SUB-THEME: MONOGASTRICS

GROWTH PERFORMANCE, HAEMATOLOGICAL AND SERUM BIOCHEMICAL INDICES OF BROILER CHICKENS FED MILLET BASED DIETS SUPPLEMENTED WITH ENZYMES

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Abstract
The study was carried out to evaluate the effects of feeding millet based diet supplemented with enzymes on the performance of broiler chickens. Three hundred and thirty (330) day-old chicks were allotted to five dietary treatments which are T1, T2, T3, T4 and T5 respectively. Each was replicated three times with twenty two birds per replicate in a completely randomized design (CRD). Feed and water were given *ad-libitum* throughout the experimental period. Data was collected on the growth performance and haematological indices and serum biochemistry. Result of the performance of the birds in showed that there were significant differences ($P<0.05$) in final weight and weight gain. There was significant difference ($P<0.05$) in feed intake, feed conversion ratio and feed cost per gain. There was significant differences ($P>0.05$) in blood chemistry parameters except for potassium, glucose albumin and uric acid levels which showed no significant differences ($P>0.05$) across the dietary treatments. Hematology indices showed no significant differences ($P>0.05$) across the dietary treatments except for White blood cell and Platelet levels. Enzyme inclusion improved the performance of the birds in weight gain and feed conversion ratio.
Key words: Millet, enzyme, performance, haemalogical indices, serum biochemistry.

Introduction

Cereals are used in chicken diets as the main source of energy while oilseeds such as groundnut cake, sunflower meal and soy-bean meal primarily contributes to the dietary protein (Choct, 2012). Maize is the common cereal used in combination with soy-bean meal or groundnut cake, to formulate broiler or layer diets. Due to its high contents of energy, low fibre, better palatability, presence of pigments and essential fatty acids, maize is widely used as an energy source in poultry diets (Panda *et al*., 2010). However, the protein content of maize is low compared to the other cereals (Dale, 1994).

Satisfying the nutritional requirements of a particular class of livestock is rapidly becoming a difficult task. This is due to scarcity and high cost of feed and feed ingredients. Furthermore, inadequate production of this grain and the intense competition for maize between man, livestock and industries especially in the drier areas of the tropics has made poultry rations more expensive. This high cost and scarcity of commercial diets for poultry may, if not addressed, result in lower income to poultry farmers and reduced protein intake among the semi-arid communities (Clement e*t al*., 2010). Millets are a group of highly variable small-seeded grasses widely grown around the world as cereal crop or grain for fodder and human food. Millets are important crops in the semi-arid tropics of Asia and Africa (especially in India, Nigeria and Niger), with 97% of millet production in developing countries (FAOSTAT, 2018). The crop is favoured due to its productivity and short growing season under dry and high temperature conditions. The most widely grown millet is pearl millet, which is an important crop in India and parts of Africa (FAOSTAT, 2018)..

To improve the utilization of millet in poultry diet, enzymes are put into consideration. Enzyme inclusion in poultry feeds is one of the major nutritional advances in the last fifty years **(**Khattak *et al.,* 2006**).** Nutritionists realized the use of enzyme in diets over a long time but until 1980's it remained beyond their reach. Poultry naturally produces enzymes to aid the digestion of feed materials. However, they do not have enzyme to break down fiber completely and need exogenous enzymes in feed to achieve that (Khattak *et al.,* 2006). Feed enzymes helps to reduce the effect of anti nutritional factors in feed ingredients, it renders the nutrient more available for digestion and absorption. Some of the enzymes that

have been used over the past in the feed industry include cellulose (β-glucanases), xylanases and associated enzymes phytases, proteases, lipases and galactosidases (Khusheeba & Sajid, 2013). This study was designed to determine the replacement value of millet for maize on performance of broiler chicken and how enzyme can improve the performance of the birds fed with millet as the main energy source.

