REPLACEMENT OF PALM KERNEL CAKE WITH KENAF GRAIN MEAL IN CASSAVA PEEL DIET ON PERFORMANCE OF WEST AFRICAN DWARF SHEEP

Omotoso, S.O.,[1*] Ajayi, F.T.,[1] Kenneth-Obosi, O.[2] and Oladele-Bukola, M.O.[1]

[1]Institute of Agricultural Research and Training, Moor Plantation, Ibadan

[2]National Institute of Horticultural Research and Training, Idi-Ishin, Ibadan

**E-mail:tobsum2006@gmail.com, +2348060838357*

ABSTRACT

This study was conducted to evaluate the effect of replacing Palm kernel cake (PKC) with Kenaf grain meal (KGM) in cassava peel-based diet on performance of WestAfrican Dwarf sheep. Sixteen female West African Dwarf sheep with the average live weight of 9.71± 0.05 kg were randomly allotted to four dietary treatments in a complete randomised design with four animals per treatment. The results showed that dry matter (88.80-88.95%) and ether extract (2.84-3.14%) contents were relatively similar.The crude protein contents were highest (16.22%) in diet 3 and lowest (14.73%) in diet 1 while the crude fibrecontent was highest in diet 1 (23.38%) and lowest in diet 2 (17.85%). The performance of the sheep differed ($p<0.05$) across the treatments. Total feed intake (662.82 g/day), weight gain (30.95 g/day) and feed conversion ratio (21.42) were best in sheep fed diet 4 (25% KGM inclusion) compared to other treatments. However, total feed intake(g/kg$W^{0.75}$) was highest ($p<0.05$) in sheep fed diet 1 (25% PKC inclusion) but lowest in sheep fed diet 2 (10% PKC and 15% KGM inclusions). In conclusion, the significant ($p<0.05$) performance of sheep fed with diet 4 (25% KGM inclusion) revealed the possibility of total replacement of PKC with KGM in cassava peel ration without negative impact on the growth of West African Dwarf sheep.

*Keywords:*Cassava peel, kenaf grain, palm kernel cake, performance, sheep

INTRODUCTION

The perennial challenge of feed scarcity and limiting Nitrogen (N) content of tropical grasses in the tropics especially in the dry season triggered several kinds of research on the exploration of crop residues and agro-industrial by-products in ruminants feeding systems. Cassava peel has been successfully used as a suitable source of energy supplement to foliage or poor quality feed but its low crude protein content requires that it should be supplemented with a dietary protein source, preferably of plant origin to make a complete feed suitable for ruminants. Similarly, palm kernel cake is a medium quality energy source, high in fibre and crude protein contents moderately (Carvalho *et al*., 2005) enough to meet the requirements of most ruminants. Though Chanjula *et al*. (2011) had reported that palm kernel cake has no effect on voluntary feed intake for ruminants at high levels, but Wan Mohammed *et al*. (1987) reported that long-term feeding of PKC could lead to copper toxicity in sheep. Often, forage legumes have been the cheapest source of protein widely accepted in ruminant feeding systems in the course of solving the limiting N content of tropical grass species. However, a promising and non-conventional protein, energy and fibre sources for ruminants that have not received adequate attention is the kenaf plant (*Hibiscus cannabinus*). Kenaf is a well-known industrial and commercial fibre crop around the world (Welber *et al.*, 2002). Even though Kenaf seed is reported as a suitable supplementary source of protein in livestock feed (Nyam *et al.*, 2009), very scanty information is available about the utilization of the grain as feed for ruminants. The high content of fibre and edible oil (LeMahieu *et al*., 2003) of kenaf seed also suggests its usefulness as a source of energy for livestock. Though kenaf plant is increasingly gaining wider acceptance by the small and large scale crop farmers for propagation as raw materials for jute and fibre industries in Nigeria, but tons of the seeds produced for subsequent propagation rapidly loss viability and get wasted because of poor storage conditions, inadequate or high cost of storage facilities which is beyond the reach of the rural poor producers. Hence, the seeds are discarded by setting it on a flame. To prevent the wastage of the non-viable Kenaf seeds and intensify efforts at promoting kenaf grain

production for wider use in the livestock industry, this study was designed to explore the potential of kenaf grain in small ruminant feeding strategy.Considering the similar dietary nutritional (protein and energy) potentials of palm kernel cake and kenaf seeds, it was hypothesized that Kenaf grain meal could replace palm kernel cake and also supplement cassava peel-based diet to promote voluntary feed intake for improved growth performance by West African Dwarf(WAD) sheep.

