Journal of Research in Biology

An International Scientific Research Journal

ISSN No: Print: 2231 –6280; Online: 2231- 6299

Original Research

Nutritive evaluation of different energy sources with Maxigrain® enzyme in broiler diets under the tropical climate of Nigeria

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ABSTRACT:

A study was carried out to evaluate the nutritive value and enzyme supplementation of different sources of energy in broiler diets on the growth performance and heamatological parameters of broiler chickens supplemented with Mazigrain® enzyme within the treated groups. Five isonitrogenous and isocaloric diets (23.17 % CP; 2831 Kcal/ME and 21.73 % CP; 2929 Kcal/ME) for the broiler starter (0 - a month) and finisher phases (5–8 months) respectively were formulated. Diet 1(maize based diet) served in as the control while diets 2, 3, 4 and 5 were supplemented with sorghum, pearl millet, cassava and sweet potatoes based diets separately. A sum of 225 day-old NAPRI X broiler chicks were haphazardly distributed to the five treatments. Every treatment comprised of 45 broilers with three repeats of fifteen birds each in a Completely Randomized Design (CRD). The general linear model protocol of S.A.S. 9.0. was used to analyze the collected data. Among the dietary groups significant changes ($P<0.05$) was found utilizing a Tukey test. Enzyme along with various energy sources have noteworthy ($P<0.05$) changes on every one of the parameters (final weight, daily weight gain, feed conversion ratio, water intake, water to feed ratio and feed cost per kilogram weight gain) except for death rate at the starter phase. Broilers that had sorghum based diet had the best performance at starter stage (final weight; 627 g, weight gain; 576.85 g, feed cost/kg gain; ^ 187.95 k). At the finisher stage, sorghum supplemented with enzyme had the best feed conversion ratio (1.96) and feed cost/kg gain; ^ 171.15 k. The optimal performance characteristics were recorded for sorghum based diets. Feed cost / kg gain was the cheapest on birds fed sorghum based diet with enzyme supplementation which was comparable with those fed the maize based diet. However, the use of enzyme enhanced the performance of birds at both the starter and finisher phases.

Keywords:
Feedstuff, nutritive value, Energy sources, Hematological parameters.

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Article Citation:
Jirgi DJ, Abeke FO, Onimisi PA and Akinsola OM
Nutritive evaluation of different energy sources with Maxigrain® enzyme in broiler diets under the tropical climate of Nigeria
Journal of Research in Biology (2016) 6(7): 2124-2130

Dates:
Received: 14 Aug 2016 **Accepted:** 12 Oct 2016 **Published:** 10 Nov 2016

Web Address:
http://jresearchbiology.com/documents/RA0609.pdf

INTRODUCTION

The increase in the total populace has prompted the need for intensifying livestock production, however this is obliged by high overhead cost particularly in Nigeria. Because of the monetary circumstance availing in the country, protein intake of most Nigerians is insufficient and frequently need protein of high biological value resultant from animal products. The rising cost of poultry feeds has continued to be a major problem in Nigeria as feed cost is about 60 to 70 % of the total cost of producing poultry meat and egg (Conolly, 2012) compared to about 50 to 60% in the developed countries. Maize frequently constitutes the most astounding extent of diet formulation of any poultry proportion. All over the world guinea corn (*Sorghum bicolar* Linn.) and millet grain crops (finger millet (*Eleusine coracam*) and pearl millet (*Pennisetum typhoids*) are essential components in the poultry diets. Millet is accounted to have less metabolizable energy, higher crude protein, crude fiber and ash than maize and sorghum (Medugu *et al*., 2011). Cassava (*Manihot esculenta*), a high energy crop is available all around the year in Nigeria. Both cassava and sweet potato have starch being the real part with low protein (2.7-7.9 percent) that clearly needs satisfactory protein supplementation (Apata and Babalola, 2012). Cassava contain toxic anti-nutritious factors, for example, cyanogenic glycosides (cyanide, linamarin, lotaustralin and hydrocyanic acid) which causes bitter taste and diminish palatability of the roots. The couple of accessible reports concurred that sweet potato can be consolidated into diets of chicken however ought not be made the primary source of energy (Afolayan, 2010). The main aim for the utilization of enzyme technology is to enhance the nutritive value of feed stuffs (Munir and Maqsood, 2013). The general health status of animals can likewise be in a roundabout way affected, bringing about less non-specific stomach upsets that are every now and again incited by the fiber components in the feed (Sheppy, 2003). In this way, the supplementation of the animal feed with appropriate enzymes to expand the proficiency of absorption can be viewed as an augmentation of the animals own digestion process (Pariza and Cook, 2010). Therefore, the aim of this study is to compare the growth performance and haematological parameters of broilers chickens fed maize, sorghum, millet, cassava and sweet potatoes as energy sources supplemented with enzymes.