Materials and Methods

The experiment was conducted at the Teaching and Research Farm of the Department of Agricultural Education, Federal College of Education (FCE) Kano. A total of three hundred and thirty (330) day old broiler chicks were used for the experiment which were purchased from a reputable outlet in Kano state, Nigeria. The birds were allotted to five dietary treatments which were designated as Diet 1,2,3,4,and 5 and replicated 3 times in a completely randomized design (CRD) each with 22 birds per replicate. Birds were reared on a deep litter house which was partitioned into pens as experimental units. All the necessary routine management practices and the recommended vaccinations were strictly observed during the study period (Van Eekeren *et al.*, 2006).

The gross compositions of the experimental diets are shown in Table 1 for broiler starter diet and Table 2 broiler finisher diet respectively.

Table 1 Composition of the Experimental Diets (Broiler Starter)

	Treatments (%)				
Feed Ingredients	**Diet 1**	**Diet 2**	**Diet 3**	**Diet 4**	**Diet 5**
Maize	45.20	0.00	0.00	0.00	0.00
Millet	0.00	47.86	47.86	47.86	47.86
Soya bean meal	20.89	18.24	18.24	18.24	18.24
Groundnut cake	17.00	17.00	17.00	17.00	17.00
Wheat offal	10.00	10.00	10.00	10.00	10.00
Lime stone	4.00	4.00	4.00	4.00	4.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Lysine	0.15	0.15	0.15	0.15	0.15
Methionine	0.20	0.20	0.20	0.20	0.20
Salt	0.30	0.30	0.30	0.30	0.30
Vitamin premix	0.25	0.25	0.25	0.25	0.25
Protease	0.00	0.00	0.00	0.02	0.02
Phytase	0.00	0.00	0.02	0.00	0.02
Total	100.00	100.00	100.02	100.02	100.02

Table 2: Composition of the Experimental Diets (Broiler Finisher)

Feed Ingredients	**Diet 1**	**Diet 2**	**Diet 3**	**Diet 4**	**Diet 5**
Maize	48.18	0.00	0.00	0.00	0.00
Millet	0.00	51.02	51.02	51.02	51.02
Soya bean meal	10.92	8.08	8.08	8.08	8.08
Groundnut cake	19.00	19.00	19.00	19.00	19.00
Wheat offal	12.00	12.00	12.00	12.00	12.00
Lime stone	6.00	6.00	6.00	6.00	6.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Lysine	0.15	0.15	0.15	0.15	0.15
Methionine	0.20	0.20	0.20	0.20	0.20
Salt	0.30	0.30	0.30	0.30	0.30
Vitamin premix	0.25	0.25	0.25	0.25	0.25
Protease	0.00	0.00	0.00	0.02	0.02
Phytase	0.00	0.00	0.02	0.00	0.02
Total	100.00	100.00	100.02	100.02	100.02

Growth Performance

The experiment lasted for eight weeks during which feed intake, live weight gain, water intake and feed conversion ratio were monitored.

Feed Intake (g): The feed intake of the birds was calculated using this formula:

Feed intake per bird (g) = $\frac{\text{Feed supplied(g)} - \text{Left over of feed(g)}}{\text{Number of birds}}$

Live-weight gain (g): The live-weight gain (g) was calculated using this formula:

Live-weight gain (g) = Final weight (g) – Initial weight (g)

Feed Conversion Ratio (FCR): The Feed Conversion Ratio (FCR) was calculated using this formula:

FCR = $\frac{\text{Total feed intake (g)}}{\text{Total body weight gain (g)}}$

Haematological and Serum Chemistry Evaluation

At the end of feeding trial, 15 birds (3 birds per treatment) were randomly selected for blood sample collection. The blood was collected from the wing vein using needle with syringe (Muhammad *et. al*., 2013). Blood was drained into two different carefully labeled bottles for haematological and serum metabolite investigation. The blood sample for hematology was collected into bottles pretreated with Ethylene Diamine Tetra Acetic acid (EDTA), an anti-coagulant. Blood samples for biochemical indices were collected into another sample bottles that does not contain EDTA. The parameters to be investigated include: Urea, Sodium, Potassium, Creatinine, Glucose, Cholesterol, Total protein, Albumin, Globulin, Uric acid, Packed Cell Volume (PCV), Red Blood Cell count (RBC), White Blood Cell (WBC) and haemoglobin, Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH) and Mean Corupuscular Haemoglobin Concentration (MCHC), Lymphocyte, Neutrophil, Monocyte, Eosinophil and Basophil (Jain, 1986). The data generated from the experiment were subjected to analysis of variance using SAS software (2003) and means were separated using Least Significance Difference (LSD).

