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Utilization of Noodle Waste as Replacement for Maize in the Diet of Broiler Starter Chickens

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Authors' contributions

This work was carried out in collaboration between authors AJO and CNO initiated the study while all authors were involved literature searches, data collection and analyses, writing, reading and approving of the final manuscripts.

Research Article

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ABSTRACT

Noodle waste (NW) is an alternative source of energy and less expensive compared to maize which is one of the main conventional source of energy in the diet of poultry. This study was designed to determine the effect of replacing maize fraction of the diet with NW on growth characteristics, cost benefits and blood indices of broiler starter chicken. One hundred and twenty day old Anak, 2000 broilers chicks of mean weight of 40.78±1.7g were randomly selected and allotted to 4 dietary treatments. Each treatment was replicated thrice with ten chicks per replicate in a completely randomized design. Four diets were formulated to contain 0% (T_1), 50% (T_2), 75% (T_3), 100% (T_4) of NW as replacement for maize fraction of the entire diet. Parameters taken were weight gain, feed intake. Feed conversion ratio, total feed cost, and cost per weight gain were calculated. The feeding lasted for 28 days.

Blood indices such as packed cell volume (PCV), Red blood cell count (RBC)and White blood cell(WBC) and total protein etc. were measured or calculated. Significant differences (P=.05) were observed in the mean total feed intake of the chicks fed diet containing varied levels of NW. There were significant differences in the mean total weight gain of chicks fed diet containing 100% NW and the control diet (P=.05),

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however, the least weight gain was recorded in the diet containing 100% NW. The feed conversion ratio was significantly different from one another (P=.05) in diet containing 0% and 100% NW as replacement for maize. The dietary treatments had no significant effect on the PCV, RBC and WBC and blood total protein (P>0.05). The lowest cost/weight gain was recorded in the diet containing 75% NW as replacement for maize while the highest cost/weight gain was recorded in the diet containing 100%NW. It was concluded that NW could replace maize fraction of the diet of broiler starter chickens up to 75% without any adverse effect on performance characteristics but at reduced cost.

Keywords: Chicken; cost/weight gain; feed efficiency; maize; noodle waste; replacement.

1. INTRODUCTION

The challenge to achieve food security according to [1] for all especially in developing countries such as Nigeria is becoming greater now than before because of growing population without increase in food production. Lack of animal protein intake in the diet of man has resulted in retarded growth and diseases such as Kwashiorkor, etc. hence there is need for increased food production especially animal protein sources such as beef, mutton, pork and poultry meat [1]. One of the major limitations to the growth of livestock industries in Nigeria is unavailability of feed ingredients at affordable prices [2,3,4]. Maize is one of the main source of energy in the diet of poultry but it is expensive due to humans consumption and industrial uses. There is urgent need to look for unconventional feed ingredients that is less expensive. A lot of studies had been conducted on the use of alternative feed ingredients such as biscuit waste, bakery waste and cassava by-products as partial or total replacement for maize with a desirable result without affecting the carcass, growth and health status of poultry adversely [2,3,5]. Noodle waste (NW) is another good source of energy that can be used to replace maize. The protein content is relatively similar to that of maize and it has high metabolizable energy, rich in minerals such as calcium and iron [4]. NW is cheaper than maize, a kilogramme of maize during the course of the feeding trial was ₦65.00 while the same quantity of NW was sold for ₦57.00/kg. The low price of noodle waste compared to maize necessitated the study. There is paucity of information on the use of noodle waste in the diet of broiler chickens, hence this trial was designed to determine the effect of replacing maize fraction of the diet of broiler starter chicks with noodle waste on feed intake, weight gain, cost benefits and blood indices such as Packed Cell Volume (PCV), White Blood Corpuscles (WBC), Red Blood Corpuscles (RBC), Total Protein, Albumin and Globulin.

2. MATERIALS AND METHODS

2.1 Source of the Birds, Experimental Design and Composition of the Experimental Diets

The experiment was carried out at the Poultry Unit of the Federal College of Animal Health and Production Technology, Moor Plantation, Ibadan which is located on Longitude 03º51E, Latitude 07º23N and Altitude 650" lies in the humid zone of the rainforest belt 0703.25 of Southwestern Nigeria with mean annual rainfall of 1220 mm and mean temperature of 26ºC. One hundred and twenty day old Anak, 2000 broiler chicks of mean weight of 40.78±1.7g

were used for the feeding trial. The birds were purchased in a local hatchery in Ibadan, Nigeria. Four diets, T_1, T_2, T_3 and T_4 were formulated to contain 0, 50, 75 and 100% noodle waste as replacement for maize fraction in a broiler starter diet respectively. The diets were formulated to contain about 23% crude protein and energy of about 2800Kcal/kg ME (Table 1). Thirty (30) birds each were randomly allotted to each of the treatment in a completely randomized design and each treatment was replicated thrice with 10 birds per replicate. Feed and water were given *ad libitum*.

