DIETARY EFFECT OF PALM OIL MILL EFFLUENT ON THE PERFORMANCE OF WEST AFRICAN DWARF GOAT

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Abstract

It is important to find alternative source(s) of feed for ruminants feeding in lieu of the limited availability of conventional concentrates and the competition for this resource by man. One plant with great potential for the livestock is oil palm tree with associated residues that include empty fruit bunches (EFB), slurries or decanted cake (DC), palm kernel cake (PKC) and Palm Oil Mill Effluent (POME). Twenty (20) West African Dwarf (WAD) goats with an average live-weight of 16.00±0.51 kg were used to evaluate the dietary effect of Palm Oil Mill Effluent (POME) on the growth performance of WAD goats. Five experimental diets were formulated such that cassava peel meal was substituted with varying levels of POME at 0% (diet A), 10% (diet B), 20% (diet C), 30% (diet D), and 40% (diet E) and fed to four (4) goats per treatment for a period of 84days. Parameters assessed include; nutrient intake, digestibility, feed/gain ratio and weight gain. Results showed that dry matter values of the diets ranged from 88.43 (diet E) 89.19% (diet D). The crude protein contents increased with increased inclusion level of POME, the highest value (19.30%) was observed in diet E and least value (10.60%) in diet A. The nutrients intake was significantly (P<0.05) influenced by the inclusion of POME in the diets. The dry matter intake ranged from 401.57 (diet E) to 554.91 (diet A). Crude protein intake (CPI) increased with increased level of POME in the diets, the highest CPI (77.50g/day) was observed in goats fed diet E. The DM, CP, CF and EE were digested better by the goats fed diet E compared to goats fed diet A. Goats fed diet E had the best weight gain (72.62 g/day) and convert their feed to flesh (5.65) better than other goats. Hence, the appreciable CPI, weight gain and feed/gain ratio of goats fed diet that contained 40% POME suggest that POME can be used as a valuable source of protein and energy supplement for ruminant during dry season to reduce cost of production and increase profitability.

Keywords: Digestibility, feed/gain ratio, POME, goat. weight gain

Introduction

Feed quantity and quality are the most important factors affecting the success of ruminants production in the tropics and cereal grains which are a common source of energy in livestock diets are been competed for by humans. Therefore, the major strategy to improve livestock industries in the tropical areas should be to increase the use of available low cost, indigenous feed resources and waste to reduce the cost of imported feed (Goh and Rajion, 2007).

Several plants wastes exist with very high nutritive value and yet remain unexploited for human and animals benefit. Oil palm industry which has been recognized for its contribution towards economic growth and rapid development has also contributed to the livestock sector due to the production of huge quantities of by-products from oil extraction process (Aziz and Abdul, 2007). Residues associated with palm oil production include empty fruit bunches (EFB), slurries or decanted cake (DC), palm kernel cake (PKC) and Palm Oil Mill Effluent (POME). POME is readily available, has high amount of crude protein (12.5%) and energy which makes it an ideal supplement for traditional cassava peels-based diets which are generally protein deficient for livestock feed. POME is used as fertilizer and soil cover materials in oil palm plantation area or biogas production while its utilization in animal feed is minimal (Devendra, 2006) Therefore, the present study was designed to evaluate the dietary effect of palm oil mill effluent on the growth performance of West African Dwarf goat.

