INTERNATIONAL JOURNAL OF SCIENCE AND NATURE

www.scienceandnature.org

PERFORMANCE AND COST BENEFIT OF SUBSTITUTING PALM OIL SLUDGE (POS) FOR MAIZE IN DIETS OF GROWER PIGS

Ezekwe, A. G., Machebe, N. S. and Enemona, J.
Department of Animal Science, University of Nigeria, Nsukka, Enugu State, Nigeria

ABSTRACT
An experiment was conducted to determine the growth performance of grower pigs fed processed palm oil sludge (POS) diet. Twenty four (24) weanling pigs having an average body weight of 19.74 ±2.41kg and consisting 12 male and 12 female crossbred (Large White and Landrace) pigs were used for the study. The pigs were randomly allotted to three compounded dietary treatments having 0, 15 and 30% processed palm oil sludge inclusion levels replacing maize as energy source. Results showed that the palm oil sludge diet significantly ($P<0.05$) improved final body weight, feed intake, weight gain and feed conversion ratio of growing pigs when compared with the control. Feed cost/kg gain was lower and better for pigs fed palm oil sludge diets (15 and 30% POS diets). Highly Significant ($P<0.01$) block (sex) effect was observed in most of the parameters determined. The efficiency of male pigs in utilizing diets containing palm oil sludge was better than that of their female counterparts. It was concluded that grower pigs can tolerate up to 30% dietary substitution of maize with processed palm oil sludge without compromising their growth performances. Economically, this level of processed palm oil sludge inclusion in the diet of grower pigs is cost effective and should be encouraged especially in rural communities where palm oil sludge are readily available and affordable.

KEYWORDS: pigs, palm oil sludge, rural communities, farmer, feed, height-at-withers

INTRODUCTION

The cost of feed in any animal production enterprise gulps over 70% of the entire cost of production (Agbakoba *et al.,* 1995). This high cost of feed is because most of the diets are based on cereal grains and oil meals, which compete both directly and indirectly with the industry and human. For sustainable swine production in many tropical countries especially Africa, alternative feeding system need to be identified, studied, developed and information generated extended to farmers in most rural communities in the country (Perez, 1997).

The prospect of using agricultural waste materials as veritable sources of feedstuff for livestock production is promising. The use of palm oil or groundnut oil to boost energy content of pig feeds have been documented (Perez, 1997). Palm oil sludge is a waste of the palm oil mill. According to Webb *et al.* (1997), it is considered a nuisance and thus it is usually discarded or further processed to reduce its pollution value. The proximate analysis of the palm oil sludge has revealed that it has excellent nutrient profile that is highly comparable to those of maize. Nigeria accounts for about 49.07% of the total palm oil produced in Africa (FAO, 1992). Consequently, there is an abundance of palm oil by-products including the sludge in the country. This product, therefore, could easily be utilised as a very cheap and efficient source of unconventional feedstuff for the pig industry. Unfortunately, this potential feedstuff which could revolutionise our indigenous pig production industry has been neglected. Information regarding its usage and possible impact on swine growth and development in Nigeria is barely available. This study was therefore aimed at determining the levels of inclusion of processed palm oil sludge in replacing maize and its effect on the performance of grower pigs in the humid tropics. The economic implication of its addition in the diet of grower pigs was also considered.

MATERIALS AND METHODS

The study was conducted in the piggery unit of the Department of Animal Science, University of Nigeria, Nsukka. Twenty four (24) weanling pigs with an average body weight of 19.74 ±2.41kg and consisting 12 male and 12 female crossbred (Large White and Landrace) pigs were used for the study. Housing and management of the experimental animals were as earlier reported (Machebe and Ezekwe, 2010). In addition, the pigs were fed 6% of their average live body weight as ration while water was served *ad- libitum*. The pigs were randomly allotted to three compounded dietary treatments having 0, 15 and 30% processed palm oil sludge replacing maize. The palm oil sludge used was sundried and milled into pellets prior to its incorporation in the compounded diets. All diets were formulated to have 16% CP and 2600Kcal/kg Metabolizable energy (Table 1).