Table 1. Gross composition of the broilers starters NW based diet

Ingredients (%)	Cost (₦/kg)	T1(0% NW)	T2(0% NW)	T3(0% NW)	T4(0% NW)
Maize	65	48	24	14	0
Noodle waste	57	0	24	36	40
*Otherfixed ingredients		52	52	52	52
Total		100	100	100	100
Cost/kg (N)		61.38	60.04	58.45	57.14
Calculated Composition					
Crude protein (%)		23.05	23.24	23.72	23.98
Energy(Kcal ME/kg)		2831.23	2811.4	2798.32	2781.24

**Others fixed ingredients: G.N.C. - 10.8; Soybean meal -22; Corn-bran -9; Fish meal -4; Bone meal - 1.5; Oyster shell - 4.0; Methionine - 0.1; Lysine - 0.1; Premix 0.25; Salt-0.25.*
Premix contains - Vitamin – Mineral Premix (BIO – MIX) Supply the following per Kg: Vitamin. A 5000Iμ; Vit. D3, 888, 000IU; Vit. E, 12,000mg; Vit. K3; 1500mg; Vit. B1, 1000mg; Vit. B2, 2000mg; Vit. B6, 1600mg; Niacin, 12,000mg; Pantothenic acid, 2000mg; Biotin, 1000mg; Vit.B12, 3000mg; folic acid, 15000mg; Choline Chloride, 60,000mg; Manganese, 10,000mg; Iron, 15000mg;Zinc, 800mg; Copper, 400mg; Iodine, 80mg; cobalt, 40mg; Selenium, 8000mg.

2.2 Data Collection

Data were collected on the growth performance (feed intake, weight gain, feed conversion ratio), haematological and serum biochemical indices. Daily Feed intake was calculated by deducting the left over feed from a weighed quantity of feed supplied daily. The birds were weighed at weekly intervals with the use of weighing balance. Feed conversion ratio (FCR) was calculated as the ratio of feed intake to weight gain. Record on mortality were also taken. The feed cost and cost per weight gain were calculated. All management practices and biosecurity measures for efficient production were observed duly observed during the course of the study. The feeding lasted for 28 days.

2.3 Chemical and Blood Analyses

At the end of the 4^{th} week feeding trial, blood samples were collected from 6 birds in each experimental group (i.e. 2 birds per replicate) for the determination of the haematological and serum biochemical parameters. The birds randomly selected were fasted from 6.00 pm to 6.00 am and bled early in the morning to avoid temporary elevation of blood metabolites by feeding. Samples were collected from the jugular vein of the birds using disposable syringes and needles (21 gauges). Samples for haematological study were collected into sample tubes containing heparin as anticoagulant for further analysis. Blood samples were analyzed for haematological parameters according to routinely available clinical methods [6]. Haematological parameters included the packed cell volume (PCV), red blood cells (RBC),

haemoglobin concentration (Hb), white blood cells (WBC), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCV), and mean corpuscular haemoglobin concentration (MCVC). The serological samples were collected into sample tubes containing no heparin. Serum was obtained after the blood was allowed to stand for 2 h at room temperature and centrifuged at 2,000 revolutions per minute (r.p.m) for 10 minutes to separate the cells from the serum. Total protein, albumin, globulin, and creatine formed the biochemical data determined [7,8]. The chemical composition of the test ingredient and experimental diets were carried out according to the method of [9].

2.4 Statistical Analysis

All data were subjected to statistical analysis of variance and means were separated if found significantly different from one another by Duncan multiple range test [10].

