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PERFORMANCE, ORGAN WEIGHTS AND BLOOD COMPOSITION OF RABBITS FED DIETARY LEVELS OF PALM OIL MILL EFFLUENT (POME)

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Target Audience: Livestock producers, animal scientists, feed millers

ABSTRACT

The performance of young growing rabbits in which corn offal was replaced by 0, 2, 5 and 10% palm oil mill effluent (POME) was evaluated for 10weeks. Addition of POME did not influence feed intake but positively affected body weight gain ($P < 0.05$) at 10% level of inclusion but not other levels. There were also no significant differences ($P>0.05$) in the carcass yield of the POME treated rabbits. The total serum protein, parked cell volume, haemoglobin concentration and the blood cells were not affected. The cholesterol distribution in liver, testes, heart and adrenal glands was not altered by the POME inclusion. The mortality recorded in this study was not attributable to dietary intake. The result suggest that up to 10% POME can replace corn offals in the diets without deleterious effects.

Keywords: Rabbits, performance, palm oil mill effluent

DESCRIPTION OF THE PROBLEM

Palm oil mill effluent (POME) is an oily brown liquid, the residual waste product obtained after the extraction oil from the fruits of the oil from *Elaeis guineensis* Jacq.). One major potential source of palm oil effluent is as a source of animal feed. Studies have shown that the effluent is essentially free from toxic constituents. Results have shown that up to 15% of maize can be replaced with palm oil mill effluent in layers diets (1; 2). Wood (3) obtained a promising result when palm oil mill effluent was mixed with molasses, copra cake, urea and mineral-vitamin supplement, up to 60% (on dry weight basis of feed) and fed to pigs. Sheep fed POME over twenty-one days showed no apparent harmful effects (4).

The potentialities of rabbit as a fast growing animal with nutritious meat that is low in fat is well recognised (5,6). Moreover, the rabbit meat is known to be particularly useful in the diets of arteriosclerosis patients because of its low fat, cholesterol and sodium contents. The rabbit has

been found to be particularly sensitive to cholesterol variation in its diet especially with respect to plasma concentration (7). It has long been established that fats provide about twice as much calories as do carbohydrates on equal weight basis. Replacement of dietary carbohydrates by an equal weight of fat is therefore, expected to lead to increase in energy density of the diets.

The present study was aimed at investigating the effects of POME-based diets on biochemical and haematological parameters in rabbits.

MATERIALS AND METHODS

Experimental Animals and their Management

Experiment was carried out on thirty-six 5-6 weeks old rabbits weighing about 500g. The rabbits were matched for weight and randomly allocated into four dietary treatment groups. Nine rabbits were allocated to each group with each rabbit serving as a replicate using the complete randomised design (CRD). The animals were individually caged, maintained on raised wire screen floors and were fed and watered *ad libitum*. On arrival at the house, the rabbits were provided the control diet for two weeks to enable them adapt to the new environment and also to stabilize them. The rabbits were fed experimental diets in the morning and fresh *Panicum maximum* in the afternoon. The rabbits were given coccidiostat during the fourth and eighth week of the study. Feed consumption weight gain of the rabbits were recorded weekly. The experiment lasted for ten weeks.

Experimental Diets:

Table 1 shows the composition of the palm oil rich effluent. Four non-isocaloric diets were prepared (Table 2). Diet one (control) had no dried palm oil mill effluent (POME) while diets 2, 3, and 4 had corn offal replaced by POME at 2, 5 and 10% respectively. The POME used in this study was collected from the Nigerian Institute for Oil Palm Research (NIFOR), Benin City, Edo State, Nigeria.

The diets were compounded at the Teaching and Research Farm of the University of Ibadan, Ibadan, Nigeria. The diets were fed in mash form.

Table 1: **Composition of Palm oil mill effluent (%)**

Component	Composition (%)
Dry matter	87.6
Crude protein	12.3
Crude fibre	11.9
Ether extract	10.9
Ash	13.5

Table 2: Composition of Experimental diets.

Diets	Level of Palm oil mill effluent (%)			
	0	2	5	10
Ingredients				
Palm oil mill effluent (POME)	0.0	2.0	5.0	10.0
Maize offal	60.01	57.74	54.31	48.58
Palm kernel meal	28.50	28.70	29.02	29.57
Groundnut cake	9.50	9.50	9.67	9.86
Bone meal	1.50	1.50	1.50	1.50
Mineral-vitamin mix*	0.25	0.25	0.25	0.25
Table salt	0.25	0.25	0.25	0.25
Determined Chemical composition (%)				
Crude protein (CP)	18.56	18.30	17.45	18.29
Crude fibre (CF)	12.71	12.88	12.94	12.94
Ether extract (EE)	4.28	4.79	4.84	5.02
Nitrogen free extract (NFE)	58.47	50.54	58.90	57.74
Ash	5.98	5.66	5.87	6.01
Energy **	9.95	10.04	10.46	11.00

