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Extract from Book of Abstract

Morphological parameters and Chemical Composition of Heamolymph of *Archachatina marginata* Snails Fed with Formulated Diets Using Quail Droppings Meal as Protein Sources.

Author (s) : Ilelaboye, N.O and Ede D.A

Department of Science Laboratory Technology, The Federal Polytechnic Ilaro, Ogun State, Nigeria

Department of Science Laboratory Technology, Redeemer's College of Technology and Management Mowe, Ogun State, Nigeria

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Four experimental diets I -V containing QDM in different ratios as substitute for protein sources were formulated and chemical composition of the snails heamolymph were determined using standard procedures.

Snails fed diet V recorded the highest feed intake, weight gain and width gain while the snails fed diet I recorded the highest feed conversion ratio (FCR) and shell length.

Proximate analysis of the snail heamolymph revealed that crude protein and ash contents value were least in snails on diet I and highest in snail on diet V. The result of mineral analysis of the hemolymph revealed that snails fed Diet V had the highest value for Calcium, magnesium, sodium, Iron, potassium and phosphorus.. The result of the study showed that the compounded diets consisting of quail droppings as protein sources were efficiently utilized by *A. marginata* snail, more than the control diet, higher growth performance of *A.marginata* was exhibited by diet V more than the other diets.

Keywords: Archachatina marginata, chemical composition, feed conversion ratio, heamolymph, morphological parameters, quail droppings meal.

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Ilelaboye, N.O[1*] and Ede D.A[2]

[1]Department of Science Laboratory Technology, The Federal Polytechnic Ilaro, Ogun State, Nigeria
[2]Department of Science Laboratory Technology, Redeemer's College of Technology and Management Mowe, Ogun State, Nigeria
[1]nasir.ilelaboye@federalpolyilaro.edu.ng
[2]dorathyede@gmail.com

ABSTRACT

The problem facing the rearing of snails is formulating an improved diet that will meet the nutrient requirement of snails, especially during the dry the scarcity of agricultural food of snails. Therefore the study aimed to formulate snail's rations with Quail Droppings Meal (QDM) that are balanced in nutrients and to determine their impact on the optimal productivity of snails. Four experimental diets I - V containing QDM in different ratios as substitute for protein sources were formulated. Growth parameters (weight gain, feed intake, shell length gain and shell circumference gain and chemical composition of the snails hemolymph were determined using standard procedures. Snails fed diet V recorded the highest feed intake, weight gain and width gain while the snails fed diet I recorded the highest feed conversion ratio (FCR) and shell length Proximate analysis of the snail hemolymph revealed that crude protein and ash contents value were least in snails on diet I and highest in snail on diet V. The result of mineral analysis of the hemolymph revealed that snails fed Diet V had the highest value for Calcium, magnesium, sodium, Iron, potassium and phosphorus.. The result of the study showed that the compounded diets consisting of quail droppings as protein sources were efficiently utilised by *A. marginata* snail more than the control diet, higher growth performance of *A.marginata* was exhibited by diet V more than the other diets.

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INTRODUCTION

Snails are invertebrates ranging from the size of a palm nut or even less to an adult fist or a little larger. Snails belong to the phylum Mollusca, class Gastropoda, a soft bodied animals which characteristically move on their belly and are often enclosed in a spirally coiled shell. (Ademola**,** Idowu, Mafiana, and Osinowo, 2004, Cobbinah**,** Vink and Onwuka, 2008).

They are found extensively in the Southern parts of Nigeria and the entire West African coastal area, central and South Africa, where the weather is most favourable for their proliferation (Herbert and Kilburn, 2004). The calcareous shell of the snail when burnt, ground into powder, mixed with oil and has been applied to boils by many indigenes in Africa as a form of treatment.

The “blood” of the snail is technically called the “haemolymph.” This colourless to bluish coloured fluid has the function of transporting nutrients to cells, thermoregulation, ionic balance, general homeostasis and pH regulation. The haemolymph is composed of water, organic compounds and inorganic salts (magnesium, calcium, sodium, potassium and chlorides). The organic compounds include hormones, carbohydrates, proteins (amino acids), and lipids. The haemolymph has a primary oxygen transporter molecule called haemocyanin. The heamolymph produced by the snails can also be used to cure hypertension, ulcer and asthma, kidney diseases, tuberculosis, anemia (Odowu , Ogunleye , Tayo, 2004).

