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Effects of breed and sex on serum biochemical indices of local and improved Nigerian chickens raised in the south-south region of Nigeria

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ABSTRACT

This research was done to assess the effects of breed and sex on serum biochemical indices in local and improved Nigerian chickens. Total of forty chickens (20 males and 20 females) from four breeds of (Frizzle feathered, Naked neck, Normal feathered and Noiler) chickens were selected at random from a population of two hundred and thirty birds raised under intensive management. At 11th week, blood samples were collected from the birds and used for biochemical analyses. The parameters measured include; Albumin, Total protein, Aspartate amino transferase, Alanine amino transferase, Alkaline phosphatase. Data generated were analyzed for least squares means using SAS 9s.2 (Version 2008).The result of the biochemical indices revealed no significant difference (p>0.05) for cholesterol, albumin, total protein and aspartate amino transferase among breeds but a high significant difference(p<0.001) for alanine amino transferase and significant difference (p<0.05) for alkaline phosphatase. The Normal feathered chickens had higher least squares means in cholesterol (3.10±0.10g/dl), total protein (41.17±2.50g/dl) and alkaline phosphatase (486±29.08iu/l).The least squares means also indicated that there was significant difference(p>0.05) between sex for all the biochemical parameters but the female sex had higher least squares means in cholesterol (2.98±0.13g/dl), albumin (15.52±0.85g/dl), total protein (39.09±1.19g/dl) and alanine amino transferase (26.90±1.29iu/l) while the male sex had higher least squares means in aspartate amino transferase (43.15±0.81iu/l) and alkaline phosphatase (455.00±29.47iu/l).The study revealed significant effect of breed on serum metabolites among the Nigerian chickens studied and the data generated could serve as baseline data for future improvement of the Nigerian native chicken breeds.

Key Words: *Serum, Naked neck, Frizzle feathered, Normal feathered, Noiler, Nigeria*

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I. Introduction

Several efforts have been directed towards the improvement of the Nigerian native chicken breed, because Machebe and Ezekwe (2004) reported that these chickens have many important gene complexes geneticists can harness in developing improved Nigerian indigenous chickens that will be kept for meat and egg that can survive in the tropics. The Nigerian native chickens have been described based on their feather type such as the normal and frizzle feathered chickens. Body structure has also been used to describe the naked neck chicken. According to Ajayi et al. (2009) the population of the normal feathered chicken in Bayelsa State, Nigeria is 91.8%. Frizzle feathered accounts for 5.2% and Naked neck, 3.0%. The usefulness of the Nigerian native chickens cannot be overemphasized it serves as a means of income and food to many living in the rural areas as a way of alleviating poverty (Njue et al. 2002). Peters et al. (2002) emphasized that the major gene complexes in the Nigerian native chickens have enabled them to thrive and perform well in the tropics that is noted for its high temperature and stress (Ibe 1993) that affects the performance of chickens negatively.

The Nigerian native chickens have the unique ability to hatch on their own, brood and scavenge for major parts of their food as well as possessing high immunity to endemic diseases. According to Ajayi *et al.* (2009) majority of Nigerians prefer the native chickens to their exotic counterparts due to their pigmentation, leanness and taste. Assessment of biochemical indices have been used to assess the health status of animals in different researches (Iheukwumere *et al*. 2008; Oguike and Ude, 2008). This is because serum biochemical indices play an important role in explaining the physiological, nutritional and pathological status of an animal (Taiwo and Ogunsami, 2003). Serum biochemical indices also assist in maintaining normal blood pressure and pH in animals by maintaining the normal osmotic pressure that exist between the circulating fluid in the animals and the fluid in the tissue spaces.

Serum biochemical analysis is used to determine the level of heart, liver and kidney functions as well as to evaluate protein quality and amino acid requirements in animals (Etim and Oguike, 2011). Although a couple of authors have assessed the effect of breed and sex on serum biochemical indices in chicken, there is still scarcity in such data comparing the local and the improved Nigerian local chickens raised in the South-South region of Nigeria. Hence, this study evaluated the effect of breed and sex on serum biochemical indices of local and improved Nigerian chickens, raised in the South-South region of Nigeria.

