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NUTRITIONAL POTENTIAL AND COST IMPLICATION OF YAM PEEL (*DISCOREA ROTUNDATA*) AS INGREDIENT FOR GROWING SNAILS (ARCHACHATINA *MARGINATA*)

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ABSTRACT: *Yam peel is a fall out during processing of yam to pounded yam or yam flour and could be used as alternative means of energy in the nutrient of livestock. The aim was to know the consequence inclusion of dry yam peeling (YP) as substitute for maize in the diet of growing Giant African land snail on feed intake, weight gain, meat qualities and priced benefits. Yam peeled was substitute at 0% (YP_1) Control, 25% (YP_2), 50% (YP_3) and 75% (YP_4) as replacement for maize fraction in the nutrient of growing Giant African land snails. Each treatment was repeated thrice with 10 snails per replicate in a completely randomized design. Parameters taken or calculated were feed intake, weight gain, shell length and width, feed conversion ratio and priced per weight gain among others. Significant differences were observed in the mean total feed consumption of the snails fed inclusion levels of yam peel meal in the diets ($P<0.05$) The main total feed consumed of 544.32 g was taken in YP_1, it was relatively similar to YP_3 the mean lowest feed consumed of 516.46g was taken in YP_4. The result of feed efficiency indicated that snails fed 0% YP as a substitute for maize fraction of the diet has most feed efficiency ($P<0.05$) and was not significantly different from YP_3. The morbidity and mortality percent were very low in all the treatments. The main dressing percentage of 43.57% was taken in YP_1 ($P<0.05$) it was not significantly different from 43.45 % and 43.13 % in YP_2 and YP_3 accordingly. Mean total no of egg laid was significantly influenced by different inclusion levels ($p<0.05$). From the study, it was revealed that weight gain, feed efficiency and dressing percentage were relatively similar in the snails fed zero percent diet and Fifty percent yam peel. The mean total number of egg laid and the size were not significantly different in the control and 50% inclusion, also the least cost per weight gain was recorded in YP_3 containing 50% YP, hence maize fraction of the diet of snails could be substitute up to 50% of yam peel without any adverse effect.*

KEYWORDS: Dressing percentage, feed efficiency, mortality, snails, reproductive indices, Yam peel

INTRODUCTION

Micro-livestock are small-bodied livestock reared mainly for meat and other by-products such as the shell of snails, fur from rabbits. The management practices are simple and they are good ventures for the women, youths and retirees that are looking for other source of income with less stress (Omole *et.al*,2012*)*. Micro-livestock include rabbits, bush rodents, bees, snails, guinea pigs, reptiles, tortoise. Snail meat is appetizing and a luxury with low fat and cholesterol level (Odeyinka, 2014). Protein content of snail meat make it other source of animal protein which is important for growth, reproduction and other metabolism performance in the body (Odeyinka, 2014). One of the constraint that affects increased production of snails is the high priced of feed. Feed constitutes about fifty to seventy percentage of total cost incurred on production (Hamzat and Longe 2014). Conventional feed ingredients such as maize, sorghum and maize shaft are expensive hence there is need to look for other feed resources that are readily accessible at affordable cost (Uchegbu *et.al*, 2008; Hamzat and Longe 2014). Series of works have been carried out on the use of agro-industrial by products (AIBs) such as cassava by products, brewer dry grains, rice bran and maize cobs in the diet of animals with an impressive result, leads to reduction in the cost of feed (Kehinde, 2009; Hamzat and Longe, 2014). Yam peel is another feed resource that can be used as an alternative ingredient. Yam peel is taken fresh by sheep and goats without any negative effect. It can be sun-dried in order to enhance its utilization. The peel contains two to six percent of crude protein depending on the cultivars, the crude fibre ranges between nine to fifteen percent. Yam peel is very accessible in all parts of Nigeria with little or no cost. It constitutes environmental nuisance where it is not properly utilized. There is scarceness of information on the utilization of yam peel in the nutrient of snails hence the feeding trial was carried out to evaluate the effect of varying inclusion level of dry yam peel in the diet of growing snails on feed consumption, weight gain, feed efficiency, carcass analysis and cost per weight gain.

