Nutritional Evaluation of Millet Hulls as a Source of Fibre in the Diets of Broiler Chickens

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Abstract
An experiment was conducted to assess the performance of broiler chickens fed different levels of millet hulls as replacement for wheat offal on growth performance and carcass characteristics of broiler chickens. One hundred day old broilers chicks were randomly allotted to five dietary treatments in which millet hulls replace wheat offal at 0%, 25%, 50%, 75% and 100%. Results showed that daily feed, daily weight gain, feed conversion ratio and feed efficiency ratio were statistically similar both at starter and finisher phase (P>0.05) .Most of the carcass characteristics guts contents and prime cuts were not affected by dietary levels (P>0.05). It was recommended that millet hulls can be incorporated into the diets of broiler chickens up to 100% to reduce feed cost, provide alternatives and improve carcass quality

Keywords: *millet hulls, broilers, growth performance, carcass characteristics*

Introduction

A large proportion of Nigerian populations are facing the problem of hunger and malnutrition as a result of inadequate protein in their diet. The contribution of animal protein in their diet is low. The inability of Nigeria to feed their teeming population with qualitative and quantitative food is a problem associated with high cost of animal protein accompanied with biological factors such as diseases and pests, social factors such as tradition, custom and ignorance (Oyawoye, 1999). In Nigeria, daily protein intake is estimated at 53.8kg per day, with only 8.4g being of animal origin. This low intake of protein leads to high rate of infant mortality, low disease resistance, poor growth and development, mental retardation, kwashiorkor etc (Adegbola, 1998). All these could be prevented by consuming adequate quantities of high quality protein (Awosanmi, 1999). However poultry birds have been reported to bridge the gap within a shortest possible time due to their short generation interval, short gestation period and fast growth rate (Maidala and Istifanus, 2012). Poultry production is only affected by high cost of inputs most especially feeds and day old chicks, limit the opportunity and advantage of poultry production in Nigeria as feed utilization accounts for 70-85% total production cost (Sanni and Ogundipe, 2005). The objective of poultry production is to produce products of high quality with minimum cost in the shortest possible time. Towards attaining this goal, it is desirable to focus on nutritional strategies that will ensure greater productivity of poultry. Millet hull is scaly protective casings of the millet or similar fine, dry, scaly plant material such as scaly parts of flowers, or finely chopped straw. Hull is indigestible by humans, but livestock can eat it and in agriculture it is used as livestock fodder, or is a waste material ploughed into the soil or burnt(Jones, 2006). Million tones of millet hulls are wasted in Nigeria after threshing of millet in the farms. These waste materials can be harnessed and used as a source of fibre for both ruminants and nonruminants. This research was

aimed at determining the effect of feeding millet hulls as a source of fibre on growth performance and carcass characteristics of broilers chickens.

Materials and Methods

Experimental Location:

This experiment was conducted at the poultry unit of school of undergraduate College of Education, Azare farm. Azare is in Katagum local government area of Bauchi State. Katagum local government is situated on the northern part of Bauchi state, Nigeria. It is located between latitudes 11^0 42' and 11^0 40^0 and longitude 10^0 31' and 10^0 11' east (Anon, 2009). It shares common boundary with Itas/Gadau local government in north west, Jama'are to the west, Dambam to the east, Misau to the south west, Giade to the south and Shira to the southwest (Azare, 2013). It has a landmass of 1,120 square kilometers (NPC, 2009). The climate of the study area is controlled by the Inter Tropical Convergent Zone (ITCZ) which is marked by the rainy and dry season. The major climate elements that influence the climate of the study area and affecting the farming system are temperature and precipitation (rainfall), the annual temperature ranged between 22-33^0 C from April to May (Bashir *et al*., 2001). The mean annual rainfall ranged between 615.6-985mm with peak between July- Augusts. The study area is in the Sudan savanna, the vegetation is greatly determined by the nature of the soil. The soil in the study area is aerosol with sandy and loamy sand texture and a high percolation rate.

