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Comparative Evaluation of Maize, Sorghum and Millet in Growing Cockerel's Ration

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Abstract: The effect of three varying dietary energy sources for cockerel was investigated. Six experimental diets were formulated and designated as D_1, D_2, D_3, D_4, D_5 D_6. Diets 1 and 4 (maize based) served as control while diets 2, 3, 5,and 6 were sorghum-based, millet-based, sorghum-oil-based, and millet-oil-based respectively. A total of 120-five week old Anak cockerels were then assigned to those diets in a Completely Randomized Design (CRD). The trial consists of 20 birds per treatment, replicated twice, with each replicate having 10 cockerel chicks. The trial lasted 8 weeks. Data were collected on feed intake and weight change while feed-to-gain ratio and economics of production were calculated. The results showed that the mean daily ratio were not significantly ($p>0.05$) affected by the dietary treatments. Weight gain was numerically higher in D_5 (millet) than maize (control) and Sorghum group. Feed intake was significantly ($p>0.05$) higher in D_5 than other treatments. All the cost analysis parameters considered were significant ($p<0.05$) with the exception of revenue (N) and gross margin (N). Diet 6 gave the highest cost per kg feed value (N59.64) while Diet 2 gave the least value (N 36.19), Diet 3 gave the highest cost/kg weight gain (N179.45) while D_4 gave the lowest value (N145.30). Diet 5. gave the best revenue (N670.00) followed by the D_4 (control) before the other treatments. Results for the gross margin indicate that D_4 (control) gave the best value (N470.03). In conclusion, replacement of maize with either sorghum or millet in cockerel's ration enhanced performance, while inclusion of palm oil at 8.5% in millet-based diet depressed performance.

Key words: Maize, millet, sorghum, palm oil, cockerel's diet

INTRODUCTION

Maize has been variously acknowledged as a major source of dietary energy in poultry nutrition. Although, produced all over the world, there is a stiff competition for the usage of maize by humans livestock and the industry. This is simply because, maize is high in energy and forms the standard (100) against which other cereal grains are compared [1]. Maize has a fat content of about 4% and this fat is high in linoleic acid (about 50%), making maize a good source of this essential fatty acid. Yellow maize contains a mixture of carotenoids, some of which, like beta carotene, cryptoxanthin and beta-zein carotene have provitamin A activity (100 to 800 mcg/100 g, expressed as beta-carotene)[2]. He further gave the Metabolizable Energy (ME) and Crude Protein (CP) of maize as 3510 kcal kg^{-1} and 8.80%, respectively.

The ever increasing competition between man and animals for available grains[3,4], the inadequate production of farm crops to meet the needs of man and his livestock[5] and the ever increasing cost of maize had made it necessary to critically re-evaluate some other grains like guinea corn, millet and wheat for poultry production. Presently, a tonne of maize is costing between ₦45,000 ($346.00) and ₦50,000 ($384.00) in Nigeria.

Sorghum can be grown successfully on poorer soils and in drier conditions than maize. Olomu[2] gave the ME and percent crude protein as 3270 kcal kg^{-1} and 9.5%, respectively. The percent ash (1.20) and fibre (2.70) are higher than that of maize. Millet had a lower ME (2555 kcal kg^{-1}), but a higher percent crude fibre (4.30), ash (3.00) and crude protein (12.0). Millet and Sorghum are relatively cheaper than maize. Peradventure, if attention is slightly shifted from maize to sorghum and or millet, there may be a fall in demand for maize which may eventually bring down its price.

The present study was designed to investigate the effects of substituting maize with either Sorghum or millet in cockerel's diets.

MATERIALS AND METHODS

One hundred and twenty day-old Anak cockerels procured from a commercial hatchery were fed commercial chick starter mash 21% CP and 2800 kcal kg^{-1} ME) for a period of 5 weeks. They were reared under strict hygienic conditions. These birds were thereafter, allocated to five treatment groups in a Completely Randomized Design (CRD). Each teatment group was divided into two replicates and each replicate group had ten birds. The

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Table 1: Composition of experimental diets

