PERFORMANCE OF GROWING RABBITS FED DIETS CONTAINING GRADED LEVELS OF PROCESSED COCOA (*Theobroma cacao*) POD HUSKS

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ABSTRACT

Performance characteristics of growing rabbits fed graded levels of processed (ash treated and rumen liquor fermented) cocoa (*Theobroma cacao*) pod husks were investigated. One hundred and twenty (120) rabbits were randomly allotted to four (4) dietary treatments at 0, 10, 20, and 30% inclusion levels and designated as diets 1, 2, 3, and 4 respectively. Each treatment group was replicated ten (10) times with three (3) rabbits representing a replicate and was fed *ad-libitum* for 56 days. The final live weight, total weight gain, average daily weight gain and feed conversion ratio of rabbits in diets 2 and 3 were similar to those on control diet but was significantly ($P<0.05$) higher than diet 4. Up to 20% processed cocoa (*Theobroma cacao*) pod husks may be included into rabbits' diets.

INTRODUCTION

The present low protein intake in Nigeria due to high cost of animal protein sources may be improved by increased rabbit production. Rabbits are highly prolific and their meat is low in fat and cholesterol (Biobaku and Dosunmu, 2003) thus making the flesh a desirable one for diabetics, hypertensive and middle aged people. However, high feeding cost due to exorbitant cost of conventional feed stuffs being used in compounding livestock feeds remains a major constraint to rabbits' production in Nigeria (Adeyemi *et al.*, 2008). This occurred because of existing stiff competition between human and animal for the conventional feed resources (Teguia and Baynen, 2004). Therefore, the search for alternative, cheap unconventional feed stuff to substitute in part or fully the conventional feed resources by animal nutritionists becomes very important. Cocoa pod husk, a major by-product from commercial cocoa farming, which forms about 70% (w/w) of the whole mature fruit of cocoa are presently under-utilized (Nortey *et al.*, 2015). Cocoa pod husk is high in fiber, lignin (14%), hemicelluloses (11%), cellulose (35%) and pectin (6%) (Alemawor *et al.*, 2009). However, various methods had been used to improve the nutritive value of cocoa pod husk, among which is ash treatment and fermentation (Adeyeye *et al.*, 2016). Therefore, the objective of this study were to determine the effect of dietary inclusion of ash treated and rumen liquor fermented cocoa pod husks on performance of growing rabbits.

MATERIALS AND METHODS

The experiment was carried out at the Rabbitary; Teaching and Research Farms of the Federal College of Agriculture (FECA), Akure, Nigeria. The cocoa pod husks were processed as previously described by Adeyeye *et al.*, (2016). Cocoa pod husk were chopped into pieces with sharp stainless steel knife, sun dried for 7-14 days. Dried corn stalks collected were also gathered and burnt to ashes and used to prepare Corn Stalk Ash solution (CSAS) by suspension in deionized water for 48 hours at room temperature and filtered. One gram of each CPH was steeped in 7mls of CSAS for seven days anaerobically and thereafter sundried and named Ash Treated Cocoa Pod Husk (ATCPH) (Adamafio *et al.*, 2004). Droppings of commercial layers' wastes were collected from FECA poultry unit sundried and milled. The ATCPH was mixed with dried layers waste (100g/kg) and molasses (50ml/kg). Freshly collected rumen liquor from slaughtered White Fulani cattle was added into the CPH and mixed properly with layers' wastes and molasses, covered and fermented anaerobically for 7 days, sundried for one week and named processed cocoa pod husks and analysed for chemical composition. Thereafter, four (4) diets (Table 1) were formulated in which processed cocoa pod

husks were included at 0, 10, 20 and 30% and designated as diets 1, 2, 3 and 4 respectively and the rabbits' diets and pelletized (4mm diameter and 8mm long). One hundred and twenty (120) healthy, five-week old growing rabbits were randomly allotted to the four (4) dietary treatments after balancing for weight in a completely randomly design. Each treatment group was replicated ten (10) times with three (3) rabbits representing a replicate. The rabbits were fed their respective diets *ad-libitum* throughout the period of eight (8) weeks.

