

COMPARATIVE DIETARY VALUES OF DRIED PAWPAW LEAVES, CASSAVA LEAVES AND ORANGE PULP FOR GIANT AFRICAN LAND SNAILS.

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This study was conducted to investigate the comparative nutritional adequacy of cassava leaves, pawpaw leaves and orange peel for snail (*Archachatina marginata*) feed components. A total of three hundred adult snails (weighing 270 – 300g each) were randomly allocated to five treatments that were replicated five times, and each replicate unit consisted of twenty snails. The diets were formulated to contain 22 % protein and 1 900 Kcal/Kg Metabolizable Energy. The result showed that the control diet (pawpaw leaves based) was most consumed, gave the highest weight gain and visceral weight, but the orange pulp based diet gave most efficient Feed Conversion Ratio (FCR) and dressing percentage ($p < 0.05$). The study recommends the use of the three test ingredients as feed components for the Giant African Land Snails.

Keywords: Snails, feed intake, weight gain, carcass analysis

The major animal protein sources for the Nigerian populace have come under severe pressure due to increasing growth of human populations, high cost of feed, persistent drought, diseases, primitive animal husbandry techniques and low productivity of local animal breeds (Fagbuaro *et al.*, 2006). Cobbinah *et al.* (2008) reported protein deficiency as a critical aspect of malnutrition in Nigeria.

Ademolu *et al.* (2014) reported that the shortage of meat could be alleviated by rearing Giant African Land Snails as a domestic animal. Snail meat is highly valued for being high in protein-cum-iron and being low in fat content. (Imevbore and

Ademosun, 1998; Agbogidi *et al.*, 2008). Adeyeye (1996) noted that snails contain almost all the amino acids required by man. The farming of snails is promising in Nigeria because of relatively small capital required to set up the business. Hamzat *et al.* (2003) reported that Nigerians are presently interested in the production of highly nutritive, medicinally complementary and efficient by-product utilizers like Snail. Snail meat is reported to be a major part of the diet of coastal Nigerians, and according to Yoloye (1984) and Ademolu *et al.* (2014), It is the cheapest source of high quality protein in Nigeria. Omole *et al.*, (2000) reported that different breeds of snails are found in Nigeria and they are characterized by their efficiency of nutrient transformation into quality protein.

A major challenge facing intensive snail farming is slow growth which could be attributed among other reasons, to nutrition. It is therefore necessary to determine the dietary value of a number of low- cost feedstuffs commonly included in snail diets. Ani *et al.* (2014) and Mogbo *et al.* (2014) earlier studied the feeding values of various low cost vegetable materials for snails in a bid to reduce the production cost of snail meat. Ademolu *et al.* (2014) concluded from a nutritional studies of snails that pawpaw leaves are better converted than high protein formulated feed. There is need to consider the feeding value of other low-cost vegetable materials that are of low cost and that are readily available. This study assessed the feeding value of cassava leaves, pawpaw leaves and orange pulp in the diet of Giant African Land Snails.

MATERIALS AND METHODS

The experiment which lasted for 3 months (90 days) was carried out at the snailery unit in Univeristy of Ilorin, Animal Production Department. A total of 300 adult snails (weighing 270-300g) were used for the study. Three diets were formulated to include equal levels of dried pawpaw leaves, cassava leaves or orange pulp (Table 1). The snails were randomly distributed to three (3) treatments in a completely randomized design, replicated five (5) times, with twenty (20) snails per replicate, and 100 snails per treatment. The diets were formulated to contain 22% crude protein and energy level of 1900 Kcal/kg using the proximate values reported by Awoyinka *et al.* (1995), Feng Shi (2007) and Nwofia *et al.* (2012) for cassava leaves, pawpaw leaves and orange pulp.

The snails were reared in bucket type cages, the buckets being perforated, upturned and placed under the shade. The bucket was filled with loosed sandy loam up to the depth of 5 cm. The snail diet and water were served in earthen plates *ad libitum*. Regular cleaning of the snailery and utensils as well as routine management practices were ensured. Feeding was done in the evenings, and the feed left over in the subsequent evening was weighed and the weight of the initial feed supplied was subtracted to estimate the feed intake. Changes in body

weight were measured on weekly basis using digital weighing balance.

Body weight gain was measured with the use of electric weighing balance. The Feed Conversion Ratio was calculated as the ratio of feed intake to weight gain. At the end of the feeding trial, thirty (30) snails were randomly selected from each treatment for carcass analysis. The snails were killed directly by breaking the shell with a small hammer (Oluokun *et al.*, 2005, Badmos *et al.* 2016). The foot (edible portion), the shell and the visceral mass were separated and weighed with electric weighing balance. The dressing percentage was calculated as ratio of the foot to the live weight (Oluokun *et al.*, 2005).