MATERIALS AND METHODS

A total of two hundred and twenty five (225) day-old broiler chicks (both sex) were utilized for the study from the National Animal Production Research Institute (NAPRI), Zaria, Kaduna State, Nigeria. The chicks were weighed and arbitrarily allocated into five groups of 45 birds each. Each group was subdivided into three (3) duplicates of fifteen (15) birds in a Completely Randomized Design (CRD). Food and water were given *ad libitum* throughout the study (56 days). The birds were weighed at the start of the trial and week after week from there on. Weight gain, feed intake, left over feeds were measured and recorded, feed conversion ratio and feed cost per kilogram gain were ascertained and death rate were recorded. Maxigrain was supplemented at 10g/100kg. Five isonitrogenous and isocaloric diets (23.17 % CP; 2831 Kcal/kg ME) and (21.73 % CP; 2929 Kcal/kg) for the broiler starter and finisher stages respectively were figured as follows :

Diet T_1: Contained maize as main energy

Diet T_2: Contained sorghum as main energy

Diet T_3: Contained millet as main energy

Diet T_4: Contained cassava as main energy

Diet T_5: Contained sweet potatoes as main energy.

The primary energy sources were utilized as diets to feed the trial groups T_1, T_2, T_3, T_4 and T_5 respectively (Table 1 and 2). All feeds were planned to meet nutrient prerequisite standards of broiler (NRC, 1994).

Table 1. Composition of the experimental broiler starter diet (0-4) levels of inclusion with Maxigrain ®enzyme

S. No	Ingredients (%)	T_1 Maize	T_2 Sorghum	T_3 Millet	T_4 Cassava	T_5 Sweet potatoes
1	Maize	49.00	0.00	0.00	0.00	0.00
2	Sorghum	0.00	49.00	0.00	0.00	0.00
3	Millet	0.00	0.00	48.00	0.00	0.00
4	Cassava	0.00	0.00	0.00	48.00	0.00
5	Sweet potatoes	0.00	0.00	0.00	0.00	48.00
6	Wheat offal	5.00	5.00	5.00	5.00	5.00
7	G/nut cake (GNC)	11.00	10.5	10.00	15.00	15.00
8	Full fat soya	25.00	25.00	25.00	25.00	25.00
9	Fish meal (local)	4.00	4.00	4.00	4.00	4.00
10	Lime stone	1.00	1.00	1.00	1.00	1.00
11	Bone meal	3.00	3.00	3.00	3.00	3.00
12	Palm oil	1.00	1.50	3.00	1.00	2.00
13	Table salt	0.30	0.30	0.30	0.30	0.30
14	Vitamin/Mineral premix	0.25	0.25	0.25	0.25	0.25
15	L-Lysine	0.20	0.20	0.20	0.20	0.20
16	D1-Methionine	0.20	0.20	0.20	0.20	0.20
17	Maxigrain ®Enzyme	0.01	0.01	0.01	0.01	0.01
18	Total	100	100	100	100	100
S. No	**Calculated analysis**					
1	ME (Kcal/kg)	2831	2829	2828	2832	2829
2	Crude protein (%)	23.17	23.12	23.15	23.13	23.10
3	Ether extract (%)	5.66	5.64	6.26	4.18	5.28
4	Crude fibre (%)	4.37	4.29	4.96	5.05	5.79
5	Calcium (%)	1.43	1.44	1.72	1.52	1.56
6	Available phosphorus (%)	0.68	0.68	0.83	0.69	0.78
7	Lysine (%)	1.46	1.44	1.53	1.43	1.51
8	Methionine (%)	0.46	0.42	0.48	0.32	0.35
9	Met + Cys (%)	0.96	0.91	0.98	0.85	0.89
10	Feed Cost/kg (N/Kg)	92.27	92.49	95.92	98.65	96.52

Bio Mix starter provide the following per kg of diet: Vit. A 2500 IU; Vit.D_3, 500 IU; Vit E 5.75 mg; Vit K_3 0.5 mg; Vit. B_1 0.45 mg; Vit B_2 1.25 mg; Niacin 6.875 mg; Pantotheric acid 1.87 mg; Vit B6 0.75 mg; Vit B12 0.00375 mg; Folic acid 0.1875 mg; Biotin H_2 0.015 mg; Choline chloride 75 mg; Cobalt 0.05 mg; Copper 0.75 mg; Iodine 0.25 mg; Iron 5 mg; Manganese 10 mg; Selenium 0.05 mg; Zinc 7.5 mg; Antioxidant 0.3125 mg.

