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Blood constituents of broiler chickens as affected by biscuit waste based diets

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Abstract

An eight week feeding trial was conducted to assess the effect of substituting maize with biscuit waste meal on the blood constituents of 144- day old Anak 2000 broiler chickens. Four experimental broiler starter and finisher diets were formulated with diet 1 serving as control to contain 0% Biscuit Waste Meal, while diets 2, 3 and 4 were formulated to contain BWM at 25, 50 and 75% inclusion levels for maize. The chicks were randomly assigned to the four treatment diets (1, 2, 3 and 4) in a completely randomized designed (CRD) and each treatment group contained three replicates with twelve chickens per replicate. Results on the blood constituents of broiler chickens fed treatment diets revealed that there is no significant (P>0.05) variation in the haematological indices assayed in this study. However, serum chemistry showed that total protein (3.13), albumin (1.30), and globulin (1.83x10mg/100ml) were significantly (P<0.05) higher in birds fed 75% BWM. Total bilirubin was highest (P<0.05) in birds fed diet 20.39x10mg/dl and least in control diet0.30x10mg/dl. Serum aspartate transaminase was higher (P<0.05) in birds that ate 25% BWM (76.67iu/g) though had values to 74.33 and 70.00iu/g in birds placed on diets 1 and 4, respectively. Serum alkaline phosphate 185.67 iu/g was also higher (P<0.05) in birds fed the control diet and least (182.33 iu/g) in birds placed on diet 4. From the overall results it is concluded that the inclusion of BWM in the diet of broiler chickens up to 50% improved the blood quality of broiler chickens.

Keywords: Broilers, Maize, Biscuit waste, maize, haematology and serum.

Introduction

One of the major developmental challenges facing most developing countries such as Nigeria is protein insufficiency and food insecurity for their ever increasing population. An average Nigerian diet is characterized by unbalanced energy and protein ratio (FAO, 1997). Energy feed sources such as maize, sorghum and millet are expensive feedstuff which constitute about 50-55% of every formulated poultry diet. Maize as a major component of livestock feed in Nigeria is expensive and its productivity has become very low due to the insurgency crisis in the North-Eastern part of the country and the recent maize worm devastation recorded in some Southern states have further increased the demand-supply gap in this energy feed resource. To this end there is an urgent need to encourage the production of small, highly prolific livestock such as rabbits, chickens, quails and grasscutters which have rapid turnover rate at a very low cost of production. The major hindrance to a profitable livestock production in Nigeria is the high cost of energy and protein feed sources like maize and soya bean meal and the competition for these feed stuffs between man and livestock is increasing on a daily basis. Meanwhile, any effort to substitute maize in poultry ration will significantly reduce cost of production (Adejumo *et al*, 2005). This has motivated Researchers; efforts in the utilization of alternative feed and cheaper energy feed resources particularly the agro industrial by-products and wastes to replace maize in

livestock feeding (Ajaja, 2005). Onuh (2005) reported that agro- industrial by products could be included at 10% level in the diet of finishing broilers without any adverse effect on performance as well as a reduction in the feed cost per weight gain of birds. Besides, cassava root meals have been successfully used in the diet of pullet chicks at 42% replacement level for maize without any deleterious effect on performance, (Agugu and Okeke,2005). Akintola and Oruwari (2007) found that cassava root meal is capable of totally replacing maize in diet of laying hens. Edache *et al.* (2007) reported that 15% cassava meal based diet is recommended for growing Japanese quail. Omoikhoje *et al.* (2010) also reported that fluted pumpkin husk meal can successfully be included in the diet of broiler chickens without any deleterious effect on performance while Babatunde (2013) concluded that cassava waste can partially replace maize in broiler diet without any detrimental effect on performance and meat quality. The focus of this study therefore is on biscuit waste which is a by-product of wheat flour processing industry into biscuits, wafers, crackers etc. A large quantity of these wastes is produced in biscuit industry but there is a dearth of information on its utilization in poultry feed formulation. This study therefore is aimed at assessing the blood constituents and carcass traits of broiler chickens fed varying levels of biscuit waste based diets.

