THE EFFECTS OF EXTRUDED CORNSOY AS PARTIAL REPLACEMENT FOR MAIZE AND GROUNDNUT MEAL IN WEANER-GROWER PIG RATIONS

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ABSTRACT

Two feeding trials were conducted using sixteen Landrace x Large White cross-bred pigs to determine the effect of feeding extruded corn-soyabean diets on performance and carcass traits in growing pigs. Extruded corn-soyabean meal was used to replace full fat soyabean at 0, 33.67 and 100% in a practical weaner and grower diets. Average feed intake was significantly ($P < 0.05$) increased by the addition of corn-soyabean to the diets. Average daily gain and feed/gain were also improved ($P < 0.05$) by Corn-soyabean diets. The use of extruded corn-soyabean meal had no significant effect on some retail cuts. However, certain carcass traits were affected ($P < 0.05$). Corn-soyabean diets improved warm dressing percentage but lowered percent lean cuts ($P < 0.05$).

Key Words: Cornsoy; Maize Gnc, Grower Pigs

INTRODUCTION

Extruded Corn Soyabean (ECS) generally referred to as Cornsoy or soyamaize is a 50:50 extruded mixture of maize and whole soyabean. In the United State of America, a mixture of 30:70 is commonly extruded as highly digestible energy source for nursery pigs (Weingartner, 1987). Soyabean has long been used to improve and complement the proteins of maize, rice, sorghum in human nutrition especially in the infant formulas. Cornsoy is a 30% protein concentrate and a good source of high energy because of its high oil content (18- 22%). The mixture used in this study was prepared at the International Institute of Tropical Agriculture (IITA), Ibadan. Recently, there has been increased demand for concentrate by farmers who desire to compound their own finished

feeds to enable them cut down on costs. Since there has been high success with Cornsoy in human nutrition and in pet diets especially in the United States where most breakfast Cereal, dog and cat foods are extruded products, it was felt that such mixes would be beneficial in livestock feeding.

Extrusion process improves the biological value of both maize and soyabean thereby making the nutrients more available to the animals. It also sterilized the product and as such improves the shelf life. The expression of the oil in the final product makes it attractive to farmers who might wish to blend it with root and tubercrop meal such as Cassava and Sweet potato. Extruded soyprotein - cassava root meal blend was shown to satisfactorily support performance and improved utilization of cassava root meal (Jorge Joao *et al*, 1980; Collins and Temalilwa 1981). It is against this background that this study was carried out to evaluate the effect of replacing maize and groundnut meal with cornsoy mix in diets for weaner and grower pigs.

MATERIALS AND METHODS:

Diets:

Extruded Cornsoy mix was prepared at the International Institute of Tropical Agriculture (IITA), Ibadan using Inta-pro extruder. the composition of experimental diets are presented in Tables 1A and 1B Graded levels of extruded cornsoy was added to the diets at the expense of groundnut meal and maize in the control diet.

Corn offal was adjusted to allow for a somewhat isonitrogenous and iso-caloric diets.

Animals:

A total of 16 large White x landrace weaner pigs (6 weeks old) was allocated to four experimental treatments on the basis of body weight. The initial average live weight of the

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pigs was 6.50kg. All the pigs were housed in concrete floored pens equipped with individual feeding units. The pigs were given feed and water ad libitum. The pigs were raised on weaner diets (Table 1A) until they attained 25kg body weight at which time they were re-allocated to four experimental treatments and were fed on grower diets. (Table 1B). They were maintained on these diets and finished at 60kg body weight. Records of weekly weight gain was taken while measurement of Carcass traits was carried out on the hot carcasses immediately after slaughter and removed of viscera and after chilling the left half of the carcasses at 0°C in the cold room for 24 hours.

Chemical and Statistical Analysis

All feed samples were subjected to proximate analysis according to the methods of the A.O. A.C. (1984) and also to gross energy determinations using adiabatic bomb calorimeter. All data were subjected to analysis of variance (ANOVA) by the methods of Steel and Torrie (1980) while Duncan's multiple range test (Duncan, 1955) was used to estimate difference between treatment means.

