PHASE FEEDING OF PIGS USING OBATANPA – A QUALITY PROTEIN MAIZE

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ABSTRACT

A total of 20 starter pigs with a mean initial weight of 8.7kg and housed in individual welded mesh cages were randomly allotted to four dietary treatments (i.e. CONTROL, OBAT-I, OBAT-II and OBAT-III), on the basis of litter origin, sex and weight. There were five replications per treatment. Pigs assigned to a particular treatment were fed a starter diet, then switched on to a grower diet and finally to a finisher diet. The starter, grower and finisher phases were terminated when the individual pigs attained liveweights of 20 ± 0.5, 50 ± 0.5 and 70 ± 0.5kg respectively. The starter diets contained either 71% normal maize (Control) or Obatanpa and the level of fishmeal was gradually decreased from 18% (Control) to 12% (OBAT-III). The level of either normal maize or Obatanpa was reduced to 65% and the fishmeal content ranged from 9 (Control) to 6% (OBAT-III) in the grower diets. In the finisher diets, the level of normal maize or Obatanpa was reduced to 57% with a further decrease in the fishmeal content from 4 (Control) to 1% (OBAT-III). There was a progressive decline in dietary crude protein and lysine content from the starter to the finisher phase of growth. Feed and water were provided ad libitum throughout the experiment. The values for feed intake, feed conversion efficiency and daily weight gain in each phase and for the overall period were not significantly (P>0.05) different for the dietary treatments. Carcass traits were also not different (P>0.05). Feed cost (cedis/kg) and feed cost/kg liveweight gains were lower in the Obatanpa- containing diets due to the fact that they contained less fishmeal.

Keywords: *Phase Feeding, Obatanpa, Quality Protein Maize.*

INTRODUCTION

Maize is a common energy source in pig diets in Ghana and elsewhere and the pig has an excellent ability to digest and utilise the nutrients in it including the starch component. It cannot however, be the sole source of protein for swine because of its relatively low protein content and low levels of essential amino acids, especially lysine and tryptophan [1]. For adequate pig performance, high-protein feedstuffs such as fishmeal, soyabean meal or synthetic amino acids must be added to maize. Fishmeal, the most common protein source, tends to be scarce at certain times of the year and may have to be imported with the limited foreign exchange available. Furthermore, the locally available fishmeal, which is made from anchovy (popularly called "Keta School Boys"), is also a major source of protein in human diets in Ghana [2]. The resulting competition between man and certain species of livestock such as poultry and pigs has been partly responsible for the high prices of feed. Feed cost has been estimated to be about 70 to 75% of the total cost of pig production [3]. A reduction in feeding cost should therefore be the ntmost concern of both nutritionists and animal producers, since it would ultimately ensure the availability of cheaper meat and meat products.

In this respect, the availability of Quality Protein Maize (QPM) is, perhaps of economic significance to pig and poultry producers. Quality Protein Maize is a maize variety that contains a similar amount of crude protein but has more lysine and tryptophan than normal maize [1, 4, 6]. Its use in the diets of pigs and poultry could reduce the need for fishmeal and other protein supplements [5].

In a rather short term feeding trial, it was observed that in diets where the sole source of protein was from maize, weanling pigs performed better on Obatanpa, a locally developed variety of QPM than on a normal maize diet [5]. This finding was confirmed in a subsequent experiment [6]. In a follow-up experiment where either the normal maize or the Obatanpa was part of a complete but single diet fed to pigs from 14 to 70kg liveweight, it was found that in the Obatanpa – based diets the level of fishmeal can be reduced by between 2 to 4 percentage units without any adverse effects on pig performance and carcass characteristics. Furthermore such Obatanpa containing diets were cheaper to formulate and feed [7]. In the experiment under reference [7], one of each of the 3 diets was fed throughout the starter, grower and finisher periods.

In view of the fact that the protein/or amino acid and indeed all other nutrient requirements of pigs vary depending on the stage of growth [8], a study was undertaken to determine the response of pigs to normal maize or Obatanpa-based diets formulated to meet the starter, grower, and finisher pigs' crude protein and/or lysine requirements. The response criteria studied were the growth performance at all the 3 phases and carcass characteristics at slaughter (70kg) as well as feed cost and economy of gain of the starter-finisher pigs.

