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Effect of Egg Weight on Hatching Weight and Incubation Period in Giant African Land Snail (*Archachatina marginata*)

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Target Audience: Physiologist, Breeder, Snail farmers, Researchers

Abstract

An experiment was conducted to determine the effect of egg weight on hatching weight and incubation period in Giant African land snail. A total of 30 Archachatina marginata eggs comprising of four weight range categories (1.24-1.55, 1.56-2.14, 2.15-2.83 and 2.84-3.20 g) were obtained from Dams of different body weight ranges (100g-150g, 151-200g, 201-250g) from Snail Physiology Research Unit of the College of Animal Science and Livestock Production, Federal University of Agriculture, Abeokuta, Nigeria. Eggs were incubated, after which both incubation period and hatching weight after hatching were monitored. Results obtained showed that egg weight group had significant effect ($P<0.001$) on hatching weight. Egg weight with weight range of 2.84-3.20 had the highest hatching weight, followed by 2.15-2.14 while other two (1.24-1.55 and 1.56-2.14 g) were not significantly different from each other. Furthermore, egg weight had no significant effect ($P>0.05$) on incubation period. Positive significant correlation was obtained between egg weight and hatching weight, and also dam weight and hatching weight. It was concluded that egg weight had effect on hatching weight of eggs. It was also discovered that egg weight had no meaningful effect on incubation period.

Keywords: Egg weight, Incubation period, Hatching weight, *Archachatina marginata*

Description of problem

Giant African land snails are generally classified as mini-livestock (1). This enterprise has a lot of prospects if the capital outlay required for its setup is considered. Another area of its advantage is the ease of sale of this animal. Currently in the country, demand outstrips supply with bulk of the snail stock coming from the wild (2, 3, 4, 5). Recently, most farmers are now interested in intensive production, which could augment the supply known to be very low.

However, there are lots of challenges which farmers need to overcome to make maximum profit. The production process requires technicalities which relate to the reproductive biology of the animal of which very limited knowledge exist. The

reproductive processes which lead to egg production are very important. Eggs are the vehicles via which future stocks are secured. Snails lay eggs after copulation and the weight and number of eggs laid varies between species. *Archachatina marginata* produce larger sized few *eggs* (2-12) compared to *Achatina achatina* with smaller eggs but higher number (100-300) (6).

Eggs laid by snails in the wild or under intensive system of management need to be incubated in the soil or other incubating media like sawdust and wood shavings (7). In the wild, egg laying, hatching and development are seasonally influenced by some climatic variables (Temperature, humidity and moisture) (1, 2) and thus may affect snail population especially with recent changes in global weather pattern. Also human activities such as deforestation, pesticide use, slash and burn agriculture and intensive snail hunting have not also favour their population. The recent increase in demand due to multiple usage (Pharmacology, traditional medicine and as delicacy) of this animal is another factor calling for an efficient technical indoor rearing of this animal (8). The key area in which effort must be intensified to promote commercial production of this animal like conventional livestock enterprise is reproduction especially fertile egg production, incubation and hatching of multiple traits eggs from proven and highly selected individual without developmental failure. However, the types of eggs incubated in terms of size (weight) and the parent source may influence predicted pattern of production. This study therefore was aimed at determining the effect of egg weight on hatching weight and incubation period in Giant African land snail (*Archachatina marginata*).

Materials and Method

Experimental Site

The experiment was carried out at the Snail Physiology Research Unit of the College of Animal Science and Livestock Production, University of Agriculture, Abeokuta, Nigeria. The location lies within the rainforest belt of Western Nigeria, latitude $7^0$14' 02.86"N, longitude $3^0$26' 19.45"E (9) and altitude 141 masl. The climate is humid with a mean annual rainfall of 1037 mm. The annual mean temperature and humidity are 34.7^0C and 82% respectively

Management of eggs

Thirty snail eggs of different weights were collected from dams of different body weight ranges as follows: 100g-150g, 151-200g and 201-250g. The egg weights were taken using sensitive weighing scale (Mettler PM 4000). The weight of each egg was noted and eggs were incubated individually in a plastic jar (top diameter 11.5cm, bottom diameter 11cm and height 9.5 cm) with perforated lids and bottoms for aeration and to prevent water logging. The jars were first laid with tissue paper and then filled to 3cm depth with sawdust moistened with tap water. The incubated eggs were then buried in the saw dust which was moistened weekly.

Management of snailets

Twenty three snailets that hatched were weighed using a sensitive weighing scale. The snailets were grouped into four based on their egg weight. Each snail was reared separately in the same type of plastic jars in which they were earlier incubated. After 8 weeks, the snails were transferred into plastic basket of dimension 30 cm by 40 cm by 24 cm. Mixture of layers mash and oven dried ground pawpaw leaves were given in ratio 1:1 (W/W). Feed (1-2g) were placed in plastic containers within the jars and water was also given *ad libitum*.

