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Nutritional Evaluation of Yam Peel Meal for Pullet Chickens: 2. Effect of Feeding Varying Levels on Sexual Maturity and Laying Performance

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Abstract

A study was conducted to determine the effect of replacing maize with yam peel meal (YPM) on sexual maturity and laying performance of pullet chickens reared on yam peel meal (YPM) based diets from day-old to point-of-lay. A total of 150 gold-coloured Anak pullet-type chicks were used for this study. The birds were reared on their various diets up till point-of-lay (20 weeks). Thereafter, they were fed a common layer diet over a 35-day trial period. The results indicated that for Diets, 1 (0%), 2(25%), 3 (50%), 4(75%) and 5 (100%), days to first egg were in the range of 161, 147, 155, 155 and 169 respectively. Weight of first egg (g) resulted in values of 50.30, 50.83, 45.83, 45.83, 45.53 and 41.63. The birds fed Diets 2, 3 and 4 in which YPM substituted 25, 50 and 75% of dietary maize attained 5, 15, 25 and 50% hen day production (HDP) earlier compared to those fed control diet and Diet 5(100% replacement) which indicated almost similar values. Weekly HDP was depressed with increasing dietary level of YPM but only significantly so at weeks 23 and 24 with particular reference to Diets 4 and 5. This was about the same trend with average weekly egg weight. Conclusively, substituting maize with YPM in pullet diets hastened sexual maturity and improved laying performance.

Keywords: Nutritional evaluation, yam peel meal, pullet, sexual maturity, laying performance.

Introduction

The use of non-conventional alternative feed resources is one way of reducing cost of poultry production because they are relatively cheaper compared to conventional grains such as maize which also provide staple foods for humans and form major raw-materials for most industries. However, like most other non-conventional agro-industrial by-products, yam peel meal (YPM) is characteristically bulky, fibrous and low in metabolizable energy (Olomu 1995). Consequently, when included in pullet diets, particularly, at very high levels over a long period of time may have some adverse effects on future performance of laying birds. The results obtained from the pullet starter and grower trials (Paper 1) revealed that YPM can replace up to 75% of dietary maize in pullet diets without deleterious effects on growth performance. It is not certain whether the feeding regimen would affect sexual maturity and laying performance. The essence of this study therefore, is to determine the effect of substituting YPM for maize, up to 100% level from day-old to point-of-lay, on sexual maturity and laying performance of pullet chickens.

Materials and Methods

Site of study: The study was conducted at the Poultry Research Unit of the Teaching

and Research Farm of the University of Benin, Ugbowo Campus, Benin City.

Birds housing and management: A total of 150 gold coloured Anak pullet type chicks purchased at day - old from a commercial hatchery was used for the trial. The birds were reared on deep litter in a standard tropical open-sided poultry house divided into experimental pens each measuring about 2.5 by 1.5m. The chicks were brooded during the first four weeks of age. During this period, the open sides were covered with plastic sheets and each pen provided with a 200 -watt electric bulb to create an optimum temperature. The birds were vaccinated against Newcastle disease at day old, 28 days of age and every three months thereafter. Gumboro vaccine was administered at 10 days of age and 21 days thereafter. Fowl pox vaccine was also given at 56 days of age. Coccidiostat was administered at two weeks of age and every two weeks thereafter for the first six weeks. Antibiotics were given at intervals of three weeks all through the trial to prevent bacterial infections.

Diets: Five diets were tested during the study. The composition of the diets are shown in Table 1. Diet 1 which served as control diet, contained about 16 crude protein (CP) and about 2700Kcal/kg metabolize energy (ME) according to the recommendation of Olomu (1995). The quantity of maize in the diet was 60kg/100kg feed (or 60% of the diet). In Diet 2, 25% of the dietary maize was replaced with YPM, thus, Diet 2 contained 45kg maize and 15kg YPM per 100kg of feed. In Diet 3, YPM was used to replace maize at 50%level, thus, maize was 30kg and YPM 30kg per 100kg of total diet. In Diet 4, maize was replaced with YPM at 75% level, thus, bringing the level of maize to 15kg/100kg and that of YPM to 45kg/100kg of Diet 4. In Diet 5, YPM replaced all the maize in the diet and, thus, Diet 5 contained 0kg maize and 60kg YPM per 100kg feed. The levels of other ingredients remained constant as no attempt was made to make the diets iso-caloric or iso-nitrogenous.

