The study was carried out at Teaching and Research Farm, Livestock Section (Poultry Unit) of the Federal University of Technology, Akure, Ondo State, Nigeria with Latitude 07° 16^1 and 7° 18^1 N and Longitude 05° 09^1 and 05° 11^1E. There are bimodal rainfall patterns which start from March to July and September to October with average of 1,556mm per annum. The average ambient temperature was 30 - 32°C and relative humidity of 80% (Climate data, 2018).

A total of 120-day old chicks were purchased from reputable farms in Abeokuta and Ibadan, Ogun and Oyo States of Nigeria respectively. Thirty (30) chicks of each strain were procured and used for the study that lasted for eight (8) weeks. The strains were normal feather, naked neck; frizzle feather and Marshall Broiler chickens. The experiment was arranged in a completely randomized design (CRD) and the birds were distributed into four treatments according to their strain. Each strain was replicated three times at 10 birds per replicate. The birds were fed experimental diet *ad-libitum* containing 23% crude protein and 2,685.49Kcal/kg metabolizable energy. Adequate health preventive measures were ensured during the period of the experiment. At the end of the experiment, blood samples were collected from twelve (12) birds per strain during slaughtering and emptied into well labelled clean test-tubes with the aid of slanted rack test-tube holder, kept on ice pack in cool containers to avoid denaturing of proteins and were taken to the laboratory within 2 hours of collection and allowed to stand for about 4-5 hours in a slanted position till it clotted. A straw-coloured liquid (serum) which had gathered on the clotted blood was harvested by decanting it from the test tube into cryo-preservative containers (serum bottles) and stored in the freezer at -4^0C before eventual use. The serum biochemical indices studied were: serum total protein (TP), albumin (ALB), chol (CHOL), globulin (GLB), alkaline phosphate (ALP), alanine aminotransferase (ALT) and aspartate aminotransferase (AST). The serum parameters were determined using a commercial kit of Randox Laboratories Ltd., Ardmore Diamond Road, Crumlin, Co. Antrim, United Kingdom.

Data generated were analyzed on computer using SAS (2008) version 13 statistical software. Where significant differences were observed, means were separated using appropriate subroutine of the same statistical package. The statistical model used was:

$Yij = \mu + Ti + \epsilon ij$

Where: Yij= Serum sample of jth bird in the ith strain (j = 1- 30)

μ = General mean

Ti = Fixed effect of the ith strain (i = 1- 4)

ϵij = Residual error

RESULTS AND DISCUSSION

The least square means for the effect of strain on the estimation of total protein (TP)from other serum biochemical parameters in simple linear function fitted for the experimental birds at 8 weeks of age is presented in Table 1.In Naked neck (NN) strain, there were no significant differences ($p>0.05$) among the parameters except for cholesterol (CHOL) and globulin (GLB). Reverse was the case with normal feather (NF) as all these parameters were significantly different ($p<0.05$) except for CHOL and aspartate aminotransferanse (AST). Alkaline phosphate (ALP), CHOL and Albumin (ALB) were not significant ($p>0.05$) in Frizzle feather (FF) while other parameters were highly significant ($p<0.01$). Similarly, all the parameters were highly significant ($p<0.01$) in Marshall Broiler (MB) chicken strains except for ALB. High values of serum total protein were indication of quality protein of the experimental diet (Tewe, 1985); the higher the albumin, the higher the clotting ability of blood and hence prevention of haemorrhage (Robert and Rawnsley, 2003). The present study revealed that the inter relationship between total protein (TP) and the other serum biochemical parameters were significantly different ($p<0.05$) among the four strains.

Table 1: Estimation of TP in simple linear function fitted for TP – other serum biochemical parameters for the various chicken strains

Breeds	Functions	SE	R^2 (%)	LS
NN	$Y = 51.04 – 0.02X_1$	0.13	0.25	NS
	$Y = 32.85 + 4.21X_2$	4.80	8.79	NS
	$Y = 87.27 – 0.62X_3$	0.50	15.89	**
	$Y = 26.24 + 0.64X_4$	0.82	7.14	NS
	$Y = 18.78 + 0.87X_5$	0.56	23.18	NS

