GENETIC RELATIONSHIP BETWEEN SERUM ALKALINE PHOSPHATASE AND BLOOD HAEMATOLOGICAL AND BIOCHEMICAL TRAITS IN MALE AND FEMALE BROILER LINES

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Abstract

This study was conducted to genetically evaluate the relationship between serum alkaline phosphatase (SAP) and blood haematological and biochemical traits of male and female broiler lines at National Animal Production Research Institute (NAPRI),Shika, Nigeria. Data on blood sample were collected from twenty four birds sampled from male line, female line, male and dam control . Blood samples were taken from the wing veins of the birds and stored in heparine tubes for haematological analysis. Another blood samples were collected into non anticoagulated tube for serum analysis of Alkaline phosphatase and other blood chemistry which include Total Protein (TP) and Acetylcholine esterase (Ach). The haematological parameters considered were pack cell volume (PCV), Haemoglobin counts (Hb) and Red blood cell (RBC). The results of this study revealed that there were significant ($P<0.05$) differences in serum alkaline phosphatase except in other blood parameters where no significant differences were observed. There were positive and negative genetic correlations between serum alkaline phosphatase and blood traits measured. The measured blood traits were positively and negatively correlated among each other. It is therefore concluded that the significant ($P<0.05$) difference obtained in the serum alkaline phosphatase implies that it is affected by line. High genetic correlations between serum alkaline phosphatase and blood biochemical traits are indications of linkage and pleiotropy effects among these traits. It therefore implies that, Serum Alkaline phosphatase (SAP) can be used as a marker for selection for improved blood biochemical traits.

Keywords: Broiler birds, haematological and biochemical parameters, serum alkaline phosphatase and genetic correlations

Introduction

The major sources of poultry meat in Nigeria are broiler chicken, spent layers and cockerels. Broilers are specially made for meat production because they have short turn-over rate, better feed conversion ratio, rapid growth rate and ability to utilize feedstuffs and bi-products regarded as wastes to man. The performance of broiler birds is determined by its genotype and environmental factors (Boukwamp *et al.*, 1973; Edward and Denman, 1975).In general, blood examination is performed for several reasons as a screening procedure to assess general health condition (Jain, 1993). A significant difference in serum alkaline phosphatase and haematological traits of groups of birds could be of value to breeders for selection in early life. Serum alkaline phosphatase is an important enzyme in chicken which is princely found in bones, kidney, liver, plasma and intestinal mucosa. It functions to help in absorption of protein, carbohydrate and fat (Das and Deb 2008). According to Alm El Dein *et al.* (2008), birds with lower level of plasma alkaline phosphatase activity had significant ($P<0.05$) earlier sexual maturity and body weight at sexual maturity higher than those of low values. Suchint *et al.* (2004) reported that haemoglobin (Hb) and Pack Cell Volume (PCV) of male chickens were higher than that of females. Silver *et al.*, (2007) reported higher ALP (Alkaline Phosphatase) serum activity at 21 days of age due to a higher bone development in broiler birds, as compared to older ages as opposed to AST (aspartate aminotransferase), LDH (lactate Dehydrogenase), and CK (creatine kinase). his study was therefore designed to determine the genetic relationship between serum alkaline phosphatase and blood traits in male and female broiler lines in NAPRI, Shika, Zaria.

Materials And Methods

Experimental Site and Birds

The research was carried out at the Poultry Research Unit of National Animal Production Research Institute (NAPRI) Shika, Zaria, Kaduna State. Shika lies between latitude 11° 12`N, longitude 7° 33`E and at altitude of 640m above sea

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level. The area falls within the Northern Guinea Savannah having an average annual rainfall of 1100mm. (Akpa and Jokthan, 1996).

The birds used for this study comprised of 4 groups each of sire line, dam line, sire control and dam control line from a collapsed groups of Hubbard and Anak broiler birds in National Animal production Research Institute (NAPRI). Water and feed were provided *ad-libitum*.

