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COMPARATIVE ANALYSIS OF THE GROWTH PERFORMANCE AND HAEMOLYMPH BIOCHEMICAL PROPERTIES OF NORMAL AND ALBINO GIANT LAND SNAIL- ARCHACHATINA MARGINATA

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http://dx.doi.org/10.4314/ejesm.v4i2.11

Abstract

This study was conducted to compare the growth performance and haemolymph metabolites concentrations of two snail ecotypes-normal skin and albino snail raised in captivity for eight weeks. The growth performance was measured by body weight gain, shell length gain and shell circumference gain while the measured haemolymph metabolites were glucose, protein, lipids, Na^+, K^+ ,Ca^{2+}, Cl^- and PO_4^{2-}. Normal snail recorded better growth performance and growth rate (3.432x) than albino snails (2.166x). Similarly significantly higher (P<0.05) haemolymph metabolites (35.0mg/dl, 54.0g/l, 24.5mg/dl for glucose, protein and lipids respectively) were recorded by normal snails. However, no significant difference (P>0.05) was recorded in the concentrations of minerals of the two snails species haemolymph. The domestication of the two snail ecotypes is thus recommended for heliculturist.

Keyword: Albino snails, *Archachatina marginata,* biochemical value, haemolymph.

Introduction

The importance of African giant land snail to the development of the nation's economy and improvement of the nutritional status of its consumers has received numerous attentions in literature (Ademolu *et al.,* 2007; Akinnusi, 2002 and Amusan and Omidiji, 1998). In traditional medicine, snails flesh and haemolymph are used to prepare concoction for pregnant women and in some healing procedures (Akinnusi, 2002). Thus, the numerous uses had in recent times increased the demand for snails and it products leading to its domestication as the wild collections could not meet up with the high demand.

One ecotype of snail that has been extensively used in traditional medicine is the albino snails popularly called white-skinned snails. Although edible, it is not eaten by some people because of taboos and superstition surrounding it (Amusan and Omidiji, 1998). It is believed to be dedicated for sacrifice to the gods. Ketiku and Adeleke (1998) compared the nutrient composition of the flesh of the normal snails with that of the albino. They observed a significantly higher (P<0.05) protein and minerals in the albino snail than the normal skinned.

Albinism is a hereditary deficiency of pigmentation which may involve the entire body or parts of the body. It is believed to be caused by an enzyme deficiency involving the metabolism of melanin during prenatal development (Allegretti e*t al.,* 2009). There are two main types of albinism in snails: albino shelled and albino-bodied but the genes responsible for them had not been known.

Snails generally are nocturnal, thus, feeding reproduction and locomotory activities are at the peak in the night (Yoloye, 1994; Ademolu *et al.,* 2010). Hodasi (1982) reported that perpetual light (both day and night) promoted rapid growth as continuous light at night have activatory effect on the snails, thus increasing their activity and rate of

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food consumption. Odiete (1999) however, reasoned that the nocturnal behavior is a form of adaptation that assists the snails in reducing body moisture lost common during the day.

So far in Nigeria, there has not been any effort in raising the albino snails in captivity despite its high demand by traditionalists as well as better nutritive value than normal snails. One way to enhance interest in its domestication is to have information on its growth performance in captivity and knowledge of its haemolymph biochemical properties which gives an insight to its internal physiology. The focus of this study is to compare the growth performance and haemolymph biochemical properties of normal and albino snail, *Archachatina marginata* in captivity.

Materials and Methods

The study was carried out at the Animal House of the Department of Biological Sciences, University of Agriculture, Abeokuta, Nigeria. Forty (40) young individual snails with average weight 80.15±0.2g were used for the experiment on growth performance (20 albino and 20 normal snails). They were purchased from the local farmers at the Kuto market, Ogun State, Nigeria. The snails were brought to the animal house in plastic baskets and later transferred to wooden cages in the Animal house where the study was conducted. The wooden cages were partitioned into four (4) equal compartments (0.5 X 0.5 X 0.2m) and were filled with loamy soil up to 2cm.

The twenty (20) albino snails were randomly divided into four compartments of five snails each (the same was done for normal snails). The snails were fed *ad-libitum* with fresh pawpaw leaves throughout the experimental period at 7pm daily (Ademolu *et al.,* 2010). Water was also made available to snails in water troughs present in each compartment.

