

Short communication

Performance characteristics of goats fed supplemental cocoa seed testa-based diet

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Abstract

An increase in goat production in the tropics have led to continuous competition with humans for food as most protein given conventional feedstuff (Groundnut cake, Palm kernel cake, Soybean) among others are becoming scarce and expensive, thus, there is need to find non-conventional feeding material which can considerably substitute the conventional feed stuff without negative consequences on the animal. This research work therefore, was aimed at the performance characteristics of West African Dwarf (WAD) goats fed cocoa seed testa (CST) as a replacement for palm kernel cake concentrate supplement to a basal grass diet. Twelve West Africa dwarf goat of 15-16 months with an average weight of 16.5 kg were used for the experiment. They were randomly allocated to three concentrates diets such that 0%, 50%, 100% were for group A, B and C, respectively of palm kernel cake (PKC) were replaced with cocoa seed testa (CST). Each of the three groups was reared on any of the concentrate supplements fed to a basal diet of the grass (*Cynodon nlemfuensis*). The experiment lasted for six weeks, in which two weeks were used to acclimatize the animals to the cages. Result of the experiment showed a significant difference ($P < 0.05$) in mean overall feed intake, weight gained and feed conversion ratio among the treatments. The average daily weight gain and overall weight gain among the treatment groups were significantly difference ($P < 0.05$). Goats fed diet B utilized the feed better with weight gain of 2539.96 g followed by those of diet C with weight gain of 1969.94 g. Inclusion of cocoa seed testa from 50 % to 100 % replacement for palm kernel cake enhance the growth of West African dwarf goat.

Keywords: Cocoa Seed Testa, Feed, Goat, Palm Kernel Cake, Supplement

Des Caractéristiques de performance des chèvres nourries de graines de testa supplémenté à basede cacao



Résumé

Une augmentation de la production des chèvres dans les zones tropicales a conduit à une concurrence continue avec les humains pour la nourriture car la plupart des protéines étant donné les aliments conventionnels (gâteau à l'arachide, gâteau palmiste, soja) entre autres sont de plus en plus rares et coûteux, il est donc nécessaire de trouver du matériel d'alimentation non conventionnel qui peut remplacer considérablement les aliments conventionnels sans conséquences négatives sur l'animal. Ce travail de recherche visait donc les caractéristiques de performance des chèvres naines d'Afrique de l'Ouest (le 'WAD') nourries de graines de testa à base de cacao (le 'CST') en remplacement du supplément de concentré de gâteau au palmiste à un régime basal d'herbe. Douze chèvres naines d'Afrique de l'Ouest de 15 à 16 mois avec un poids moyen de 16,5 kg ont été utilisées pour l'expérience. Ils ont été attribués au hasard à trois régimes concentrés de telle sorte que 0%, 50%, 100% étaient pour le groupe A, B et C, respectivement du gâteau de palmiste (le 'PKC') ont été remplacés par des testicules de graines de cacao (le 'CST'). Chacun des trois groupes a été

élevé sur l'un des suppléments de concentré alimentés à un régime basal de l'herbe (Cynodonlemfuensis). L'expérience a duré six semaines, au cours de laquelle deux semaines ont été utilisées pour acclimatiser les animaux aux cages. Le résultat de l'expérience a montré une différence significative ($P < 0,05$) dans l'apport alimentaire global moyen, le poids gagné et le ratio de conversion des aliments pour animaux parmi les traitements. Le gain de poids quotidien moyen et le gain de poids global parmi les groupes de traitement étaient significativement différence ($P < 0,05$). Les chèvres nourries de régime B utilisé l'alimentation mieux avec un gain de poids de 2539,96 g suivie par ceux de l'alimentation C avec gain de poids de 1969,94 g. L'inclusion de graines de testa à base de cacao de 50 % à 100 % de remplacement pour le gâteau au palmiste améliore la croissance de la chèvre naine d'Afrique de l'Ouest.

Mots-clés: graines de cacao, Testa, Alimentation, Chèvre, Gâteau palmiste, Supplément

Introduction

The long term survival of animal production in Nigeria depends to a large extent on the ability of the farmers to provide adequate feed materials in the right quantity and quality for animal intake (Ettu and Onwuka, 2015). The National Agricultural Sample Survey opined that Nigeria has an estimated 72.5 million goats as against his human population of about 195,656,437 in 2018. This population of goat is next to poultry and contributes 24% of meat supply in the country, they are more prolific than cattle and are hardy than sheep within the tropics. (Oni, 2002; Omotoso, *et al*, 2018). Wilkinson and Lee (2018), in their research said goats as a ruminant have grasses as their natural diets which are numerous in the tropics. Most of the economic important grasses also supplies food to humans (Maize, Guinea corn, Millet etc). This brings about competition between goats and human. Thus there is need for alternative sources of feed for ruminants. There is the need to harness nutrient available in agriculture waste and agro – industrial by – products for livestock feeding after a nutritional evaluation, this could lower the cost of production without sacrificing efficiency in livestock production (Ranjhan S. K. 1993; Ajila *et al.*, 2012). Cocoa seed testa is a by- product of Cocoa processing industries in Nigeria which is either set on fire or allowed to rot away. If CST is duly

evaluated through animal feeding, it can be encouraged as a feedstuff and so become an alternative to one of the conventional feedstuff. Nutritional evaluation of CST will contribute to the existing knowledge on utilization of lesser known agro- industrial products and the pool of digestible nutrients in these products. Thus, this research work is aimed at evaluating the performance characteristics of WAD goats fed with cocoa seed testa (CST) as a replacement for palm kernel cake concentrate supplement to a basal grass diet.

