Journal of Agriculture and Social Research (JASR) Vol. 11, No. 1, 2011

BIO-CHEMICAL EVALUATION OF YAM PEEL MEAL FOR BROILER CHICKENS

EZIESHI, E. V.* AND J. M. OLOMU
Department of Animal Science, University of Benin, Benin City, Nigeria
Corresponding author's Email: ev.ezieshi@yahoo.com

ABSTRACT

The nutritional properties and inclusion levels of yam peel meal (YPM) in broiler diets were investigated. Four diets in which YPM substituted maize at 0, 25, 50 and 75% were fed to 180 Anak broiler-type chickens over a 63-day period. Results indicated that YPM contained 89.74% dry matter (DM), 12.03% crude protein (CP), 9.31% crude fibre (CF), 1.03% ether extract (EE), 8.56% ash and 69.07% nitrogen-free extract (NFE). Similarly, mineral analysis revealed that YPM contained 0.12% calcium, 1.28% phosphorus, 0.16% magnesium, 0.31% potassium and 0.91% sulphur among others. The amino acid contents observed were: Alanine, 0.60%; arginine, 0.87%; leucine, 0.51%; lysine, 0.83%; methionine, 0.21%; phenylalanine, 0.38% and proline, 0.29% among others. Yam peel meal resulted in apparent metabolisable energy (AME) of 3,070.5 kcal/kg and AME_n *of 3,027.4 kcal/kg. Results of the feeding trial indicated that body weight gain of broiler chickens was not significantly depressed (P>0.05) except at 75% replacement level. Feed intake per bird was not significantly affected (P>0.05) by diets. Feed-to-gain ratio appeared to increase with increase in the level of dietary YPM. There was a decrease in feed cost per bird as dietary YPM increased. Increased level of dietary YPM seemed to increase water intake by broiler chickens. From the results of the studies, it can be concluded that YPM can substitute up to 50% of dietary maize for broiler chickens without any adverse effect on performance and at reduced cost of feed production.*

Keywords: yam peel, amino acids, minerals, broiler starter, broiler finisher, fiber, diets,

INTRODUCTION

Over the years, maize has not only served as a staple food for humans and a major raw material for most industries but, also a major source of energy in poultry diets, which makes it expensive and sometimes unavailable due to its seasonality. This scenario has resulted in increased cost of feed production with a corresponding increase in the prices of poultry products. As a result, efforts have been made by researchers to source for alternative energy sources that are cheaper and more readily available than maize. One of such potential alternatives is yam peel meal (YPM) that could serve as a cheaper energy source in poultry diets (Adeyemo and Borire, 2002). Its availability in Nigeria was 1,000 tonnes in 1993 and 1,700 tonnes in 2000 (Presidential Task Force on Alternative Formulation of Livestock Feed, 1992). Yam peel meal is obtained in substantial quantities from household kitchens, commercial eateries and markets but, information on the chemical composition is scanty. There is the need to determine some nitro-chemical properties of YPM to ensure its judicious utilization as a feed ingredient. Studies with YPM (Ekenyen *et al.,* 2006; Akinmutimi and Onen, 2008) revealed that it can replace up to 15% of the maize in broiler chicken diets without adverse effects on performance and at reduced cost of production. The essence of this study was, therefore, to determine the extent to which YPM can replace dietary maize for broiler chickens without adverse effects on performance.

MATERIALS AND METHODS

Site of study

The study was conducted in the Teaching and Research Farm of the Faculty of Agriculture, University of Benin, Benin city, Edo State, Nigeria

Yam Peels

Wet yam peels (predominantly from white yam) were obtained from a number of eateries and household kitchens in Benin City and its environs, then sun-dried before they were milled into YPM. The YPM so obtained were then incorporated into the diets of broilers and used for formulating the experimental diets.

Determination of Metabolizable Energy (ME)

The ME values of yam flour and YPM were determined with the ingredient substitution method using 27 five-week-old Anak broiler chickens managed in standard wire cages equipped with droppings pans. Yam flour was included to, comparatively, evaluate the ME of yam flour and YPM. At the beginning of the studies, the birds were divided into nine groups, on equal weight bases, with three birds per group. Three groups were then, randomly, assigned to each of the three dietary treatments: There were three dietary treatments namely:

Diet 1: was a standard broiler starter diet and served as the basal (control) diet (Table 1);
Diet 2: contained 80% of Diet 1 and 20% of yam flour, and
Diet 3: contained 80% of Diet 1 and 20% of YPM.