RESULTS:

WEANERS:

Proximate composition of diets used in this study are presented in Table 2. the performance data of the weaner pigs are presented in Table 3. The results include average daily gain (ADG), average daily feed intake (ADFI) and feed per gain ratio (F:G). Average daily feed intake and average daily gain were significantly affected ($P < 0.05$) by the addition of Cornsoy to the diets. The trend of results showed an increase ($P < 0.05$) in ADFI. Diet 4 having full substitution of GNM significantly improved ($P < 0.05$) feed intake over the control diet. Average daily gain were 0.19, 0.22, 0.23, and 0.31kg for diets 1, 2, 3, and 4 respectively. Diet 4 significantly improved ADG ($P < 0.05$) while the other levels of Cornsoy diet showed slight improvement over the control diet. Feed: gain ratio was not significantly affected by the level of Cornsoy in the diets but diet 4, was the most

significantly utilised by weaner pigs followed by corn-groundnut meal diet. Feed: gain ratio were 2.29, 2.41, 2.42 and 2.19kg diet per kg weight gain.

GROWERS:

The performance data are presented in Table 4. Average daily feed intake and feed: gain ratio were significantly influenced ($P < 0.05$) by the use of Cornsoy in the diets. ADFI was significantly improved ($P < 0.05$) in diet 2, but other diets (3 and 4) were neither different to the control nor diet 2. However, ADG was depressed in diet 2. Diets 1 and 4 supported faster but non significant growth rate. Feed: gain ratio was significantly affected by the use of diet 2 ($P < 0.05$) while other levels of Cornsoy diets were similar. Feed: gain ratio were 2.61, 3.49, 2.22 and 2.46kg diet per kg weight gain.

CARCASS CHARACTERISTIC:

Carcass measurements are presented in Table 5. The results of most of these measurements showed no significant difference between diets. The trend for most parts indicated increased in yield as the level of cornsoy increased in the diets. This is particularly true for the estimated percent fat cuts. However, backfat deposition was the same for all levels of Cornsoy diet and were not significantly different ($P > 0.05$) Warm dressing percentage was significantly affected by the addition of Cornsoy to the diets, ($P < 0.05$). Diets 3 and 4 were higher ($P < 0.05$) than Diets 1 and 2. Percent lean cuts were significantly decreased ($P < 0.05$) in diet 4. This is to say that diets 1, 2, 3, supported ($P < 0.05$) lean tissue development. Carcass length was not significantly affected by the level of cornsoy but the trend showed to decrease due to the use of diets 3 and 4.

DISCUSSION:

This study was conducted to determine the comparative benefit of using extruded Corn-Soyabean mix (Cornsoy) as a plant protein concentrate in practical swine diet as against groundnut meal which has hitherto been the conventional protein supplement in poultry and

livestock feeds. Cornsoy diet was shown to support healthy feed intake, Commensurate growth rate and efficient feed utilization. Performance characteristics were significantly improved ($P < 0.05$) by the use of cornsoy. This is due to improved digestibility and availability of nutrients in the cooked maize and soyabeans.

The results showed that the use of cornsoy will significantly improved feed intake and growth rate. This is in line with the findings of Nesheim and Garlich (1966); Cooke *et al*, (1972); Fetuga *et al*, (1975.) They suggested that performance, efficiency of gain and carcass quality are closely related to the intake level of nutrients especially protein and energy. Extruded products such as full fat soyabeans have been shown to be of good quality since extrusion cooking increase bio-availability of its nutrients (Sell, 1984; Thomason 1986; Wiseman, 1986; Yao *et al*, 1981).

Significantly higher ($P < 0.05$) yield of carcass was produced with cornsoy diets. Warm dressing percentage was significantly improved ($P < 0.05$). In diets 3 and diet 4. However, excellent lean cut was produced on the control diet at the expense of fat cuts. Estimated loin eye area was not significantly affected by dietary treatment but all levels of Cornsoy diets tended to lower loin eye area. This may be explained by the gross imbalance of amino acids especially the deficiency of methionine (Table 1A & 1B). Amino Acid imbalance has been shown to have direct effect on tissue deposition and carcass yield (Chuba *et al*, 1985).

Table 1A and 1B show the levels of Lysine and Methionine in the experimental diets. They indicated deficiency of the two most limiting amino acids, lysine and methionine. Extruded cornsoy should however be strongly considered by feed millers in concentrate composition.