Design and management of experimental animal

A total of 144- day old Anak 2000 broiler chicks were used for the study. Thirty six birds each were selected based on their average initial weights and each group of birds was allotted to each of the four treatment diets (1, 2, 3 and 4) in a complete randomized design (CRD). Each treatment group contained 3 replicates of 12 chicks each. All chicks were brooded for four weeks in a deep litter compartment. The house, feeders, and drinkers were properly washed and disinfected. The birds were fed commercial broiler starter diet for one week acclimatization period. The birds had access to experimental feeds and clean water *ad-libitum.* Routine medication, vaccination and other management practices were carried out throughout the duration of the experiment.

Experimental diets

A total of four treatment diets (1, 2, 3 and 4) of four broiler starter and finisher were formulated. Diet 1 was formulated to contain 55.5% maize (control diet), while 2, 3 and 4 were formulated by replacing the percentage of maize in diet 1 with 25, 50 and 75% levels of biscuit waste meal (BWM) respectively. Both starter and finisher diet were Iso-nitrogenous (23 and 21%) and Iso-caloric (2800 and 3000Kcal/ME/Kg)

Table 1: Proximate composition of maize and biscuit waste meal

Component	Maize	Biscuit Waste
Dry matter	88.00	92.40
Crude protein	9.00	7.87
Crude fat	4.20	10.16
Crude ash	1.90	1.62
Starch	72.00	49.46

Source: West et al. (1989)

Table 2: Percentage compositions of broiler starter diets

	Inclusion levels of Biscuit waste meal (%)			
	0	25	50	75
	Diets			
Ingredients	1	2	3	4
Maize	55.5	41.13	27.25	13.37
Biscuit waste meal	0.00	13.87	27.25	14.63
Soya bean meal	34.00	34.00	34.00	34.00
Fish meal	3.00	3.00	3.00	3.00
Wheat offal	2.00	2.00	2.00	2.00
Palm kernel cake	2.00	2.00	2.00	2.00
Bone meal	2.00	2.00	2.00	2.00
Lime stone	1.00	1.00	1.00	1.00
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Total	**100.00**	**100.00**	**100.00**	**100.00**
Calculated analysis				
Crude protein	23.09	23.09	23.80	22.66
ME (kcal/kg)	2868.00	2829.00	2898.00	2857.00

Table 3: Percentage compositions of broiler finisher diets

	Inclusion levels of Biscuit waste meal (%)			
	0	25	50	75
	Diets			
Ingredients	1	2	3	4
Maize	55.5	41.50	27.50	13.50
Biscuit waste meal	0.00	14.00	28.00	42.00
Soya bean meal	30.00	30.00	30.00	30.00
Fish meal	1.50	1.50	1.50	1.50
Wheat offal	4.50	4.50	4.50	4.50
Palm kernel cake	4.50	4.50	4.50	4.50
Bone meal	2.00	2.00	2.00	2.00
Lime stone	1.00	1.00	1.00	1.00
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Total	**100.00**	**100.00**	**100.00**	**100.00**
Calculated analysis:				
Crude protein	21.11	20.97	21.82	20.68
ME (kcal/kg)	2968.00	2929.00	3002.00	2957.00

***Calculated**

Haematological studies of broiler chickens fed treatment diets

Blood samples were collected at 8 weeks from three fasted broiler chickens per treatment using syringes and needles through the wing vein, samples were collected into a set of sterilized tube containing ethylene diamine tetra acetic acid (EDTA) labeled bottles as anti coagulants, while another set of blood samples were collected from the same bird into non- heparinised tubes for serum

chemistry determination. Packed cell volume (PCV), red blood cell (RBC), white blood cell (WBC), and haemoglobin (Hb) were determined using improved neubaur haemacyanometer after dilution and cyanomethanoglobin method respectively as described by Dacie and Lewis, (1991). Mean corpuscular volume (MCH), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC) and serum metabolites such as total protein, albumin, creatinine, urea, conjugated and total bilirubin, serum alanine transaminase (S-ALT), Serum aspartate transaminase (S-AST), and serum alkaline phosphatase (S-ALP) were determined using the method of Hyduke, (1975), while globulin was estimated by the subtraction of albumin value from serum total protein value according to Dacie and Lewis (1991).

Statistical analysis

Data collected were subjected to a one-way analysis of variance (ANOVA) and differences between treatment means were compared using Duncan's Multiple Range Test (Duncan, 1955). All statistical procedures were in accordance to Steel and Torrie (1990) with the aid of SAS (1999) package.