Diet 1 (as control), Diet 2, and Diet 3.

A three-day adaptation period was allowed for the birds to acclimatize with the cages and feed, followed by quantitative collection of total droppings at 24-hourly intervals. Feed and water were provided *ad libitum* during the period while, avoiding spillages from the troughs. The feed for each group was weighed at the start and at the end of the collection period to determine feed intake during the trial. The droppings for each of the 3-day collection period per group were rid off extraneous materials, weighed fresh, oven-dried at 105°C for 72 hrs to constant weights before they were bulked and finely ground to obtain a homogenous mixture. Samples of the diets and dried excreta as well as yam flour and YPM were assayed for gross energy (GE) using an adiabatic bomb calorimeter and nitrogen content according to A.O.A.C. (2001) procedure. The apparent metabolizable energy (AME) of the basal diet and substituted diets were calculated as follows:

$$\text{AME (kcal/kg)} = \frac{\text{GE of feed - GE of excreta}}{\text{Feed intake}}$$

From the AME of the basal and substituted diets, the AME of yam flour and YPM were calculated using algebraic equation: *(:0.8x + 0.2y = b Kcal/kg)*. The nitrogen-corrected apparent metabolizable energy (AMEn) for each sample was also calculated with the aid of the predetermined nitrogen values. . .

Live Performance and Nutrient Retention Studies

Studies were conducted to determine the effect of replacing maize with YPM in broiler diets on live performance and nutrient retention by broiler chickens. The experiment was conducted in two stages: broiler starter and broiler finisher stages. Four diets were tested during the broiler starter stage. Diet 1, which served as the control diet, was formulated to meet the nutrient requirements of broiler starter chicks according to the recommendation of Olomu (1995). In Diets 2, 3 and 4, 25%, 50% and 75% by weight respectively of the maize contained in Diet 1 was replaced with YPM. No attempt was made to make the diets iso-nitrogenous or iso-calorific in order not to underestimate the value of the ingredient. Thus, the levels of other ingredients remained constant. The compositions of the broiler starter diets are shown in Table 1.

One hundred and eighty Anak broiler chickens obtained at day-old were used for the study. The chicks were brooded during the first four weeks within which they were vaccinated according to schedule. Coccidiostat and antibiotics were administered at regular intervals all through the experimental period to prevent coccidiosis and bacterial infections. The birds were reared on deep litter in a standard tropical poultry building divided into 12 pens each measuring 2.5 m by 1.5 m. The chicks were placed on commercial broiler starter mash for one week to stabilize them prior to the commencement of the study. At one week of age, the chicks were weighed and randomly allotted to 12 similar groups (replicates) with 15 birds per group on equi-weight basis. Three replicates were allocated to each dietary treatment in a completely randomized design. Throughout the experiment, feed and water were provided *ad libitum* while, the birds were observed daily for evidence of mortality. Weight gain and feed intake per bird were recorded at weekly intervals and feed-to-gain ratio was computed, accordingly. Average daily water intake per bird was also determined for each week. The starter stage lasted from one to five weeks of age. At five weeks of age, three birds were randomly selected from each group and transferred to metabolic cages to determine nutrient retention giving three replicates of three birds per treatment.

The management and feeding of the birds were as described under the ME study above. Excreta collection and handling were the same as described for the ME study. The dried faecal samples collected for each group over the three days period were bulked and ground to obtain a homogenous mixture. Representative samples of feed and excreta were later analyzed for proximate composition using the procedure of A.O.A.C. (2001).

From the proximate composition of the feed and excreta, percentage nutrient retentions were determined. At the end of the broiler starter stage, all the birds used for the trial were fed the control diet from five to six weeks of age. At six weeks of age, all the birds were mixed up and randomly divided into 12 similar groups (replicates) in terms of starting weight. Three replicates were assigned to each treatment diet in a completely randomized design. Four diets were tested as with the broiler starter trial. The replacement regimen was the same as described for the broiler starter diets. The parameters studied and methods of data collection were similar to those described for the starter stage above. The broiler finisher stage lasted from six to nine weeks of age. The composition of the finisher diets are shown in Table 1.

