

**EFFECTS OF FEEDING DIFFERENT PROTEIN FEEDSTUFF ON
GROWTH PERFORMANCE AND CARCASS QUALITY OF SNAIL
(ARCHACHATINA MARGINATA)**

ABSTRACT

The study examined the effect of feeding different protein feedstuff on the growth performance and carcass quality of Snail (*Archachatina marginata*). The study was carried out at the snail division, Department of Animal Science, Faculty of Agriculture and Natural Resources Management Enugu State University of Science and Technology. Sixty clinically healthy snails were allotted to four treatment diets designated as T₁ the control, which was made up of T₂ contained only (has) soybean meal, T₃ only groundnut cake and T₄ only fishmeal. Each treatment was replicated thrice in a Completely Randomized Design. Data were collected on weight gain using digital electronic weighting scale (Atonic electronic scale), feed intake, shell length and shell width were measured using venire caliper while carcass evaluation (characteristics) was done using Atomic electronic scale. Data collected were subjected to one-way analysis of variance using SPSS version 20 (2012). Findings revealed that statistical differences ($P<0.05$) were found in weight gain, shell characteristics as well as carcass characteristics. The result also showed that protein rich in calcium sources are ideal for snail production as the edible fraction, visceral weight and shell weight showed statistical differences ($P<0.05$) from T₃ (85g, 55.38g, 41g) to T₄ (80.6g, 45.32g, 44g) then T₂ (75g, 42.08g, 37g) and T₁ (71g, 40.37g, 34g) in that order.

INTRODUCTION

In Nigeria the most common meat protein sources are come mostly from poultry, beef, mutton and pork. These major protein sources are on the decline because of high cost of feed, low productivity of these animals as well as prevalence of pest and disease. However, in recent times micro livestock (snail, termite, grasshopper) and other organisms is gaining popularity as protein source in the country. Nigeria is richly endowed with different species of snails, varying in size, colour, adaptability and performance (8,7). *Archachatina marginata* is the largest large snail (10). Snail meat is now a delicacy in Nigeria. This has necessitated snail farming on commercial basis. Successful snail farming demands the knowledge of snail nutrition. Protein is vital for most biological activity such as tissue growth (1,3,9) thus feed compounded for snail must be balanced to ensure growth, reproduction as well as attain 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 (Juvenile, grower, breeder of _____ weeks old) snails were selected from a pool of one hundred snails. 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.

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, T₂ contained only soyabean meal, T₃ groundnut cake and T₄ contained fish meal as the only 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

Experimental procedure

The sixty (60) snails were randomly allotted to the various treatment groups. Each treatment group contained fifteen (15) snails. Each treatment was 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 parameter. 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 caliper on weekly basis. Carcass parameters were evaluated by weighting the edible, visceral, shell and the mucus. Mucus weight were 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) for mean separation and significant difference conducted using Duncan Multiple Range Test as contained in SPSS version 20 (2012).

Results and Discussion.

The results of feeding different protein feedstuff on *Archachatina marginata* are summarized in the tables below:

Table 2; Effect of feeding different protein feedstuff on the growth performance of snails

Parameter	Treatments			
	T1	T2	T3	T4
Average final wgt (g)	152 ^c	160 ^b	183 ^a	176 ^d
Average initial wgt (g)	109.67	108.83	109.04	108.68
Average daily wgt gain (g)	0.47 ^b	0.57 ^b	0.83 ^a	0.77 ^a
Average daily feed intake	1.47	1.53	1.67	1.47
FCR	3.12 ^c	2.86 ^b	2.01 ^a	1.91 ^a

a,b,c means within row with different superscript differ (p<0.05) statistically

Weight Gain

The result of the feeding trial showed that T₃ had a weight gain of (183g), T₄ (176g) T₂ (160g) and T₁ (152g). This represents the average weight gain for the various treatments. The average daily weight gains also showed that, T₃ had (0.83g), followed by T₄ (0.77g), T₂ (0.57g) and T₁(0.47g) respectively. Statistical differences (P < 0.05) were observed among the treatment groups. The average final weight gains for T₃ and T₄ did not differ (P >0.05) significantly but T₃ and T₄ differed (P <0.05) significantly from T₂ and T₁. The result showed that snails can convert effectively groundnut cake (plant protein) better than animal protein. The result is different from the finding that effect of different protein sources on growth performance is not pronounced (6,2,11)

Feed Intake

Feed intake for the various treatment groups; 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; however numerical differences were found. This showed that snail feed intake is not related to protein source.