Data collected were subjected to Analysis of Variance (ANOVA) of the Completely Randomized Design and the significant means were separated by Duncan Multiple Range Test (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

The result revealed that the feed intake of cassava leaves diet (Table 3) was higher than pawpaw leaves diet, the intake of which was also higher than that of orange pulp diet in many of the weeks. This was the trend for the 12 weeks of the study. The intake of all the three diets increased from over 9 grams per snail per week to over 20 grams. The

Table 2: Gross Composition of the Experimental Diets (%)

Ingredients	Diet (Treatment) 1	Diet (Treatment) 2	Diet (Treatment) 3
Maize	21	20	22
GNC	21.50	22	24
SBM	8	7	6.5
F/Meal	4	3	3.5
Corn Bran	7.0	8	6
PKC	6.13	7	5
Oystershell	13.7	12.5	11.5
Bone Meal	3.35	5	6
Vit. Premix	0.5	0.5	0.5
Test Ingredient	CLM (15)	PL (15)	OP (15)
Total	100 kg	100	100
ME (Kcal/kg)	1955.48	1910.58	2035.20
Crude Protein (%)	22.78	22.76	22.52
Calcium (%)	6.28	6.27	6.21

Note: CLM= Cassava leaf meal; PL= Pawpaw leaf meal; OP= Orange Pulp

Table 3: Average Feed Intake of Snails

Treatment	Cassava Leaves	Pawpaw leaves	Orange Pulp	SEM
Week 1	10.63 ^b	10.35 ^b	9.60 ^a	± 0.21
Week 2	13.59 ^c	11.33 ^b	10.36 ^a	± 0.29
Week 3	16.76 ^c	13.11 ^b	11.29 ^a	± 0.40
Week 4	17.50 ^c	14.51 ^b	12.01 ^a	± 0.45
Week 5	19.19 ^c	15.94 ^b	13.04 ^a	± 0.54
Week 6	20.09 ^c	17.27 ^b	14.10 ^a	± 0.62
Week 7	21.53 ^c	18.42 ^b	15.75 ^a	± 0.72
Week 8	21.78 ^c	18.83 ^b	16.75 ^a	± 0.76
Week 9	22.69 ^c	19.31 ^b	17.75 ^a	± 0.82
Week 10	23.25 ^c	20.09 ^b	18.75 ^a	± 0.89
Week 11	23.67 ^b	20.93 ^a	19.75 ^a	± 0.95
Week 12	24.54 ^b	21.55 ^a	20.75 ^a	± 1.02

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

Table 4: Average Weight Gain of Snails (g)

Treatment	Cassava Leaves	Pawpaw leaves	Orange Pulp	SEM
Week 1	2.05 ^b	1.77 ^a	1.95 ^b	± 0.01
Week 2	2.03 ^a	2.30 ^b	2.08 ^a	± 0.01
Week 3	2.34 ^b	2.15 ^a	2.10 ^a	± 0.01
Week 4	2.36 ^b	2.27 ^b	1.95 ^a	± 0.01
Week 5	2.27 ^a	2.23 ^a	2.23 ^a	± 0.01
Week 6	2.25 ^a	2.20 ^a	2.25 ^a	± 0.01
Week 7	1.75 ^a	2.23 ^b	2.38 ^c	± 0.01
Week 8	2.40 ^a	2.40 ^a	2.47 ^a	± 0.01
Week 9	2.82 ^c	2.10 ^a	2.42 ^b	± 0.01
Week 10	1.95 ^a	1.97 ^a	2.03 ^a	± 0.01
Week 11	1.70 ^a	1.85 ^b	1.92 ^b	± 0.01
Week 12	2.05 ^c	1.60 ^b	1.27 ^a	± 0.01

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

increase in feed intake is apparently due to growth and metabolism demanding more nutrients as the age of snail increased. The general increase in feed intake as age of snail increased was reported by Amusan and Omidiji (1998), Akinusi (2002) and Badmos *et al.* (2011). The highest intake recorded was 24.54 grams which was by cassava leaves at week 12. Cassava leaves appeared most preferred, perhaps due to higher sugar and fat content compared to other test ingredients (Nwofia *et al.*, 2012). Fat and

carbohydrate metabolism are associated with taste and aroma (Drewnowski, 1997). Green, leafy based diets are generally preferred by snails, as was earlier reported in a study by Ademolu *et al.* (2014) where pawpaw leaves consumption was higher than that of compounded and more nutritious diets. Weight gain as shown in Table 4 was highest for snails on cassava leaves diet than the pawpaw leaves and the orange pulp diets. The peak of gain was 2.82 grams per week in week 9 by snails on the cassava