Materials and Methods

The research was carried out at the Teaching and Research Farm and the Nutrition laboratory of Animal Production and Health Department, Federal University of Technology, Akure, Nigeria. POME was gotten from a reputable palm oil farm in Ile-oluji, Ondo State and was air-dried for 5-7days under shade to prevent reduction in protein and oil content, while the cassava peels was collected from cassava or "garri" processing industry at Ogbese, Owo road, Akure and were sun-dried for 3-5days depending on the intensity of the sun to reduce the moisture and cyanide content. Five experimental diets were formulated such that cassava peels was substituted with POME at 0% (diet A), 10% (diet B), 20% (diet C),

30% (diet D) and 40% (diet E) with other convectional feed ingredients at fixed proportions (Table 1). Twenty (20) West African Dwarf goats of 1 - 2 years of age with average live weight of 16.00±0.51kg were used. The goats were allotted to five dietary treatments having four (4) goats per diet in a completely randomized design experiment and fed the diets *ad libitum* for a period of 84days (excluding thirty days adjustment period). Daily records of feed intake as well as weekly weight gain of each goat were determined. The POME-based diets and faecal samples were analyzed for proximate composition while urine samples were analyzed for nitrogen using methods of AOAC (2002). All data generated were subjected to the one-way analysis of variance (ANOVA) using the general linear model procedure of SAS (2008). Where significant differences are observed, Duncan's Multiple Range Test (Duncan, 1955) was employed to compared the means.

Results and Discussion

Result of nutrient composition of experimental diets was shown in Table 2. The observed values were significantly ($P<0.05$) influenced by the treatment except dry matter (DM) and gross energy (GE). The dry matter values ranged from 88.43 (diet E) 89.19% (diet D The crude protein contents increased with increased inclusion level of POME, the highest value (19.30%) was observed in diet E and least value (10.60%) in diet A these values are above the critical 8% crude protein required by ruminants for optimum microbial activities in the rumen (Norton, 2003). The crude fibre content of the diets ranged between 15.38 (diet E) to 20.10% (diet B) and the gross energy of the diets ranged from 14.00 to 14.91KJ/100gDM. Performance of the goats was presented in Table 3. The nutrients intake, digestibility coefficients, average daily weight gains and feed gain ratio values were significantly ($P<0.05$) influenced by the inclusion of POME in the diets. The dry matter intake of goats reduced with the increased inclusion of POME in the diets. This observation corroborates the report of Tackette *et al.* (1996) that feeding dietary fat to farm animals reduces dry matter intake. Crude protein intake increased with increased inclusion of POME in the diets, the goats fed diet A had the least (58.82 g/day) and the highest (77.50 g/day) was observed in goats fed diet E. The observed CP intake values were more than the minimum requirements for maintenance of 41.50g/day crude protein for goats (NRC, 1981). The crude fibre intake was highest in goats fed diet A and least value observed in goats fed diet E. Ether extract intake of goats increased with the increased inclusion of POME in the diets, the goats fed diet E had the highest (37.91 g/day) The dry matter digestibility of goats fed diets D and E was improved compared to goats fed diet A, this observation might be attributed to the protein quality of the diets and thus, the diets were palatable and digestible. The digestibility coefficients of crude protein increased with increased level POME in the diets, this observation agreed with the report of Onetti (2001) that animals fed supplemented fat digest more protein. The digestibility of ether extract increased with increased lipid content of the diets, it might implied that the lipid content increased the degree of non-saturation, which enhances the digestibility of fatty acids (Duckett and Gillis, 2010). Goats fed diet E had the highest weight gain and best feed/gain ratio than all other goats though, this might be attributed to the palatability and protein quality of the diets. This agreed with the findings of Adebowale and Taiwo (1996) that weight gain was dependent on the dry matter, protein intake and digestibility of the nutrients.

Conclusion

This study revealed that palm oil mill effluent (POME) has a good nutritive potentials that can enhance ruminant production when supplemented with low quality feed ingredients and hence will reduce environmental pollution. It was concluded that the performance of West African Dwarf goats in terms of nutrient intake, digestibility, body weight gain and feed/gain ratio were optimal at 40% of POME inclusion in diet E.

