Journal of Cell and Animal Biology Vol. 1 (5), pp. 084-086, March, 2008
Available online at http://www.academicjournals.org/JCAB
ISSN 1996-0867 © 2007 Academic Journals

Full Length Research Paper

Effect of replacement of cocoa bean shell for maize on growth, carcass characteristics and organoleptic properties of growing snail *(Archachatina marginata*)

A. O. Owosibo[1], R. A. Hamzat[2]* , A. M. Raji[1], S. B. Fasoyiro[3] and L. O. Obisesan[1]

[1]Federal College of Animal Health and Production Technology, I.A.R. and T., Ibadan, Nigeria.
[2]Cocoa Research Institute of Nigeria (CRIN), Idi-Ayunre, Ibadan, Nigeria.
[3]Institute of Agricultural Research and Training, Moor Plantation, Ibadan, Nigeria.

Accepted 14 December 2007

In a completely randomized design, a total of 120 growing snails of mean weight 156.69 ± 3.4 g were used to investigate the effect of partial replacement of maize with cocoa bean shell (CBS) for growing snail for 20 weeks. There were five treatments and three replicates of 8 snails each. The diets contained 0.0, 2.5, 5.0, 7.5 and 10.0% CBS in partial replacement of maize and designated T_1, T_2, T_3, T_4 and T_5 respectively. The parameters taken were weight gain, feed intake from which feed conversion ratio was calculated. There were significant differences ($P < 0.05$) in the values obtained for mean weekly weight gain and mean weekly feed intake. Meanwhile, the values for 10.0% CBS based diets were comparable to control. The feed conversion ratio was similar across the treatments. Values obtained for mean weekly shell length increment, mean weekly shell width increment and mean weekly shell thickness increment were not affected by inclusion of CBS in the diets of snails. The values obtained for carcass characteristics of snail were not significantly different ($P > 0.05$) and so not affected by the treatment. Values obtained for organoleptic properties revealed no difference in flavour, after taste, mouth feel and general acceptability at 10% replacement level in comparison to control except for colour and texture. The inclusion of CBS up to 10% in the diets of snail had no detrimental effect on the performance, carcass characteristics and general acceptability of the snails. Based on the present results, cocoa bean shell could replace maize in the diet of snail up to 10%.

Keywords: growth, carcass values, organoletic properties, snail, cocoa bean shell.

INTRODUCTION

Cocoa tree *Theobroma cacao* is widely cultivated in Nigeria. In addition to the highly flavoured cocoa, cocoa tree provides by-products such as Cocoa Butter (CB), Cocoa Pod Husk (CPH) and Cocoa Bean Shell (CBS) among others. Cocoa bean shell is a potential tropical feed resources and its utilization in animal feeding will greatly reduce the disposal problem facing the cocoa processing factories in Nigeria. The dried CBS contained 13.12% crude protein; 13.00% crude fibre; 8.71% ether extract; 9.15% Ash and 2400 ME kcal/kg (Olupona et al., 2003). Several studies on the broilers, cockerel chicks and finishers, laying hens have established the inclusion of rate of cocoa bean shell (CBS) in these poultry rations. Ten percent dietary inclusion of CBS in replacement for maize was found suitable in layers diets (Olubamiwa et al., 2000). Hamzat and Babatunde (2006); Hamzat et al. (2006) reported the suitability 5 and 7.5%; 10%; 10 and 15% inclusion of cocoa bean shell in the diet of broiler and cockerel chicks and finishers respectively. In the present communication, influence of graded levels of SBC has been studied on the growth rate and carcass characteristics of growing snail.

MATERIALS AND METHODS

A total of 120 growing snails 156.69 3.4 (*A. marginata*) of means weight were used for the feeding trial that lasted 140 days in a completely randomized design. The trial has 5 treatments and was replicated thrice with 8 snails per replicate. Five diets were formulated which contained 0.0, 2.5, 5.0, 7.5, 10.0% and were de-

*Corresponding author. E-mail: rahamzat6nov@yahoo.com

Table 1. Gross composition of experimental diets (%).

