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Metabolites of Broiler Chickens Fed Three Millet Varieties Based Diets as Replacement for Dietary Maize

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ABSTRACT: *This experiment was conducted to evaluate the blood metabolites response of broiler chickens fed different millet variety-based diets as alternative feed option in broiler diets. Four experimental diets were formulated such that the diets contained pearl millet (T2), Finger millet (T3, Douro millet (T4) and the control diet (T1) contained maize. The diets were fed to Four hundred and eighty (480) Anak 2000 strain day old broiler chicks in a 56 days feeding trial. The diets were randomly assigned to four groups of 120 birds in a completely Randomized Experimental Research Design (CRD) replicated 3 times with 40 birds per replicate. Feed and water were provided ad libitum. The results obtained showed no significant differences ($p<0.05$) in all the parameters measured on haematological parameters. The serum biochemical indices showed that total protein (22.67-34.00), albumin (9.67-15.00), urea (0.23-0.96), creatinine (21.33-35.00), cholesterol (1.70-2.38) were significantly ($p>0.05$) affected by the experimental diets. Althogh, the values for glucose (9.56-9.86) and bilirubin (7.5-9.43) were statistically similar. It was concluded that Dauro and finger millet varieties can favorably replace maize in broiler diets without adverse effects on blood haematology and biochemistry of broiler chickens and thus, will help reduce the cost of broiler production especially for farmers in the millet production areas.*

KEYWORDS: broilers, millet based diets, metabolites.

INTRODUCTION

Poultry sub-sector is the most commercialized of all the sub-sectors of the Nigerian agriculture. Poultry industry occupies a major position in the livestock sector of agricultural production because birds reproduce much quicker to produce meat and eggs and returns high profits on investment (Obioha, 1992). Poultry birds have short generation interval, short gestation period and fast growth rate compared to other livestocks such as cattle, goat or sheep (Maidala & Istfanus, 2012)). About 41.23% of animal protein yield per annum in Nigeria is derived from poultry meat and egg (Adegbola, 2004), with only 9.79% and 12.43% from cattle and pigs respectively. Medugu *et al.* (2011) reported that the production of animals with short generation interval such as poultry is essential to overcome the problem of animal protein shortage in Nigeria.

Among the various species of poultry, broiler chickens are of greater advantage in meat production as they can provide quicker return in their investment within a short period of 6 to 8 weeks (Medugu *et al.,* 2010). Increasing broiler chicken production is the best alternative solution to the scarcity of Nigerian animal protein (FAO, 2014). Broiler chickens are genetically selected for fast growth rate and are raised for meat rather than egg production and have a larger body frame and weight than layers (Beutler, 2007). Oluyemi and Robberts (2000) stated that broilers are well-known for their fast growth rates, high feed conversion ratio and low level of activity and reach up to 1.6 to 2.0 kg in 8 to 10 weeks. Broiler chickens play a significant role in providing the animal protein required by man to meet his daily protein intake (Maidala & Istifanus, 2012). Improved broiler chickens production is one of the veritable ways of attaining sustainable and fast production of high-quality animal protein to meet the increasing demand of the Nigerian increasing population (Okosun and Eguaoje, 2017). Atteh (2002) reported broiler birds as having high growth rate, high feed conversion ratio, short gestation interval and traits that respond to feeding and nutritional manipulation within days.

Nigerian livestock industry is greatly affected by high cost of feeds. A number of studies have revealed that feed costs constitute one of the highest variable costs in the poultry chicken production process (Nmadu *et al*., 2014). Feed constitutes the major cost of poultry production, amounting to about 70 percent of the total production cost (Asfaw, 2016).

Over the decades maize remained the major energy source for poultry feeds, the stiff competition for maize between livestock, man and industries, fluctuations in prices and unavailability of this grain bring about high cost of broiler feeds thus, causing a serious economic losses in broiler production in Nigeria (Duru & Dafwang, 2010). The use of maize as the sole energy source in poultry feed formulation is becoming impracticable as a result of the degeneration in the land cultivated for maize due the changes in climatic conditions (Kwari *et al*., 2014).

However, the major interest of the farmers is to minimize cost and maximize profit which cannot be achieved unless the cost of feeds is reduced to the reasonable level. Since primitive times, millet and sorghum were the most cultivated cereal crops grown successfully in both arid and semi-arid regions of Africa and Asia (Nyannor *et al.*, 2007). As a result of little industrial uses of millet in Nigeria its cost is less in the areas of production. Millet is well adapted to areas characterized by high ambient temperature, low rainfall and low soil fertility and hence can be grown where other cereals cannot live. Maidala and Abdullahi (2016) pointed out that millet contain significant amount of nutrients more closely to maize and can grow well on poor sandy soils. Millet has been identified as a suitable alternative to maize in low rainfall and sandy areas and grows well under poor soil condition, erratic rain and high temperatures (Okosun, & Eguaoje, 2017).

