

Growth response of broiler chickens fed varying levels of sheanut cake

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ABSTRACT

A 4-week study (264 broiler chickens, Cobb strain) evaluated growth response of broilers to varying levels of sheanut cake (SNC) in rations. Four dietary treatments in which SNC was incorporated at 0 (control), 2.5, 3.5 and 4.5 per cent were tested from 4 to 8 weeks of age of the birds. Diets were isonitrogenous (200 g kg⁻¹ CP) and isocaloric (12.0 ME MJ kg⁻¹). Complete randomized design was used and each diet was replicated three times. Each replicate comprised 22 birds (10 females and 12 males) with initial mean live weight of 668 g per bird. Variables measured included feed intake, weight gain, feed conversion efficiency, mortality, feed cost, haemoglobin level (Hb), and packed cell volume (PCV). Feed and water were provided *ad lib*. Mean daily weight gain and feed intake did not differ significantly ($P>0.05$) for birds fed diets containing 2.5 per cent SNC and the control diet. There was, however, a significant ($P<0.05$) depression in weight gain and feed intake when higher levels of SNC (3.5 and 4.5%) were included in the diets. Feed/gain ratios were similar ($P>0.05$) for all diets except 4.5 per cent SNC diet, which was poor. The PCV and Hb values were significantly increased ($P<0.05$) with increasing inclusion of SNC. Feed cost was significantly ($P<0.05$) reduced with increasing level of SNC in the diet. The inclusion of SNC in the diet of broiler chickens at 2.5 per cent had no deleterious effect on their growth performance and also reduced cost of feeding.

RÉSUMÉ

DEI, H. K., POBI, N. O. & OTCHERE, E. O. : *Réaction en croissance de poulets de chair nourris de quantités variables de la farine du sous-produit de noix de karité moulu.* Une étude de quatre semaines (264 de poulets de chair, de la race de Cobb) était entreprise pour évaluer la réaction en croissance de poulets de chair aux quantités variables de la farine du sous-produit de noix de karité moulu (SNKM) dans les rations. Quatre traitements alimentaires en quels était incorporé le SNKM à 0 (contrôle), 2.5, 3.5 et 4.5% étaient mis à l'essai sur les volailles âgés de 4 à 8 semaines. Les régimes étaient isoazotés (200 g kg⁻¹ CP) et isothermiques (12.0 ME MJ kg⁻¹). Un dessin complet choisi aux hasard était utilisé et chaque régime était répété trois fois. Chaque répétition comprenait 22 volailles (10 femelles et 12 mâles) avec le poids vif moyen initial de 668 g par volaille. Les paramètres mesurés comprenaient la consommation alimentaire, le gain de poids, l'efficacité de conversion alimentaire, la mortalité, le coût d'aliment, le niveau de hémoglobine (NH) et le volume de cellule tassée (VCT). L'aliment et l'eau étaient fournies *ad libitum*. Le gain de poids moyen quotidien et la consommation alimentaire n'ont pas différé considérablement ($P > 0.05$) pour les volailles nourries de régime contenant 2.5 de SNKM et pour le régime de contrôle. Il y avait toutefois une dépression en gain de poids et en consommation alimentaire lorsque plus hauts niveaux de SNKM (3.5 et 4.5%) étaient inclus dans les régimes. Les proportions d'aliment / gain étaient semblables ($P > 0.05$) pour tous les régimes sauf le régime de 4.5% de SNKM qui était faible. Les valeurs de VCT et NH étaient considérablement augmentées ($P < 0.05$) avec l'augmentation de l'inclusion de SNKM. Le coût d'aliment était considérablement réduit avec l'augmentation du niveau de SNKM dans le régime. L'inclusion de SNKM dans le régime de poulets de chair à 2.5% n'avait pas aucun effet délétère à leur résultats de croissance et réduisait aussi le coût d'alimentation.

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Introduction

Maize, the commonest source of energy in poultry diets, is also a common staple in Ghanaian diets. This competition for maize has resulted in its high price as well as occasional scarcity on the market. It is, therefore, necessary to find other energy food sources like agricultural by-products to either replace or supplement the energy requirements of poultry.

Sheanut cake (SNC), an agro-industrial by-product, has a nutrient composition of 7.9 per cent moisture, 15.7 per cent crude protein, 16.4 per cent ether extracts, 4.8 per cent ash, and 21.5 MJ ME kg⁻¹ (Okai & Bonsi, 1989; Rhule, 1995). However, the major set-back of the cake as a feed ingredient is its low nutritive value (Atuahene, Donkoh & Asante, 1998), resulting in its inability to support good growth performance when used in large quantities because of the theobromine and saponin it contains (Gohl, 1981).