Eight (8) grower pigs (4males and 4 females) were assigned to each treatment. Each treatment had 4 replicate with two pigs serving as replicate. A randomised complete block design was used as the experimental layout with different levels of palm oil sludge in the diet serving as treatments whereas sex was used as a blocking variable. Weekly live body weight and daily feed intake were measured using a weighing scale. This was used to calculate weight gain, feed conversion ratio and feed cost/kg gain of the pigs during the entire 12 weeks duration of the study. The data were analyzed in accordance with the procedure of analysis of variance (ANOVA) using SPSS computer package (SPSS, 2001). Significant treatment means were separated using Duncan's Multiple Range Test (Duncan, 1955).

TABLE 1. Percentage composition of experimental diets

Ingredients (%)	T1 (0% POS)	T2 (15% POS)	T3 (30% POS)
Maize	25	21.25	17.50
Palm oil sludge	0	3.75	7.50
Rice bran	15.50	15.50	15.50
Cassava meal	15.25	15.25	15.25
Groundnut cake	20	20	20
Palm kernel cake	19	19	19
Palm oil	2.50	2.50	2.50
Bone meal	2.00	2.00	2.00
Salt	0.50	0.50	0.50
Vit./Mineral premix [a]	0.25	0.25	0.25
Total	100	100	100
Calculated			
Crude protein	16	16	16.10
Crude fibre	9.98	10.34	10.69
ME (Kcal/kg)	2649.70	2655.90	2662.00
Proximate			
Dry matter	92.08	92.05	92.00
Crude fibre	10.85	12.20	14.60
Crude protein	15.90	15.65	15.52
Gross energy	3.40	3.95	4.22

[a] Supplied per kg of diet: 5,000IU Vit. A; 1,000,000 IU Vit. D_3; 800 mg Vit. E; 400 mg Vit. K; 1,200 mg Vit. B_2; 1,000 mg Vit. B_3; 4mg Vit. B_{12}; 3,000 ng Niacin; 4,000 mg Vit. C; 112,000 mg Chlorine; 24,000 mg Mn; 8,000 mg Fe; 1,600 mg Cu; 18,000 mg Zn; 500 mg Iodine; 48 mg Selenium; Antioxidant (BHT).

TABLE 2. Performance and cost benefits of feeding processed palm oil sludge to grower pigs

	Treatments (%)					
Parameters	0	15	30	SEM	Prob. (Block)	Prob. (Treatment)
Body weight(kg)						
Initial	19.68	20.05	19.51	2.34		
Final	31.48[b]	35.04[a]	34.22[ab]	1.71	0.010	0.050
Feed intake (kg/day)	0.21[b]	0.23[b]	0.29[a]	0.02	0.001	0.010
Weight gain (kg/day)	0.14[c]	0.17[b]	0.19[a]	0.01	0.001	0.010
FCR	1.68[a]	1.45[c]	1.56[b]	0.03	0.001	0.042
Feed cost/kg gain (₦)	77.58[a]	56.75[b]	59.2[b]	0.28	0.018	0.050
Feed cost (₦)	44.32	41.42	38.60			
Cost differential (₦)	-	2.91	5.73			
Body measurements (cm)						
Body length	78.4[a]	75.05[b]	73.53[b]	0.19	1.07	0.042
Height-at-withers	45.95	46.23	46.32	0.59	2.57	0.647

FCR-feed conversion ratio, SEM- standard error of the mean, Prob.-Probability

RESULTS AND DISCUSSION

The results of the effect of inclusion of processed palm oil sludge in the diets of growing pigs on performance characters are shown in Table 2. Addition of palm oil sludge in the diet of grower pigs significantly ($P<0.05$) improved the final body weights, feed intake, and weight gains of pigs. Final body weights of pigs on 15% and 30% POS were significantly ($P<0.05$) higher than the control pigs (0%POS). In addition, significantly high ($P<0.01$) improvement in feed intake of the pigs was observed as the amount of palm oil sludge in the diet increased from 15 to 30%. Higher increase in feed intake (0.29kg/day) was observed for pigs fed 30%POS diet. A non-significant difference in feed intake was recorded for pigs on 0% and 15%POS diets. Increased feed consumption obtained in pigs on 30% POS inclusion suggests that the palatability of the diet at this level is still adequate. This result agrees with reports of Hertrampt (1988) and Hutagalung *et al.* (1997). These authors reported significantly higher feed intake in pigs fed POS diet. The increased consumption rate could be attributed to the relative increase in the amount of palm oil in the feed which seemed to improve palatability thus making the animals more disposed to ingesting the feed. Significant ($P<0.05$) variation in weight gains of pigs among the treatment groups were observed. Weight gains increased slightly as POS was increased from 15% to 30% level in both male and female pigs. Daily weight gains of pigs differed among the treatment groups. Body weight changes of pigs in 30% POS diets was higher for all the treatment groups followed by those of pigs on 15%POS and 0%POS, respectively. This result suggests that grower pigs can tolerate up to 30%POS inclusion in their diet without any deleterious effects on their performances. This report contradicts those of