Data Collection

Data were collected weekly on the following parameters for eight (8) weeks: body weight (using a sensitive weighing balance, Metller-PM.II-K, UK), shell length and circumference (using vernier caliper, Hanna, H1-3.52, Canada)

Haemolymph Chemical Analysis

Ten snails (5 each from albino and normal) (78.5±0.1g) were purchased separately for this part of the study. They were thoroughly cleaned with clean napkin to remove all the sand and debris on the month aperture and shell. The haemolymph collection was done by breaking the shell at the apex (Ademolu *et al.,* 2007). The protein content of the haemolymph was done by Biuret method (Henry *et al.,* 1974) while glucose and lipid content were determined by the methods of Baunniger, (1974) and Grant (1987) respectively. The sodium, potassium, calcium, chloride and phosphate content of the haemolymph were assayed by standard methods of A.O.A.C (1990).

Statistical Analysis

Data collected from the experiments were analyzed by one way analysis of variance (ANOVA) and student- Newman kuel's test was used for the means separation. Relationship between the weight and age (weeks of the experiment) was done by regression. Linear equation was used to determine the growth rate of the two snails' ecotypes

Results

The results of the growth performance of albino and normal snails are shown in table 1. Normal skinned snails had a significantly higher ($P<0.05$) shell length gain than albino snails. Similarly, the normal snail had a statistically higher weight gain (27.3g) than albino snail (17.5g) (Table 1).

The growth curve of the two snail ecotypes is shown in figure 1. Although they have similar growth curves, the linear equation revealed a higher growth rate (3.432x) in normal snails than albino snails (2.166x). Similarly, the regression analysis showed a high positive relationship between the weeks and the weight in the two snail ecotypes (though the value is higher in normal snails).The weight gain pattern of the experimental snails is shown figure 2. The two snails gained more weight at the onset of the experiment than the end. Also the pattern of weight gain was irregular.

Table 2 shows the results of the biochemical composition of the haemolymph of the two snail ecotypes. There were significant differences in the concentrations of the haemolymph metabolites. Normal snails had significantly higher concentrations of haemolymph organic substance (protein, lipids, and glucose) than albino snails. Also, protein had the highest concentration in the haemolymph while lipid had the least concentration.

However, no significant difference (P>0.05) was recorded in the haemolymph concentration of the inorganic substances. Na^+ and Cl^- had the highest haemolymph concentration while PO_4^{2-} recorded the least concentration.

Discussion

The study revealed that normal skinned snails had better growth performance than albino snails. This observation agrees with the report of Amusan and Omidiji (1998) that normal snails are usually bigger and grow faster than albino snails. The lack of melanin pigment on the skin of albino snails makes them to be sensitive to light and heat which might possibly influence their feeding pattern. Hodasi, (1982) observed that light regimes affect the behavior and feed intake of *Achatina achatina* raised in laboratory.

Snails are ectothermic animals whose physiological processes were affected by environmental factors like temperature (Odiete, 1999). The irregular pattern in weight gain of the snails experienced in this study confirms this fact. Ademolu *et al.,* (2007) and Osunkeye *et al.,* (2006) similarly observed irregularity in the growth pattern of *A. marginata.* This might be due to variations in amount of water lost to the environment or differences in the feed intake during the study. Furthermore, higher weight gain noticed at the early week of the experiment might not have been unconnected to the increase in feed intake at this period as snails are known to feed more on fresh feeds/diet than one they are familiar with.

Normal skinned snails recorded a significantly higher protein, glucose and lipids concentrations in the haemolymph than the albino snails. This result is contrary to the result of Ketiku and Adeleke (1998) where albino snails recorded a higher flesh protein and minerals. The low feed intake of albino snails due to sensitivity to heat and light might have undoubtedly resulted in low concentration of haemolymph metabolites. Haemolymph biochemical properties had often determined the growth performance of land snail *A. marginata* as the animal possesses an open circulatory system (South, 1990 and Ademolu *et al.,* 2006). However, higher concentrations of haemolymph metabolites might be accountable for the more susceptibility of normal snails to parasitic infection than albino snails as earlier reported by Allergrett, *et al.,* (2009). Odaibo *et al.,* (2000) had earlier reported the occurrence of nematode, *Rhaditis axei* in African giant land snails- *A. margina and A. achatina* in south western Nigeria.

