Replacement value of cassava flour for maize in layers' diet containing bovine blood-rumen content meal

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ABSTRACT

One hundred and twenty 35-week-old hens were used in the 8-week trial to determine the inclusion level of cassava flour that will substitute maize in layers' diet containing bovine blood-rumen content meal (BBRCM). Experimental diets containing 8 per cent BBRCM and 0, 33.33, 66.67 and 100 per cent cassava flour replacement for maize were fed to the test hens. Feed supply was pegged at 130 g/hen/day for all birds. Only hens on the control diets gained weight throughout the study period, and the rate of lay decreased ($P<0.05$) with increasing level of cassava flour in the diet. Egg weight tended to drop as the level of cassava flour in the diet increased. The inclusion of cassava flour in test diets reduced the price of feed. From the results, it is suggested that 66.67 per cent of maize in layers' diet can be replaced with cassava flour.

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RÉSUMÉ

ADENIJI, A. A. & BALOGUN, O. O.: *La valeur de remplacement de maïs avec la farine de manioc dans le régime des pondeuses contenant la farine du sang bovin-contenu de rumen.* Cent vingt poules, qui avaient l'âge de 35 semaines étaient utilisées pour l'essai de huit semaines. L'étude étaient visée à déterminer le niveau d'inclusion de farine de manioc qui peut remplacer le maïs dans le régime de pondeuses contenant la farine du sang bovin et du contenu de rumen (FSBCR). Les régimes expérimentaux contenant 0, 33.33, 66.67, et 100 % de remplacement de maïs avec la farine de manioc étaient nourries aux poules d'essai et tous les régimes contenaient 8% d'inclusion de FSBCR. La provision d'aliment était fixée à 130 g/poule/jour pour toutes les volailles. Seule les poules suivant les régimes de contrôle gagnaient de poids durant toutes la période d'étude et la proportion de ponte diminuait ($P < 0.05$) avec l'augmentation du niveau de la farine de manioc dans le régime. Poids d'œuf avait la tendance de baisser comme le niveau de la farine de manioc du régime diminuait. L'inclusion de la farine de manioc dans le régime d'essai baissait le prix d'alimentation. Il est suggéré que 66.67 % de maïs dans le régime des pondeuses pourrai être remplacé avec la farine de manioc.

Introduction

Cereal grains, particularly maize, normally constitute a major proportion of poultry feed as the energy source. The amount of grains available for human and animal consumption is limited and its price has remained high, contributing to the high cost of poultry feed. Consequently, feeding acceptable human feedstuff to animals increases competition between humans and animals. This fact, coupled with the prohibitive prices of cereal grains, makes it urgent to find suitable and cheaper substitutes for maize in poultry and livestock feed.

Conflicting results were recorded when cassava root meal was fed to layer birds (Vogt, 1966; Enriquez & Ross, 1972; Hamid & Jalaludin, 1972). The minimum level at which performance was significantly poor varied widely in these reports. Cassava flour as a substitute for maize could supply energy to animals. In addition, Wright (1993) reported that on dry matter basis, a hectare

of land would yield more of processed cassava flour than maize (w/w).

The blood and rumen content are abattoir wastes that are collected fresh at slaughtering time at the slaughter slab and processed into a single ingredient–bovine blood-rumen content meal (BBRCM). The BBRCM have been fed to the different classes of poultry. The 10, 20 and 8 per cent inclusion levels have been recommended for pullet chicks, growing pullets and layers, respectively (Adeniji, 1996). The dried rumen content has been fed to poultry (Emmanuel, 1978; Abubakar & Yusuph, 1991) and ruminants (Alhassan, Lufadeju & Bello, 1985).

Therefore, the trial aimed at determining the inclusion level of cassava flour that will effectively substitute maize in layers' diet containing BBRCM.

Materials and methods

Two hundred and forty Olympia black hens at 35 weeks of age were used for the 8-week trial. Sixty hens were randomly allocated to each of four treatments such that there were three replicates of 20 birds each. The four experimental diets each contained 8 per cent BBRCM (Table 1). The experimental diets were fed to the test hens for 1 week adjustment period before the 8-week data collection started. All the hens were dewormed at the begining of the trial. Feed intake was fixed at 130 g/hen/day while water was supplied *ad libitum*.