REFERENCES

- A.O.A.C. (1984) Official methods of Analysis (14th ed) Association of Official analytical Chemists (AOAC) Washington. D.C.
- CHUBA, L.I; J.R. PEO, A.J. LEWIS M.C. BRUM. R. D. FRITSCHER and J.D. CRENSHAW (1985) Effect of dietary fat on pig performance and dust level. *J. Anim Sci.*, 61:763 - 766
- COLLINS, J.L. and C.R. TEMALILWA (1981) Cassava flour fortification with soy flour. *J. Food Sci.*, 1025 - 1028
- COOKE, R.G;A. LODGE and D. LEWIS (1972) Influence of energy and protein concentrations in the diets on the performance of growing pigs. *Anim. Food.*, 14: 35 - 46
- DUNCAN, D.B. (1955) Multiple range and F - test biometrics 11: 1- 42
- FETUGA, B.L., G.M. BABATUNDE AND V.A. OYENUGA (1975) Protein levels in diets for European pigs in the tropics. 1 the effect of methionine supplementation on the protein requirement of growing pigs *Anim. Prod.* 20: 133 - 146
- JORGE JOAO, W.S.L.G. ELIAS and R. BRESSANI (1980) Effect of extrusion cooking on nutrient availability of Cassava-Cowpea mix for chicks *Arch. Lat. Ames. Nutr.*, 30: 539-550
- NESHEIM, M.C. and J.D. GARLICH (1966). Digestibility of unheated soyabean meal for hens, *J. Nutr.* 38: 187 - 191.
- SELL, J.L. (1984) Use of extruded whole soyabean in poultry diets. Iowa State University Poult. Newsletter Jan, pp 3-5
- STEEL, R.G. and J.H. Torrie (1980) Principles and procedures of statistics. A Biometrical Approach (2nd ed). McGraw Hill Book Co., N.Y.
- THOMASON, D.M. (1986) Whole soyabeans in Poultry diets *Tech Report American Soyabean Association (ASA) St. louis, Missouri*
- WEINGARTNER, K. (1987) Processing, Nutrition and utilization of soyabeans. In: soyabean for the tropics; research, production and utilization. S.R. Singh, K.O. Rachie, K.E. Dashill (eds.) John Wiley and Son Ltd., N.Y.
- WISEMAN, J. (1986) In : recent advances in Animal nutrition. W. Hoesign and D.J. Cole (eds.), London, Butterworths.
- YAO, J.J; S.L. WEI and M.P. STEINBERG (1981) Chemical Composition of Soyabean *J. Amer. oil Chem. Soc.* 60: 1245 - 1251

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Table 1A: COMPOSITION OF PIG WEANER DIETS

INGREDIENTS	DIETS			
	1A	2A	3A	4A
MAIZE	64.00	56.00	48.00	35.00
MAIZE OFFAL	5.00	7.00	10.00	16.00
FISH MEAL	5.00	5.00	5.00	5.00
GROUNDNUT MEAL	23.00	15.75	7.75	-
EXTRUDED CORNSOY	-	13.75	26.75	41.50
BONE MEAL	1.25	1.25	1.25	1.25
OYSTER SHELL	0.75	0.75	0.75	0.75
SALT	0.25	0.25	0.25	0.25
PREMIX ¹	0.25	0.25	0.25	0.25
TOTAL	100.00	100.00	100.00	100.00
CALC. C.P.(%)	20.72	20.89	20.75	21.12
CALC. M.E. (Kcal/g/G)	3.08	3.06	3.08	3.07
CALC. METHONINE (g/kg)	7.50	8.47	9.22	10.15
(g/kg)	3.60	3.29	3.28	3.27
RECOMMENDED METHIONINE ²	5.60	6g/kg diet		

- 1 Premix supplied the following nutrients/kg of rations; Vit A., 11, 785 I.U Vit D., 1944.3 I.U. Riboflavin, 5.4mg; pantothenic acid 9.82mg; Nicotinic acid 24.55mg; Folic acid 0.98mg; Chloride 4×10^5 mg; Vit E, 4.91I.U; Vitk2. 20mg Vit B 0.01mg; Methionine 245.53mg, Cobalt 1.23mg; iodine 0.98mg, cu 9.82mg; Na.55.0mg; Zn49.11mg; and Fe. 19.64mg.

