



Original Research

Effect of Feeding Palm Oil (*Elaeis guineensis*) Sludge as a Partial Replacement of Maize on the Performance of Growing Crossbred (Large White Yorkshire x Zovawk) Pigs

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Abstract

An experiment was conducted to study the performance of growing pigs fed diet having different levels of palm oil sludge (POS) as a replacement of maize. Fifteen growing crossbred pigs (Large White Yorkshire x Zovawk) of average BW 27.06 kg were randomly selected and divided into three groups with 5 pigs per group in a completely randomized design. Three experimental iso-nitrogenous and iso-caloric rations were formulated (NRC, 1998) where dried palm oil sludge was incorporated at the rate of 0%(Group-1), 15%(Group-2) and 25% (group-3) level by replacing maize. The feeding trial was continued for 42 days. The final body weight (kg) was 49.16 ± 3.08 , 45.10 ± 3.61 and 44.34 ± 2.86 for Group-1, Group-2 and Group-3, respectively. There was no significant difference ($P > 0.05$) in the average feed intake, average daily gain and feed conversion ratio among the different treatment groups. Blood biochemical parameters did not differ significantly ($P > 0.05$), irrespective of different dietary treatments and were within the physiological range of pigs. It was concluded that palm oil sludge up to 25% can be incorporated in the diet of cross bred pigs by replacing maize grain without adverse effect on the growth performance and blood biochemical parameters in pigs.

Key words: Blood Biochemical Parameters, Crossbred Pigs, Performance, Palm Oil Sludge

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Introduction

Among the livestock species, pig finds an important place as it is being reared by the socio-economically weaker section of the society particularly in the North Eastern Region of India. The high cost of conventional feed ingredients is the principal limiting factor to the efficient animal production. Moreover, there is a competition between human and non-ruminants for the cereal grains owing to ever increasing



human population. Thus, Agro-industrial by-products have become important feed components in livestock and poultry diets. A by-product of interest in palm oil production in terms of substituting energy in conventional monogastric diet is palm oil sludge (POS). According to Borja and Bank (1994), about 2.5-3.0 tonnes of Palm oil mill effluent (POME) is produced as by-product for the production of one tonne of crude palm oil during the extraction process. POS is the material that remains after decanting the POME and it has a crude protein (CP) of 96g/kg and metabolisable energy (ME) of 17.76 MJ/kg (Devendra, 1977). Hence, this makes it relatively comparable to maize with 90 g/kg CP and 14.37 MJ/kg.

POS has been effectively used in the diets of livestock and poultry replacing conventional energy source with encouraging results. Perez (1997) also found improvement in the carcass measurement in growing pigs when maize was replaced even up to 30% by POS in the diets and Hertrampt (1988) observed increased feed intake, average daily gain and a significant reduction in feed cost in pigs when POS was used in place of maize at a level of 15 to 30 %. However, no scientific studies have been carried out in India to know the potential use of POS in pig's diet. Therefore, this experiment was conducted to study the performance of growing pigs fed diet having different levels of palm oil sludge as a replacement of maize.

Materials and Methods

The experiment was carried out at the All India Coordinated Research Project (AICRP) Farm College of Veterinary Science and Animal Husbandry, Selesih, Mizoram. The POS used in the experiment was procured from Godrej Agrovet Limited, Kolasib, Mizoram. The POS was sundried and grounded before incorporating at graded level in the pig's diet. Fifteen crossbred growing pigs (Large White Yorkshire x Zovawk) of 4-5 months of age with average body weight (27.06 ± 3.13 kg) were randomly divided into three groups in a completely randomized design with 5 pigs per group. Three experimental iso-nitrogenous and iso-caloric rations were formulated (NRC, 1998) where palm oil sludge was incorporated at the rate of 0%, 15%, and 25% level by replacing maize. The experimental growing pigs were housed under intensive system of management following standard managerial practices. The piglets were housed individually. The feed was offered individually and wholesome drinking water was made available all the times. Individual body weights of the pigs were recorded before the starting of feeding experiment and thereafter at weekly intervals before feeding and watering in the morning hours using an electronic scale to assess the body weight changes and growth rate.

Blood samples were collected aseptically from the anterior vena cava using 10 ml syringes from all the pigs at the end (42nd day) of the experimental period and allowed to clot before centrifuging to obtain the serum and stored at -20°C until analyzed. The serum metabolites such as total protein, albumin, globulin, urea, serum glutamate pyruvate transaminase (SGPT) and serum glutamate oxalo-transaminase (SGOT) were estimated using commercial kits of Coral Clinical Systems, Goa, India.

The chemical composition of feed was determined by the methods of AOAC (2000). Data collected on various parameters were statistically analyzed by completely randomized design (CRD) method as described by Snedecor and Cochran (1994). Means were compared by Duncan multiple range test (DMRT) using statistical package for social studies (SPSS. 17.0.1v, 2008) software.