Materials and methods

Twelve West African dwarf bucks were purchased from a popular market in Ogun State, they are about 16 months old, with an average weight of 16.5 kg. The experimental animals were randomly divided into three groups of 4 per group. Each was kept in individual metabolic cage modified for separate collection of faeces and urine. They had access to feed and clean water daily. They were certified free from ecto and endo-parasites through veterinary services.

Experimental diet

Three isonitrogenous and isocaloric concentrate diets were formulated such that 0%, 50%, 100% of palm kernel cake (PKC) was replaced with cocoa seed testa (CST). Each of the 3 groups of goats was reared on any of the concentrate supplements fed with

a basal grass (*Cynodon nlemfuensis*). Weighed quantities of the chopped grass and supplement were offered daily at 08:00 h ad-libitum. Any residue was weighed to obtain voluntary intake. Each animal was also weighed once a week. The experiment lasted for seven weeks including 2 weeks for adjustment of the animals to the cages.

Collection of faeces

At week 7 of the experiment total faecal output was measured daily 10% of the total was saved in a polythene bag for each animal and taken to the laboratory for drying in Axiom Laboratory Hot Air Oven. Dried fecal samples were collected for each animal for 6 days and were bulked and kept for analysis.

Weight gain

The goats were weighed before the commencement of the experiment and repeatedly weighed weekly in the morning before feeding, to observe any weight change using Camry® spring balance (hanging scale).

Analytical procedure

Samples of faeces, CST, grass were dried (for DM), then ground through 0.2 mm sieve in a hammer mill. Accurately weighed quantities were analyzed for CP, CF, EE, and Ash using AOAC (2010) procedure. The gross energy (kcal/g DM) was determined with ballistic bomb calorimeter. The results so obtained were used for calculation of digestibility of CP, CF, EE,

Ash and gross energy.

Statistical analysis

The data were subjected to analysis of variance (ANOVA) and the treatment means were separated using New Duncan's Multiple Range Test. Statistical significance was assumed at a value of $P < 0.05$. All statistical analysis was performed with SPSS software (version 19.0, SPSS Inc).

Results

Proximate composition of feed stuffs

The proximate composition of the experimental diet shown in Table 1, revealed that the crude protein content of Cocoa seed testa is higher than that of palm kernel cake.

Ingredient composition of the diet

Goat fed diet A had 0 % and 100 % inclusion of Cocoa seed testa and Palm kernel cake respectively. While those on diet B and C had Cocoa seed testa and Palm kernel cake inclusion of 50 : 50 % and 100 % : 0 % respectively as shown in Table 2.

Performance characteristics of Goat fed varying level of experimental diet supplemented with basal grass

Table 3 shows the average weight gain, feed intake and feed conversion ratio of treatment groups. Goats fed 50:50 % (Diet B) inclusion of Cocoa seed testa and Palm kernel cake performed best in terms of weight gain and feed conversion ratio.

Table 1: Proximate composition (g/100g) of feed stuffs fed to the West African goats

	Cocoa seed testa	Palm kernel cake	Maize offal	Grass (cynodon)
Crude protein	18.0	17.7	6.0	8.6
Crude fiber	19.0	18.0	15.0	21.0
Ether extract	8.0	11.0	5.1	6.0
Ash	7.8	8.2	5.8	5.0
NFE	47.2	45.1	68.1	59.4
Gross-energy kcal/g DM	4.2	5.6	4.0	3.5

Table 2: Ingredient composition of the experimental diet.

	A	B	C
Maize Offals	69.0	69.0	69.0
Palm kernel cake	30.0	15.0	0.0
Cocoa seed testa	0.0	15.0	30.0
Mineral/Vitamins premix	0.5	0.5	0.5
Common salt	0.5	0.5	0.5
TOTAL	100	100	100

Table 3: Feed intake, live weight gain per head obtained for the WAD goats fed varying level of experimental diet supplemented with basal grass

Parameters	Groups			± SEM
	A 0%	B 50%	C 100%	
Average Initial weight (g)	16350	16350	16370	0.7
Average Final weight (g)	18290.33 ^b	18889.96 ^a	18339.94 ^b	1.5
Average weight gain (g)	1940.33 ^b	2539.96 ^a	1969.94 ^b	1.3
Average weekly weight gain (g)	485.08 ^b	634.99 ^a	492.49 ^b	0.8
Average daily weight gain (g)	69.29 ^b	90.71 ^a	70.35 ^b	0.6
Average daily Feed intake (g)	1151.63	1088.13	925.67	0.8
Overall Feed intake (kg)	32.23	30.46	25.91	0.6
Feed Conversion ratio	16.61 ^a	11.99 ^c	13.15 ^b	4.2

a,b,c= means along the same row with any identical superscript are with significance($p>0.05$)
SEM= Standard Error of Means

Discussion

The chemical composition of the experimental diet shown in Table 1, revealed that the crude protein content of Cocoa seed testa is higher than that of Palm kernel cake. This observation is in accordance with the findings of Ogunsiye *et al.* (2017).