Preliminary studies have shown that SNC can partially replace maize in the rations of monogastric animals such as pigs (Okai & Bonsi, 1989; Rhule, 1995), broiler chickens (Atuahene *et al.*, 1998), and exotic guinea fowls (Sumani, 2001).

The large quantity of SNC produced by the Kassadjian Ltd and Bosbel Vegetable Oil Enterprise in Tamale is dumped at the processing sites. Probably, feed processors are unaware of its feeding value in the diet of poultry as a means of reducing high feed costs in poultry production. The need also is to adequately assess the nutritive value of SNC for its usefulness as a feed ingredient for broiler chickens in a hot, dry savanna climate.

The specific objectives of this study were to determine the optimum inclusion level of SNC in grower diets of broilers and to assess the cost of feeding SNC.

Materials and methods

A total of 264 4-week-old birds with mean weight of 668 g per bird were randomly allotted in equal numbers (12 females: 10 males) to four experimental diets incorporating 0, 2.5, 3.5 and 4.5 per cent

sheanut cake.

Table 1 shows the composition of the experimental diets. The control diet, T₁, contained no SNC while the remaining diets, T₂, T₃ and T₄, contained SNC in proportions of 2.5, 3.5 and 4.5 per cent, respectively. The diets were formulated to be isocaloric (12 ME MJ kg⁻¹) and isonitrogenous (200 g kg⁻¹ CP).

Completely randomized design was used. Variables measured included weight gain, feed intake, feed conversion efficiency, PCV, Hb, and mortality. The birds were raised from 4 to 8 weeks of age.

The experimental diets were chemically analysed using standard procedures (AOAC, 1984). All the variables measured, except mortality, were analyzed using the analysis of variance (Steel & Torrie, 1980). Differences between means were separated using Fisher's Least-square Difference Test.

Results and discussion

Table 2 shows the results of the effect of feeding varying levels of SNC on broiler chicken performance. Feed intake was significantly ($P < 0.05$) depressed when T₃ and T₄ were fed to the birds. However, birds fed T₂ consumed similar ($P < 0.05$) quantities of feed as their counterparts fed T₁. The observation agrees with the finding of Atuahene *et al.* (1998) who did not observe any significant difference in feed intake when SNC was incorporated at 2.5 per cent in broiler diet. Sumani (2001) also reported the same observation when the same level of SNC was fed to exotic guinea fowls. This was attributed to the low level of SNC in the diet. The depression in feed intake between T₁ and T₃ and T₄ could be attributed to the high concentration of antinutritional factors such as theobromine, tannins, and saponins (Cheeke, 1976). These antinutritional factors, particularly saponins, affect feed intake because they are unpalatable and also irritate the membranes of the mouth and digestive tract (Livingston *et al.*, 1977).

Weight gain was severely depressed ($P < 0.05$)

TABLE 1
Composition of Grower Diets (g kg⁻¹)

	T ₁	T ₂	T ₃	T ₄
Sheanut cake	-	25	35	45
Maize	600	575	565	555
Fish meal	160	157	155	154
Wheat bran	220	223	225	225
Oyster shell	10	10	10	10
Dicalcium phosphate	5	5	5	5
Vitamin-mineral premix ^a	25	25	25	25
Salt	25	25	25	25
Nutrient analysis ^b				
Crude protein	197.1	200.2	212.6	193.3
Ether extracts	28.0	23.3	20.4	30.0
Total carbohydrates	604.1	620.5	618.2	626.3
Ash	68.7	62.6	53.0	48.3
Calcium	14.5	10.5	9.5	10.0
Phosphorous	4.5	4.3	4.5	3.2
Gross energy (MJ kg ⁻¹)	14.9	14.7	14.7	15.3

^aA kilogramme of diet supplied: Vitamin A 10,000,000 IU, Vitamin D₃ 2,000,000 IU, Vitamin E 15,000 mg, Vitamin K₃ 2,000 mg, Vitamin B₁ 1,000 mg, Vitamin B₂ 5,000 mg, Vitamin B₆ 3,000 mg, Vitamin B₁₂ 10 mg, D-Ca Pantothenate 10,000 mg, Nicotinic acid 20,000 mcg, Folic acid 300 mcg, Biotin 29 mg, Choline chloride 200,000 mg, Iron 45,000 mg, Copper 2,000 mg, Manganese 60,000 mg, Cobalt 500 mg, Zinc 50,000 mg, Iodine 2,000 mg, Selenium 200 mg, BHT + Ethoxyquin 625 mg.

^bDetermined values expressed on "as fed" basis.

