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Serum Metabolites and Haematological Reference of Broiler Birds Fed Varying Levels of Bakery waste Meal Based Diets.

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ABSTRACT

Eight weeks feeding trials were conducted to determine the effect of substituting maize with bakery waste meal on the haematological reference and serum metabolites of 90-day old MarshalStarter broiler birds. Three experimental starter and finisher diets were formulated with diet 1 as control containing 0% bakery waste meal diet (BWMD), while diets 2 and 3 contained BWMD at 50 and 100% inclusion levels for maize. The chicks were randomly assigned to the three treatment diets (1, 2 and 3) in a completely randomized design and each treatment group had three replicates with ten chickens per replicate. The result on the haematological indices revealed that MCV values were significantly influenced ($p<0.05$) by the treatment diets with highest value of (135.50±0.21fl) among birds fed 50% BWMD. MCH also significantly varied ($p<0.05$) among birds fed the treatment diets with highest (42.77±0.31pg) recorded among birds maintained on the control diet. Serum biochemical indices revealed that phosphorus value were significantly higher ($p<0.05$) in birds fed the control diet with the mean value of 3.63±0.09mg/100ml. Total cholesterol was significantly higher ($p<0.05$) in birds fed 100% BWMD. The overall results from this study suggested that the inclusion of bakery waste meal in the diet of broilers up to 100% did not have any detrimental effect on the blood profile of the birds. But precaution had to be taken in the incorporation of BWMD at this level because of the increase effect on the cholesterol level of the blood.

Keywords: *Broilers, Haematology, Bakerywaste meal, Maize, Serum*

INTRODUCTION

One of the challenges facing farmers in Nigeria is their inability to adequately feed their increasing population with the right proportion of carbohydrate and protein (Ahaotu, 2018a). Maize and soya bean meal which are predominantly used ingredients for energy and protein in poultry feed in Nigeria are highly exorbitant due to higher demand for it by humans as food and for industrial purposes (Bot *et al*., 2013; Etuk *et al*., 2012).These ingredients constitute about 75% of the formulated poultry diet. Besides the high cost of maize as a major component of feed, its productivity is low in Nigeria (Opaluwa *et al.*, 2015). Poultry production also offers the greatest scope for increasing the quality and quantity of protein intake in Nigeria because of the short generation interval and prolificacy (Ojo, 2003 and Ahaotu *et al.*, 2018b). Egena and Aya (2007) reported that the replacement of maize with cornflakes waste meal up to 100% level had no adverse effect on the performance of broiler chickens. The substitution of maize with 50% bakery waste in layers diet significantly reduced cost of production and enhanced performance (Adeyemo *et al.*,2003).

Thus, this study focused on bakery waste, non-conventional feedstuffs. Bakery is produced from wheat flour, refined palm oil, iodized salt, glutamate and flavour spices (Eniolorunda, 2011).

During the packaging process of the bakery, the waste obtained is sold to livestock industry as bakery waste (Longe, 1987).Bakery waste has no anti-nutritional factors and the high-energy content of bakery waste makes it a good substitute for maize (Olayemi *et al.*, 2007).This study was therefore conducted to examine the

serum metabolites and haematological referenceof broilers fed varying levels of bakerywaste meal based diets.

MATERIALS AND METHODS

Location and Duration of the Study

The experiment was carried out at the Poultry unit of Teaching and Research Farm, Imo State Polytechnic Umuagwo, Nigeria for a period of eight weeks.

Sources of Ingredients

Bakery waste meal for the study was procured from a commercial vendor in Imo State, Nigeria while other feed ingredients were purchased from a commercial dealer of feed ingredients in Owerri, Imo State, Nigeria.

Design and Management of Experimental Animal

A total of 90 day-old Marshal Starter Broiler birds were used for the study. Thirty birds each were selected based on their average initial weights and each group of birds was allotted to each of the three treatment diets (1, 2 and 3) in a complete randomized design (CRD). Each treatment group had 3 replicates of 10 chicks each. All chicks were brooded for four weeks in a deep litter pen.

The house, feeders, hovers and drinkers were properly washed and disinfected. The birds were fed commercial broiler starter diet for one week stabilization period.

The birds had access to experimental feeds and clean water *ad-libitum.* Routine management practices were carried out throughout the duration of the experiment.

Experimental Diets

A total of three treatment diets (1, 2 and 3) of broiler starter and finisher were formulated. Diet 1 was formulated to contain 42.94% maize (control diet), while 2 and 3 were formulated by replacing the percentage of maize in diet 1 with 50 and 100% levels of bakery waste meal diet (BWMD) respectively.

Both starter and finisher diet were iso-nitrogenous (23 and 21%) and iso-caloric (2800 and 3000Kcal/ME/Kg).