Table 5: Average Weekly Feed Conversion Ratio of Snails

Treatment	Cassava Leaves	Pawpaw leaves	Orange Pulp	SEM
Week 1	5.19 ^a	5.83 ^b	4.92 ^a	± 0.74
Week 2	6.71 ^b	4.93 ^a	4.99 ^a	± 0.71
Week 3	7.16 ^b	6.10 ^a	5.38 ^a	± 0.55
Week 4	7.41 ^b	6.37 ^a	6.16 ^a	± 0.47
Week 5	8.44 ^c	7.16 ^b	5.86 ^a	± 0.43
Week 6	8.93 ^c	7.85 ^b	6.96 ^a	± 0.37
Week 7	12.30 ^c	8.28 ^b	6.63 ^a	± 0.30
Week 8	9.07 ^c	7.84 ^b	6.63 ^a	± 0.34
Week 9	8.03 ^b	9.20 ^c	7.38 ^a	± 0.31
Week 10	11.92 ^c	10.17 ^b	9.16 ^a	± 0.20
Week 11	13.93 ^c	11.31 ^b	9.87 ^a	± 0.16
Week 12	11.98 ^a	13.48 ^b	15.31 ^c	± 0.11
MEAN FCR	9.26 ^c	8.21 ^b	7.44 ^a	±0.35

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

Table 6: Carcass Analysis of Snails.

Treatment	Cassava Leaves	Pawpaw leaves	Orange Pulp	SEM
Live weight (g)	271.83 ^a	294.98 ^a	274.88 ^b	51.25
Shell (g)	78.30 ^a	85.08 ^b	87.13 ^c	4.54
Foot (g)	98.98 ^a	102.10 ^{ab}	105.60 ^b	6.79
Viscera (g)	39.78 ^a	49.15 ^c	44.55 ^b	1.30
Dressing Percentage (%)	36.41 ^b	34.61 ^a	38.42 ^c	0.87

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

leaves diet. Weight gain fluctuated weekly but generally decreased at later weeks. The weight gain range is similar to that of Ademolu *et al.* (2014) which was between 5.97 and 14.02 g.

The general trend of Feed Conversion Ratio (FCR) as shown in Table 5, for the 12 weeks of study, was that of FCR being lowest for orange pulp and being highest for cassava leaves. FCR was lowest at week 1, but decreased at later weeks. The lowest FCR was 4.92 for the snails on orange pulp at week 1, while the same snail (average of snails on orange pulp) at week 12 recorded FCR of 15.31. Earlier study on young snails fed moringa based diets (Ani *et al.*, 2014) reported FCR ranging between 6.56 and 10.11 %, which is within the (lower) range reported in the present study. The lower range of the FCR is expected at younger age

of snails when the growth of snail tissues are rapid. Badmos *et al.* (2011) similarly reported FCR range of 1.40 to 1.61 for growing snails, while Ademolu *et al.* (2014) reported FCR range of 1.33 to 4.84 for one month old snails.

The result of carcass values were all significantly affected by the dietary treatment ($p<0.05$). The average live weight and viscera weight were highest for snails on pawpaw leaves based diets, but the shell weight, foot weight, and dressing percentage were higher with orange pulp diet. The visceral weight of the pawpaw leaves based diet might be due to the complexity of fiber fractions in the pawpaw leaves, which made digestion more tasking, necessitating intense gastro intestinal activity. According to Ademolu *et al.* (2014), it is possible that the presence of fibre in pawpaw leaves aids

digestion and motility of alimentary canal. Generally, orange pulp appears to be a more nutritious and efficient feed ingredient for snails, as it led to higher growth of shell, foot, and higher dressing percentage. This might be due to vitamins and micronutrients present in the orange pulp. The dressing percentage reported in this trial corroborates the work of Hamzat *et al.*, (2003) where the highest dressing percentage was 37.07%. In the study of Ani *et al.* (2014), dressing percentage of snails ranged between 37.23 and 32.58 %, and is in agreement with the results of this work.

Mogbo *et al.* (2014) compared the feeding value of three vegetables (*Talinum triangulare*, *Moringa oleifera*, and *Carica papaya*) for snails, and recommended that the leaves be compounded into the diets of snails. Ani *et al.* (2014) concluded that *Moringa Oleifera* leaf meal can be included up to 20% MOLM in the diet of growing snails without deleterious effect on the growth performance and carcass yield of the snails.

CONCLUSION

It can be concluded that the feed intake, weight gain and visceral weight of snails fed cassava leaves was highest but orange pulp gave the best FCR and dressing percentage. The efficiency of orange pulp (in terms of lower feed conversion ratio) is higher than that of pawpaw leaves, which is also higher than cassava leaves. This study recommends that cassava leaves, pawpaw leaves and orange pulp be used as constituents of snail feed without any deleterious effect.

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