normal processes of the organism. Contaminants that are more bioavailable pose greater risk to the environment and potentially to human health than similarly toxic but less available contaminants. The aims of this present study were therefore to examine the effect of benzene-contaminated water on serum cholesterol and triglyceride concentration of *C. gariepinus* and its effects as a possible stress agent.

MATERIALS AND METHODS

Reagents

Chemicals and solvents used are of analytical grade and most are products of Sigma-Aldrich Inc, St. Louis, U.S.A.

Experimental Water

The experimental water for the study was collected from the supply of Adekunle Ajasin University, Akungba-Akoko, Ondo State, Nigeria.

The experimental water sample was contaminated with 10µg/ml of benzene and was divided into two experimental groups of 10 fish each. Group A (minus benzene) and Group B (plus benzene)

Experimental Animal and Management

Twenty (20) African catfish (*Clarias gariepinus*) were obtained from the Department of Environmental Biology and Fishery, Adekunle Ajasin University, Akungba-Akoko, Ondo State, Nigeria. These fish were fed (3%of mean body weight) with commercial feeds obtained from Livinco feeds, Jubilee Road, Ikare Akoko, Ondo State, Nigeria. The experimental animals were kept inside a transparent plastic container assigned into two (2) groups of ten (10) fish each. This was also replicated to make additional two groups. The fish were cultivated in benzene-free water from the University Supply and water contaminated with 10µg/ml benzene respectively. The feeding exercise lasted for 8 weeks but was preceded by 2 weeks of acclimatization.

Isolation of Tissues

The fish were left outside water for a while after which they were dissected and heart was removed. The blood was obtained through cardiac puncture. Each blood sample was thereafter centrifuged at 3,500rpm for about 15 minutes using refrigerated centrifuge RC650s and the serum obtained was preserved at -8°C until required for use.

Preparation of Homogenate

The isolated tissue were weighed and a portion of each tissue was cut out, chopped into very small pieces and then homogenized using pre-cooled pestle and mortar in a bowl of ice cubes. The tissue homogenates were diluted using normal saline solution to the tune of 1 in 30 dilutions. The diluted homogenates were stored at temperature of -8°C until required for use.

Biochemical Assays

Serum Total Cholesterol Concentration was determined following the method described by Abell *et al.,* [9]. Cholesterol reacts with acetic acid/acetic anhydride mixture in the presence of concentrated sulphuric acid to give a green colour. The absorbance of the colour at 570nm which is proportional to the amount of cholesterol in the sample is read on a spectrophotometer. Serum triglycerides concentration was determined following the method described by National Cholesterol Education Programme (NCEP) [10].

Statistical Analysis

Analysis of variance ANOVA; Duncan's Multiple Range Test (DMRT) was the statistical analysis used [11]. $P < 0.05$ was regarded as significant.

RESULTS

Table 1 shows the body weight gain of *C. gariepinus* cultivated in benzene contaminated water. The body weight gain of fish cultivated in benzene contaminated water was significantly ($p<0.05$) higher than that cultivated in benzene free water (control).

Table 2 shows the liver/body weight, kidney/body weight, heart/body weight and brain/body weight of fish cultivated in benzene-contaminated water. The heart/body weight of *C. gariepinus* cultivated in water contaminated benzene was found to be significantly lower than that of control ($p<0.05$) while those of liver, kidney and heart/body weight was found not be significantly different from that control ($p>0.05$).

The concentration of cholesterol in *Clarias gariepinus* cultivated in benzene contaminated water is significantly ($p<0.05$) lower than those cultivated in tap water (control) while the concentration of triglyceride in *Clarias gariepinus* cultivated in benzene contaminated water is significantly ($p<0.05$) higher than control as shown on table 3.

Table 1: Body weight gain (g) of *C. gariepinus* cultivated in benzene-contaminated water.

Treatment	Groups	Body Weight gain
Water – Benzene (control)	A	110 ± 5^{a}
Water + Benzene (test)	B	200 ± 11^{b}

Results are means of 10 determinations ± SEM. Values carrying different superscripts are significantly different (p<0.05).

Table 2: Organ-body weight ratio (%) of *C. gariepinus* cultivated in benzene-contaminated water.

Groups	Liver	Kidney	Heart	Brain
A*	1.42 ± 0.12^{a}	0.27 ± 0.03^{a}	0.28 ± 0.04^{a}	0.34 ± 0.03^{a}
B	1.09 ± 0.19^{a}	0.38 ± 0.08^{a}	0.13 ± 0.01^{b}	0.36 ± 0.05^{a}

Results are means of 10 determinations ± SEM. Values carrying different superscripts are significantly different (p<0.05).

*See table 1 for description of groups.

Table 3: Concentration of serum cholesterol and triglycerides of *C. gariepinus* cultivated in water contaminated with benzene.

Treatment	Cholesterol (mg/dl)	Triglyceride (mg/dl)
Water – Benzene	42.21 ± 0.02^{a}	12.80 ± 0.30^{a}
Water + Benzene	25.38 ± 0.18^{b}	37.74 ± 0.24^{b}

Results are means of 10 determinations ± SEM. Values carrying different superscripts are significantly different (p<0.05).

