Journal of Animal Health and Production 2 (4): 51 – 54
http://dx.doi.org/10.14737/journal.jahp/2014/2.4.51.54

Research Article

Haematological Traits and Serum Chemistry of Broiler Chicken Fed Bread Waste Based Diets

Animashahun Razaq Adekunle[1*], Omoikhoje Stanley Omoh[2]

[1]Department of Animal Science, Landmark University, P.M.B. 1001, Omu Aran, Kwara State; [2] Department of Animal Science, Ambrose Alli University (AAU) P.M.B. 14, Ekpoma, Edo State of Nigeria
*Corresponding author: animashaun.rasaq@lmu.edu.ng

ARTICLE HISTORY

Received: 2014–07–18
Revised: 2014–08–24
Accepted: 2014–08–26

Key Words: Bread waste meal (BWM), Haematology, Serum indices

ABSTRACT

This study was carried out to determine the effects of partial replacement of maize with 50% bread waste meal (BWM) on the haematological traits and serum biochemical indices of broiler chickens. One hundred and twenty days old Anak 2000 broiler chicks were used in an eight week feeding trial; thirty (30) chicks were selected per treatment group and each group was allocated to four treatment diets (1, 2, 3 and 4) with three replicates per treatment in a Completely Randomized Design (CRD). Diet 1, the control diet contain maize and soya bean meal (SBM) as basal diet; while 50% of maize in diet 1 was replaced with BWM in diets 2, 3 and 4 using SBM, groundnut cake meal (GNC), and 50% SBM + 50% GNC respectively as a protein source. The results showed that the haematological traits were significantly ($P<0.05$) influenced by the test diets, though the values obtained are within the normal range for broiler chickens. Packed cell volume (PCV) ranged from 39.60% in Diet 1 to 35.10% in Diet 4; White blood cells (WBC) from 271.10 to 251.10 (x 10^3/ µl), red blood cells (RBC) from 31.60 to 26.30 (x10^6/ µl), haemoglobin (Hb) from 13.17 to11.30 (g/dl), mean corpuscular volume (MCV) from 125.50 to 129.60 (fl) mean corpuscular haemoglobin (MCH) from 41.70 to 43.40 (µg) and MCHC from 33.60 to 32.80 (g/dl). The results of the serum biological indices showed that total protein and its fractions, and serum glucose were significantly ($P<0.05$) affected by the test, however these values are within the normal range for broiler chickens. From the above, therefore, it can be concluded that BWM at 50% inclusion can be included in the diets of broiler chickens as replacement for maize without any adverse effect on the blood profile of broiler chicken.

ARTICLE CITATION: Adekunle AR Omoh OS (2014). Haematological traits and serum chemistry of broiler chicken fed bread waste based diets. J. Anim. Health Prod. 2 (4): 51 – 54.

INTRODUCTION

The potential of poultry industry in alleviating the challenges of low availability of animal protein for human consumption in developing countries is being hampered by high cost of production (Damisa, 2008). The use of agro–industrial by–products have been one of the panaceas for high feed cost in developing countries. However, several authors have looked in the direction of different agro industrial by–products such as pineapple waste, Bambara groundnut, poultry waste, chicken offal, rice bran, castor oil bean, kolanut husk, rumen content, sunflower seed cake, shrimp waste meal, etc. in order to solve this problem (Adeniji CA 2005, Ani and Okorie 2005, Babatunde, et al., 2001, Dairo et al., 2005, Hamzat and Babatunde 2001). Bread waste, a by–product of bakery industry is cheap and abundantly available in Nigeria; it is rich in energy, low in fibre but high in vitamins (Abdulatif et al., 2004, and Dabron et al., 1999). It is a possible agro–industrial by–product that can be incorporated into broiler chickens feed as energy source in order to decrease the cost of production. In a study, Omole et al., (2011) assessed the performance and cost benefits of replacing maize fraction of the diet of growing snails (*Archachatina margi*nata) with bread waste and concluded that bread waste meal (BWM) can replace 100% maize fraction of snail diets without any deleterious effect in the performance of the snails. Likewise, Fakunmoju (2014), observed better performance in catfish when their meal was supplemented with BWM.