Due to the tremendous medical property of snail, there is a growing interest for snail, hence the growth in snail farming. The popularity of snails in the world is reduced by indiscriminate hunting and deforestation, which destroy the snails habitat. Rearing of land snails as a domestic animal would therefore help in some measures to satisfy the demand and survival of the species. However, one problem facing the rearing of snails is formulating an improved diet that will meet the nutrient requirement of snails at a cheaper cost, especially during the dry season when agricultural food of snails will not be available

In order to do this successfully, attention has to be given to protein, because of its immense role in animals’ well-being which includes growth, maintenance, hormonal and enzymatic activities. It has been shown that poultry litter/dropping can serve as potential source of protein because of its non-protein nitrogen (NPN) that can be easily converted to protein by animal and it is a cheaper source of protein when compared to commercial source of protein which are beyond small scale snail farmers (Ademolu et al, 2004, Ilelaboye & Adegbola, 2018), but there is little information on the use of Quail droppings. The aim of this study is to examine the growth performance and chemical composition of haemolymph of giant land snails fed with Quail droppings as a source of proteins.

MATERIALS AND METHODOLOGY

Location and Source of Materials

The research was carried out in the Department of Science Laboratory Technology, Federal Polytechnic Ilaro, Ogun state, Nigeria. Ilaro is a small city in Nigeria, situated at 6.89° North latitude, 3.02° East longitude and 68m elevation above the sea level. The daily temperature in Ilaro ranges between an average minimum of 23 °C to a maximum of 34.2 °C. The quail litter used for this work was the droppings of caged layers collected from a commercial farm in Ilaro. It was spread and sun-dried for one week while raking at intervals. Stones and other foreign materials were removed. When dried, the litter was ground into fine powder using a hammer mill to produce quail dropping meal of 2 mm particle size.

Experimental Snails and Treatments

The snails used for the study were of edible species of *A. maginata.* Fifty *(*50) pieces of snail having average weight of 153.7 g were purchased from Olatomi's farm and transported to the animal house, and five (5) snails were put into each compartment of the cage. Bags of loamy soil was collected from a farm land in Ilaro located at Trem side and heated in order to kill any microorganism present in the soil that can affect the snail. A cage with adequate perforations to enhance the easy flow of air and proper drainage was built for the snail samples which serve as habitat for the snail. The cage is of six segments, each segment of the cage has two rooms containing ten snails. Treated humus soil was used to fill the cage up to about 6 cm and dried almond fruit leaves was placed over the soil to serve as mulch for the snails. The soil was sprinkled with water twice daily to keep the internal environment moist. Since snails are nocturnal animals and feed mostly at night (Ademolu, 2004), they were fed with the diets every evening between 4.00 and 6.00 p.m. for 12 weeks. (84 days). The cage was cleared of leftover feed and excreta of the snails every day to prevent the buildup of pathogens. The daily feed intake was determined by subtracting the weight of leftover feed from its previous weight before feeding the snails.

Experimental Diets

The quail dropping was used in different ratios as protein sources to compound four experimental snail diets (Diets II-V) containing at least 20% crude protein and Diets I served as control.

Table 1. Composition of experimental diets

	DIET I	DIET II	DIET III	DIET IV	DIET V
Maize	31.5	31.5	31.5	31.5	31.5
Protein source	64.8	47.8	30.55	13.3	
Bone meal	1.20	1.20	1.20	1.20	1.20
Lime stone	2.25	2.25	2.25	2.25	2.25
Premix	0.25	0.25	0.25	0.25	0.25
Quail droppings		17	34.25	51.5	64.8
	100	100	100	100	100

The snails were fed 15g of moisted diest every evening between 4:00 and 6:00pm for 12 weeks. The daily feed intake was determined by subtracting the weight of leftover feed from its previous weight before feeding the snails.

Data Collection

Three snails each per replicate in a treatment were marked for data collection. The growth performance of the snails was determined by measuring the following parameters every week: Body weight was taken using a weighing balance (Camry electronic kitchen scale model EK 5350.O.1g), shell length and shell width were measured with Vernier calipers, and feed conversion ratio was calculated. The three marked snails from each treatment were picked, and broken at the apex to collect the hemolymph. Proximate analysis was carried out on the experimental diets and snail's hemolymph using standard AOAC methods (AOAC, 2007) Mineral analysis was carried out on the experimental diets and the hemolymph using Atomic Absorption Spectroscopy (AAS).

One-way Analysis of variance (ANOVA) was used to analyse data collected and significant differences were separated by Duncan Multiple Range Test using the Statistical package for the social sciences for windows SPSS (2007).

