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Comparative evaluation of maize, sorghum, millet and biscuit waste meal as dietary energy sources for laying Japanese quails in a derived savannah zone of Nigeria.

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Abstract

An eight-week feeding trial was conducted to compare the potential of maize, sorghum, millet and biscuit waste meal (BWM) as energy sources in diets of laying Japanese quails. One hundred and forty four laying quails (15 weeks old) were divided into 4 dietary treatment groups and each group replicated thrice with 12 quails each. Quails on dietary treatment group I were fed maize based diet while groups 2, 3 and 4 were fed sorghum, millet and BWM based diets respectively.

Results showed significant differences in daily feed intake, hen-day production and feed conversion ratio. Quails fed millet and BWM based diets had the highest feed consumption while those on millet had the highest kg feed per dozen egg laid. Quails on BWM and sorghum based diets recorded the highest ($p<0.05$) hen day production. Daily weight gain, egg weight and feed cost per dozen egg revealed no significant ($p>0.05$) variations among dietary treatments. Data on egg quality traits indicated non-significance ($p>0.05$) among most parameters measured except for yolk color and shell thickness where quails fed millet and biscuit meal recorded highest egg yolk color. Quails fed biscuit and maize diets had thicker shells than those fed with sorghum or millet based diets.

The findings indicated that BWM, millet and sorghum proved to be tolerable in the diets of laying Japanese quail in a derived savannah zone of Nigeria.

Keywords: biscuit waste meal, sorghum, millet, maize, energy, Japanese quails.

Introduction

Maize (Zea mays) is the major energy source in poultry diets accounting for between 45 and 55% of most poultry feeds (Bamgbose et al. 2004). Maize also serves as the major staple food for a good proportion of people in tropical areas. Consequent upon its ever-increasing demand for human consumption, industrial utilization and livestock feed, there has been a continuous rise in its market price, ultimately increasing the cost of animal feed.

This has been the major obstacle in developing the Nigerian poultry industry. In view of these, evaluation of millet, biscuit waste meal (industrial by-product) and sorghum as alternative energy feedstuffs to maize becomes imperative in areas where their uses are less common, for instance in Southwestern Nigeria. This is expected to broaden the feed resource

base for the livestock feed industry especially monogastric animals.

In addition, the introduction of quail farming to Nigeria in 1992 (Haruna et al, 1997), has also widen the scope for the availability of high rich proteinous food and of research (NVRI, 1996; Olubamiwa et al, 1999; Edache et al, 2005). The present study was thus conceived to provide information on the use of biscuit waste meal, millet and sorghum as alternative dietary energy sources to maize in quail diet, through comparison of their efficiencies in terms of performance and egg quality parameters of the recently domesticated Japanese quails in a derived savannah zone of Nigeria.

Materials and Method

The experiment was conducted at the Centre for Quail Research Ladoke Akintola

Table 1: Composition of experimental diets (%)

Ingredients	Diets			
	1	2	3	4
	(Maize)	(Sorghum)	(Millet)	(BWM)
Maize	55.0	_	_	_
Sorghum	-	55.0	-	-
Millet		-	55.0	-
BWM	-	-	-	55.0
Soybean Meal	30.0	30.0	30.0	30.0
Fishmeal (72%)	4.0	4.0	4.0	4.0
Wheat offal	6.80	6.80	6.80	6.80
Bone meal	2.50	2.50	2.50	2.50
Oyster shell	1.00	1.00	1.00	1.00
Premix[1]	0.25	0.25	0.25	0.25
Methionine	0.20	0.20	0.20	0.20
Salt	0.25	0.25	0.25	0.25
Analysed contents				
Dry matter	88.9	89.8	89.6	90.0
Crude protein	21.1	22.8	21.2	21.5
Ether extract	3.91	3.19	3.47	4.63
Crude fibre	4.16	4.22	5.59	3.82
Ash	3.63	3.96	4.89	S4.77
Nitrogen free extract	56.2	55.6	54.5	56.3
[2]MEkcal/kg	3007	2988	2917	3086
[3]Feed cost (N/kg)	60.0	59.0	51.5	49.20-

[1]Premix supplied per kg diet: - Vit A, 1500 LU; Vit E, 5mg; Vit D3,300IU;
Vit, K, 3 mg, Vit B1,2mg; Vit B_2,5.5mg; Niacin, 25mg; Vit $B_{,2}$, 10ug; Choline, 120mg, Mn, 5.2mg; Mb, 240mg; Zn, 25mg; Cu, 2.6g; Folic acid, 2mg; l,2mg; Fe,5g; Pantothenic acid, lOmg; Biotin, 30.5g; Antioxidant56mg.
[2]ME Calculated metabolizable energy
[3] Feed cost: 1 US dollar=130Naira.

