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Agriculture

Sheanut Cake As A Substitute For Maize In The Diet Of Growing Gilts

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ABSTRACT

The effects of diets containing 0, 5, 10 and 15% sheanut cake (SNC) fed *ad libitum* to 20 growing gilts during a 10 week feeding trial were studied. Growth and reproductive performances were observed after the withdrawal of SNC from the diets over a period of 22 weeks and one parity respectively.

The inclusion of SNC significantly ($P<0.05$)depressed growth rate and feed conversion efficiency but not feed intake. However, feed cost (cedis/kg) reduced with increasing levels of SNC. The post withdrawal growth and reproductive performances for all the pigs were not significant different ($P>0.05$).

Keywords: sheanut cake, maize, gilts, growth, reproduction.

INTRODUCTION

The sheabutter tree(*Butyrospermum paradoxum*: *Gaertn. F*) grows wild in the savanna zones of Africa. In Ghana,sheabutter trees are widely distributed in the Northern Savanna Zone and even though there are very few large plantations, large quantities of sheanuts (seeds) are harvested annually and processed locally or exported. 40,000t of sheanuts were exported to the U.K., Japan and the Netherlands during the 1985/86 season (Anonymous, 2) but total production of sheanuts is likely to be about 100,000t.

The fat obtained by local processing may be used for cooking, lighting, soap manufacture and also as a medical ointment, hair and body cream.

The residual cake, after removing the 45-55% fat in the seed, is known as sheanut cake (SNC). This product has virtually been regarded as a waste material in Ghana and with the onset of factory-scale processing it is quite likely that large quantities would become available. Chemical analysis of batches of locally-produced SNC at the Nutrition Laboratory, U.S.T., has shown that it contains 20% CP, 12% EE, 4.8% Ash, 0.9% CF and 54.5% Carbohydrates; it could therefore be a good replacement for feed ingredients that are in high demand for human consumption such as maize and fishmeal.

However Morgan and Trinder [1] and Gohl [2] had reported that SNC was unpalatable, could irritate the digestive tracts of animals and could be particularly toxic to pigs. These effects were attributed to the presence of tannins and saponins in SNC. There is very little information about the levels of inclusion at which these effects would occur or about the performance of pigs after SNC has been withdrawn from diets. The objective of this experiment was to determine the effects of feeding diets containing varying levels of SNC on the performance of growing gilts. The post-withdrawal growth and reproductive performance of the gilts were also monitored.

MATERIALS AND METHODS

In Experiment 1 the effect on growth performance of feeding SNC-containing diets to growing pigs was studied. Experiment 2, which had 2 phases; I and II lasting 12 and 10 weeks respectively was designed to monitor the post-withdrawal growth and reproductive performance of pigs fed previously on SNC-containing diets.

Experiment 1

Samples of factory-produced sheanut cake were obtained from West African Mills Ltd., Takoradi, Ghana. Four diets containing 0, (T_0), 5(T_5), 10(T_{10}) and 15% (T_{15}) SNC were formulated to have about 20% CP. All the diets contained maize, fishmeal, wheatbran and micro-ingredients (Table 1) and the levels of SNC specified were included at the expense of maize.

A total of twenty young Large White gilts, balanced for age, weight and litter origin were alloted to the 4 diets using the completely randomised design (CRD). They were housed in individual (163 x 63cm) concrete-floored pens in a well-ventilated growing barn. Both feed and water were made available to the pigs ad libitum and on an individual basis.

TABLE 1: PERCENTAGE COMPOSITION OF DIETS FED DURING EXPERIMENT 1

	Dietary Treatments			
Ingredient	0% SNC	5% SNC	10% SNC	15% SNC
Maize	67.5	62.5	57.5	52.5
SNC	-	5	10	15
Fishmeal	19	19	19	19
Wheat bran	11.8	11.8	11.8	11.8
Dicalcium phosphate	0.5	0.5	0.5	0.5
Oyster Shell	0.5	0.5	0.5	0.5
Vitamin & Tracemineral premix*	0.2	0.2	0.2	0.2
Common Salt	0.5	0.5	0.5	0.5
Analysed Composition %				
Dry Matter	90.2	90.2	90.1	90.0
Crude Protein	20.0	20.1	20.4	20.7
Crude Fibre	3.4	3.5	3.9	4.1
Ether Extract	4.8	5.7	5.9	6.3
Ash	7.5	7.6	7.9	8.0

* Vitamin Trace-mineral premix provided the following/kg of diet:

