PERFORMANCE AND BLOOD PARAMETERS OF BROILER CHICKENS FED MILLET-BASED DIETS SUPPLEMENTED WITH ENZYMES

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ABSTRACT
This study evaluated the effects of adding exogenous enzymes to millet-based diets on the growth performance indices, haematology, blood chemistry and carcass characteristics of broiler chickens. A total of 180 day - old broiler chicks were randomly assigned to five dietary treatments (TRT 1- 5) replicated thrice with 12 birds per replicate in a completely randomized design. All necessary routine management practices and recommended vaccinations were strictly observed during the study period. All necessary routine management practices and recommended vaccinations were strictly observed during the study period. The growth performance parameters such as weight gain, feed intake and feed conversion ratio (FCR) were recorded. Blood samples were collected for haematological and biochemical analysis. The results revealed significant differences in feed intake and feed conversion ratio (FCR) among treatments. Additionally, variations in blood chemistry and haematological indices were observed, highlighting the physiological responses of broilers to enzyme supplementation. It was concluded that enzyme supplementation in millets- based diets improves broiler chickens' performance by enhancing nutrient utilization, feed conversion efficiency and health.
Keywords: Millet, Broiler chickens, Performance characteristics, Exogenous enzymes

INTRODUCTION

The inclusion of alternative feed ingredients such as millet in poultry diets has gained attention due to cost-effectiveness and nutritional benefits. NRC (1996) has reported that millet has no tannin, contains 5-7% oil and has higher protein and minerals than maize. The report further revealed that millet can replace maize in the diets of broiler chickens without adverse effects on growth rate or feed conversion ratio. Millets are a group of highly variable small-seeded grasses widely grown globally as cereal crops or grains 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 (McDonough *et al.,* 2000). The crop is favored 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 (FAO 1996). Finger millet, proso millet, and foxtail millet are also important crop species. In the developed world, millets are less important. For example, in the United States only proso millet is significant, which is mostly grown for bird seed (McDonough *et al.,* 2000).

While millets are indigenous to many parts of the world, it is believed that they had an evolutionary origin in tropical western Africa, as that is where the greatest number of both wild and cultivated forms exist (FAO 1994). Millet has been an important food staples in human history, particularly in Asia and Africa. They have been under cultivation in East Asia for the last 10,000 years (Lu, H; *et al.,* 2009).

However, its utilization may be limited by the presence of anti-nutritional factors. Enzyme supplementation is a common strategy to enhance nutrient availability and improve poultry performance (Adebiyi *et al.,* 2005). This study assesses the impact of millet-based diets supplemented with two exogenous enzymes (phytase and protease) on broiler chickens growth performance, blood chemistry, and haematological parameters.

MATERIALS AND METHODS

Experimental Site

The experiment was conducted at the Teaching and Research Farm, Department of Animal Science, Bayero University, Kano.

Experimental Birds, Design and Management

A total of 180 day-old broiler chicks were randomly assigned to five dietary treatments (TRT 1-5) replicated thrice with 12 birds per replicate in a completely randomized design. All necessary routine management practices and recommended vaccinations were strictly observed during the study period.

Experimental Diets

Five experimental diets were formulated with varying levels of millet-based diets supplemented with enzymes as shown in Table 1 and 2 for both starter and finisher feed respectively. The diets were designated as:
Diet 1- Maize-based diet
Diet 2- Millet-based diet
Diet 3- Millet-based diet with Smizyme (Phytase)

Diet 4- Millet-based diet with Biozyme (Protease)
Diet 5- Millet-based diet with Smizyme and Biozyme
The experimental period lasted for eight weeks. Performance parameters such as weight gain, feed intake and feed conversion ratio (FCR) were recorded. Blood samples were collected for hematological and biochemical analysis.

Table 1: Ingredient 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

**Premix (Vitamin-mineral mixture) contained in 25kg of diet: Vitamin A, 10,000 I.U; Vit D_3, 2,000 IU; Vit E, 23,000mg; Vit K_3, 2000mg; Vit B_1, 1,800mg; Vit B_2, 5,500mg; Niacin, 27,500mg; Pantothenic acid, 7,500mg; Vit B_6 3,000mg; Vit B_{12}, 15mg; Folic acid, 750mg; Biotin, 60mg, Choline chloride, 300,000mg; Iodine, 3000mg; Iron, 1000mg; Manganese, 40,000mg; Selenium, 40,000mg; Zinc, 200mg; Antioxidant, 1.250mg;*