3. Results and Discussion

Table 2 shows the chemical composition of the test ingredient and experimental diets. The protein content of NW was 10.02% which was relatively similar to the report of [4]. The protein content of NW is relatively higher than that of maize which was 9.89. The fibre content of NW was a bit lower than that of maize. The ether extract of NW was higher than that of maize. The protein content of the experimental diets fell within recommended values of protein requirements for chicken [3,11]. The fibre content of the experimental diets also fell within the recommended values [11] as shown in Table 2. The results of summary of growth performance of chicken fed varying levels of NW are shown in Table 3. There was no significant difference in the mean total feed intake in T_1, T_2 and T_3 (P>.05). There was a significant difference in mean feed intake of chicken in the control diet ($T_{1)}$ and T_4 (P=.05). The feed intake numerically increased from T_1 to T_4 which could be due to differences in protein and energy levels. It has been reported that birds do eat to satisfy their energy requirements, the higher the energy level of the feed, the lesser the feed intake while chicken eat more when the energy levels of the feed is low [11]. Significant differences (P=.05) were observed in the mean total weight gain across the treatments as shown in Table 3. Birds in the control diet had significantly higher weight than those in T_4 (P=.05). The dietary treatments had no significant influence in T_1, T_2 and T_3 as reported. The feed conversion ratio followed the same trends with the mean weight gain. The feed efficiency was relatively similar in the control diet, T_2 and T_3 (P>0.05).

Table 2. Determined proximate composition of maize, noodle waste and Experimental Diets

Parameters	Maize	Noodle waste	T_1 (0%)	T_2 (50%)	T_3 (75%)	T_4 (100%)
Dry matter	93.78	92.74	94.99	95.67	94.38	95.34
Crude protein	9.89	10.02	22.96	23.01	23.25	23.78
Crude fibre	5.76	4.58	4.61	4.47	4.38	4.26
Ether extract	6.78	8.34	5.67	5.98	6.14	6.55
Ash	11.89	12.24	9.87	8.89	9.23	9.75
Nitrogen free extract	65.68	64.82	56.89	57.65	57.00	55.66

Table 3. Summary of performance characteristics and cost benefits of broilers starters fed noodle waste based diet as replacement for maize

Variables (Means)	T_1 (0%)	T_2 (50%)	T_3 (75%)	T_4 (100%)	± SEM
Initial weight. (g)	41.5	40.65	42.05	41.9	2.35
Final weight. (g)	789.38 [a]	788.61 [a]	783.4 [a]	742.3 [b]	7.23
Weight gain (g)	747.88 [a]	747.96 [a]	741.35 [a]	616.11 [b]	6.67
Total feed intake (g)	1578.03 [c]	1585.7 [bc]	1589.9 [b]	1614.2 [a]	9.78
Mortality (%)	3.33	0.00	3.33	0.00	
Feed conversion ratio	2.11 [b]	2.12 [b]	2.15 [b]	2.62 [a]	0.12
Cost/kg feed (₦ /kg)	61.38 [a]	60.04 [a]	58.45 [ab]	57.14 [b]	2.25
Total feed cost (₦ /kg)	96.98 [a]	95.46 [a]	92.24 [b]	92.20 [b]	1.95
Cost/wt. gain (₦ /kg)	129.3 [b]	127.28 [b]	125.6 [b]	148.38 [a]	3.32

Means with different superscripts along the same row are significantly different (P<0.05)

The relative similarity in performance observed in the birds fed control diet and those fed 75% NW as replacement for maize implied that maize could be replaced up to 75% by NW in the diet of broiler starter chicken without affecting the growth and feed efficiency, again the nutritive quality of noodle waste is relatively similar to that of maize as shown in Table 3. The poor performance of birds in T_4 could be due to low energy level when compared to T_1. It has been reported that higher weight is recorded in birds fed higher energy diet [5]. The low mortality of less than 5% reported in all the treatments indicates that the ingredient had no detrimental effect on the birds. Proper adherence to management practices of the birds could also be responsible for the low mortality across the treatments. The results of cost analysis shows that the cost/kg feed and total feed cost reduced as the level of NW increased from zero to 100% in the diets (Table 3). The highest cost/weight gain was recorded in the diet that contained 100% noodle waste while the lowest cost/weight gain was reported in T_3 as observed in Table 3. The lowest cost/weight gain reported in T_3 could be due to low cost of NW compared to maize as reported earlier. Low cost per weight gain has been observed by several authors when conventional feed ingredients was replaced by less expensive unconventional feed ingredients [2,4,5]. Considering the cost benefits only, maize in the diet of chicken could be partially replaced with noodle waste up to 75%.

