

Growth Performance and Economy of Production of Pullets Fed on Different Energy Based Sources

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Abstract—This experiment was conducted for 8 weeks to evaluate the growth performance and economics of pullets fed on different dietary energy sources. A total of 300 Harco black was used for this experiment. The birds were completely randomized and divided into four diet treatment groups. Each treatment group had three replicates of twenty-five birds per replicate. Four diets containing maize, spaghetti, noodles, and biscuit was formulated to represent diet 1, 2, 3 and 4 respectively. Diet 1 containing maize is the control, while diet 2, 3, and 4 contains spaghetti, noodles, and biscuit waste meal at 100% replacement for maize on weight for weight basis. Performance indices on Feed intake, body weight, weight gain, feed conversion ratio (FCR) and economy of production were measured. Blood samples were also collected for hematology and serum biochemistry assessment. The result of the experiment indicated that different dietary energy source fed to birds significantly ($P < 0.05$) affect feed intake, body weight, weight gain, and feed conversion ratio (FCR). The best cost of feed per kilogram of body weight gain was obtained in Spaghetti based diet (₦559.30). However, the best performance were obtained from diet 1 (maize), it can be concluded that spaghetti as a replacement for maize in diet of pullet is most economical and profitable for production without any deleterious effects attached. Blood parameters of birds were not significantly ($p > 0.05$) influenced by the use of the dietary energy sources used in this experiment.

Keywords—Growth performance, spaghetti, noodles, biscuit, profit, hematology and serum biochemistry.

I. INTRODUCTION

AS the population of the developing world continues to rise, the demand for animal protein (especially from poultry products) for human consumption is rising in turns to meet this need [1].

Most commercial and small livestock holders lack access to good quality feedstuff with adequate energy content that is needed for adequate animal growth and performance. Maize is by far the most commonly used energy supplying cereal in the production of poultry. It accounts for between 40 to 60 percent of the metabolisable energy and also between 15 to 20 percent of the protein in poultry diets [2].

Although, global production of maize has been reported to

have increased by over 30% ahead of wheat, sorghum, oat and barley which has remained relative constant between 1993 to 2003 [3], recent forecast indicated that slight decline in maize production may account for the major decrease in global cereal production by 2015 with an expected reduction of about thirty million tonnes while utilisation is expected to increase by twenty-six million tonnes [4]. Apart from the increasing competition for maize by man as food stuff, its use as biofuel has been reported to be at the increase in the leading maize exporting country such as United State of America, China among others [5]. Since most developing countries depends on bulk importation to augment local production, reduction in available amount of maize imported into these countries accounts for the hike in price of maize due to forces of demand and supply and more recently due to the exchange rate.

Agro-industrial by-products (AIBs) in poultry feed holds enormous potential in alleviating the existing critical situation of high cost and inadequate supply of feed [6, 7]. Considerable efforts have been made to improve the utilization of these AIBs in practical monogastric nutrition.

Biscuit waste meal [8], [9], Noodles waste [10], [11] and Spaghetti waste [12] has been used separately used as replacement for maize in monogastric feed production. The availability and reduced cost of the aforementioned substitutes when compared to maize is considered an advantage in reducing the overall cost of production, apart from the fact that they do not have any negative effect on the animal. Having concluded that the aforementioned agro industrial by products are possible replacement for maize based on separate trials, it is therefore necessary to investigate the effect of total inclusion of these ingredients for maize on growth performance and blood chemistry of pullet under the same condition.

A. Experimental Site

The experiment was carried out at the poultry unit of the training and research Farm of School of Agriculture, Lagos State Polytechnic, Ikorodu, Lagos state.

B. Experimental Birds and Management

Three hundred Harco Black chicks used in the experiment were obtained from a reputable farm in Ogun State Nigeria. Birds were assigned to four dietary treatments, each treatment was replicated thrice with twenty five birds allotted per replicate assigned in a completely randomized design. The experimental pen and surroundings was well cleaned and disinfected two weeks before the arrival of the chicks. On arrival of the chicks, all brooding activities commenced and

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the birds were fed ad libitum. Clean water was supplied to the birds adequately. Medication, vaccination and all necessary routine management followed according to prevailing schedule for chicks in the experimental vicinity.

C. Experimental Diets

Four experimental diets were formulated containing different dietary energy sources. Diet 1 contains maize as the control while diets 2, 3, and 4 contains Spaghetti, Noodles and Biscuit waste meal respectively as their dietary energy sources. The diets were formulated on weight to weight replacement value of maize by other dietary energy sources without compromising the requirement as described by [13]. The ingredients and calculated analysis were shown in Table I. Chemical composition of the test ingredients were determined according to [14].

