SUBSTITUTION VALUE OF MAIZE OFFAL FOR MAIZE IN DIETS OF LAYING HENS

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ABSTRACT

Two hundred and sixteen Golden Hubbard strain of laying hens, aged 32 weeks, were used to investigate the optimal level of maize offal (MO) that could replace maize with no detrimental effects on the performance of the hens. Graded levels of MO (0, 10, 20, 30, 40 and 50%) replaced equal levels of maize in six dietary treatments (1 to 6 respectively). There were no significant ($P > 0.05$) differences between diets in egg production and weight gain of the hens. Eggs weight was highly influenced ($P < 0.01$) by the dietary treatments, with 30% MO producing the heaviest eggs. Increasing dietary levels of MO significantly ($P < 0.01$) increased feed consumption. Feed conv ersion efficiency differed ($P < 0.05$) only at 50% levels of dietary MO. Of the egg quality parameters investigated, albumen, yolk and shell percentages were not affected ($P > 0.05$) by the MO, while the Haugh Units were ($P < 0.05$).

Key words: Maize offal, laying hens, performance, egg quality.

INTRODUCTION

Increasing costs of conventional feedstuffs have contributed immensely to the low level of animal proteins in the developing countries. This becomes more apparent when such livestock competes directly with humans for the same feedstuffs. Moreover, it is unlikely that there will be surpluses from grains upon which poultry production can develop in these countries. In a situation like this, the most logical step is to direct efforts towards harnessing by-product and wastes which are not directly utilisable by man and take advantage of the ability of animal to convert them into wholesome animal products for human consumption. One of such readily available and cheap feed substitutes in Nigeria is maize offal, a by-product of maize (which is fairly synonymous with maize bran). The by-product is rich in B-vitamins (Eusebio, 1980) and has 88% of the feeding value of maize (Eusebio, *et al*, 1968). It has not been extensively investigated in feeding trials in Nigeria although many feed millers have been using it to replace wheat offal which is now becoming scarce and expensive.

The study reported here was conducted to establish the optimal level of MO that could replace maize grain in the diets of laying hens with no significant detrimental effects on the performance of laying hens.

MATERIALS AND METHODS

Two hundred and sixteen laying hens of the Golden Hubbard strain, 12 weeks of age at the start of the study, were maintained in battery cages.. The MO was obtained from Ladokun Feeds, Ibadan, while the remaining feedstuffs were bought from local markets in Ibadan.

The experimental arrangement was a completely randomised design with six dietary treatments. Each treatment was replicated thrice with twelve hens per replicate. Graded levels (0, 10, 20, 30, 40 and 50%) of MO replaced yellow maize as shown in Table 1. The hens were randomly distributed into the treatment groups in such a way that average live weight for each treatment was approximately the same. Theywere then fed on their assigned diets for a 2-week adjustment period. The final weights were taken at the end of the study (week 12). All diets and water were provided *ad libitum*. Feed consumption was recorded weekly and daily records of egg production were kept. Eggs were collected

TABLE 1. COMPOSITION OF EXPERIMENTAL DIETS

Ingredients	DIETS 1	2	3	4	5	6
Yellow maize	54.0	44.0	34.0	24.0	14.0	4.0
Groundnut Cake	22.0	22.0	22.0	22.0	22.0	22.0
Fish meal	1.5	1.5	1.5	1.5	1.5	1.5
Rice bran	11.9	11.9	11.9	11.9	11.9	11.9
Maize offal	-	10.0	20.0	20.0	40.0	50.0
Bone meal	6.0	6.0	6.0	6.0	6.0	6.0
Oyster shell	4.0	4.0	4.0	4.0	4.0	4.0
Common salt	0.5	0.5	0.5	0.5	0.5	0.5
Vitamin-mineral Premix*	0.1	0.1	0.1	0.1	0.1	0.1

*Composition per kg (Uni-vit 15, Roche) of diet.

Vitamin A, 8,000 iu D3, 1,500 iu E, 3.0 iu K 3.0mg; B2, 2.5mg; B6, 0.3mg; nicotinic acid, 8.0mg; Calcium pantothenate, 3.0mg; B12, 8.0mg/tonne; iron, 5.0mg; manganese, 10.0mg; copper, 0.2mg; zinc, 4.5mg; iodine, 0.15mg; cobalt, 0.02mg; selenium, 0.01mg.

once daily between 0600-0700 hours and weighed.

Twelve fresh eggs were taken from each dietary treatment per week for the last four weeks (weeks 9-12), weighed and broken out, then separated into albumen, yolk and shell. The latter three were expressed as percentages of the whole egg weights. Albumen quality (Haugh Unit) was determined as described by Brant *et al.* (1951) from the above eggs for the same period.

The diets and MO were analysed for their proximate constituents using standard methods (A.O.A.C. 1975).

All data were subjected to analysis of variance according to Steel and Torrie (1960). Differences between means were determined by Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

The results of weight gains of laying hens and egg production are presented in Table 3. although there were no significant differences in the two parameters, Diets 2 and 3 produced the highest weight gains (0.43g) while Diet 3 had the best hen-day egg production. That the 50% MO did not depress rate of egg production confirmed reports of Deaton *et al.* (1977). All the birds on this study obtained sufficient energy by consuming more of the fibrous diets (Table 3). Moreover, chemical analysis showed that MO contains only 6.2% crude fibre (Table 2) and could not have been limiting in energy content. The slightly better performances ($P > 0.05$) of Diets 3, 2 and 6 over the control (Diet 1) seems to indicate that MO enhanced egg production. Diet 4 supported the lowest rate of production but produced the heaviest eggs (Table 4).

