Response of broiler chickens fed diets containing loofah gourd *Luffa cylindrical* (M.J. Roem) seed meal

Onigemo*, M. A., Agbalaya, K and Tijani, L. A.

Department of Animal Production and Fisheries, Lagos State Polytechnic, P.O. Box 249
Ikorodu, Lagos, Nigeria

*Corresponding Author: maonigemo@yahoo.com.

Abstract

The scarcity and increasing cost of conventional plant protein sources prompted researches into potential feed resources that are relatively of less importance to man. Loofah gourd (*Luffa cylindrical* (M.J. Roem)) is a plant that is widely available in most tropical, subtropical and temperate region. In Nigeria it grows luxuriantly uncultivated and the sponge is often used for domestic cleaning while the seeds are discarded. The seeds were de-hulled, milled and fed at 0, 5, 10, 15, and 20% dietary levels of inclusion as partial/total replacement for groundnut cake. One hundred and fifty (150) day-old broiler chicks were divided into five (5) groups and each was fed the experimental diets for fifty six (56) days in a completely randomised design (CRD) arrangement. Data collected included the average feed intake (AFI), average weight gain (AWG), live weight (LW) feed conversion ratio (FCR), protein efficiency ratio (PER), haematology indices such as pack cell volume (PCV), red blood cell count (RBC), white blood cell count (WBC) and haemoglobin (Hb), serological variables such as Alanine aminotransferase (ALT), aspartic aminotransferase (AST), alkaline phosphatase (ALP) and carcass characteristics. Loofah gourd seed meal (LGSM) significantly ($P < 0.05$) depressed the feed intake, weight gain, live weight, and protein efficiency ratio of the birds as the dietary inclusion of LGSM increased in a similar trend. AFI, AWG, and PER were significantly highest ($P < 0.05$) in birds on the control group (125.88 g/day, 51.37 g/day, and 1.81 respectively) and lowest in those on 20% LGSM (62.88 g/day, 19.35 and 1.39 respectively). PCV and Hb were significantly highest ($P < 0.05$) in birds on the control group (10.46 g/dl and 34% respectively) and lowest in those on 15% LGSM (21%) and 10% LGSM (6.98 g/dl) respectively. Birds fed with the control diet had the lowest ($P < 0.05$) AST (86.13 U/I), ALT (5.67 U/I) and ALP (112,338.90) and those on 20% LGSM had the highest AST (104.18 U/I), ALT (10.98 U/I) while the highest ALP (201,762.90) was in birds fed 10% LGSM. Weight of liver and spleen expressed as percentage of live weight were significantly lowest in birds on the control group (1.38 and 0.18 respectively) and highest in those on 15% LGSM (4.08 and 1.50 respectively). The increased in liver and spleen weight coupled with increased serum enzymes activities suggest the presence of anti-nutrient in LGSM. Hence, the use of LGSM beyond 5% level of inclusion is not beneficial in the production of broiler.

Keywords: Loofah gourd seeds, Broiler, Growth performance, Carcass characteristics, Haematology, serology.

Introduction

The poultry industry has been growing consistently over the years around the globe and has witnessed a remarkable development in the last few decades more than any type of livestock. The industry has

made tremendous advancement in the areas of nutrition, management and organization through dietary requirement in precise terms of energy, amino acid, minerals and vitamins (Adu, 1997). Start the next sentence here.

However, the progress made so far in the poultry sub-sector of the Nigerian livestock industry is currently being undermined by the escalating cost of feed derived largely from the exorbitant prices of feed ingredients with attendant challenges of increasing competitive demand by man and animal hence a limitation in the production of livestock products to meet human nutritional and other industrial needs (Apata and Ojo, 2000; Dairo, 2008a&b).

The conventional vegetable protein sources such as soya bean and groundnut cake are very expensive in developing countries due to high exchange rate as many of them still import these commodities (Dairo, 2008b). Cost of feeding has continued to be the major determinant of profit in this industry accounting for about 50 - 70 % of production cost, hence, the search for alternative feed ingredients has become a major research objective in Nigeria (Bolu and Adekeja, 2008).

Loofah gourd plant *Luffa cylindrical* is a crawling plant that grows in wild and abandoned building structures, fences and walls in towns and villages in Nigeria (Dairo, 2008a). The nutritive value of loofah gourd seeds has been reported (Akubor and Chukwu, 1999; Dairo *et al.*, 2007; Amoo *et al.*, 2008; Olaofe *et al.*, 2008; Obboh and Aluyor, 2009). Amoo *et al.*, (2008) reported that its high protein concentration value makes it a good protein supplement especially in animal feeds.

