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Full Length Research Paper

Effects of age, breed and sex on the serum biochemical values of Turkeys (*Meleagridis gallopova*) in South-eastern Nigeria

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This study was carried out to establish the serum biochemical values of turkey (*Meleagridis gallopova*) as well as determine the sex, age and breed effects on these characters. Blood samples collected in the morning from each turkey at 6th and 12th week of age, comprising of 60 black and 45 white breeds were used in this study. Total protein, albumin and alkaline phosphate means were 5.56±0.15, 2.5±0.1 and 26.44±1.55 g/dl respectively. Cholesterol, aspartate transaminase (AST) and alanine transaminase (ALT) means were 161±2.83 mg/dl, 74.87±1.87 U/L and 17.86±1.33 U/L respectively while globulin had a mean of 3.16±0.2 mg/dl. The mean total protein value (4.81±0.17 and 6.38±0.28 g/dl) of black and white breeds respectively indicated significant difference (P<0.05). Albumin, cholesterol and globulin values also indicated significant difference (P<0.05) between the breeds, while alkaline phosphate, AST and ALT showed no significant difference (P<0.05) between the breeds. The mean total protein, albumin, globulin and AST of the turkeys revealed significant difference (P<0.05) between ages 6 and 12 weeks while alkaline phosphate, cholesterol and ALT showed no significant (P>0.05) difference between the ages. Sex generally had no significant (P>0.05) effect on the characters.

Key words: Turkeys, serum, age, breed, sex, biochemical values.

INTRODUCTION

Publications for white blood cell counts and differentials, serum albumin, aspartate transaminase (AST) and alanine transaminase (ALT) have not been previously reported for domestic or wild turkeys (Bounous et al., 2000). Strong differences are reported (Sturkie and Textor, 1978; Warren, 1995) between serum chemistry characteristics of local breeds of turkey at different ages from different geographical and agricultural zones of the world. Serum biochemical values have been established in most domestic mammalian species (Jain, 1986; Adejumo et al., 2005). However, limited information is available for domestic avian species, (Ola et al., 2000; Oke et al., 2001) and even less has been established for Turkey species more so in the local breeds (Zinki, 1986). Publications for parameters available in domestic turkeys are limited to packed cell volume, cholesterol, glucose, calcium and total protein (Rhian et al., 1944; Bell et al., 1957; Bell and Sturkie, 1965). These findings were aimed at establishing the diagnostic baseline of blood characteristics of farm animal (Orji et al., 1986b).

Research (Pagot, 1992; Cannon, 1992) has shown that biochemical characteristics of blood - albumins, transferine, alkaline phosphatase, immunoglobulin G_1 and G_2 are established genetic markers. These biochemical and molecular characters enable the study of the genetic structure or parentage situation of livestock

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population under small holder conditions like ours in the tropics. Phenotypic characterization could also be supported by genotype identification through laboratory studies of gene markers or biochemical polymorphisms (Gall et al., 1994).

This reference data presented for biochemical values could significantly boost the genetic improvement and breeding of the turkeys through the use of marker assisted selection by providing baseline information. There is need therefore to establish the reference data to characterize the blood serum biochemistry for the turkeys in Nigeria.

MATERIALS AND METHODS

Source of the birds

70 white and 70 black turkey poults were procured at day old from Gofons Hatcheries Nigeria Limited, Owerri, Imo State, Nigeria. They were raised at the poultry unit of Federal University of Technology Owerri Teaching and Research farm from day old to 12 weeks of age.

The experiment was conducted between May 1st and August 30th 2006. Prestarter diet of 29.76% crude protein, starter diet of 26.4% crude protein and finisher diet of 21.35% crude protein were offered *ad-libitum* from day old to 12 weeks of age. Clean water was also offered *ad-libitum* throughout the experiment. The birds were aged approximately 6 weeks at first bleeding and 12 weeks old at second bleeding. They had mean body weight of 2.5 and 4.6 kg at 6 weeks and 12 weeks old respectively. In addition, the breed weighed 3.4 and 4.2 kg respectively for black and white breeds. They were also certified clinically healthy at the time of bleeding.

Blood collection

Blood samples were collected from 60 black and 45 white turkeys randomly at 6 and 12 weeks of age. A 23-G needle was used to puncture the brachial vein after cleaning the area with methylated spirit, and blood sample collected. A total of 8 ml of blood was collected from each bird; 3 ml was transferred into ethylene diamine tetra acetic (EDTA) acid treated bottle, while the remaining 5 ml was left in the syringe to coagulate to produce sera for blood biochemistry analysis.