MATERIALS AND METHOD

The sum of one hundred and twenty snails of mean weight 78.46± 4.4g were used for the study. The snails were quarantine for one week before the commencement of the feeding trial. Yam peel was gathered from a restaurant in Ibadan, Oyo state, Nigeria and sun-dried. Dry yam peel was later added at varying inclusion level with other feed ingredients at 0% (YP_1) Control, 25% (YP_2), 50% (YP_3) and 75% (YP_4) as substitute for maize fraction of nutrient of growing snails. Each dietary treatment was repeated three times with 10 snails per replicate in a completely randomized design. The diets were formulated to contain about 24% crude protein and energy of about 2400 kcal/kgME (Table 1).

Table 1: Feed Composition of Experimental Diet.

Ingredient (%)	YP_1 (0% YP)	YP_2 (25% YP)	YP_3 (50% YP)	YP_4 (75%YP)
Maize	22.00	16.5	11	5.5
Soya bean meal	10.5	10.5	10.5	10.5
Yam peel	0.0	5.5	11	16.5
*Others fixed ingredients	67.5	67.5	67.5	67.5
Total	**100.0**	**100.0**	**100.0**	**100.0**
Calculated analysis				
Crude protein (%)	24.43	24.18	23.72	23.19
Metabolizable energy (kcal/KgME)	2429.1	2419.11	2400.23	2384.44

*Other fixed ingredients: G.N.C. – 19.0; rice-bran -17.5; Fish meal -3; Bone meal -2.15; Oyster shell-9.5, Brewer dry grain-15.8; Methionine - 0.1; Lysine - 0.1; Premix 0.25; Salt-0.1

Feed intake and weight gain were measured on daily and weekly basis with the use of digital weighing balance. Feed intake was calculated by subtracting the left-over feed from the feed given while the weight gain was calculated by deducting the initial weight from the final weight. Shell length and width were measured on weekly basis with vernier caliper. Micrometer screw gauge was used to measure the shell thickness on weekly basis. Feed conversion ratio were calculated as the ratio of feed intake to weight gain. Feed cost and cost per weight gain were also calculated. Total number of egg s laid and hatched were calculated. Feed conversion ratio were calculated as the ratio of feed intake to weight gain. Carcass analysis was carried out at the end of the feeding trial by randomly selecting eight snails from each treatment and weighed separately. Each snail was killed by striking the shell with a club. The shell, foot and viscerals were separated and weighed separately. The meat samples (feet) were cooked separately for 18 minutes without salt and 120ml of water was added to the meat before cooking. The meat samples (which were coded) were served to ten panelists to assess for organoleptic properties of the snail meat according to the methods of (Kehinde, 2009) in which case the rating were 1, 2, 3, 4, 5, 6, 7, 8 and 9 correspond to Like extremely, Like very much, Like moderately, Like slightly, Neither like nor dislike, Dislike slightly, Dislike moderately, Dislike very much, and Dislike extremely, respectively. The meat organoleptic properties were rated for colour, appearance, flavor, texture, taste and overall acceptability. The chemical composition of the experimental diets was done according to the method of A.O.A.C. (1990). All data were subjected to statistical analysis using analysis of variance and the means were separated if they are significantly different using Duncan Multiple Range Test (SAS, 1999).

RESULTS AND DISCUSSION

The proximate composition of the test ingredient and experimental diets are shown in table 1. The crude protein content of the yam was 4.87 as shown in table 2. The protein reported is relative similar to the report of Uchewa, *et.al.,* (2014). The crude protein of the experimental diets is in line with the recommended values as observed by Omole, (2003).