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Table 1: Gross composition of the experimental diets

Feed ingredients	A	B	C	D	E
Cassava peels	45.50	40.95	36.40	31.85	27.30
POME	0.00	4.55	9.10	13.65	18.20
Wheat offal	32.00	32.00	32.00	32.00	32.00
Palm kernel cake	17.00	17.00	17.00	17.00	17.00
Groundnut cake	3.50	3.50	3.50	3.50	3.50
Bone meal	1.50	1.50	1.50	1.50	1.50
Salt	0.50	0.50	0.50	0.50	0.50

Diet A (Control) 0% POME; Diet B - 10% POME; Diet C - 20% POME; Diet D - 30% POME; Diet E - 40% POME.

Table 2: Nutrients composition of experimental diets fed to WAD goats

Nutrients	A	B	C	D	E	±SEM
Dry matter	89.09	88.95	89.00	**89.19**	88.43	0.02
Crude protein	10.60^{e}	14.96^{d}	15.08^{c}	**15.99^{b}**	19.30^{a}	0.74
Crude fibre	19.78^{d}	20.10^{a}	20.08^{b}	**20.01^{c}**	15.38^{e}	0.49
Ether extract	4.28^{e}	7.37^{d}	7.89^{c}	**8.45^{b}**	9.44^{a}	0.47
Ash	8.10^{e}	9.87^{d}	10.38^{c}	**11.60^{b}**	14.47^{a}	0.57
Nitrogen free extract	43.81^{a}	37.56^{b}	34.83^{c}	**33.62^{d}**	30.59^{e}	1.19
Gross energy. (kg/100gDM)	14.00	14.91	14.66	**14.81**	14.46	0.05

abc = means within the same row with different superscripts are significantly different (P<0.05)

Table 3: Performance of WAD goats fed experimental diets

Parameters	A	B	C	D	E	±SEM
Intake (g/day)						
Dry matter	554.91^{a}	436.41^{b}	441.67^{b}	**421.55^{b}**	401.57^{b}	18.11
Crude protein	58.82^{e}	65.29^{d}	66.61^{c}	**67.41^{b}**	77.50^{a}	1.61
Crude fibre	109.76^{a}	87.72^{b}	85.86^{b}	**84.35^{b}**	61.76^{c}	4.07
Ether extract	23.75^{e}	32.16^{d}	34.85^{c}	**35.62^{b}**	37.91^{a}	1.31
Nitrogen free extract	234.11^{a}	163.92^{b}	153.83^{bc}	**141.73^{bc}**	122.84^{c}	10.48
Gross Energy. (KJ/day)	77.71^{a}	65.05^{b}	64.29^{b}	**62.44^{b}**	58.06^{b}	0.38
Digestibility co-efficient (%)						
Dry matter	68.75^{ab}	61.65^{b}	63.59^{b}	**67.11^{ab}**	74.62^{a}	1.72
Crude protein	69.73^{c}	73.59^{b}	74.34^{ab}	**76.38^{ab}**	81.82^{a}	1.09
Crude fibre	84.17	81.03	82.10	**85.85**	85.89	0.81
Ether extract	66.42^{c}	75.64^{b}	78.12^{b}	**81.11^{ab}**	86.10^{a}	1.90
Nitrogen free extract	57.78^{c}	65.72^{b}	65.85^{ab}	**69.80^{ab}**	54.19^{a}	1.86
Gross energy	60.39^{c}	65.31^{b}	66.57^{b}	**69.33^{ab}**	73.69^{a}	1.08
Performance						
Initial weight (kg)	16.05	16.10	16.10	**16.05**	16.05	0.51
Final weight (kg)	18.65	20.25	20.95	**21.65**	22.15	0.52
Weight gain (kg)	2.60^{b}	4.15^{ab}	4.85^{ab}	**5.60^{a}**	6.10^{a}	0.44
Weight gain (g/day)	30.96^{b}	49.41^{ab}	57.74^{ab}	**66.67^{a}**	72.62^{a}	5.24
Feed/gain ratio	20.95^{a}	8.83^{b}	7.82^{b}	**6.97^{b}**	5.65^{b}	1.74

abc = means within the same row with different superscripts are significantly different (P<0.05)