University of Technology (LAUTECH) Teaching and Research Farm, Ogbomoso. The climatic variables of the location were previously described by Akinbola (1998).

Maize and other ingredients were purchased from a reputable commercial feed mill in Ogbomoso while millet and guinea corn were obtained from a local market within Ogbomoso Township. The biscuit waste meal (BWM) was prepared by milling biscuit waste procured from Farmers' Depot, Ijebu-Ode, Nigeria. The experimental diets were formulated (Table 1) with protein and energy contents varying between 21-23% protein and 2900 -3100 ME kcal/kg respectively. The diets were formulated such that maize, sorghum, millet and BWM were included at the rate of 55% each in diets 1,2,3 and 4 respectively. Other ingredients were fixed so as to introduce as little variation as possible to the diets.

A total of one hundred and forty-four (15 weeks old) laying quails out of a flock obtained from the National Veterinary Research Institute, Vom were used for this study. The quails were divided into four dietary groups and each group subdivided into three replicates of twelve quails each. They were housed in quail battery cages designed at the Centre. Wood shavings were used as litter material in the cages. The diets and water were offered *ad libitum* during the eight week experimental period. Feed intake, body weight, feed conversion ratio, hen-day egg production and feed cost /kg gain constituted the response criteria. Mean body weights on replicate basis were recorded at the beginning of the experiment and fortnightly thereafter. Feed intake was recorded weekly while daily egg production was noted. Egg quality parameters (Haugh unit, egg yolk color, yolk height, yolk length and breadth, shell thickness, and egg weight) were measured as described by(Odunsi *et al* 2002).

Proximate analysis of diets and test ingredients were determined according to AOAC, (2000). Data obtained were subjected to analysis of variance (Steel and Torrie, 1980) and treatment means where significant were separated using Duncan Multiple Range Test (Duncan 1955).

Results and Discussion

The proximate compositions of maize, sorghum, millet and BWM are shown in Table 2. The proximate contents indicated that sorghum, millet and BWM had slightly higher crude protein and ash than maize. Sorghum and millet are higher in crude fibre than maize or BWM. The higher nitrogen free extract in maize resulted in a higher metabolizable energy content. BWM contains higher ether extract and ash than the three conventional feed resources.

The productive performance and egg quality values of quails fed different energy sources throughout the 56-day experimental period are presented in Table 3. The daily feed intake differed significantly ($p<0.05$) among the dietary treatments with quails on millet and BWM consuming significantly ($p<0.05$) more than those fed sorghum or maize based diets. Quails on maize or sorghum had similar ($p>0.05$) feed consumption. The values recorded in this study were within the range reported by Ekine and Oruwari (2007) who fed quails com meal and oil based diets. Hen day production showed that layer quails on sorghum and BWM

performed better than those on millet or maize. The hen day production values ranges between 70 - 79%, which is considerably higher than values recorded by Olubamiwa et al (1999). It was observed that the higher feed intake by quails fed millet based diet did not translate into better egg production. In fact they also had a poorer feed conversion ratio in terms of kg feed/dozen egg. Dietary treatments had no significant ($p>0.05$) effect on

Table 2: Proximate composition of test ingredients (%)

Nutrients (%)	Maize	Sorghum	Millet	BWM
Dry Matter	91.1	90.3	90.9	89.4
Crude protein	9.1	12.1	11.6	9.60
Ether extract	3.8	2.7	3.2	6.18
Crude Fibre	2.6	2.8	5.3	1.7
Ash	1.3	1.9	3.6	6.5
Nitrogen free extract	74.3	70.8	66.5	65.4
ME (Kcal/kg)[1]	3249	3134	3006	3145

Calculated from the formula:
[1] ME (Kcal/kg) = 33 x %CP + 81.8 x % EE + 35.5 x % NFE

Table 3: Productive performance and egg quality values of Japanese quail fed maize, sorghum, millet and biscuit waste meal based diets.

