Original Research Article

Effect of cassava peel based diets on performance and Meat quantity of snail (*Archachatina marginata* Swainson)

Abstract

The effect of cassava peel (CPL) incorporation (0,5, 10 and 15%) in the diets of growing snails (average initial weight 66.0 ± 0.15g) on the growth performance, shell morphological changes, digestibility of nutrients, carcass yield and mineral element composition of the meat was investigated. The nutritional trial adopted four T_1 (0%), T_2 (5%), T_3 (10%) and T_4 (15%) almost isocaloric and isonitrogenous diets. Two hundred and forty growing snails were randomly allotted at 60 snails/treatment, while each treatment was replicated three times. The digestibility of nutrients was evaluated at the 12^{th} of the fourteen-week trial. Data collected were analyzed in a complete randomized design using (ANOVA), a significant difference among the means was separated using Duncan's multiple range test. Cassava peel is rich in NFE (70.0%), low in crude protein (3.94%), while the four diets held almost equal proximate composition. Feed intake increased ($P<0.05$) from T_1 to T_4 and T_1 (control) had the best ($P<0.05$) carcass yield. Survivability of snails at all levels was 100%. Highest dry matter digestibility (70.01%) was obtained in T_1; the digestibility of other nutrients also reduced ($P< 0.05$) with CPL incorporation. Meat mineral composition was not compromised by the treatments. Cassava peel based diet was favourably utilized at 15% CPL incorporation without any adverse effect on feed intake, growth, meat quality and carcass yield, farmers should adopt it.

Keywords: Growth performance, Nutrients digestibility, snail meat, cassava peel, growing snail

Introduction

Snail farming has become a promising job creation and empowerment venture that is engaging many farmers as a means of promoting good health and job creation policy of the Federal Government of Nigeria (Kingsley, 2019). It is very common in peri-urban settlements to find backyard micro-livestock rearing and Snail domestication inclusive (Omole, 2002).

There are various reasons for the increasing acceptability of snail farming such as no noise or air pollution, low capital outlay and facility unlike poultry and other livestocks, that are capital intensive (Kehinde, 2009).

Snail meat is very beneficial to its consumers, due to its low level of fat (1.35%), cholesterol (0.5 mg /100mg), low density lipid (3.08 mg/ 100g), high density lipid (1.86 mg/ 100mg) and free fatty acid (3.50mg/100mg) Ebenso et al (2019) . It was further buttressed by Babalola and Akinsoyinu (2009) that snail meat is leaner, juicy and delicious.

The full benefits of the good attributes of snails cannot be explored, if snail supply is left to the gatherers, this has prompted the Forestry Research Institute of Nigeria to lead in the captive rearing of a snail, formulation of least cost snail ration and reduction of maturity period. It is also active in the supply of foundation stock, in order to salvage snail from imminent extinction (Kehinde, 2019).

Feeding has been a big threat to the livestock industry, because it has been variously computed that feeding constitutes about 70% of the cost of animal production (Oluyemi, and Robert, 2000). Then many alternative feedstuffs that are cheaper and available throughout the year have been used to promote products and sustain the chemical content of snail meat (Bobadoye et al., 2010), due to the feeding habit of snail as a monogastric herbivore, trials have been conducted on the adoption of mulberry leaf, cassava peel, leaf, sieviate, chaff, gliricidia and leuceana leaf in the feeding of snail. This was done to screen the plants and assess their safety in snail feeding.

It is a fact that snail cannot subsist only on forages, they perform better on compounded ration. A trial by (Omole, 2002) on the use of plant materials to feed snail showed a ridiculous low dressing percentage of less than 40%. To optimize forages in snail feeding, they are incorporated at different levels which must be determined (Akinnusi et al., 2019). In this study, cassava peel was systematically included in the feed of snail at 0, 5, 10 and 15% to assess its effect on performance, nutrient digestibility and quality of meat. The meat quality is important because the consumer cherishes it as a source of protein and treatment of ailments.

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 the 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 every day and the left over was measured to determine feed intake, weight change in the treatment was determined every week, by using well-calibrated electric weighing balance. FCR was 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 determined with the use of micrometre 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 spectrophotometric 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

Table 1; shows the gross composition of cassava peel based diets, with cassava peel inclusion at (0, 5, 10, and 15%) in the diet of snails. The diets were compounded to meet the nutritional need of growers snail. The diets had almost the same levels of crude protein (23.34- 23.98%) and Metabolizable energy (2390- 2401kcal /kg).

Table 1. Gross composition of cassava peel based diets fed to snail.