Experimental Design: On arrival, the chicks were placed on a commercial chicks starter mash for one week in the first instance to acclimatize them. Thereafter, the chicks were weighed and divided into 15 groups on similar weight basis at 10 birds per group. Each group constituted a replicate. Three replicates were randomly assigned to each of the five dietary treatments in a completely randomized design.

Data Collection: The birds were maintained on their respective diets up till the end of 20 weeks of age (point of lay). Thereafter, the birds were fed a layer diet (Table 2) during 35 days trial period in order to determine the effect of rearing diets (Table 1) on laying performance of the birds. During this period age at first egg (sexual maturity), days to 5, 15, 25 and 50% hen day production (HDP) were recorded. The weights of eggs laid during the period up to 50% egg production were also determined at weekly basis. Hen day production was calculated as the total number of eggs collected per replicate per day divided by the number of birds on that replicate, expressed as percentage.

$$\text{HDP} = \frac{\text{Total number of eggs per day}}{\text{x}} \quad \frac{100}{}$$

Number of birds per replicate 1

Statistical analysis: Data collected during the trial were subjected to analysis of variance using the completely randomized design and mean separation was done where there were significant differences (SAS, 2002).

Table 1: Percentage Composition of Pullet Diets

	Diet (% replacement)				
Ingredients	**1(0)**	**2(25)**	**3 (50)**	**4(75)**	**5(100)**
Maize	60.0	45.0	30.0	15.0	00.0
Yam peel meal	0.0	15.0	30.0	45.0	60.0
Soya bean meal	15.4	15.4	15.4	15.4	15.4
Wheat bran	20.0	20.0	20.0	20.0	20.0
Bone meal	03.0	3.0	3.0	3.0	3.0
Salt	0.35	0.35	0.35	0.35	0.35
Premix	0.25	0.25	0.25	0.25	0.25
Limestone	1.0	1.0	1.0	1.0	1.0
	100.0	100.0	100.0	100.0	100.0
Cost per kg diet (N)	67.62	60.12	52.62	45.12	37.62
Calculated Analysis					
ME, kcal/kg	2,713.8	2,647.9	2,581.8	2,516.3	2,450.4
Crude protein, %	15.83	16.31	16.80	17.28	17.77
Crude fibre, %	3.89	4.97	6.05	7.14	8.22
Total phosphorus, %	0.94	0.95	0.96	0.97	0.98
Calcium, %	1.30	1.32	1.33	1.35	1.37
Lysine, %	0.91	0.98	1.06	1.14	1.22
Meth + cystine, %	0.53	0.51	0.50	0.48	0.47

1. Supplied per kg diet: vitamin A, 12,000iu; vit E, 30mg; miacin, 40mg; biotin, 0.5mg; vit. $B_{1,}$ 2.250; vit. $B_{2,}$ 6mg; vit $B_{6,}$ 4.5mg; vit. B_{12}, 0.15mg; vit. K_3, 2mg; pantothenic acid, 15mg; vit. $D_{3,}$ 2500iu; folic acid, 1.5mg; choline chloride, 300mg; cobalt, 0.5mg; copper, 5mg; iodine, 1.0mg; iron, 20mg; manganese, 80.0mg; selenium, 0.2mg; zinc, 50mg; antioxidant, 125mg.

Table 2: Composition of layer diet fed to pullet chicks (20-24) weeks

Ingredient (%)	Percentage composition
Maize	40.0
Soybean meal	15.2
Wheat bran	10.0
Palm kernel	19.7
Bone-meal	3.50
Limestone	11.0
Salt	0.35
Premix	0.25
Total	100.0
Calculated analysis:	
Crude protein (%)	16.61
Metabolizable energy (kcal/kg)	2386.9
Crude fibre (%)	5.77
Calcium (%)	5.18
Total phosphorus (%)	0.93
Lysine (%)	0.89
Methionine + Cystine (%)	0.55

Each kg of premix contained the following: vitamin A, 3,400,000iu; vitamin D_3, 600,000iu; vitamin E, 4,000mg; niacin, 6,000mg; biotin, 200mg; vitamin B_1, 600mg; vitamin B_2, 1,800mg; vitamin B_6, l,200mg; vitamin B_{12}, 6mg; vitamin K_3, 400mg; pantothenic acid, 1800mg; folic acid, 240mg; choline chloride,70,000mg; cobalt, 80mg; copper, l,200mg; iodine, 400mg, iron, 8,000mg; manganese, I6,000mg; selenium, 80mg; zinc, 12,000mg; and antioxidant, 500mg.

