GROWTH PERFORMANCE AND LIPID PROFILE OF *Achatina achatina* SNAILS FED VARYING LEVELS OF *Moringa oleifera* LEAF MEAL

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ABSTRACT
This study was conducted to investigate the effect of feeding varying levels of Moringaolifera leaf meal (MOLM) on the growth performance and lipid profile of Achatinaachatina species of snails. A total of one hundred and twenty snailets with initial average weight of 9.71-10.29g were randomly assigned into five dietary treatments T0, T1, T2, T3 and T4 containing 0%, 2.5%, 5%, 7.5% and 10% dietary inclusion of dried MOLM respectively. The snailets were randomly assigned to five treatment groups of 24 snails and replicated three times with eight snailets per replicate in a completely randomized design (CRD). Feed and water were supplied ad libitum to the snails throughout the 8 weeks experimental period. The response parameters evaluated were body weight gain, feed intake, feed conversion ratio, shell length, shell width and lipid profile of the snail meat. Results showed that snails on treatment four recorded the highest ($P<0.05$) final body weight (27.95g), average daily weight gain (0.34g) and better feed conversion to meat (2.77). There was significant ($P<0.05$) reduction in the high density lipoproteins, low density lipoproteins and total cholesterol of snail meat with increase in the level of MOLM inclusion in the diets. It was concluded that dietary inclusion of dried Moringaolifera leaf meal at 10% can be included in the diet of growing snails to improve the growth performance and lower the low density lipoproteins of Achatinaachatina snails.
Keywords: Moringa, Lipid profile, Growth performance, Snails.

INTRODUCTION
The conventional and regular sources of animal protein supply in the country like beef, pork, goat meat and poultry are getting out of reach of the common populace due to the economic down-turn. There is therefore the need to look inward and integrate into our farming system some non-conventional meat sources (Ebenebe, 2000). A typical example of this non-conventional meat source is snail.

Snails are good converter of vegetable protein to useful animal protein (Obi *et al.,* 2001). Snail meat is rich in protein, low in fats and a rich source of iron (Orisawuyi, 1989). The protein in snail meat compares favourably with conventional animal protein sources (Imevbore and Ademosun, 1988). The use of plant leaves and various plant extracts considered to be natural products that consumers would accept have received increased attention as possible feed additives such as antibiotic growth promoter replacements following their ban by the European Union in 2006 on the use of antibiotics (Hernandez *et al.,* 2004). One such plant is *Moringaoleifera,* commonly known as the drumstick tree (Sarwatt*et al.*, 2002).

The incorporation of *Moringaoleifera*leaf meal in the diet of growing snails may be of help in meeting the nutritional and health requirement of snails as well as enhance their growth performance, thereby enabling them to attain maturity and market weight within a shorter period of time.*Moringaolifera* leaf meal have been reported to be very efficient in promoting growth as well as reducing the cholesterol level in other livestocks like broilers, layers and rabbits.This study was therefore designed to evaluate the lipid profile and growth performance of snail fed varying levels of *Moringaolifera* leaf meal

MATERIALS AND METHODS
Location and Duration of Experiment
The experiment was conducted at the Snailery Unit of the Department of Animal Science, University of Nigeria, Nsukka. Nsukka lies within longitude 6°45'E and 71E and latitude 7°12.5'N (Ofomata, 1975) and on the altitude 447m above sea level. The climate of the study area is typically tropical, with relative humidity ranging from 65 – 80% and mean daily temperature of 26.8°C (Agbaghaet *al.,* 2000). The rainy season is between April and October while dry season is between November and March with annual rainfall range of 1680 –

1700mm (Breinholt*et al.*, 1981). The experiment lasted for three months.

Experimental Animal and Management

One hundred and twenty (120) *Achatinaachatina*snailets were used for the study. The snails were divided randomly into five (5) groups of 24 snailets each in a completely randomized design (CRD) and assigned to the five dietary treatments which contained 0%, 2.5% 5%, 7.5% and 10% inclusion of moringa leaf meal in T0, T1, T2, T3 and T4, respectively. Each treatment was replicated three times with 8 snailets per replicate. Each replicate was housed in a plastic basket measuring 30cm in diameter and 13cm in height with proper perforations to enhance easy flow of air and proper drainage. Each plastic basket was filled with sandy loam soil sprinkled with water to 5cm depth. Baskets used were with functional lid which helped to check the problem of the snails escaping from the pen or mixing up with others. The soil was watered two times daily from tap water to keep it moistened and provide the snails with moderately humid environment to prevent them from aestivating. Feed and water was provided *ad libitum* throughout the period of the study which lasted for 10weeks. Fresh feed was given to snails daily. The quantity of feed that was offered to the snails daily was weighed before introduction and the leftover were also weighed to determine daily feed intake.

