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

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Abstract
This study examined the rheological indices of chickens exposed to factory sites in Nnewi Nigeria. A total of twenty-nine (29) chickens aged four (4) to five (5) months comprising of 16 chickens exposed to factory sites and 13 non exposed chickens (control birds) were used for the present study. Five (5) ml of blood sample was collected from the heart of the animal into EDTA containers for the evaluation of rheological indices under study. The red cell count (RCC), hemoglobin (Hb), packed cell volume (PCV), mean corpuscular hemoglobin concentration (MCHC), total white blood cell (TWBC) and lymphocyte levels were assayed by using Mythic 22 automated hematology analyzer observing standard laboratory practice. The RCC and lymphocyte levels of the factory chickens were significantly increased ($p<0.05$) while the neutrophil levels were significantly decreased ($p<0.05$) compared to the control chickens. However, there was no statistical significant difference. ($p>0.05$) between the Hb, PCV, MCHC and TWBC levels of the factory chickens and the control birds respectively. These results may be attributed to the short duration of this study and the fact that these chickens were not directly exposed to these industrial effluents.

Keywords: Chickens, Factory sites, Heavy metals, Rheological indices, Elele, Nnewi.

Introduction
Chickens dominate about 98% of the total poultry members (ducks, turkeys and Guinea fowls) which are reared in Africa[1]and out of the 150 million chickens in Nigeria, 120 million are of local origin or breeds while the remaining 30 million are of exotic origin.[2] Local chickens are widely distributed in the rural areas of Nigeria where they are kept by the majority of the rural population. Several investigations[3-5] have reported that each rural household in Nigeria has an average of 11 to 34 local chickens. These chickens find their way into various places including areas of industrial concentration in search of food and water, during which they may be exposed to different forms of effluents emanating from such industries.[6] These effluents are chiefly composed of heavy metals.

Heavy metals are found naturally in the ecosystem with varying concentrations but a large amount of such heavy metals are introduced into the ecosystem due to the activities of humans. The occurrence of some of these heavy metals in the environment is of great ecological importance due to their toxicity at certain level, and its translocation through food chains which are considered as persistent.[7] Factories where these heavy chemicals can be released from include; chemicals, pharmaceuticals, biocides, electronic goods, food, beverages, vegetable oils, fishing, plastics, paints, dyes, cement, asbestos, glass, ceramics, oil refinery, tanneries, soap and detergents, tobacco, ship building and breaking, iron and steel, metal finishing, auto assembling and manufacture, thermal power generation, paper and printing and also forge and foundry[6]. According to Dibner *et al*.[8], some heavy metals known to be potentially toxic include lead, cadmium, selenium, nickel, cobalt, copper, manganese etc. Lead has been reported to cause hemolysis, damages on the RBC, cell membranes, intestinal tissue and affects gut function [9-11,6]. Previous studies on the effects of cadmium and chromium on hematologic indices of poultry birds have shown differing results.[12,13,6] The haematological parameters of chickens are significant because they reflect inherent genetic differences amongst the breeds of chicken.[14] In our previous studies, we have shown various effects of the exposure of birds to factory sites on the kidney function status.[15] This current work focuses on the assessment of rheological indices of chickens (*Gallus Gallus domestica*) exposed to factory sites in Nnewi, Anambra State, South Eastern Nigeria.

Materials and Methods
Experimental Site
This study was carried out around four factories sites within Nnewi metropolis, Anambra State, Nigeria. The factories involved in this study include lead acid battery manufacturing factory, cable manufacturing factory, metal fabricating factory and metal forging factory.

Experimental Design, Research Procedure and Parameters Measured
This is a cross-sectional study designed to assess the rheological indices of chickens (*Gallus gallus domestica*) exposed to factory sites in Nnewi, Nigeria. A total of twenty-nine (29) chicks comprising of sixteen (16) chicks exposed to factory sites and thirteen (13) non-exposed chicks were grown to adult birds (chickens) for the study. 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 aged between four (4) and five (5) months. 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.

At the end of the study period that lasted eighteen (18) 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. 5mls of blood sample was collected from the heart into EDTA containers for estimation of haematological parameters. The hematological parameters including haemoglobin (Hb), packed cell volume (PCV), Red Cells count (RCC), Mean Corpuscular Haemoglobin Concentration (MCHC), Total White Blood Cells (TWBC), Neutrophil and Lymphocyte were evaluated using Mythic 22 automated hematology analyzer.