Haematological observations provide valuable information about health of human and animals. According to Afolabi et al., (2010), changes in haematological parameters are often used to determine health status of the body and to know the degree of environmental, nutritional and/or pathological stresses. The factors that affect the blood like drugs, pathogenic organism or nutrition will certainly affect the entire body adversely or moderately in terms of health, growth, maintenance and reproduction (Oke et al., 2007). A readily available and fast means of assessing clinical and nutritional health status of animals on feeding trials may be the use of blood analysis, because ingestion of dietary components has measurable effects on blood composition (Maxwell et al., 1990). Adamu et al., 2006 observed that nutrition had significant effect on haematological values like PCV, Hb and RBC. Togun et al., (2007) reported that when the haematological values fall within the normal range reported for the animal, it is an indication that diets not have any adverse effect on haematological parameters during the experimental period but when the values fall below the normal range, it is an indication of anaemia. WBC roughly represents the immune status of the animals; when WBC (leucocytes) falls within the normal range, it indicated that feeding patterns do not affect the immune system; most immunological abnormalities observed in malnutrition are usually reversed with adequate adjustment to the quality of the feed (Ameen et al., 2007). According to Adekoya et al., (2008), increase in neutrophils: lymphocyte ratio is a good indicator of stress which could be of nutritional origin. Serum parameters are important in the proper maintenance of the osmotic pressure between the circulating pH and the fluid in the tissue spaces so that exchange of materials between the blood and the cells could be facilitated. Moreover, these parameters contribute to the viscosity and maintenance of normal blood pressure and pH (Ladokun et al., 2008).

Therefore, this study was undertaken to assess the effect of substituting maize with 50% BWM on the haematological and biochemical indices of broiler chickens.

ISSN: 2308–2801

MATERIALS AND METHODS

Feed and Experimental Design

The experiment was carried out in the Poultry Unit of Teaching and Research Farms, Ambrose Alli University (AAU) Ekpoma, Edo state of Nigeria. BWM was collected from Irebhor Bakery, Ekpoma, sundried for two weeks, grind and sieved. Other ingredients for feed formulation were obtained from Ekpoma town. Thirty chicks per group were assigned to four treatment diets (1, 2, 3 and 4) in a completely randomized design (CRD). Each treatment group has further divided into three replicates (ten chicks/replicate) and assigned to separate cages. All the chicks were fed the control diet for one week of acclimatization period, subsequently, the chicks were allowed free access to the experimental diets and clean water throughout the duration of the feeding trial *ad libitum*. Four broiler starter and finisher diets (1, 2, 3 and 4) were formulated; Diet 1, the control diet contains maize and soya bean meal (SBM) as basal diet; while 50% of maize in diet 1 was replaced with BWM in diets 2, 3 and 4 using SBM, groundnut cake meal (GNC), and 50% SBM + 50% GNC respectively as a protein source (Table 2). All diets were isonitrogenous and isocaloric.

Table 1: proximate composition of bread waste meal (BWM) and maize

Parameters	BWM	Maize
Dry matter (%)	93.00	90.18
Crude protein (%)	10.00	12.38
Crude fibre (%)	2.70	1.04
Ether extract (%)	4.00	2.14
Ash (%)	1.30	0.64
Nitrogen free extract (%)	75.00	73.98
Metabolizable energy (MJ/Kg)	14.41	12.35

Sample Collection and Preparation

Three birds were randomly selected from each replicate on weight equalization basis and blood samples were collected from each of them through a wing vein. Two sets of blood samples were collected from each bird, one set into a labeled EDTA specimen bottle for hematological indices determination, while the second set were collected in specimen bottles without anti–coagulant (EDTA) for serum indices determination.