	Treatments			
Ingredients %	**T_1**	**T_2**	**T_3**	**T_4**
Maize	22.50	21.60	21.10	21.10
Maize Offal	10.00	9.00	9.00	7.00
Wheal Offal	10.85	7.35	4.35	1.35
Palm Kernel Cake	5.00	5.00	3.50	1.10
Soya bean cake	25.70	22.10	22.10	22.00
Groundnut cake	10.00	14.00	14.00	16.50
Fish meal	4.00	4.00	4.00	4.00
Oyster shell	9.70	9.70	9.70	9.70
Bone meal	2.15	2.15	2.15	2.15
Grower premix	0.10	0.10	0.10	0.10
Cassava peel	0.00	5.00	10.00	15.0
Estimated Nutrients Composition crude protein	23.98	23.45	23.34	23.38
Metabolizable Energy (Kcal/kg)	2400	2399	2401	2390

Table 2: Shows the proximate composition of cassava peel (CPL) and cassava peel based diets. It revealed the crude protein, crude fiber, either extract, Ash and Nitrogen free extract. The diet had the following proximate constituents, crude protein (23.34 – 23.98%) crude fiber (6.45-6.91%) ether extract (20.18- 3.48%), Ash (8,71- 8,96%) and NFE (57.15-57.897). Cassava peel was high in fiber (18.21%) and low in crude protein (3.94%).

Table 2: Proximate composition of cassava of cassava peel (CPC) and cassava peel based diets fed to growing snails.

	Treatments				
	CPL	**T_1**	**T_2**	**T_3**	**T_4**
Proximate Parameters %					
Dry matter	92.00	92.15	92.83	92.45	93.01
Crude protein	3.94	23.98	23.45	22.34	23.38
Crude fibre	13.21	6.45	6.62	6.91	6.97
Ether Extract	1.03	3.48	3.31	3.26	3.18
Ash %	3.82	8.94	8.96	8.71	8.65
NFE	70.00	57.15	57.86	57.78	57.84

Growth performance indices were shown on table 3, this revealed, the feed intake, weight gain, shell morphological changes and cost per gram weight gain. Initial weight of the snail (66.50 – 66.75g), final weight gain (141.74 – 150.31g), shell thickness increment (0.05mm), shell length increament were not significantly varied. Highest daily feed intake was recorded for T_4 (42.00g) and least in the control treatment (35.95g), however, better ($P<0.05$) and comparable feed conversion value were recorded in T_1, T_2, and T_3.

Carcass yield was significantly varied in all the treatments, with the best ($P<0.05$) performance obtained in T_3 with 10% of cassava peel inclusion.

Table 3: Growth performance indices of snail fed cassava peel based diets

	T_1	**T_2**	**T_3**	**T_4**	**SEM±**
Initial body weight (g)	66.75	66.75	66.500	66.60	3.20
Final body weight (g)	144.50	150.39	149.04	141.74	2.50
Daily weight gain (g)	6.50^{ab}	6.97^{a}	6.92^{a}	6.27^{b}	0.05

Daily feed intake	35.95^{c}	38.21^{a}	38.05^{a}	42.00^{a}	0.70
Feed conversion ratio	5.43^{b}	5.41^{b}	5.43^{b}	6.01^{a}	0.60
Dressing percentage (%)	44.32^{b}	44.09^{b}	44.77^{a}	42.50^{c}	0.40
Offal weight (g)	22.67^{b}	22.83^{b}	22.88^{b}	25.13^{b}	0.30
Shell weight (g)	33.01^{a}	33.09^{a}	32.47^{b}	31.39^{c}	0.50
Shell thickness increment (mm)	0.05	0.05	0.05	0.05	-
Shell length increment (mm)	0.07	0.25	0.24	0.25	0.06
Shell width increment (mm)	6.21	6.25	6.28	6.29	0.29
Mortality					

Table 4- Shows the digestibility of nutrients, such as crude protein, crude fiber, ether extract and nitrogen-free extract, which were all significantly ($P<0.05$) Varied – best performance in terms of nutrients digestibility was recorded in the control treatment (T_1).

Table 4: Nutrients digestibility of snails feed cassava peel based diets.

	T_1 (0%)	**T_2(5%)**	**T_3 (10%)**	**T_4 (15%)**	**SEM±**
Nutrient					
Dry matter	70.01^{a}	69.05^{a}	64.05^{b}	64.00^{b}	1.1
Crude protein	69.00^{b}	69.05^{b}	65.00^{a}	64.99^{a}	1.0
Crude fibre	62.00^{c}	58.69^{b}	58.67^{b}	58.00^{b}	1.2
Ether Extract	62.00^{a}	61.00^{b}	59.00^{c}	56.66^{d}	0.75
Nitrogen Free extract	62.33^{a}	61.00^{b}	60.00^{b}	60.00^{b}	2.0

Table 5, shows the mineral profile and pH values of snail meat fed CPL based diets. The level of calcium (105.00 -105.7mg/100g), potassium (0.049 – 0.06mg/100g), Iron (1.88 – 1.99mg/100g) Phosphorus (22.40 – 22.65mg/100g), Copper (0.66 – 0.71mg/100g), Sodium (1.20 – 1.29mg/100g) and pH (9.40) were not significantly ($P<0.05$) influenced by the treatments.