Results

Table 3 presents the results of final body weights, total feed intake and sexual maturity of pullet chicks raised on diets containing different levels of YPM. The results indicated that at point-of-lay, final body weight decreased significantly ($P< 0.05$) with replacement of dietary maize with YPM. The replacement of 25, 50 and 75% dietary maize with YPM did not yield any significant difference in final body weights. The value of final body weights recorded on the diets were 1260, 1255 and 1260 g/bird which were significantly lower than that of control diet (1336 g/bird) but higher than that of Diet 5 with 100% replacement (883g/bird). Total feed intake by the bird increased significantly with the replacement of 25% maize in the diet with YPM but decreased subsequently as replacement level increased. However, the decrease in feed intake from Diet 4 to 5 was not significant ($P > 0.05$). The results also indicated that the birds fed Diet 2 with 25% level of replacement of maize with YPM came into lay earlier than the birds fed other diets. However, days to first egg was not significantly ($P > 0.05$) different among the groups of birds fed Diets 2(25%), 3(50%) and 4(75%). Diet 5(100%) recorded the highest number of days to first egg which, however, was not

significantly different from that of the control group fed the maize-based diet (Diet 1). The value of days to first egg obtained for Diet 1 (0%) compared with those of Diets 3(50%) and 4(75%). Weight of first egg was not significantly affected by the replacement of 25% dietary maize with YPM but subsequently decreased significantly with increased percentage replacement. Days to 5, 15, 25 and 50% HDP was lowest with the birds fed Diet 2 in which YPM replaced 25% dietary maize. However, the differences in days to 5, 15, 25 and 50% HDP among Diets 2(25%), 3(50%) and 4(75%) were not significant. ($P>0.05$). The replacement of 50 and 75% dietary maize with YPM (Diets 3 and 4) resulted in almost similar values of days to 5, 15, 25 and 50% HDP which were not significantly different from those of the control diet. The results further indicated that the replacement of all the maize in the diet with YPM (Diet 5) resulted in the lowest values of days to 5, 15, 25 and 50% HDP.

The results of laying performance of pullets are presented in Table 4. According to the results, weekly HDP appeared to be higher with the group of birds fed the control diet, although the difference was not significant ($P > 0.05$) compared to those fed Diet 2 with 25% replacement level. The results showed that weekly HDP obtained for Diet 2 (25%) was not significantly different from those of Diets 3(50%) and 4(75%). Weekly HDP for Diet 5 in which all the maize was replaced with YPM with respect to weeks 21 and 22, compared favourably with those of control group (Diet 1), Diet 2 and Diet 3. Hen-day production for the period of five weeks was almost uniform for all groups except for Diet 5(100%) in which HDP for five weeks was significantly $P<0.05$) lower. The results indicated that there was no significant difference in weekly egg weight up till 50% replacement level. Weekly egg weight was significantly ($P < 0.05$) lower with the birds fed Diet 4(75%). However, the YPM diets recorded comparable values of weekly egg weight with particular reference to weeks 21 and 22 as was the case of weekly HDP.

Discussion

The results indicated that the birds raised on the YPM -based diets with up to 75% replacement level came into lay earlier than those fed the control diet. The reason for this trend cannot be immediately explained. However, the results of body weights indicated that the groups of birds fed Diets 2,3 and 4 in which 25, 50 and 75% of maize was replaced with YPM recorded almost similar values of body weights (1260, 1255 and 1260 g/bird) which were significantly lower than that of control diet, without YPM (1336g/bird) but higher than that of Diet 5 in which YPM replaced all the dietary maize (883 g/bird). Groups 2, 3 and 4 birds laid their first eggs at 147, 155 and 155 days of age respectively as distinct from the control group (161 days of age) and Group 5 (169 days of age). The above observation contradicts the findings of Lesson and Summer (1994) and Obasohan (2008) who reported that body weight gain bears some relevance with age at first egg and that pullets may come into production early as a result of rapid rate of growth. The trend

of feed intake as observed in this study reveals that total feed intake at 20 weeks of age did not show any relationship with sexual maturity since the values of total feed intake observed with Groups 2, 3 and 4 which attained sexual maturity at about the same time, were significantly (P<0.05) different.