The differences in the concentration of the minerals in the haemolymph of the two snail ecotypes were not significant. This suggests that mutation does not affect the concentrations of the haemolymph minerals. Akinloye and Olorode (2000) similarly observed that haemolymph mineral concentrations of *A. marginata* are relatively stable and seldom charges in life. Furthermore, Na^+ recorded the highest concentration in the haemolymph followed by Cl^-. South (1990) and Ademolu *et al.,* (2009). similarly reported that Na+ and Cl^- are the most abundant ions in the haemolymph of slug *Arion ater* and land snail *A. marganata* respectively.

The higher concentration of Na^+ and PO_4^{2+} in the haemolymph of albino snails than normal snails (though not statistically significant) might be responsible for the more aggressive native of albino snails as reported by Amusan and Omidiji (1998). Na^+ plays a significant role in nervous communication while PO_4^{2+} supplies tissues with necessary energy in form of ATP.

The domestication of these two snail ecotypes should be encouraged as the growth performance is now known and the growth rate can thus be predicted. The high demand for albino snails by traditionalist as well as its higher nutritive value should encourage heliculturists to embark on its rearing in captivity. Although normal snails had better growth performance than albino snails, the haemolymph biochemical properties of albino snails may probably make its more resistant to parasite infection and thus less prone to mortality.

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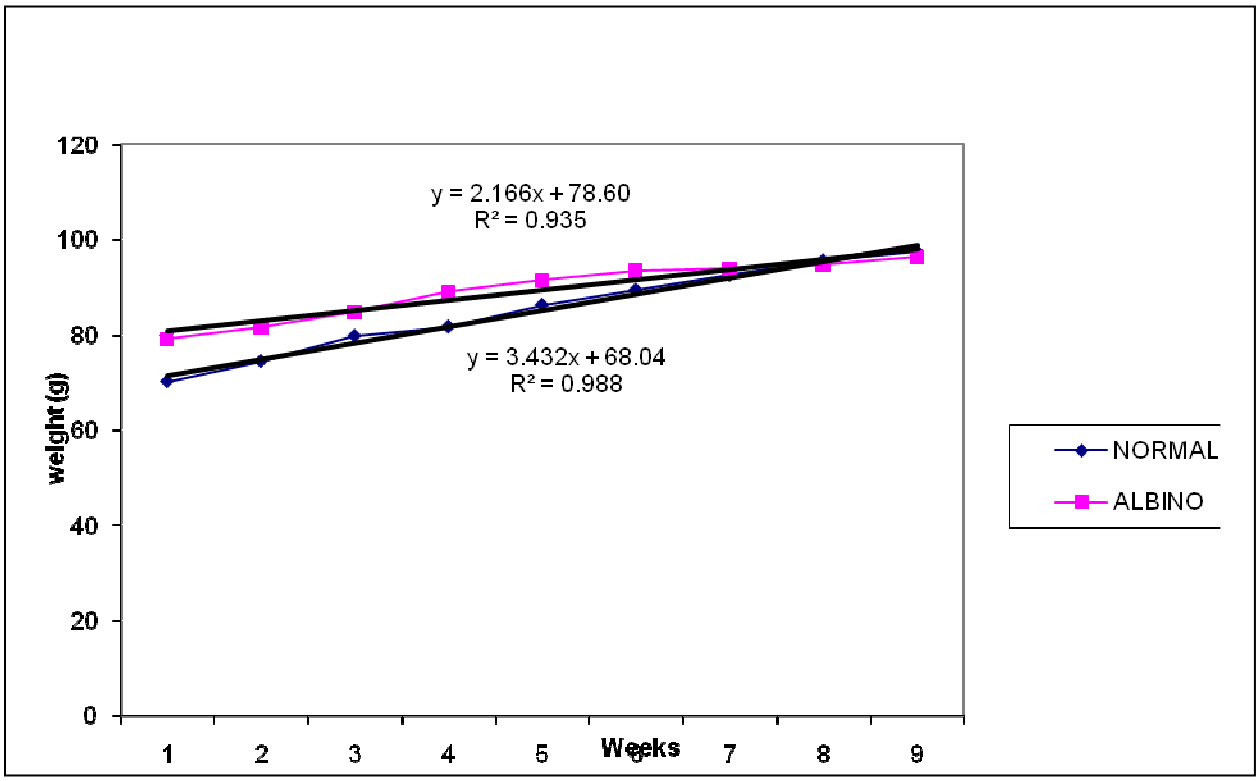
Table 1: The Growth performance of the Normal and Albino Snails (*Archachatina marginata*) reared in captivity