Data Collection and Analysis

Blood samples were taken from the wing veins of the 6 birds sampled from each group and stored in heparine tubes for haematological analysis. Another blood samples were collected into non anticoagulated tube for serum analysis of Alkaline phosphatase and other blood chemistry which include Total Protein (TP) and Acetylcholine esterase (Ach). The haematological parameters considered were pack cell volume (PCV), Haemoglobin counts (Hb) and Red blood cell (RBC). Blood pH was determined by using digital electric pH meter (JENCO model No. 608 USA) immediately after blood samples collection. Haemoglobin counts were determined by the cyanomethanoglobin method. RBC was determined by a manual method using hematocytometer (Campbell 1995). Pack cell volume (PCV) was obtained by drawing heparinised blood into micro haematocrit tube and centrifuged at 11000rpm for 3 minutes, and then haematocrit values were determined and expressed as a percentage of pack cell volume (PCV). The platelets were separated from other elements by method described by Cruz 2013. For the serum alkaline phosphatase (SAP), acetylcholine (Ach) and total protein (TP), blood sample was allowed to coagulate and the serum was centrifuged for 16 hours to separate the serum. The serum was then deep frozen (-20°C) until analysis. Methods described by Bassey *et al.* (1946), George *et al.* (1961) and Abd El Azim (2012) were adopted for the analysis of (SAP), (Ach) and (TP) respectively.

Data on blood traits were analysed using General Linear Model procedures of SAS (2002). Significant differences among means were separated using Duncan's Multiple Range Test (Duncan 1955).The genetic correlations between two traits were obtained by analysis of covariance (ANCOVA) using a procedure of statistical analysis system (SAS, 2002). The general formula for estimating correlation is as described by Falconer (1989).

$$r = \frac{COVxy}{\sqrt{\sigma_X^2 \sigma_Y^2}}$$

Results And Discussion

The results of the least squares means for the biochemical and haematological parameters for sire line, dam line, sire control and dam control is presented in Table 1. The values of the serum alkaline phosphatase (SAP) obtained in this study was 64.67µ/l for sire line, 63.33µ/l for dam line, 69.00µ/l for sire control and 63.17µ/l for dam control. The values for Acetylcholine esterase (Ach) ranged from 19.17 to 21.50mg/dl for all the lines. The values for total protein (TP) also ranged from 6.83 to 7.08mg/dl for all the lines. The haematological values obtained for sire line, dam line, sire control and dam control ranged from 2.29 to $2.53\times10^6/mm^3$ for RBC, 28.78 to 31.00% for PCV, 14.98 to 16.68g/dl for Hb, 27.17 to $29.87\times10^6/l$ for platelet and 7.13 to 8.97 for pH. There was no significant ($P>0.05$) difference in all the biochemical and haematological traits observed except in the serum alkaline phosphatase. Biochemical and heamatological values are widely used to determine genetic relationship and pathological adaptations including general health condition of animals. The significant difference obtained in serum alkaline phosphatase showed that there is line effect of serum alkaline phosphatase and this could pose advantage of better performance in terms of body weight. The similarities obtained in the blood traits for all the lines are indications that line had no effect on these traits and this showed absence of deleterious health implication due to lines.

The values of RBC, PCV and pH obtained in this study were not different from values obtained in the literature considering the work of Suchint *et al.*(2004) and Abd El Azim (2012), except for Hb which was higher than the value obtained by Abd El Azim (2012). The values of TP ranged from 6.83 to 7.08mg/dl and SAP ranged from 63.17 to 64.67µ/l and these disagreed with the value obtained by Abd El Azim (2012) for TP (4.60) and SAP (143), respectively. The differences could be due to breed and environmental effects.