Table 5: Mineral profile of meat of snails fed cassava peel based diets.

Parameters mineral Element	**T_1 (0%)**	**T_2 (5%)**	**T_3 (10%)**	**T_4 (15%)**	**SEM±**
Calcium (mg/100g)	103.35	105.70	105.45	105.00	0.5
Potassium (mg/100g)	49.00	50.00	60.00	54.00	2.0
Iron (mg/100g)	1.99	1.98	1.99	1.88	0.3
Phosphorus (mg/100g)	22.50	22.60	22.65	22.40	0.10
Copper (mg/100g)	0.69	0.70	0.91	0.66	0.10
Sodium (mg/100g)	1.27	1.28	1.29	1.20	0.10
PH	9.40	9.40	9.40	9.40	

Discussions

The gross composition of cassava peel based diets fed to growing snail showed the inclusion of cassava peel into four almost isocaloric and isonitrogenous diets, the diets were formulated to meet the nutritional needs of growing snails, based on the recommendation of Omole (2002), that snails require diets that are high in crude protein, for proper metabolism and growth performance, it also impacted on the carcass yield. It was evident from the findings of Kehinde (2019), that snail cannot subsist on forage alone. This agreed with the observation of Ayoola and Adeyeye (2010) and Mogbo et al (2014), when they stated that snail feed must be high in protein to promote growth and shell thickness.

Snail shell formation and integrity are important survivability index, hence appropriate inclusion of Oyster shell, bone meal and mineral premix are important. It is a common to experience for snail to leak each others shell or for nutrients to irrigate from the foot and haemolymph, which resulted to weight loss confirmation of the importance of snail shell to survival.

The diets and CPL were analyzed for their proximate composition, so as to ascertain their levels of dry matter and constituent crude protein, crude fiber, ether extract, ash and NFE. The diets had (23.34 – 23.98%) crude protein, this range agreed with the recommended adequate level suggested by Sam et al (2014). The adoption of cassava peel as an energy source was limited by its low level of crude protein (3.94%) and thus requires supplementation from protein concentrates (Akintola and Tewe, 2001 and Akinfela et al., 2013). Cassava peel is also high in crude fiber (13.21%), this has been implicated in nutrient digestibility.

Daily weight gain was best in T_2 and T_3, while values in T_1 and T_4 compared ($P<0.05$). Highest feed intake ($P<0.05$) was recorded in T_4, because of the compensatory feed intake by the snails, due to low bulk density of the diets fed to snail in T_4 and since animals feed to meet their need for growth, cell formation and survival (Kehinde 2009). Feed conversion was least and comparable ($P<0.05$) in T_1 to T_3, while diet T_4 was least utilized, a confirmation of the view of Akinfala and Tewe (2001) that cassava products are high in fiber and cause a lot of nutrient dilution thus rendering such diet poorly utilized.

Dressing percentage for the treatments (42.50 – 44.77%) were significantly varied, best ($P<0.05$) carcass yield was obtained in T_3, however, all the values obtained were above the threshold of below 40% dressing percentage obtained for growing snails fed forages (Omole, 2002), due to their inadequacy of nutrients to meet snail metabolism.

Offals weight increased as the level of cassava peel in the diet increased, highest ($P<0.05$) was obtained in T_4, which could be attributed to the muscular activities of the intestine, to digest fiber. Shell integrity was sustained at all levels, this reflected in the comparable ($P<0.05$) shell thickness increment, shell length increment and shell width increment and guaranteed survivability (100%) recorded in all the treatments, since shell in protects all the internal body parts of snail, in practice, snail with broken shell rarely survive (Akinnusi, 2019).

The digestibility of dry matter reduced from T1 to T4, which is directly related to the reduced bulk density of cassava peel based diets (Okon et al 2016), which can be enhanced by the fermentation of cassava peel, to break the cell wall, improve its digestibility and throughout protein enrichment (Kehinde et al., 2019).

This trial revealed that snail meat is rich in evaluated nutrients, such as Ca (105–105.700mg/100g), K (49.00 – 60.00mg/100g), Fe (1.88 – 199mg/100g), P (22.40–22.65mg/100g) Cu (0.66 – 0.71mg/100g) and Na (1.20 – 129mg/100g): these values agreed with the findings of Eruvbetine (2012), Akinnusi et al. (2019). It could be implied that the benefit of eating snail meet were not lost, due to the adequacy of these nutrients in snail raised on cassava peel based diets.

Conclusion

It could be stated that cassava peel is low in crude protein, high in crude fiber and Nitrogen Free Extract. Growing Snail utilized cassava peel based diet without any deleterious effect on the shell, carcass yield, survival and nutrients content of the snail meat. Cassava peel can be properly utilized by snail at an inclusion level of 15%.

Recommendation

Snail farmers should adopt the use of cassava peel in the diets of snail, because it is available all year round, its use will keep the environment clean and promote snail production.

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