Growth Parameters	Normal Snails	Albino snails
Initial shell length (cm)	8.2	8.11
Final shell length (cm)	8.6	8.27
Average shell length gain (cm)	0.4^{a}	0.16^{b}
Initial shell width (cm)	4.47	4.19
Final shell width (cm)	4.52	4.34
Average shell width gain (cm)	0.05^{b}	0.15^{a}
Initial shell circumference (cm)	15.10	14.33
Final shell circumference (cm)	15.62	14.98
Average shell circumference gain (cm)	0.52^{b}	0.65^{a}
Initial average weight (g)	70.13	79.25
Final average weight (g)	97.43	96.30
Average weight gain (g)	27.30^{a}	17.05^{b}

a,b mean values with the different superscripts across the row are significantly different ($p<0.05$)



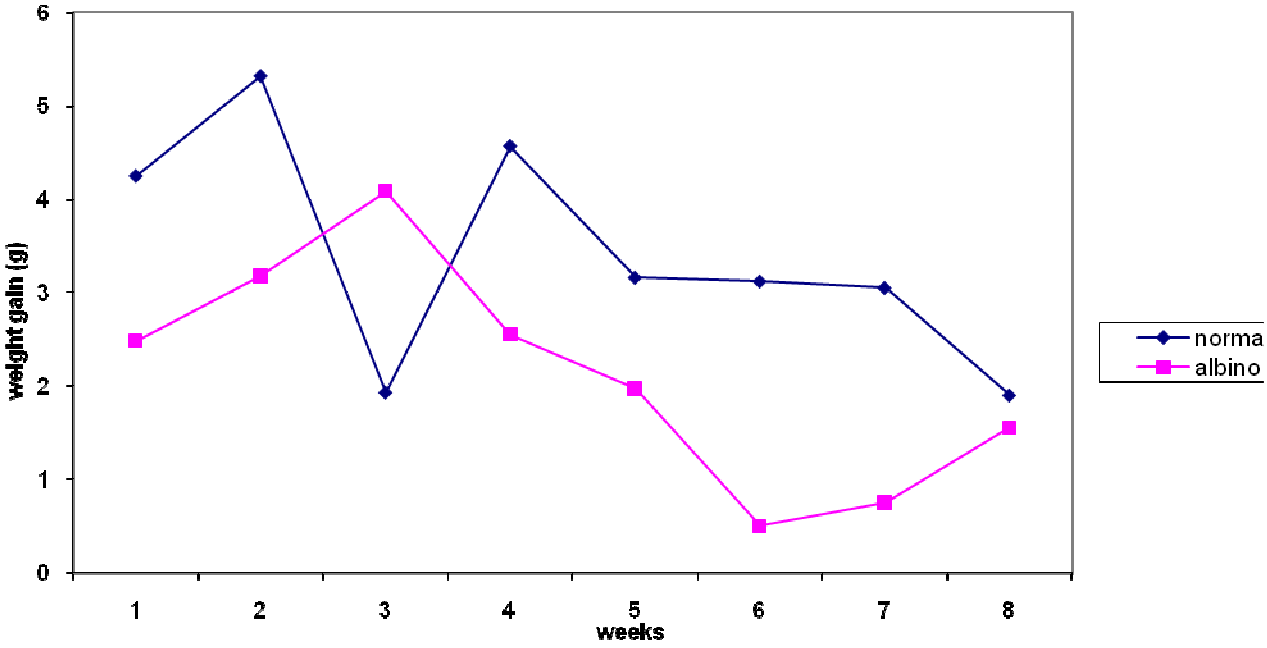


Fig 2: Weight gain changes of normal and albino snails

Table 2: The Haemolymph Biochemical Values of Normal and Albino Snails (*Archachatina marginata)*

Haemolymph Metabolites	Normal Snails	Albino snails
Glucose (mg/dl)	35.0^{a}	25.0^{b}
Total protein (g/l)	54.0^{a}	47.1^{b}
Lipids (mg/dl)	24.5^{a}	15.9^{b}
Na^{+} (mmol)	133.5	135.0
Ca^{2+} (mmol)	10.15	10.1
Cl^{-} (mmol)	99.5	100.0
PO_4^{2-} (mg/dl)	2.7	3.0

a,b mean values with the different superscripts across the row are significantly different ($p<0.05$)