Results and Discussion

The chemical composition of dried POS used for formulating the diets for the study is presented in Table 1. The mean values for dry matter(DM), crude protein(CP), crude fiber(CF), ether extract(EE), nitrogen free extract(NFE), total ash(TA), acid insoluble ash (AIA) and digestible energy were 90.75%, 14.06 %, 18.11%, 8.70%, 36.61%, 22.52%, 13.57% and 3312.85 kcal/kg, respectively.

Table 1: Composition (%) of palm oil sludge

Components	POS (%)	Maize
Moisture (%)	9.25	9.8
Dry matter (%)	90.75	90.1
Crude protein (%)	14.06	9
Ether extract (%)	8.7	2.3
Crude fibre (%)	18.11	2
Nitrogen free extract (%)	36.61	73.9
Total ash (%)	22.52	2.9
Acid insoluble ash (%)	13.57	1.6
Digestible energy Kcal/Kg	3312.85	3600

POME is the residue left from the purification of the crude palm oil and it generally includes various liquids, dirt, residual oil and suspended solids, mainly cellulosic material from the mesocarp of the fruits. By using the decanter-drier system, a lighter co-product is recovered from POME in the form of decanter solid which is generally considered as palm oil sludge. A similar result was observed by Wong and Wan Zahari (1992) and Wan Zahari *et al.* (2000). They found the content of CP, CF, NDF, ADF, EE and TA of POME as 12.5%, 20.1%, 63%, 51.8%, 11.7 and 19.5%, respectively. However, it contradicts to the findings reported by Earp and Newal (1976), Abu *et al.* (1984), Habib *et al.* (1997), Bobadoye *et al.* (2008) and Faradonbeh *et al.* (2011). Bobadoye *et al.* (2008) reported that DM, CP, CF, EE, NFE and ash of palm oil sludge were 76.29%, 8.85%, 8.00%, 26.30%, 31.34% and 1.10 % respectively. Faradobeh *et al.* (2011) also observed 77.29% DM, 9.85% CP, 9.0% CF, 27.30% EE, 32.34% NFE and 2.10% ash in POS used in commercial chicks. This considerable variability in the chemical composition of POS is due to the oil palm varieties (Bamikole and Ikatua, 2009) and the method of oil extraction (Seephueak *et al.*, 2011). The wide variability in ash content is also been reported by Gurmit Singh (1994) in POME. The high ash content in the present study maybe due contamination by soil and dirt which is reflected in the content of acid insoluble ash (13.56%) of POS. Yet, the protein and energy content of POS was comparable with maize making it a good

alternative to maize for pig. The ingredients and chemical composition of the experimental diets (Group-1, Group -2 and Group- 3) fed to the animals are presented in Table 2.

Table 2: Body weight changes in growing pigs fed dried POS

Parameters	Group 1	Group 2	Group 3	SEM	P-Value
Initial BW, kg	27.75±2.96	26.94±2.99	26.50±3.45	1.7	0.964 ^{NS}
1 st wk	32.60±2.78	31.16±3.03	30.89±3.22	1.64	0.921 ^{NS}
2 nd wk	37.48±2.68	35.19±3.21	34.45±3.04	1.65	0.784 ^{NS}
3 rd wk	40.86±2.84	38.22±3.31	37.58±3.02	1.7	0.756 ^{NS}
4 th wk	44.03±2.78	40.75±3.44	40.13±2.95	1.72	0.673 ^{NS}
5 th wk	46.61±3.08	43.08±3.52	42.25±2.89	1.78	0.631 ^{NS}
Final BW, kg	49.16±3.08	45.10±3.61	44.34±2.86	1.81	0.572 ^{NS}

NS= Non-significant

The results of the effect of inclusion of processed POS in the diets of growing pigs on performance characters are depicted in Tables 3&4. The average dry matter intakes were 1586.10±41.72, 1574.80±30.95 and 1571.20±34.3029 g/head/day for Group-1, Group-2 and Group-3, respectively.

Table 3: Ingredient and chemical composition (%) of experimental diets

Ingredient	Diet (%)		
	Group 1(0% POS)	Group 2(15% POS)	Group 3(25%POS)
Maize	50	42.5	37.5
Palm oil sludge	0	7.5	12.5
Soyabean meal	21	20	19
Wheat bran	22	23	24
Fish meal	5	5	5.33
Mineral mixture	1.5	1.5	1.5
Salt	0.5	0.5	0.5
Total	100	100	100
Calculated			
Crude protein	18.36	18.42	18.35
DE Kcal/kg	3256.25	3222.08	3195.08
Estimated			
Crude protein	17.72	17.88	17.5
Ether extract	1.82	2.37	2.51
Crude fibre	5.06	7.14	7.47
Total ash	7.6	8.07	9.5
Acid insoluble ash	1.05	2.12	2.54
DE Kcal/kg	3258.8	3351.6	3382.1