However there is dearth of information on the use of Loofah gourds seeds in poultry ration. This study was carried out to investigate the potentials of dietary inclusion of loofah gourd seed meal in the diets of broiler chicks on growth, haematology and carcass characteristics.

Materials and Methods

The experiment was carried out at the

Poultry Unit of the Teaching and Research Farm, School of Agriculture, Lagos State Polytechnic, Ikorodu, Lagos State located at latitude 6.37N of the equator and longitude 3.33E of the Greenwich Meridian. Loofah gourd seeds used for the study were harvested from the wild, fallow farmlands and abandoned buildings in Ikorodu, during the dry season. The gourds were broken, opened and the fibres were sliced into half and agitated to release the enmeshed black seeds. The seeds were dehulled using Bur^h melon shelling machine, winnowed to separate the off-white melon-like seeds from the black seed coat and thereafter milled in a plate mill to obtain loofah gourd meal (LGSM). The *loofah* gourd seed meal (LGSM) was included at 0%, 5%, 10%, 15%, and 20% dietary as partial/total replacement for groundnut (GNC). The LGSM and the five experimental diets were analysed for proximate composition using the procedure of AOAC (2010) while the gross energy was determined using IKA[®] WERKE calorimeter system, C 2000 control high pressure bomb calorimeter. The experimental diets were fed to one hundred and fifty (150) day-old broiler chicks for fifty six (56) days. The experiment was laid out in Completely Randomised Design (CRD). Each experimental diet constitutes a treatment which was replicated three times with ten (10) birds per replicate. Feed and water were provided *ad libitum*. At the fifty sixth (56th) day of the trial, two birds per replicate were slaughtered for carcass evaluation and blood samples were collected in lithium heparin bottle and ethylene diamine tetra acetic acid (EDTA) bottle for serological and haematological analysis respectively. The birds are starved of feed for 24 hours prior to slaughtering and were provided with water *ad libitum*. Haematological variables such as

haemoglobin (Hb), packed cell volume (PCV), red blood cell counts (RBC), and white blood cell counts (WBC) were determined by the procedure of Sastry (2004), while the total protein, was analysed according to the methods described by Peters *et al.*, (1982). Serum enzymes activities of alanine aminotransferase (EC 2.6.1.1.1), aspartic amino transferase (EC 2.6.1.1.2) and alkaline phosphatase (EC 3.1.3.1) were also determined as documented by Reitman and Frankel, (1957). Data on performance indices such as feed intake (FI) and weight gain (WG) and the above mentioned haematological and serological variables were collected. The following data were generated from the above primary data:

- (i) Feed conversion ratio (FCR) = FI/WG
- (ii) Protein efficiency ratio (PER) = WG/PI

- (iii) Mean corpuscular volume (MCV) = PCV/RBC
- (iv) Mean corpuscular haemoglobin (MCH) = Hb/RBC

All data collected were analysed using ANOVA and the differences in means were separated by Duncan Multiple Range Test. All statistics analyses were done using the Assistat-Statistical Assistance 7.6 beta software computer package developed by Silva and Azevedo, (2009).

Results and Discussion

The result of the proximate analysis (Table 2) revealed that the loofah gourd seeds used in this study contained 40.43% CP which is relatively lower than 43.1% CP reported by Olafe, (2008) and relatively higher than those reported by Dairo, (2008a) and Dairo *et al.*, (2013). The Crude Fat content of the loofah gourd seed used in this study is relatively lower than those

Table 1: Composition of experimental diets (%)

Ingredients	Levels of inclusion of LGSM				
	0	5	10	15	20
Maize	48	48	48	48	48
Palm Kernel Cake	10	10	10	10	10
Wheat offal	11	11	11	11	11
Groundnut cake	20	15	10	5	0
LGSM	0	5	10	15	20
Blood meal	5	5	5	5	5
Fishmeal (72%)	2	2	2	2	2
Palm oil	2	2	2	2	2
Bone meal	1.5	1.5	1.5	1.5	1.5
Salt	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
<i>Determined Analyses</i>					
Dry matter	85.25	85.69	86.13	86.57	87.01
Crude Protein	22.51	22.42	22.33	22.24	22.14
Crude fibre	4.72	3.40	3.23	3.03	2.97
Ether extract	6.08	6.76	7.43	8.10	8.87
ASH	3.05	4.26	3.96	3.66	3.36
NFE	48.89	48.86	49.18	49.53	49.67
Gross Energy MJ/Kg	17.46	18.02	18.59	19.16	19.73