Chemical Analyses

Samples of YPM were assayed for dry matter (DM), crude protein (CP), crude fibre (CF), fat or ether extract (EE) and ash contents while, nitrogen-free extract (NFE) was calculated by difference (A.O A.C., 2001). Mineral analysis was done using the atomic absorption spectrophotometer (Vogel, 1989). Samples of YPM were assayed for amino acid profile using chromatographic analysis with thin layer chromatographic plates.

Data Analyses

Data obtained were subjected to analysis of variance (ANOVA) procedures in a completely randomized design. The Duncan's New Multiple Range Test (DNMRT) was used to determine significant differences among means (S.A.S, 2002).

RESULTS

The results of proximate, mineral and amino acid analysis (on DM basis) are presented in Table 2. The recorded nutrient content of the fresh yam peels gave 89.74% DM, 12.03% CP, 9.31% CF, 1.03% EE, 8.56% ash and 69.07% NFE. The results of mineral analysis indicated that yam peel contained 0.12% calcium, 0.28% phosphorus, (0.16% magnesium, 0.31% potassium, 0.19% sulphur, 18.50 ppm copper, 21.06 ppm zinc, 235 ppm iron, 105 ppm manganese, 0.70ppm molybdenum and 0.23ppm selenium (Table 2). The results further indicated that YPM contains the essential and most non-essential amino acids although, at relatively low levels that are below recommended daily requirements of most farm animals

Table 3 shows the results of metabolizable energy (ME) studies with yam flour and YPM using broiler starter chicks at five weeks of age). The results indicated that the ME and the nitrogen-corrected apparent metabolizable energy (AME_n) values were both higher for yam flour (3,112.8 kcal/kg and 3,027.4 kcal/kg) than for YPM (3,070.5 kcal/kg and 2,965.4 kcal/kg), respectively.

The results of the trial with broiler starter chicks are presented in Table 4. The results indicated that body weights were not significantly (P>0.05) affected up till 50% level of replacement of maize with YPM. The replacement of 75% maize in the diet with YPM resulted in significant (P<0.05) depression in body weights. Feed intake was not significantly affected (P>0.05) by diets with the replacement of dietary maize with YPM. However, feed intake appeared to decrease on the YPM – based diets. Feed-to-gain ratio was not significantly affected (P>0.05) when 25% of dietary maize was replaced with YPM. The replacement of 50% and 75% of dietary maize with YPM resulted in linear increase in feed-to-gain ratio. The inclusion of YPM in the diet significantly decreased (P<0.05) feed cost per bird. Feed cost per bird decreased progressively with increasing level of replacement. However, the decreases were not significant (P>0.05). Feed cost per kilogram liveweight gain appeared to increase at 75% level of replacement and decreased significantly (P>0.05) at 25% and 50% levels. Water intake by the birds was not significantly affected (P>0.05) by dietary treatments. Water-to-gain ratio appeared to increase with increasing level of replacement, the increase being significant only at 75% level. Water-to-feed ratio, energy consumed and protein consumed were not significantly affected by diets. Protein efficiency ratio decreased linearly with replacement of 50%, and 75% dietary maize with YPM.

Results of the trial with broiler finisher chickens indicated that the replacement of 25 and 50% of the maize in the diet with YPM, did not significantly affect (P>0.05) final body weight and body weight gains while, the replacement of 75% of the maize with YPM resulted in significant (P<0.05) decrease in body weights (Table 5). Feed intake was not significantly affected (P>0.05) by the diets. However, there appeared to be some numerical increases in feed intake by the birds at 25% (Diet 2) and 50% (Diet 3) replacement levels. Feed-to-gain ratio significantly increased as YPM replaced maize in the diet but the increase was not significant except at 75% replacement level. Feed cost per bird decreased with increasing level of replacement but only significantly so at 75% replacement. Feed cost per kilogram live weight gain was not significantly (P>0.05) affected by diets. Water intake increased significantly (P<0.05) with the replacement of maize with YPM in the diet. However, the value of water intake obtained from Diet 4 with 75% replacement level was not significantly different form that of the control diet. Water-to-gain ratio appeared to increase with increasing levels of maize replacement. However, the increase was only significant (P<0.05) at 75% level. Water-to-feed ratio, energy consumed and protein consumed were not significantly (P>0.05) affected by dietary treatments. Protein efficiency ratio decreased gradually with increasing level of replacement of maize with YPM.