Heamatological parameters

Toward the end of the finisher stage, six samples of birds were arbitrarily chosen from every treatment groups (*i.e.* two birds per replicate) and 2mls of blood sample was taken from each of them by means of the wing vein and put into an sample bottle containing anti-coagulant (Ethylene Di-amine Tetra Acetic Acid - EDTA) and later checked for Packed Cell Volume (PCV), Hemoglobin level (HB) and Total Protein (TP) as indicated by the strategies portrayed by Finn and Lamb (1991) at the hematological research center of Veterinary Teaching Hospital, Ahmadu Bello University, Zaria (Schalm *et al*.,1975) .

Statistical analysis

All data obtained were subjected to Analysis of Variance (ANOVA) utilizing the SAS (2002). General linear model. significant changes between treatment implies were isolated utilizing Duncan Multiple Range

Table 2. Composition of the experimental broiler finisher diet for (5-8 weeks) levels of inclusion with Maxigrain ®enzyme

S. No	Ingredients (%)	T_1 Maize	T_2 Sorghum	T_3 Millet	T_4 Cassava	T_5 Sweet potatoes
1	Maize	52.35	0.00	0.00	0.00	0.00
2	Sorghum	0.00	51.70	0.00	0.00	0.00
3	Millet	0.00	0.00	54.05	0.00	0.00
4	Cassava	0.00	0.00	0.00	49.00	0.00
5	Sweet potatoes	0.00	0.00	0.00	0.00	50.00
6	Wheat offal	5.00	5.00	5.00	5.00	5.00
7	G/nut cake (GNC)	8.00	7.65	3.00	13.00	9.35
8	Full fat soya	25.00	25.00	25.00	25.00	25.00
9	Fish meal (local)	3.00	3.00	3.00	3.00	3.00
10	Lime stone	1.00	1.00	1.00	1.00	1.00
11	Bone meal	3.00	3.00	3.00	3.00	3.00
12	Palm oil	2.00	3.00	5.30	2.00	3.00
13	Table salt	0.30	0.30	0.30	0.30	0.30
14	Vit/M. premix	0.25	0.25	0.25	0.25	0.25
15	L-Lysine	0.20	0.20	0.20	0.20	0.20
16	D1-methionine	0.20	0.20	0.20	0.20	0.20
17	Maxigrain ®enzyme	0.01	0.01	0.01	0.01	0.01
18	Total	100	100	100	100	100
S. No	**Calculated analysis**					
1	ME (Kcal/kg)	2929	2934	2913	2911	2917
2	Crude protein (%)	21.73	21.57	21.58	21.69	21.63
3	Ether extract (%)	6.43	6.82	7.92	4.89	5.78
4	Crude fibre (%)	4.25	4.16	4.74	5.05	5.79
5	Calcium (%)	1.25	1.26	1.56	1.34	1.37
6	Available phosphorus (%)	0.65	0.65	0.81	0.66	0.75
7	Lysine (%)	1.38	1.36	1.40	1.33	1.38
8	Methionine (%)	0.46	0.42	0.46	0.32	0.35
9	Met +cys (%)	0.91	0.87	0.91	0.79	0.81
10	Feed cost/kg (N/Kg)	88.62	87.183	98.81	90.81	89.60

Bio Mix broiler finisher provides the following per kg of diet: Vit. A 2500 IU; Vit.D_3, 500 IU; Vit E 5.75mg; Vit K_3 0.5mg;Vit. B1 0.45mg; Vit B2 1.25 mg; Niacin 6.875 mg; Pantotheric acid 1.87 mg; Vit B6 0.75 mg; Vit B_{12} 0.00375 mg; Folic acid 0.1875 mg; Biotin H2 0.015 mg; Choline chloride 75 mg; Cobalt 0.05 mg; Copper 0.75 mg; Iodine 0.25 mg; Iron 5 mg; Manganese 10 mg; Selenium 0.05 mg; Zinc 7.5 mg; Antioxidant 0.3125 mg

Test (DMRT).