RESULTS AND DISCUSSION

Fermentation is carried out to be a major process of caffeine and theobromine elimination which according to Adamafio *et al.,* (2004) enhances nutrient contents of foods through the biosynthesis of vitamin and protein by improving the protein quality and fibre digestibility. It also enhances micronutrients availability and aids in degrading anti- nutritional factors as observed by Adeyemi *et al,* (2008) for rumen filtrates fermented cassava root meal and Adeyemi *et al,* (2011) for fermented pineapple peel. Chemical analysis showed that processed cocoa pod husk has 14.72% crude protein, 16.93% crude fibre, 5.3% ether extract, 14.73% ash, 1.17 mg/g caffeine and 1.47 mg/g therobomine. The average daily weight gain of the rabbits (19.24 to 23.02g/rabbit/day) were higher than weight range of 17.65 to 18.80g /rabbit/day recorded by Agunbiade *et al.*, (1999) for rabbits fed cassava leaf and peel meal, Osakwe and Nwose, (2008) (11.77-19.83g /rabbit/day) and Ibrahim *et al.*, (2014) (6.55-12.70g /rabbit/day), but however lower than 25.5-31.00g/rabbit/day (Lebas *et al.*, (1986)) and 44.10-45.10g/rabbit/day (Mora *et al.*, (2014). The similarity of the average daily weight gain and feed conversion ratio of the rabbits fed control (diet 1) and those with 10 and 20% processed cocoa pod husks inclusive diets (diet 2 and 3) shows that the inclusion of processed cocoa pod husks at those two levels did not precipitate any negative effect on the growth performance of the rabbits. However, the depressed ($P<0.05$) total weight gain, average daily weight gain and feed conversion ratio recorded in diet 4, compared to other diets may be as a result of increase in anti nutrients (such as caffeine and threobromine) concentration at 30% processed cocoa pod husks inclusion. This result agreed with Cunningham (1970), who recorded retarded growth and decreased feed efficiency in pig as a result of high level caffeine in diets. Rabbits fed 20% processed cocoa pod husks inclusive diets (Diet 3) had the lowest average daily feed intake but utilized the experimental diet better than others as reflected by the results of feed conversion ratio. This is in contrast to the report by Osakwe and Nwose, (2008) and Ogunsipe *et al.*, (2014) that feed intake increases as levels of inclusion of various agro-industrial wastes increases. Feed conversion ratio observed in this study i.e. 2.79-3.62 were better than 5.39-6.30 reported by Ogunsipe *et al.,* (2011) for rabbits fed graded levels of glyricidia leaf protein concentrates and 4.42-5.85 reported by Ekwe *et al.*, (2011) for rabbits fed cassava seviate. In conclusion, processed cocoa pod husks could be included in growing rabbits' diets up to 20% level.

REFERENCES

Adamafio, N. A., Afeke, I. K., Wepeba, J, Ali, E. K. and Quaye, F. O. (2004). Biochemical composition and in vitro digestibility of Cocoa (*Theobroma cacao*). *Ghana J. Sci.* 44: 29-38.

Adeyemi, O. A, Ajado, A.O, Okinbayo, A. O. and Enolanda, O. O (2011). Response of growing rabbits to graded levels of fermented and unfermented pineapple peels. *Nig. J. Ani. Prod.* 38(1): 86-98.

Adeyemi, O. A, Fasina, O. E, Ashnoli, B. A, Adebayo, M. A, and Wade, O. E. (2008). Cassava peels and leaves in diets of rabbits: Effects of performance and Carcass characteristics. *Nig. J. Ani. Prod.* 26(2): 167-173.

Adeyeye, S.A., Agbede, J.O., Aletor, V.A., Oloruntola, O.D., Ayodele, S.O. and Ahaotu, E.O. (2016). Effects of Rumen Liquor Fermentation on the Proximate Composition and Anti-Nutritional Factors of Ash - Extract Treated Cocoa *(Theobroma cacao)* pod husks. *Proc. 21st Ann. Con. Animal Science Association of Nigeria 18 – 22, 2016/ Port Harcourt-* Supplementary Volume I page 34-37.

Agunbiade, J. A., Adeyemi, O. A., Fasina, O. E., Ashnoli, B. A., Adebayo, M. A. and Wade, O. E. (1999). Cassava peels and leaves in diets of rabbits: Effects of performance and carcass characteristics. *Nig. J. Anim. Prod.* 26(2): 167- 173.

Biobaku, W. O. and Dosunmu, E. O. (2003). Growth performance of rabbits fed graded levels of processed and un-dehulled sunflower seed. *Nig. J. of Anim. Prod.* 30(2): 179-184.

Cunningham H.M (1970). Effect of caffeine on growth, feed efficiency and leanness of growing pigs and its interaction with calcium, zinc and corn oil. *Can. J.Anim.Sci.* 51: 95-102.

Ekwe, O. O., Osakwe, I. I. and Nweze, B. O. (2011). The Effects of replacing maize with cassava seviate using banana leaves as basal forage in the diet of weaned rabbits. *Ozean J. Appl. Sci.*. 4(1): 51-58.