Table 2: Proximate compositions of loofah gourd seeds

Parameters	(%)
Dry Matter	93.03
Lipid	20.00
Protein	40.43
Ash	3.35
Crude fibre	6.64
Nitrogen Free Extract	22.61
Metabolizable energy (MJ/Kg)	20.09

reported by Olafe *et.al.* (2008) and Dairo, (2008a). Also the crude fibre of the loofah gourd used in this study is comparable to the one reported by Dairo, (2008 a&b) and relatively higher to that of reported by Olafe, (2008). The difference in the nutrient value of loofah gourd seed used in this study and those reported in literature might be attributed to the different type of processing the seeds were subjected to prior to analysis. However the crude protein content of LGSM was within the range of 36% - 48% reported for plant vegetable sources such as soya bean meal, groundnut cake, Cottonseed cake, and Sunflower seed cake (Crampton and Harris, 1969; Kearn, 1982; NRC, 1984; Baize, 2000). The growth performance, haematology and serum biochemistry of broilers fed LGSM with the experimental diet is shown in Table 3. The feed intake of the birds were significantly ($P<0.05$) depressed by the increasing dietary levels of LGSM, hence birds fed with the GNC control diet had the highest feed intake. The lower feed intake of birds on diets containing LGSM might be attributed to the comparable high energy content of the diets since the birds will consume enough to satisfy their physiological requirements (Ferket and Genart, 2006). However, the proportionate change in energy does not correspond to the rate of reduction in feed consumption; hence the low palatability of diets containing LGSM as a result of the presence of anti-nutrients in the seed may

be the major reason for the depressed feed intake. Dairo, (2008a) observed similar depression in feed consumption of rabbits fed loofah gourd seeds which was attributed to the presence of presence of tannin and oxalic acids in seed.

The weight gain and protein efficiency ratio follows a similar trend as the feed intake, hence the significantly ($P<0.05$) lowest WG and PER was recorded in birds fed with diets containing 20% LGSM as a result of the lowest feed and protein consumption, since growth is closely associated feed and protein consumption (Siegel and Wisman, 1966; Pym and Nichols, 1979; Rolland-Cachera, 1995; Ferket and Genart, 2006). The depressed weight gain observed in birds fed with diets containing LGSM might be as a result of its relatively high Saponin content (Dairo, 2008 a&b). Saponin are primarily characteristics by bitter taste and foaming properties thereby causing retardation of growth rate, due to reduction in feed intake (Kumar, 1991). Hence, diets containing LGSM were not efficiently utilized as reflected in the worst FCR value in comparison to the GNC control diet.

Some of the haematological variables were all within the range reported for healthy birds (Hassan *et al.*, 2012; Adeyemo and Sanni, 2013). The blood indices such as Hb, RBC, PCV, MCV, MCH, WBC, were significantly ($P<0.05$) different among birds fed with different diets. The Hb, RBC, PCV, follow a similar trend as the highest

Table 3: Growth performance, haematology and serum biochemistry of broilers fed LGSM.

VARIABLES	%Levels of inclusion of LGSM					SEM
	0	5	10	15	20	
Feed intake (g/bird/day)	125.88 ^a	110.06 ^{ab}	81.99 ^{bc}	66.37 ^c	62.88 ^c	12.34
Weight gain (g/bird/day)	51.37 ^a	35.49 ^{ab}	30.98 ^{bc}	26.48 ^{bc}	19.35 ^c	5.37
FCR	2.45 ^{c a}	3.1 ^{ab bc}	2.65 ^{bc ab}	2.51 ^{c a}	3.25 ^{a c}	0.16
PER	1.81 ^a	1.79 ^a	1.69 ^{ab}	1.44 ^{bc}	1.39 ^c	0.09
Hb (g/dl)	10.46 ^a	11.31 ^a	6.98 ^b	7.82 ^b	7.64 ^b	0.86
PCV (%)	34 ^a	31.5 ^a	23 ^b	21 ^b	23.5 ^b	2.58
RBC (T/L)	3.60 ^a	3.04 ^a	2.60 ^b	2.65 ^b	2.40 ^b	0.21
WBC(G/L)	16.48 ^a	14.88 ^{ab}	14.40 ^b	14.56 ^b	17.12 ^a	0.55
MCV (fl)	88.73 ^b	88.69 ^b	87.77 ^b	90.11 ^{ab}	94.44 ^a	1.18
MCH(pg)	2.95 ^b	2.95 ^b	2.92 ^b	2.96 ^b	3.14 ^a	0.04
AST(U/I)	86.13 ^c	91.36 ^{bc}	96.60 ^{ab}	100.78 ^a	104.18 ^a	3.23
ALT (U/I)	5.67 ^c	7.66 ^{bc}	8.10 ^b	8.72 ^{ab}	10.98 ^a	0.86
ALP(U/I)	112,338.90 ^b	157,050.90 ^{ab}	201,762.90 ^a	119,604.50 ^b	127429.20 ^b	18535.50