Ingredients	T_1	T_2	T_3	T_4	T_5
Maize	24.00	21.50	19.00	16.50	14.00
Soyabean meal	42.00	42.00	42.00	42.00	42.00
Brewers dry grain	6.75	6.75	6.75	6.75	6.75
Palm kernel cake	15.00	15.00	15.00	15.00	15.00
Bone meal	7.40	7.40	7.40	7.40	7.40
Oyster shell	4.30	4.30	4.30	4.30	4.30
Salt	0.30	0.30	0.30	0.20	0.30
Premix	0.25	0.25	0.25	025	0.25
Cocoa bean shell	0.00	2.50	5.00	7.50	10.00
Total	100	100	100	100	100
ME kcal/kg	2300.46	2274.61	2248.76	2222.91	2197.00
Crude protein	24.33	24.44	24.54	24.65	24.75

* T_1 – 0.0% CBS; T_2 – 2.50% CBS; T_3 – 5.00% CBS; T_4 – 7.50% CBS; T_5 – 10.0% CBS. *CBS – Cocoa Bean Shell.

Table 2. Performance characteristics of growing snails fed experimental diets.

Parameter (%)	T_1	T_2	T_3	T_4	T_5
Mean initial weight (g)	159.91	153.16	155.01	152.33	158.77
Mean final live weight (g)	238.81	231.56	237.41	234.13	235.13
Mean weekly weight gain (g)	3.96^{ab}	3.93^{ab}	4.12^{a}	4.09^{a}	3.82^{b}
Mean weekly feed intake (g)	46.35^{a}	41.82^{b}	43.40^{ab}	48.60^{a}	44.75^{ab}
Mean feed conversion ratio	11.70	10.64	10.53	11.88	11.71
Mean weekly shell length increment (mm)	1.33	1.37	1.36	1.41	1.40
Mean weekly shell width increment (mm)	0.83	0.78	0.84	0.86	0.81
Mean weekly shell thickness (mm)	0.08	0.08	0.08	0.08	0.07

* T_1 – 0.0% CBS; T_2 – 2.50% CBS; T_3 – 5.00% CBS; T_4 – 7.50% CBS; T_5 – 10.0% CBS.
- CBS – Cocoa Bean Shell.

signated T_1, T_2, T_3, T_4 and T_5 respectively (Table 1).

The snails were reared in a cage of 0.5 x 0.5 x 0.5 m^2 compartments each. The bottom of the case was filled with moist top soil to a depth of 10 cm and the top was covered with mosquito net reinforced with wire netting for proper aeration. The experimental diets were supplied *ad libitum*. The feed intake was taken on daily basis by subtracting the left over from the feed offered while the weight gain was taken on a weekly basis with the use of electric weighing balance. The shell length and shell width - increments were taken on weekly basis with the use of vernier caliper calibrated in mm. Shell thickness increment was taken on weekly basis with the use micrometer screw gauge. At the end of the feeding trial, 9 snails were randomly selected from each treatment for carcass analysis. Breaking the shell with hard object killed the snails. The foot (edible portion), the shell and the visceral were then separated and weighed separately with electric weighing balance. The dressing percentage was calculated as the ratio of food to the live weight. The feet were washed with aluminium sulphate (Alum) to remove the slime in preparation for organoleptics properties.

After washing the feet with water each treatment was separately cooked for 30 min in 50 ml of water without salt. Organoleptic evaluation was done by placing 10 pieces of the cooked snail meat and measuring about 2 cm^3 of each of the treatments on flat white boots and labeled in such a way to prevent disclosure of the identity of the samples. The cooked meat was presented for sensory evaluation by a panel of 10 judges on a nine point Hedonic scale (1 was disliked extremely and 9 was liked extremely) (Larmond, 1977).

Water was also provided for judges to rinse their mouth after each assessment. Qualities assessed by the judges were colour, texture, flavour, after taste, mouth feel and general acceptability. The proximate composition of the experimental diets was carried out according to the method of A.O.A.C. (1990). The data were subjected to analysis of variance using S.A.S (1999) and significant treatment means were separated with Duncan Option of the same software.

RESULTS AND DISCUSSION

The result obtained for mean weekly weight gain and mean weekly feed intake were significantly different ($P < 0.05$). Mean weekly weight gain varied from 3.82 g for snails fed 10% CBS based diet to 4.12 g for snails fed 5% CBS based diet. Mean feed intake was significantly lowered for snails fed 2.5% CBS based diets. However, feed conversion ratio was comparable among the treatment which might mean cocoa bean shell do not depress the conversion of the fed diets to flesh. Meanwhile the

Table 3. Carcass analysis and organoleptic properties of snails fed graded levels of cocoa bean shell (CBS) in partial replacement for maize.