Ingredients	D_1	D_2	D_3	D_4	D_5	D_6
Yellow maize	50.30	-	-	40.30	-	-
Sorghum	-	50.30	-	-	49.00	-
Millet	-	-	50.30	-	-	42.00
Palm oil	-	-	-	-	1.30	8.50
Palm kernel meal	24.00	24.00	24.00	24.00	24.00	21.80
Soybean	18.00	18.00	18.00	18.00	18.00	21.00
Fish meal (Danish)	2.00	2.00	2.00	2.00	2.00	2.00
Bone meal	3.00	3.00	3.00	3.00	3.00	3.00
Salt	0.25	0.25	0.25	0.25	0.25	0.25
Oyster shell 2.00	2.00	2.00	2.00	2.00	2.00	2.00
Methionine	0.10	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10	0.10
Vit. Min. Premix.	0.25	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00	100.00
Calculated Analysis						
CP (%)	18.11	18.61	18.11	18.11	18.47	18.14
ME (Kcal kg^{-1})	2775.00	2725.10	2352.58	2775.00	2773.00	2768.50

Vit Min Premix (Vitadizgbf) Provided per 2.5 kg, Vitamin A 8.000.00 iu: Vitamin D_3 1, 600.000 IU; Vitamin E 5,000 I U; Vitamin K 2,000 mgr; Thiamine, B_1 1500 mgr; Ribofiavin, B_2 4,000 mgr; Pyridoxine, B6 1500 mgr; Niacin 15,000 mgr; Vitamin B_{12} 10 mgr; Pantothenic, Acid 5,000 mgr;Folic acid 500 mgr; Biotin 20 g; Choline 200 g; Anti-Oxidant, 125 g; Manganese 80 g; zinc 50 g; fron 20 g; Copper 5 g; lodine 1.2 g; selenium, 200 mgr; Cobalt 200 mg

control diet[1] contained maize as the major energy source while diets 2 and 3, respectively had their maize completely substituted with sorghum and millet. The second group of diets[4-6] also had maize, sorghum and millet respectively as their energy source but diets 5 and 6 were supplemented with palm oil to enhance the energy level of the diets (Table 1). Feed and water were provided ad-libitum. Other routine poultry management procedures were strictly followed. The trial lasted 8 weeks.

Feed intake was recorded daily. Body weight of each replicate was noted at the start of the trial and subsequently on a weekly basis. The feed conversion ratio (feed/gain) and feed cost/kg gain (N) were calculated.

All data collected were subjected to analysis of variance and means were separated using Duncan Multiple Range Test according to Steel and Torrie [6].

RESULTS AND DISCUSSION

The proximate analyses of the test ingredients and of the experimental diets are presented in Table 2 and 3, respectively. The results revealed that millet had higher crude protein (11.90%), crude fiber (7.92%) and total ash (3.83%), than maize and sorghum. This is in agreement with the findings of Luis and Sullivan[7] who studied seven cultivars of proso millet and they observed higher amounts of protein and ash than sorghum grains or corn. Maize had higher crude fat (4.18%) and gross energy than sorghum and millet. This is in agreement with the report of Olomu[2]. The differences observed could be due to sources[8], varieties[9], maturity at the time of harvesting, cultural practices[7], how long the grains had been stored and condition of storage. Processing could also

Table 2: Proximate Composition of the test ingredients used in this trial

Fraction	Maize	Sorghum	Millet
Dry matter (%)	87.62	88.74	87.91
Moisture (%)	12.38	11.26	12.09
Fat (%)	4.18	3.55	3.92
Ash (%)	1.50	2.21	3.83
Crude fibre (%)	2.55	2.05	7.92
Crude protein (%)	11.20	1.0.85	11.90
Gross energy (kcal kg^{-1})	4182.0	3539.0	3428.0

Table 3: Proximate Composition of experimental diets used in this trial

Fraction	D_1	D_2	D_3	D_4	D_5	D_6
Dry matter (%)	89.18	89.72	89.06	89.76	90.15	90.26
Moisture (%)	10.82	10.28	10.94	10.24	9.85	9.74
Fat (%)	3.89	4.21	3.91	4.18	3.97	4.28
Ash (%)	8.91	9.21	10.21	9.84	10.13	10.42
Crude fibre (%)	4.81	5.11	5.34	4.96	5.13	5.23
Crude protein (%)	15.75	16.80	16.45	15.40	16.10	17.15
Gross energy (kcal kg^{-1})	2914.0	2934.0	2962.0	2974.0	2981.0	2992.0

contribute to the differences in the proximate composition alongside the type of soil on which the crops were cultivated.

The proximate analysis of the experimental diets also revealed that Dry Matter (DM) (90.26%), fat (4.28%), Ash (10.42%), crude protein (17.15%) and gross energy (2992 kcal kg^{-1}) were highest in D_6 compared to other diets. This could be due to the high palm oil supplementation of the diet. crude fibre was highest in D_6 (5.34%) followed by D_6, D_5 D_2, D_4 and D_1 in that order. This reflects the higher fibre content of millet than sorghum and maize and agreed with the findings of Luis *et al.*[7].