TABLE I
GROSS COMPOSITION OF DIFFERENT ENERGY SOURCES DIETS

Ingredients	Experimental Diets			
	Diet 1	Diet 2	Diet 3	Diet 4
Maize	49	-	-	-
Spaghetti	-	49	-	-
Noodles	-	-	49	-
Biscuit	-	-	-	49
Palm kernel Cake	23	23	23	23
Groundnut Cake	21.3	21.3	21.3	21.3
Fishmeal	1	1	1	1
Soybean	2	2	2	2
Limestone	1	1	1	1
Bone meal	0.5	0.5	0.5	0.5
Palm oil	1.5	1.5	1.5	1.5
Lysine	0.1	0.1	0.1	0.1
Methionine	0.1	0.1	0.1	0.1
Salt	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25
Calculated Analysis				
Crude Protein	20.10	20.17	20.13	20.51
Metabolisable Energy	3004.44	2997.98	3195.15	2912.44

D. Blood Collection & Analysis

Blood samples of each birds were collected at the end of the experiment into labelled Ethylene-deamine tetra-acetic acid (EDTA) treated tubes for haematological analysis and another into tubes without anticoagulant for serum biochemical evaluation. Blood parameters were evaluated according to the method already described by [15], [16].

TABLE II
PROXIMATE COMPOSITION (% DRY MATTER) OF THE TEST INGREDIENTS USED FOR THE FORMULATION

	Test Ingredients				SEM
	Maize	Spaghetti	Noodles	Biscuit	
Dry Matter	96.01 ^a	94.55 ^b	90.01 ^d	91.50 ^c	0.01
Crude Protein	9.99	10.13	10.04	10.82	0.00
Crude Fibre	3.16 ^a	2.90 ^b	2.86 ^b	2.07 ^c	0.01
Ether Extract	4.35 ^d	5.16 ^c	9.62 ^a	7.98 ^b	0.02
Ash	3.79	3.71	3.68	3.55	0.01
ME (kcal/kg)	3410.89 ^b	3397.72 ^{bc}	3800.10 ^a	3223.15 ^c	0.04

abc=means with difference superscript on the same row differ significantly (p<0.05)

E. Data Collection and Analysis

All data were subjected to analysis of variance test and all significant means were separated with Duncan Multiple test using Assisat software version 7.7 beta developed by [17].

TABLE III
PERFORMANCE OF PULLET CHICKENS FED ON THREE DIFFERENT SOURCES OF ENERGY

Parameters	Test Ingredients				S.E.M
	Maize	Spaghetti	Noodle	Biscuit	
Initial weight	32.00	31.80	31.95	32.10	0.00
Ave. Feed Intake	156.97 ^b	143.49 ^c	122.26 ^d	161.09 ^a	0.07
Ave. weight gain	78.03 ^a	78.43 ^a	77.68 ^b	73.29 ^b	0.01
Feed Conversion Ratio	2.03 ^{ab}	1.85 ^b	1.58 ^c	2.21 ^a	0.01
Final Weight	656.65 ^a	659.20 ^a	653.40 ^a	618.40 ^b	0.08

abc=means with difference superscript on the same row differ significantly(p<0.05)

TABLE IV
HAEMATOLOGICAL AND BIOCHEMICAL INDICES OF PULLETS FED ON DIFFERENT ENERGY SOURCES DIETS

Haematological indices	Test Ingredients				SEM
	Maize	Spaghetti	Noodles	Biscuit	
PCV (%)	22.33	21.33	23.33	22.00	0.13
Hb (G/L)	8.77	8.63	8.60	8.80	0.03
WBC (G/L)	5173.33	4453.67	5506.67	5053.33	91.06
RBC (T/L)	2.94	3.11	3.17	2.94	0.03
MCV (fL)	72.37	71.07	73.71	70.94	0.17
MCH (G/L)	25.06	24.18	25.06	24.64	0.13
MCHC (%)	34.01	34.43	32.58	33.29	0.14
Neutrophils (%)	29.00	29.33	30.67	30.66	0.16
Lymphocytes (%)	68.33	64/33	68.34	69.00	0.56
Serum Indices					
Total Protein	46.27	48.24	50.01	50.69	0.01
Glucose (Mg/dl)	59.09	67.98	71.69	56.51	0.02
Albumin (mg/dl)	1.43	2.35	2.85	2.81	0.00
ALP (u/l)	111.61	129.72	142.14	121.44	0.04
CHOL(mg/dl)	69.35	73.84	79.02	70.65	0.01
Uric acid (u/l)	1.47	0.98	1.22	1.10	0.00

TABLE V
ECONOMY OF PRODUCTION OF PULLETS FED ON DIFFERENT ENERGY SOURCES BASED DIETS

	Test Ingredients				SEM
	Maize	Spaghetti	Noodles	Biscuit	
Total Feed Intake	10.05 ^a	8.04 ^c	6.85 ^d	9.02 ^b	0.01
Feed Cost/kg	119.79 ^a	90.39 ^c	97.74 ^b	89.41 ^d	0.06
Total feed Cost	1203.3 ^a	726.31 ^c	669.19 ^d	806.57 ^b	0.96
Total weight gain	624.55 ^b	627.40 ^a	421.45 ^d	586.30 ^c	0.08
Feed Cost/kg gain	118.03 ^c	129.70 ^b	119.50 ^c	144.03 ^a	0/02

abc=means with difference superscript on the same row differ significantly(p<0.05)

II. RESULTS AND DISCUSSION

Gross composition and calculated analysis of the experimental diets is shown on Table I. Diet 2, 3 and 4 contain spaghetti, noodles and biscuit waste meals respectively as complete replacement for maize which is Diet I (control).

