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Prediction of Body Weight Using Morphometric Indices in Giant African Land Snail in Three Zones of Imo State

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Abstract
Prediction of body weight using morphometric indices in giant African land snail *(Achatina marginata)* was studied for the three (3) agro-ecological zones in Imo State (Owerri, Okigwe and Orlu zones). One hundred and sixty (160) snails in Imo State were surveyed in course of this study. Data were generated through measurement of body weight, shell length, shell width, shell thickness, mouth length, weight of shell, weight of visceral, length of foot and thickness of foot. Data collected were subjected to regression analysis using SPSS statistical package. Results showed generally highly significant value ($p<0.01$) R^2 value and R-value across the zones. Highly significant difference ($p<0.01$) was observed in Owerri zone for the weight of shell, and the shell length While in Okigwe zone, only the weight of visceral showed a significant effect ($p<0.01$). In Orlu zone also, the shell width, shell mouth length and foot thickness showed a significant effect ($p<0.01$). The study therefore recommends that the linear model used, fits the data. Hence a comprehensive selection program for improvement of *A. marginata* in Imo State could be planned using the regressions coefficients obtained from the study.

Keywords: Land **s**nails, *Achatina marginata*, Morphological traits

Introduction

Conventional and regular sources of animal protein in the country like beef, pork, goat meat, fish, poultry, and so on, are getting out of the reach of the common populace due to their high price coupled with the economic down-turn (Olayide, 2004). To bridge this gap, various non-conventional animal protein sources like snail, cricket, and winged termite are now being explored. Snail meat, (also known as Congo meat) is reported (Ademolu *et al.,* 2004), to be high in protein, low in fat, and a source of iron. Many species of edible land snails are recognized in Nigeria but the popular species of economic interest in the West Africa are giant snails (*Archatina archatina*) and *Archachatin amarginata*. Recent study reveals that the two species of snails are good sources of protein. There is therefore the need to estimate the relationship between the body weight and other morphological traits in snail with a view to set up a breeding program. This study intends to predict body weight of snail using morphometric indices

Materials and Methods

The research was conducted in Imo state located in South-East Nigeria. A total of 150 (50 from each zone) mature snails of average weight (75-125g) were randomly sampled in the selected local government areas of the state between June-July 2015 during the field survey stage of the work. The animals were housed in a hutch made with a wire mesh. The hutch was divided into 9 sections, in a complete randomized design (CRD) representing the different LGAs taking into considerations. Data were collected on the morphological trait which includes body weight, shell length, shell width, shell thickness, shell mouth, and weight of shell, weight of visceral mass, foot length, and thickness of foot.

The SPSS (1996) statistical package was used to evaluate the multi-regression analysis with model below;

$Y= a + b_1x_1 + b_2x_2 + \ldots\ldots b_kx_k + e$……Equ 1

Where, Y = Body weight (dependent variable); X_1-X_K = Morphometric traits (independent variable); b = regression coefficient of morphometric traits; a = intercept

Results and Discussion

The result on table .1shows the multiple regression analysis of body weight on the morphometric traits of *A. marginata* in Owerri zone. This reveals a significant ($p<0.05$) $R^2$and R values of 0.888 and 0.94 respectively. This value disagrees with the low R^2 value (4.7%) by Okon and Ibom (2011) for hatching weight and morphometric traits. Most morphometric traits showed a positive regression coefficient ranging from 0.08 to 16.84 for the foot length and shell length respectively, although none, except the foot length was significant. Weight of shell and weight of viscera were negative and had similar value, -0.04. the observed positive regression coefficient values for the shell length, shell width, shell thickness, mouth length, foot length and foot thickness reveals that, a unit increase in any of the traits, would amount to an expected increase of the body weight by a constant amount of 16.84, 11.06, 8.67, 9.02, 0.46 and 0.08 respectively. However, positive correlation here denote that the pairs of traits, body weight and morphometric traits have direct relationship or they are controlled by same gene in the same direction as earlier pointed out by Ibom (2009) and Okon *et al.* (2009b).

Table 1: Multiple regression analysis of body weight, on morphometric traits of A. *marginata* in Owerri zone

Variable	symbol(term)	T value	Coeff+SEM
Constant term	a	-	-136±89.22
SHL	b1	4.72*	23.73±5.03
SHW	b2	0.33NS	2.56±7.68
SHT	b3	0.36NS	5.74±16.12
MOL	b4	-0.82NS	-5.27±6.43
WTS	b5	0.34NS	0.13±0.35
WTV	b6	-0.48NS	-0.14±0.29
FTL	b7	-0.04NS	-0.18±4.8
FTT	b8	1.71NS	4.28±2.51
Multiple co-eff of determination (%)	R^2		88.8%
Multiple Correlation	R		94.2%
F-value (calculated)			8.94
F-value (tabulated)	(p<0.05)		8.94^{NS}
	(p<0.01)		5.47**

a. *p<0.05 **p<0.01 NS- non significant

b. Foot thickness (FTT), weight of shell (WTS), Shell Thickness (SHT), shell width (SHW), weight of Visceral (WTV), shell mouth (MOL), Shell length (SHL).Dependent Variable : BDYWT

The result on table 2 shows the multiple regression analysis of body weight on the morphometric traits of *A. marginata* in Orlu zone. This reveals a significant (p<0.05) R value of 0.607, and a non-significantR^2 value of 0.368. This value agrees with the low R^2 value (4.7%) by Okon and Ibom (2011) for hatching weight and morphometric traits. Most morphometric traits showed a positive regression coefficient ranging from 0.13 to 14.94 for the foot length and shell thickness respectively, although none, except the foot length showed a significant-value. The mouth length had a negative coefficient value of-18.6. The observed positive regression coefficient values for the shell length, shell thickness, weight of shell, weight of viscera, foot length and foot thickness indicates that, a unit increase in any of the morphometric traits, would bring about an expected increase of the body weight by 10.17, 14.94, 5.87, 0.13, 0.88 and 0.24 respectively.