Percentage nutrient retention by broiler chicken is presented in Table 6. The results indicated that percentage DM significantly (P<0.05) decreased with the replacement of maize with YPM in the diet. There was no significant difference (P>0.05) in DM retention between Diets 2 and 3 while, Diet 4 gave the lowest DM retention. Crude protein retention decreased (P<0.05) with increasing level of replacement of maize with YPM. Diet 1 had the highest percentage CP retention while, Diet 4 recorded the lowest. Crude fibre retention significantly (P<0.05) increased as percentage replacement increased. Therefore, Diet 1 gave the least CF retention while, Diet 4 gave the highest. Percentage fat retention did not follow any definite pattern. Diet 2 gave the highest value of fat retention, which was not significantly different (P>0.05) from that of the control diet (Diet 1) which gave a value almost similar to those of Diets 3 and 4 with 50% and 75% replacement levels, respectively. Percentage ash retention was not significantly (P>0.05) affected by the replacement of maize with YPM at 25% (Diet 2) and 50% (Diet 3) levels. Diet 4 (75%) yielded the lower ash retention compared to the other diets. Percentage NFE was not significantly (P>0.05) affected by dietary treatments.

DISCUSSION

The proximate chemical composition of yam peel showed that YPM cannot be classified as a protein feed source since the CP content was just about 12% but as an energy source like maize. The CP value of yam peel observed was comparable to that reported by Akinmutimi and Onen (2008) but higher than that reported by Ekenyem *et al.* (2006). The variation in CP value of yam peel over time may be attributed to variation in variety or source of yam or depth of peeling during processing of yam. The recorded CF content of yam peel may be considered optimal for non-ruminants such as poultry and pigs and may be too low for most ruminants. Consequently, non-ruminants may tolerate higher dietary levels of yam peel meal compared to some other agricultural by-products such as palm kernel meal which gave a CF content as high as 17% (Ezieshi and Olomu, 2004). The CF value observed in the study was higher than the values earlier reported (Ekeyem *et al.*, 2006; Akinmutimi and Onen, 2008). From the results of the study, yam peel recorded a very low fat content which agrees with the findings, of Ekeyem *et al.*, (2006) and Akinmutimi and Onen (2004).

The value of ash content observed is an indication that yam peel contains moderate amounts of minerals for livestock performance. The contents of most of the common minerals of yam peel shown in Table 2 are within acceptable range (Olomu, 1995) and the ratio of calcium to phosphorus *(0.10)* meets the requirements of most farm animals. The amino acid contents of yam peel observed in the study (Table 2) are very low compared to those of most conventional feedstuffs such as soyabean meal and groundnut cake to meet the requirements of farm animals. It therefore, means that YPM-based diets should be supplemented with synthetic amino acids to meet the requirements of most animals.

The results of the balance study (Table 3) indicated that yam flour had a ME of 3112.8 kcal/kg which is lower than the value earlier reported by Olomu (1995). The ME of YPM observed in the study was slightly higher than the value reported by Ekenyem *et al.* (2006). The difference in ME values of YPM may be attributed to differences in the source,type or method of processing of yam (Akinmutimi and Onen, 2008).

The results obtained with the starter chicks and finisher chickens indicated that body weights tended to decrease with increasing level of replacement of maize with YPM. The poor performance of the birds fed the YPM diets compared to the control diet (without YPM) may be related to the higher CF level of the YPM diets. The observed 9.31% CF content of YPM is about four times higher than the 2.1% reported for maize (Olomu, 1995). It has been reported that fibre serves as an energy diluent (Ezieshi and