Yeoung (1980) and Swatson (1979). These authors recommended 15% as the optimum POS inclusion level beyond which adverse effect on body weight gains of birds may be observed. Breed/ genotype, environmental difference (nutrition, management, ambient temperature etc), and variations in the sources and methods used in processing POS could possibly cause wide variations in the efficient utilization of sludge by animals. Feed cost/kg gain was significantly higher (P<0.01) for the control pigs (0% POS diet) and low for pigs fed 15 and 30%POS diets. Although, there was non-significant (P>0.05) differences in the cost of feed per kg gain of pigs fed 15 and 30%POS diets, the least feed cost/kg gain of ₦ 61.14 was observed for pigs on 15%POS. This indicates that the cost of feed required to gain 1kg body weight of pigs was better for pigs on 15%POS diet. In line with reports of Devendra and Mutharajah (1976) and Hertrampt (1988), it is more economical to use palm oil sludge to replace maize in pigs' diet probably because it costs little or nothing to get palm oil sludge unlike maize. The cost differentials shows that practically for every one tonne (1000kg) of feed consumed by the pigs, the farmer saves about ₦ 291 and ₦ 573 respectively when he uses 15 and 30%POS to substitute maize in the diets of pig. Main effect of block (sex) was highly significant (P<0.01) in all the performance indices studied. For instance, feed intake, weight gain, feed conversion ratio and feed cost/kg gain in body weight was better (P<0.01) in males than female pigs. Thus it is economically better to feed male pigs with palm oil sludge than female pigs since male pigs fed POS diets recorded highly significant (P<0.01) lower feed cost/kg gain that female pigs.

Non-significant (P>0.05) treatment x block (sex) effect was recorded for most of the growth parameters studied excluding feed intake which was significant (P<0.05) (Table 3; Fig.1-3).

TABLE 3. Treatment x block effect on the performance of grower pigs fed processed palm oil sludge

		Treatments (%)				
Parameters	Block(sex)	0	15	30	SEM	Prob.
Final body weight	Male	28.12	36.37	35.19	4.45	0.205
	Female	33.88	30.42	29.50		
Feed intake (kg/day)	Male	0.22	0.23	0.29	0.53	0.050
	Female	0.21	0.28	0.30		
Weight gain (kg/day)	Male	0.17	0.21	0.20	0.07	0.571
	female	0.10	0.12	0.16		
FCR	Male	1.70	1.31	1.56	1.03	1.14
	Female	1.78	1.65	1.70		
Feed cost/kg gain (₦)	Male	75.17	51.96	57.80	1.67	3.54
	Female	78.90	64.29	68.39		
Body measurements (cm)						
Body length	Male	82.8	80.83	76.10	6.53	1.42
	Female	72.01	69.28	70.95		
Height-at-wither	Male	48.60	46.23	43.81	0.79	2.16
	Female	43.30	44.06	43.19		