RESULTS AND DISCUSSION

Table 2: **Proximate composition (%DM) Mineral composition (mg/100g) of the experimental diets**

parameters	Diet I	Diet II	Diet III	Diet IV	Diet V
Proximate					
moisture	10.80^{ab}±.28	10.70^{a}±.07	10.67^{a}±.16	10.89^{a}b±.09	11.17^{b}±.08
protein	26.42^{a}±1.17	29.22^{b}±08	31.44^{c}±.13	32.58^{c}±.06	34.49^{d}±.09
fat	4.02^{c}±.16	3.51 ^{c} ±.08	3.37^{b}±.14	3.24 ^{b} ±.06	2.82^{a}±.10
fibre	5.39^{a}±.38	6.37^{b}±.07	7.85^{c}±.14	8.85^{d}±.14	10.31^{e}±.11
ash	9.01^{a}±.74	10.52^{b}±.07	11.71^{c}±.15	13.43^{d}±.09	15.23^{e}±.01
Carbohydrate	44.37^{a}±.71	39.68^{b}±.04	34.96^{c}±.13	31.02^{d}±.15	25.99^{e}±.03
Energy	313.96^{c}±10.84	312.51^{c}±6.27	295.91^{b}±1.31	283.55^{b}±.87	267.28^{a}±.64
Minerals					
Sodium	484.58^{a}±.59	525.37^{b}±.87	584.22^{c}±.40	622.45^{d}±1.07	683.24^{e}±1.08
Potassium	831.69^{a}±.44	901.20^{b}±1.34	969.98^{c}±7.4	1041.85^{d}±.49	1105.85^{e}±1.20
Calcium	65.07^{a}±.66	69.58^{b}±.95	87.57^{c}±1.09	95.71^{d}±.27	108.51^{e}±.69
Magnesium	6.15±1.10	6.32±.60	7.19±.38	7.57±.20	7.97±.91
Iron	84.60^{a}±.40	89.80^{b}±.46	97.36^{c}±.44	104.57^{d}±.71	112.09^{e}±.49
Phosphorus	21.43^{a}±.18	21.74^{a}±.44	26.10^{b}±.42	28.36^{c}±.20	29.58^{c}±.1.03

All the diets were well received and eaten by the snails, but the consumption of the diets by the snails varied significantly ($p<0.05$). There was no definite pattern of feeding during the experimental period; the amount of feed consumed was high in the first four weeks of the experiment, followed by a decline in feed intake from week five. Hence confirms Ademolu et al. (2004) findings that snails have more preference for new food than a familiar food.

As shown in Table 2, there was a significant difference ($P<0.05$) in the proximate composition of the experimental diets. Diet V (100% quail dropping meal) has the highest per cent crude protein, fibre and ash concentration and the snails fed with this Diet gave the best performance and probably satisfying the growth requirement for snails (Siyanbola, 2008).

The result of the mineral analysis of the experimental diets revealed that significant difference ($P<0.05$) exist in the concentration of all the experimental diet's minerals, except magnesium where significant difference does not exist.(Table 2) This result indicated that there was an increase in the concentration of all the minerals from diet I to diet V.

Growth Performance of Snail

Table 3 Growth response and nutrient utilization of snail fed experimental diets

Growth parameters	DIET I	DIET II	DIET III	DIET IV	DIET V
Initial weight(g)	153.95±5.16	154.15±4.45	149.30±8.49	159.95±2.33	162.93±6.1
Final weight(g)	218.23±5.13	218.95±4.10	215.54±9.54	226.71±3.38	237.38±15.
Weight gain(g)	64.28±.04	64.80±.35	66.24±1.05	66.76±1.05	75.45^{b}±9.1
Initial width(cm)	50.80±.00	51.45±1.41	51.90±2.26	52.48±.25	54.00±2.83
Final width(cm)	68.58±.00	69.46±1.91	70.07±3.05	70.84±.33	72.90±3.82
Width gain(cm)	17.78±.00	18.01±.49	18.17±.79	18.37±.09	18.90±.99
Initial length(cm)	104.73^{b}±.81	102.45^{ab}±1.	101.10^{a}±.42	103.25^{ab}±1.20	104.53^{b}±.3
Final length(cm)	147.66^{b}±1.1	144.45^{ab}±1.	142.55^{a}±.60	145.58^{ab}±1.69	147.38^{b}±.4
Length gain(cm)	42.94^{b}±.33	42.00^{ab}±.55	41.45^{a}±.17	42.33^{ab}±.49	42.86^{b}±.13
Feed intake(g)	181.50^{a}±6.3	182.75^{a}±3.1	204.50^{b}±12.0	193.75^{ab}±1.77	245.50^{c}±.0
FCR	2.82^{a}±.00	2.82^{a}±.01	3.09^{b}±.00	2.90^{ab}±.01	3.25^{c}±.00