Data Collection

Growth performance parameters measured

The initial and final body weights of the snails were measured at the beginning and the end of the experiment.

Parameters calculated

Body weight gain (g) = final body weight – initial body weight.

$$\text{Average body weight gain (g)} = \frac{\text{Body weight gain within the period of study}}{\text{Number of days within the period of study}}$$

$$\textit{Daily feed intake} = \frac{\text{Feed offered (g)} - \text{feed refusal (g)}}{\text{Number of Snail}}$$

$$\textit{Feed conversion ratio} = \frac{\text{Feed Intake}}{\text{Weight gain}}$$ (Jabeen*et al.*, 2004)

Lipid Profile Determination

Total cholesterol in the sample was estimated using cholesterol enzymatic end point method (Randox laboratory UK, BT 294Q7 based on method by Richman (1973). Randox laboratory kit method was used for Total triglyceride Concentration determination based on method by Tiez (1990). HDL cholesterol was estimated using Randox laboratory reagent, UK BT4QT precipitant method by Jacob *et al.*, (1990). Low density lipoprotein, very low density lipoprotein (LDL and VLDL) and chylomicron fractions are precipitated quantitatively by addition of phosphotyngtic acid in the presence of magnesium ions.

Proximate determination of the diet

The crude protein, crude fat, ash, and moisture content of the samples of the five experimental diets were determined following A.O.A.C. (2000) procedure.

Statistical Analysis

Data collected were subjected to analysis of variation (ANOVA) using Statistical Package for Social Sciences SPSS, (2007) and significantly different means were separated using Duncan New Mutiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Effect of *Moringa olifera* Leaf meal on growth performance of snails

The result of the effect of varying inclusion levels of *Moringa olifera* leaf meal on the growth performance of growing snails is presented in Table 2.

The results showed that initial weight, average shell width increase, and average daily feed intake had no significant difference ($p>0.05$) among the treatments. However the effect of *Moringa olifera* leaf meal on average daily weight gain, average shell length increase and feed conversion ratio were significant ($p<0.05$) among the treatments. There was no difference in the feed intake of the treatments. This partly concurs with studies done by Nuhu (2010) who reported that MOLM had no effect on feed intake at various diets formulated for weaner rabbits. Treatment 4 produced snails with highest average weight gain (0.34g/snail/day) compared snails in other treatments. This may be due to the higher protein content of the diet which was efficiently metabolized for growth. Among the treatment groups also, T4 showed the best value

for FCR (2.77), which made it comparatively a better diet than the rest, since lower values of feed conversion ratio indicates superiority of the diet (Rashid *et al.*, 2008).

Fayenuwo *et al.* (2015) had reported higher average weight gain and feed conversion ratio of growing snails fed higher concentration of MOLM diet (75%) over other treatments. The range of values in average daily weight gain obtained in this study compared favourably with those obtained by Adu *et al.* (2002); Ejidike (2004) and Ejidike and Ajileye (2007) who independently recorded average daily weight gains of 0.30 – 0.64g/snail/day, 0.63 – 1.06g/snail/day and 0.4-0.6g/snail/day, respectively. The results on body weight gain and FCR showed that snail being a herbivore performed well on leaf-based diets and also indicates that *Moringa olifera* leaf meal up to the level of inclusion in treatment 4 were well utilized. This is in agreement with the report by Ejidike (2001) that increased protein level of diets results in better efficiency of utilization and better growth performance. The growth promoting factor can as well be as a result of the antibiotic factor contained in the leaf extract of moringa plant which exerts anti-microbial effects as well as stimulating effect on the digestive system of the animal (Osman *et al.*, 2005).

Effect of *Moringa olifera* leaf meal on the lipid profile of *Achatina achatina* snail meat

The result of the effect of varying inclusion of *Moringa olifera* Leaf meal on the Lipid profile of growing snails is presented in Table 3.