**Vitamin-mineral mix per kg contained: Vit. A 3,000,000 I.U.; Vit D 6,000,000 I.U.; Vit E, 4,000 mg; Vit K 600mg; Vit B_{12} 1,200mg; Vit B_3 2,000 mg; Vit B_3 2,000 mg; Vit b_2 1.2mg; Niacin, 6,000mg; Choline, 84,000 mg; Mn 24,000mg; Fe 800mg; Cu 16,000mg; Zn 18,000 mg; I_2 500mg; Se 48mg; Antioxidant (BHT).*

***Calculated on the basis of ingredient composition.*

Medication:

No specific medication routine was followed but prophylatic precautions were taken when possibilities for disease outbreak was apparent.

Collection of Data:

Feed intake was recorded by subtracting the leftovers from the amount of feed offered and the difference gave the feed consumed. This was carried out on a weekly basis. Growth performance as expressed by weight changes was recorded by weighing the rabbits weekly. Rabbits were weighed in post-absorptive state. Blood samples were collected from three rabbits per treatment. This was done by puncturing the prominent vein of the ear with the help of a gauge needle. Samples for haematological parameters determination were collected into sample bottles into which 0.3g of EDTA (anticoagulant) had been previously added, while the blood samples for serum constituents were untreated with anticoagulant and allowed to clot before centrifuging.

Slaughtering:

At the end of the 70-day period the rabbits were sacrificed by neck dislocation. Different organs were immediately taken out, cleaned for extraneous tissues and weighed warm. Organs were frozen and stored until analysis for cholesterol.

Chemical Analysis:

Proximate analyses of the diets were carried out by procedures of AOAC (8). Packed cell volume (PCV) was determined in quadruplicate using microcapillary tubes and centrifuge at 1,000g for 5 minutes (9). Red cell, white blood cell and platelet counts as well as haemoglobin (Hb) were determined using standard methods described by Dacie and Lewis (10). The following serum constituents were determined using standard methods (11): albumin, globulin, total protein, creatinine and urea nitrogen. Cholesterol was determined by method of Kim and Goldberg (12).

Statistical Analysis:

Results obtained were subjected to statistical analysis using the Analysis of Variance (ANOVA). Where significant differences occur between means comparison were made using Duncan multiple range test (13).

RESULTS

Performance characteristics

Table 3 shows the growth performance, average daily feed intake, weight gain and feed conversion ratio of rabbits fed different levels of supplementary dried palmoil mill effluent. The average final weights at

Table 3: Performance of rabbits fed supplementary palmoil mill effluent (POME) Levels of palmoil mill effluent (%)

Parameters	Level of Palm oil mill effluent (%)			
	0	2	5	10
Ave initial liveweight (g)	528.0±15.0	528.52±12.3	556.21±15.22	578.0±14.20
Ave. final liveweight(g)	963.21 ± 23^{c}	1128.10 ± 12.3^{b}	1126.46 ± 32^{b}	1308.22 ± 82.90^{a}
Ave. daily feed intake (g)	73.55±3.02	71.43±7.80	75.18±10.22	74.07±0.93
Ave daily weight gain (g)	7.77±4.24^{c}	10.72±5.6^{b}	10.18±3.3^{b}	13.04±1.27^{a}
Feed conversion ratio	9.47^{c}	6.66^{a}	7.39^{b}	5.68^{a}
Gross protein intake (g)	764.89	732.00	734.65	758.67
Mortality	11.11	22.22	0.0	11.10

a,b,c, Treatment means in the same horizontal row not bearing the same superscript are significantly different ($P<0.05$).

the tenth week of the experiment were 963.00 ±± 23.1, 1128 ±± 120, 1226.46 ±± 201.2 and 1308 ±± 167.00gm for rabbits fed 0, 2, 5 and 10% POME supplemented diets respectively. Rabbits fed 10% POME appeared to have the highest average final live weight, which was not significantly different from values obtained for rabbits fed 3 and 5% POME ($P>0.05$). However, rabbits fed POME showed significant difference ($P<0.05$) in average final weights than rabbits that received no POME supplementation (control). The total weight gain recorded for all the dietary treatments were 435,600, 570 and 730g for rabbits on diets 1-4 respectively. Rabbits fed POME showed significantly different ($P<0.05$) total weight gain different from rabbits that received no POME supplementation. Average daily weight gains recorded were 7.77 ± 4.24, 10.72 ± 5.6, 10.18± 3.33 and 13.04 ± 4.40g for rabbits on diets one to four respectively.