Vitamin A: 12,000 iu; Vitamin D_3: 2,000 iu; Vitamin E: iu: Vitamin K; .002mg; Vitamin B1: .002 mg; Vitamin B2: .0045 mg: Vitamin B6: .004mg; Vitamin B12: .01mcg; Pantothenic acid: .012mg Nicotinic acid: .003mg; Folic acid; .001mg; Biotin: .015mcg; Manganese; .06mg: Iodine, .001mg; Zinc: .05mg; Iron: .025 mg; Copper: .005mg: Selenium: .001mg; and Antioxidant (BHT) .1mg

During the 10-week growth trial, weekly feed intake and live weight changes were recorded and from these average daily feed intake, weight gain and feed conversion efficiency were calculated. At the end of this period all the 18 surviving gilts (5,5,5, and 3 from treatments T_0, T_0, T_{10}, and T_{15} respectively) were kept for the second experiment.

Experiment 2

The gilts from each treatment were group-fed during this experiment. During phase I (12 weeks), gilts were allowed 5% of their mean weekly liveweight as feed and in phase II (10 weeks), this was reduced to 3% to minimise fat deposition. The composition of the common SNC-free diet fed during these two phases is shown in Table 2. There was ad libitum access to water. Liveweight changes were again recorded weekly throughout the experiment and gilts were served at the second estrus by a Large White boar. Pregnant gilts remained in their original groups and continued to be group-fed until 10 days prepartum when they were moved into pens in the farrowing house.

TABLE 2: PERCENTAGE COMPOSITION OF COMMON DIET FED IN THE POST-WITHDRAWAL PERIOD (EXPT. 2)

Ingredient	%
Maize	60
Fishmeal	8
Wheat bran	30.4
Dicalcium phosphate	0.5
Oyster shell	0.5
Common salt	0.5
Vitamin Trace-Mineal Premix*	0.1
	100
Analysed Crude protein, %	16.0

* Composition is as shown in Table 1

At parturition, the total number of pigs born alive and individual birth weight were recorded. Sows were fed ad libitum postpartum and routine management practices such as iron administration were undertaken. Pigs were weaned at 5 weeks of age and at weaning, number weaned and individual weaning weights were recorded for each litter.

Feed samples were analysed using standard laboratory procedures(AOAC,3) Data collected were subjected to analysis of variance [3] and comparisons among treatment means were made by the Duncan's Multiple Range Test where necessary. Coefficients of orthogonal polynomials were used to determine the response curves due to treatments by partitioning the treatment sum of squares into linear, quadratic and cubic components in experiment 2. Regression coefficients (b) were calculated where necessary.

RESULTS AND DISCUSSION

Experiment 1

Pigs fed with the 15% SNC diet had the lowest growth rate, the value obtained was significantly ($P<0.05$) different from the others (Table 3). Feeding of SNC-containing diets had a significant ($P<0.05$) linear effect ie. a reduction of one per cent in gain for every one per cent increase in SNC level in the diet. There was however no significant quadratic effect. The poorer growth rate could be attributable to the lower feed intake and the effect of tannins since the adverse effects of this anti-nutritional factor on growth performance and diet digestibility has been clearly established.

Daily feed intake decreased slightly ($P>0.05$) as the level of SNC in the diet increased. Feed intake had a significant linear effect. The linear coefficient of regression value (Table 3) confirms that there was a 2% decline in feed intake as the level of SNC incorporation increased by 1%. It has been reported that SNC has a bitter, astrigent taste [5,6] and even though lack of facilities did not permit the determination of the levels of anti-nutritional factors such as tannins

TABLE 3: GROWTH PERFORMANCE OF GILTS FED VARYING LEVELS OF SNC

	Dietary Treatments					
Parameter	0% SNC	5% SNC	10% SNC	15% SNC	Sign ∅	b+
No of Pigs	5	5	5	3	-	-
Initial wt. (kg)	15.26	15.01	15.24	16.21	NS	-
Final wt. (kg)	50.90^a	44.90^b	48.10^a	37.50^b	*	
Feed Intake (kg/pig/day)	1.70	1.53	1.64	1.41	NS	-0.02
Wt. Gain (kg/pig/day)	0.57^a	0.48^a	0.50^a	0.35^b	*	-0.01
Gain:Feed	0.33^a	0.31^b	0.30^{bc}	0.25^c	*	-0.01
Feed Cost (cedis/kg)	23.55	22.46	21.38	20.20	-	
Cost of gain (cedis/kg gain)	70.41	71.65	70.13	81.77	-	-

+ = Coefficient of regression (Linear effect at 5%)

* = Significant at 5%

abc= means in a row bearing different superscripts differ (P<0.05)

∅ = Significance

NS = not significance at 5%

and saponins in the SNC used here, the review of Cheeke [7] had indicated that other feed or feed materials containing saponins had led to depression in feed intake.