RESULTS AND DISCUSSION

Table 3 shows the performance characteristics of broiler starter chicks fed different energy source with enzyme. Dietary treatments had significant ($P< 0.05$) effects on final weight, weight gain, feed intake, feed/ gain ratio, feed cost/kg gain (N/kg), water intake (ml/ bird) and water: feed ratio. It was observed that chicks fed sorghum as main energy source with enzyme had the best results in terms of final weight, weight gain, feed intake and water intake. Chicks fed sweet potatoes (T_5) and cassava (T_4) had significantly ($P>0.05$) the least performance in terms of final weight and weight

Table 3. Performance characteristics of broiler chickens fed different energy sources with enzyme supplementation (0-4 weeks)

S. No	Ingredients	T_1 Maize	T_2 Sorghum	T_3 Millet	T_4 Cassava	T_5 Sweet potatoes	LOS
1	Initial weight (g/bird)	50.2±0.8	50.1±1.2	50.2±0.6	50.1±0.9	50.1±0.6	NS
2	Final weight (g/bird)	528.3±11.2^{c}	627.0±11.9^{a}	583.2±10.8^{b}	334.4±11.0^{e}	465.2±10.7^{d}	*
3	Weight gain (g/bird)	478.2±11.1^{c}	576.8±11.4^{a}	533.1±11.0^{b}	284.3±9.88^{e}	415.1±10.3^{d}	*
4	Feed intake (g/bird)	1146.4±40.8^{b}	1172.2±40.5^{a}	1179.2±41.2^{a}	920.1±40.0^{c}	947.1±41.0^{d}	*
5	Feed/gain ratio	2.4±0.5^{a}	2.0±0.8^{a}	2.2±0.6^{a}	3.2±1.1^{b}	2.3±0.5^{a}	*
6	Feed cost/kg gain (N/ Kg)	221.2±54.9^{c}	187.9±54.0^{a}	212.2±54.7^{b}	319.2±54.2^{d}	220.2±54.0^{c}	*
7	Water intake (ml/bird)	1448.0±20.1^{b}	1513.3±20.3^{a}	1513.3±20.8^{a}	1498.3±20.0^{a}	1499.3±21.0^{a}	*
8	Water: feed ratio	1.3±0.3^{c}	1.3±0.3^{c}	1.3±0.3^{c}	1.6±0.8^{b}	1.5±0.6^{a}	*
9	Mortality rate (%)	8.9±3.6	6.7±3.9	6.7±3.9	6.6±3.0	6.2±2.7	NS

^{abcd}Means in the same row with different superscript are significantly different; SEM= Standard Error of Means

gain. However, birds fed sorghum based energy diet (T_2) had the least feed cost compared to all other dietary treatments. This could be due to the effect of more cellulase activity in Maxigrain. This might be due to the fact that maxigrain was able to hydrolyze the NSP present in sorghum effectively. Maxigrain® could have enhanced the usage of dietary fibres and other energy giving supplements in this manner by expanding the amount of feed devoured by broilers fed enzyme supplemented diets. This concurs with the report of Sekoni *et al*. (2008) that Maxigrain® supplementation enhances the reaction of numerous vital nutrients and metabolizable energy. The impact of multiple–enzymes preparation (Maxigrain®) to enhance the overall performance of broilers nourished these dietary fibres was plausible .

Table 4 shows the performance characteristics of broiler finisher chickens fed diets with different energy sources and supplemented with enzyme. Enzyme supplementation on dietary treatments had significant ($p<0.05$) effect on final weight, weight gain, feed intake,

Table 4. Performance characteristics of broiler finisher chickens fed diets containing different energy sources with enzyme supplementation (5-8 weeks)