Blood Sample Collection and Preparation

Three birds each were randomly selected from each replicate on weight basis and blood samples were collected from each of them through wing vein using syringe and needle. 5ml of blood samples was collected from each bird into a labeled ethylene diamine tetra acetic acid (EDTA) specimen bottles for determination of haematological reference.

Then the second set of 5ml of blood samples were also collected from the same birds into heparinized tubes for serum metabolites.

Determination of Serum Metabolites and Haematologicalreference

Packed cell volume (PCV), red blood cell (RBC), white blood cell (WBC), haemoglobin (Hb), total protein, albumin, globulin, uric acid, calcium, phosphorus and total cholesterol were determined using methods as described by Dacie and Lewis (1991).

The standard ratios of the mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were calculated according to Jain (1986).

Statistical Analysis

Data from the study were subjected to a one way analysis of variance (ANOVA) and significant treatment means were compared using Duncan's multiple range tests as outlined by Steel and Torrie (1990).

Table 1. *Proximate composition of maize and Bakerywaste meal diets*

Component	Maize	Bakery waste meal
Dry matter	88.00	88.00
Crude protein	8.90	8.57
Crude fibre	2.70	2.80
Crude fat	4.20	17.14
Crude ash	1.90	0.90
NFE	74.90	58.59
Calcium	0.02	0.05
Phosphorus	0.29	0.32
ME (Kcal/Mg)	3315.45	3799.07

NFE: Nitrogen free extract

Table 2. *Percentage Compositions of broiler Starter and finisher Diets*

Ingredients (%)	Inclusion levels of BWMD (%)					
	0	50	100	0	50	100
	Starter Diets			Finisher Diets		
	Diet 1	Diet 2	Diet 3	Diet 1	Diet 2	Diet 3
Maize	42.94	21.47	42.92	44.13	22.07	0.00
Bakerywaste meal	0.00	21.50	42.97	0.00	22.07	44.80
Soya Bean Meal	21.86	21.86	21.86	16.04	16.46	16.46
Groundnut cake	15.00	15.00	15.00	15.00	15.00	15.00
Fish meal	1.00	1.00	1.00	1.77	1.77	1.77
Wheat offal	16.24	16.24	16.24	19.77	19.77	19.77
Oyster shell	2.36	2.36	2.36	2.28	2.28	2.28
Premix	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.01	0.01	0.01	0.01	0.01	0.01
Methionine	0.01	0.01	0.01	0.01	0.01	0.01
Salt	0.30	0.01	0.01	0.01	0.01	0.01
Total	100.00	100.00	100.00	100.00	100.00	100.00
Calculated analysis						
Crude protein	21.00	20.70	20.85	21.00	20.70	20.85
ME (Kcal/Kg)	2800.00	2813.00	2825.00	2800.00	2813.00	2825.00

Table 3. *Haematological reference of broiler chickens fed the treatment diets*

Parameters	Inclusion levels of BWMD (%)		
	0	50	100
	Diet 1	Diet 2	Diet 3
Haemoglobin (g/dl)	10.30 ± 0.37	10.53 ± 0.32	9.40 ± 0.36
PCV (%)	31.63 ± 0.99	32.80 ± 0.92	29.03 ± 0.95
RBC ($x10^6$/dl)	2.47 ± 0.07	2.61 ± 0.06	2.20 ± 0.08
WBC (x 10^3/dl)	260.13 ± 2.44	271.70 ± 2.43	257.10 ± 2.43
MCV (fl)	128.80 ± 0.23^b	135.50 ± 0.21^a	125.83 ± 0.20^c
MCH (pg)	42.77 ± 0.31^a	41.73 ± 0.27^b	40.23 ± 0.25^c
MCHC (g/dl)	32.50 ± 0.25	32.07 ± 0.24	32.37 ± 0.24

abc: Means in the same row with varying super script differ significantly (p<0.05)

