Original Research Article

Effect of Cassava by Product on Performance and Cost of Snail (*Archachatina marginata*) Production

Abstract

A twelve week feeding trial was conducted with (n=225 growing snails) with an average weight of 88.95± 8.10g to access their growth response and nutrients digestibility. The snails were fed pawpaw leaf meal (PLM), cassava leaf meal (CLM), cassava peel meal (CPM), cassava sieviate meal (CSM) and cassava chaff meal (CCM) in a complete randomized design at 45 snails per treatment of five treatments, while each treatment was replicated three times. The proximate and fiber fractions of the feed stuffs were also determined and data were analyzed using ANOVA. The proximate evaluation showed highest crude protein in PLM (31.35%) and least in CSM (2.34%). Highest crude fiber was obtained for CPM (16.21%) and least in CCM (3.98%) CSM had the highest NFE (87.41%). Highest neutral detergent fiber (NDF) 59.33%, acid detergent fiber (ADF) 34.24%, acid detergent lignin (ADL) (9.18%), cellulose (25.59%) and hemicelluloses 25.06% was obtained for PLM. Outstanding (PL< 0.05%) weekly weight gain, weekly feed intake, nutrient digestibility and carcass yield were obtained in snails on PLM and CLM followed by CPM. Snails utilized Cassava by-product without any adverse effect.

Keywords: Snails, Digestibility,Fiber,Carcass yield

INTRODUCTION

The cost of animal production is high and has been computed to be about 60-80% of the total cost of animal production, this is because of the high cost of feed ingredients and irregular supply (Oluyemi and Robert,2000). Convectional feed ingredients such as maize, soyabean, groundnut cake etc.are expensive and there is need to seek for alternatives.(Agunbiade et al 2011) the high cost of feed and animal protein has created a wide protein gap, the Nigerian food balance sheet of 4.82g/caput/day of animal protein was much lower than the FAO minimum recommendation of 35g/ caput/ day from livestock products (kehinde (2009) and (FAO 2010) this was attributed to the inherent problem of lower production from conventional livestock, due to their poor growth rate, poor feed utilization and small mature body size (Bawa et al 2012)

Alternative sources of animal protein such as snails and other micro livestock are now domesticated for poverty alleviation and increased animal protein intake (Omole 2002).The meat of snail is cherished and regarded as a delicacy, due to its high quality protein, low fat and its richness in mineral salts such as Iron, Calcium, Magnesium etc.

This study tried to evaluate the response of giant land snail (*Archachatina marginata*) to cassava leaf meal (CLM), cassava sieviate meal (CSM), cassava peel meal (CPM), cassava chaff meal (CCM) and pawpaw leaf meal (PLM) as the control treatment, due to its high nutritive value and snails have been found to have good performance response when fed with pawpaw leaf meal. (Akinnusi et al 2018).

The choice of cassava based product is due to their all year round availability, cheapness and high level of carbohydrates (Kehinde 2019). Cassava peel was obtained after the peeling of the tubers, while the leaves are collected after cassava harvesting, cassava seiviate is a by-product of cassava flour sieving and the chaff is derived when cassava solution is sieved. Cassava by products have been used previously to feed livestock by (Tewe, 1997,Akinfala et al 2019, Aguihe et al 2019 and Kehinde et al 2019) and incorporated into poultry diets to reduce cost of production.

The cassava by products used were derived from tropical manihot species (TMS) 30572 sourced from the Agroforestry farm of the forestry research institute of Nigeria and the main anti nutritional factor in cassava (Cyarogenic glucoside) has reduced to a tolerable level by processes like drying, peeling, frying, retting and boiling.

The benefits of nail farming include easy handling, low cost of production, no pollution and low incidence of diseases (Akinnusi et al 2018, Ejidike amd Oyekunle 2019). The most common snail species in Nigeria is *Archachatina marginata*, it is the biggest snail species in Nigeria and its adoption in this trial will further promote snail rearing in captivity.

Materials and method

Experimental site

The trial was conducted at the Wildlife Department Snail Section of the Forestry Research Institute of Nigeria, Ibadan Oyo State, Nigeria.

Experimental animals

Two hundred and forty growing snails of an average weight of (60±0.25g) were sourced from the departmental farm, the snails were randomly allotted to the treatments (0,5,10 and 15% inclusion of cassava peel) at 60 snails per treatment, while each treatment was replicated thrice.

Management of experimental snails

The snails were housed in concrete pens of dimension 0.25 x 0.25. 1m^3 for growing snails. The pen was provided with concrete drinkers and feeders. Water was offered throughout the trial, while known quantity of feed was offered, they were fed in the evening, due to their nocturnal nature. The trial lasted for fourteen weeks.