Experimental Birds and their Management

One hundred (100) Anak 2000 day old chicks (DOC) were used for this research work. Before the arrival of the chicks, the pens were cleaned, washed and disinfected with antiseptic liquid (Dettol). Three days to the arrival of the chicks to the pens after brooding fresh dry saw dust was spread on the floor to serve as litter material. Two days before the arrival of the day old chicks, the brooding pen was arranged. Heat and light sources were provided using 200 watts electric bulb but in case of electric failure, a rechargeable lantern and a kerosene stove were used to supply light and heat for the chicks. The birds were vaccinated with Gumboro and Lasorta vaccine at the required age of vaccination. Their drinking water was treated with antibiotic to prevent infection. After the brooding period of one week (7 days) the chicks were weight and assigned to 5 experimental diets. The experimental diets include; treatment 1 control (100% wheat offal), treatment 2 (25% millet hulls and 75% wheat offal), treatment 3 (50% millet hulls and 50% wheat offal), treatment 4 (75% millet hulls and 25% wheat offal) and treatment 5 with 100% millet hulls. Each of the treatment was replicated twice consisting of ten (10) birds per replicate (10 birds per pen) in a completely randomized design (CRD).

The millet hulls were grounded in the hammer milling machine before it was incorporated into the feed. The percentage composition of the experimental diets was shown in Table 1 and 2 for broiler starter and finisher respectively. During the study period mortality rate, data on feed intake, weekly weight gain and feed conversion ratio were collected and recorded.

Data Collection

The birds were fed with the experimental diets for 8 weeks (56 days) during which data on several parameters were collected and recorded on daily basis while others were taken on weekly basis. Feed intake and weight gain were determined. Mortalities were recorded as they occurred. Weight leftover fed were also subtracted from the total feed supplied for the week to obtain feed consumption per week for each of the replicates. The birds were weighted at the beginning of the experiment for their initial weight and thereafter on weekly basis. At the end of

the experiment 2 birds from each treatment (1 bird per replicate) were randomly selected based on the average group weight. The selected birds were bled, dressed and eviscerated to determine the carcass characteristics. Each bird was weighted before been slaughtered or bled and weighted again after defeathered to record the plucked weight. The head, legs, back, neck, wings, breast and thigh for each carcass were removed and the parts were weighted. All the weights taken were recorded and the dressing per cent was calculated from the data recorded as shown below:-

$$\text{Dressing per cent} = \frac{\text{Carcass weight}}{\text{Live weight}} \times 100$$

The weight of all organs (the heart, lungs, liver, gizzard and abdominal fat) and the Gastro-intestinal tract (small and large intestine) were measured using Staton 461 electric scale. The gut components were expressed as percentage of live weight.

Data Analysis

The data collected for all the parameters including daily feed intake, daily weight gain, feed conversion ratio and feed efficiency ratio were subjected to analysis of variance technique. ANOVA balanced design Steel and Torrie 1980 where significant differences were found Duncan's multiple range tests was used to separate the means (Duncan's, 1955).

Table 1: Percentage composition of experimental diets fed to broiler starter phase (1-4 weeks) of age

INGREDIENTS	Control 25%	50%	75%	100%	
Maize	45.25	45.25	45.25	45.25	45.25
Soya bean	35.85	35.85	35.85	35.85	35.85
Wheat offal	10.00	7.50	5.00	2.50	0.00
Millet hulls	0.00	2.50	5.00	7.50	10.00
Fish meal	5.00	5.00	5.00	5.00	5.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Lysine	0.20	0.20	0.20	0.20	0.20
Methionine	0.20	0.20	0.20	0.20	0.20
Salt (NaCl)	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
TOTAL	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated analysis					
Crude protein	23.00	23.00	23.00	23.00	23.00
Metabolizable energy	2800	2800	2800	2800	2800

Crude fibre	5.70	5.70	5.70	5.70	5.70

Each kilogram contains; vit. A, 10,000,000 IU, vit. D_3 2,000,000 IU, Vit. E 23,000mg, Vit. K_3 2.000mg, Vit, B_1 1,800mg, Panthothenic Acid 7,500mg, Vit. B_6 3,000mg, Vit. B_{12} 15mg, Folic acid 750mg, Biotin 11260mg, Choline Chloride 300,000mg, Cobalt 200mg, Copper 3,000mg, Iodine 1,000mg, iron 20,000mg, Manganese 40,000mg, Selenium 200mg, Zinc 30,000mg, Antioxidant 1,250mg

Table 2: Percentage composition of the experimental diets fed broiler finisher phase diet (5-8 weeks) of age

INGREDIENTS	CONTROL	25%	50%	75%	100%
Maize	48.45	48.45	48.45	48.45	48.45
Soya bean	27.65	27.65	27.65	27.65	27.65
Wheat offal	15.00	11.25	7.25	3.75	0.00
Cowpea testa	0.00	3.75	7.25	11.25	15.00
Fish meal	5.00	5.00	5.00	5.00	5.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Lysine	0.20	0.20	0.20	0.20	0.20
Methionine	0.20	0.20	0.20	0.20	0.20
Salt (NaCl)	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
TOTAL	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated analysis					
Crude protein	21.00	21.00	21.00	21.00	21.00
Metabolizable energy	3000	3000	3000	3000	3000
Crude fibre	6.70	6.70	6.70	6.70	6.70