S. No	Ingredients	T_1 Maize	T_2 Sorghum	T_3 Millet	T_4 Cassava	T_5 Sweet potatoes	LOS
1	Initial weight (g/bird)	687.7±1.9	687.7±1.2	687.3±1.5	687.7±1.4	683.5±1.6	NS
2	Final weight (g/bird	2250.0±59.3^{a}	2440.0±51.1^{a}	2334.1±55.5^{a}	1866.7±57.6^{b}	1904.3±56.9^{b}	*
3	Weight gain (g/bird)	1562.3±55.2^{a}	1752.3±59.3^{a}	1646.7±57.9^{a}	1179.4±59.0^{b}	1220.8±58.2^{b}	*
4	Feed intake (g/bird)	3250.0±14.5^{c}	3440.1±14.0^{a}	3334.1±14.1^{b}	2866.7±15.0^{d}	2906.3±14.6^{d}	*
5	Feed/gain ratio	2.1±0.2^{c}	1.9±0.1^{a}	2.0±0.1^{b}	2.4±0.4^{e}	2.4±0.3^{d}	*
6	Feed cost/kg gain (N/ Kg)	184.4±4.2^{b}	171.2±3.8^{a}	200.1±4.0^{c}	223.3±3.9^{d}	213.3±3.1^{d}	*
7	Water intake (ml/bird)	4060.1±37.3^{d}	4090.4±37.0^{d}	4966.0±36.4^{a}	4749.8±32.3^{b}	4258.4±37.0^{c}	*
8	Water: feed ratio	1.3±0.4^{c}	1.2±0.6^{c}	1.5±0.1^{b}	1.7±0.3^{a}	1.5±0.2^{b}	*
9	Mortality rate (%)	0.0±0.0 ^{a}	0.0±0.0 ^{a}	0.0±0.0 ^{a}	3.3±1.9 ^{b}	0.0±0.0 ^{a}	*

^{abc}Means in the same row with different superscript are significantly different; SEM=Standard Error of Mean

Table 5. Haematological parameters of broiler finishers chickens fed different energy sources with enzyme supplementation (5-8 weeks)

S. No	Ingredients	T_1 Maize	T_2 Sorghum	T_3 Millet	T_4 Cassava	T_5 Sweet potatoes	LOS
1	PCV (%)	27.7±1.9[a]	28.3±2.2[a]	28.3±2.7[a]	21.3±2.1[b]	27.0±2.5[a]	*
2	Hb (g/dl)	8.9±0.6[a]	9.4±0.1[a]	9.4±0.5[a]	7.1±0.6[b]	9.0±0.2[a]	*
3	TP (g/dl)	3.4±0.4[b]	3.3±0.2[b]	5.5±0.4[a]	2.9±0.2[b]	3.1±0.1[b]	*
4	WBC (10^3/ml)	3.6±0.8[b]	5.2±0.5[a]	4.9±0.8[a]	2.8±0.3[c]	3.3±0.8[b]	*
5	RBC (10^6/ml)	4.1±0.5[a]	6.1±0.2[a]	6.2±0.9[a]	2.1±0.4[b]	2.9±0.5[a]	*

[abc]Means in the same row with different superscript are significantly different; SEM= Standard Error of Means.

feed cost/kg gain, water intake, water: feed ratio and mortality rate except in feed to gain ratio. Feed cost was best in sorghum (249.03) based diet. The final weight, weight gain, feed to gain ratio and feed intake were best with birds fed sorghum (2440.00g, 1752.33g, 1.96 and 3440.07g) compared to maize (2250.00g, 1562.33g, 2.08 and 3250.00g) and millet (2334.07g, 1646.74g, 2.02 and 3334.07g) respectively. Mortality was recorded to be low and similar across the dietary treatment groups except in birds fed cassava based diet (T_1). The significant effect in the performance characteristics of birds fed the dietary treatments in this study was similar to the findings of Medugu *et al*. (2011) who reported similar variation among birds fed diets with different energy sources supplemented with enzymes. This implied that the enzymatic profile in Maxigrain® preparation could hydrolyze the Non-Starch Polysaccharide (NSP) of sorghum diet so as to make nutrients and minerals more available for the birds as compared to millet, maize, and cassava.

The hematological parameters of broiler birds on different energy sources with enzyme supplementation are shown in Table 5. Enzyme supplementation on dietary treatments had significant ($p<0.05$) effect on PCV, Hb, TP, WBC and RBC. Haemoglobin count was highest for birds fed sorghum, millet, sweet potatoes followed by maize and cassava respectively. Total protein was highest for chickens fed millet followed by birds fed maize, sorghum, sweet potatoes and cassava respectively. WBC had the highest numerical value for sorghum while RBC recorded the highest count for millet based diet. Significant variations that existed among the dietary treatments implied that enzyme supplementation had influenced on the tested materials. Values obtained in this study were within the range for healthy chickens as reported by Oladele and Ayo (1999).

CONCLUSION

The following conclusions and recommendations could be drawn from this study; Enzyme supplementation had significant effect on the growth performance with the exception of mortality rate at starter phase. Heamatological parameters were significantly influenced by enzyme supplementation.

Conflict of interest

The authors have not declared any conflict of interest.

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