FCR-feed conversion ratio, SEM- standard error of the mean, Prob.-Probability

FIGURE-1

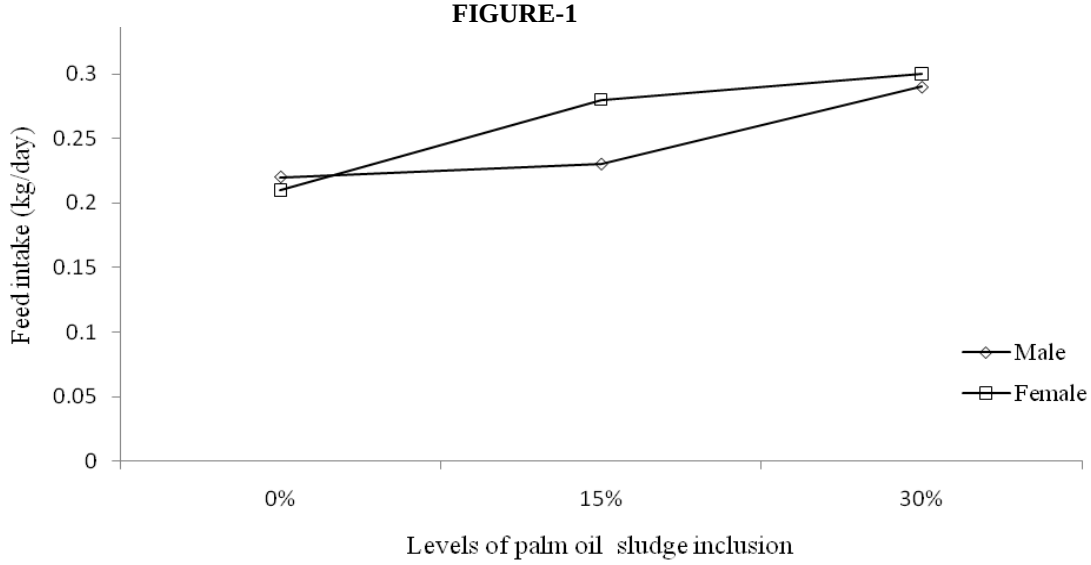

FIGURE-2

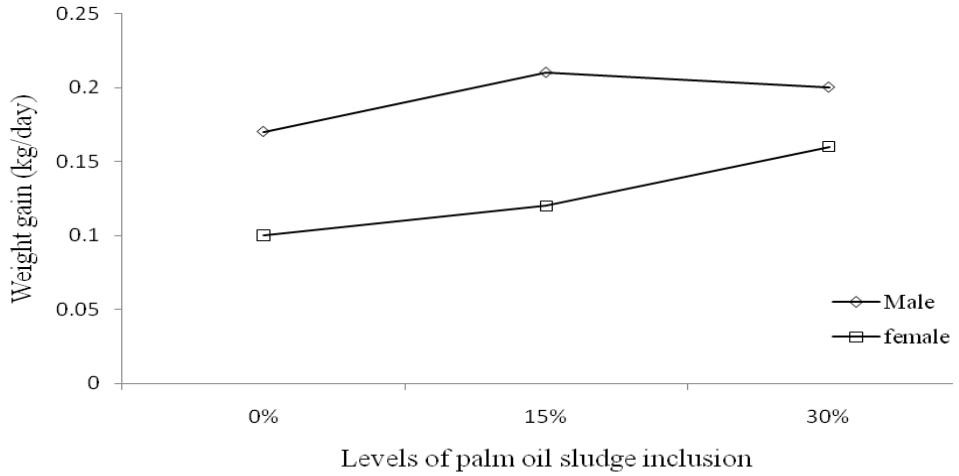

Fig 2: Treatment x block (sex) effect on weight gain of pigs fed palm oil sludge diets

FIGURE-3

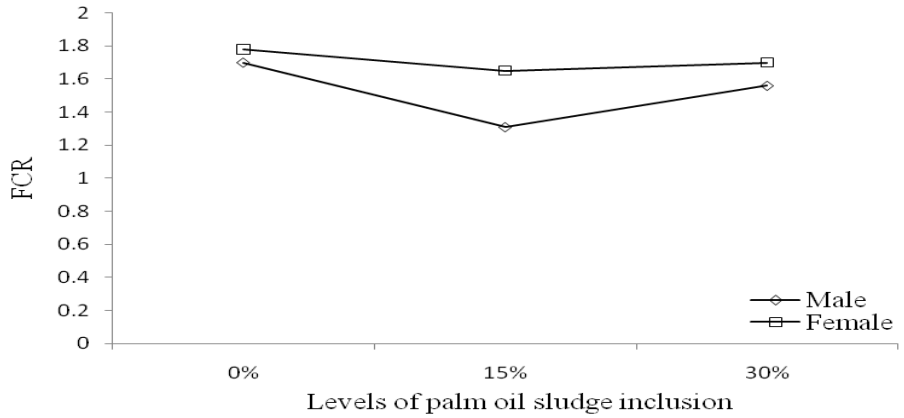

Fig 3: Treatment x block (sex) effect on the feed conversion ratio of pigs fed palm oil sludge