Experimental Layout

	Egg wt Range (gms)	**No of Obs**
1	1.24 - 1.55	6
2	1.56 - 2.14	6
3	2.15 -2.83	6
4	2.84 -3.20	5

Data collecton and statistical analysis

Data collected include: Egg weight, dam weight, hatching weight, weekly weight, and Incubation period. Data collected for individual snails were subjected to ANOVA using the least-square analysis (10). Significant means were separated using Duncan Multiple Range Test (11). Data for individual snails were also subjected to linear and quadratic regression analysis. Models used are listed below:

1. Linear Model: $Y= A + B*X$

Where:

Y= Live weight in grams
X= Age in days
A= Constant term
B= The regression coefficient

2. Quadratic Model: $Y1=A_1+B_1x+CX^2$

Where:

Y1 = Live weight in grams
X = Age in days
A_1= The constant term
B_1 and C = The linear and quadratic regression coefficient

Treatment effect on B was determined by the least square analysis of variance. Pearson correlation coefficient was estimated between egg weight and hatching weight and egg weight and dam weight.

Linear and quadratic model

Regression

Linear (Y = A + B*X)
Egg wt. vs Hwt
H = -0.081 + 0.672 (E)
$R^{2 =}$ 0.814, $P < 0.001$
Quadratic ($Y = A + B*X + C*X^2$)
$H = 1.966 – 1.361 (E) + 0.0461(E^2)$
$R^2 = 0.988$, $P < 0.05$

Results and Discussion

Table 1 shows the least square means of hatching weight and incubation period of different egg weight groups of experimental snails. Egg weight group had significant effect ($P<0.001$) on hatching weight. Egg weight group 2.84 - 3.20 g recorded the highest hatching weight (2.118 ± 0.095 g), followed by

weight group 2.15-2.83 g (1.555 ± 0.087 g). Egg weight group of 1.24 – 1.55 and 1.56 – 2.14 g (0.947 ± 0.087 and 1.100 ± 0.087) were not significantly different from each other. The result of this study is in line with the report of Williams (12) who reported that egg size typically affects hatching size in birds. It was further substantiated that the weight at hatching depended on the residual yolk sac which was directly influenced by the egg size. Also, since larger eggs were laid by larger dams, then, there was probability that their hatching weight would be higher (13). Study by Ibom *et al*. (14) also reveal that snailet weight at hatching correspond to size of eggs incubated for crossbred snails. This observation of this study is also not different from the report of several authors (15, 16, 17). The values of egg incubation period reported in this study are within the normal range been reported by several authors (18, 19, 2, 20)

Table 1: Least – square means of hatching weight and incubation period of different egg weight groups of experimental snails

Egg Weight Group		Numbers Observation	Hatching weight (g)	Incubation period(days)
1	1.24-1.55	6	0.947 ± 0.087^{c}	32.5 ±2.325
2	1.56 -2.14	6	1.100 ± 0.087^{c}	33.5 ±2.325
3	2.15 -2.83	6	1.555 ± 0.087^{b}	24.7 ±2.325
4	2.84 -3.20	5	2.118 ± 0.095^{a}	29.6 ± 2.546

$^{a.b.c}$ Means in the same column with different superscripts differ significantly ($P< 0.05$).

Table 2 shows the result of correlation analysis of egg weight, dam weight and hatching weight. Significant positive correlation ($P< 0.001$) was observed between egg weight and hatching weight ($r = 0.902$). Similarly, significant positive correlation was observed between egg weight and dam weight ($r = 0.715$). Dam weight was also positively and significantly ($P<0.05$) correlated with hatching weight ($r = 0.563$). Observation made in this study is in line with the report of Sowunmi *et al.*, (13) who obtained positive correlation between body size and egg weight. The positive correlation observed between egg weight and hatching weight clearly showed the advantage of incubating larger eggs which had positive influence on post-hatch growth rate (21). Study conducted by Adeleke (22) showed that eggs laid by snails of liveweight group 400 – 549 g had a mean hatching weight of 3.15 g while those of 100 -249g and 250 – 399g had lower hatching weights (2.75g and 2.56g) which is also in line with the observation of this study. Reports by several authors indicated a strong positive genetic correlation between body weight

and egg weight of dam of most species (23, 24, 25, 26, 27, 28).

Table 2: Correlation analysis of egg weight, Dam weight and Hatching weight.

	HTW	DW
EWT	0.902***	0.715***
DW	0.563*	-

* P< 0.05 *** P < 0.001
EWG = Egg Weight DW = Dam WEIGHT HTW =HATCHING WEGHT

Conclusion and application

From the result of this study, it can be concluded that

1. Eg weight group had effect on hatching weight of eggs, range of 2.84 -3.20 gave heavier hatching weight compared to other weight group.
2. Incubation period was not significantly affected by egg weight group.
3. It can therefore be recommended that larger egg weight group should be sorted and set/incubated were large number of eggs are produced, especially where incubation facility cannot accommodate large number of eggs produced specifically during the raining season under intensive commercial production.

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