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Effects of partial replacement of maize with yam peel (*Discorea rotundata*) in diet of juvenile snails (*Archachatina marginata*)

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This study was conducted to determine the effects of inclusion of dry yam peel (YP) on performance characteristics and cost benefits of growing snails. Yam peel was included at 0% (YP_1) control, 25% (YP_2), 50% (YP_3) and 75% (YP_4) as replacement for maize fraction of diet of juvenile snails. Each dietary treatment was replicated thrice with 8 snails per replicate in a completely randomized design. Parameters measured were feed intake, weight gain, shell length and width. Feed conversion ratio was calculated. Significant difference was observed in the mean total weight gain ($P < 0.05$). The highest mean weekly weight gain of 10.25 g was recorded in YP_1 which was not significant ($P > 0.05$) different from YP_3. The lowest mean weekly weight gain of 7.26 g was recorded in snail fed highest level of YP in the diet (YP_4). The result of feed efficiency shows that snails fed 0.0%YP had the best feed efficiency ($P < 0.05$) which was almost similar to YP_3. The highest dressing percentage of 43.56% was recorded in YP_1 ($P < 0.05$) which was not significantly different from 42.56 and 41.99% in YP_2 and YP_3 respectively. The highest cost per weight gain of N226.75 was recorded in YP_4 while the lowest cost per weight gain of N196.56 was recorded in snail fed diet containing 50% YP as replacement for maize fraction of the diet. It could be concluded that weight gain, feed efficiency and dressing percentage were relatively similar in the snails fed control diet and 50% YP as replacement for maize fraction of the diet and that 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% with yam peel for feed cost reduction.

Key words: Cost/weight gain, dressing percentage, feed intake, weight gain, snails, yam peel.

INTRODUCTION

Snail meat is tasty and it is a delicacy with low fat and cholesterol levels (Ejide, 2008; Kehinde, 2009). The high protein content of the meat make it an alternative source of animal protein which is important for growth, reproduction and other metabolism activities in the body (Esonu, 2000). One of the limiting factors for the increased production of snails is the high cost of feed. Feed constitutes about 50 to 70% of total cost of production. Conventional feed ingredients such as soybean meal, groundnut cake, fish meal and maize are expensive hence there is need to look for alternative feed resources that are readily available at affordable price. A lot of studies have been conducted on the use of agro-industrial by products (AIBS) such as cassava peel, brewer dry grains, rice bran and maize cobs in the diet of livestock with encouraging results, resulting in the reduction in the cost of feed (Osei and Amoj, 1987; Hamzat, 2004; Tewe, 2004; Iyayi, 2008; Kehinde, 2009). Yam peel (*Discorea rotundata*) is another feed resource that can be used as an alternative ingredient. Yam peel is

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Table 1. Gross 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	24	24	24	24
Yam peel	0.0	5.5	11	16.5
*Others fixed ingredients	54.0	54.0	54.0	54.0
Total	100.0	100.0	100.0	100.0
Cost/kg feed (N/kg)	53.25	49.56.	45.87	42.15
Calculated analysis				
Crude protein (%)	24.53	24.18	23.72	23.19
Metabolizable energy (kcalKg/ME)	2429.1	2413.11	2400.23	2364.44

*Other fixed ingredients: Brewer dry grains. - 19.8, Fish meal-4, Ground nut cake-10, Bone meal-2.15, Oyster shell-9.8, Premix-0.25.

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.

consumed fresh by sheep and goats without any adverse effect. Yam peel can be sun-dried in order to enhance its utilization. The peel contains 2 to 6% of crude protein depending on the varieties, the crude fibre ranges between 9 to 15% (Akinmutimi et al., 2006; Uchegbu et al., 2008). Yam peel is readily available in all the parts of Nigeria with little or no cost. It constitutes environmental hazard where it is not properly utilized. There is paucity of information on the utilization of yam peel in the diet of snails hence the feeding trial was conducted to determine the effects of various inclusion of dry yam peel in the diet of juvenile snails on the feed intake, weight gain, feed efficiency, carcass analysis and cost per weight gain.

MATERIALS AND METHODS

A total of ninety six juvenile snails (*Archachatina marginata*) of less than three months and with mean weight of 37.46 ± 4.4 g were used for the feeding trial. The snails were selected from snail pen of the Institute of Agricultural Research and Training, Ibadan, Nigeria. The snails were acclimatized for one week before the commencement of the feeding trial. Yam peel was collected from a restaurant in Ibadan, Oyo state, Nigeria and sun-dried. Dry yam peel was later incorporated with other feedstuffs at 0% (YP_1) Control, 25% (YP_2), 50% (YP_3) and 75% (YP_4) as replacement for maize fraction of diet of juvenile snails. Each dietary treatment was replicated thrice with 8 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). Feed intake and weight gain were measured on a daily and a weekly basis with the use of sensitive 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 ratios were calculated as the ratio of feed intake to weight gain. Feed cost and cost per weight gain were also calculated. The prevailing market prices of the feed ingredients at Ibadan, Oyo State, Nigeria where the feed ingredients were purchased at the time of study were used to calculate the feed cost/kg feed and the cost of the feed to produce a unit weight (N/kg 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 respectively. The chemical compositions of the experimental diets and the foot were done according to the method of A.O.A.C. (1990). All data were subjected to statistical analysis using analysis of variance and all the means were compared if they are significantly different using Duncan multiple range test (SAS, 1999).