The daily feed consumption (Table 3) was highly influenced ($P < 0.01$) by the graded levels of MO. The rise in feed intake of hens on high MO diets was an attempt to satisfy their energy needs. This is in consonance with the findings of Abdelsamie et al. (1983). The depressive effect of fibre at certain critical level on appetite reported by El-Kotoury et al. (1971) and Nwokolo et al. (1985) was not observed in this

TABLE 2. ANALYSED COMPOSITION OF DIETS AND MAIZE OFFAL (% O.M.)

Nutrients	DIETS 1	2	3	4	5	6	M.O.
Dry matter (%)	90.18	90.25	90.42	91.09	90.34	91.84	89.7
Crude-protein (%)	16.89	17.14	16.98	17.01	17.12	17.22	9.5
Crude fibre (%)	5.83	6.19	6.65	6.99	7.47	7.98	6.2
Ether extract (%)	+	+	+	+	+	+	5.8
Ash (%)	3.53	3.60	3.81	3.97	4.13	4.28	2.7
N.F.E. (%)	+	+	+	+	+	+	65.5
M.E.Kcal/kg)*	2753	2678	2603	2528	2453	2378	2550

+ Not determined

* Calculated.

TABLE 3 PERFORMANCE OF LAYING HENS AS INFLUENCED BY MAIZE OFFAL

Parameters	DIETS 1	2	3	4	5	6	SE
Av. body Wt. gain (kg)	0.25	0.43	0.43	0.37	0.26	0.27	00.42 NS
Egg Prod./hen/ d (%)	68.6	70.3	70.5	67.1	67.9	69.5	1.47 NS
Feed intake/hen/ d. (g)	134.5^a	143.5^b	138.2^a	149.0^c	145.1^b	163.0^d	5.89 **
F.C.E.(Kg) feed/ kg eggs produced)	3.2^a	3.4^a	3.2^a	3.4^a	3.4^a	3.7^b	0.13 *

NS Non significant difference

a,b,c,d, Means with different superscripts within a parameter differ significantly.

*, ** Significant difference ($P < 0.05$, $P < 0.01$, respectively).

SE Standard error estimate.

study. It is probable that the hens were not challenged with such high levels of fibre

Means of feed conversion efficiency (Table 3) from Diets 1 to 5 were similar ($P > 0.05$) but differed ($P < 0.05$) only at 50% MO. This was attributed to lower energy density of Diet 6 when compared with the rest (Table 2).

Highly significant differences ($P < 0.01$) were observed between treatment means for egg weight (Table 4). The results show that increasing levels of MO from 30 to 50% in the diets improved egg size significantly ($P < 0.01$). This is in agreement with the finding of Abdoul-Seoud et al. (1970). It might be true that energy-dilution effect of MO was responsible for these observation as once reported (Abdoul-Seoud et al. (1970). It is also probable that there are some unidentified egg-size factors which are more concentrated in MO than in maize grain. Jensen et al.. (1957) had earlier highlighted the fact that an unidentified factor necessary for obtaining maximum egg size is present in yellow maize. Laying hens on Diet 3 produced the lightest eggs (P.01). This could be due to the highest egg number ($P < 0.05$) produced since the two parameters (egg weight and egg production

TABLE 4. EFFECT OF DIETARY MAIZE OFFAL ON EGG QUALITY CHARACTERISTICS

Parameters	DIETS 1	2	3	4	5	6	SE
Av. egg Weight (g)	62.0^b	61.2^b	60.4^a	64.9^d	63.6^c	63.0^c	1.58 **
Av. Haugh Unit	84.6^b	84.0^b	81.6^a	83.8^b	84.1^b	80.3^a	1.54 *
Av. Albumen Weight (%)	60.5	60.1	61.3	61.6	59.5	60.8	2.10 NS
Av. Yolk Weight (%)	28.0	28.3	27.7	28.0	28.9	27.9	1.16 NS
Av. Shell Weight (%)	11.6	11.7	11.1	11.4	11.6	11.3	0.15 NS

NS Non significant difference

a,b,c,d Means with different Superscripts within a parameter differ significantly.

*, * * Significant difference ($P < 0.05$, $P < 0.01$ respectively).

SE Standard error estimate

rate) are inversely correlated (Harms and Douglas, 1960).

Albumen, yolk and shell percentages (Table 4) were not significantly influenced by MO. The Haugh Unit scores were statistically ($P < 0.05$) affected by the MO as shown in Table 4. Throughout the period of the study, Diets 1, 2, 4 and 5 sustained secretion of thick albumen ($P < 0.05$) as shown in the Haugh unit scores (Table 4). A similar observation was reported in the work of Piliang *et al.* (1982). This was presumed to have resulted from dilution of energy concentration of the feed. The low Haugh Unit scores of eggs produced from Diet 3 may be explained partly from the point of egg production since correlation coefficient between rate of egg production and Haugh Unit is negative (Harms and Douglas, 1960). In conclusion, this study has demonstrated that MO is a good substitute for maize in diets of laying hens.

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