	Diets				
Parameter	**1(Maize)**	**2(Sorghum)**	**3(Millet)**	**4(BWM)**	**SEM**
Performance					
Daily feed intake (g)	21.9[b]	23.3[b]	25.6[a]	26.4[a]	1.04
Hen day Production (%)	72.8[b]	78.5[a]	70. l[b]	75.8[a]	2.05
Daily weight gain (g)	0.28	0.25	0.32	0.24	0.01
FCR (Kg feed /doz egg)	0.36[b]	0.36[b]	0.44[a]	0.39[b]	0.22
Feed cost/doz egg (N)	21.64	21.41	22.57	20.31	0.41
Egg quality					
Egg weight (g)	10.8	10.1	10.4	10.6	0.21
Haugh unit (%)	93.7	91.4	93.9	94.2	0.05
Yolk index	0.32	0.33	0.34	0.33	0.01
Yolk color	1.20[b]	1.31[b]	1.92[a]	2.01[a]	0.34
Shell thickness (cm)	0.37[a]	0.21[b]	0.22[b]	0.32[a]	0.48
Shell weight (g)	0.68	0.68	0.68	0.69	0.01
Yolk weight (g)	2.75	2.56	2.68	0.69	0.02
Albumen weight (g)	6.37	5.80	6.04	6.31	0.11
Yolk/Albumen ratio	0.43	0.44	0.44	0.43	0.02

a,b,c. Means with different superscripts along the same row are significantly different ($p<0.05$) FCR = Feed conversion ratio 94

daily weight gain and feed cost per dozen eggs.

Maize has remained the major dietary energy source for poultry because other energy sources do not support similar growth rate when used to completely replace maize (Mcnab and Shannon, 1994, Longe, 1987). Earlier, Peterson (1969) had reported that maize promoted better growth rate than guinea corn, oat or barley and recently, Umoren and Ojo (2007) confirmed that maize was the best energy source in the diets of growing rabbits in their study with cassava, cocoyam and *Jcacinia manni*. On the other hand, Ekine and Oruwari (2007) reported a depressive egg production performance in quails fed about 53% corn meal based diet, in relation to quails fed cassava meal, palm kernel oil, soya oil and a practical diet. They concluded that the low egg production with high corn diet could not be fully explained hence should warrant further investigations so as to ascertain the egg production depressing effects observed. Okon et al (2007) reported no adverse effects on growth, weight gain and feed conversion ratio when 25 and 50% boiled sun-dried coco yam replaced maize in diets of growing Japanese quails.

Sorghum is the cereal crop that is extensively cultivated apart from maize in Nigeria. Its inferiority to maize in poultry diets has been attributable to tannin content and poor amino acid availability despite its higher crude protein (Nelson et al, 1975). The higher feed intake by quails on millet-based diet could be as a result of the low dietary energy content whereas the consumption by quails fed BWM could be linked to increase in palatability. It shows that quails positively responded to sweet tasty nature of BWM based diets. Biscuit meal contains sugar and mineral salts. The reason for the slightly higher hen-day production for quails on sorghum diet might not be unconnected with the low egg weight laid. It has been postulated that there is an inverse relationship between egg weight and egg number. The larger the egg size, the lower the egg number (Odunsi et al 2002).

Egg quality parameters of quails fed different energy sources are given in Table 3 Statistical analysis revealed that there were no significant differences ($p>0.05$) between the treatment groups with respect to egg weight, Haugh unit, yolk index, shell weight, yolk weight, albumen weight and yolk/albumen ratio. The mean yolk color and shell thickness were however influenced ($p<0.05$) by dietary treatments. Shell thickness values were significantly ($p<0.05$) higher for quails fed maize and BWM. Quails fed millet or sorghum had a reduction in shell thickness, which could have been due to the reported cases of tannin affecting calcium and phosphorus metabolism in both ingredients (Butler, et al, 1984; Chubb, 1982). Olayeni et al (2007) reported that incorporation of biscuit meal into layer diets had no adverse effect on shell thickness which is similar to observations recorded with quails in the present study. Perhaps, the higher mineral content in biscuit impacted positively on shell thickness and shell weight. Similarly, incorporation of biscuit waste meal had no negative influence on other egg quality parameters. The yolk color increased possibly due to the various colorant and flavoring agents used during biscuit manufacturing. The Haugh unit values were generally higher (91-94%) than the

minimum of 72% recommended by USDA as being acceptable. This indicated freshness and high quality eggs. Observations during the feeding trial showed that quails on BWM had slightly higher watery droppings. The watery nature could be due to the higher salt and sugar content in the biscuit waste.

Economically, diets containing maize and sorghum were the most expensive followed by millet and BWM. The feed cost/dozen egg was least for quails fed BWM, which is an advantage at producing cheaper eggs. Based on the findings in this study, it appears that quails can easily tolerate any of the energy sources without major deleterious effect on performance, egg quality or economy of production. Possibly, inclusion of biscuit waste meal at graded levels for quails might reveal some trends in the response criteria.

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