Feed conversion ratio: The feed conversion ratio was observed to be best for T_4 (1.91g), closely followed by T_3 (2.01g), T_2 (2.86g) and T_1 (3.12g) respectively. This showed that snails fed on fish meal **only have** the best feed conversion ratio, followed by snails fed groundnut cake and **then** those fed on soyabean meal. The control group had the least feed conversion ratio. This showed that snails require protein from sources with high biological value like more calcium in the feed.^T

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

Parameter	Treatments			
	T1	T2	T3	T4
Av final shell length (mm)	130.20 ^b	131.80 ^b	133.7 ^a	136.6 ^a
Av initial shell length (mm)	117.7	118.60	118.06	117.11
Av daily shell length (mm)	0.140 ^b	0.148 ^b	0.175 ^a	0.217 ^a
Av final shell width (mm)	59.2 ^b	63.4 ^a	64.7 ^a	66.2 ^a
Av initial shell width (mm)	53.7	54.2	53.82	52.96
Av daily shell width (mm)	0.062	0.103	0.122	0.149 R

a,b,c means within row with different superscript differ ($p < 0.05$) statistically

Shell Characteristics

The average final shell length for the various treatment groups were T_4 (136.6mm), **which was statistically the same with T_3** (133.7mm), T_2 (131.80mm) and T_1 (130.20mm). This result showed that T_4 had the highest shell length. The result also showed statistical difference ($P < 0.05$) among the various groups, that is T_4 and T_3 did not differ ($P > 0.05$) significantly, however T_4 and T_3 differed significantly ($p < 0.05$) from T_2 and T_1 . Average daily shell length also followed same pattern as average daily final shell length.

Average final shell width showed that T_4 (66.2mm) **made (had)** the highest gain followed by T_3 (64.7mm), T_2 (63.4mm) and T_1 (53.7mm). The shell width of T_4 , T_3 and T_2 differed ($P < 0.05$) statistically from T_1 . The average daily shell width followed same trend as average final shell width. T_4 best performance with regards to shell length and width respectively is related to the high content of

calcium and phosphorus in local fish meal. This is also an indicator that calcium plays a vital role in snail growth and development.

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

Parameter	Treatments			
	T1	T2	T3	T4
Av final wgt (g)	152 ^c	160 ^b	183 ^a	176 ^a
Avfinal wgt of visceral (g)	40.37 ^c	42.08 ^c	55.38 ^a	44.32 ^b
Avweight of edible part(g)	71 ^b	75 ^b	85 ^a	80.6 ^a
Av weight of shell (g)	34 ^c	37 ^c	41 ^b	44 ^a
Av weight of mucus(g)	6.63 ^b	5.92 ^c	6.62 ^b	7.08 ^a

a,b,c means within row with different superscript differ (p<0.05) statistically

Carcass Characteristics

The edible fraction of the various treatment is T₃ (85g), T₄ (80.6g), T₂ (75g) and T₁ (71) respectively. This showed also that statistical (P<0.05) were observed among the various treatment groups.

Weight of the visceral are as follows; T₃ (55.38g) T₄ (45.32g), T₂ (42.08g) and T₁ (40.37g). 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). This also showed that statistical (P<0.05) differences were observed among the various treatment groups with regards to shell weight.

Conclusively, the above study showed that protein supply rather than source has significant effect on snail performance however, protein of high biological value (animal protein) proved the better in terms of meat yield.

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UNDER PEER REVIEW

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REVIEWER'S COMMENT

Line 1 – 3	Should go like this Effects of Feeding different protein diets in growth performance and carcass Quality of Snails (<i>Archachatina Marginata</i>)
Line 10	Put S in effects and change Feedstuffs to diets
Line 11	Snail before the scientific name
Line 12	Change division to unit
Line 13	Put the ages of the experimental animal e.g Juvenile, grower, breeder, which are _____ weeks old
Line 14	Add S to diet
Line 15	T1 is the control diet what is it made up of?
Line 16	After fish meal put as the main protein source
Line 19	It should be Carcass characteristics
Line 21	Should be Findings revealed statistical differences
Line 24	It should be edible portion
Line 31	Delete come mostly from and put proteins sources are
Line 53	Put the age of snail you worked with e.g grower
Line 60	It should be T1 was the control diet containing what type of protein source? T2 had soya beans
Line 61	Delete contained, fish meal as the main protein source
Line 67	Delete each treatment group and type which were replicated three times

Line 73	Change parameter to characteristics
Line 78 – 79	Washing of the snail shell as well as gentle wash on the shell Please check this (statement)
Line 82	After (ANOVA) delete for mean separation and significant differences conducted and type while significantly different means were separated
Line 86, 89, 112 & 143	Delete feedstuff and put diet
Line 98	T3 had 0.83g
Line 104	Put sources after protein
Line 116	Delete only have and put as their main protein sources
Line 117	Delete then and on
Line 135	Delete may and put had
Line 137	After T2 put were statistically the same but
Line 153	T4 is it 45.32g or 44.32g

REFERENCES

Note: After the Volume the number which is in bracket should be followed by a comma and not colon

Line 168	Check line 168, 170,177
Line 180	No publisher's address

Line 184 Place the bracket where it should be then after Nigeria put
 Unpublished in bracket
Line 191 Number is incomplete
Line 203 Put (Unpublished) before Ph.D
Line 208 Put (Unpublished) before Master of Science
Line 212 Numbers in complete

Notes: Contained is not a typical Research Word you can use having or had