Table: 1B COMPOSITION OF PIG GROWER DIETS

INGREDIENTS	DIETS			
	1B	2B	3B	4B
MAIZE	60.00	55.00	47.00	40.00
MAIZE OFFAL	13.00	14.00	15.00	16.00
GROUNDNUT MEAL	22.00	14.74	7.26	-
EXTRUDED CORNSOY	-	11.26	25.74	39.00
BONE MEAL	2.00	2.00	2.00	2.00
OYSTERSHELL	1.50	1.50	1.50	1.50
SALT	0.50	0.50	0.50	0.50
PREMIX ¹	1.00	1.00	1.00	1.00
TOTAL	100.00	100.00	100.00	100.00
CALC. CP(%)	18.20	17.20	17.70	17.60
CALC. ME (kcal/g)	2.85	2.85	2.85	2.85
CALCULATED LYSINE (g/kg)	4.78	5.44	6.51	7.43
CALCULATED METHIONINE (G/KG)	2.18	2.18	2.26	2.31
RECOMMENDED METHIONINE (g/kg)	4.00			

1. Premix supplied the following nutrients/kg of rations; Vit A., 11, 785 I.U Vit D., 1944.3 I.U. Riboflavin, 5.4mg; pantothenic acid 9.82mg; Nicotinic acid 24.55mg; Folic acid 0.98mg; Chloride 4×10^5 mg; Vit E, 4.91I.U; Vitk2. 20mg Vit B 0.01mg; Methionine 245.53mg, Cobalt 1.23mg; iodine 0.98mg, cu 9.82mg; Na.55.0mg; Zn49.11mg; and Fe. 19.64mg.

Table 2: PROXIMATE COMPOSITION AND GROSS ENERGY OF DIETS

ITEM (%)	DM	CP	EE	CF	ASH	NFE	GE (Kcal./g)
DIET 1A	91.60	19.60	7.44	3.04	2.98	66.94	3.97
B	89.50	16.42	5.52	5.04	6.30	65.72	3.99
2A	91.70	19.27	5.93	3.29	4.33	67.24	3.87
B	91.00	17.90	5.32	4.32	6.98	65.48	4.16
3A	89.40	19.54	6.77	2.98	3.47	67.24	3.87
B	91.20	17.79	4.98	4.70	6.26	66.27	4.02
4A	90.70	20.14	9.21	3.04	3.59	64.02	3.92
B	92.20	18.40	6.83	5.01	7.24	62.52	4.26

Table 3: PERFORMANCE OF WEANER PIGS FED EXPERIMENTAL DIETS

Item	Diets				SEM
	1A	2A	3A	4A	
AV. Initial Wt (kg)	6.70	6.35	6.20	6.70	-
AV. Final Wt (kg)	17.75	20.05	20.70	24.05	-
AV. Daily Feed Intake (kg)	0.56 ^a	0.76 ^{ab}	0.70 ^{a,b}	0.88	0.05*
AV. Daily Grain (kg)	0.19 ^a	0.22 ^{ab}	0.23 ^{ab}	0.31 ^c	0.01*
Feed : Gain	2.29	2.41	2.42	2.19	0.06

* Means Without Common Superscripts in Horizontal Row are Significantly Different (P. <0.05)

Table 4: PERFORMANCE OF GROWER PIGS FED EXPERIMENTAL DIETS

ITEM	DIETS				SEM
	1B	2B	3B	4B	
AV. INITIAL WT. (kg)	19.00	23.45	20.85	19.80	
AV. FINAL WT. (kg)	54.20	55.35	54.95	55.25	
AV. DAILY FEED INTAKE (kg)	1.34 ^a	1.69 ^b	1.46 ^{ab}	1.59 ^{ab}	0.06*
AV. DAILY GAIN (kg)	0.64	0.58	0.62	0.64	0.02
FEED GAIN	2.61 ^a	3.40 ^b	2.22 ^a	2.46 ^a	0.17*

Means Without Common Superscripts In Horizontal Rows Are Significantly Different (P<0.05)

Table:5 CARCASS CHARACTERISTICS OF PIGS FED CORNSOY OR GROUNDNUT MEAL

Item	Diets				Sem
	1	2	3	4	
Warm Dressing%	67.80 ^a	67.35 ^a	73.60 ^b	69.90 ^{ab}	1.04*
Estimated LEA'(cm ²)	27.75	22.60	19.50	25.00	1.62
Lean Cut (%)	75.75 ^a	69.95 ^{ab}	70.95 ^{ab}	69.05 ^b	0.86*
Fat Cut (%)	25.75 ^c	30.05 ^{ab}	29.05 ^b	30.95 ^a	1.04*
Backfat Thickness (cm)	3.70	3.70	3.80	3.75	0.07
Carcass Length (cm)	68.10	68.00	65.85	66.70	0.36

* Loin Eye Area
Means Without Common superscripts in Horizontal rows are Significantly Different (P<0.05)