	$Y = 39.51 + 0.25X_6$	0.60	2.10	**
NF	$Y = 41.02 + 0.02X_1$	0.07	1.52	**
	$Y = 26.60 + 8.43X_2$	2.61	56.66	***
	$Y = 0.22 + 0.67X_3$	0.65	11.72	NS
	$Y = 36.73 + 0.40X_4$	1.01	1.87	NS
	$Y = 49.13 – 0.14X_5$	0.62	0.62	**
	$Y = 37.27 + 0.25X_6$	0.29	8.61	**
FF	$Y = 12.02 – 0.28X_1$	0.20	19.35	NS
	$Y = 52.93 – 2.16X_2$	1.96	13.28	***
	$Y = 32.77 + 0.17X_3$	0.31	3.45	NS
	$Y = 73.49 – 0.91X_4$	0.81	13.67	**
	$Y = 40.31 + 0.16X_5$	0.60	0.96	NS
	$Y = 38.58 + 0.20X_6$	0.47	0.85	***
MB	$Y = 65.51 – 0.10X_1$	0.05	46.09	**
	$Y = 48.34 + 0.52X_2$	5.02	0.27	**
	$Y = 63.33 – 0.23X_3$	0.25	17.22	**
	$Y = 52.32 – 0.08X_4$	0.53	0.56	**
	$Y = 21.87 + 1.73X_5$	0.64	64.33	NS
	$Y = 61.77 – 0.29X_6$	0.26	23.37	***

NN = Naked Neck, NF = Normal Feather, FF = Frizzle Feather, MB = Marshal Broiler, Y = TP, X_1 = ALP, X_2 = ALT, X_3 = CHOL, X_4 = AST, X_5 =ALB, X_6 = GLB, ALP = Alkaline phosphate, AST = Aspartate aminotransferase, CHOL = Cholesterol, ALT = Alanine aminotransferase, TP = Total protein, A LB = Albumin, GLB = Globulin. ** Highly significant ($p<0.01$), *** significant ($p<0.001$), NS =Not significant.

Coefficient of determination (R^2) was highest in ALB(23.18%) and lowest in ALP(0.25%) for naked neck while it was highest in ALT(56.66%) and lowest in ALB with 0.62%for NF. It was similarly highest and lowest in FF for ALP(19.35%) and GLB(0.85%) respectively. In MB, the highest R^2 value of 64.33% and 0.27% were observed in ALB and ALT respectively. Generally, coefficient of determination (R^2) was highest in the ALB for MB having 64.33% and lowest in ALP for NN with 0.25%. The higher the value of R^2 in any of the studied parameter, the more accurately the total protein present in the body systems chickens can be predicted. Based on the foregoing, albumin, globulin and cholesterol had significant, positive and direct relationships with the serum total protein in all the chicken strains. Albumin (X_5) had the highest contribution to serum total protein in MB and NN, alanine aminotransferase (X_4) in FF and aspartate aminotransferase (X_2) in NF. The negative values obtained indicated that as the serum total protein is increasing, the contribution of such parameter in decreasing and vice versa. Where there is no significant difference, it implies that the parameter did not have serious deleterious health challenges on the chickens especially as it related to the liver; because increased activities of these enzymes in the serum were well-known diagnostic indicator of liver injury (Oboh and Akindahunsi, 2005).

The prediction of total protein (TP) from other serum biochemical variables showed that Alanine aminotransferase had the highest contribution to the value of total protein in the experimental birds except in Marshal Broiler which had Albumin as the parameter with highest contribution. These parameters were generally significant ($P < 0.05$) across the genotypes used for this study which is in line with Schalm's *et al* (2000). However, some of the parameters were not significantly different ($p>0.05$). on the basis of coefficient of determination (R^2), Alanine amonotransferase (ALT) had the highest accuracy of prediction to total protein (TP) in Normal feather, Accuracy of prediction was best in Frizzle feather with aspartate aminotransferase (AST) while albumin (ALB) was the best prediction of total protein in naked neck and Marshall broiler genotypes.

CONCLUSION AND RECOMMENDATIONS

The present study showed that variations existed in the serum biochemical parameters of the experimental birds. Generally, alkaline phosphate (ALP) had the highest contribution to total protein (TP) in the birds except in Marshal Broiler genotype which had its highest contribution with Albumin (ALB). Accuracy of estimating TP from other serum biochemical parameters on the basis of coefficient of determination (R^2) varies from one genotype to the other in this study. Estimation of TP

from its respective parameters was generally significant across the strains used in the study. In general, the result showed that serum biochemical parameters can be used to predict TP accurately in poultry birds. Serum biochemical parameters can be used to assess the immunological status, well-being and meat quality of poultry birds vis-a-vis their health and physiological status. The research recommended that government should provide adequate funding for researches in this area of poultry production.

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