The results of the haematological indices shows that the PCV, RBC and WBC of the birds in all the treatments were relatively the same (P>.05). The monocytes, lymphocyte, Eosinophil and Basophil of the birds in all the treatments were not significantly influenced by the varied inclusion of noodle waste as replacement for maize in the diet of the chicken as observed in Table 4 and the values for all aforementioned haematological indices were in agreement with the report of several authors [8,12,13]. Haematological parameters are important indicators of health status in animals and have been an indispensible tool in the diagnosis, treatment and prognosis of many diseases. Blood assay is a sensitive indicator that reveals the birds general health as general changes in the parameters can be seen when no other abnormality is detected [8,13].

Table 4. Haematology parameters of broilers starters fed noodle waste based diet as replacement for maize

Parameters (Means)	T_1 (0%)	T_2 (50%)	T_3 (75%)	T_4 (100%)	± SEM	Level of significant
PCV (%)	29.45	29.36	29.46	29.48	2.12	NS
R.BC(x 10^6/µ1)	4.59 [b]	4.61	4.60	4.63	0.21	NS
Haemoglobin (g/dl)	10.95	11.12	11.15	11.21	0.56	
WBC (x 10^3/µ1)	11.75	11.01	11.34	11.30	1.23	NS
MCHC%	31.56	31.61	31.70	31.84	2.43	NS
Neutrophil %	34.89	35.11	35.03	36.12	3.01	NS
Monocyte%	0.38	0.38	0.39	0.38	0.02	NS
Eosinophil	0.15	0.16	0.15	0.16	0.02	NS

Means along rows with different superscript are significantly different from each other (P<0.05)

The WBC plays a major role in defending the body against disease-producing bacteria, viruses and fungi, a deficiency in WBC may result in an increased susceptibility to infections [8,13]. A decrease in white blood counts is a reflection of the decline in the production of WBC for defensive action against infection [12,13]. Blood protein, abumin and globulin were relatively similar across the treatments (P>.05) (Table 5) and fell within recommended values [8,14]. The results obtained in this study for RBC, WBC, HBC, PCV, blood protein, globulin and albumin also buttress the report that noodle waste could be used as alternative feed ingredient without any adverse effect on health status of the birds as earlier reported. The present findings suggest that the diets did not give rise to acute general infection and inclusion of test ingredient did not pose any adverse effect on health status of the chicken and this ascertain that the birds were healthy and this could be responsible for low mortality of less than 5% recorded in the course of the feeding trial Based on weight gain, feed intake feed conversion ratio, cost per weight gain and results of blood indices such as packed cell volume Red blood cell count, White blood cell and blood total protein etc. it could be concluded that NW could replace maize fraction of the diet of broiler starter chicks up to 75% without any adverse effect on performance and health status but at reduced cost.

Table 5. Serum biochemical parameters of broilers starters fed noodle waste based diet as replacement for maize

Parameters (Means)	T_1 (0%)	T_2 (50%)	T_3 (75%)	T_4 (100%)	± SEM	Level of significant
Total protein (g/dl)	5.13	5.11	5.23	5.28	0.34	NS
Globulin (g/dl)	3.34	3.41	3.45	3.46	0.14	NS
Glucose Mg/dl)	156.8	157.01	159.2	159.8	3.46	NS
Albumin g/dl	2.61	2.61	2.64	2.71	0.14	NS
Creatine Mg/dl	1.21	1.24	1.30	1.34	0.11	NS

Means along rows with different superscript are significantly different from each other (P<0.05)

4. CONCLUSION AND RECOMMENDATION

Significant differences (P=.05) were observed in the mean total feed intake of the chicks fed experimental diets. There were significant differences in the mean total weight gain of chicks fed diet containing 100% NW and the control diet (P<0.05), however, the least weight gain was recorded in the diet containing 100% NW. The feed conversion ratio was not

significantly influenced by dietary treatments (P>0.05). The dietary treatments had no significant effect on the PCV, RBC and WBC and blood total protein (P>0.05). The lowest cost/weight gain was recorded in the diet containing 75% NW as replacement for maize while the highest cost/weight gain was recorded in the diet containing 100%NW. It was concluded that NW could replace maize fraction of the diet up to 75% without any adverse effect on performance, blood haematology and serum bio-chemicals but at reduced cost. It could be recommended that farmers could include noodle waste up to 75% as replacement for maize fraction of the entire diet of broiler starter chickens in order to reduce cost.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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