Parameter (%)	T_1	T_2	T_3	T_4	T_5	SEM
Mean live weight (g)	251.79[a]	229.59[ab]	177.41[c]	214.81[b]	20515[b]	36.14
Mean foot weight (g)	93.32	89.28	68.90	77.22	74.82	
Mean shell weight (g)	54.97	43.62	34.41	51.57	45.67	
Mean visceral weight (g)	51.58	44.58	40.59	47.49	47.72	
Dressing percentage	37.24	38.55	38.00	36.59	36.54	5.13
Visceral/live weight (%)	20.54	20.08	22.36	22.30	23.40	4.48
Shell live weight (%)	21.61	18.78	19.66	23.58	21.91	4.48
Organoleptic properties						
Colour	7.30a	7.10a	6.80ab	6.90ab	5.90b	1.28
Texture	7.30a	6.20ab	6.70ab	6.60ab	5.90b	1.82
Flavour	7.40a	7.20ab	6.60ab	6.40b	7.00ab	0.78
After taste	6.60ab	7.20a	6.00ab	5.50b	6.00ab	1.75
Mouth feel	6.10b	7.60a	6.70ab	6.30ab	6.80ab	1.75
General Accetability	7.44ab	7.67a	7.33ab	6.33b	6.22b	1.39

ab: Means with different superscript are significantly different ($P < 0.05$).
* T_1 – 0.0% CBS; T_2 – 2.50% CBS; T_3 – 5.00% CBS; T_4 – 7.50% CBS; T_5 – 10.0% CBS.
CBS – Cocoa Bean Shell.

best conversion was obtained for snail fed 5% CBS based diet (Table 2). The result obtained for mean weekly shell length increment, shell width increment and shell thickness increment were similar among the treatment (Table 2). This suggests that inclusion of CBS in the diets of snails had no negative influence on process of shell formation even when CBS partially replaced maize up to 10%. The result obtained for mean live weight, mean foot weight, mean shell weight and mean visceral weight were significantly different ($P < 0.05$) (Table 3). This was as a result of difference in weight of the snail used in carcass evaluation. However, the dressing percentage was similar across the treatment hence the inclusion of CBS in the diets of snails did not alter the dressing percentage of snails negatively. The nutrients obtained by snails for the production of flesh in all the CBS based diets were adequate since there was no depression in the dressing percentage. The result obtained for organoleptic properties showed that colour and texture were significantly lowered in the snails fed 10% cocoa bean shell in replacement for maize while flavour, after taste, mouth feel and general acceptability were similar to control even at 10% replacement level (Table 3). The results revealed that, cocoa bean shell does not exert any negative effect on flavour, after taste, mouth feel, general acceptability, except for colour and texture at 10% replacement level.

Conclusion

Snails tolerated partial replacement of maize with cocoa bean shell up to 10%. This will definitely be of advantage to snail farmers in terms of cost and also reduce the disposal problem facing the cocoa processing factories in Nigeria.

ACKNOWLEDGEMENTS

The authors are grateful to the Provost, Federal College of Animal Health and Production Technology, Moor Plantation, and the Executive Director, CRIN, Ibadan, Nigeria, for the permission given to publish this paper.

REFERENCES

AOAC (1990). Association of Official Analytical Chemists, 15th ed., Washington, D.C.. Analytical System Institute, Inc. Cary, N.C.

Hamzat RA, Babatunde BB (2006). Utilization of cocoa bean shell as a feed ingredient for broiler chickens. In: Book of Abstract of the 15th International Cocoa Research Conference, Costa Rica.

Hamzat RA, Babatunde BB, Adejinmi AA, Olubamiwa O (2006). Performance characteristics of cockerels fed cocoa bean shell based diets. In the Book of Abstracts of the 15th International Cocoa Research Conference, Costa-Rica.

Larmond E (1977). Laboratory method of sensory evaluation of foods. Research Branch, Canadian Department of Agriculture Publication 56-59.

Olubamiwa O, Odewumi WO, Longe OG, Hamzat RA (2000). Practical inclusion of cocoa bean shell in poultry feeds: A preliminary report. In: Proceedings of the 13th International Cocoa Research Conference, Sabah, Malaysia. pp. 981 – 986.

Olupona JA, Abodunwa JA, Fayoyin FK (2003). Response of laying hens to graded levels of cocoa bean shells. In: Proceedings of the 28th Ann. Conf., Nig. Soc. Anim. Prod. (NSAP), Volume 28. pp. 247 – 249.