There was no significant difference ($P>0.05$) in average dry matter intakes among the treatment groups. This result contradicts to Hertrampf(1998) and Ezekwe *et al.* (2011). Ezekwe *et al.* (2011) reported that POS diet significantly ($P<0.05$) improved feed intake by the growing pigs when compared to control diets, which could be due increase in palatability and taste. The weight gain across the groups over 42 days of

trial was non-significant ($P>0.05$) and the average daily gains were 509.70 ± 39.78 , 432.57 ± 26.73 and 424.76 ± 25.64 g/d for Group-1, Group-2 and Group-3, respectively. The feed conversion ratios were not significant ($P>0.05$) and the values for Group-1, Group-2 and Group-3 were 3.72 ± 0.39 , 4.11 ± 0.28 and 4.20 ± 0.31 , respectively.

Table 4: Effect of POS on the performance of growing pigs

Parameters	Group 1	Group 2	Group 3	SEM	P-Value
Initial BW, kg	27.75 \pm 2.96	26.94 \pm 2.99	26.50 \pm 3.45	1.7	0.964 ^{NS}
Final BW, kg	49.16 \pm 3.08	45.10 \pm 3.61	44.34 \pm 2.86	1.81	0.572 ^{NS}
Average Daily gain(g/d)	509.70 \pm 39.78	432.57 \pm 26.73	424.76 \pm 25.64	17.68	0.115 ^{NS}
Average feed intake(g/d)	1586.10 \pm 41.72	1574.80 \pm 30.95	1571.20 \pm 34.30	20.11	0.956 ^{NS}
FCR	3.72 \pm 0.39	4.11 \pm 0.28	4.20 \pm 0.31	0.18	0.559 ^{NS}

NS= Non significant

The findings are in accordance with Abu *et al.* (1984) who reported that oil palm slurry can be substituted upto 30% replacing maize without any adverse effect on feed efficiency and weight gain. Vroom (1978) observed significantly increase in body weight and better carcass characteristics from pigs on diets containing palm oil sludge by replacing maize component of diet at 0%, 10%, 15% and 20% in weaner pigs. Hertrampt (1988) also reported an increase in the average daily gain in addition to a significant reduction in feed cost when palm oil sludge was used in place of maize at a level of 15 to 30 percent in pigs. Promising results were observed in this study and this is very important for the utilization of palm oil sludge since palm is a native plant to many developing countries, particularly in tropical regions (Sundu and Dingle, 2002).

The inclusion of POS in the compounded diets of cross bred pigs resulted in the reduction of feed cost and was found to be Rs.38.01/-, Rs.36.43 and Rs. 35.38/- per kg of feed for G1, G2 and G3, respectively. The effect of replacing maize with POS on the blood biochemical parameters of growing pigs is shown in Table 5.

Table 5: Effect of POS on blood biochemical parameters in experimental pigs

Parameters	Group 1	Group 2	Group 3	SEM	P-Value
Total protein (g/dl)	8.82 \pm 0.22	8.03 \pm 0.31	8.58 \pm 0.33	0.18	0.183 ^{NS}
Albumin (g/dl)	4.46 \pm 0.15	3.90 \pm 0.15	4.14 \pm 0.16	0.1	0.072 ^{NS}
Globulin (g/dl)	4.37 \pm 0.19	4.13 \pm 0.26	4.45 \pm 0.31	0.14	0.695 ^{NS}
Urea (mg/dl)	21.91 \pm 1.06	28.27 \pm 2.67	25.28 \pm 3.40	1.54	0.256 ^{NS}
SGPT (U/l)	37.51 \pm 0.60	38.12 \pm 2.06	41.64 \pm 1.78	0.99	0.190 ^{NS}
SGOT(U/l)	39.74 \pm 3.74	35.63 \pm 2.12	32.72 \pm 0.83	1.56	0.185 ^{NS}

NS= Non-significant

The three groups on average had 8.03 to 8.82 g/d/l total protein, 3.90 to 4.46 g/dl albumin, 4.13 to 4.45 g/dl globulin, 21.91 to 28.27 mg/dl urea, 37.51 to 41.64 U/l SGPT and 32.72 to 39.74 U/l SGOT. The increasing

level of POS did not significantly ($P>0.05$) affect the levels of total protein, albumin, globulin, urea, SGPT and SGOT and were within the physiological range for pigs. To the best of our knowledge, there were no previous studies on the effects of palm oil sludge on blood profiles, so no comparisons can be made. It is evident from the result that there was efficient utilization of protein and the levels in the diet were able to support the normal protein reserves in the growing pigs. Moreover, the uniformity in the level of hepatic serum enzymes shows that there was no liver damage due to toxic substances.

Conclusion

This experiment has shown that palm oil sludge up to 25% can be incorporated in the diet of cross bred pigs by replacing maize grain without adverse effect on the growth performance and blood biochemical parameters in pigs. However, a long term study is recommended to evaluate the full potential use of POS as a feed for livestock and poultry.

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