The lower feed intake observed in diet B and C with 50 %, 100% levels of inclusion of cocoa seed testa could be as a result of its odour and grittiness. This finding supports that of Yaakugh *et al.* (1994) who indicated that the digestibility of a diet is inversely related to its fiber content. Result also shows a significant difference ($P<0.05$) in the average daily weight gain and overall weight gain among the treatment groups. Goats on diet B has the highest weight gain followed by those of diet C. Lowest value of weight gain was from diet A. This result was better than the average daily weight gain of 53g/day reported by Abil *et al.* (1992) when they replaced cotton seed cake and maize with wheat bran in the diet of sheep. The FCR also varied significantly ($P<0.05$) among the treatments, it was highest in diet A followed by diet C then diet B, this corroborate the report of Odo *et al.* (2014) that variations in FCR among livestock are due to body weight and efficiency of nutrient utilization of the diet.

Conclusion and recommendation

From the trial it can be concluded that the inclusion of cocoa seed testa from 50 % to 100 % replacement of palm kernel cake increased the weight of West African dwarf goat. Also, 50% substitution level of PKC with CST is recommended.

Further research is recommended to ascertain the supplementation of CST with other relative conventional feed ingredient and other grasses.

References

- Abil, J. U., Iji, P. A., Umunna, N. N. and Dim, N. I. 1992. The replacement value of wheat bran or cotton seed cake and maize in the diet of sheep. *Bull. Anim. Hith. Prod. Afr.*, **41**: 65-69.
- Ajila, C. M., Brar1, S. K., Verma, M., Tyagi, R., Godbout, D. S. and Valéro, J. R. 2012. Bio-processing of agro-byproducts to animal feed. https://www.researchgate.net/publication/221879667_Bio-processing_of_agro-byproductstoanimalfeed/link/568fbc4108aead3f42f46ed5/download (15-05-2020 11:00am)
- AOAC, 2010. Association official Analytical chemists; Official

Methods of Analysis, 12th Edition.

- Aregheore, E. 2002.** Chemical Evaluation and Digestibility of Cocoa (Theobroma cacao) Byproducts Fed to Goats. *Tropical animal health and production*. 34. 339-48. 10.1023/A:1015638903740.
- Duncan D. B. 1955.** Multiple Range and Multiple F- Tests. *Biometrics* 11: 1-42.
- Ettu, R. O., and Onwuka, C. F. I. 2015.** Mineral and fibre intake of West African Dwarf sheep fed boiled cocoa seed testa and sorghum dust cassava root meal based diets. *Nigerian Journal of Animal Production*. 42(1)
- Lu, C. and Potchoiba, M. 1990.** Feed intake and weight gain of growing goats fed diets of various energy and protein levels. *Journal of animal science*. 68. 1751-9. 10.2527/1990.6861751x.
- Odo, B. 1., Marire, B. N. and Nnam, O. C. 2014.** Replacement Value of Poultry Waste for Wheat Offal and Palm Kernel Cake (P.K.C.) in Broiler Diet. *International Journal of Applied Science and Technology* Vol. 4, No. 3; 255
- Ogunsipe, M. H., Ibidapo, I., Oloruntola, O. D. and Agbede, J. O. 2017.** Growth performance of pigs on dietary cocoa bean shell meal. *Livestock Research for Rural Development*. Volume 29, Article #18. Retrieved July 7, 2020, from <http://www.lrrd.org/lrrd29/1/ogun29018.html>
- Omotoso, O., Bode, B., Idris A. and Fajemisin, A. N. 2018.** Effects of differently treated theobroma cacao pod husk silage and cassava peel meals on nutrient utilization and weight gain of west african dwarf goats. *Animal research international*. 15(2): 3020–3033 3020
- Oni, O. O. 2002.** Breeds and genetic improvement of small ruminants. In: Small Ruminant Production Training Workshop, National Animal Production Research Institute, Shika, Zaria, Nigeria. pp1-7
- Ranjhan, S. K. 1993.** Agro-industrial by-products as component of livestock rations. In: Animal Nutrition in the Tropics. New Dehli, India: *Vikas Publishing House PVT Ltd*, 222–258.
- Wilkinson, J. M. and Lee, M. R. F. 2018.** Review: Use of human-edible animal feeds by ruminant livestock. *Aug; 12(8):1735-1743*. doi:10.1017/S175173111700218X . <https://www.ncbi.nlm.nih.gov/pubmed/28893333>
- Yaakugh, S., Smith, U. and Varich, W. 1994.** Poultry feeding in tropical and subtropical countries, FAO Agricultural development paper 820

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