MATERIALS AND METHODS

The experiment was carried out at the sheep and goat unit of the Institute of Agricultural Research and Training, Moor Plantation, Ibadan. Animals selected from the herd for the experiment were given prophylactic treatments against ecto and endo-parasites and adjusted to their treatments diets over a 2-week preliminary period, followed by 84-day feeding trial. Sixteen WAD female sheep with the average live weight of 9.71± 0.05 kg were randomly allotted to individual pens and to one of four treatment diets in a complete randomized design with four animals per treatment.

FEED PROCESSING, FEEDING AND GROWTH TRIALS

Feed ingredients were sourced from animal feedstuff vendors, while dried kenaf grain was collected from the Kenaf and Jute Fibre Programme of the Institute of Agriculture Research and Training, Ibadan. Fresh Guinea grass (*Panicum maximum*) was harvested from an established pasture of the Research Institute and allowed to wilt under room temperature before feeding. Kenaf grain and dried cassava peel were crushed with attrition and hammer mills, respectively into small particle size (1.5-2.5 mm) to allow for proper mixing with other ingredients. Thereafter, the crushed feedstuffs were separately weighed and mixed according to the proportion of each dietary treatment as enumerated in Table 1. Experimental diets (Table 1) were offered separately to individual animals at 3% body weight at 08:00 h. Wilted Guinea grass was offered to all the sheep at 2% body weights at 16:00 h. Provision was made for a daily feed allowance of 10% above the previous week's consumption. Clean water was served *ad libitum*.The initial body weighs of the animals were taken and recorded before the commencement of the experiment. Daily feed intake was determined by subtracting feed refused from feed offered over a 24-h period, while live weight changes were measured once each week before feeding in the morning throughout the 105 days experimental trial excluding 2 weeks of the adaptation period.

CHEMICAL AND STATISTICAL ANALYSIS

Dried samples of the experimental diets and guinea grass were analyzed for Crude protein (N×6.25), Dry matter, ether extract, ash, and crude fibre contents as described (AOAC, 2000). Data obtained were subjected to analysis of variance and Duncan's Multiple Range Tests was used to detect significant differences among means at $p< 0.05$.

Table 5: Ingredient composition (g/100g DM) of the experimental diets

Ingredients (kg)	Diet 1	Diet 2	Diet 3	Diet 4
Dried cassava peel	55.0	55.0	55.0	55.0
Palm kernel cake	25.0	10.0	5.0	-----
Kenaf Grain	-----	15.0	20.0	25.0
Corn bran	15.0	15.0	15.0	15.0
Soya bean meal	2.5	2.5	2.5	2.5
Di-calcium phosphate	1.0	1.0	1.0	1.0
Limestone	0.75	0.75	0.75	0.75
Premix	0.25	0.25	0.25	0.25
Salt	0.5	0.5	0.5	0.5
Total	100	100	100	100

RESULTS AND DISCUSSION

Table 2 shows the proximate composition of the experimental diets, guinea grass and major test ingredients. The value of dry matter (88.80-88.95%) for the experimental diets was relatively similar. The crude protein (14.73-16.22%) content for all the diets was above the minimum requirement recommended for sheep (Gatemby, 2002). The highest CP value of diet 3 (16.22%) could be due to the combined effect of the test ingredients (palm kernel cake and kenaf grain meal) CP contents. The ash content ranged from 7.15-7.48%. The ether extract values of diets 3 and 4, 1 and 2 were respectively similar, which is an indication that ether extract values (2.84-3.14%) of the experimental diets were not above the dietary fat (5-6%) that could inhibit microbial activity and reduce nutrient digestibility (Kucuk *et al*., 2003) in ruminants. The range of crude fibre was above the minimum level of 17% recommended for ruminants (NRC, 2001). The highest value of crude fibre in diet 1 (23.38%) compared to diets 2 to 4 respectively, with varying proportion of PKC and KGM could have resulted from the inclusion of palm kernel cake, which has been reported to contain a high amount of lignin due to contamination of nutshells (Mok, 2013). The high CP, crude fibre and low ether extract values of the experimental diets reveal the nutritive value of palm kernel cake and kenaf grain meal to supplement cassava peel and ability to promote ruminal microbial activity to improve the digestibility of feed.