Growth performance evaluation

Known quantity of feed was offered to the snails everyday and the left over was measured to determined feed intake, weight change in the treatment was determined on a weekly basis, by using well calibrated electric weighing balance. FCR was the evaluated by dividing the feed intake by the weight gain.

Shell morphological changes were determined by using vernier caliper to measure the shell length, while the shell thickness was determine with the use of micrometer screw gauge.

Nutrient digestibility determination

This was carried out at the end of the 12th week of a 14 week trial. Four snails from each replicate were moved to the constructed wooden metabolic cage of dimension 0.2x 0.2 x0.5 m^3, which was lined with a thin foam, for easy collection of voided excreta, the excreta voided were accurately measured on a daily basis, dried in hot air oven at 105bc until the moisture content was constant, then allowed to cool, ground and stored for subsequent proximate analysis determination, by the methods of A.O.A.C (2005)

Proximate and macronutrient analysis of Snail meat

The proximate composition of snail meat was determined by the official methods of analysis of absorbed by the Association of Analytical Chemists (A. O. A. C 10th edition 2005). This elicited the component crude protein, crude fiber, ether extract, Nitrogen free extract , and Ash . All analysis were done in triplicates

The level of calcium, potassium and sodium was determined by the method of A.C, Arc (995.11) by the use of the Jen way digital flame photo meter (PF86 model), Phosphorus content of the meat sample was determined by the use of spectro photometric method (A.O.A.C 975.11) and Magnesium by A.O.A.C (975.23)

Statistical analysis

Data collected were subjected to Analysis of variance (ANOVA), using Complete Randomized Design while significant means were separated using Duncan's Multiple Range Test of (1995) as explained by Sam *et al*,. (2019).

RESULTS OF TRIAL IN WHICH SNAILS WERE FED WITH CASSAV BY PRODUCTS AND PAWPAW LEAVES

Table 1 shows the proximate analysis of the feedstuff (PLM, CLM, CPM, CSM and CCM) shows that PLM the control diet had highest ($P<0.05$) crude protein (31.35%), ash (10.86%) and least NFE (45.61%). Highest crude fiber (16.21%) was recorded for CPM, while CSM had highest($P<0.05$) NFE (87.41%) and least ($P<0.05$) in crude protein.

TABLE 1 PROXIMATE COMPOSITION OF CASSAVA BY-PRODUCTS AND PAWPAW LEAF

	TREATMENTS				
Parameters (%)	**PLM**	**CLM**	**CPM**	**CSM**	**CCM**
Crude Protein	31.35	19.45	3.94	2.34	3.62
Crude Fiber	11.42	12.15	16.21	7.35	3.98
Ether Extract	0.76	2.10	1.03	0.25	0.46
Ash	10.86	8.94	4.67	5.12	4.25
Nitrogen Free Extract	45.61	57.39	78.09	87.41	81.66

CLM = Cassava Leaf Meal

CSM = Cassava Sieviate Meal

PLM = Pawpaw Leaf Meal

CPM = Cassava Peel Meal

CCM = Cassava Chaff Meal

Table 2 Elicited the fiber fraction cyanide and gross energy contents of the feedstuffs. CPM had the highest($P<0.05$) NDF (59.83%), ADF (34.24%), ADL (9.18%), cellulose (25.59%) and hemi cellulose (25.06%), while CSM was least ($P<0.05$) in NDF, ADF, ADL cellulose, hemicelluloses and gross energy (2900 K Cal/Kg).

TABLE 2: FIBRE FRACTION ANALYSIS, CYANIDE AND GROSS ENERGY OF CASSAVA BY-PRODUCTS AND PAWPAW LEAF

	TREATMENTS					
PARAMETERS (%)	**PLM**	**CLM**	**CPM**	**CSM**	**CCM**	**± SEM**
Neutral Detergent Fiber	54.79^{b}	59.83^{a}	44.2^{d}	46.54^{c}	54.79^{b}	0.26
Acid Detergent Fiber	30.40^{c}	34.24^{a}	20.67^{e}	22.92^{d}	32.68^{b}	0.16

Acid Detergent Lignin	8.29^{b}	9.18^{a}	4.21^{d}	5.16^{c}	8.29^{b}	0.02
Cellulose	24.39^{b}	25.59^{a}	23.57^{c}	23.62^{c}	24.39^{b}	0.13
Hemicellulose	22.11^{c}	25.06^{a}	16.46^{c}	17.76^{d}	24.39^{b}	0.03
HCN (mg/kg)	32.68^{a}	21.42^{d}	13.24^{d}	16.24^{c}	-	0.02
Gross Energy (Kcal/Kg)	2800^{c}	2834^{d}	2900^{c}	3116^{b}	3672^{a}	0.16

abcde: Means along the same row with different superscripts are significantly different ($p<0.05$).