The results on the triglyceride (TG) and Very Low density Lipoprotein (VLDL) showed no significant difference ($p>0.05$) among the treatments. However, the results on the total cholesterol (TC), high density lipoprotein (HDL), low density lipoprotein cholesterol (LDL) showed significant difference ($p<0.05$) among the treatments. Results obtained from this study showed that MOLM inclusion in snail diets was instrumental in total cholesterol, HDL, and LDL reduction. The total cholesterol was least in treatment 4 which has the highest inclusion of MOLM (61.67g/dl) and highest in the control treatment (69.67). The LDL concentration was least in T4 also (19g/dl) and highest in the control (51.33g/dl). The fact that inclusion of MOLM resulted in a decrease in LDL affirms its potential as a hypocholesterolemic agent on snails. This is in agreement with the report of Ghasi et al (2000). The mechanism of cholesterol reduction is thought to be through the lowering of LDL by B-sitosterol, the bioactive phytoconstituent isolated from *Moringa oleifera* (Ghasi*et al.*, 2000). Considering the dose of MOLM used (10%), and the level of serum cholesterol-lowering effect achieved, it can be concluded that leaf of *Moringa oleifera*is a potent hypocholesterolemic agent. Although the effect of increasing doses of the extract on the cholesterol concentration was not pursued, still, greater reductions in cholesterol level may be achieved with higher doses of the extract. The cholesterol lowering ability of *Moringa oleifera* might also be due to the presence of saponins in the plants (Hsu *et al.*, 2006). Saponins prevent excessive intestinal absorption of cholesterol which and it is contained in moringa leaf.

CONCLUSION

Ten percent inclusion of *Moringa olifera* leaf meal in the diet of snail increased the weight gain and reduced the LDL cholesterol level of snail meat. Snail farmers should incorporate 10% *Moringa olifera* leaf meal in the diets of growing snails to improve their weight gain and reduce the low density lipoproteins of the meat.

REFERENCES

Ademola, K.O., Idowu, A.B., Mafiana, C.F. and Osinowo, O.A. (2004). Performance, proximate and mineral analyses of African giant land snail (*Achachatina marginata*) fed different nitrogen sources. *African Journal of Biotechnology*. 3(8): 412-417.

Ademosun, A.A. and Omidiji, M.O. (1999).The nutrient value of African giant land snail (*Archachatinamarginata*).*Journal of Animal Protection Researc*h 8(2): 876 – 877.

Adu, O.A., Ojurongbe A.O. and Omole A.J. (2002). Performance and Carcas Analysis of Giant land Snails (*Archachatina marginata*) fed supplementary diets. *Proc. 27th Ann. Conf. Nig. Soc.For Anin. Product (ASAP)*, March 17-21,2002. Fed Univer.of Tech. Akuref Nigeria.

Agbagha, F.M., Ezema F.U. and Omeke, B.C.O. (2000) Studies of Mangaement Effects on Fertility of Purbred and Crossbred Exotic Gilts in Two Breeding Farms at Nsukka.*Nigeria Journal of Animal Production*. 28(1)Pg 20.

Ani, A.O., Ogbu C.C., Elufidipe C.O. and Ugwuowo L.C. (2013). Growth performance of African giant land snail (*Achatina achatina*) fed varying dietary protein and energy levels. ARPN *Journal of Agricultural and Biological Science*.VOL. 8, NO. 2, Pp. 184.

AOAC (2000). Association of Official Analytical Chemists international (AOAC) Official methods of analysis, 17th edition AOAC International, Gaithersburg, MD, USA

Breinholt, K.A., Gowen, F.A. and Nwosu, C.C. (1981).Influence of Environmental and Animal Factors on Day and Night Grazing Activity of Imported Holstein Freisian Cows in the Humid Lowland Tropics of Nigeria.*Trop. Animal Produc.*6:4.

Duncan D.B. (1955).New Multiple Range Test. Biometrics. 11: 1-42.

Ebenebe, C.I. (2000). "Mini Livestock Production in Nigeria.The present and future".*Proceedings of 5th Annual Conference of Animal Science Association of Nigeria*, Port Harcourt, Nigeria September 19-22.