II. Materials and Methods

The research was conducted at the Teaching and Research Farm of the Faculty of Agriculture, University of Port Harcourt, Port Harcourt suited in Obio-Akpor Local Government Area of River State, Nigeria. The site is located at longitude and latitude of 4.77N and 6.45E with an average temperature of 26^{o}C. Total of forty chickens (20 males and 20 females) from 4 breeds (Frizzle feathered, Naked neck, Normal feathered and Noiler) were selected at random from a population of two hundred and thirty birds raised under intensive management. The birds were feed properly and all necessary medication and vaccines were given. Fresh water was also provided adequately. Good biosecurity was also maintained. At the 11th week birds were subjected to 12 hours fasting prior to blood collection. Blood was collected from the wing web of each chicken using a sterile syringe and needle into a sterile test tube without anticoagulant (plain parameters) for serum biochemical analyses. Serum was obtained by centrifugation of the blood samples and

were stored (at -10 ˚C) until they were analyzed to determine the serum metabolites such as cholesterol, Total protein (TP), albumin (ALB) aspartate amino transferase (AST), alanine amino transferase (ALT) and alkaline phosphate (ALP). Data generated were subjected to least squares means using SAS 9.2 version 2008. Level of significance were reported at ($p<0.05$) and with the use of superscripts.

III. Results and Discussion

Tables 01 and 03 shows the least squares means and standard error for the effect of breed on serum biochemical indices at 11 weeks. The serum biochemical parameters of four Nigerian local and improved chickens are shown in Tables 01 and 02.There was no significant ($p>0.05$) effect of breed on alanine amino transferase (ALT) and Cholesterol. The least squares mean indicated that there was a significant difference ($p<0.05$) among breeds for Albumin (ALB), Total protein (TP), Alkaline phosphatase (ALP). The Normal feathered chickens had higher numerical least squares means in cholesterol (3.10±0.10g/dl), total protein (41.17±2.50g/dl) and alkaline phosphatase(486±29.08iu/l). Also, Naked neck chickens had higher least squares means in albumin (16.28±0.95g/dl) and aspartate amino transferase (AST) (43.9±1.01iu/l). Furthermore, Noiler chickens had lower least squares means for all the biochemical parameter except in aspartate amino transferase (AST) and alkaline phosphatase (ALP) that were of the same range with other breeds.

Tables 02 and 03 show the least squares means and standard error for the effect of sex on serum biochemical indices at 11 weeks. The effect of sex had no significant effect ($p>0.05$) on all the biochemical parameters. The interaction between the breed and sex was also not significantly different ($p>0.05$) for all the biochemical parameters. The least squares means also indicated that there was no significant difference($p>0.05$) between sex for all the biochemical parameters but the female sex had numerical higher least squares means in cholesterol (2.98±0.13g/dl), albumin (15.52±0.85g/dl), total protein (39.09±1.19g/dl) and alanine amino transferase (26.90±1.29iu/l) while the male sex had numerical higher least squares means in aspartate amino transferase (43.15±0.81iu/l) and alkaline phosphatase (455.00±29.47iu/l).

Table 01. Least squares mean and standard error for the effect of breed on serum biochemical indices at 11 weeks

Sources of variation	N	Cholesterol (g/dl)	ALB (g/dl)	TP (g/dl)	AST (iu/l)	ALT (iu/l)	ALP (iu/l)
Frizzle feathered	10	2.73±0.18	15.85±0.97^{ab}	38.57±2.72^{ab}	42.00±0.98	28.30±1.34^{a}	484.25± 40.75^{a}
Naked neck	10	2.79±0.18	16.28±0.95^{a}	39.73±1.36^{ab}	43.90±1.01	27.40±0.87^{a}	399.41± 52.40^{ab}
Noiler	10	2.88±1.20	12.91±0.78^{b}	24.23±1.45^{b}	41.20±0.95	17.2±1.89^{b}	341.1± 43.85^{b}
Normal feathered	10	3.10±0.10	15.89±1.12^{ab}	41.17±2.50^{a}	42.3±0.77	28.3±1.59^{a}	486± 29.08^{a}

a, b: Means with different letters on same column are significantly different ($p<0.05$).
ALB = albumin, TP = total protein, AST = aspartate amino transferase,
ALT = alanine amino transferase, ALP = alkaline phosphatase.

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Table 02. Least squares mean and standard error for the effect of sex on biochemical indices at 11 weeks

Source of variation	N	CHOLESTEROL (g/dl)	ALB (g/dl)	TP (g/dl)	AST (iu/l)	ALT (iu/l)	ALP (iu/l)
Female	20	2.98±0.13	15.52±0.85	39.09±1.19	41.55±0.77	26.90±1.29	400.85±33.82
Male	20	2.77±0.07	14.94±0.57	37.75±1.86	43.15±0.81	23.70±1.55	455.00±29.47

ALB = albumin, TP = total protein, AST = aspartate amino transferase,
ALT = alanine amino transferase, ALP = alkaline phosphatase.