Ibrahim, A. A, Aliyu, J, Muhammed, A.I, and Amin, A. B (2014). Effects of different dietary levels of Sabara leaf meal (*Guinera senegalensis*) replacement on growth performance and nutrients digestibility of rabbits on North western Nigeria. *Nig. J. Ani. Sci.* 16(1): 76-84.

Lebas, F., County, P., Romvier, R. and Roak, A. H. (1986). The Rabbit: Husbandry Health, and Production. *Animal Production and Health Series No 21.* Food and Agriculture Organization, Rome Italy.

Mora, L. M., Mora, A. S. M. T., Scapinello, C., Bicudo, S. J., Araiyo, I. G., Curcelli, F. and Barros, T. F. M. (2014). Digestible energy of unpeeled cassava root meal and its effects on growth performance and carcass traits in rabbits. *World Rabbits Sci.* 22: 105-111.

Nortey T.N., Kpogo D.V., Kpogo A.L., Naazie A and Oddoye E.O.K (2015). Cocoa pod husk is a potential feed ingredient in laying hen diets. *Livestock Res. Rural Dev.* 27(6).

Ogunsipe, M. H. and Agbede, J. O. (2014): Performance response, Carcass evaluation and economic benefits of rabbits fed Sorghum offal-based diets. *African J. Food, Agric. Nutr.Dev.* 14(1), 8585-8601.

Ogunsipe, M. H., Akinbami, A. S. and Ibidapo, I. (2011). Performance evaluation and economics of production of rabbits fed graded levels of glyricidia leaf protein concentrates as replacement for groundnut cake protein. *Int. J. Agric. Sci. Res.Tech.* 1(2): 67-72.

Osakwe, I. O. and Nwose, R. N. (2008). Feed intake and nutrients digestibility of weaner rabbits fed cassava peels as replacement for maize. *Ani. Res. Int.* 5(1): 770-773.

Teguia, A., and Beynen, A. C. (2004). Broiler Performance upon dietary substitution of Cocoa Pod Husks for Maize. *Int. J. Poultry Sci.* 3:779-782.

Table 1. Composition of experimental diet

	Level of processed coca pod husk (%)			
	0	10	20	30
Ingredients	Diet 1	Diet 2	Diet 3	Diet 4
Maize	16.00	15.50	15.50	14.50
RLFCPH	0.00	10.00	20.00	30.00
Wheat offal	2.50	1.50	1.50	1.50
Soya bean meal	8.65	7.65	7.65	7.65
BDG	25.90	24.40	19.40	13.40
Rice bran	26.90	18.90	15.90	12.90
SBM Hay	5.00	5.00	5.00	5.00
Maize Husk	13.00	13.00	13.00	13.00
Bone meal	1.00	1.00	1.00	1.00
Premix	0.25	0.25	0.25	0.25
Methionine	0.15	0.15	0.15	0.15
Lysine	0.10	0.10	0.10	0.10
Salt	0.25	0.25	0.25	0.25
Vegetable oil	0.30	0.30	0.30	0.30
Total	100.00	100.00	100.00	100.00
Calculated analysis (%)				
Crude protein	17.19	17.16	17.17	17.18
Crude fibre	16.03	16.04	16.06	16.05
Energy (kcal/kg)	2540.80	2539.00	2538.32	2534.88
Calcium	0.50	0.50	0.50	0.5
Phosphorus	0.31	0.30	0.31	0.34
Lysine	0.75	0.73	0.72	0.73
Methionine	0.45	0.44	0.43	0.46

Table 2. Performance of Rabbits fed level of processed cocoa pod husk

	Level of processed cocoa pod husk (%)					
	0	10	20	30		
	Diet 1	Diet 2	Diet 3	Diet 4	SEM	P value
Initial weight (g/rabbit)	524.18	523.17	523.48	524.78	0.27	0.09
Final live weight (g/rabbit)	1748.00^{a}	1784.40^{a}	1812.60^{a}	1602.60^{b}	28.86	0.01
Total weight gain (g/rabbit)	1223.80^{a}	1261.20^{a}	1289.10^{a}	1077.40^{b}	29.07	0.01
Average daily weight gain (g/rabbit/d)	21.85^{a}	22.52^{a}	23.02^{a}	19.24^{b}	0.52	0.01
Total feed intake (g/rabbit)	3698.62	3618.17	3604.12	3902.12	71.66	0.43
Average daily feed intake (g/rabbit/d)	66.05	64.61	64.36	69.69	1.28	0.43
Feed conversion ratio	3.03^{a}	2.88^{a}	2.79^{a}	3.62^{b}	0.11	0.01