Table 3 had the performance of the snails in forms of growth, feed intake, shell morphology, nutrient digestibility and cost of feed per gramm weight gain. Highest ($P<0.05$) average weekly weight gain was recorded for snails fed PLM (4.53g) and CLM (4.44g) followed by those on CPM and least and compared values in snails fed with CSM and CCM. Feed intake also followed the same trend. Highest shell length movement was recorded for PLM (0.95mm), while shell thickness was highest ($P<0.05$) in CPM. Digestibility of crude protein, crude fiber and ether extract was highest ($P<0.05$) and comparable in snails fed with PLM and CLM followed by CPM. Cost of feed per gramm weight gain was ₦ 0.035, ₦ 0.035, ₦ 0.05, ₦ 0.05 and ₦ 0.06 for PLM, CLM, CPM, CSM and CCM respectively.

TABLE 3: Growth Performance, Nutrient Digestibility and Economy of Production of Snails Fed Cassava By-Products and Pawpaw Leaf.

	TREATMENTS					
PARAMETER	**PLM**	**CLM**	**CPM**	**CSM**	**CCM**	**± SEM**
Initial Body Weight (g)	88.75^{a}	89.71^{a}	88.68^{a}	89.01^{a}	89.56^{a}	0.97
Final Body Weight(g)	143.05^{a}	142.96^{a}	120.12^{b}	111.84^{c}	112.45^{c}	4.68
Average Weekly Weight Gain(g)	4.53^{a}	4.44^{a}	2.62^{b}	1.90^{c}	1.94^{c}	1.15
Average Weekly Feed Intake(G)	33.22^{a}	32.47^{a}	25.36^{b}	21.48^{c}	21.58^{c}	1.89
Feed Conversion Ratio	7.32^{c}	7.43^{c}	9.68^{b}	11.29^{a}	11.31^{a}	0.25
Average Weekly Shell Length Increment(mm)	0.95^{a}	0.72^{b}	0.61^{c}	0.56^{d}	0.57^{d}	0.01

Average Weekly Shell Thickness Increment(mm)	0.03[b]	0.03[b]	0.07[a]	0.02[b]	0.02[b]	0.01
Average Weekly Shell Width Increment(mm)	0.54[a]	0.53[a]	0.52[a]	0.46[b]	0.46[b]	0.04
Ether Extract Digestibility%	80.05[a]	81.09[a]	79.09[b]	75.00[c]	75.04[c]	0.20
Crude Protein Digestibility%	76.25[a]	75.25[a]	74.28[b]	72.15[b]	72.12[b]	2.98
Crude Fiber Digestibility%	60.86[a]	60.05[a]	59.86[a]	57.75[b]	57.28[b]	1.14
Cost Feed/Kg (₦)	5.00	5.00	5.00	5.00	5.00	-
Cost Of Feed/Gramme Weight Gain (₦)	0.035	0.035	0.05	0.05	0.06	-
Carcass Yield (%)	38.47[a]	38.41[a]	36.90[b]	36.85[b]	36.82[b]	1.0

abcde: means along the same row with different superscripts are significantly ($p<0.05$) different.

DISCUSSIONS ON THE PERFORMANCES OF GROWING SNAILS FED CASSAVA BY PRODUCTS BASED DIETS

The feedstuff adopted for this feeding trial are cheap and available, the choice of pawpaw leaf meal as the control diet is because it is the most preferred diet of snail (Akintola et al 2019) the proximate analysis of the feedstuff revealed CLM and PLM as protein rich feedstuffs, with 19.42% and 31.75% respectively, the others (CPM, CCS and CSM) are by products of cassava tuber processing and they had low protein content which ranged from 1.82% to 3.94%, this confirmed the findings of Adesehinwa (2018) that cassava by products are low in crude protein and any diet with cassava based needs protein fortification through the addition of protein concentrate or by fortification with limiting amino acid. CPM, CCM and CSM are good energy substrates.

Cassava by products and PLM fiber fraction were determine to ascertain quantitative and qualitative fiber content and compost ion. Neutral D***** fiber (bulk fiber) (59.83%), ADF (34.24%) ADL (9.18%), cellulose (25.39%) and hemicelluloses were highest ($p<0.05$) in CPM, the ADL level is very important for fiber utilization, source it is the part of fiber that is not digestible and also impair the digestibility of other nutrients, this corroborates the findings of Aina and oluwasanmi (2003) that utilization of fiber is influenced by its content of lignin.