Study area

The study was conducted at the poultry research unit of Agricultural Science Education Department of Aminu Sale College of Education, Azare in Bauchi state. The state is situated in the north-eastern part of Nigeria and lies between latitudes 9º 30’ and 12º 30’ North and longitudes 8º 45’ and 11º45’ East Greenwich meridian (Modibbo & Sumi, 2014).

Sources and processing of ingredients

A Millet grain which was the test ingredient was purchased at Azare market, Bauchi state. The grains were milled and mixed with other feed ingredients to compound the experimental diets. Proximate composition was determined at Biochemical laboratory of department of Biochemistry national veterinary research institute Vom, Plateau state.

Experimental birds and management

Four hundred and eighty Anak 2000 strain day-old broiler chicks were purchased from National Veterinary Research institute Vom, Plateau state, the chicks were brooded for one week on deep litter. All routine management practices and medications were strictly adhered to as recommended by FAO (2014). The chicks were randomly assigned to four dietary treatments with one hundred and twenty birds per treatment each replicated three times as forty birds per replicate in a Completely Randomized experimental Research Design (CRD). Four different diets containing 3 different varieties of millet with corn as control were formulated and designated as control (T1), Pearl millet-based diet (T2), Finger millet-based diet (T3), and Dauro millet-based diet (T4), respectively. The experiment lasted for eight weeks.

Blood profile analysis

At the end of the experiment, blood samples were randomly collected from sixteen birds (i.e. four birds per replicate) in each treatment group using 2ml disposable syringe and needle. The blood samples were collected and stored in sterilized glass tubes/bottles containing Ethylene Diaminetetetra-acetic Acid (EDTA) for Haematological studies while samples for biochemical studies were collected and stored without anticoagulant. The birds were fasted for twelve hours and bled the next morning to avoid temporary elevation of blood metabolites by feeding as observed by Bush (1975). The Haematological parameters including Red blood cells (RBC), packed cell volume (PCV), white blood cells (WBC), hemoglobin (HB) concentration, mean corpuscular hemoglobin concentration (MCHC), mean corpuscular hemoglobin (MCH) and mean corpuscular volume (MCV) were all determined according to routine available clinical method. Serum biochemical indices measured were total serum protein, glucose, serum albumin, urea, creatinine, cholesterol, direct bilirubin and conjugate bilirubin subjected to analysis of variance (ANOVA) balanced technique as described by Steel and Torrie (1980) while difference between treatments means were separated for significance at 0.05 level of significance by Duncan's multiple range test (Duncan's, 1955).

RESULTS AND DISCUSSION

The proximate composition of the experimental diets is shown in table 1, the haematological and serum biochemical parameters are shown in table 2. The result showed no significant difference ($p>0.05$) among the treatment groups for all the haematological parameters measured. Packed cell volume (PCV) and haemoglobin (HB) did not show any particular trend, but on numerical basis, recorded the highest values for T1 (23.66%) and T4 (23.66%) chickens. The values reported in this study for packed cell volume (PCV) and haemoglobin (HB) (22.33-23.66 and 7.23-7.96%) are in agreement with (22.23-26.83%) reported by Afolayan *et al*. (2014), it however, fells below the

normal range of 31-33% reported by Clement *et al*. (2010). However, the findings of this study regarding Red blood cells (2.08-2.09x10^6ul, packed cell volume (22.33-23.66%), white blood cells (219.00-222.83x10^6ul) and haemoglobin (7.23-7.96g/dl) does not conform the report of the study of Clement *et al*. (2010) who observed a significant ($p<0.05$) differences in Red blood cells (1.82-3.10x$10^3$$mm^{3)}$, Packed cell volume (20.00-31.67%) and haemoglobin (4.07-6.83g/dl). The total protein levels were 27.33g/l, 22.67g/l, 34.00g/l and 28.00g/l respectively. The albumin levels were 12.00g/l, 9.69g/l, 15.00g/l and 12.33g/l respectively. The urea levels were 0.41mmmol/l, 0.29mmmol/l, 0.23mmmol/l, and 0.96mmmol/l respectively. The creatinine levels were 35.00 mmmol/l, 21.33 mmmol/l, 28.33 mmmol/l and 22.67 mmmol/l respectively. The cholesterol levels were 1.93 mmmol/l, 1.70 mmmol/l, 2.31 mmmol/l and 2.38 mmmol/l respectively. There were significant differences ($p>0.05$) in all the biochemical indices measured across the treatments measured except glucose (9.56-9.86 mmmol/l) and bilirubin (7.5-9.43umol/) which were statistically similar. The result of the present study is in line with the report of Mohammed *et al.* (2016) which indicates a significant difference ($p<0.05$) in biochemical indices measured. However, the findings of the present study did not support the report of clement *et al*. (2010) who observed no significant difference ($p>0.05$) for Albumin (12.00-14.00g/l), Urea (3.10-3.45g/dl), and Cholesterol concentrations (2.65-3.65mmol/l) when maize was substituted by sorghum and millet in diet of broiler chickens.