Table 3: Sexual Maturity of pullets fed varying levels of YPM

Parameters	Diet (Percentage Replacement) 1(0%)	2(25%)	3(50%)	4(75%)	5(100%)	SEM
Final body weights at point- of- lay (g/bird)	1335.7^{a}	1259.5^{b}	1255.1^{b}	1260.4^{b}	882.9^{c}	20.68
Total feed intake at point- of- lay (g/bird)	4728^{b}	4964^{a}	4334^{c}	4038^{d}	3936^{d}	5352
Age at 1st egg (days)	161.0^{ab}	147.0^{c}	154.7^{bc}	154.7^{bc}	168.7^{a}	2.91
Weight of 1st egg (g)	50.30^{a}	50.83^{a}	45.83^{b}	43.53^{c}	41.63^{d}	0.44
Age (days) to: 5% HDP	161.0^{ab}	147.0^{c}	154.7^{bc}	154.7^{bc}	168.0^{a}	2.95
15% HDP	162.67^{b}	152.00^{c}	156.33^{bc}	156.33^{bc}	170.33^{a}	2.07
25% HDP	167.7^{ab}	155.3^{c}	157.7^{bc}	163.0^{abc}	170.3^{a}	3.01
50% HDP	170.7^{ab}	157.7^{d}	160.7^{d}	165.7^{bc}	175.3^{a}	2.26

Means in the same row bearing different superscripts differ significantly (P<0.05).
SEM: Standard Error of Means

Table 4: Laying performance of pullets fed varying levels of YPM

Parameters	Diet (Percentage Replacement) 1(0%)	2(25%)	3(50%)	4(75%)	5(100%)	SEM
Hen Day Production (%)						
Week 20	-	43.0	-	-	-	-
Week 21	48.30^{a}	46.94^{ab}	45.43^{b}	45.60^{b}	46.57^{ab}	0.56
Week 22	49.57^{a}	47.67^{ab}	48.43^{ab}	45.27^{b}	47.73^{ab}	1.02
Week 23	50.80^{a}	50.83^{a}	49.97^{a}	47.00^{b}	41.50^{c}	0.67
Week 24	52.50^{a}	52.13^{ab}	50.63^{bc}	49.97^{c}	44.27^{d}	0.49
HDP for 5 weeks	27.34^{a}	28.8^{a}	28.16^{a}	26.67^{a}	20.52^{c}	1.06
Weekly egg weight (g)						
Week 20	-	43.0	-	-	-	-
Week 21	48.30^{a}	46.94^{ab}	45.43^{ab}	45.60^{b}	46.57^{b}	0.48
Week 22	49.57^{a}	47.67^{ab}	48.43^{ab}	45.27^{b}	47.73^{ab}	1.04
Week 23	50.80^{a}	50.83^{a}	49.97^{a}	46.90^{a}	43.00^{c}	0.81
Week 24	52.50^{a}	52.13^{a}	50.97^{a}	49.97^{b}	44.43^{c}	0.47

Means in the same row bearing different superscripts differ significantly (p<0.05).
SEM: Standard Error of Means

Weight of first egg was not significantly affected by the replacement of 25% maize on the diet with YPM but subsequently decreased as dietary level of YPM increased suggesting that egg weight may be a function of feed intake. The results indicated that feed intake beyond 25% replacement level declined linearly as dietary level of YPM increased. Feed intake is positively correlated with intake of essential nutrients including energy (Olomu, 1995). Weight of first egg was optimum on Diets 1 and 2 with moderate feed intake suggesting that the birds fed such diets obtained adequate energy for enhanced egg weight. The high crude fibre levels of the YPM diets may have been responsible for the reduced energy intake on the diets. Ezieshi and Olomu (2004), reported that fibre increases the bulk of a diet and when present in high concentration limits the weight of feed intake by the birds, thereby, imposing a physical limitation on the intake of digestible nutrients. The decrease in feed intake by the YPM group of birds may probably be responsible for decreased body weight gain by the birds. The results of age to reach 5, 15, 25 and 50% HDP indicated that from the onset of lay, laying progressed accordingly following almost the same trend as age at first egg, with Diets 2, 3 and 4 attaining 50% HDP earlier than control group and Diet 5 as in age at first egg. The results of weekly HDP indicated that HDP progressively improved as the laying progressed for the various treatments, suggesting that HDP is a function of age and stage of lay (Ezieshi *et al*., 2003). The increase in egg weight observed for the various treatments as egg production progressed is a well-known phenomenon. The average egg weights reported here are consistent with those earlier reported (Olomu and Offiong, 1983; Ezieshi *et al*., 2003).

Conclusion

From the results obtained in this study, it can be concluded that the substitution of YPM for maize hastened sexual maturity and significantly improved laying performance of pullet chickens. However, weight of first egg was significantly depressed beyond 25% substitution level. It is hereby recommended that YPM can be used as an alternative energy source to maize in order to reduce cost of production.

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