Ingredients*	Starter				Finisher			
	1	2	3	4	1	2	3	4
Maize	53.00	26.50	26.50	26.50	55.00	27.50	27.50	27.50
BWM	0.00	26.50	26.50	26.50	0.00	27.50	27.50	27.50
SBM	34.80	34.80	0.00	17.40	30.00	30.00	0.00	15.00
GNC	0.00	0.00	34.80	17.40	0.00	0.00	30.00	15.00
Fish meal	2.00	2.00	2.00	2.00	1.50	1.50	1.50	1.50
Wheat offal	7.00	7.00	7.00	7.00	10.00	10.00	10.00	10.00
Bone meal	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Premix	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Salt	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Lysine	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
L–Methionine	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Calculated Analysis:								
Crude protein(%)	23.03	23.34	22.98	23.24	21.18	21.43	21.13	21.30
ME (Kcal./Kg)	2849	2840	2820	2861	3013	3083	3016	3025

Table 2: Composition of broiler starter and finisher diets

*BWM= bread waste meal; SBM= soya bean meal; GNC= groundnut cake meal GNC; ME= Metabolizable energy

Determination of Haematological Indices

Packed cell volume (PCV), red blood cell (RBC), and white blood cell (WBC) were quantitatively determined using improved Neubar's haemacytometer after dilution, while haemoglobin level was analyzed using cyanomethaemoglobin method 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 the procedure of Jain (1986).

Determination of Biochemical Indices

Blood samples collected without anticoagulant were used to determine the biochemical components. Serum glucose and urea were estimated by the methods described by WHO (1980) while total cholesterol was determined by the colorimetric enzyme method as outlined by Bush (1975). Similarly, serum total protein, albumin and globulin concentrations were determined by Biuret reactions (Bush, 1975).

Statistical Analysis

Data generated were subjected to a one way analysis of variance (ANOVA) and means were compared for significant differences using the Duncan's Multiple range test as outlined by Steel and Torrie (1990) using the SAS (1999) package.

RESULTS AND DISCUSSION

The effect of dietary treatment on haematological indices of broiler chickens is shown in Table 3. The results showed that the packed cell volume (PCV), white blood cells (WBC),red blood cells (RBC), haemoglobin (Hb),and mean corpuscular volume (MCV) were significantly affected ($P<0.05$) by the diets. Birds fed diet 1(the control) has the highest PCV with an average value of 39.60%, while diet 4 (50% BWM and 50%SBM +50% GNC) has the least value of 35.10%; the same pattern was observed for WBC, RBC, Hb, and MCV. The values obtained for mean corpuscular haemoglobin concentration (MCHC) 33.10, 33.60, 33.33 and 32.80 g/deal in birds reared on diets 1,2, 3 and 4 respectively, were not significantly ($P<0.05$) different. All the haematological values obtained in this study were within the normal range (Maxwell et al., 1990; CCAC, 1993; Nse Abasi et al., 2014). These observations could be correlated with those reported by Wikivet (2013) who observed the following as the normal haematological values for bird: 35.9–41.0% (PCV), 11.60–13.68G/dl (Hb), 4.21–4.84x 10^6/ml (RBC), 4.07–4.32X10^3/ml (WBC), 81.60–89.10Fl (MCV), 27.20–28.90Pg (MCH), and 32.41–33.37% (MCHC). The similar values obtained in this study are an indication of the quality of the test diets as haematological parameters are a reflection of the animal responsiveness to both external and internal factors which include feed and feeding.

ISSN: 2308–2801

Table 3: Haematological indices of broiler chickens as affected by the dietary treatments

Parameters*	Diets				SEM**
	1	2	3	4	
PCV(%)	39.60[a]	38.97[ab]	35.50[bc]	35.10[c]	0.46
WBC (x 103/ µl)	271.10[a]	264.80[b]	256.70[b]	251.10[b]	0.62
RBC (x106/ µl)	31.60[a]	28.70[b]	26.30[c]	26.30[c]	0.12
Hb(g/dl.)	13.17[a]	12.40[b]	11.97[ab]	11.30[b]	0.26
MCV(fl.)	125.50[c]	127.60[b]	129.60[a]	128.90[ab]	0.32
MCH (þg)	41.70[b]	43.30[a]	43.40[a]	41.80[b]	0.31
MCHC (g/dl.)	33.10	33.60	33.33	32.80	0.21