The values of total protein (22.67-34.00g/l) obtained in this study differed significantly ($p<0.05$), with diet T3 recording the highest value (34.00) and diet T2 having the lowest value (22.67g/l). Total protein is usually a reflection of the protein quality (Medugu *et al*., 2010). Blood albumin (g/l) concentration differed significantly ($p<0.05$) among the treatment groups. However, Glucose ((9.56-9.86g//l) was not affected ($p>0.05$) by the dietary treatments. Blood urea concentration (0.23-0.96mg/dl) and Creatine (21.33-35.00mmol/l) values were also significantly ($p<.05$) affected by the dietary treatments. High value for blood urea concentration was recorded in diet T4 (0.96mg/l) while diet T1 recorded the highest value for creatinine concentration (35.00mg/dl). The range of values (27.33-3400g/l) for total protein obtained in the current study is lower than the values (55.99-61.07g/l) obtained for Rabbits as reported by Jibuwa *et al*. (2016). The range of values (1.70-2.38) obtained in the current study is lower than the values (2.65-3.65mmol/l) reported by Clement *et al*. (2010) when maize was replaced by sorghum or millet-based diet in broiler diet.

Table 1
Proximate composition of maize and three millet varieties

	Dietary Treatments			
Parameter	T1	T2	T3	T4
Dry matter (DM (%)	93.69	92.42	92.42	93.18
Crude protein (CP) (%)	8.84	7.72	8.84	9.53
Crude fiber (CF) (%)	2.61	3.61	3.22	2.91
Ether extract (EE) (%)	3.01	1.50	1.20	2.01
Ash (%)	2.01	1.93	2.72	1.82
NFE (%)	77.22	78.20	76.93	76.91
Calcium (%)	0.30	0.32	0.30	0.32
Phosphorus (%)	0.06	0.01	0.01	0.02
ME (kcal/kg)	3233.95	3308.05	3275.65	3272.65

Table 2
Haematology and biochemical indices of broiler chickens fed three millet variety-based diets as replacement for dietary maize

Dietary treatments					
Parameters	**T1**	**T2**	**T3**	**T4**	**SEM**
Haematology parameters					
Haemoglobin (g/dl)	7.86	7.46	7.96	7.23	0.31^{ns}
Packed cell volume (%)	23.66	22.66	23.66	22.33	1.07^{ns}
White blood cell ($x10^6\mu l$)	222.66	222.46	219.00	222.83	5.67^{ns}
Red blood cell ($x10^6\mu l$)	2.09	2.20	2.08	2.08	0.14^{ns}
MCV (%)	113.38	102.95	116.44	106.95	5.20^{ns}
MCHC (%)	33.24	32.94	33.76	33.32	0.30^{ns}
MCH (%)	37.68	33.92	39.50	34.65	2.14^{ns}
Biochemical indices					
Glucose (mmol/L)	9.86	9.56	9.70	9.86	0.94^{ns}
Urea (mmol/L)	0.41^{a}	0.29^{b}	0.23^{b}	0.96^{a}	0.004*
Creatinine (mmol/L)	35.00^{a}	$2133^{.c}$	28.33^{b}	22.67^{c}	7.00*
Cholesterol (mmol/L)	1.93^{ab}	1.70^{b}	2.31^{a}	2.38^{a}	0.25*
Total protein (g/L)	27.33^{b}	22.67^{b}	34.00^{a}	28.00^{b}	9.147*
Albumin (g/L)	12.00^{b}	9.67^{a}	15.00^{d}	12.33^{b}	1.67*
Direct bilirubin ($\mu mol/l$)	8.67	7.50	8.86	9.43	3.04^{ns}
Conjugate bilirubin $\mu mol/l$	3.07	2.40	3.13	3.32	0.77^{ns}

Means with different superscripts on the same row differ significantly (P<0.05
SEM = Standard error mean, ns = not significant (P>0.05)

Conclusion- Millet grain is readily available with little or no economic value and its inclusion in diets of broiler chickens has no advance effects on the haemotoloical indices and will help reduce the cost of broiler production.

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