Olomu, 2008a), thereby, interfering with energy utilization. The body weights observed were within the range reported by Ezieshi and Olomu, (2008b). The similarity in feed intake between the groups of birds fed the control diet and those fed the YPM diets in both the starter and finisher phases. This may be related to the fact that the energy levels of the diets were close enough (Table 3). The increased feed-to-gain ratio observed on YPM diets can be attributed to the lower body weights recorded on the diets compared to control diet as observed during the starting and finishing periods. Feed cost per bird, generally, decreased with increasing dietary levels of maize replacement with YPM. This may be related to the difference in cost per kilogram maize and YPM. Maize was about four times more expensive than YPM during the period of study. Water intake was not significantly affected by diets during the starting period. The values of water intake obtained during the starting period agree with the findings of others (Ezieshi and Olomu, 2004; Ezieshi and Olomu 2008a, 2008b), while the water intake during the finishing phase was higher than that of the starter phase suggesting that water intake is a function of age (Richards, 1976). The water-to-feed ratios observed during the starter and finisher phases ranged from 2 to 3 suggesting that the birds consumed about 2 to 3 times more water than feed. This is in agreement with the report of Olomu (1995).

The higher DM retention by the birds fed the control diet compared to those fed the YPM-based diets, may be attributed to the absence of YPM in the diet. The lowest percentage DM retention was recorded for Diet 4 with the highest (75%) level of maize replacement with YPM. This mighty be related to the level of CF in the diet, suggesting that the higher the CF content of a feed, the lower the digestibility of the feed (McDonald *et al,* 1983). The results further revealed a decrease in CP retention by the chicks. This decrease may be attributed to the higher CF level of the YPM diets. McDonald *et al.* (1983) reported that CF retention increased as the level of replacement of maize with agro-industrial by-products increased. Percentage fat retention appeared to decrease as dietary energy level decreased. Consequently, fat retention was lower on Diets 3 and 4 with higher levels of YPM compared to the control diet. Percentage ash retained was known to reduce with increasing level of YPM. This may be related to the higher CF levels of the YPM diets.

CONCLUSION

Results of chemical analysis revealed that yam peel meal (YPM) contains moderate amounts of feed nutrients that can sustain broiler chickens for optimum performance. The metabolic studies showed that YPM is an energy source since it recorded a high energy value (3070.5kcal/kg) which is comparable with that of maize(3510.0kcal/kg). Furthermore, results of nutrient retention studies indicated that broiler chickens can utilize YPM to some extent because of its high crude fibre level. From the results of the feeding trial, it can be concluded that YPM can replace up to 50% of the maize in broiler chicken diets without any visible adverse effect on performance and at reduced cost of production. The data on nutrient content reported in this study are recommended as standards for use by feed millers and farmers. It is further recommended that YPM be used as an alternative energy source to maize in broiler chicken diets to reduce cost of feed production.

REFERENCES

Adeyemo, A.I. and Borire, O.F. 2002. Response of giant snail *(Archatina marginata)* to graded levels cf yam peel meal-based diets. Proceedings of the 27th annual conference, Nigerian Society for Animal Production (NSAP), March 17th -21st, 2002.

Akinmutimi, A.H. and Onen, G.E. 2008. The response of broiler finisher birds fed graded levels of yam peel meal in place of maize based diet. *International Journal of Poultry Science,* 7: 474-477.

A.O.A.C. (Association of Official Analytical Ahemists). 2001. *Official methods of analysis* (17th edition). Horwit, W. (ed) A.O.A.C. Inc, Arlington, U.S.A.

Ekeyem, B.U., Madubuike, F.N. and Dike. O.F. 2006. Effects of partial replacement of yam peel meal for maize on performance and carcass characteristics of finisher chickens. *International Journal of Poultry Science,* 5: 942-945.

Ezieshi, E.V. and Olomu, J.M. 2004. Comparative performance of broiler chickens fed varying levels of palm kernel cake and maize offal. *Pakistan Journal of Nutrition,* 3: 254-257.

Ezieshi, E.V. and Olomu, J.M. 2008a. Nutritional evaluation of palm kernel meal types: 1. Proximate composition and metabolizable energy values. *African Journal of Biotechnology,* 6: 2484-2886.

Ezieshi, E.V. and Olomu, J.M. 2008b. Nutritional evaluation of palm kernel meal types: 2. Effects on life performance and nutrient retention in broiler chicker. diets. *African Journal of Biotechnology, 1:* 1171-1175.

McDonald, P., Edwards, R.A. and Greenhalgh. J.F.D. 1983. *Animal Nutrition.* 3rd edition Longman group limited, pp 393-409.