RESULTS AND DISCUSSION

Oleredeet *al.* (1996), Sokumbi and Egbunike (2000), Omoikhojeet *al.* (2011); Adeyeye *et al.*, (2013) and Igeneet *al.*(2012)revealed that blood is the life of all animals.Any abnormal variation in the haematology of the cell impairs the primary physiological functions of the animals' body. The haematologicaltraits of broiler birds as influenced by the dietary treatments revealed that Hb, PCV, RBC, WBC and MCHC did not vary significantly (p>0.05) among the treatment groups (Table 3). However, MCV and MCH had significant different (p<0.05) by the treatment diets. MCV was significantly favoured (p<0.05)in broilers fed on 50% BWMD (135.50±0.21 fl), followed by birds fed 0% BWMD (128.80±0.23 fl) and least in birds that consumed 100% BWMD (125.83±0.20 fl). MCH was significantly higher (p<0.05) in birds fed the control diet (42.77±0.31 pg), followed by birds fed 50% BWMD (41.73±0.27 pg) and least in birds fed 100% BWM based diet (40.23 ± 0.25 pg). The significant difference (p<0.05) recorded in MCV and MCH levels of broiler birds fed BWMD may be positively correlated with protein quality present in the diet, since haematocrit and haemoglobin are known to be influenced by protein qualities and levels (Ahaotu *et al.*, 2016; Mitruka and Rawnsley, 1977). The increase in the levels of MCV and MCH as the level of BWMD increased indicated that the diets were of high quality. The similarities in haemoglobin levels among the birds irrespective of the tested diets may be an indication of the efficiency of the chickens in metabolizing the diets. Haemoglobin is responsible for cellular respiration, which is an important metabolic reaction (Okonkwo and Ahaotu, 2014). The values of WBC obtained in this study were within the normal limits for broiler birds (Ahaotu*et al.*, 2018a) which indicated that the birds passed through normal physiological process such as the production of antibodies which is associated with blood

characteristics. Ayo –Enweremet *al.* (2017) reported that haematological constituents are always a reflection of animal's responsiveness to both internal and external environments which include feeds and feeding. The non-significant values for PCV, RBC and MCHC despite increasing levels of BWMD suggested that the diets were of good quality and free from anti-nutrients. However, all the haematological reference fell within the normal range for chickens (Ajasin *et al.*, 2010, Ahaotu *et al.*, 2013 and Maxwell *et al.*, 1990)

Table 4. *Serum metabolites of broiler chickens fed the treatment diets*

Parameters	Inclusion levels of BWMD (%)		
	0	50	100
	Diet 1	Diet 2	Diet 3
Total protein (g/100mg)	3.07 ± 0.27	3.70 ± 0.26	3.40 ± 0.26
Albumin (g/100mg)	2.20 ± 0.06	2.23 ± 0.04	2.40 ± 0.08
Globulin (g/100mg)	0.87 ± 0.28	1.53 ± 0.26	1.13 ± 0.27
Uric acid (g/100mg)	2.67 ± 0.51	2.33 ± 0.49	2.53 ± 0.48
Calcium (mg/100ml)	9.83 ± 0.22	9.07 ± 0.23	9.70 ± 0.21
Phosphorous (mg/100ml)	3.36 ± 0.09	3.27 ± 0.08	1.97 ± 0.08
Glucose (mg/100ml)	193.33 ± 15.17	177.00 ± 15.16	194.00 ± 15.19
Total cholesterol (mg/100ml)	70.67 ± 1.86	94.00 ± 1.88	97.33 ± 1.89

abc: means in the same row with varying super script differ significantly ($p<0.05$)

The serum metabolites of broiler birds revealed that significant differences ($p<0.05$) existed in the values of phosphorus and total cholesterol of broilers fed the test diets, but total protein, albumin, globulin, uric acid, calcium and glucose values were not significantly different ($p>0.05$) from one another (Table 4). Broiler birds maintained on 0% BWMD had significantly higher ($p<0.05$) value of phosphorus (3.63±0.09mg/100ml), followed by 3.27±0.08 and 1.97±0.08 mg/100ml in broilers placed on 50 and 100% BWMD based diets respectively.

Total cholesterol was significantly higher ($p<0.05$) in birds fed 100% BWMD (97.33±1.89/100ml), followed by94.00±1.88/100ml in birds fed 50% BWMD and 70.67±1.86/100ml in birds fed the control diet. It was obvious from the result that total cholesterol increased progressively as the level of BWMD increased. However, birds fed on 50 and 100 % BWMD had similar ($p>0.05$) values of cholesterol. The increase in the cholesterol value of diets 2 and 3 may not be unconnected to fat content of BWMD.

However no significant variations ($p>0.05$) were noted in the albumin, globulin and glucose values of all the tested diets. Hoffenberg and Block (1996) had earlier reported that serum protein and albumin synthesis depend on the availability of protein and as protein intake increases, the rate of synthesis increases where a catabolic rate does not easily change.

The uric acid values were not significantly affected ($p<0.05$) which signified that there was no observable muscular wastage due to protein adequacy. This trend was in agreement with the reports of (Lamidi *et al.* 2008 and Omoikhoje *et al.*2011).

CONCLUSION

The results from this study suggested that the inclusion of bakery waste meal in the diet of broilers up to 50% did not have any detrimental effect on the blood reference of the birds. Precaution in the incorporation of BWMD at this level is necessary due to the increase effect on the cholesterol level of the blood.

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