In all treatment groups, male pigs consumed slightly less feed but gained more weight than its female counterparts. This observation was more in pigs fed the POS diets. Main effect of block was highly significant ($P<0.01$) for final body weight, feed intake, weight gain, feed cost/kg gain and linear body measurements (body length and height at withers) in favour of male pigs. For instance, weight gain of male and female pigs fed 0, 15 and 30% palm oil sludge diets were, respectively, 0.17 Vs 0.10kg, 0.21 Vs 0.12kg and 0.20 Vs 0.16kg. The results suggest that male pigs can utilize palm oil sludge based diet better than its female counterparts. According to Bradfield (1968) and Holness (1991), males generally are heavier than the females at birth and as a result grow faster, have leaner carcasses and convert feed more efficiently than females. Thus, given the same diets, the male animals would have better growth performance with reference to deposition of muscle and lean tissues than their female counterparts (Holness, 1991). Significant differences ($P<0.05$) in body length measurements was observed among the treatment groups. Body lengths of the pigs decreased as the level of POS in the diet was increased from 15 to 30%. Pigs fed the control diet had higher body length compared with those fed POS diets. Observed decrease in body length measurements in the pigs as level of POS in the diet was increased could imply that pigs fed POS diets are at high risk of depositing more fat than lean tissues as they grow. This effect was more in female than in male pigs. Non-significant differences ($P>0.05$) in height-at- wither measurements of the pigs was recorded.

It was concluded that although pigs fed 15% POS diet numerically had the least feed cost/kg gain values, grower pigs can tolerate up to 30% dietary substitution of maize with processed palm oil sludge without any deleterious effects on performances. Thus 30% replacement of maize with processed POS in the diets of grower pigs is economically viable and pig farmers in many rural communities where this unconventional feed ingredient are available should be encouraged to use them in feeding their animals.

REFERENCES

Agbakoba, A. M., Onwubu, E.O and Amuhu, U. (1995) Evaluation of optimum supplementary level of poultry grower mash with sweet potato leaves in rabbit feeding. Proc. The 10th Annual Workshop on Animal Feeding Systems. Research and Extension. NRCRI Umudike

Bradfield, P.G.E (1968) Sex differences in the growth of sheep. In: Growth and development of mammals (G.A. Lodge and G.E.Lammings, Eds.) Butterworth, London. pp 92-108

Devendra, C and Muthurajah, R.N (1976) The utilization of palm oil by-products by sheep. Reprint No.8, Malasian Int. Symposium on oil palm processing and marketing, June 17-19, Kuala Lumpor. P21.

Duncan, D. B (1955) Multiple Range and Multiple F-Tests. Biometrics 11:1-42.

FAO (1992) Food and Agricultural Organization Production Year Book, Rome.

Hertrampt, J (1988) Unconventional Feedstuffs for Livestock. Muhle+Mischfuttertechnik 125(9):108-109.

Holness, D.H (1991) *Pigs*. The Tropical Agriculturist. The Technical Centre for Agricultural and Rural Cooperation. Coste, R and Smith, J (eds). Revised Edn. Macmillan Publishers Ltd, Oxford.

Hutagalung, R.L., Chang, C.C, Toh, k.M and Chang, H.C. (1977) Potential of Palm oil mill effluent as feed for growing-finishing pigs. Planter, Kuala Lumpur. 53:2-3.

Machebe, N. S. and Ezekwe, A. G. (2010) Predicting body weight of growing-finishing gilts raised in the tropics using linear body measurements. Asian J. Exp. Biol. Sci., 1 (1):162-165.

Perez, R (1997) Feeding Pigs in the Tropics. Food and Agricultural Organization Animal Production and Health Paper, Rome.

SPSS (2001) Statistical Package for Social Sciences (SPSS) for windows, Version 8. SPSS Inc. USA.

Swatson, H (1974) The effects of different levels of palm oil slurry on the performance and carcass characteristics of broiler chicks. Unpublished B.Sc Honors Dissertation, University of Science and Technology, Dept. of Animal Science, Kumasi, Ghana.

Webb, B. H., Hutagalung, R. L and Chean, S. T (1977) Palm oil mill waste as animal feed. Processing and utilization. International Development in Palm oil. Earp. D.A and Nawal, W. Eds. Incorporated Society of Planters. Kuala Lumpur. Pp125-145.

Yeoung, S. W (1980) The nutritive value of palm oil by-products for poultry. Proc. Abstr. First Asia-Australia Animal Science Congress. Abstr. No. 45:17.