Figure 1 shows the total weight gain for all the rabbits at the end of the tenth week feeding trial. The average daily feed intake varied from 71.43 - 75.18g and these values did not vary significantly from one treatment to another ($P>0.05$). Feed conversion ratio showed that rabbits on diets 1 and 3 had the better FCR than rabbits on diets 2 and 4. The weights of the different organs at slaughtering of the animals fed POME diets are also shown in Fig. 2.

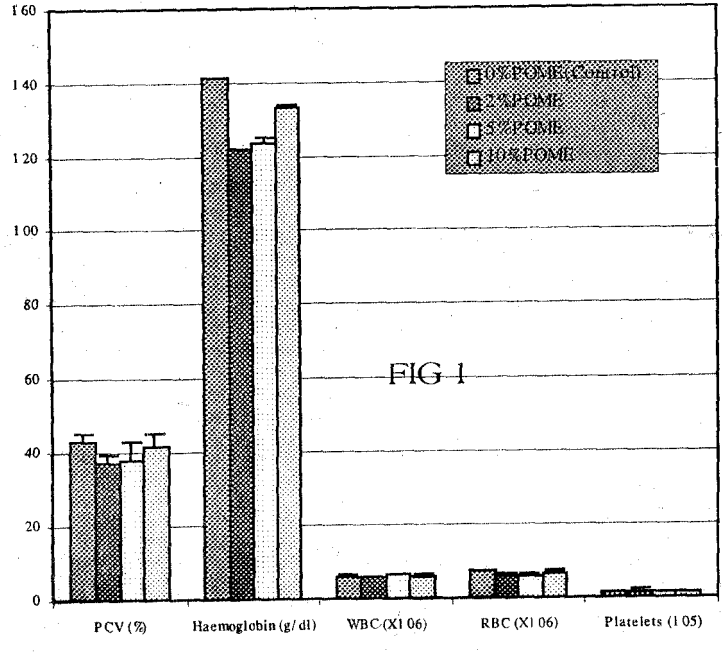

Figure 1: Haematological indices of rabbits fed supplementary Palm oil mill effluent

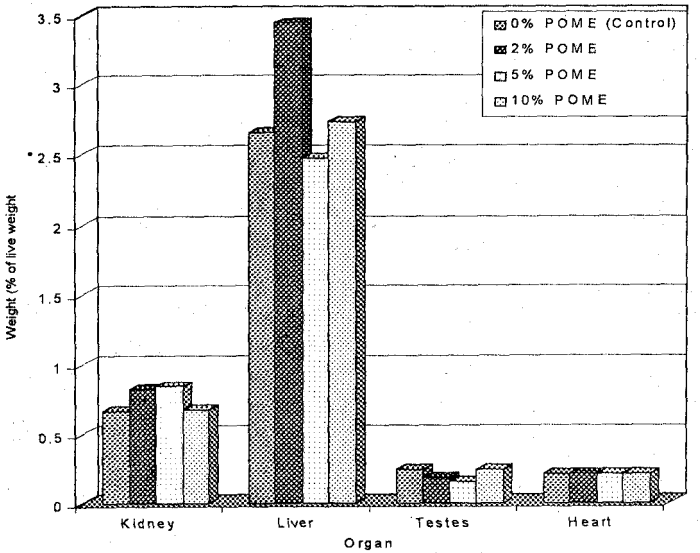

Figure 2: *Organ weights (as % of live weight) at slaughtering of rabbits fed supplementary palm oil mill effluent*

Haematological and biochemical indices

The haematological indices are shown in Fig. 3. Haematocrit (PCV) values of 43.33 ± 1.53, 37.33± 2.08, 38.00± 5.29 and 41.69 ± 3.21% were obtained for treatments one to four respectively. Even though treatments one seems to show a higher haematocrit value than other treatments such an observation was not significant (P>0.05). The haemoglobin concentration for all treatments showed a similar as observed with the PCV values. The values recorded for the treatments were 141.13 ± 10.22, 122.23 ± 20.00, 123.37 ± 25.10 and 133.50 ± 10.82 accordingly. No significant differences were observed for the treatments except for blood platelets which was raised by 2% POME diet when compared with the control (P < 0.05).

The serum biochemical indices are shown in Table 3. Serum albumin levels of 2.18 ± 0.20, 2.97 ± 0.88, 2.32 ± 2.32 and 2.45 ± 0.22 gm/dl were obtained for treatments one to four respectively. Addition of palm oil mill effluent did not affect total protein and globulin levels (P>0.05). However, the high Creatinine levels observed for the 10% POME treatments showed significant difference (P<0.05).