TABLE 2
Effects of Varying Levels of SNC on Growth Performance and Cost of Feeding Broiler Chickens

Parameter	Inclusion levels of SNC (%)				± SEM
	0	2.5	3.5	4.5	
Mean initial live weight (g bird ⁻¹)	668.0	668.0	668.0	668.0	-
Mean final live weight (g bird ⁻¹)	1756.4 ^a	1693.5 ^{ab}	1656.9 ^b	1397.8 ^c	95.15*
Mean weight gain (g bird ⁻¹ day ⁻¹)	40.5 ^a	38.2 ^{ab}	36.9 ^b	27.7 ^c	3.37*
Mean feed intake (g bird ⁻¹ day ⁻¹)	116.3 ^a	112.9 ^{ab}	108.2 ^b	98.2 ^c	5.22*
Feed/Gain (g g ⁻¹)	2.9 ^a	3.0 ^a	2.9 ^a	3.6 ^b	0.30*
Hb (g dl ⁻¹)	6.9 ^a	7.6 ^b	7.3 ^c	7.7 ^b	0.12*
PCV (%)	28.2 ^a	28.8 ^b	29.5 ^c	29.5 ^c	0.37*
Mortality (%)	0.121	0.1	0.1	0.1	-
Mean feed cost (¢ bird ⁻¹ day ⁻¹)	7.1 ^a	205.6 ^b	193.0 ^c	175.4 ^d	4.83*
Mean feed cost kg ⁻¹ gain (¢ bird ⁻¹)	5,585.08 ^a	5,612.87 ^a	5,464.66 ^a	6,729.51 ^b	64.06*

Means bearing same letters (a,b,c,) on rows are not significantly different *(P>0.05)

SEM – standard errors of mean

when inclusion levels of SNC exceeded 2.5 per cent in the diet (Table 2). Atuahene *et al.* (1998) and Sumani (2001) had similar results in broiler chickens and exotic guinea fowls when SNC was fed in their diets. The observed differences in weight gain when SNC was fed beyond 2.5 per cent could be attributed to the influence of saponins, which might have acted as a bonding agent with protein, thereby reducing protein digestibility (Livingston *et al.*, 1977; Liener, 1990) and inhibiting growth.

When T₂ was fed to the birds, no significant difference ($P>0.05$) was observed in feed conversion (feed/gain) compared with that of birds on T₁, but those of birds on T₃ and T₄ were depressed ($P<0.05$). This observation again agrees with those of Atuahene *et al.* (1998) and Sumani (2001) who attributed the depression in feed use to the influence of saponins, which might have reduced nutrient digestibility (Liener, 1990) when in high concentration in the diet.

Mortality recorded was unrelated to the inclusion of SNC in the diet. Post-mortem examination showed that birds died as a result of coccidiosis. It was generally observed that at low levels of SNC in diets of monogastric animals (poultry and pigs), no health-related problems were observed (Okai, 1998).

The SNC diets had higher ($P<0.05$) Hb and PCV values than the control. Although Godwin & Mercer (1972) reported that saponins (which are surfactants) when in low concentrations in diets, could cause haemolysis of the red blood cells, this study did not show any evidence of haemolysis. A clear reason was lacking for the increase in these parameters in the SNC diets. Probably, the levels of saponins in the experimental diets were quite low. Evidence suggests that saponins in low concentrations can improve nutrient use.

The cost of feeding broiler chickens when SNC was incorporated at varying levels in their diets indicated a significant difference ($P<0.05$) between the control and all the diets containing SNC. The cost of feeding decreased with

increasing inclusion levels of SNC. This confirms the findings of Poku (1987), Okai & Bonsi (1989), and Sumani (2001) who reported a decrease in feed cost when SNC was fed to monogastric animals. The cost of feeding monogastric animals is often reduced whenever unconventional local feedstuffs are used (Okai, 1998). This was partly due to virtually low or no cost of SNC. However, Table 2 shows that feed cost per kilogramme live weight gain of the bird was significantly ($P<0.05$) increased when SNC was used beyond 3.5 per cent in the diet. This could be attributed to the poor feed conversion efficiency of the diet in which the concentration of SNC was high.

Conclusion

The study has shown that sheanut cake can be incorporated into rations for growing broiler chickens at a concentration of 2.5 per cent without any adverse effect on their performance. Besides, the use of sheanut cake in the diet has the potential of reducing the cost of feeding broiler chickens. Therefore, feed processors should look at the feasibility of incorporating it into broiler grower diet. However, the need is to further assess the usefulness of sheanut cake through processing to reduce the concentration of the antinutritional factors present.

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