Ethical Consideration

This was gotten from Ethical Committee, Nnamdi Azikiwe University Teaching Hospital, Nnewi, Anambra State, Nigeria.

Statistical Analysis

The data gotten from this study were presented as mean±SD and values between groups compared by Students t-test using Statistical package for social sciences (SPSS) (Version 16) software. Statistical significance was tested at $P<0.05$.

Results

Table 1 presents the result of the rheological indices of the factory and control chickens.

The red cell count (RCC) and lymphocyte levels of the factory chickens were significantly increased ($p<0.05$) while the neutrophil levels were significantly decreased ($p<0.05$) compared to the control chickens.

However, there was no statistical difference ($p>0.05$) between the Hb, PCV, MCHC) and TWBC levels of the factory chickens and the control.

Table 1: Effect of industrial effluents on the status of rheological indices in chickens exposed to factory sites.

Parameter	Control (n=13)	Factory (n=16)
Hb (g/dL)	12.33±0.21[a]	12.35±0.21[a]
PCV (%)	37.00±6.30[a]	37.06±6.50[a]
RCC (µ/L)	3.25±0.57[a]	3.86±0.57[b]
MCHC (g/dL)	33.33±0.24[a]	31.44±7.35[a]
TWBC (µ/L)	45.87±5.61[a]	43.88±7.65[a]
Neutrophil (%)	19.69±9.85[a]	14.75±4.59[b]
Lymphocyte (%)	78.92±11.05[b]	83.44±4.38[a]

Values are in mean (±SD); within row, means with different alphabet letters are statistically significant ($p<0.05$).

Discussion

The haematological values of chickens can be used to evaluate the state of health of either a single chicken or an entire population and would constitute a basic requirement for an indispensable preliminary knowledge of the biological material chosen for study.[16] The results of the rheological indices of the factory birds used in this work have shown that the Hb, PCV, MCHC and TWBC values did not differ significantly from the control chickens while the RCC, neutrophil and lymphocyte values differed. Haematological values of chickens are influenced by a number of physiological factors such as age, breed, sex, climate, geographical location, season, nutritional status, and life habit of species, pregnancy, among other physiological factors.[17-22] The essence of this analysis is to find out how far the environments in which these chickens live affect their haematological parameters in chicken blood in Nigeria.

The results obtained here are inconsistent and seemed to bear no direct relationship with the expected effects of the environment to the chickens. This may be supported by the fact that some of the metal levels obtained in our previous work in this area were statistically different when their levels in factory chickens were compared with the control birds.[23] This situation is in line with the findings of Ogbe *et al*.[24] who reported such inconsistent result when they treated *Eimeria Tenella*-infected broilers with aqueous extract of the wild mushroom (*Ganoderma spp*.) and went on to hold the view that fluctuations in haematological values of avian birds are normal phenomenon and in most cases the variations may depend on the physiological state of the chickens.[25] A reason to adduce here may be the short duration of these experimental chickens and the fact that these chickens were not directly exposed to these effluents.

Conclusion

Conclusively, the present study showed significant elevations in the red cell count and lymphocyte levels with significant reduction in neutrophil levels while the other remaining parameters studied were similar in both groups. These findings may be due to the short duration of these experimental chickens and the fact that these chickens were not directly exposed to these effluents.

Conflict of Interest: None.

References

1. Gueye EF. Family Poultry must no longer be a hidden harvest. *Int Networks Fam Poultr Dev* 2005;1:1-2.
2. RIM. Nigerian National Livestock survey, Federal Development of Livestock and pest control services, Abuja, 1992;12:287.
3. Adene DF. An appraisal of the Health Management Problems of Rural Poultry stock in Nigeria. In: Rural poultry in Africa. Proceedings of International Poultry workshop, Ile-Ife, Nigeria, 1990;88-89.
4. Dafwang II. Survey of the Rural poultry production systems in the Eastern middle-belt of Nigeria. In: Rural Poultry in Africa. Proceedings of International Poultry Workshop. Ile-Ife Nigeria, 1990;221-225.