Results and discussion

The mean values for packed cell volume (PCV), haemoglobin (Hb), white blood cells (WBC), red blood cells (RBC), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) of broilers (Table 4) were not significantly ($P>0.05$) influenced by the treatment diets. The non significant ($P<0.05$) variation in almost all the haematological indices of broilers could be ascribed to the quality of the test diets. This implies that the test diet were in no way inferior to the control. Packed cell volume and haemoglobin value was highest (32.07% and 10.89g/100ml) in birds fed 75% BWM and lowest (29.00% and 9.67g/100ml) among birds fed diet 3. The similarities in the values of Packed Cell Volume (PCV) and haemoglobin (Hb) in broilers irrespective of the dietary treatments indicated that the birds obtained food nourishment from the diets as these indices are determinants of the nutritional status of the animal (Freeman, 1984). White blood cell was similar but highest value ($25.50x10^6/cm^3$) was recorded in birds fed 50% BWM, followed by ($22.99x10^6/cm^3$) in diet 2 and lowest ($19.66x10^6/cm^3$) in birds placed on diet 4. The similarity in white blood cell values of bird placed on all the treatment diets could be ascribed to the fact that the test diet is of high nutritional quality and that the diets were safe for consumption which was in agreement with (Olabamiji, *et al.,* 2007). Red blood cells was highest ($6.51x10^6/cm^3$) in bird fed diet 4 and lowest comparable values (6.50, 6.50 and $6.50x10^6/cm^3$) in birds fed diets 1, 2 and 3 respectively. The similarity in Red blood cell values of bird placed on all the treatment diets could be ascribed to the fact that the birds placed on the treatment diets were not anaemic which agrees with the report of (Olabamiji *et al.,* 2007). Mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were similar among birds fed treatment diets with highest mean values (5.02fl, 1.69pg, and 3.63g/dl) in birds placed on 75% BWM but lowest (4.46fl, 1.49pg and 3.23g/dl) in birds fed diet 3. The values of WBC, RBC, MCV, MCH and MCHC of broilers were not affected by the test diets and were within the normal range reported by Maxwell *et al.* (1990). This is also similar to the findings of Oboh and Igene (2004) in cockerels that rice offal could be included in the diets of cockerels

up to 75% level of replacement for wheat offal. The values recorded for the haematological indices assayed in this study fell within the normal range reported byMitruka and Rawnsley (1981).

Table 4: Haematological indices of broiler Chickens fed the treatment diets

	Inclusion levels of buscuit waste meal (%)				
	0	25	50	75	
	Diets				
Parameters	**1**	**2**	**3**	**4**	**SEM±**
PCV (%)	31.67	31.67	29.00	32.07	1.25
Hb (g/100ml)	10.56	10.56	9.67	10.89	0.42
WBC ($x10^6/cm^3$)	21.23	22.99	25.50	19.66	3.67
RBC ($x10^6/cm^3$)	6.50	6.50	6.50	6.51	0.67
MCV (fl)	4.87	4.87	4.46	5.02	0.19
MCH (pg)	1.62	1.62	1.49	1.67	0.06
MCHC (g/dl)	3.52	3.52	3.52	3.63	0.14

SEM+: standard error of mean, BWM: Biscuit waste meal

Table 5 showed that serum total protein, albumin, globulin, urea, total bilirubin, Serum aspartate transaminase (S-AST) and serum alkaline phosphatase (S-ALP) were significantly (P<0.05) influenced by the treatment diets. Meanwhile, creatinine, conjugated bilirubin, and serum alanine transaminase (S-ALT) were not significantly (P>0.05) affected by the dietary treatments. Total protein value (3.67g/100ml) was significantly (P<0.05) highest in birds fed 75% BWM, followed by diets 3 and 2 (3.00 and 2.67g/100ml) and least in the control diet (2.24g/100ml). Albumin was highest significantly (P<0.05) in birds fed 75% BWM (1.30g/100ml), followed by a comparable values (1.03, 1.07 and 0.87g/100ml) recorded in birds on 50, 25 and 0% BWM respectively. Globulin was significantly highest (P<0.05) in birds maintained on diet 3 (1.97g/100ml) and comparable value (1.83g/100ml) recorded in diet 4 and least in the control diet (1.37g/100ml). Data obtained for serum biochemical indices indicated that serum total protein, albumin and globulin were significantly (P<0.05) increased as the inclusion level of BWM increases from 0 to 75% BWM. However, birds that were on diets 1, 2 and 3 had similar values which reflect the quality of protein in the test diets because those indices are indicators of high quality protein. Moreover, serum protein and albumin synthesis depends on the availability of protein and as protein intake increases the rate of synthesis increases whereas catabolic rate does not easily change. Urea was significantly (P<0.05) affected by the treatment diets, the control diet had the highest value of 5.33mg/100ml, followed by 3.97mg/100ml in birds that ate 75% BWM, while comparable values (2.67 and 2.67mg/100mg) were recorded in birds that consumed diets 2 and 3. Creatinine was also similar (P>0.05) in the birds fed the treatment diets with highest value (0.50/100ml) recorded in diet 2, followed by in diet 4 (0.37/100ml) and lowest in birds placed on 50%BWMbased diet (0.23/100ml). The significant reduction in the values of serum urea and the non significant variation in the values of serum creatinine further attest to the quality of the test diets. This is because urea and creatinine have been reported to be associated with poor or reduced protein utilization leading to increase in the catabolism of amino acids which are subsequently degraded into urea and