Correlations

The genetic correlations of serum alkaline phosphatase and blood traits are shown in Tables 2and 3. For sire line, serum alkaline phosphatase showed low and positive correlations with acetylcholine esterase (0.236), high and positive with total protein (0.672) and moderate but negative correlations with pack cell volume (PCV) (-0.307) and high but negative with haemoglobin (-0.388). For dam line, correlations of serum alkaline phosphatase with all the parameters estimated were negative and ranged from low to moderate (-0.148 to -0.255) though moderate and

Table 1: The least squares means (±SE) of the blood biochemical and haematological parameters of sire line, dam line, sire control and dam control

Traits	Sire line	Dam line	Sire control	Dam control	SEM
SAP(mg/dl)	64.67[b]	63.33[b]	69.00[a]	63.17[b]	2.830
Ach(mg/dl)	21.50	20.83	21.33	19.17	1.610
TP(mg/dl)	7.05	6.83	7.08	6.92	0.880
RBC($\times 10^6 mm^3$)	2.29	2.38	2.41	2.53	0.096
PCV (%)	28.78	29.82	29.85	31.00	1.153
Hb (g/dl)	14.98	15.68	16.11	16.68	0.687
Platelet ($\times 10^6$/l)	27.17	28.60	28.67	29.83	3.413
pH	7.13±	7.22	7.32	8.97	0.853

[a,b,c] = Means with the same superscript within the same row for a particular parameter are not significantly (P>0.05) different. SAP=Serum Alkaline phosphatase, Ach=Acetylcholine esterase, TP=Total Protein, RBC=Red Blood Cell, PCV=Pack Cell Volume, Hb=Haemoglobin

Table 2: The genetic correlation of serum alkaline phosphatase with blood parameters traits of sire line (above diagonal) and dam line (below diagonal)

	SAP	Ach	TP	RBC	PCV	Hb
SAP		0.236	0.672	-	-0.307	-0.388
Ach	0.261		0.699	-0.537	-0.307	-0.388
TP	-0.255	-0.054		-	0.289	0.275
RBC	-	-	-		-	-
PCV	-0.252	-0.403	0.507	-		-
Hb	-0.148	-0.171	0.743	-	-	

SAP=Serum alkaline phosphatase, Ach= Acetylcholine, TP=Total protein, RBC=Red Blood Cell, PCV=pack cell volume, Hb=Haemoglobin

Table 3: The genetic correlation of serum alkaline phosphatase with blood parameters traits of sire control (above diagonal) and dam control (below diagonal)

	SAP	Ach	TP	RBC	PCV	Hb
SAP		0.958	-0.714	-	0.025	0.043
Ach	0.366		0.650	-	-0.046	0.11
TP	-0.023	0.093		-	0.500	0.472
RBC	-0.469	0.093	-		-	-
PCV	-0514	-0.198	0.428	-		0.993
Hb	-0.653	-0.032	0.272	-	-	

SAP=Serum alkalin e phosphatase, Ach= Acetylcholine, TP=Total protein, RBC=Red Blood Cell, PCV=pack cell volume, Hb=Haemoglobin

positive with acetylcholine esterase (0.261). For sire control, serum alkaline phosphatase showed positive correlations with all the traits analyzed and ranged from low to high (0.025 to 0.958) except with total protein which was high and negative (-0.714). For dam control, serum alkaline phosphatase showed negative correlations with all the parameters estimated and ranged from very low to high (-0.023 to -0.653) except with acetylcholine esterase (0.366) where high but positive correlations was obtained.

The positive and high correlation between serum alkaline phosphatase and total protein in the sire line indicated that as one selects for serum alkaline phosphatase, there will be improvement that will be made on total protein. The positive and high correlation obtained between serum alkaline phosphatase and acetylcholine esterase in both sire and dam control indicates strong relationship among these traits and this implies that serum alkaline phosphatase can predict the muscular activities of these birds since acetylcholine esterase helps in muscle contraction.

Conclusion

From the results obtained in this study, the significant difference (P<0.05) obtained in the serum alkaline phosphatase implies that it is affected by line. Low to high and positive genetic correlations of serum alkaline phosphatase with acetylcholine esterase (0.236 in sire line; 0.261in dam line; 0.958 in sire control and 0.366 in dam

control) and total protein (0.672) in sire line are indications of linkage and pleiotropy effects and that Serum Alkaline Phosphatase (SAP) can be used as a marker for selection for improved blood biochemical traits.

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