Results and Discussion

Performance Characteristics of Broiler Chicken Fed Millet Based Diets Supplemented With Enzymes

Table 3 below shows the performance characteristics of broilers fed millet based diets supplemented with enzymes. The final weight and weight gain of the birds were statistically the same. There was a significant difference ($P<0.05$) in feed intake. TRT 5 has the highest feed intake followed by TRT 2,3and 4 which are statistically the same, TRT 1 recorded the lowest feed intake. The feed conversion ratio is best in TRT 3, followed by TRT 2, 4, and 5, TRT 1 has the lowest feed conversion ratio when compared to other treatments. The feed cost per gain is high in T1 and lowest in T3.

Table 3: Performance characteristics of broilers fed millet based diets supplemented with enzymes

	Treatments					
Parameters	1	2	3	4	5	**SEM**
Initial weight g/ bird	41.67	41.67	37.87	39.39	39.39	**38.18**
Final weight g/ bird	1657.96	1820.06	1834.77	1894.71	1931.48	**57.72**
WG g/bird/day	35.36^{b}	40.53^{a}	41.61^{a}	42.29^{a}	43.69^{a}	**3.59**
FI g/bird/day	78.39^{c}	90.84^{b}	90.83^{b}	94.11^{b}	101.37^{a}	**2.03**
WI ml/bird/day	156.60	162.82	161.59	163.06	171.86	**7.54**
FCR	2.22^{ab}	2.24^{ab}	2.18^{b}	2.23^{ab}	2.32^{a}	**0.09**
FC/gain (Naira)	283.61^{a}	252.97^{bc}	244.06^{c}	264.79^{ab}	263.63^{b}	**5.74**

TRT= treatment, SEM= Standard error mean, Means within the same row with different superscript are significantly different (P<0.05).

Blood Chemistry of Broiler Birds Fed Millet Based Diets Supplemented With Enzymes at 8 Weeks

Table 4 shows the blood chemistry of broiler birds fed millet based diets supplemented with enzymes at 8 weeks. There was no significant difference in the Potassium, Glucose, Albumin and Uric acid levels in the blood across the treatments. There was significant difference in the Urea, Sodium, Creatinine, Total protein, Globulin levels across the treatments with TRT 5 having the highest level.

Table 4: Blood chemistry of broiler birds fed millet based diets supplemented with enzymes

PARAMETERS	TRT 1	TRT 2	TRT 3	TRT 4	TRT 5	SEM
Urea mmol/L	2.58^{bc}	2.52^{c}	3.02^{ab}	2.55^{c}	3.10^{a}	**0.13**
Sodium mmol/L	135.50^{c}	139.83^{a}	135.83^{bc}	139.50^{ab}	134.67^{c}	**1.19**
Potassium mmol/L	6.17	5.72	6.03	5.72	5.60	**0.28**
Creatinine mmol/L	52.40^{b}	65.33^{ab}	61.00^{ab}	67.83^{ab}	69.83^{a}	**4.69**
Glucose mmol/L	8.08	8.17	7.40	6.56	8.53	**0.66**
Total protein mmol/L	45.50^{b}	52.33^{a}	43.83b	43.17^{b}	45.83^{b}	**1.27**
Albumin g/L	18.83	17.00	20.17	16.17	18.00	**1.45**
Globulin g/L	26.83^{b}	35.33^{a}	23.33^{b}	27.00^{b}	29.50^{ab}	**1.84**
Uric acid mmol/L	295.50	355.17	332.50	440.67	318.17	**77.19**

TRT= treatment, SEM= Standard error mean, Means within the same row with different superscript are significantly different (P<0.05).