Table 2: Proximate composition (g/100g DM) of experimental diets, Kenaf grain meal and Guinea grass

Parameter	Diet 1	Diet 2	Diet 3	Diet 4	KGM	PKC	Guinea grass
Dry matter	88.81	88.80	88.87	88.95	93.23	93.80	88.76
Crude protein	14.73	14.93	16.22	15.73	21.44	18.44	8.60
Ether extract	2.84	2.95	3.08	3.14	3.48	6.82	2.85
Ash	7.48	7.33	7.15	7.27	5.40	5.21	9.04
Crude fibre	23.38	17.85	19.19	18.77	11.27	15.36	32.33
NFE	51.59	56.95	54.37	55.09	58.41	54.17	47.18

NFE= Nitrogen Free extract; KGM= Kenaf grain meal; PKC= Palm kernel cake

The feed intake and growth performance of WAD sheep fed cassava peel concentrate with varying inclusions of palm kernel cake and kenaf grain meal differed significantly ($p<0.05$) across the treatments (Table 3). Total feed intake ranged from 538.96-662.82 g/day, being highest in sheep fed diet 4 (25% KGM inclusion) but lowest in sheep fed diet 1 (25% PKC inclusion). However, total feed intake in metabolic body (g/kg$W^{0.75}$) weight was highest (93.41 .g/kg$W^{0.75}$) in sheep fed diet 1 and lowest (79.74 g/kg$W^{0.75}$) in sheep fed diet 2. The significantly higher total feed intake observed for all the sheep fed diets containing KGM is an indication that the experimental feed was well accepted, which corroborates the findings of Sgwane *et al*. (2008) that kenaf seed increased dry matter intake of sheep fed low-quality hay. This also suggests that the nitrogen content of kenaf seed was sufficient to improve ruminal microbial activities for feed degradability and consequently increased intake. The highest weight gain (30.95 g/day) and efficiency of feed conversion were observed for sheep fed diet 4 (25% KGM inclusion) compared to other treatments (16.07-21.43 g/day) groups. Even though the

high crude protein in KGM and moderate protein in PKC are highly degradable and soluble in the rumen (Carvalho *et al*., 2005), cassava peel which is a source of highly fermentable carbohydrate in ruminant ration could have protected the nitrogen of KGM-PKC from total degradation in the rumen for subsequent absorption in the abomasum and small intestine as documented (Kardaya *et al*., 2009). Therefore, the significantly higher weight gain of sheep fed diet 3 and 4, respectively compared with sheep fed diet 2 (15% KGM +10% PKC) affirms that between 20-25% of KGM could successfully replace PKC in cassava peel ration for sheep. Hence, the variations in performance observed across the treatments further elucidate the potential of KGM to replace PKC as supplementary protein and energy sources for small ruminant feeding.

Table 3: Performance of West African dwarf (WAD) sheep fed cassava peel with varying inclusions of palm kernel cake and kenaf grain meal

Parameters	T1	T2	T3	T4	SEM
Feed intake (g/day)					
Cassava peel-kenaf grain concentrate	280.71^{d}	295.15^{c}	313.63^{b}	344.27^{a}	7.16
Guinea grass	258.25^{d}	315.06^{c}	320.37^{a}	318.55^{b}	7.82
Total feed intake (g/day)	538.96^{d}	610.21^{c}	634.00^{b}	662.82^{a}	13.82
Total feed intake (g/kg$W^{0.75}$)	93.41^{a}	79.74^{d}	80.46^{c}	82.34^{b}	1.67
Weight gain (g/day)					
Initial body weight (kg)	9.48	9.62	9.86	9.88	0.05
Final body weight (kg)	11.20^{c}	10.97^{d}	11.66^{b}	12.48^{a}	0.18
Weight gain (g/day)	20.48^{c}	16.07^{d}	21.43^{b}	30.95^{a}	1.64
Feed conversion ratio	26.32^{c}	38.01^{a}	29.59^{b}	21.42^{d}	1.81

