Carcass Evaluation of Snails (*Archachatina marginata*) Fed Diet Containing Varying Levels of African Yam bean (*Sphenostylis stenocarpa* L.)

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Abstract

Understanding the effects of different feed ingredients incorporated into livestock feed and the demand for nutritious and sustainable food sources necessitate the need to explore alternative feed options for livestock. Evaluating the potential benefits of incorporating African Yam Bean (AYB) into snail diets is crucial in optimizing feed efficiency and enhancing the profitability of Snail farming. The study was designed to determine the effect of African Yam Bean meal (AYB), an underutilized legume in the diet of snails on dressing percentage, texture, flavor, general acceptability, protein and fat contents of the meat. 120 growing snails with mean weight of 73.42 ± 2.5g were used for the feeding trial. 4 diets were formulated to contain African Yam Beans (AYB) at 0% (AYB_1) Control, 50% (AYB_2), 75% (AYB_3) and 100% (AYB_4) as replacement for soya bean fraction in the diet. Complete Randomized Design was used for the trial; each treatment was replicated thrice with 10 snails per replicate. Carcass evaluation (dressing percentage, texture, flavor, general acceptability, protein and fat contents of the meat among others) were carried out at the end of the 120 days feeding trial. The dressing percentage of the snails was not significantly influenced by dietary treatments (P>0.05) and varied between 44.43 and 45.34%. The offal live weight and shell live weight percent were not significantly influenced by the varying inclusion of AYB in the diet (P>0.05). There were no significant difference in the crude protein (CP), taste of the meat, color, flavor, texture of the meat and general acceptability of the meat (P> 0.05). The Physico-chemical qualities of the meat were not affected by the inclusion of AYB in the diet. African Yam Bean meal could therefore be harnessed as alternative feed ingredient to Soyabean meal for snail.

Keywords: Giant African Land Snail, African Yam Bean meal, Evaluation, Carcass

Évaluation des carcasses d'escargots (*Archachatina marginata*) Régime alimentaire contenant différents niveaux de haricots igname africains (*Sphenostylis stenocarpa* L.)

Résumé

Comprendre les effets des différents ingrédients alimentaires incorporés dans l'alimentation du bétail et la demande de sources alimentaires nutritives et durables nécessitent d'explorer des options alternatives d'alimentation du bétail. L'évaluation des avantages potentiels de l'incorporation de haricots igname africains (HIA) dans l'alimentation des escargots est cruciale pour optimiser l'efficacité alimentaire et améliorer la rentabilité de l'élevage d'escargots. L'étude a été conçue pour déterminer l'effet de la farine haricots igname africains (HIA), une légumineuse sous-utilisée dans l'alimentation des escargots, sur le pourcentage de

vinaigrette, la texture, la saveur, l'acceptabilité générale, la teneur en protéines et en matières grasses de la viande. 120 escargots en croissance d'un poids moyen de 73,42 ± 2,5 g ont été utilisés pour l'essai d'alimentation. Quatre régimes ont été formulés pour contenir des haricots igname africains (HIA) à 0 % (HIA_1) témoin, 50 % (HIA_2), 75 % (HIA_3) et 100 % (HIA_4) en remplacement de la fraction de soja dans l'alimentation. Un plan randomisé complet a été utilisé pour l'essai ; chaque traitement a été répété trois fois avec 10 escargots par répétition. L'évaluation des carcasses (pourcentage de vinaigrette, texture, saveur, acceptabilité générale, teneur en protéines et en matières grasses de la viande, entre autres) a été réalisée à la fin de l'essai d'alimentation de 120 jours. Le pourcentage de dressage des escargots n'était pas significativement influencé par les traitements alimentaires (P > 0,05) et variait entre 44,43 et 45,34 %. Le poids vif des abats et le pourcentage du poids vif des coquilles n'étaient pas significativement influencés par l'inclusion variable de HIA dans le régime alimentaire (P > 0,05). Il n'y avait pas de différence significative dans la protéine brute (PB), le goût de la viande, la couleur, la saveur, la texture de la viande et l'acceptabilité générale de la viande (P> 0,05). Les qualités physico-chimiques de la viande n'ont pas été affectées par l'inclusion de HIA dans l'alimentation. La farine d'igname africaine pourrait donc être exploitée comme ingrédient alimentaire alternatif à la farine de soja pour les escargots.

Mots-clés : escargot terrestre géant d'Afrique, farine de haricots d'igname africains, évaluation, carcasse

Introduction

Conventional feed ingredients such as Soyabean meal, groundnut cake meal and fish meal which are major sources of protein in diet of snails are expensive (Omole *et al.*, 2016; Odeyinka, 2014) hence there is need to look for alternative source of protein which is available and affordable (Odeyinka, 2014). It has been established by authors that substituting conventional feed ingredients with unconventional ones has led to reduction of cost (Odeyinka, 2014). African yam beans are common legume in Nigeria but are considered as underutilized (Klu *et al.,* 2001; Adewale *et al.,* 2013). Conventional feed ingredients such as soyabean meal, groundnut cake meal and fish meal which are major sources of protein in diet of snails are expensive therefore alternative source of protein which is available and affordable should be considered. The potential utilization of African Yam Bean in Snail diets appears promising due to its high nutritional content. Evaluating the potential benefits of incorporating African Yam Bean (AYB) into snail diets is crucial in optimizing feed efficiency and enhancing the profitability of Snail farming.