Table 2: Determined Proximate Composition of the yam peel and the Experimental diets

Parameters	**YP**	**YP_1 (0%YP)**	**YP_2 (25% YP)**	**YP_3 (50% YP)**	**YP_4 (75%YP)**
Dry Matter	95.34	94.24	93.98	94.49	93.90
Crude Protein	4.89	24.09	23.98	23.51	23.42
Crude Fibre	12.24	10.67	10.89	10.99	11.07
Ether Extract	3.34	4.24	4.18	4.12	4.02
Ash	9.78	9.55	9.49	9.27	9.14
Nitrogen Free Extract	69.75	51.45	51.56	52.11	52.35

YP- Yam peel

There was significant difference in the mean total feed intake of the snails fed experimental diets ($P<0.05$). The highest total feed intake of 723.72 g was recorded in YP_1 which was not significantly different from YP_2 while the mean lowest feed intake of 710.57 g intake was recorded in YP_4 as shown in Table 3. The significant difference was observed in the mean total weight gain ($P<0.05$). The highest mean weight gain of 166.76 g was recorded in YP_1 which was not significant ($P>0.05$) difference from YP_3. The lowest mean weight gain of 138.78 g was recorded in snail fed highest level of YP in the diet (YP_4). The result of feed efficiency shows that snails fed 0% YP as replacement for maize fraction of the diet had the best feed efficiency ($P<0.05$) which was not significantly different from YP_3 which implies that yam peel could be used to replace 50% of the maize fraction of the diet of snail without any appreciable loss in growth rate. No mortality was recorded in the course of the feeding trial which signifies that yam peel could be used as alternative feed resource.

Table 3 Growth performance of snails fed different inclusion levels of yam peel in the diet

Parameters (Means)	**YP_1 (0% YP)**	**YP_2 (25% YP)**	**YP_3 (50% YP)**	**YP_4 (75%YP)**	**±SEM**
Initial weight (g)	76.45	75.87	74.67	75.49	3.78
Final weight (g)	243.21^{a}	242.34^{a}	238.93^{a}	214.27^{b}	8.98
Total weight gain (g)	166.76^{a}	166.47^{a}	164.26^{a}	138.78^{b}	6.71
Total feed intake (g)	723.72^{a}	724.12^{a}	719.45^{b}	710.57^{c}	4.13
Feed conversion ratio	4.34^{b}	4.35^{b}	4.38^{b}	5.12^{a}	0.25
Shell length increment (mm)	11.93	11.90	11.09	10.76	1.45
Shell width increment (mm)	9.75	9.76	9.72	9.70	0.72
Shell thickness increment (mm)	0.12	0.12	0.11	0.11	0.03
Mortality (Number)	0	0	0	0	
Dressing percent (%)	44.89^{a}	43.98^{a}	42.99^{ab}	40.57^{b}	1.94
Cost/weight gain (N/kg)	398.45^{a}	392.56^{b}	387.78^{c}	389.95^{bc}	3.68
Shell/live weight (%)	24.47	24.57	24.43	24.01	1.39

Means along rows with different superscript are significantly different from each other ($P<0.05$)

Significant differences were not observed in the shell length, width and thickness of the snails fed diet containing varying levels of yam peel as replacement for maize (P>0.05). This revealed that feed intake and weight gain reported in snails fed 0% and 50% YP as substitute for maize were similar to the observation of Omole (2003). The lowest weight gain recorded at highest inclusion level of YP could be due to lowest feed intake recorded in YP_4 as it has been established that Esonu, (2000) that feed intake has positive connection on growth rate of an animal, also the protein level and energy levels reduced as the level of yam peel were added up in the diets as shown in table 3. The least feed intake and weight gain reported in the diet contain 75 percent was in accordance with report of Kehinde (2009) and Hamzat and Longe (2014) who reported low feed and weight at highest inclusion level of Kolanut pod and dry cassava peel meal respectively in the nutrient of snails. Strict adherence to good management practices could be responsible for zero mortality recorded, also it has been stated that snails are hardy animal (Omole *et.al,*2012*)*. From table 3, the result of the dressing percentage was influenced by dietary treatments. The highest dressing percentage of 44.89% was recorded in the diet containing zero percent inclusion of yam $peel_1$ (P<0.05) which was not significantly different from 43.98 % and 42.99 % in diet containing 25% and 50% respectively. The dressing percentage observed in YP_1 and YP_3 were in accordance with the report of Kehinde (2009). The least dressing percentage of 38.56% was reported in YP_4. The results of the total estimate of each diets shows that the cost per kg feed (CPW) reduced as the level of Yam Peel in the diet increased from YP_1 to YP_3 as reported in YP_3 (Table 3). The highest cost per weight gain as indicated in the control while the lowest cost per weight gain was recorded in YP_3. The lowest CPW observed in YP_3 implies that the cost per weight gained is optimal at 50% level of inclusion of yam peel as replacement.