It was also suggested that the reduction in feed intake could be due to either an irritation of the digestive tract or adverse effects on rate of passage [7]. Feed conversion efficiency (Table 3) deteriorated as the level of SNC in the diet increased from 0 to 15% (P<0.05). The value obtained were however neither linear nor quadratic.

Two gilts fed the diet containing 15% SNC died during the 7th week of the experiment. Postmortem examination indicated acute enteritis. SNC contains tannins and saponins [1,2]. Oakenfull[8] noted that even though saponins would usually be retained in the digestive tract gastrointestinal lesions could occur in severe cases of poisoning, leading to the entry of saponins into the blood stream. Liver damage, red blood corpuscle hemolysis, respiratory failure, convulsions and coma have been reported in such situations [9]. Dietary SNC levels hic than 25% have been suggested to be 1 to pigs[1]; even though the age or weight of pigs studied was not specifi by these authors in view of the 40% mortality observed with the 15% SNC diet, it is suggested that toxicity may occur below the 25% inclusion level.

Experiment 2

The growth performance of the pigs during this experiment is shown in Table 4. In phase I, there was a slight increase in the feed intake of the pigs which had been fed the highest amount of SNC in experiment I. This may be indicative of attempts to compensate for the earlier poor feed intake and growth rate. The values obtained for the final weight, feed intake, weight, weight gain and FCE were similar (P>0.05). In the

TABLE 4: PERFORMANCE OF THE GILTS DURING PHASE I AND II OF THE POST-WITHDRAWAL PERIOD (EXPERIMENT 2)

Phase and Parameter	Previous Dietary Treatments				
Phase I (12 weeks)	0% SNC	5% SNC	10% SNC	15% SNC	Sign
Initial wt. (kg)	50.9[a]	44.9[ab]	48.1[a]	37.5[b]	*
Final wt. (kg)	102.4	94.8	102.3	94.8	NS
Feed intake (kg/pig/day)	3.24	3.10	3.19	3.58	—
Wt. gain (kg/pig/day)	0.61	0.59	0.65	0.68	NS
Gain: Feed	0.19	0.19	0.20	0.19	NS
Phase II (10 weeks)					
Initial wt. (kg)	102.4	94.8	102.3	94.8	NS
Final wt. (kg)	131.8	130.4	132.5	128.0	NS
Feed intake (kg/pig/day)	3.30	2.96	2.89	2.96	—
Wt. gain (kg/pig/day)	0.42	0.51	0.43	0.48	NS
Gain: Feed	0.13	0.17	0.15	0.16	NS

* Means in a row bearing different superscripts differ significantly ($P<0.05$)

TABLE 5: REPRODUCTIVE PERFORMANCE OF GILTS

Parameter	Previous Dietary Treatments				
	0% SNC	5% SNC	10% SNC	15% SNC	Sign
No of gilts	4	4	4	3	-
No born	8.3	7.3	10.0	7.3	NS
No born alive	8.0	6.3	9.7	6.7	NS
Birth wt. (kg)	1.18	1.15	1.15	1.12	NS
Weaning wt. (kg)	6.7	5.6	6.3	6.3	NS
No weaned	7.0	6.3	8.0	6.0	NS

NS = Not significant at 5% level of probability second-phase this trend continued with pigs fed the SNC-containing diets growing slightly faster and more efficiently (Table 4). Consequently, at the end phase II and at the time of mating all gilts had similar (P>0.05) liveweights.

Eifteen out of the 18 gilts completed the first reproductive cycle, whilst one gilt each from the 0, 5 and 10% SNC treatments were culled for a variety of reasons including anatomical abnormalities that became evident during this experiment. The data for reproductive performance is shown in Table 5. No consistent trend that could possibly have been attributed to previous feeding practices were observed in number born and number born alive. The authors are not aware of any corroborative evidence on these parameters in the literature on pigs fed SNC-containing diets during early growth.

CONCLUSION

In Ghana, SNC is currently regarded as a waste product and it therefore has no market value. Its inclusion in the diet at the expense of maize which is a major food and feed ingredient led to reduction in feed cost. However, because of the very poor growth performance of pigs fed the 15% SNC-containing diet during experiment 1, its inclusion led to a conspicuously higher cost of gain (Table 3). The experiment has however shown that it is possible for pigs to achieve good growth performance after a period of poor growth due to the feeding of a diet that may have contained anti-nutritional factors. Reproductive performance was also not significantly (P>0.05) affected.

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