*Each kilogram contains Vit A 3600, 000iu. Vit. D_3 600.000 IU. Vit E 4.000.000mg. Vit B_1-B_6 640, 1600, 600, 4.00mg. Panthothenic acid 2000mg, Biotin 300mg. Manganese 16000mg. Manganese 16000mg. Selenium 80mg. Vit. K_3 600mg. Cobalt 80mg. Copper 1200mg. Zinc 12,000mg. Folic acid 200mg. Choline chloride 700000mg. Antioxidant 500mg.

Results

The proximate composition of the millet hulls is presented on Table 3, results showed that millet hulls is high in crude fibre (35.21%) making a potential fibre source for monogastric and ruminants animals (Table 3). The performance characteristics of broiler chicks fed various level of millet hulls in the starter phase is shown in Table 4. The daily feed intake ranged from (33.75-40.89g) and the differences between the value were statistically similar (P>0.05) chicks on control (0%) diet (wheat offal) consumed more feed compared to the experimental diets but are statistically similar (P>0.05). The daily weight gain varied between (2.42-4.56) and the difference between the value are statistically not significant (P>0.05). Broiler chicks fed the control diets have the best feed conversion ratio. The feed efficiency ratio ranged between (0.22-0.41) and the difference between the values are statistically similar (P>0.05) birds on control which is (0%) diets had the highest feed efficiency ratio (0.41).

Table 3: proximate composition of millet hulls

Parameters	Percentage
Dry matter	94.00
Crude protein	5.20
Crude fibre	35.21
Ether extract	1.40
Ash	7.20
Nitrogen free extract	51.00

Table 4: Performance characteristics of broilers fed millet hulls at starter phase (0-4 weeks of age)

Parameters	0%	25%	50%	70%	100%	SEM
Daily feed intake	34.57	40.89	38.75	33.75	36.60	NS
Daily weight gain	14.28	11.42	9.84	7.39	12.85	NS
Feed conversion ratio	2.42	3.58	3.94	4.56	2.85	NS
Feed efficiency ration	0.41	0.27	0.25	0.22	0.35	NS
Mortality (%)	0	1	0	2	0	NS

NS = Not significant (P<0.05), SEM = Standard error of means

In the finisher phase, daily feed intake ranged from 75.00 in 75% millet hulls to 105.54g in the 25% millet hulls based diet and the difference between the values were not statistically significant (P>0.05). The daily weight gain varied between 26.32g in the control diets to 34.10g in 50% millet hull diet and the values were not affected by the various levels of millet hulls (P>0.05). The feed conversion ratio and feed efficiency ratio were not affected by the levels of millet hulls (Table 5)

Table 5: Performance characteristic of broiler chickens feed various level of millet hulls at finisher phase (5-8 weeks of age)

Parameters	0%	25%	50%	75%	100%	SEM
Daily feed intake	82.86	105.54	89.11	75.00	80.00	NS
Daily weight gain	26.32	26.10	34.10	32.61	24.52	NS

Feed conversion ration	3.14	4.04	2.61	2.30	3.26	NS
Feed efficiency ration	0.39	0.30	0.38	0.32	0.41	NS
Mortality (%)	0	0	2	0	0	-

SEM = standard error of means, NS = Not significant (P<0.05)

Carcass Characteristics of Broiler Chickens Fed Various Levels of Millet Hulls.

The live weight obtained in the study which varied from (1550-275.0g) and the difference between the value are statistically significant (P<0.05). The slaughter weight ranged between 77.04-86.67% and the difference between the values are not statistically significant (P>0.05)(Table 6).The pluck weight of broiler chickens fed various level of millet hulls ranged from 62.725 – 77.00% and the difference between the value are not statistically significant (P>00.5). The eviscerated weight of broiler fed various level of millet hulls ranged from 38.49-54.040% and the difference between the value are statistically not significant (P>0.05). (Table 6)

Table 6: Carcass characteristics of broiler chickens fed various level of millet hulls.

Parameters	0%	25%	50%	75%	100%	SEM
Live weight	1550.0	1750.0	2750.0	2100.0	2200.0	*
Slaughter weight	85.680	85.780	86.665	77.045	79.165	NS
Pluck weight	72.65	71.23	77.00	62.72	66.16	NS
Dressed weight	68.24	74.04	69.06	71.70	78.49	NS

SEM = Standard error of means, NS = Not significant.