As depicted in Table 3, no definite pattern was observed in the level of feeding by the snails as the level of inclusion of Q.D.M. increases. Highest feed intake (245.50 g) was observed in snails fed Diet V, and the lowest feed intake of 181.50 g and 182.75 g were observed in those fed Diet I and II. The result of statistical analysis showed a significant difference in the F.C.R., with snails on Diets I and II having the lowest (2.82) value Diet V had the highest F.C.R. value (3.25). There was an appreciable weight gain by the experimental snails. but no significant difference between the experimental snails fed on Diet I- IV, however, weight gained by snail fed Diet V differed significantly and was the highest (75.45 g). The result is in agreement with the claim of other researchers that weight gain and feed efficiency were improved with a higher amount of dietary protein and energy (Onimisi and Omage 2004). The shell length gain in the experimental snails varied significantly, snails on Diet I had the highest shell length gain while snails on Diet III recorded the least shell length gain. There was a remarkable width gained by the experimental snails. Snails fed on Diet V had the highest width gain while snails fed on Diet I had the lowest width gain. The observed highest mean weight and shell width gains recorded in snail fed on diet V might likely be due to high crude protein and mineral content present in the diet (Table 2), and correlate with the findings of Adeyeye (2000) Ademolu 2004, Ilelaboye and Adegbola (2018), and Siyanbola (2008). that snails has the ability to utilize the nutrient in animal waste to develop body and shell. Comparatively, compounded diets have an excellent role to play in the farming of the snail all year round without facing scarcity of food during the dry period as against plant Ejidike and Afolayan (2010).

Proximate and Mineral Composition of the Snail Hemolymph

Table 4: proximate and mineral composition of the snail hemolymph.

parameters	Diet I	Diet II	Diet III	Diet IV	Diet V
Proximate					

Dry matters	4.81^{a}±.14	5.37^{b}±.08	6.06^{c}±.04	6.45^{d}±.14	7.17^{e}±.14
protein	37.26^{a}±.08	38.26^{b}±.07	39.31^{c}±.06	40.34^{d}±.35	41.35^{e}±.04
fat	14.41^{a}±.13	15.07^{b}±.08	15.65^{c}±.14	16.11^{d}±.04	16.81^{e}±.16
ash	1.16^{a}±.23	1.30^{a}±.03	1.49^{ab}±.00	1.78^{b}±.14	1.83^{b}±.11
Carbohydrate	42.36^{a}±.04	40.01^{b}±.04	37.50^{c}±.25	35.33^{d}±.04	32.85^{e}±.13
Energy	447.94±1.33	448.90±.88	448.06±.52	447.70±1.05	448.68±.17
Minerals					
Sodium	1.33±.30	1.55±.03	1.27±.78	2.04±.35	2.07±.64
Potassium	1.07^{b}±.37	.70^{ab}±.11	83^{ab}±.33	.90^{b}±.01	2.2^{b}±.05
Calcium	1.20±.15	.76±.35	1.73±.15	1.18±.33	1.50±.73
Magnisium	.53±.03	.43±.06	1.03±.66	.86±.58	.84±.30
Iron	31.71^{d}±.66	31.03^{cd}±.69	28.55^{bc}±1.91	25.79^{a}±.66	27.93^{ab}±.43
Phosphorus	14.52^{a}±.37	14.56^{a}±72	15.27^{a}±.34	16.81^{b}±.37	17.45^{b}±.23

The result of proximate analysis showed that increase in the level of QDM in the experimental diets caused a significant($p<0.05$) rise in snails' haemolymph proximate composition: dry matter (4.81% - 7.17%), crude protein (37.26 % -41.35%), fat (14.41 % -16.81 %), and ash (1.16 % -1.73 %), (Table 4). There was significant ($p<0.05$) reduction in carbohydrate of haemolymph from 42.36% (diet I) to 32.85% (diet V). There was no significant ($p<0.05$) difference in the energy values of the haemolymph of snail reared on the experimental diets. The high protein content of haemolymph in the present study agrees with the report of USDA, (2006) on the nutritional protein value of snail's hemolymph.

Table 4 showed the result of the mineral profile of haemolymph of snails. There were significant ($p<0.05$) difference s in all the minerals analyzed in all the treatment groups: sodium(1.33-2.07 mg/100g), potassium(0.70-2.20 mg/100g), calcium(0.76-1.50 mg/100g), magnesium(0.43-1.03 mg/100g), iron(27.93-31.71 mg/100g) and phosphorus(14.52-17.45 mg/100g). The hemolymph of experimental snail fed diet V had the highest concentration of sodium, potassium, calcium and phosphorous while snails on diet I recorded the highest concentration of magnesium and iron in hemolymph of the experimental snails. Of all the minerals tested for in hemolymph, Iron recorded the highest concentration. High concentration of iron and the presence of other vital minerals like calcium, magnesium and zinc may be responsible for the high intake of snails' hemolymph by pregnant women as reported by Adeyeye (1996). The use of quail dropping in the formulation of feed for *A. manginata* positively affect the nutritive value of the snail.

CONCLUSION

In conclusion the results of this study showed that diet V positively affected the proximate and mineral composition hemolymph. Therefore, the use of Quail droppings in the formulation of feed for *A. archachatina* will positively affect the nutritive value of the snail. These materials are affordable to the farmers since they will be available to him almost free of charge.

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