The proximate composition of the test ingredients is shown in Table II. The results showed that maize has the lowest

moisture content (96.01% DM) while the highest moisture content (90.01% DM) was observed in noodles waste meal. Water is an important content in confectionaries, the test ingredients in used in this experiment were not further dried before milling. Crude protein did not differ significantly ($P>0.05$) among the test ingredients. Crude protein of the test ingredient used in this study were similar to those reported by some authors; 10.02% CP for Noodles [11], 10.8% CP for Biscuit [6]. The crude fibre was significantly higher in maize compared to others while the energy sources meets the requirement for energy based feedstuffs as recommended by [14] for chicken.

Table III indicates the growth performance of pullet chicken fed on three different sources of energy. There were no significant difference in the initial weight of the birds. All other growth parameters were significantly ($P < 0.05$) influenced by different sources of energy used in the study.

The highest average feed intake was observed in birds fed diet containing NW while the lowest intake was observed in group fed on diet containing Spaghetti. High intake in diet 4 may be due to lower calorie level in the diet compared to others, this is in agreement with the findings of [18] who observed that feed intake of birds reduced as the energy density of feed increases. However, the result of this experiment contradict that of the report of [6], [8] who stated that complete replacement of maize reduced feed intake in broiler chicken. The birds fed on the diet 2 (SWM) was significantly ($P<0.05$) higher in mean weight gain to those on diets 1 (maize), 3(NWM) and 4 (BWM). Similar trend was reported by [12] on broiler fed with pasta with or without enzyme. While [19] had reported that the inclusion of biscuit waste meal can be used up to 50% replacement of maize in broiler improved the weight gain, [6] and [20] reported a slightly higher weight gain in piglets fed on maize diet than biscuit waste meal diet. The further reduction in weight gain observed in this experiment may be due to differences in physiological state of the birds. Total replacement of maize with noodle waste meal in cockerel diet was also reported to have significantly reduced the final weight of the birds [11].

Feed conversion ratio is an assessment of animal ability to utilise feed mass to achieve certain economic output such as weight in poultry. Feed that have low feed conversion ratio are considered more efficient than those with high FCR. The feed conversion ratio was highest in birds fed on diet 4, followed by those on diet 1 and 2, while the lowest was reported in diet 3. The result supports those of [8], [21] who revealed that biscuit and noodle are superior in FCR when compared to maize.

The haematological and serum biochemistry parameters of the experimental birds are presented in Table IV. The result showed that there were no significant ($P<0.05$) differences among the energy sources fed to pullets for all the blood parameters. Blood parameters are vital indicator to understanding the patho-physiological situation of the system of an animal and may be important in diagnosing the structural and functional status of animal exposed to toxic challenge or infections. The haematological parameters includes red blood

cell (RBC), white blood cell (WBC), haemoglobin (Hb), mean corpuscular haemoglobin concentration (MCHC), mean corpuscular haemoglobin (MCH), mean corpuscular volume, (MCV) and packed cell volumes (PCV) while biochemical characteristics includes total protein, glucose, albumin, alkaline phosphatase and cholesterol. . The similarity in haematology and serum characteristics of all treatment in this study shows that all energy sources used in the experiment can be used in place of maize either partially or whole without altering the blood chemistry of birds. All blood parameters falls within the values reported for healthy birds by [15], [22].

The result of the economic analysis of experimental diets fed to pullets is shown on Table V. Economic analysis showed that it cost more to produce a kilogram of diet 1 (Control diet) than diet 2, 3 and 4 respectively. Total feed cost consumed was also significantly higher for birds fed on diet 1 compared to those on diets 2, 3 and 4. However, diet 4 containing BWM had the highest cost per unit weight gain while the lowest was obtained in birds fed on diet 2 which contains SWM. The increase in cost of feed per unit weight gain may be attributed to high feed intake of birds fed on diet 4. Birds on diets 4 also showed a significantly lower weight gain which may also contribute to the higher cost per unit weight gain on feed consumed. Poultry production becomes alluring and worthwhile when less expensive non-conventional feedstuffs can be a whole or partial substitute for the more expensive convection like maize and still produce same or better output [23].

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