

1 **EFFECTS OF FEEDING DIFFERENT PROTEIN DIETS IN**
2 **GROWTH PERFORMANCE AND CARCASS QUALITY OF SNAILS**
3 **(ARCHACHATINA MARGINATA)**

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8 **ABSTRACT**

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10 The study examined the effects of feeding different protein diets on growth
11 performance and carcass quality of Snail, *Archachatina marginata* at the snail
12 unit, Department of Animal Science, Faculty of Agriculture and Natural
13 Resources Management Enugu State University of Science and Technology.
14 Sixty clinically healthy snails were allotted to four treatment diets designated as
15 T₁ the control, contained all the ingredients, T₂ contained only soybean meal, T₃
16 only groundnut cake and T₄ only fishmeal as the main protein source. Each
17 treatment was replicated thrice in a Completely Randomized Design. Data were
18 collected on weight gain feed intake using digital electronic weighing scale
19 (Atonic electronic scale), shell length and shell width were measured using
20 venire calliper while carcass characteristics were done using an Atomic
21 electronic scale. Data collected were subjected to one-way analysis of variance
22 using SPSS version 20 (2012). Findings revealed ... statistical differences
23 (P<0.05) were found in weight gain, shell characteristics as well as carcass
24 characteristics. The result also showed that protein rich in calcium sources are
25 ideal for snail production as the edible portion, visceral weight and shell weight
26 showed statistical differences (P<0.05) from T₃ (85g, 55.38g, 41g) to T₄ (80.6g,
27 45.32g, 44g) then T₂ (75g, 42.08g, 37g) and T₁ (71g, 40.37g, 34g) in that order.

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30 **INTRODUCTION**

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32 In Nigeria the most common meat protein sources are poultry, beef, mutton and
33 pork. These primary protein sources are on the decline because of the high cost
34 of feed, low productivity of these animals as well as incidence of pest and
35 disease. However, in recent years micro-livestock (snail, termite, grasshopper)
36 and other organisms are gaining popularity as a protein source in the country.
37 Nigeria is richly endowed with different species of snails, varying in size,
38 colour, adaptability and performance (8,7). *Archachatina marginata* is the
39 largest snail (10). Snail meat is now a delicacy in Nigeria. This has necessitated
40 snail farming on commercial basis. Successful snail farming demands the
41 knowledge of snail nutrition. Protein is vital for most biological activity such as
42 tissue growth (1,3,9) thus feed composition for snail must be balanced to ensure
43 growth, reproduction as well as achieve market size in time (4). The study was

carried out to evaluate the effect of various protein sources on the performance of *Achachatina marginata*.

MATERIAL AND METHODS

The feeding trial was carried out at the snail unit Teaching and Research Farm Department of Animal Science, Faculty of Agriculture and Natural Resources Management, Enugu State University of Science and Technology (ESUT), Enugu.

Experimental Animal/Housing

Sixty (60) clinically healthy snails were selected from a pool of one hundred snails with an average age of 120 days. The snails were brought from a snail farm at Ukana, Udi Local Government Area, Enugu State. They were housed in plastic basket measuring 60cm x 50cm x 20cm. The plastic basket was properly perforated for easy movement of air and penetration of sunlight. The baskets were filled with 5cm loamy soil which was moistened by sprinkler for proper growth of the snails.

Experimental Diet

Four (4) Experimental diets were formulated for the snails. These diets were designated as T₁, T₂, T₃, and T₄. T₁ was the control containing the three treatment protein sources, T₂ contained only soyabean meal, T₃ groundnut cake and T₄ fish meal as the main protein source.

Table 1: Composition of the experimental diet

Ingredient	Treatments			
	T ₁	T ₂	T ₃	T ₄
Maize	54	54	54	54
Brewer's spent grain	22	22	22	22
Soyabean	8	20	-	-
Groundnut	7	-	20	-
Fish meal	5	-	-	20
Oyster shell	2	2	2	2
Bone meal	1.5	1.5	1.5	1.5
Premix	0.5	0.5	0.5	0.5
Total	100	100	100	100
Crude protein	17.08	17.08	17.08	17.08
Energy(MJ/KGM.E)	11.87	11.87	11.87	11.87

Each 2.5kg of premix contains Vit. A 10,000,000i.u, Vit. D3 2,000,000i.u, Vit. E 20,000i.u, Vit K 2,250mg, Ribofalavin B2 5,000mg, Thiamine B1 1,750mg, Pyridozine B6 2,750mg, Niacin 27,500mg, Pantothenic Acid 7,500mg, Vitamin B12 15mg, Biotin H12 50mg, Folic Acid 7,500mg, Chlorine Chloride 400gr,

Cobalt 200mgr, Copper 5gr, Iodine 1.2gr, Iron 20gr, Manganese 80gr, Celenium 200mg, Zinc 50gr, Antioxidant 125gr.