MATERIAL AND METHODS

Twenty Large White starter pigs with a mean weight of 8.7kg were randomly allotted to four dietary treatments on the basis of sex, litter origin and weight. There were five replications for each treatment and each treatment consisted of 2 males and 3 females. The males were castrated when each pig attained a liveweight of 20 ± 0.5kg. Housing for the individual pigs consisted of 160x 65x102cm welded mesh, concrete-floored cages. Feed and water troughs were provided in each cage. The compositions of the diets, which were formulated on "as-fed" basis, are shown in Table 1. Pigs were fed diets containing either 71% normal maize or Obatanpa at the starter phase with the level of fishmeal gradually decreasing from 18 (Control) to 12% (OBAT-III). In the grower phase (20-50 ± 0.5kg), the level of maize was reduced to 65% and fishmeal content ranged from 9 to 6%. The level of maize was again reduced to 57% and the fishmeal content ranged from 4 to 1% in the finisher (50-70 ± 0.5kg) phase. There was therefore progressive decline in dietary crude protein from the starter to the finisher phase. Feed and water were provided ad libitum. All pigs were weighed at weekly intervals and pigs that attained liveweight of 20 ± 0.5kg were switched first onto the grower diet then finally to a finisher diet when the liveweight of 50 ± 0.5kg was attained. Pigs were slaughtered at 70 ± 0.5kg. Weekly feed intakes, liveweight changes and carcass parameters such as dressing percentage, carcass length, mean backfat thickness, loin eye area and the weights of primal cuts were recorded.

Samples of the various diets were chemically analysed using analytical methods described by AOAC [9] and all the data collected were analysed by the analysis of variance technique [10].

RESULTS AND DISCUSSION

Growth Performance

The chemical compositions of the 4 diets fed during each of the 3 phases are shown in Table 1. With regard to the protein content it was observed that the analysed composition of the diets did not differ considerably from the calculated values. The calculated lysine levels tended to decrease as the crude protein levels decreased. However, the values were similar to the requirements reported in the literature [8] for the various phases of growth.

The mean daily feed intakes for pigs fed the various diets are shown in Table 2. The values within any particular phase were not significantly different (P>0.05) even though numerical differences were observed. A major factor influencing feed intake in pigs is the energy content of the diet [11, 12]. The similarities in intake suggest that the energy contents of the diets were similar. The average daily weight gain (ADG) values for the three phases are also shown in Table 2. The ADG (kg/day) values for the starter phase were 0.530, 0.481, 0.467 and 0.520 for the pigs fed the Control, OBAT-I, OBAT-II and OBAT-III diets respectively while the corresponding

Table 1: Percentage Composition of Diets

Phase	Starter				Grower				Finisher			
Diets	Control	Obat - I	Obat -II	Obat-III	Control	Obat -I	Obat -II	Obat-III	Control	Obat -I	Obat -II	Obat -III
Ingredients (%)												
Normal Maize (Okomasa)	71	-		-	65	-	-	-	57	-	-	-
Obatanpa	-	71	71	71	-	65	65	65	-	57	57	57
Wheatbran	10.55	12.3	14	16	25	26	26.8	27.8	37.8	38.8	39.8	40.55
Fishmeal	18	16	14	12	9	8	7	6	4	3	2	1
Oyster Shell	-	0.25	0.55	0.55	0.55	0.55	0.75	0.75	0.75	0.75	0.75	1
Salt	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Premix*	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100	100	100	100	100	100	100	100
Calculated Composition (%)												
Crude Protein	20.5	19.5	18.4	17.5	16.4	15.9	15.4	15	14.4	13.9	13.4	13
Lysine	1.19	1.2	1.1	1.01	0.78	0.83	0.78	0.73	0.57	0.61	0.56	0.51
Calcium	0.85	0.86	0.88	0.80	0.68	0.63	0.67	0.62	0.54	0.50	0.46	0.51
Phosphorus	0.83	0.79	0.76	0.72	0.72	0.71	0.69	0.67	0.71	0.69	0.66	0.66
Crude Fibre	3.97	4.14	4.31	4.51	5.25	5.35	5.43	5.53	6.31	6.41	6.51	6.58
Gross Energy Mj/Kg	3.32	3.31	3.29	3.28	3.2	3.19	3.18	3.18	3.08	3.08	3.07	3.06
Analysed Composition (%)												
Dry Matter	88.1	86.7	86.6	86.8	86.9	87.5	87.5	87.3	87.7	88	88.1	88
Crude Protein (As- fed)	20.1	19.8	18.9	18.1	16.95	15.69	15.37	15.2	15.35	14.4	14.27	13.38
Crude Protein (DM)	23.4	22.8	21.6	20.8	19.51	17.93	17.57	17.41	17.50	16.4	16.2	15.2