^{abcd} means with different superscript differs significantly (P<0.05).

values were observed in birds fed with diet containing 20% LGSM which differed significantly from those fed the control diet (containing GNC) that was in turn similar to those fed with 5% LGSM. The serum total protein, AST, and ALT tend to increase as the level of inclusion of LGSM was increased probably as a result of intense detoxification of the anti-nutrients in LGSM and this is reflected in the weight of liver and spleen which also followed a similar trend. Increased serum aminotransferase activities have been associated with overbearing liver activities and/or hepatic injury (Vroom and Israeli 1990). All the variables investigated under the carcass analysis (Table 4) differed significantly (P<0.05) among the birds fed the experimental diets, although they did not follow any particular trend except the live weight, the weight of gizzard, heart, liver and spleen expressed as a percentage of the live weight. The live weight followed a similar trend as the weight gain while the weight of the organs appeared to

increase as the level of LGSM increased in the diet. The higher weight of gizzard of birds fed with LGSM was as a result of the higher crude fibre of the diets containing LGSM. Dietary crude fibre has been reported to improve the size of gizzard (Jiménez-Moreno *et al.*, 2009).

Conclusion

Broilers fed with diets containing loofah gourd seed meal had depressed growth as revealed in the lower feed intake, weight gain, protein efficiency ratio and worst feed conversion ratio. The serum aminotransferase and weight of liver and spleen were higher compared to the Groundnut cake control diet. The inclusion of LGSM at 5% (25% replacement value for GNC) appeared to be optimum as birds on this diet had similar PER, PCV, RBC and comparable PER with those on control diets, hence, LGSM can be used to replace 25% of GNC in the diets of broiler chicken.

Table 4: Average Weight of organs and cut parts of birds expressed as Percentage of live weight

VARIABLES	Levels of inclusion of LGSM					SEM
	0	5	10	15	20	
Live weight (g)	2503.82 ^a	1741.52 ^{ab}	1525.22 ^{bc}	1308.92 ^{bc}	966.62 ^c	257.68
Dressing percentage	73.06 ^{ab}	64.59 ^{bc}	57.69 ^c	68.01 ^b	79.36 ^a	3.68
Drum Sticks	14.43 ^{bc}	23.08 ^{ab}	29.26 ^a	15.89 ^{bc}	13.51 ^c	3.02
Thighs	11.72 ^b	12.19 ^b	18.78 ^a	13.61 ^b	10.11 ^b	1.48
Wings	15.14 ^b	19.84 ^b	27.92 ^a	20.59 ^b	18.57 ^b	2.10
Breast	22.52 ^{bc}	24.63 ^{ab}	28.27 ^a	23.36 ^{ab}	17.71 ^c	1.71
Neck	8.75 ^{ab}	10.28 ^a	11.38 ^a	6.63 ^b	6.80 ^b	0.94
Back Cavity	19.51 ^{ab}	20.97 ^a	21.63 ^a	21.79 ^a	17.14 ^b	0.87
Gizzard	1.92 ^c	2.30 ^{bc}	3.38 ^{ab}	3.98 ^a	3.50 ^a	0.39
Heart	0.48 ^a	1.39 ^a	1.88 ^a	3.21 ^a	2.87 ^{ab}	0.50
Liver	1.38 ^c	2.12 ^{bc}	3.60 ^a	4.08 ^a	3.19 ^{ab}	0.49
Spleen	0.18 ^c	0.51 ^{bc}	0.78 ^{bc}	1.50 ^a	1.07 ^{ab}	0.23

^{abcd} means with different superscript differs significantly (P<0.05).

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