Recommended inclusion is 2.5kg per ton of feed.

Experimental procedure

The sixty (60) snails were randomly assigned to the various treatment groups. Each treatment group contained fifteen (15) snails which were replicated three times in a Completely Randomized Design with five snails per replicate. The experiment lasted for a period of eighty-nine (89) days.

Measurement and data collection

Data were collected on growth performance by measuring the weight gain, feed intake, shell length, shell width and carcass characteristics. The weight gain was measured every seven days using a digital electronic weighting balance (Atomic electronic scale). Feed intake was measured on daily basis. Shell length and width were measured using Vernier calliper on a weekly basis. Carcass parameters were evaluated by weighting the edible, visceral, shell and the mucus. Mucus weight was determined by careful washing of the shell as well as gentle washing on the shell, edible and visceral with alum until constant weight was obtained. The design of the experiment was Complete Randomized Design (CRD). Data collected were subjected to one-way analysis of variance (ANOVA) while significantly different means were separated using Duncan Multiple Range Test as contained in SPSS version 20 (2012).

RESULTS

The results of feeding different protein diets on *Archachatina marginata* are summarised in the tables 2 and 3:

Weight Gain

The result of the feeding trial showed that T₃ weighed highest at maturity though not significantly different ($P < 0.05$) from T₄ but significantly ($P < 0.05$) different from T₂ and T₁ in that order. This result was repeated in like manner with average weight gain for the various treatments as shown in table 2.

Feed Intake

Feed intake from Table 2 showed that feed intake was highest in this order T₃ (1.67g), T₂ (1.53g), with T₁ (1.47g) and T₄ (1.47g) having same feed intake. No statistical ($P > 0.05$) differences were observed in feed intake.

Feed conversion ratio: The feed conversion ratio was observed to be best for T₄ (1.91g) and least for the control (T₁; 3.12). The superiority of snails fed on

fish meal diet over T₃ (groundnut cake) and T₂ (soyabean meal) was not significant (P < 0.05). However, snails fed on the three treatment diets were significantly better (P < 0.05) in feed conversion ratio than those on control diet.

Shell Characteristics

The result showed that T₄ had the highest shell length (136.mm) though not significantly different (P>0.05) from T₃ (133.7mm), however they differed significantly (p< 0.05) from T₂ and T₁. This same result patten was observed in average daily shell length.

Average final shell width showed that T₄ (66.2mm) had the highest gain followed by T₃ (64.7mm), and the shell width of T₄, T₃ and T₂ were statistically the same but from T₁. The average daily shell width followed same trend as average final shell width.

Carcass Characteristics

The edible portion of the various treatment showed that T₃ and T₄ were highly superior (P<0.05) from T₂ and T₁ with T₃ (85g), T₄ (80.6g), to T₂ (75g) and T₁ (71) respectively.

The visceral weight also differed statistically (P<0.05) among the various treatment groups. The shell weight of T₄ (44g) was the highest followed by T₃ (41g), T₂ (37g) and T₁ (34g).

Table 2: Effect of feeding different protein diets on the growth performance of snails

Parameter	Treatments			
	T1	T2	T3	T4
Average initial wgt (g)	109.67±0.541	108.83±0.617	109.04±0.456	108.68±0.492
Average final wgt (g)	152 ^c ±0.513	160 ^b ±0.623	183 ^a ±0.430	176 ^a ±0.411
Average daily wgt gain (g)	0.47 ^b ±0.024	0.57 ^b ±0.016	0.83 ^a ±0.019	0.77 ^a ±0.011
Average daily feed intake (g)	1.47±0.012	1.53±0.019	1.67±0.013	1.47±0.022
Feed conversion ratio	3.12 ^c ±0.049	2.86 ^b ±0.044	2.01 ^a ±0.035	1.91 ^a ±0.037

means within row with different superscript letters differ by Duncan test with p < 0.05

Table 3: The effect of feeding different protein diets on shell characteristics.

