Assessment of lipid profile levels of chickens (*Gallus gallus domestica*) exposed to factory sites in Nnewi, Anambra State, South Eastern Nigeria

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Abstract
This study investigated the lipid profile levels of the factory chickens in Nnewi, Anambra State, Nigeria. A total of twenty-nine chicks aged between four and five months were grown to adult birds (chickens) for the study. They were allowed to feed from the surrounding homeland until they were due for the experiment. The chickens were sacrificed to obtain the blood for analyses. Thereafter, 5ml of blood sample was collected from the heart into plain containers for estimation of biochemical parameters: triacylglycerol (TAG), total cholesterol (TC), low density lipoprotein (LDL), high density lipoprotein (HDL), and very low density lipoprotein (VLDL). Biochemical parameters were assayed using standard laboratory methods. Thereafter, the data obtained were subjected to statistical analysis by Students t-test using Statistical package for social sciences (SPSS) (Version 16) software and Statistical significance was tested at $P<0.05$. The result showed that the mean serum TAG, TC, LDL-C, and VLDL-C were elevated and HDL-C reduced as against the control birds, but none was statistically significant ($P>0.05$). These findings may be attributed to the short duration of this study.

Keywords: Industrialization, Industrial effluent, Lipid profile, Factory chickens (*Gallus gallus domestica*), Nnewi.

Introduction
Industrialization of the modern world has been found to generate compounds which are deleterious to life especially to those who work in such industries. Nnewi is one of such growing industrial towns in South Eastern Nigeria and it is the second largest city in Anambra State. Several of such industries in Nnewi are manufacturers of such products as motor car and motor cycle spare parts, electrical appliances, cooking utensils, lead acid batteries, plastics, lead ingots etc. Many of such industries are in close proximity with the living population with the attendant poor enforcement of environmental laws.[1] One of the major effluents of some of these industries is 'heavy metals'.

The term "heavy metals" assumes a variety of different meanings throughout the different branches of science. Although "heavy metals" lacks a consistent definition in medical and scientific literature, the term is commonly used to describe the group of dense metals or their related compounds, usually associated with environmental pollution.[2] Elements fitting this description include lead, mercury and cadmium. The rather broad definition of heavy metals may also be applied to toxic metalloids like arsenic, as well as nutritionally-essential trace minerals with potential toxicities at elevated intake or exposure (e.g., iron, zinc, copper).[2,3] They have relatively high density and are toxic or poisonous even at low concentration.[4] Heavy metals are among the contaminants in the environment and they bio-accumulate. This bio-accumulation results when there is an increase in the concentration of a chemical in a biological system over time compared with the natural concentration of the chemical in the environment.[5] These metals/metalloids include lead (Pb), cadmium (Cd), mercury (Hg), arsenic (As), chromium (Cr), copper (Cu), selenium (Se), nickel (Ni), silver (Ag) and zinc (Zn). Other less common contaminants include aluminum (Al), cesium (Cs), cobalt (Co), manganese (Mn), molybdenum (Mo), strontium (Sr) and uranium (U).[6] Beside the natural activities, almost all human activities also have potential contribution to produce heavy metals as side effects (7,8). In small quantities, certain heavy metals are nutritionally essential for a healthy life and are referred to as trace elements such as iron (Fe), copper (Cu), manganese (Mn) and zinc (Zn).[9,3] Some of these trace elements maintain the metabolism of the human body, however, at higher concentrations; they can lead to poisoning and environmental pollution.[10]

Combustion processes are the most important sources of heavy metal pollution particularly power generation, smelting, incineration and the internal combustion engine.[11-13] Exposure to some of these environmental pollutants such as zinc, lead, copper, nickel, chromium, cadmium, etc. have been linked to some common health problems such as chronic fatigue, aggressiveness, anxiety, anorexia, muscular and joint pains, constipation, insomnia and high blood pressure.[14] Several occupations are at risk of heavy metal contamination such as electricians, mechanics, glaziers, welders, painters, architects, abrasive blasters, etc. These metals are a cause of environmental pollution (heavy metal pollution) from a number of sources including lead in petrol, industrial effluents and leaching of metal ions from the soil into lakes and rivers by acid rain. Heavy metal toxicity in the liver bring degenerative changes in enzymes of lipid peroxidation, glutathione, glutathione peroxidase, catalase, and superoxide dismutase - biomarkers of acute hepatic damage.[15] Blood profiles of chickens can be used as a

diagnostic tool to assess the health status of an individual and/or flock.[16] There is limited information concerning the normal blood profiles of different indigenous chickens of varying age and for husbandry regimens in Nigeria.[17] Such information apart from being useful for diagnostic and management purposes could equally be incorporated into breeding programmes for genetic improvement of indigenous chickens.[18] Hence, this study investigated the lipid profile levels of the Factory Chickens in Nnewi, Anambra State, Nigeria.