*PREMIX: Inclusion rate is 2.5kg/tonne to supply the following per tonne of feed: Vit.A, 10,000,000 IU; Vit.E, 4,000mg; Vit.B_1, 500mg; Nicotinic acid, 8,000mg; VitB6, 1,000mg; Vit.D3, 3,000,000 IU; Vit.K3, 2,000mg; Vit.B2, 3,000mg; Pantothenic acid, 3,260mg; Vit. B12, 3000mcg; Iron, 10,000mg. Copper, 3,000mg; Iodine, 500mg; Zincbacitracin, 5,000mg; Manganese, 40,000mg; Zinc, 30,000mg; Selenium, 100mg.

values for the grower phase were 0.634, 0.684, 0.609 and 0.642kg. In the finisher phase the ADG values were 0.507, 0.492, 0.509 and 0.554kg/day for the Control, OBAT-I, OBAT-II and OBAT-III diets respectively. Again, there were no significant differences (P>0.05) between the observed means for any of the phases.

Reports from Canada [13] and Nigeria [14, 15] have indicated that increasing the dietary protein level may lead to higher growth rate. The trend observed here suggests that the levels of crude protein and lysine in all the diets at each of the phases met the requirement for optimum growth. Clearly the values for the grower phase were numerically higher than those for the starter and finisher phases and indicate that the grower pigs grew at a faster rate than the starter and the finisher pigs.

The efficiency of feed conversion values were not significantly (P>0.05) influenced by the various dietary treatments at any of the 3 phases of growth (Table 2). Burgoon et al., [1] had also not observed any significant

Table 2: Performance of pigs on the 4 Dietary Treatments

Item	Dietary Treatments				Se*	S*
	Control	Obat-I	Obat-II	Obat-III		
Starter Phase (8-20 ± 0.5kg)						
No. of Pig	5	5	5	5		NS
Mean Initial wt. (kg)	8.76	8.70	8.76	8.78	560	NS
Mean Final wt. (kg)	21.3	21.2	20.3	21.1	449	NS
Mean DFI (kg/day)	1.16	1.10	1.11	1.23	049	NS
ADG (kg/day)	0.530	0.481	0.467	0.520	025	NS
Mean FCE (feed/gain)	2.20	2.31	2.38	2.36	074	NS
Mean Duration (days)	23.8	26.6	25.2	23.8	2.270	NS
Feed cost/kg (¢)	862.96	820.79	778.50	736.90	-	-
Feed cost/kg gain (¢)	1898.51	1896.02	1852.83	1739.08	-	-
Grower Phase (20-50 ± 0.5kg)						
Mean Initial wt. (kg)	21.3	21.2	20.3	21.1	449	NS
Mean Final wt. (kg	51.6	49.6	51.0	50.7	604	NS
Mean DFI (kg/day)	1.93	1.98	1.95	2.14	063	NS
ADG (kg/day)	0.634	0.680	0.609	0.642	029	NS
Mean FCE (feed/gain)	3.19	3.42	3.21	3.33	144	NS
Mean Duration (days)	49.0	49.0	50.4	46.2	2.475	NS
Feed cost/kg (¢)	661.30	640.50	619.24	598.44	-	-
Feed cost/kg gain (¢)	2109.55	2190.51	1987.76	1992.81	-	-
Finisher Phase (50-70 ± 0.5kg)						
Mean Initial wt. (kg)	51.6	49.6	51.0	50.7	604	NS
Mean Final wt. (kg	69.9	70.7	69.9	70.6	377	NS
Mean DFI (kg/day)	2.32	2.37	2.44	2.54	085	NS
ADG (kg/day)	0.507	0.492	0.509	0.554	034	NS
Mean FCE (feed/gain)	4.69	4.85	4.82	4.70	239	NS
Mean Duration (days)	37.8	43.4	37.6	36.4	3.500	NS
Feed cost/kg (¢)	539.24	518.44	497.64	476.26	-	-
Feed cost/kg gain (¢)	2529.04	2514.43	2398.62	2238.42	-	-
Overall (8.8-70 ± 0.5kg)						
Mean DFI (kg/day)	0.557	0.515	0.529	0.572	064	NS
ADG (kg/day	1.82	1.80	1.83	1.97	072	NS
Mean FCE (feed/gain)	3.36	3.53	3.47	3.46	163	NS
Mean Duration (days)	110.6	119.0	113.4	106.4	6.319	NS

DFI - Daily feed intake
ADG - Average daily weight gain
FCE - Feed conversion efficiency
+Se - Standard error
*S - Level of Significance
NS - Not significant at P>0.05

treatment difference when they compared a normal maize-based diet containing 0.99% dietary lysine with a QPM-based diet containing 1.05% lysine, but with less soybean meal. The earlier studies [5, 6, 7] had provided some useful information on the potential usefulness of Obatanpa and the results obtained here have confirmed this.