[abc]; means in the same row with varying superscript differ significantly (P<0.05); * PVC: packed cell volume; WBC: white blood cells; RBC: red blood cells; Hb: haemoglobin, MCV: mean corpuscular volume; MCH: mean corpuscular haemoglobin; MCHC: mean corpuscular haemoglobin concentration; ** SEM: standard error of mean

Parameters	Diets				SEM
	1	2	3	4	
Total protein (g/dl)	5.50[a]	5.00[ab]	4.60[b]	5.10[ab]	0.18
Albumin (g/ dl)	1.80[b]	2.10[a]	2.0[ab]	2.20[a]	0.14
Globulin (g/ dl)	3.70[a]	2.90[b]	2.60[b]	2.90[b]	0.2
Creatinine (g/ dl)	0.60	0.20	0.90	0.60	0.24
Urea (g/ dl)	4.70	4.30	3.30	5.00	0.33
Glucose (mg/ dl.)	328.30[a]	204.30[b]	205.70[b]	202.30[b]	1.31
Cholesterol (mg/ dl)	111.3	111.7	109.3	128.3	1.04

[ab] means in the same row with varying superscript differ significantly (P<0.05)

Table 4: Serum chemistry of broiler chickens as affected by the dietary treatments

Table 4 represents the serum biochemical indices of the broiler chickens fed the experimental diets. The serum biochemistry is routinely used for detection of organ diseases in domestic mammals (Malik et al., 2013). It has been reported that serum biochemical constituents positively correlate with the quality of the diet (Adeyemi et al., 2000). It is accepted that serum protein profile and the absolute values of individual fractions are an excellent basis for a tentative diagnosis (Kaneko, 1997). Total serum proteins, albumin and globulin of broiler chickens fed 50% BWM were significantly influenced by the dietary treatments; the highest serum protein of 5.50% was recorded in birds on diet 1 (control) while the lowest of 4.60% was observed in diet 3 (50% BWM and groundnut cake meal basal meal). Globulin fraction followed the same pattern as the total protein values; however, despite the slight significant influence in these values, they are within the normal physiological values for chickens (Suchint, et al., 2004). This implies that the BWM–based diets possessed identical dietary qualities with the control diet.

It was observed that the result obtained for broilers on diets 2 and 4 were comparable (P< 0.05) similar and better than those on diet 3, this may be due to differences in the crude protein of soya bean meal (46.22% crude protein) and groundnut cake meal (42.10% crude protein) in their respective diets (Ghadge et al., 2009)

The values obtained for creatinine, urea, and cholesterol for all the dietary treatment groups are comparable to those reported for broilers fed diet 1 (0% bread waste meal). Non-significant differences (P<0.05) in the mean value of creatinine imply that BWM has a similar effect on the kidney of the birds across the dietary treatments; also creatinine value being an indicator of muscle mass catabolism (Ladokun et al., 2008). This result showed the normal physiological process in the broiler chickens fed the test diets and it confirmed the nutritional adequacy of the experimental diets (Maikano, 2014) as significant values out of the normal range indicate poor utilization of dietary protein (Hoffenberg, et al., 1996). The serum glucose was significantly (P< 0.05) influenced by the incorporation of the test diets; the values ranged from 328.30mg/dl in control diet to 202mg/dl in diet 4. Birds have a much higher normal glucose value than mammals. Diabetes mellitus could result from elevated blood glucose (›1000mg/dl), and very low values are often due to bacterial contamination or sample stored too long before analyzed (Gunarson, 2006). In this study, the cholesterol values are similar in all the treatment groups. Gunarson (2006) reported that by measuring cholesterol of feed, the fat metabolism can be assessed. Obesity could result from eating too much seed with excess fat. Elevated cholesterol levels are associated with hypothyroidism, hepatic lipidosis, high fat diets and starvation. The lower and non–significant cholesterol levels observed in this study are an indicator of health benefit of incorporating BWM in broiler chicken diets.