Parameter	Treatments			
	T1	T2	T3	T4
Av initial length (mm)	117.7±0.221	118.06±0.214	118.06±0.168	117.11±0.121
Av final shell length (mm)	130.20 ^b ±0.209	131.80 ^b ±0.244	133.7 ^a ±0.279	136.6 ^a ±0.117

Av daily shell length (mm)	0.140 ^b ±0.004	0.148 ^b ±0.010	0.175 ^a ±0.098	0.217 ^a ±0.007
Av initial shell width (mm)	53.7±0.212	54.2±0.278	53.82±0.246	52.96±0.222
Av final shell width (mm)	59.2 ^b ±0.010	63.4 ^a ±0.013	64.7 ^a ±0.034	66.2 ^a ±0.011
Av daily shell width (mm)	0.062±0.0002	0.103±0.0045	0.122±0.0023	0.149±0.0032

means within row with different superscript letters differ by Duncan test with $p < 0.05$

Table 4: The effect of feeding different protein diets on carcass characteristics.

Parameter	Treatments			
	T1	T2	T3	T4
Av final wgt (g)	152 ^c ±0.714	160 ^b ±0.675	183 ^a ±0.666	176 ^a ±0.732
Av final wgt of visceral (g)	40.37 ^c ±0.234	42.08 ^c ±0.278	55.38 ^a ±0.243	44.32 ^b ±0.288
Av weight of edible part(g)	71 ^b ±0.943	75 ^b ±0.738	85 ^a ±0.896	80.6 ^a ±0.844
Av weight of shell (g)	34 ^c ±0.546	37 ^c ±0.566	41 ^b ±0.744	44 ^a ±0.689
Av weight of mucus(g)	6.63 ^b ±0.045	5.92 ^c ±0.057	6.62 ^b ±0.667	7.08 ^a ±0.698

means within row with different superscript letters differ by Duncan test with $p < 0.05$

DISCUSSION

It seems that the non significant difference ($p < 0.05$) between the mean values of feed intake by the snails on the three experimental diets was in partial agreement with (23) and (13). However, when the feed conversion ratio was considered, snails fed on fish meal as their main protein source have the best feed conversion ratio, followed by snails fed groundnut cake and those fed soyabean meal. The control group had the least feed conversion ratio. This showed that snails require protein from sources with high biological value as well as more calcium in the feed.

To this extent, as shown in Tables 2, 3 and 4, T₃ and T₄ had significant increase ($p < 0.05$) in final weight, shell length, edible portion, visceral weight and shell weight. This could be attributed to the synergistic effect of the protein and energy composition of the protein sources. (9) had shown the importance of high protein and energy levels of different feed ingredient (soyabean, groundnut cake and fishmeal) in performance of broiler birds. They observed increased performance of birds fed soyabean over groundnut cake which is contrary to the result of this study. However, when consideration is made of the high feed intake and feed conversion ratio of broilers fed groundnut cake over soyabean in this study, it points to the fact that the snails may have preferred groundnut cake over soyabean following their natural instinct of being well adapted to groundnut found in the southern eastern Nigeria than soyabean which is found

mainly in the northern part of Nigeria. In addition, the result showed that snails can convert groundnut cake (plant protein) effectively better than animal protein sources following their natural instinct and availability of the plant protein source which was different from the finding that effect of different protein on growth performance of broiler chickens was not pronounced (12,6,20).

On the other hand, considering the biological value of protein source in broiler performance, (11) and supported by (3) on the importance of calorie to protein ratio in the diets of snails; they showed that snails performed better with diets of high protein and high energy content. Thus, a well balanced calorie to protein is very important for snail performance. This enhanced growth performance due to well balanced protein and energy value has been documented by various authors (1, 21, 5, 19 and 22) and was in line with the current finding of superior performance of snails fed groundnut cake and fishmeal.

The same improved performance was observed for shell length and width on feed sources (T_3 & T_4) having balanced protein and energy values (14). The same was the trend observed for carcass characteristics as it had been shown that improved values have been attributed to higher protein and energy value (2 and 3).

The foregoing supports the result of this study which showed that snails fed on fish meal, an animal protein source with high biological value had the best feed conversion ratio and high final weight though less than those fed groundnut cake numerically without significant difference ($p < 0.05$). Similarly, snails fed fishmeal (T_4) had best performance with regards to shell length and width respectively. This also is related to the high content of calcium and phosphorus in local fish meal which is an indicator that calcium plays a vital role in snail growth and development.

CONCLUSION

Conclusively, the above study showed that protein source has significant effect on snail performance complemented by sources which attend to their natural instinct as indicated by superior values of groundnut cake (plant protein source) over fishmeal (animal protein source) however, protein of high biological value (animal protein) proved the better in terms of meat yield.

Ethical Disclaimer:

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

Consent Disclaimer: NA

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