Cholesterol levels in organs

The total serum cholesterol levels and cholesterol distribution in the organs are presented in Table 5. Addition of 2% and 5% POME did not significantly affect serum cholesterol levels. However, there was a significant increase in the level of the same parameter in the 10% POME group (P < 0.05). For

Table 4: Haematology and Serum Biochemical indices of rabbits fed supplementary palm oil mill effluent

Indices	Level of Palm oil mill effluent (%)			
	0	2	5	10
Albumin (g/dl)	2.18 ± 0.20	2.97 ± 0.88	2.32 ± 0.57	2.45 ± 0.22
Globulin (g/dl)	1.66 ± 0.18^{b}	1.42 ± 0.12^{bc}	2.04 ± 0.19^{a}	1.26 ± 0.25^{c}
Total Protein (g/dl)	4.00 ± 0.11	4.39 ± 0.85	4.38 ± 0.39	3.70 ± 0.66
Creatinine (g/dl)	2.05 ± 0.14^{b}	1.62 ± 0.06^{c}	2.29 ± 0.27^{ab}	2.54 ± 0.12^{a}
Urea Nitrogen (g/dl)	20.71 ± 0.94	20.95 ± 1.87	20.62 ± 0.10	17.05 ± 0.58
Total serum cholesterol g/dl)	55.28 ± 2.77^{b}	58.73 ± 0.49^{b}	67.37 ± 2.90^{a}	68.49 ± 0.90^{a}

a,b,c: Treatment means in the same horizontal row not bearing the same superscript are significantly different (P<0.05).

Table 5: Tissue and Serum Cholesterol levels (mg/g tissue wt) of rabbit fed supplementary levels of palm oil mill effluent

Indices	Level of Palm oil mill effluent (%)			
	0	2	5	10
Kidneys	13.43 ± 1.25	11.75 ± 2.26	15.56 ± 3.34	14.82 ± 0.36
Liver	3.14 ± 0.41	2.71 ± 0.74	4.91 ± 1.67	3.52 ± 0.13
Testes	5.24 ± 0.09^{a}	6.86 ± 0.26^{ab}	10.95 ± 4.15^{b}	5.65 ± 0.39^{a}
Heart	5.90 ± 1.30	6.38 ± 0.12	8.80 ± 1.16	7.81 ± 1.90
Adrenals	100.61 ± 20.08	90.71 ± 41.60	80.66 ± 19.49	86.99 ± 9.97
Serum (g/dl)	55.28 ± 2.77^{b}	58.73 ± 0.49^{b}	67.37 ± 2.90^{a}	68.49± 0.90^{a}

a,b,c: Treatment means in the same horizontal row not bearing the same superscript are significantly different (P<0.05)

the kidney, no significant difference was observed in the cholesterol concentration for treatments 1 to 4 (13.43 ± 1.25, 11.75 ± 2.26, 15.56 ± 3.34 and 14.48 ± 0.36mg/g of tissue respectively, P>0.05). Also, cholesterol distribution in the liver, testes, heart and adrenal glands did not differ significantly in all the groups.

Post mortem examination

Post mortem examination in the few animals that died in the course of this study (Table 2) indicated that there were severe autolysis, soiled peritoneum and hind limbs, congested trachea and lungs. The stomach content were hard and covered with mucus, watery intestinal materials and contained numerous oocysts.

DISCUSSION

Reports are available on the potentials of leafmeals, leaf protein concentrates and Seedmeals as animal feed sources (14 -16).

In the present work, we investigated the effects of feeding rabbits with diets containing Palm oil mill effluent (POME) on some biochemical and haematological indices. We have shown here that up to 10% of POME can replace corn offal in rabbit diet without compromising performance. This is a confirmation and extension of previous reports on the use of POME in diet formulation for pigs (3), Sheep (4) and poultry (1).

The mortality recorded in this experiment could not have been due to the treatments. The results of the post-mortem examination indicate that the rabbits probably died of intestinal coccidiosis, enteritis and /or constipation. The absence of major side effects such as diarrhoea tend to suggest that the pressed residue did not contain any toxic compounds which could interfere with nutrient utilisation in rabbits. High mortality and diarrhoea have been observed in rabbits fed with several leafmeal diets (13). The low toxicity of POME diet may be related to the anti-oxidant status of Palm oil. Farombi and Britton (17) reported the anti-oxidant activity of palm oil alpha and beta carotene in organic solution. Anti-oxidants are free radical scavengers. The free radicals are known to attack lipids, proteins, carbohydrates and DNA to induce oxidation, cleavage, cross-linking and modification which eventually cause tissue damage (18).

Since no work has been reported in literature on POME in rabbit nutrition, our results will be compared with reported studies on feed sources in rabbits. The observed feed intake and weight gain in this study is similar to those observed by Dada et al (15) on growing rabbits fed *Glicidia sepium* leafmeal as a replacement for groundnut. Also, the control values of growth, haematological and biochemical parameters reported in the present study agree with values reported previously by other workers in the rabbit (19 - 22).

CONCLUSION

Our results suggest that POME could be incorporated into commercial rabbit feeds to at least a level of 10%.

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