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

			Treatments		
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

**Premix (Vitamin-mineral mixture) contained in 25kg of diet: Vitamin A, 10,000 I.U; Vit D_3, 2,000 IU; Vit E, 23,000mg; Vit K_3, 2000mg; Vit B_1, 1,800mg; Vit B_2, 5,500mg; Niacin, 27,500mg; Pantothenic acid, 7,500mg; Vit B_6 3,000mg; Vit B_{12}, 15mg; Folic acid, 750mg; Biotin, 60mg, Choline chloride, 300,000mg; Iodine, 3000mg; Iron, 1000mg; Manganese, 40,000mg; Selenium, 40,000mg; Zinc, 200mg; Antioxidant, 1.250mg;*

RESULTS AND DISCUSSION

Performance Characteristics

The performance characteristics of broilers chickens fed millet-based diets supplemented with enzymes are shown in Table 3. The final weights and weight gains of the birds were statistically similar across treatments. TRT 5 exhibited the highest weight gain (43.69 g), while TRT 1 had the lowest (35.36 g). This suggests that enzyme supplementation had a positive effect on nutrient utilization, aligning with findings by Kiarie *et al.* (2013).

There was a significant difference ($P<0.05$) in feed intake. TRT 5 recorded the highest feed intake (101.37 g), while TRT 1 had the lowest (78.39 g). The addition of enzymes probably improved digestibility, which increased feed intake (Olukosi, Cowieson & Adeola, 2010). TRT 3 had the best FCR (2.73), while TRT 1 had the poorest (3.06), indicating that enzyme supplementation improved feed efficiency. Similar trends were observed by Selle *et al.* (2006).

Table 3: Performance Characteristics of Broilers Fed Millet-Based Diets Supplemented with Enzymes

PARAMETERS	TRT 1	TRT 2	TRT 3	TRT 4	TRT 5	SEM
Initial weight(g/b)	41.67	41.67	41.67	41.67	41.67	48.18
Final weight(g/b)	1657.96	1820.06	18344.77	1894.71	1931.48	57.25
Weight gain(g/b)	35.36^{b}	40.53^{a}	41.61^{a}	42.29^{a}	43.69^{a}	3.59
Feed intake (g/b)	78.39^{c}	90.84^{b}	90.83^{b}	94.11^{b}	101.37^{a}	2.03
FCR	3.06	2.83	2.73	2.89^{ab}	2.94^{ab}	0.09

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

Blood Chemistry

The blood chemistry of broilers is presented in Table 4. Urea, sodium, creatinine, total protein, and globulin levels varied significantly (P < 0.05) across treatments, with TRT 5 having the highest values. This supports the findings of Erdaw *et al.* (2016), who reported that protein metabolism can be impacted by enzyme supplementation.

No significant differences (P > 0.05) were observed in potassium, glucose, albumin, and uric acid levels, suggesting stable metabolic functions across treatments.

Table 4: Blood Chemistry of Broiler Birds Fed Millet Based Diets Supplemented with Enzymes

			Treatments			
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).

Hematologic Indices

Table 5 presents the haematological indices of broiler chickens fed millet-based diets supplemented with enzymes. White blood cell (WBC) and platelet (PLT) levels varied significantly (P < 0.05). TRT 1 had the highest WBC count (109.63×10^{9}/l), while TRT 5 had the lowest (26.83×10^{9}/l). Haematological stability is essential for immune function and overall health (Adeola & Cowieson, 2008). Other haematological indices, including packed cell volume (PCV), haemoglobin (HB), and red blood cell (RBC) counts, showed no significant differences (P > 0.05), indicating that enzyme supplementation did not negatively affect haematopoiesis.

Table 5: Haematologic 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×10^{12}/l	2.58	1.76	1.87	2.88	1.64	0.73
WBC ×10^{9}/l	109.63^{a}	0.00^{b}	39.40^{ab}	29.30^{ab}	26.83^{ab}	25.77
PLT ×10^{9}/l	4.83^{ab}	1.67^{ab}	1.83^{ab}	5.67^{a}	1.50^{b}	1.21
MCH (pg)	63.03	44.80	43.83	66.63	42.88	17.97
MCHC(fl)	48.87	34.20	33.77	49.80	32.67	13.84
MCV (g/dl)	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).

CONCLUSION

The results suggest that enzyme supplementation in millet-based diets improves broiler chickens' performance by enhancing nutrient utilization, feed conversion efficiency, and health. These findings support the integration of enzyme supplementation in poultry nutrition strategies.

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