Olomu, J.M. 1995. *Monogastric Animal Nutrition - Principles and Practice.* A Jachem publication, Benin City, Nigeria, pp.320.

Presidential Task Force on Alternative Formulation of Livestock Feed. 1992. Report on livestock numbers, feed resources inventory and supplies 2. Office of the Secretary to the Government of the Federal Republic of Nigeria, Abuja.

Richards, S.A. 1976 The effect of environmental temperature on water intake of broiler *chickens, Journal of Agricultural Science,* 87: 527-532.

SAS, 2002. Statistical Analysis Systems proprietary software release. SAS Institute Inc., Cary NC.

Vogel, A.I. 1989. *Quantitative Inorganic Analysis.* Longman publishers, pp.925.

Table 1: Percentage composition of experimental diets

	Starter Diet (Pecentage compostion)				Finisher Diet (Pecentage compostion)			
	1 (0%) 0	2 (25%)	3 (50%)	4 (75%)	1 (0%) 0	2 (25%)	3 (50%)	4 (75%)
Maize	60.00	45.00	30.00	15.00	68.00	51.00	34.00	17.00
Yam peel meal	0.00	15.00	30.00	45.00	0.00	17.30	34.00	51.00
Soya bean meal	35.40	35.40	35.40	35.40	28.30	28.30	28.30	28.30
Bone meal	2.55	2.55	2.55	2.55	2.00	2.00	2.00	2.00
Oyster shell	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Salt	0.35	0.35	0.35	0.35	0.30	0.30	0.30	0.30
Premix	0.50	0.50	0.50	0.50	0.20	0.20	0.20	0.20
Methionine	0.10	0.10	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	0.10	0.10
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Cost per kg diet, N	66.06	57.01	51.96	44.91	64.56	56.57	48.58	40.59
Calculated Analysis								
Metabolisable energy, kcal/kg	2976.84	2910.99	2845.14	2779.29	3082.98	300.35	2933.72	2859.09
Crude protein,, %	22.45	22.93	23.42	23.90	90.71	20.26	20.81	21.36
Crude fibre, %	2.71	3.79	4.87	5.96	2.59	3.81	5.04	6.27
Total phosphorus, %	0.81	0.82	0.83	0.84	0.68	0.69	0.70	0.72
Calcium, %	1.21	1.23	1.25	1.26	1.04	1.06	1.08	1.09
Lysine, %	1.44	1.52	1.60	1.67	1.21	1.30	1.39	1.48
Meth + Cystine, %	0.67	0.65	0.64	0.62	0.60	0.58	0.56	0.54

Table 2: Percentage (%) proximate composition, mineral content and amino acid profile (%) (on dry mater basis) of yam peel meal

Proximate Composition (%)	Mineral content	Amino acid Profile (%)	
Moisture 10.26	Calcium (%) 0.1 2	Alanine	0.64
Dry matter 89.74	Phosphorus (%) 1 .28	Arginine	0.87
Crude protein 12.03	Magnesium (%) 0.16	Leusine	0.51
Crude fibre 9.31	Potassium (%) 0.31	Lysine	0.83
Ether extract 1 .03	Sulphur (%) 0.91	Methionio	0.21
Ash 8.56	Copper (ppm) 18.50	Phenylalanine	0.38
Nitrogen-free	Zinc (ppm) 21.06	Proline	0.29
Extract 69.07	Iron (ppm) 235.0	Serine	0.16
	Manganese (ppm) 105.0	Threonine	0.27
	Molybdenum (ppm) 0.70	Tyrosine	0.26
	Selenium (ppm) 0.23	Valine	0.15
		Aspartic Acid	0.66
		Cystine	0.17
		Glycine	0.30
		Histidine	0.19
		Isoleucine	0.38
		Tryplophane	0.11

Table 3: Metabolizable energy, ME (kcal/kg) values of yam flour and yam peel meal

Ingredients	AME (kcal kg)	AME_n (kcal/kg)
Yam flour	3112.8^a	3027.4^a
Yam peel meal	3070.5^b	2965.4^b
SEM	20.04	18.12

Means within columns with same superscripts are not significantly different P>0.05)