5. Nwosu CC. Review of Indigenous Poultry Researches in South-Eastern Nigeria. Proceedings of International workshop on Rural poultry in Africa. Ile-Ife, Nigeria, 1990;13-16.
6. Gabol K, Khan ZM, Umair AKM, Khan P, Fatima F, Siddiqui S, *et al*. Induced Effects Of Lead, Chromium And Cadmium On Gallus Domesticus. *Can J Pure Appl Sci* 2014;8(3)3035-42.
7. Abdul-Jameel A, Sirajudeen J, Abdul-vahith R. Studies on heavy metal pollution of ground water sources between Tamilnadu and Pondicherry, India. *Adv Appl Sci Res* 2012;3(1):424-9.
8. Dibner JJ. Early nutrition of zinc and copper in chicks and poults: impact on growth and immune function. Proceedings of the 3rd Mid Atlantic Nutrition conference, Timonium MD, 2005.
9. Foulkes EC. Transport of toxic metal lead across the intestinal tissue. *J Environ Health* 2011;2(1):1428-38.
10. Evoy MM. Lead damage Gut function. *J Toxicol Res* 2012;8(2):28-32.
11. Shaheen T, Akhtar T. Assessment of Chromium in Cyprinus carpio through hematological and bio chemical blood markers.*Turk J Zool* 2012;36(5):682-90.
12. Caiying Z, Guoliang H, Xiaoquan G. Effect of Cadmium on hematologic values of Broiler chicken. *Acta Agric Univer Jiangxiensis* 2005;27(2):279281.
13. Cui H, Yang G, Pen X, Junliangm D, Debing L. Effect of Copper Toxicity on Blood Biochemical Parameters in Broilers. ActaVeter E.T. *Zootech Sinica* 2005;36(12):1329-33.
14. Agaie BM, Uko O. Effects of season, sex and species on the packed cell volume of guinea and domestic fowls in Sokoto state of Nigeria. *Nig Veter J* 1998;19:95-9.
15. Okpogba AN, Ogbodo EC, Okpogba JC, Analike RA, Amah AK, Odeghe BO, et al. Assessment of kidney function status in chickens (*Gallus gallus domestica*) in rural (Elele) and urban (Nnewi) Areas. *J Med Sci Clin Res* 2018;6(12):1048-52.
16. Sharmin ML, Myenuddin M. Hematological values of the indigenous chickens. *Bangl J Veter Med* 2004;2(2):163-4.
17. Tibbo M, Woldemeskel M, Argaw K, Rege JEO. Serum enzyme levels and influencing factors in three indigenous Ethiopian sheep breeds. *Compar Clin Pathol* 2008b;17(3):149-55.
18. Cetin N, Bekyurek T, Cetin E. Effect of sex, pregnancy and season on some haematological and biochemical blood values in Angora rabbits. *Scand J Lab Ani Sci* 2009;36(2):155-62.
19. Farooq H, Samad HA, Sajjad S. Normal reference Haematological values of one-humped camels (Camelus Dromedarius) kept in Cholistan desert. *J Ani Plant Sci* 2011;21(2):157-60.
20. Okonkwo JC, Okonkwo IF, Ebyh GU. Effect of breed, sex and source within breed on the haematological parameters of the Nigerian goats. *Online J Ani Feed Res* 2011a;1(1):8-13.
21. Okonkwo JC, Omeje JS, Okonkwo IF. Effect of source and sex on blood protein fractions of West African dwarf goats (WADG). *Res Opin Ani Veter Sci* 2011b;1(3):158-61.
22. Devi R, Kumar MP. Effect of ageing and sex on the cerulo-plasmin (Cp) and the plasma protein levels. *J Clin Diagn Res* 2012;6(4):577-80.
23. Okpogba AN, Ogbodo EC, Ugwu EC, Oguaka VN, Dike CC, Ujowundu FN et al. Comparative assessment of heavy metal levels in chickens (Gallus *gallus domestica*) in rural (Elele) and urban (Nnewi) Areas. *Asian J Sci Technol* 2018;9(11):9056-9.
24. Ogbe AO, Atawodi SE, Abdu PA, Oguntayo BO, Noel D. Oral treatment of *Eimeria Tenella*-infested broilers using aqueous extract of wild mushroom (*Ganoderma spp*.): Effect of haematological parameters and histopathology lesions. *Afr J Biotechnol* 2013;9(52):8923-7.
25. Islam MS, Lucky NS, Islam MR, Ahad A, Das BR, Rahman MM, et al. Haematological parameters of Fayoumi, Assil and local chickens reared in Sylhet Region in Bangladesh. *Int J Poult Sci* 2004;3(2):144-7.

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