Table 4 Reproductive performance of Snail fed diets containing snail shell

Parameters (Mean values)	**YP_1 (0% YP)**	**YP_2 (25% YP)**	**YP_3 (50% YP)**	**YP_4 (75%YP)**	**±S.E.M.**
Total egg laid (Number)	16.12 [a]	16.03a	15.45ab	13.34b	1.24
Weight of the eggs(g)	5.89a	5.76a	5.23a	4.23b	0.56
Egg shell length (mm)	4.59	4.42	4.40	4.10	0.34
Egg shell width (mm)	3.71	3.70	3.64	3.34	0.21
Incubation period (day)	31.23	31.22	31.21	31.20	1.32
Weight of hatchling at day old (g)	5.79	5.83	5.74	5.34	0.12
Shell length hatchling (mm)	3.60	3.62	3.63	3.61	0.03
Shell width hatchling (mm)	2.85	2.84	2.84	2.82	0.02

Means along rows with different superscript are significantly different from each other (P<0,05)

The mean total no of egg laid was significantly influenced by different varying inclusion levels of yam peel (p<0.05), YP1, YP2 and YP3 were not significantly affected by the dietary treatments (p>0,05) (Table 4). The mean weight of the eggs also was not significantly different from one another across the treatments (p>0,05), the lowest value was observed in YP4. The value reported in the control diet and 50 % inclusion was relatively similar to that of Ajasin, *et.al.*, (2010). The weight of the eggs was also affected by dietary treatments. The highest weight was observed in

YP1 which was relatively the same with that of YP3 while the lowest weight of the egg laid was observed 4 in YP4 as shown in table. The mean egg shell length and width were relatively similar across the treatments (p>0,05). The mean incubation period of the snails in all the treatments was not affected by dietary treatments (p>0,05). The incubation period reported was similar to the observation of several authors who reported incubation period of 30 to 32 days (Omole *et.al.*,2012; Popoola, *et.al.,* 2019). The mean weight of the hatchlings at day old was significantly different from one another across the treatments (p>0,05). The results of the weight follow the same patter with the size of the eggs laid as shown in the table and this in agreement with the reports of Kehinde, (2009) who concluded that there is positive correlation between the size of the egg laid and the size of the hatchlings. The mean egg shell length and width of the hatchlings were relatively the same across the treatments.

Table 5: Organoleptic properties of the meat of snails fed different inclusion levels of yam peel in the diet

Mean Score Values	**YP_1 (0% YP)**	**YP_2 (25% YP)**	**YP_3 (50% YP)**	**YP_4 (75%YP)**	**±S.E.M.**
Colour	6.74	6.78	6.76	6.77	0.44
Taste	7.24	7.23	7.24	7.27	0.46
Flavour	6.76	6.74	6.76	6.78	0.47
Texture	6.69	6.68	6.69	6.68	0.45
General Acceptability	7.60	7.62	7.63	7.64	0.6

Means with the same superscripts are not significantly different (P > 0.05).

The results of the organoleptic properties of the meat shows that the there was no significant difference in the taste of the meat (P>0.05) as shown in table 5, the values ranged between 7.23 and 7.27. The color, flavor and texture of the meat were not influenced by (P>0.05) the varying inclusion of YP in the diets (Table 5) The generally acceptability of the meat as observed by the panelists was not significant different form one another. The results of organoleptic property of the meat also buttressed the fact that yam peel could be used to replace maize without effect on meat qualities

CONCLUSION

It could be concluded that weight gain, feed efficiency and dressing percentage were relatively similar in the snails fed control diet and 50% YP. The mean total number of egg laid and the size were not significantly different in the control and 50% and 50% inclusion, also the lowest cost per weight gain was recorded in YP_3 containing 50% YP hence maize fraction of the diet of snails could be replaced up to 50% of yam peel without any adverse effect. It is recommended that breeding snails can tolerate up to 50% yam peel as partial replacement for maize.

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