Table 4: Effect of substituting yam peel meal for maize on productive performance of broiler starter chicks (1 to 5 weeks of age)

	Diet (Percentage composition)				
Performance parameter	**1 (0%)**	**2 (25%)**	**3 (50%)**	**4 (75%)**	**SEM**
Final body weight, g/bird	1093.8^{a}	1004.6^{ab}	*925. 6*^{ab}	713.7^{b}	90.2
Weight gain, g/bird	997.4^{a}	909.8^{ab}	829.8^{ab}	621.7^{b}	89.452
Feed intake, g/bird	2616.3	2369.2	2511.0	2524.3	206.645
Feed-to-gain ratio	2.64^{c}	2.6 l^{c}	3.04^{b}	4.06^{a}	0.12
Feed cost per bird, N	172.84^{a}	135.07^{b}	130.47^{b}	113.3^{bc}	12.59
Feed cost per kilogram live weight gain, N	174.3^{ab}	148.9^{c} 215.17	158.1^{bc}	182.4^{a}	6.4
Water intake, ml/bird/day	203.30		211.85	210.37	9.795
Water-to-gain ratio	7.25^{b}	8.49^{b}	8.93^{b}	11.89^{a}	0.58
Waler-to-fecd ratio	2.74	3.25	2.95	2.93	0.20
Energy consumed, kcal/bird	7,788.4	6,896.4	7,143.7	7,014.2	6,06.42
Protein consumed, g/bird	601.7	543.7	589.0	604.9	47.61
Protein efficiency ratio	1.65^{a}	1.67^{a}	1.40^{b}	1.03^{c}	0.061

Means within rows with same or no superscripts are not significantly (P> 0.05) different

Table 5: Effect of substituting yam peel meal for maize on productive performance of broiler finisher chicken (6 to 9 weeks of age)

	Diet (Percentage composition)				
Performance parameter	**1 (0%)**	**2 (25%)**	**3 (50%)**	**4 (75%)**	**SEM**
Final body weight, g/bird	2027.0[a]	1884.0[ab]	1833.3[a]	1265.0[b]	89.49
Body weight gain, g/bird	933.4[a]	922.5[a]	907.8[a]	551.8[b]	44.082
Feed intake, g/bird	3018.1	3251.8	3427.7	3033.5	212.45
Feed-to-gain ratio	3.23[b]	3.55[b]	3.78[b]	5.50[a]	0.21
Feed cost per bird, N	194.9[b]	184.0[a]	166.2[a]	123.2[b]	12.03
Feed cost per kilogram live weight gain, N	208.8	200.5	183.7	22.3	11.00
Water intake, m I/bird/day	375.9[b]	440.6[a]	463.6[a]	411.5[ab]	16.69
Water-to-gain ratio	14.1[b]	17.0[b]	17.9[b]	26.3[a]	1.26
Water-to-feed ratio	2.62	2.92	2.83	2.87	0.224
Energy consumed, kcal/bird	9308.9	9782.2	10055.2	8673.7	638.82
Protein consumed, g/bird	603.9	657.8	719.8	649.3	439.61
Protein efficiency ratio	1 .56[a]	1.41[ab]	1.26[b]	0 85[c]	0.087

[a, b, c]Means within rows with same superscripts are not significantly (P> 0.05) different

Table 6: The Effect of replacing maize with yam peel meal (YPM) on percentage nutrient retention by broiler chicks (At 5 weeks old)

	Diet (Percentage composition)				
Performance parameter	**1 (0%)**	**2 (25%)**	**3 (50%)**	**4 (75%)**	**SEM**
Dry natter (%)	75.0[a]	60.1[b]	60.1[b]	50.1[c]	1.82
Crude protein (%)	72.1[a]	63.1[b]	56.7[c]	48.8[d]	0.81
Crude fibre (%)	37.7[c]	44.9[b]	49.9[a]	52.0[a]	1.10
Ether extract (%)	54.6[ab]	55.9[a]	53.5[b]	52.6 [b]	0.65
Ash (%)	51.8[a]	51.0[a]	50.4[ab]	48.7 [b]	0.65
NFE (%)	38.4	28.9	28.8	29.8	3.47

Means within rows with same or no superscripts are not significantly (P>0.05) different