The acute shortage of animal protein in Nigeria and Africa in general has led to research in domesticating of unconventional livestock such as snails and grass-cutters as alternative source of animal protein. Domestication of the aforementioned animals will also prevent them from extinction as a result of hunting and destruction of their natural habitat. There is growing interest in rearing snails for meat and source of income. The major limitation to snail production is a quality feed at affordable prices. Some of the feed given to snails include; fruits such as pawpaw, water melon, cucumber and pineapple.

An important aim of research in animal production is to enhance cost effective livestock production while providing adequate animal protein and livestock by-products for human consumption. Most legumes are consumed by human while also serving as plant protein source for livestock. Although, reasons for

under-utilization of indigenous pulses as feedstuff for livestock and as food for humans are varied, the presence of potent anti-nutritional substances in these seeds is a significant factor. The antinutritional factors include: protease inhibitors, haemagglutinins (lectins), tannins, glycosides and alkaloids. These anti-nutritional factors limit the use of raw African yam bean in livestock feed although various processing techniques tend to reduce the antinutritional factor content of the seed (Eniola *et al.*, 2007). Several studies indicate that heat processing such as aqueous and dry heating (toasting) increases the digestible nutrients available to young non ruminant animals, especially grasscutter, snails, young chicks, resulting in improved growth. The hulls of legumes consist of poorly digestible glumes that completely enclose the seed. Removal of this hull should therefore increase the concentration of digestible nutrient level for livestock comparable with that of soyabean. However, some authors reported sub optimal performance when broilers are fed processed mucuna bean meals (Emiola *et al*., 2003; Emiola *et al.*, 2007). This was attributed to varying concentrations of residual trypsin inhibitor and haemagglutinins in the meals. Emphasis has been placed on the various ways of inactivating the anti-nutritional factors in the legume seed and the improvement of the nutritive value. However, little attention has been given to the evaluation of the effects of intake of residual anti-nutritional factors in processed legume seeds on performance and nutrient utilization of microlivestock fed African yam bean meal. There is paucity of information in the use of African yam bean meal in the diet of snails hence the study was conducted to determine the effect of replacing soyabean meal with varying levels of African yam bean meal in the diet of growing snails.

Materials and Methods

Source of test ingredient

750kg of African Yam beans (AYB) was purchased from a market in Ibadan, Oyo state, Nigeria. It was toasted and ground before incorporating with other feed ingredients.

Experimental design and data collection

A total of 120 growing snails (*Archachatina margi*nata), mean weight 73.42 ± 2.5g of about 3 months of age were used for the feeding trial. Four diets were formulated to contain African Yam beans (AYB) at 0% (AYB_1) Control, 50% (AYB_2), 75% (AYB_3) and 100% (AYB_4) as replacement for soyabean meal fraction in the diet of growing snails. Completely randomized design was used for the trial and each treatment was replicated thrice with 10 snails per replicate. The diets were formulated to contain about 24% crude protein and energy of 2600 kcal/kgME. (Table 1) All management practices were adhered to as suggested by *(*Omole *et al*., 2016). Carcass analysis was carried out at the end of the feeding trial of 120 days by randomly selecting 4 snails from each replicate and weighed separately. Each snail was killed by striking the shell with a club. The shell, foot and visceral were separated and weighed separately. The meat samples were cooked without salt and 400mL of water was added to the meat before cooking separately for 30 minutes. The cooked meat samples (foot) were served to twenty taste panelist for evaluation (colour, appearance, flavor, texture, taste and overall acceptability) with the aid of questionnaires that were administered. The rating was 1-9 which correspond to dislike extremely, dislike very much, dislike moderately, dislike slightly, Neither like nor dislike, like slightly, like moderately, like very much, like extremely. The treatment scores was assessed by choosing the score rating of each samples with highest frequency and then the mean scores of treatment based samples. The chemical composition of meat was done according to the method of (AOAC, 1990).