^{abcd}= Means with the same superscripts in the same row are significantly different ($p<0.05$)

CONCLUSION

The highest total feed intake (662.82 g/day), daily live weight gain (30.95 g/day) and better feed conversion ratio (21.42) observed for sheep fed with diet 4 (25% KGM inclusion) revealed the possibility of total replacement of PKC with KGM in cassava peel ration without negative impact on growth performance of West African Dwarf sheep. It is therefore concluded that kenaf grain meal could replace PKC and supplement cassava peel which is a low nitrogen crop residue diet often utilised in small ruminant feeding systems.

REFERENCES

Association of Official Analytical Chemists (AOAC). (2000). Official methods of analysis.17th ed. Arlington, VA, USA.

Carvalho, L.P.F., Melo, D.S.P., Pereira, C.R.M., Rodrigues, M.A.M., Cabrita, A.R.J. and Fonseca, A.J.M. (2005). Chemical composition, *in vitro* digestibility, N degradability and enzymatic intestinal digestibility of five protein supplements.*Animal Feed Science Technology*, 119: 171-178.

Chanjula, P.Y., Siriwanthananukul and Lawpetchara. (2011). Effect of rubber seed kernel and palm kernel cake in combination on nutrient utilization, rumen fermentation characteristics, and microbial populations in goats fed *Brachiaria humidicola* hay-based diets. *Asian-Australian Journal of Animal Science*. 24:73-81.

Gatenby, R. M. (2002). Sheep. The Tropical Agricultural Series. McMillan publishers. Pp. 408-515.

Kardaya, D., Wiryawan, K.G, Parakassi, A. and Winugroho, H.M. (2009). In vitro slow-release urea characteristics under different molasses levels contained in rice straw-based diets. *Indonesian Journal of Animal Veterinary Science*, 14: 177-191.

Kucuk, O., Hess, B.W., Ludden, P.S. and Rule, D.C. (2003). Effects of increasing dietary forage in limited-fed ewes fed a 6% fat diet. *Sheep and Goat Research Journal*, 18:25-33.

LeMahieu, P. J., Oplinger, E. S. and Putnam, D. H. (2003). Kenaf. Alternative Field Crops Manual.

Mok, C.H., Lee, J.H. and Kim, B.G. (2013). Effects of exogenous phytase and betamannanase on ileal and total tract digestibility of energy and nutrient in palm kernel expeller-containing diets fed to growing pigs. *Animal Feed Science Technology*, 186:209–213.

NRC (2001). Nutrient Requirements of Dairy Cattle.7th ed. National Academy Press, Washington, D.C.

Nyam, K. L., Tan, C. P., Lai, O. M., Long, K. and Che Man, Y. B. (2009). Physicochemical properties and bioactive compounds of selected seed oils. *LWT–Food Science and Technology*, 42: 1396–1403.

Sgwane, T. S., Teleni, E. and Gardiner, C. P. (2008). Kenaf seeds (*Hibiscus cannabinus* L.) as a protein supplement to sheep. Australian Rangeland Society.15th biennial Conference Proceedings, 'A climate of Change in the Rangeland'.pp 1-4.

Wan Mohamed, W.E., Hutagulung, R.I. and Chen, C.P. (1987). Feed availability, utilisation and constraints in plantation-based livestock production system. Proceedings 10th Annual Conference Malaysian Society Animal Production, pp. 81-100.

Webber, C. L., Bhardwaj, H. L. and Bledsoe, V. K. (2002). Kenaf production: Fibre, feed and seed. Trends in New Crops and New Uses. (Eds J. Janick and A. Whipkey), ASHS Press, Alexandria, VA, pp. 327-329.