The mean daily body weight gain, mean daily feed intake and feed-to-gain ratio values are summarized in Table 4. The mean daily weight gain, final body weight and feed-to-gain ratio were not significantly ($p>0.05$)

Table 4: Performance response of cockerels fed varying dietary energy sources

Parameters	D_1	D_2	D_3	D_4	D_5	D_6	SEM
Mean initial body weight (g)	430.00	415.00	405.00	405.00	400.00	390.00	17.5
Mean final body weight (%)	1675.00	1675.00	1623.00	1775.00	1750.00	1575.00	5875
Mean total weight gain (%)	1270.00	127.00	1210.00	1345.00	1350.00	1206.00	6100
Mean daily weight gain (g)	22.68	22.68	21.61	24.12	241.05	21.52	1.95
Mean daily feed intake (%)	84.64	90.18	97.01	84.64	102.41	64.09	0.01
Mean total feed intake (g)	4740.00	5050.00	5433.00	4730.00	5735.00	3589.00	33.33
Feed-to-gain ratio	3.73	3.98	4.49	3.52	4.25	2.98	

a.b.c.d.e. Means within the same row bearing different superscripts differ significantly ($p<0.05$) 1.75, 5.86, 6.10

Table 5: Economics of feeding varying energy sources to cockerels

Parameters	D_1	D_2	D_3	D_4	D_5	D_6	SEM
Cost kg feed (N)	41.22	36.19	41.22	41.22	37.17	37.17	0.00
Total feed consumed perbird (g)	4750	5050	5433	4730	5735	3589	0.00
Cost kg weight gain (N)	1542.10	146.10	179.445	145.300	158.120	177.870	59.033
Cost of total production (N)	195.800	182.760	223.970	194.970	213.165	214.035	0.001
Revenue (N)	635.00	625.00	650.00	665.00	602.50	602.50	11.12
Gross margin (N)	439.20	442.24	401.06	470.03	461.84	388.47	12.62

a.b.c.d.e. Means within the same row bearing different superscripts differ significantly ($p<0.05$)

affected by the dietary treatments. This is an indication that maize could be replaced with millet or sorghum despite the anti-nutritional content of these ingredients. A further confirmation of the report of Artkinson *et al.*[10] who reported that small or no differences were observed in either body weight, feed efficiency or percent mortality when either corn or milo was fed. Weight gain was numerically higher in D_5 (millet) than maize (control) and sorghum group. This finding agreed with the reports of Luis *et al.*[7] and Andrews and kumar[11], that the millet group performed better than the maize and Sorghum group. This could also be because of the slight palm oil supplementation in the diet which has been shown to enhance growth, feed conversion ratio, increase appetite and alleviate the growth depression effect of heat stress[12,13].

Feed intake was significantly ($p<0.05$) higher in D_5 than other treatments. This could be due to the slight palm oil supplementation of the diet which improved the palatability thereby increasing appetite[14] Diet 6 showed a significantly ($p>0.05$) low feed intake than other treatments. This is due to the excessive palm oil inclusion in the diet which is known to cause depression in growth and feed intake[13].

Table 5 shows the cost analysis of the six experimental diets. All the parameters considered were significant ($p<0.05$) with the exception of revenue and gross margin. Diet 6 gave the highest cost per kg feed value (N59.64) while Diet 2 gave the least value (N36.19), Diet 3 gave the highest cost/kg weight gain (N145.30). The result of the cost per kg feed indicated that sorghum (D_2) is cheaper than maize and millet even with slight palm oil supplementation, maize and millet, however, had the same cost. Diet 5 gave the best revenue (N670.00) followed by the D_4 (control) before the other treatments. Results for the gross margin indicate that D_4 (control) gave the best value(₦ 470.03). However, an observed insignificant effect on gross margin and revenue is a clear indication that sorghum and millet could replace maize on weight for weight basis. Sorghum, if supplemented with 1.3% palm oil in cockerel's diet would generate more revenue than maize. Millet supplemented with excessive palm oil would negatively affect the performance of cockerels as well as increase cost.

CONCLUSION

Sorghum and millet can be comparatively used in place of maize. Also, the supplementation of sorghum with 1.3% palm oil favourably compared with maize but the supplementation of millet with 8.5% palm oil depressed performance of cockerels and increased the cost of feed. Farmers should therefore take advantage of these findings, so as to improve on their earnings from cockerel production.

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