Statistical Analysis

All data were subjected to statistical analysis using analysis of variance and the means were separated if they were significantly different using Duncan Multiple Range Test (SAS, 2000)

Results and Discussion

The results from the experiment are presented in Tables 1-4 below

Table 1: Gross Composition of Experimental Diet

Ingredient (%)	AYB_1 (0%)	AYB_2 (50%)	AYB_3 (75%)	AYB_4 (100%)
Maize	22.0	22.0	22.0	22.0
Soya bean meal	24.0	12.0	4.0	0.0
African yam beans	0.0	12.0	20.0	24.0
Fish meal	4.0	4.0	4.0	4.0
Groundnut cake	10.0	10.0	10.0	10.0
Rice-bran	14.0	14.0	14.0	14.0
Bone meal	2.3	2.3	2.3	2.3
Brewer dried grain	13.45	13.45	13.45	13.45
Oyster shell	9.70	9.70	9.70	9.70
Table salt	0.1	0.1	0.1	0.1
Methionine	0.1	0.1	0.1	0.1
Lysine	0.1	0.1	0.1	0.1
Premix	0.25	0.25	0.25	0.25
Total	100.0	100.0	100.0	100.0
Calculated Nutrient Composition				
Crude protein (%)	24.22	24.21	24.13	24.08
Metabolizable (kcal/KgME) energy	2605.2	2599.3	2589.45	2572.12

Table 2: Summary of carcass composition of Snail fed diets containing African Yam Bean meal (AYB).

Parameters	AYB_1 (0%)	AYB_2 (50%)	AYB_3 (75%)	AYB_4 (100%)	± SEM
Average Live weight (g	357.10	356.62	355.12	350.92	6.65
Shell weight (g)	87.06	83.38	84.20	81.73	4.45
Offal weight (g)	78.99	78.99	78.52	77.38	3.12
Foot weight (g)	161.91	161.58	159.63	155.91	4.99
Dressing percent (%)	45.34	45.31	44.95	44.43	2.97
Offal/live weight (%)	22.12	22.15	22.11	22.05	2.31
Shell/live weight (%)	24.38	23.38	23.71	23.29	2.41

Table 3: Proximate composition of Snail meat fed diets containing African Yam bean meal (AYB) (% dry matter)

Composition (%)	AYB_1 (0%)	AYB_2 (50%)	AYB_3 (75%)	AYB_4 (100%)
Dry matter	24.56	24.14	24.45	24.51
Crude protein	20.56	20.51	20.48	20.44
Crude fibre	0.08	0.07	0.07	0.06
Ether extract	0.91	0.93	0.92	0.93
Ash	11.78	11.76	11.73	11.62

Table 4: Sensory properties of the meat of growing Snails fed varying levels of AYB in the diet

Mean Score Values	AYB_1 (0%)	AYB_2 (50%)	AYB_3 (75%)	AYB_4 (100%)	±S.E.M.
Colour	6.52	6.51	6.53	6.52	0.44
Taste	6.23	6.23	6.24	6.23	0.42
Flavour	6.16	6.15	6.14	6.12	0.45
Texture	6.12	6.14	6.13	6.13	0.41
General Acceptability	6.45	6.46	6.48	6.44	0.4

The protein content of the experimental diets (Table 1) fell within recommended values of protein requirements for growing snails as reported by (Omole *et al*., 2016). The dressing percentage of the snails vary between 44.43 and 45.34% (P>0.05) (Table 2). The offal live weight and shell live weight percent were not significantly influenced by the varying inclusion of AYB in the diet. The dressing percentage (DP) recorded in the study was relatively the same with the reports of (Omole *et al*., 2016). The non-significant differences in the DP in all the treatments buttressed the fact that African yam bean meal could replace the soybean fraction of the diet of growing snails without affecting the meat yield. The chemical composition of the meat is shown in Table 3. There was no significant difference (P> 0.05) in the crude protein (CP) of the meat in all the treatments. The protein recorded in the treatments is in accordance with the report of (Odeyinka *et al*., 2014; Omole *et al*., 2016) in a nutritional evaluation of the meat of snail fed diet containing varying levels of quality protein maize. The fat content of the meat in all the treatments were not significantly influenced (P> 0.05) by the dietary treatments as shown in Table 3. The fat content values ranged from 0.91% in AYB1 to 0.93% in AYB4. The fat content of the snails in all the treatments was low compared to other livestock conventional livestock such as pork, chicken and beef (Odeyinka, 2014; Hamzat and Longe, 2014). The low fat content of the meat of the snails makes it a good antidote for fat related diseases such as high blood pressure caused by too much fat and high cholesterol level in the body (Hamzat and Longe, 2014). The result of the organoleptic properties of the meat of the snails fed diets containing AYB as replacement for soybean meal is as shown in Table 4. The results indicated that the taste of the meat was not influenced by the dietary treatments as observed by the panelists (P>0.05). Table 4 also shows that color, flavor, texture of the meat are not (P>0.05) influenced by the varying inclusion of

AYB in the diet across the treatments. The general acceptability of the meat by the panelists was relatively the same in all the treatments (P> 0.05), the physico - chemical qualities of the meat were not affected by the inclusion of AYB in the diet of snails

Conclusion

Results in this study indicated that African Yam Beans is a good source of alternative feed stuff in replacing soya bean meal as source of protein in diets of snails and it can be incorporated up 75% replacement level without any deleterious effect on growth and physico–chemical qualities of snail's meat which support the use of AYB as alternative feed source for snails' production.

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