Nutrition is to have previously adopted different processing methods to improve fiber utilization, such as boiling soaking grinding and fermentation, which reduced fiber content of feedstuffs and improve their levels of crude protein, in this trial the cassava by products had passed through, drying and soaking in some instances to reduce anti nutritional factors. Aguile et al (2019) and Akintal et al (2018) stated that processing of cassava by products reduced cyanide and made it safe for consumption by monogastrics. Evaluation of cyanide in this trial revealed that PLM does not contain cyanide, while CLM, CPM, and CSM had cyanide below lethet dose of 100ppm.

The significant ($p<0.05$) high feed intake, weight gain and shell morphological changes obtained for PLM and CLM could be attributed to their higher crude protein contents, which improve feed palatability and feed intake (Agunbiade et al 2002 and tewe 1997). Average weekly feed intake in PLM (7.43g) compared and higher ($p<0.05$) then the values for snails fed with CLM, CSM and CCM. The crude protein content of the feedstuffs is important and has been known to affect feed intake and consequently weight gain and feed conversion ratio, which were best in snails fed PLM and CLM.

Omole (2002) reported that the bioavailability of calcium and phosphorus for shell thickness increment depended on crude protein content, fiber ADL and ADF and feed intake, which were more favourable in PLM. CLM and CPL followed by compared ($p<0.05$) in PLM (0.54mm), CLM (0.53mm) and CPL (0.53mm) and were better ($p<0.05$) then (0.46mm) obtain for CCM and CSM. Improved shell thickness in CPL was attributed by Omole 2002 to the high level of hemicelluloses in CPM, which enhanced calcium and phosphorus utilization, unlike growth in snail which is directly related to protein and feed intake, shell thickness is regulated by shell mineralization. This trial corroborated the findings of kehinde et al (2006), that high level of dietary to crude protein include feed palatability and digestibility in monogastrics, this was exemplified by superior ($p<0.05$) digestibility of other extracts, crude protein and fiber recorded for snails fed PLM and CLM. Reduced cost of production was achieved in snails fed PLM and CLM. These two forages were outstanding in snail feeding.

REFERENCES

Adesehinwa, A.O.K (2008). A review paper on energy and protein requirement of pigs and the utilization of fibrous feedstuff in Nigeria. African Journal of Biotechnology 7(25); 4798-4806

Aguile, P.C and Kehinde, A.S (2019). Performance, haematological and serum biochemistry of broiler chickens fed differently processed shea butter cake meal Nigerian Journal of Animal Science 21(2):231-239.

Agunbiade, J.A, Adeyemi. O.A,Salau, K.O and Taiwo A.A (2011) Utilization of hatchery waste meal in cassava products based broilerfinisher diets. Nigerian journals of animal production vol 38(2)74-81

Agunbiade, J.A, Adeyemi. O.A, Adepoju O.A. and Lawal O.A. (2002), the use of whole cassava meal and leaf in broiler diets. Tropical Journal of Animal Science 5(1); 161-173.

Ruminant estimate of acid detergent fiber, neutral detergent fiber of different foodstuffs. The proceedings of the 28th Annual conference of Nigeria society for animal production pp 311-313.

Akinfala, E.O, Aimusan, K.O and Adeyemi A.A (2019) characterization of carbohydrate fractions of cassava plant meal and its utilization by giving pigs. Nigerian Journal of AnimalProduction Vol. 46 (1): 77-84.

Akinnusi, F.A.O, Oni O.O and Ademolu K.O (2019). Variation in chemical composition of shell and haemolymph of giant African Land Snail *Achachatina marginata* during wet and dry seasons in Nigeria. Journal of molluscan Research Vol 5:31-36

Akinnusi, F.A.O, Adeoye, A.S, Bello, I.T and Ajuwon, A.O (2018) comparative growth and feed intake analysis of albino and normal skinned Giant African Land Molluscan Research Vol 4:18-24.

A.O.A.C (2005). Official methods of Analytical chemists washinton DC-

Duncan, D.B (1955) New Multiple range and Multiple F Test Biometrics 14:1-45

Ejidike, B.N and oyekunle S.K (2019) survival and growth performance of African Land Snails (*Achatina fulica*) juveniles reared on different soil types. Journal of Molluscan Research Vol 5:25-30.

F.A.O (2015). Agricultural handbook: poultry meat and eggs 1st edition. Food and Agriculture organization investment division Rome Italy.

Kehinde, A.S, Aguihe P.C and Samuel, K.U (2019). Enzyme supplementation on blood chemistry of growing Japanese Duals fed sundried yam peel based diets. Nigerian Journal of Animal production 46 (1):113-115.

Kehinde, A.S(2019). Wealth creation and employment through snail production and research, Journal of Molluscan ResearchVol 5:1-3.