CONCLUSION

The results as shown above indicate that the bread waste meal can serve as an alternative energy source in broiler feed, without any adverse effects on the haematological and biochemical indices of the broilers.

CONFLICT OF INTEREST

There is no conflict of interest.

REFERENCES

Abdulatif A, Salah M, Al–Tulaihna, Hutail A (2004). Nutritional evaluation of dried Bakery Product. Pakistan J. of Nutr. 3 (5): 294 – 299

Adamu S, Thomas A, Iseh NM, Fatihumi MY, Esieno KAN (2006). Normal values of haematology of Nigeria adopted albino rats (*Rattus norvegicus*) in Zaria. Proc of the 31st Annual Conf of Nig Soc for Anim Prod (NSAP).

Adekoya AY, Ayo AY, Sackey AKB, Adelaiye A. B. (2008). Haematological changes in pigs administered with ascorbic acid and transported by road for four hours during the harmattan season. Proc of 42nd. Annual Conf. of the Agric Soc. of Nig. 2008: 659 – 663.

Adeniji CA (2005). Performance and carcass characteristics of broiler chicken fed high fibre sunflower seed cake diet. Nig. J. of Anim. Prod. 32: 198 – 203.

Adeyemi OA, OE Fashina, MO Balogun (2000). Utilization of Full–Fat Jatropha Seed in Broiler Diet: Effect on Haematological Parameters and Blood Chemistry. Proc. 25th Annual Conference Nig Soc Anim. Prod (NSAP) 2000: 108 – 109.

Afolabi KD, Akinsoyinu AO, Olajide R, Akinleye SB (2010). Haematological parameters of the Nigerian local grower chickens fed varying dietary levels of palm kernel cake(p.247). Proceedings of 35th Annual Conference of Nigerian Society for Animal Production.

ISSN: 2308–2801

Ameen SA, Adedeji OS, Akingbade AA, Olayemi TB, Oyedapo LO, Aderinola A (2007). The effect of different feeding regimes on haematological parameters and immune status of commercial broilers in derived Savannah zone of Nigeria. Proc. of 32 Annual Conf. of the Nig Soc for Anim Prod. (NSAP) 146 – 148.

Ani AO, AV, Okorie (2005). The effects of graded levels of dehulled and cooked castor oil bean meal on performance of broiler starters. Nig. J. of Ani. Prod. 32: 54 – 60.

Babatunde BB, Hamzat RA, Adejimi OO (2001). Replacement value of kolanut husk meal for maize in rabbit diets. Trop. J. of Ani. Sci. 4 (2): 127 – 133.

Bush BM (1975). Veterinary Laboratory Manual. William Heineman Medical Books Ltd., London, UK.

CCAC (Canadian Council of Animal Care) (1993). Breeding physiological and nutritional parameters by species. Extract from: Guide to the cure and use of experimental animals. 2nd. Edition (Appendix D). http://www.yonsei.ac.kr pp. 1 – 3

Dabron BL, Waidroup PW, Harms RH (1999). True Metabolizable energy of dried bakery product for use in broiler diet. Poult. Sci. 69: 72 – 75.

Dacie JV, Lewis SN (1991). *Practical haematology* 8th edition Longman group Ltd. Pp 22 – 68

Dairo FAS, Aina OO, Asafa A.R (2005). Performance evaluation of growing rabbits fed varying levels of rumen content and blood rumen content mixture. Nig. J. of Ani. Prod. 32: 67 – 73.

Damisa MA (2008). The supply response of food and cash crop to price and macroeconomic policies in Nigeria 1970 – 2004. (Unpublished).