RESULTS AND DISCUSSION

The results of the chemical compositions of yam peel (YP) and that of experimental diets are shown in Table 2. Yam peel is low in protein but has a high fibre content which indicates that yam peel can be used as a source of

Table 3. Growth performance of snails fed at 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)	37.56	38.21	37.25	36.56	4.92
Final weight (g)	201.56^a	198.69^a	191.97^a	153.16^b	9.23
Total weight gain (g)	164.0^a	160.48^a	154.72^a	116.6^c	7.91
Total feed intake (g)	698.72^a	686.72^a	664.16^b	594.72^c	20.13
Weekly weight gain (g)	10.25^a	10.03^a	9.67^a	7.26^b	2.45
Weekly feed intake (g)	43.67^a	42.92^a	41.51^b	37.17^c	3.02
Feed conversion ratio	4.26^b	4.28^b	4.30^b	5.12^a	0.25
Shell length increment (mm)	12.14	12.10	12.09	12.04	1.67
Shell width increment (mm)	9.78	9.78	9.75	9.71	0.72
Shell thickness increment (mm)	0.13	0.13	0.12	0.12	0.03
Mortality	0	0	0	0	

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

Table 4. Carcass analysis of 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
Final weight (g)	200.33^a	197.89^a	192.78^a	154.56^b	9.85
Shell weight (g)	47.20^a	46.46^{ab}	44.76^b	34.63^c	5.75
Offal weight (g)	43.85^a	41.72^a	39.64^a	28.69^b	5.8.3
Foot weight (g)	87.26^a	84.22^a	80.95^a	59.60^b	6.87
Dressing percent (%)	43.56^a	42.56^a	41.99^{ab}	38.56^b	2.97
Offal/live weight (%)	21.89	21.08	20.56	18.56	2.11
Shell/live weight (%)	23.56	23.48	23.22	22.41	21.31

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

fibre. The protein content of the diet reduced as the level of YP in the diet increased. There was a significant difference in the mean total feed intake across all treatments. The highest weekly feed intake of 10.25 g was recorded in YP_1 which was almost similar to YP_2 while the lowest feed intake of 37.17 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 weekly weight gain of 10.25 g was recorded in YP_1 which was not significant ($P > 0.05$) difference from YP_3. The lowest mean weekly weight gain of 7.26 g was recorded in snail fed highest level of YP in the diet (YP_4). The result of feed efficiency shows that snails fed 25% YP as replacement for maize fraction of the diet had the best feed efficiency ($P < 0.05$), the result 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. The results of feed intake and weight gain recorded in snails fed 0 and 50% YP as replacement for maize were similar to the observation of Omole (2003) and Kehinde (2009). 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 by many researchers that feed intake has positive correlation with growth rate of an animal (Esonu, 2000; Hamzat, 2004). The lowest feed intake and weight gain recorded in YP_4 was in accordance with observation of Hamzat (2004) and Kehinde (2009) who reported low feed and weight at highest inclusion level of Kolanut pod and dry cassava peel meal respectively in the diet of snails. Strict adherence to management practices could be responsible for zero mortality recorded, also it has been reported that snails have the ability to respond to adverse environmental condition by covering the surface with epiphragm (Omole, 2003). The shell length, width and thickness were not significantly influenced by the varying inclusion levels of YP in the diets ($P > 0.05$). As shown in Table 4, the foot weight which is the edible part is influenced by the dietary treatments ($P < 0.05$). The highest dressing percentage of 43.56% was recorded in YP_1 ($P < 0.05$) which was not significantly different from 42.56 and 41.99% in YP_2 and YP_3 respectively. The lowest dressing percentage of 38.56% was recorded in YP_4. The results of cost analysis shows that the

Table 5. Cost analysis 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
Total weight gain (g)	0.16	0.16	0.16	0.12	
Total feed intake (g)	0.70	0.69	0.66	0.60	
Cost/kg feed (N)	50.13^a	49.56^a.	47.65^a	45.35^b	2.26
Total feed cost (N/kg)	35.09^a	34.20^a	31.45^b	27.21^c	2.23
Cost/weight gain (N/kg)	219.31^b	213.75^b	196.56^c	226.75^a	9.76

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

cost per kg feed and total feed cost reduced as the level of YP in the diet increased from YP_1 to YP_4 as shown in Table 5. The highest cost per weight gain of N226.75 was recorded in YP_4 while the lowest cost per weight gain of N196.56 was recorded in snail fed diet containing 50% YP as replacement for maize fraction of the diet. The low cost/weight gain recorded at inclusion level of unconventional feed support the observation of Iyayi (2008) that the use of alternative feed resources could lead to profitable non-ruminant production in developing countries.

In conclusion, weight gain, feed efficiency and dressing percentage were similar in the snails fed control diet and 50% YP as replacement for maize fraction of the diet. 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% for feed cost reduction.

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