Blood biochemistry analysis

The blood sample in the syringes were spinned on a centrifuge at 3000 rpm and the serum collected with a Pasteur pipette, transferred into a serum bottle and then stored at 2 to 8°C in a refrigerator for serum analysis. Total serum protein was determined by using the quantitative *in vitro* procedure with the burette method according to Tietz (1995). The serum protein concentration (g/dl) for each blood sample was read off on spectrophotometer. The serum enzyme - AST, ALT and Alkaline phosphate were determined by using RANDOX SGOT, RANDOX SGPT and RANDOX ALP kits respectively. AST otherwise known as Glutamic-oxaloacetic transaminase was measured by monitoring the concentration of oxaloacetate hydrazones formed with 2, 4-dinitrophenyl hydrazine. ALT- Glutamic pyruvic transaminase was measured by monitoring the concentration of pyruvate hydrazones formed with 2, 4 - dinitrophenyl hydrazine. Alkaline phosphate was measured by the concentration of phosphate from P-nitrophenyl phosphate. Albumin and globulin were determined as component parts from which the total protein was derived from. Cholesterol was determined spectrophotometrically in plasma.

Experimental design

A 2×2×2 factorial experiment in a completely randomized design model was used to estimate the treatments effects, that is, age, sex and breed effects. The model is as follows:

$$Y_{ij} = \mu + S_i + e_{ij}$$

Where Y_{ij} is the individual observation; μ = the population mean; S_i = the sex, age and breed effects on blood parameters, and e_{ij} = the error term.

Measurements were taken according to age, sex and breed with each treatment replicated three times. ANOVA procedure according to SAS (1999) was used to test for significant differences between the treatment means. All recorded weights and serum biochemical values were expressed as means and standard error of the means (Mean ± SEM). The means were then subjected to the Duncan new multiple range tests as outlined by SAS® software pack (SAS version 8) to separate the means that were significantly different.

RESULTS AND DISCUSSION

Table 1 shows the means for normal serum biochemical values for Turkeys. Table 2 shows the breed effect of serum biochemical values at 12 weeks of age. The white breeds showed significantly higher total protein and globulin while the black breeds showed significantly higher albumin and cholesterol. There was no significant breed effect on alkaline phosphate, aspartate transaminase (AST) and alanine transaminase (ALT).

Table 3 presents the age effect of serum biochemical values at 6 and 12 weeks of age. The total protein, globulin and aspartate transaminase showed significantly higher values at 6 weeks, while albumin was significantly higher at 12 weeks. Table 4 presents the sex effect of serum biochemical values on turkey. The results observed showed that sex has no effect on the serum biochemical values of turkeys.

The females had higher mean values for alkaline phosphate, globulin and ALT, but were not statistically significant. The slightly higher mean values for total protein and albumin (5.56±0.15 2.51±0.1 g/dl, respectively) in this study were similar to the reported values (3.6-5.5 and 1.1-2.1 g/dl) by Bounous et al. (2000) as established reference interval for 4 months old turkey in temperate environment. Our values for total protein and albumin compared favorably with the findings of Verma et al. (1975) for adult domestic chicken, Orji et al. (1986a) and Ozbey et al. (2004) for the guinea fowl. This could be attributed to temperature fluctuations in the tropics which have effect on the blood biochemical parameters and subsequently on production. The ALP value observed in this study was higher when compared with values (225-499 iu/L) reported by Bounous et al. (2000). Quist et al. (2000) reported similar low value (353.36 mg/dl) in the control experiment with quails. Its high value could be

Table 1. Means for normal serum biochemistry analytes for Turkeys.

Analyte	Mean ± SEM
Total protein (g/dl)	5.56±0.15
Albumin (g/dl)	2.51±0.1
Alkaline phosphate (g/dl)	26.44±1.55
Cholesterol (mg/dl)	161.42±2.83
Globulin (mg/dl)	3.16±0.20
Aspartate transaminase AST (U/L)	74.87±1.87
Alanine transaminase ALT (U/L)	17.86±1.33

Means with different superscripts are significantly (P<0.05)

Table 2. Breed Effect on Serum Biochemistry of Turkey at 12 weeks of age.