Table 03. Least means squares for the effects of breed and Sex on biochemical indices at 11 weeks

Sources of variation	DF	Cholesterol (g/dl)	ALB(g/dl)	TP(g/dl)	AST(iul)	ALT(iul)	ALP(iul)
Breeds	3	0.2782 ^{ns}	24.35*	89.52*	12.83*	293.40 ^{ns}	4998*
Sex	1	0.4203 ^{ns}	3.306 ^{ns}	17.95 ^{ns}	25.60 ^{ns}	102.40 ^{ns}	3095 ^{ns}
breed*Sex *Age	3	0.1929 ^{ns}	6.832 ^{ns}	93.19 ^{ns}	12.60 ^{ns}	19.13 ^{ns}	1203 ^{ns}
Error	32	0.2348	9.768	40.96	7.91	19.45	1809

=Significant (p<0.05), *= highly significant (p<0.001), ns= not significant.*
ALB= Albumin, TP= Total Protein, AST= Aspartate Amino Transferase,
ALT= Alanine Amino Transferase, ALP= Alkaline Phosphatase.

Variation in serum biochemical indices across breeds had been reported by other authors (Dulta *et al*. 2013; Odunitan *et al*. 2017; Lopez *et al*. 2018). Cholesterol was not significant across breeds. However, numerical variations were observed. Normal feathered chickens recorded the highest numerical value in serum cholesterol. This value was similar to those reported by Rezende *et al*. (2017) but lower than those reported by Lopez *et al*. (2018) in their work on Creole and Hyline brown chickens. The cholesterol values recorded in this study were also lower than those reported by Ilo and Egu (2018) who recorded higher values of 95.38mg/dl and Ladokun *et al*. (2008) who assessed variation in hematological and biochemical indices using naked neck and normally feathered Nigerian indigenous chickens.

Significant breed effect on albumin was observed in this study. Naked neck recorded the highest numerical value in serum albumin which was higher than the range of numerical value of 3.48-3.27gdl reported by Ladokun (2008). Lower albumin suggests poor blood clotting which could result in hemorrhage (Egu 2017). However, the serum albumin value in this study was lower than the range reported by Ilo and Egu (2018). The result of this study was similar to the report of Lopez *et al*. (2018) who recorded lower albumin values of 1.7g/dl in Creole and 1.4g/dl in Hyline brown chickens when they evaluated hematological and biochemical indices as well as chemical composition of eggs of creole and Hy-line Brown laying hens. Odunitan *et al.* (2018) and Ogunwole *et al.* (2017) also recorded lower albumin values. However, Rezende *et al.* (2017) recorded similar values in broiler breeders in rearing age.

Total protein varied significantly across breeds. The values of total protein recorded in this study were higher than those reported by Iheukwumere *et al.* (2006) where serum Total protein values ranged from 7.60±0.27mgdl to 8.20±0.30mgdl. According to Esonu *et al.* (2001) variations in Total protein have been attributed to differences in breed and the nutritional status of the chickens. Similar total protein values were reported by Rezende *et al*. (2017) while Lopez *et al.* (2018), Odunitan *et al.* (2018) and Ogunwole *et al.* (2017) recorded lower values. Variation in AST values as a result of breed was reported by Odunitan *et al.* (2018) with higher values and

Ogunwole *et al*. (2017) with lover AST values. The values of ALT reported in this study are similar to the 19.77iu/l reported by Ogunwole *et al*. (2017) but higher than those reported by Odunitan *et al*. (2018) with values ranging from 3.00 to 6.25iu/l. ALP varied significantly across the breeds with Normal feathered chickens having the highest value. Higher values have been reported by Odunitan *et al*. (2018).

The effect of sex on biochemical indices in this study showed no significant difference ($p<0.05$). This report is supported by Ilo and Egu (2018) in their work on the effect of genotype on hematology and serum biochemistry of Nigerian indigenous roosters (cockerels). However, Rezende *et al*. (2017) reported that females had higher cholesterol value of 3.44g/dl as compared to the 2.80g/dl. Also, Odunitan *et al*. (2018) reported that male chickens had cholesterol values ranging from 115.50mg/dl to 230.63mg/dl while it ranged from 106.25mg/dl to 113.63mg/dl in their female counterparts. Rezende *et al*. (2017) had reported similar values of serum albumin of 10.60g/dl in males and 13.70g/dl in females and for Total protein with 24.60g/dl in males and 28.00g/dl in females. This report agreed with the report of Simaraks *et al.* (2004) and Pampori and Igbal (2007) who studied the serum total protein in broiler and the native chickens of Kashmir respectively. Lisano and Quay (1997) reported higher mean total protein value in female than in male turkeys. Ibrahim *et al.* (2011) also reported higher values of total protein when they assessed the effect of sex on biochemical indices in Nigeria indigenous chickens. Odunitan *et al.* (2018) reported lower values for AST and ALT but higher values for ALP.

IV. Conclusion

This study has revealed significant effect of breed on serum metabolites among the Nigerian chickens studied and that sex did not significantly affect serum metabolites. This information contained here could serve as baseline data for future improvement of the Nigerian indigenous chicken breeds.

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