creatinine. Total bilirubin was significantly higher (P<0.05) in diet 2 (0.93x10mg/dl), followed by in diet 4 (0.63x10mg/dl) and least in the control diet 0.30x10mg/dl. The non significant (P>0.05) effect of the test diets on conjugated bilirubin of the birds also indicate the quality of the dietary treatments as the predominance of bilirubin in the serum is occasioned by liver damage due to toxic infection disease of the liver. These observations corroborated the findings of Aderemi *et al.* (2004) and Aderemi (2007). Serum aspartate transaminase (S-AST) values were significantly higher (P<0.05) in birds placed on diet 2 (76.67iu/g), followed by a comparable values (74.33 and 70.00iu/g) in birds on diets 1 and 4 and least in diet 3(61.33iu/g). Serum alkaline phosphatase activity was higher (P<0.05) in birds fed the control diet (185.67iu/g), followed by 184.33iu/g in diet 2 and least 182.33iu/g in diet 4. The results on serum enzymes of broiler chickens indicated that S-ALT was not significantly (P<0.05) influenced by the treatment diets while (S-AST) and (S-ALP) showed a significant variation among the birds fed the treatment diets. The non significance recorded in (S-AST) further attested to the quality of the treatment diets irrespective of the inclusion levels of BWM. This is because ALT, AST, and ALP and other enzymes are indicators of heart and liver damage (Egbewande and Olorede, 2003; Fashina *et al*., 2008). Moreover, the serum biochemical indices obtained for this study fell between the normal range as established by Rose *et al*. (1978) for broiler chickens.

Table 4: Serum biochemical indices of broilers fed treatment diets

	Inclusion levels of biscuit waste meal (%)				
	0	25	50	75	
	Diets				
Parameters	**1**	**2**	**3**	**4**	**SEM±**
Total protein (g/100ml)	2.24^{c}	2.67^{b}	3.00^{b}	3.13^{a}	0.25
Albumin (g/100ml)	0.87^{b}	1.07^{b}	1.03^{b}	1.30^{a}	0.06
Globulin (g/100ml)	1.37^{b}	1.60^{b}	1.97^{a}	1.83^{a}	0.24
Urea (g/100ml)	5.33^{a}	2.67^{b}	2.67^{b}	3.67^{b}	0.42
Creatinine (g/100ml)	0.27	0.50	0.23	0.37	0.09
Conjugated bilirubin (x10mg/dl)	0.27	0.04	0.04	0.04	0.01
Total bilirubin(x10mg/dl)	0.30^{c}	0.93^{a}	0.58^{b}	0.63^{b}	0.11
S-ALT(iu/g)	7.67	8.00	9.33	9.67	1.42
S-AST (iu/g)	74.33^{a}	76.67^{a}	61.33^{b}	70.00^{a}	3.83
S-ALP (iu/g)	185.67^{a}	184.33^{ab}	183.67^{bc}	182.33^{c}	0.50

abc: **Means in the same row with varying super script differ significantly (P<0.05),**
SEM+: standard error of mean

Conclusion

From the overall results, it is concluded therefore that the inclusion of biscuit waste meal in the diet of broiler chickens up to 75% improves the blood quality of broilers chickens.

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