DISCUSSION

The present study observed a marked decrease in cholesterol level but increase in triglyceride level in the serum of *Clarias gariepinus* cultivated in 10 µg/ml benzene contaminated water when compared to control. The observed decrease in cholesterol and elevated triglyceride levels appears to be an indication of the stress agent (benzene) introduced which predispose a disease state, hypocholesterolemia and hypertriglyceridemia in the fish. One biomolecule that appears to be altered by stress is cholesterol [12]. Changes in the constituent of water can induce stress in fish [13]. This observation suggests that somehow benzene interferes with cholesterol and triglyceride levels in the tissue of catfish. This could be attributed to either impaired de novo synthesis or accelerated rate of degradation of cholesterol in the tissue of this fish.

Adeyemi *et al.,* [14] reported that hepatotoxicity may predispose to tissue failure in albino rats due to consumption of *Clarias gariepinus* raised in water contaminated with mixtures of organic toxicants such as phthalate, benzene and cyclohexane. Consumption of *Clarias gariepinus* propagated in contaminated water could impair kidney function and may result in kidney damage [15].

In conclusion, the present study seems to suggest that *Clarias gariepinus* cultivated in (10µg/ml) benzene contaminated water for 8 weeks tends to increase in body weight gain but decrease in the heart-body weight ratio while the cholesterol level decreases with increase triglyceride level. These findings suggest that somehow the increase triglyceride concentration of catfish cultivated in benzene contaminated water contributed to decrease in heart-body weight ratio which might raise a risk of heart disease and may be a sign of metabolic syndrome in the fish. The activity of the triglyceride also predisposes to decrease in the cholesterol level observed in the fish. However, this study suggest that African catfish (*Clarias gariepinus*) cultivated in benzene contaminated water may not be good for consumption by human, and may perhaps, lead to presentation of clinical manifestation that can alter the functionality of some organs such as kidney or predispose to liver hepatotoxicity during metabolism if consumed by man.

REFERENCES

1. Gabriel, U.U., Ezeri, G.N and Amakiri, E.U. Liver and Kidney Histopathology: Biomarkers of No. 1 Fuel Toxicosis in African Catfish, *Clarias gariepinus*. Journal of Animal and Veterinary Advances 2007; 6 (3):379-384.
2. Monroe, M. Landfill Leachate Treatment: VSEP Offers a Revolutionary Solution – Introduction New logic Research, Inc. Company 2001.
3. Adeyemi, O., Oloyede, O. and Oladiji, A. Effect of Leachate-contaminated Groundwater on the Growth and Blood of Albino of Rats. *The Internet Journal of Hematology* 2006; Volume 3 Number 2.
4. Nantel, M. Municipal Wastewater Pollution In British Colombia. *Environment Probe* 1996.
5. Sunmonu, T. O. and Oloyede, O. B. Biochemical assessment of the effects of crude oil contaminated catfish (Clarias gariepinus) on the hepatocytes and performance of rat. *African Journal of Biochemical Research* 2007; 1(5):083-089.
6. Adeyemi, O., Ajayi, J. O., Olajuyin, A. M., Oloyede, O. B., Oladiji, A. T., Oluba, O. M., Adeyemi, O., Ololade, I. A. and Adebayo, E. A. Toxicological Evaluation of the Effect of Water Contaminated with Lead, Phenol and Benzene on Liver, Kidney and Colon of Albino Rats. *Food and Chemical Toxicology* 2009; 47:885-887
7. Adeyemi, O., Oginni, O., Igbakin, A. P., Adeyemi, O and Osubor, C. C. To what extent will contaminated water affect physical, haematological and lipid properties of *Clarias gariepinus*? *Experimental and Toxicological Pathology* 2011; 63:61-67.
8. Suter, G. W., Vermier, T., Munns, W. R. Jr., and Sekizawa, J. Framework for the integration of health and ecological risk assessment. *Human Ecological Risk Assessment* 2003; 9:281–302.
9. Abell, L., Levy, B., Brodie, B. and Kendall, F. Standard Methods in Clinical Chemistry *J. biol. Chem* 1958; 26:2
10. National Cholesterol Education Programme (NCEP). *HDL, LDL and TG assay*, in PMC 2001.
11. Duncan, D. B. Multiple range and multiple F test. *Biometrics* 1955; 11:1-10.

12. Kumar, R., Sharma, M., Puri, J., Jain, I., Singh, S., Kapoor, K., Ansari, N., and Singh, S. Effect of Hypolipidemic drugs on stress induced alteration on Lipid Profile in rats. *The Internet Journal of Pharmacology* 2010; Volume 8 Number 1.
13. Rottmann, R.W., Francis-Floyd1, R., and Durborow, R. The Role of Stress in Fish Disease. Southern Regional Aquaculture Center, Department of Agriculture 1992; 474:1-4.
14. Adeyemi, O., Osubor, C. C. and Adeyemi, O. Toxicological evaluation of the effect of *Clarias gariepinus* (African catfish) cultivated in water contaminated with phthalate, benzene and cyclohexane on liver of albino rats. *African Journal of Food Science* 2010; 4(1):026-031.
15. Adeyemi, O. and Osubor, C. C. Assessment of nephrotoxic effect of *Clarias gariepinus* (African catfish) cultivated in water contaminated with phthalate, benzene and cyclohexane on albino rat. *Nigerian Journal of Life Sciences* 2010; 4(2):1-19.