Materials and Methods

Experimental Design

A total of twenty-nine chicks comprising of sixteen chicks exposed to factory sites and thirteen non-exposed chicks were grown to adult birds (chickens) for the study. They were aged between four and five months. The chicks in the exposed group were obtained from the surrounding households, about 250m, to these factories under study (lead acid battery manufacturing factory, cable manufacturing factory, metal fabricating factory and metal forging factory) while the chicks to serve as control were obtained in Elele. They were allowed to feed from the surrounding homeland until they were due for the experiment. Control chickens of the same age group were obtained from environments outside Nnewi. The chickens were sacrificed to obtain the blood for analyses.

Collection of Blood from the Chickens

At the end of the study period that lasted eighteen weeks, the (birds) chickens were each anaesthetized with ether soaked in absorbent cotton wool and kept in a dessicator with the lid firmly put in place to prevent evaporation. Approximately, 5ml of blood sample was collected from the heart into plain containers for estimation of biochemical parameters (TAG, TC, LDL, HDL, VLDL). Serum Triacylglycerols (TAG) was determined using enzymatic method as described by;[19] Total cholesterol (TC) concentration was determined using enzymatic method as described by.[20] The determination of the serum concentration of high density lipoprotein cholesterol (HDL-C) was assayed according the method of,[21] while the serum concentrations of LDL-C and VLDL-C were calculated using the method according to.[22]

Ethical Consideration

Ethical approval for the research was obtained from Ethical Committee, Nnamdi Azikiwe University Teaching Hospital, Nnewi, Anambra State, Nigeria (NAUTH/CS/66/Vol.2/149).

Statistical Analysis

The data were presented as mean±SD and the mean values of the control and test group were compared by Students t-test using Statistical package for social sciences (SPSS) (Version 16) software. Statistical significance was tested at $P<0.05$.

Results

There was no significant difference observed between the mean serum triacylglycerols (TAG) level obtained in the factory exposed chickens when compared with the control birds ($p>0.05$), (See table 1).

Also, the mean serum total cholesterol level did not differ significantly between the values obtained in the factory exposed birds compared with the control chickens ($p>0.05$), (See table 1). Furthermore, the mean serum concentrations of LDL-C, and VLDL-C show a higher trend and HDL-C show a lower trend compared with the control birds, but none was statistically significant ($P>0.05$), (See table 1).

Discussion

The present study investigated the lipid profile levels of Chickens (*Gallus gallus domestica*) exposed to factory sites in Nnewi, Anambra State, Nigeria.

In this study, no significant statistical difference was observed between the control serum TAG (triglyceride) level and the factory chickens. High levels of triacylglycerol can dispose one to development of CVD and stroke; while low triacylglyerol levels may deprive the body of energy and is an indication of an underlying pathology.[23]

In the present study, the mean serum total cholesterol level did not differ significantly between the values obtained in the factory exposed birds compared with the control chickens. Cholesterol is one of the most controllable risk factors for heart disease, heart attack and stroke and it causes cardiovascular disease which is a leading cause of disability and premature death.[24] The result obtained in this study is within normal acceptable range.

Table 1: Lipid profile levels of the factory chickens (*Gallus gallus domestica*)

Chickens	TAG (mmol/L)	TC (mmol/L)	HDL-C (mmol/L)	LDL-C (mmol/L)	VLDL-C (mmol/L)
Control (n=13)	0.67±0.47	3.41±1.29	0.91±0.23	2.21±0.23	0.29±0.06
Factory (n=16)	0.75±0.41	3.81±1.13	0.89±0.21	2.60±0.37	0.32±0.05
t-value	-0.504	0.740	0.121	-1.267	-0.454
p-value	0.618	0.377	0.893	0.216	0.653

*Statistically significant at $p<0.05$; Results are Mean±SD.

Furthermore, the mean serum concentrations of LDL-C, and VLDL-C were elevated and HDL-C reduced as against the control birds, none was statistically significant. LDL cholesterol is a signal of adverse effect in the health of factory birds and high LDL cholesterol is known to dispose to development of CVD because this lipoprotein can cause cholesterol to become deposited in the walls of the arteries, they can become blocked, leading to decreased blood and a heart attack. These findings may be attributed to the short term duration of exposure of the birds to these areas. This result is in contrast with the report of Imasuen and Otoikhian,[25] who observed significant differences in the lipid profile in blood of a group of Nigerian chickens (Gallus, *gallus domesticus*).

Conclusion

In conclusion, there were no significant statistical differences observed between serum TAG, TC, HDL-C, LDL-C and VLDL-C levels in the factory exposed and control chickens. These findings may be attributed to the short duration of this study.

Conflict of Interest: None.

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