The liver weight range between 1.02-2.20% and were statistically similar. The value of Gizzard, small intestine, large intestine, abdominal part, lungs weight range from 1.22-1.64%, 0.28-0.78%, 2.03-5.83%, 0.55-0.91% and 0.27 – 0.60% respectively and were statistically significant (P<0.05).

Table 7: Gut characteristics of broiler chicken fed various level of millet hulls

Parameters	0%	25%	50%	75%	100%	SEM
Gird	1.22	1.60	1.26	1.64	1.60	NS
Lungs	0.43	0.60	0.27	0.40	0.42	NS
Small intestine	0.78	0.65	0.28	0.40	0.37	*
Large intestine	5.83	4.44	2.87	2.03	2.25	*
Abdominal part	5.83	4.44	2.87	2.25	2.03	*
Heart	0.45	0.48	0.29	0.31	0.22	NS
Liver	2.20	2.09	1.45	0.97	1.02	NS

SEM = Standard error of means NS = Not significant (P>0.05), * = Significant (P<0.05)

The cut of parts of broilers fed various levels of millet hulls diets where is shown in Table 8. Results showed there was significant difference in head and shanks (P<0.05) and not significant difference in neck, wings, breast, thigh, and breast muscle (P<0.05) and (P>0.05) and (P>0.05). Breast muscle is one of the few carcass parameters that determine the quality and yield of carcass (Medugu *et al.*, 2010) but it was not affected by different levels of millet hulls.

Table 8: Cuts of parts of broiler chickens fed various level of millet hulls

Parameters	0%	25%	50%	75%	100%	SEM
Head and shank	5.80	5.51	4.31	2.56	2.67	*
Neck	4.07	3.89	5.56	2.55	2.67	NS
Chest	3.15	2.78	2.38	0.89	2.12	NS
Thigh	19.61	21.06	19.26	17.32	14.40	NS
Wings	6.35	5.80	4.25	3.56	3.56	NS
Breast	12.27	13.87	11.36	12.25	9.83	NS

SEM = Standard error of means, NS = Not significant (P>0.05), * = significant (P<0.05).

Discussion

Millet chaff contain higher crude fibre (35.21%) compared to other conventional crude fibre sources that are used in poultry ration such as wheat offal, maize offal and dried brewers grain (Aduku, 2004). The similar feed intake in both starter and finisher phase can be attributed to proper utilization of the experimental diets which met the nutrient requirements of the broiler chickens in the tropics (Oluyemi and Roberts, 2000). The values of feed intake were within the range of 43.20-45.00g reported by Ali *et al*., 2008 on wheat bran. The daily weight gain were not affected by the level of millet phase both at starter and finisher phases, the values of the daily weight gain is higher than 21.55-25.00g reported by Oladumoye, and Ojebiyi (2010) on rice bran with or Without Roxazyme G2G which is another fibre source. The feed conversion ratio and feed efficiency ratio are not affected by various levels of millet hulls and this can be attributed to utilization of fibre in the millet hulls and values are within the range of values (2.07-3.20) reported by Adama *et al*., 2007 on broiler chickens fed sorghum brewer dried grain. The low yield in live weight (P<0.05) of broilers fed the control diet can be attributed to better utilization of millet hulls than the wheat offal and the live weight increases as you increase the levels of millet hulls (Table 6). The slaughter weight, pluck weight and dressed weight were not affected by the various levels of millet hulls. This can be attributed to proper utilization of millet hulls, since dressed weight is the major determinants of carcass yield (Medugu *et al*., 2010). The organs weights were not affected by the various levels of millet hulls in the broiler diets except the small intestine, large intestine and abdominal fat (P<0.05). The weight of small intestine decreases as you increase the levels of millet hulls. The abdominal fat decreases as you increase the levels of millet hulls and the lower the abdominal fat the better the carcass quality (Medugu *et al*., 2010). Inclusion of higher levels of millet hulls resulted in concomitant decrease in abdominal fat which resulted in high carcass quality.

Conclusion

Considering the results of this study, millet hulls can be used as alternative fibre source in the diet of broiler chickens and can be used up to 100% in the diet of broiler chickens without deleterious effects on growth performance, carcass yield and reduction in cost of production. Higher inclusion levels can result in producing lean meat by broiler chickens which determined high carcass quality.

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