Analyte	Mean ±SEM of black breeds	Mean ±SEM of white breeds
Total protein (g/dl)	4.81±0.17^{b}	6.38±0.23^{a}
Albumin (g/dl)	2.67±0.10^{a}	2.34±0.16^{b}
Alkaline phosphate (g/dl)	24.70±2.06	28.12±2.31
Cholesterol (mg/dl)	171.46±4.11^{a}	150.63±3.60^{b}
Globulin (mg/dl)	2.10±0.18^{b}	4.39±0.33^{a}
Aspartate transaminase AST (U/L)	76.91±2.72	72.79±2.56
Alanine transaminase ALT (U/L)	18.42±1.38	17.30±2.26

Means with different superscripts are significantly different (P<0.05).

Table 3. Age effect on serum biochemistry analytes for 6weeks and 12weeks old turkeys.

Analyte	Mean ± SEM of 6 weeks old	Mean ± SEM of 12 weeks old
Total protein (g/dl)	6.22±0.33^{a}	4.90±0.16^{b}
Albumin (g/dl)	1.46±0.12^{b}	3.48±0.12^{a}
Alkaline phosphate (g/dl)	23.41±2.57	28.97±3.37
Cholesterol (mg/dl)	160.91±5.44	161.90±5.47
Globulin (mg/dl)	4.74±0.33^{a}	1.39±0.11^{b}
Aspartate transaminase AST (U/L)	78.95±2.67^{a}	70.87±4.14^{b}
Alanine transaminase ALT (U/L)	17.89±2.83	17.82±2.09

Means with different superscripts are significantly different (P<0.05).

Table 4. Sex effect on serum biochemistry analytes for turkeys.

Analyte	Mean ±SEM of males	Mean ±SEM of females
Total protein (g/dl)	5.66±0.58	5.53±0.63
Albumin (g/dl)	2.48±0.55	2.13±0.15
Alkaline phosphate (g/dl)	22.57±1.55	27.96±4.87
Cholesterol (mg/dl)	165.34±4.30	149.21±8.04
Globulin (mg/dl)	3.18±0.99	3.38±1.10
Aspartate transaminase AST (U/L)	73.36±4.19	70.63±4.97
Alanine transaminase ALT (U/L)	15.09±2.04	16.47±1.43

Means with no superscripts are not significantly different (P > 0.05).

related to the calcification of turkey bones. The serum cholesterol value was within the range for guinea fowls

reported (Ozbey et al, 2004) giving the impression that the serum cholesterol levels is not affected by the temperature variation in the tropics.

The AST value observed in our study was low when compared with the reference interval observed by Bounous et al. (2000). The increase in temperature to 33°C reported (Ozbey et al., 2004) did not have a significant effect on AST value in quail and as such, the low value observed in this study could be attributed to specie difference. The ALT value observed in this study was slightly higher than reported in the literature (Ozbey et al., 2004).

The differences ($P<0.05$) observed in relation to breed revealed that the white breed possesses higher values for the total protein and globulin, while higher values for albumin and cholesterol were observed in the black breed. These findings were inline with the observations of Nwosu (1979) and Oluyemi (1998) who reported significant differences in serum biochemical values for chicken and duck due to breed and species. The apparently higher values for serum total protein and globulin observed in the white over the black breed might be due to inherent physiological traits in the breed. The higher globulin value also gives the impression that the white breed can resist infection better, recalling that globulin binds with hemoglobin and other niafers and fights infection.

The higher values obtained in the black breed for albumin and cholesterol suggests that the black breed can stand more stress. This could be attributed to the fact that album as a reservoir of protein contributes to the colloidal osmotic pressure, acid base balance and also carrier for small molecules like vitamins, minerals, hormone and fatty acids. While cholesterol being a precursor of steroid hormones, vitamin D and bile acids could suggest a better reproductive performance of the black breed.

Age difference observed for total protein, globulin and AST at 6 weeks could be attributed to the fact that the young animal whose feed intake comprises of higher proportion of protein for growth and muscle development will exhibit more in the serum. This will be subsequently used up for the set purpose. The superiority of the globulin at this age gives the impression of a better resistance and survival at this age. The apparent superiority of albumin in the 12 weeks old could be as a result of the accumulated total protein breakdown since it serves as the major reservoir of protein.

Conclusion

Turkey improvement over the years has been based primarily on selection programmes with considerations of the body traits as key breeding parameter. This study therefore has tried to establish baseline information on serum biochemical markers which can be used for characterization of turkey and for genetic evaluation of poultry as stated by Nwosu (2005) as vital breeding parameters for the prediction of these growth traits.

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