Table 5 shows the hematology of the blood sample collected. There was no significant difference in the hematology indices amongst all the treatments except for WBC and PLT levels.

Table 5: Hematology indices of blood for broiler birds fed millet based diets supplemented with enzymes

PARAMETERS	TRT 1	TRT 2	TRT 3	TRT 4	TRT 5	SEM
PCV %	33.20	23.10	24.27	38.53	21.58	**9.43**
HB g/dL	16.15	11.83	12.30	19.20	10.55	**4.73**
RBC x10^{12}/L	2.58	1.76	1.87	2.88	1.64	**0.73**
WBC x10^{9}/L	109.63^{a}	0.00^{b}	39.40^{ab}	29.30^{ab}	26.83^{ab}	**25.77**
PLT x10^{9}/L	4.83^{ab}	1.67^{ab}	1.83^{ab}	5.67^{a}	1.50^{b}	**1.21**
MCH pg g/dL	63.03	44.80	43.83	66.63	42.88	**17.97**
MCHC g/dL	48.87	34.20	33.77	49.80	32.67	**13.84**
MCV FL	128.83	87.27	86.53	133.80	87.43	**35.89**

PCV: Packed Cell Volume, HB: Hemoglobin, RBC: Red Blood Cell count, WBC: White Blood Cell, HB: haemoglobin, MCV: Mean Corpuscular Volume, MCH: Mean Corpuscular Haemoglobin, MCHC: Mean Corpuscular Haemoglobin Concentration. SEM= Standard Error Mean, Means within the same row with different superscript are significantly different (P<0.05).

Discussion

The lower feed intake in TRT 1 in Table 3 could be due to high energy of the diet since birds only eat to satisfy their energy need . The daily weight gain was significantly influenced by the dietary treatments. This is in agreement with the study of Adamu (2005) who replaces yellow sorghum for maize and found

significant difference (P<0.05) in the daily weight gain, the millet group (Dauro millet and Gero millet) has the highest body weight gain which also agreed with the findings of Bramel-Cox *et. al.* (1992), this could be due to higher oil content of millet than that of maize which has been reported to enhance feed intake, feed conversion ratio improves appetite and ameliorates growth depressive effects of heat stress Yunusa *et.al.* (2015), Amor *et al*. (2021) also agreed with the fact that millet has more lipid content than that of maize.

There was significant improvement (P<0.05) in weight gain of broilers in TRT 5, 4 and 3 respectively when maize was completely replaced by millet and enzyme included in the diet. These findings were also confirmed by Kantharaja *et al.* (1995). But this does not conform to the findings of Rama Rao *et al.* (2002) who reported that broilers fed on diet containing pearl millet, finger millet or sorghum as principal source of energy had significantly lower weight gain and poor feed conversion efficiency compared to the maize fed group. The better weight gain in the millet based diet with enzymes conforms to the findings of Elangovan *et al.* (2004) who concluded that diet containing finger millet or poor quality of grain can be improved by adding commercial feed enzyme preparation. The haematology and blood chemistry profile in Table 4 and 5 of the birds are significantly the same this shows that the non-significant values of the hematology parameters across all dietary treatments, was probably an indication of adequate nutrition for these birds which is in contrast to the findings of Ikhimioya *et al.,* (2000) and Oladele *et al.,* (2001) who linked lower values of these parameters to inadequate nutrition.

Conclusion and Recommendation

It can be concluded that the response of broiler chickens fed Millet based diets supplemented with enzymes (Phytase and Protease) improved the performance of the birds in weight gain and feed conversion ratio. Therefore it is recommended that farmers in areas of millet production in Nigeria can conveniently replace maize with millet and addition of enzymes (Phytase and Protease) can be of added advantage on the performance of their birds as they help in improving digestion and utilization of the grain (millet).

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