The observed negative value of b for mouth length indicates that that any unit decrease in the trait will lead to a concordance decrease of the body weight by a factor, 18.60. However, positive correlation here denote that the pairs of traits, body weight and morphometric traits have direct relationship or at least they are controlled by same gene in the same direction as earlier pointed out by Ibom (2009) and Okon *et al.* (2009b). More so, the intercept, a, has a negative value which signifies that in the absence of all studied morphometric traits, the body weight will decrease by 138.39±110.36. This agrees with the fact that snail weight can be predicted using quantitative or morphometric trait as predicted by Okon and Ibom (2011). T-test showed that none of the morphometric traits was significant. This could be attributed to few data set used from this zone.

Table 2: Multiple regression analysis of body weight, on morphometric traits of A. *marginata* in Orlu zone.

Variable	symbol(term)	T value	Coeff+SEM
Constant term	a	-	-138.39±110.36
SHL	b1	2.20NS	10.17±4.6
SHW	b2	1.86NS	14.94±8.04
SHT	b3	-1.41NS	-18.60±13.18
MOL	b4	1.15NS	5.87±5.11
WTV	b6	0.46NS	0.13±0.28
FTL	b7	0.19NS	0.88±4.74
FTT	b8	0.09NS	0.24±2.55
Multiple co-eff of determination (%)	R^2		36.8%
Multiple Correlation	R		60.7%
F-value (calculated)			2.17
F-value (tabulated)	(p<0.05)		1.96*
	(p<0.01)		3.42^{NS}

a. *p<0.05 **p<0.01 NS- non significant

b. Foot thickness (FTT), weight of shell (WTS), Shell Thickness (SHT), shell width (SHW), weight of Visceral (WTV), shell mouth (MOL), Shell length (SHL).Dependent Variable: BDYWT

The result on table 3 shows the multiple regression analysis of body weight on the morphometric traits of *A. marginata* in Okigwe zone. This reveals a highly significant ($p<0.01$) R^2 and R value of 0.95 and 0.975 respectively. The R^2 value indicates that the linear model has accounted for 95% of variability in the data. This gives the impression that the model fits the data, whereas, the R value indicates that for every change in the morphometric traits, the body weight is 97.5% likely to change, supporting the highly significant positive correlation among morphometric traits and body weight earlier reported by Okon, Ibom, et al., 2010. The observed morphometric traits with positive correlation coefficient: shell length, shell width, shell thickness, mouth length, weight of shell, foot length and foot thickness, shows that any unit increase in any of the traits, will amount to 16.84, 11.06, 8.67, 9.02, 0.46 and 0.08 increase in the body respectively. this in line with the findings of Ibom (2009) and Okon *et al.* (2009), that morphometric traits of snails are directly related to the body weight of snail.

On the other hand, the observed negative values of b for weight of shell and weight of viscera indicate that, for any unit decrease in the traits, there will be a decrease of the body weight by 0.04. More so, the intercept, a, has a negative value which signifies that in the absence of all studied morphometric traits, the body weight will decrease by 212.23±18.1. This agrees with the fact that snail weight can be predicted using quantitative or morphometric trait as predicted by Okon and Ibom (2011). The shell length showed highly significant ($p<0.01$) T-value at 80 % confidence level, while shell width, shell thickness and mouth length showed a significant ($p<0.05$) T-value, and other morphometric traits were not significant. This is an indication that any improve on any of these traits will result to an increase in the body weight of snail, as pointed out earlier by Ibom (2009).

Table 3. Multiple regression analysis of body weight, on morphometric traits of A. *marginata* in Okigwe zone.

Variable	symbol(term)	T value	Coeff+SEM
Constant term	a	-	-212.23±18.10
SHL	b1	8.07**	16.84±2.09
SHW	b2	4.39*	11.06±2.52
SHT	b3	3.48*	8.67±2.49
MOL	b4	3.32*	9.02±2.72
WTS	b5	-0.39NS	-0.04±0.10
WTV	b6	-0.43NS	-0.04±0.93
FTL	b7	-0.74NS	0.46±0.63
FTT	b8	1.07NS	0.08±0.07
Multiple co-eff of determination (%)	R^2		89%
Multiple Correlation	R		94.2%
F-value (calculated)			8.94
F-value (tabulated)	(p<0.05)		8.94^{NS}
	(p<0.01)		5.47**

a. *p<0.05 **p<0.01 NS- non significant

b. Foot thickness (FTT), weight of shell (WTS), Shell Thickness (SHT), shell width (SHW), weight of Visceral (WTV), shell mouth (MOL), Shell length (SHL).Dependent Variable : BDYWT

Conclusion

The need or quest for animal protein supply cannot be possible without the inclusion of non-conventional sources of animal protein into human diet, to make meat affordable for both the rich and the poor. To ensure the sustainability of the enterprise, the productive capability of the animal must be improved. This cannot be achieved without considering the quantitative measurements, correlation among performance traits and development of selection programs for effective planning. This study therefore has tried to increase the base line knowledge of the relationship between some morphometric traits and body weight of *A. marginata.* Hence predict the body weight using regression and correlation

Recommendation

Therefore a comprehensive selection program could be planned for improvement of *A. marginata* in Imo State using the regressions coefficients obtained from this study.

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