The BBRCM was prepared by mixing the

TABLE 1

Composition of Layers' Diets (kg/100 kg)

Ingredient	*1 (0% CRM*)*	*2 (33.33% CRM)*	*3 (66.67% CRM)*	*4 (100% CRM)*
BBRCM	8.00	8.00	8.00	8.00
Dried brewer's grain	20.00	20.00	20.00	20.00
Cassava flour	0.00	1.75	6.65	9.47
Maize	30.00	20.00	10.00	0.00
Maize offal	9.65	17.90	23.00	30.18
Methionine	0.10	0.10	0.10	0.10
Full fat soybean	20.00	20.00	20.00	20.00
Fish meal	2.00	2.00	2.00	2.00
Bone meal	2.00	2.00	2.00	2.00
Oyster shell	7.50	7.50	7.50	7.50
Salt	0.50	0.50	0.50	0.50
Vit-mineral premix**	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Proximate composition (% analyzed values)				
CP	18.41	18.24	18.76	18.76
EE	6.09	5.24	5.72	5.46
CF	6.78	7.19	7.35	6.78
ME (Kcal/kg calculated)	2485.78	2483.57	2490.07	2425.40

* Cassava flour replacement for maize

** Agricare product which contained: vit A, vit E, vit K, riboflavin, vit B12, pantothenic acid, nicotinic acid, choline, chloride, folic acid, pyridoxine, biotin, phosphorus, calcium, selenium, iodine, copper, manganese, zinc, iron, coxistac, terramycin, antioxidant and anticaking agent.
(The percentage composition of the vitamins and micronutrients were not given by the manufacturer).

bovine blood and its rumen content at a ratio of 1:3(w/w). The blood was collected fresh at the abattoir at slaughtering time, while the rumen content was also collected immediately after the visceral was split open. The mixture was boiled for about 2½ h and sun-dried until moisture content was below 15 per cent. It was later milled for particle reduction.

Records of mortality, initial and final live weights, daily egg production, and egg weight were kept. Four eggs, randomly selected per replicate on weekly basis, were measured. The height of the thick albumen was measured to the nearest 0.1 mm with a micrometer screw gauge mounted on a tripod, and the width with a pair of vernier calipers. Thereafter, the eggs were cracked open and the internal quality parameters (Haugh units, yolk indices, yolk colour, and egg shell thickness) determined. The albumen height and egg weight were used to compute Haugh units (Haugh, 1937). A micrometer screw gauge was used in measuring the shell thickness. The Roch colour fan was used to determine the yolk colour.

All data were subjected to an analysis of variance appropriate for the completely randomized design. Treatment means were compared by the Duncan's Multiple Range Test (Steel & Torrie, 1980). The method of AOAC (1980) was used for the proximate analysis of feed.

Results

The BBRCM fed contained 31.42 per cent crude protein, 12.48 per cent crude fibre, and a metabolizable energy value of 2686 Kcal/kg. Table 2 shows the effects of replacing cassava flour for maize on laying performance of test hens.

The initial and final body weights seemed comparable for hens in the different treatment groups. The diet had no significant effect ($P>0.05$) on the body weight of birds. Only hens on the control diet gained weight (10 g) throughout the 8-week study period. Hens fed on the diets containing 33.33 and 100 per cent cassava replacement for maize neither lost nor gained weight. The rate of laying was significantly ($P<0.05$) decreased with the increase in the level of cassava in the diets. Hens on the control diets had the highest hen day production (HDP) (83.36 per cent) while the hens on the 100 per cent cassava-substituted diet had the lowest ($P<0.05$) rate of lay (76.01). The effect ($P>0.05$) of treatment on the observed egg weight was non-significant, which tended to reduce drop as the level of cassava flour in the diet increased. The egg weight

TABLE 2

Effects of Cassava Flour Replacement for Maize on Laying Performance

Parameter	*Percentage of cassava substitution for maize*				
	0	*33.33*	*66.67*	*100*	*SEM*
Initial live wt (g)	1900	1910	1910	1910	0.031 NS
Final live wt (g)	1910	1910	1900	1910	0.020 NS
Body wt gain (g)	10.0	0.0	-10.0	0.0	14.142 NS
Egg production (% hen-day)	83.36[a]	79.46[a]	79.39[a]	76.01[b]	1.432
Egg wt (g)	56.27	55.61	54.68	54.39	1.134 NS
Feed efficiency (kg of feed/dozen egg laid)	1.87	1.96	1.96	2.05	
Cost of feed/25 kg bag (naira)*	507.13	488.75	471.93	451.14	
Feed cost/dozen eggs (naira)*	38.0	38.36	37.04	37.10	

Treatment means in the same rows not followed by the same letter are significantly different ($P<0.05$).
*Prices were based on current market (year 2001).
138 naira = $1
NS = no significant difference ($P>0.05$).

range was from 56.27 to 54.39 g for hens on the control and the total substitution of cassava for maize diets, respectively.