The feed cost and the feed cost/kg liveweight weight values were lowest in the finisher phase (Table 2) because of the corresponding decrease in the inclusion rate of fishmeal. The reductions in feed cost with the use of Obatanpa observed in this experiment have earlier been reported [7, 16]. It is worth mentioning that the overall performance data shown in Table 2 indicates that pigs on the Control, OBAT-I and OBAT-II diets took extra 4.2, 12.6 and 7 days respectively to reach the slaughter weight of 70±0.5kg.

Table 3: Carcass Characteristics of Pigs fed the 4 Diets

	Dietary Treatments				Se+*	S*
	Control	Obat-I	Obat-II	Obat-III		
No. of pig	5	5	5	5		
Mean liveweight at slaughter (kg)	69.9	70.7	69.9	70.6	.377	NS
Mean dressed wt. (kg)	49.7	49.7	49.8	49.5	.589	NS
Mean dressing percentage	71.1	70.2	71.3	70.1	.759	NS
Mean length of carcass (cm)	71.8	74.0	72.6	73.7	.575	NS
Mean wt. of shoulder (kg)	3.6	3.7	3.8	3.5	.110	NS
Mean wt. of loin (kg)	7.14	7.24	7.31	7.20	.343	NS
Mean wt. of belly (kg)	5.6	5.4	5.5	5.9	.165	NS
Mean wt. of ham (kg)	6.95	7.15	7.25	7.01	.145	NS
Mean loin eye muscle area (cm^2)	32.4	32.0	34.4	29.0	1.345	NS
Mean backfat thickness (cm)	2.88	2.59	2.84	2.89	.231	NS
Absolute values of some body components (kg)						
Mean wt. of head	4.82	4.98	4.49	4.60	.148	NS
Mean wt. viscera	9.44	9.77	9.31	10.06	.416	NS
Mean wt. GIT (full)	6.92	6.94	6.73	7.48	.394	NS
Mean wt. GIT (empty)	2.88	2.79	2.75	3.19	.135	NS
Mean wt of heart	0.22	0.22	0.21	0.23	.012	NS
Mean wt. of liver	1.11	1.17	1.06	1.22	.039	NS
Mean wt. of spleen	0.10	0.10	0.10	0.10	.010	NS
Relative weight (%) of some body components						
Head	6.90	7.04	6.42	6.52	.203	NS
Viscera	13.5	13.8	13.3	14.2	.566	NS
GIT (full)	9.90	9.81	9.63	10.58	.531	NS
GIT (empty)	4.12	3.95	3.93	4.52	.192	NS
Heart	0.32	0.31	0.30	0.33	.016	NS
Liver	1.59	1.66	1.52	1.73	.055	NS
Spleen	0.14	0.14	0.16	0.14	.008	NS

+Se - Standard error
S* - Significance
NS - Not significant at P> 0.05.

However, the differences in the means were not significant (P>0.05).

No significant differences (P>0.05) were observed in the carcass dressing percentages of pigs given access to the 4 dietary treatments (Table 3). This observation corroborates findings from some of the earlier studies [7]. The mean values for carcass length, backfat thickness, loin eye muscle area and primal cuts were not significantly (P>0.05) affected by the dietary treatments imposed. The non-significant differences observed may be the direct result of the similarities in growth rate.

CONCLUSION AND RECOMMENDATIONS

This phase feeding experiment has shown that with the use of Obatanpa in pigs diets, reductions in fishmeal inclusion levels of the order of 33% (starter), 33% (grower) and 75% (finisher) can be made without any significant (P>0.05) adverse effects on growth perfor-mance and carcass characteristics.

This led to reductions in feed costs and feed cost per kg gain. Future trials would attempt to find whether protein sources such as fishmeal can be completely eliminated from Obatanpa-based diets during the finishing period, when, inter alia, lysine and tryptophan requirements of pigs are at their lowest. It is further suggested that studies should be carried out to establish the usefulness of Obatanpa for pregnant and lactating sows and for creep feeding.

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