Fakunmoju FA (2014). Bread waste as a Dietary Supplement for Maize in the Practical Diets of African Giant Catfish (*Clarias gariepinus*, Burchell 1822) Fingerlings. *IOSR Journal of Agriculture and Veterinary Science (IOSR–JAVS) e–ISSN: 2319 – 2380, p–ISSN: 2319 – 2372.Vol. 7, Issue 1 Ver. V (Feb. 2014), PP 89 – 92 www.iosrjournals.org*

Ghadge VN, Upase BT, Patil PV (2009). Effect of Replacing Groundnut cake by soybean meal on Performance of Broilers. Veterinary World Vol.2 (5) www.veterinaryworld.org

Gunarson M (2006). Avian Biochemistry. Institute of Clinical Chemistry, Swedish Agricultural University. ex–episilon.slu.se/archive/00000869/04/Avian_biochemistry.pdf

Hamzat RA, Babatunde BB (2001). Performance characteristics of broiler finisher fed kola pod husk based diet. Moor J. of Agric. Res. 2: 153 –158.

Hoffenberg R, Black E, Black JF (1996). Serum Metabolites. J. of Clinical Invest. 45: 143 – 153

Jain NC (1986). *Schalm Veteniary Haemotology*. 4th edition Philadelphia, Lea and Ferbinger.

Kaneko JJ (1997). Serum Proteins and the Dysproteinemias. In: Clinical Biochemistry of Domestic Animals, 5th edn, eds Kaneko J, J Harvey and M Bruss, Academic Press, San Diego, CA, pp: 117 – 138.

Ladokun AO, Yakubu A, Otite JR, Omeje JN, Sokunbi OA, Onyeji E (2008). Haematological and Serum biochemical indices of Naked and Nomally feathered Nigerian Indigeneous Chicken in the Sub–Humid Tropical Environment. Intl J. of Poult. Sci. 7 (1):55 – 58 ISSN 1582 – 8356. Asian Network of Scientific Information.

Malik S, Kumar A, Verma AK, Gupta MK, Sharma SD, Sharma AK, Rahal A (2013). Haematological profile and blood chemistry in diarrhoeic calves affected with collibacillosis. J Anim. Health Prod. 1(1): 10 – 14

Maxwell MH, Robertson GW, Spence S, McCorquodate CC (1990). Comparison of haematological values of restricted and *ad libitum* feeding in domestic fowl, Blood characteristics. Brit. Poult. Scl. 31(3): 407 – 413

Nse Abasi N. E, Akpabio U,Okpongete R. O. and Edem E. A. (2014). Do Diets Affect Haematological Parameters of Poultry? British Journal of Applied Science & Technology. 4(13): 1952-1965, 2014 SCIENCEDOMAIN *international www.sciencedomain.org*

Oke UK, Herbert U, Ebuzoeme CO, Nwachukwu EN (2007). Effect of genotype on the haematology of Nigerian local chickens in humid tropical environment. Proc of 32nd Annual Conf of the Nig Soc for Anim Prod. 18 – 21.

Omole AJ, Fayenuwo JA, Adejuyigbe AD, Popoola YA (2011). Nutritional evaluation of bread waste as a replacement for maize in the diet of growing snails Journal of Central European Agriculture, 2011, 12(3), p.509 – 514.

SAS (1999). *Statiscal Analysis System User' guide*. Statistical SAS Institute Inc. Cary, NC 27513 USA.

Steel RGD, Torrie JH (1990): *Statiscal Analysis System User' guide*. Statistical SAS Institute Inc. Cary, NC 27513 USA.

Suchint S, Orawan C, Worapol A (2004). Haematological, electrolyte and serum biochemical values of the Thai Indigeneous Chickens (*Gallus domesticus*) in Northeastern Thailand. Sangklanakanin J. Sci. Technol. 26(3)

Togun VA, Farinu GO, Oyebiyi OO, Akinlade JA, Ajibok HO, Olaniyonu BI (2007). Comparative study of the effect of dietary replacement of 15% maize offal with pigeon pea (*Cajanus cajan*) grain or leaf meal on performance of weaners, rabbits. Proc of 32nd Annual Conf of the Nig Soc for Anim Prod. 217 – 219.

WHO (1980). Manual of Basic Techniques for a Health Laboratory. World Health Organization, Geneva, Switzerland

ISSN: 2308–2801