Birds on cassava diets seemed to have lower feed efficiency than those on the control, though not significantly ($P>0.05$) different. Gradual decrease in feed cost was observed with the higher levels of cassava flour in the diets. The price per 25 kg bag of feed with the total cassava flour substitution for maize was as low as 451.14 naira, while the cost per bag of the control diet was 507.13. No mortality was recorded on any of the treatments throughout the trial period. The feed cost per dozen eggs laid seemed comparable for the diets, but the birds fed on the 66.67 per cent cassava flour-substituted diets had the lowest feed cost per dozen eggs laid (37.04 naira).

There seemed to be a gradual increase in shell thickness with higher levels of cassava substitution for maize in the diets (Table 3). Eggs with the thinnest shell of 0.48 mm were from hens fed 33.33 per cent cassava flour diet, while the hens on total cassava replacement for maize diets had the thickest eggshell of 0.52 mm. The eggs from hens on the control and 100 per cent cassava flour-replacement diets had comparable Haugh unit values (57.61 and 57.18, respectively), which were lower than the values for eggs from hens on 33.33 and 66.67 per cent cassava flour-substituted diets (59.90 and 58.76, respectively).

Poor yolk colours were observed with the increase in the cassava flour level in the diets. The hens on the control and 33.33 per cent cassava flour-substituted diets had better ($P<0.05$) yolk colour scores (3.22 and 3.56) than the hens on the 100 per cent cassava flour-substituted diet (4.44). The hens on the control diet had the lowest yolk index value of 0.42 which seemed comparable to the 0.43 value for the eggs laid by the hens on 66.67 per cent cassava flour-replacement diet. The hens on 33.33 per cent and total cassava flour replacement for maize diets had the highest yolk index value of 0.45 each.

Discussion

The feed intake of the birds exceeded the 110 g/hen/day recommended for laying birds by NRC (1984) and Oluyemi & Roberts (1985); hence, it was pegged at 130 g/hen/day for birds on all treatments. The 8 per cent BBRCM fed across all the diets had previously been established as the optimum tolerance level by layer birds (Adeniji & Balogun, 2002). The irregular pattern of body weight gain observed could not have been due to the effect of the treatment, because hens on the highest level of cassava flour diet did not lose weight. Olson, Sunde & Bird (1969) have shown that body weight is not depressed by cassava inclusion in layers' diet. Contrary to reports of previous researchers (Enriquez & Ross, 1972; Ademosun & Eshiett, 1980), a decline in egg production with the increase in the level of cassava

TABLE 3

Effects of Cassava Replacement for Maize on the Internal Quality of Egg

Parameter	*Percentage of cassava substitution for maize*				*SEM*
	0	*33.33*	*66.67*	*100*	
Shell thickness (mm)	0.50	0.48	0.50	0.52	0.086 NS
Haugh unit	57.61	59.90	58.76	57.18	0.238 NS
Yolk colour score*	3.22[b]	3.56[b]	4.19[b]	4.44[a]	0.074
Yolk index	0.42	0.45	0.43	0.45	0.43 NS

Treatment means in the same row followed by the same letter are not significantly different ($P>0.05$).
NS = no significant difference ($P>0.05$).
* The lower the number indicated, the better the colour intensity.

flour in the diets was observed in this study. The significant decline in egg production and the poor feed efficiency observed in hens on the 100 per cent cassava flour-replacement diets show that total elimination of maize for cassava flour in layers' diet might not promote good rate of lay in fed birds.

The significant effect of diet on egg weight in this trial agrees with previous report that egg weights were similar for all diets when cassava root-meal diets were fed. The low price of cassava flour caused the decrease in the cost of feed at the higher levels of cassava flour in diet. Unlike maize, cassava is not used for livestock feeds (except for the peels); hence, its demand is not high.

The better shell thickness observed at higher levels of cassava flour in diets implies that cracked eggs will be less, which supports better egg handling and transportation. It might be necessary to maintain total dietary levels of xanthophyll pigment by appropriate diet formulation when using high levels of cassava flour meal in layers' feed to avoid having a decline in the intensity of yolk pigmentation.

It is apparent from this study that cassava flour can contribute substantially to the energy requirements of layers. It is, therefore, recommended that 66.67 per cent of maize in layers' diet can be replaced with cassava flour.

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