Ejidike, B.N. (2004). Growth Performance and Nutrient Utilization of African Giant Land Snail (*Archachatina marginata*) Hatchlings fed Different Protein diets. Food, Agriculture and Environment Vol. 2(1) 160-162.

Ejidike, B.N. and Ajileye, O. (2007). Nutrient Composition of African Breadfruit (*Treculia africana*) Seed Hull and its Use in Diets for the African Giant Land Snail, *Archachatina marginata Pakistan Journal of Nutrition* 6 (2): 201-203.

Esak, K.O. and Takerhash, I.S. (1992).Snails as pest and food.*Malaysian Journal of Economic Agriculture* 59:359 – 367.

FAO (1986).Farming Snails by FAO Better Farming.

Fayenuwo, J.O., Adekunle, O.F., Omole, A.J., Okpeze, C.N., Ajasin, F.O. and Ononogbu, C.O. (2015).Growth and Reproductive Indices of Growing Snails Fed Different Proportions of Leaves of *Moringaolifera* and Pawpaw.*Proceedings of the 4th International Conference/workshop on Giant African Land Snails (NetGALS),*Awka, Ist-4th June, 2015, Pg 155-158.

Ghasi S., Nwobodo E. and Ofili J.O. (2000).Hypocholesterolemic effects of crude extract of leaf of *Moringaoleifera Lam* in high-fat diet fed wistar rats. *J Ethnopharmacol.* 69(1):21-5.

Imevbore, E.A. (1990). Management Techniques in Rearing African Giant Land Snail (*A. marginata*).Ph.D thesis University of Ibadan, Nigeria (Unpublished).

Imevbore, E.A. and Ademosun, A.A. (1988).The nutritive value of the African giant land snail (*A. marginata*).*J. Anim. Prod. Resource.* 2(8): 76-78.

Jabeen, S., Salim, M. and Akhta, P. (2004). Feed Conversion Ratio on Major *Carp Cirrhinuiuriga* Fingerlings fed cotton seed meal. Fish meal and Barley.*Pak. Vet. J.*, 24(1).

Jurgens, M.H. (2002). Animal feeding and Nutrition. 9th Ed. Kendall/Hunt Publishing Co., Iowa, USA. pp. 144-146.

Nuhu, F. (2010).Effect of *Moringa*leaf meal (MOLM) on nutrient digestibility, growth, carcass and blood indices of weaner rabbits.Msc. Thesis, Animal Science Department of the Faculty of Agriculture and Natural Resources, Kwame Nkrumah University of Science and Technology, Kumasi 107.

Obi, O.O., Ayodeji, O.I, Adetoro, F.O. and Ogundola, F.I (2001). An Assessment of Bacterial and Fungal loads in snails (*A. Marginata*) procured from Different locations within Ibadan metropolis *Proc. 26th Annual NSAP Conf.* Vol. 26, 2000).

Ofomata, G.E.K. (1975). Nigeria in Maps.Eastern States, Ethiope Publishing Co. Ltd. Benin.

Orisawuyi, Y.A (1989). Practical guide to snail rearing Gratitude Enterprise, Lagos, pp: 27.

Osman, N., Talat, G., Mehmet, C., Bestami, D. and Simsek, G. (2005). The effect of an essential oil mix derived from oregano, clove and aniseed on broiler performance. *Intern.J.Poult. Sci.* 4:879-884.

Rashid, U., Anwar, F., Moser, B. and Knothe, G. (2008). "Moringaoleifera oil: a possible source of biodiesel. *Bioresources Technology* 99 (17): 8175-9. PMID 18474424.

Sarwatt, S.V., Kapange, S.S. and Kakengi, A.M., (2002). Substituting sunflower seed cake with *Moringaoleifera*leaves as supplemental goat feed in Tanzania. *Agro forestry systems*, 56:241-247.

SPSS.(2007). SPSS 16.0.1 for Windows.SPSS Inc., Chicago, IL, USA.

Table 1a: Percentage Composition of the Experimental Diets on dry Matter Basis

	T0 (Control)	T1	T2	T3	T4
Maize	30.200	29.706	29.214	28.720	28.232
Wheat offal	20.132	19.806	19.478	19.148	18.820
Groundnut cake	16.668	15.994	15.322	14.652	13.980
Soyabean meal	10.418	9.997	9.577	9.162	8.738
Fish meal	2.082	2.000	1.916	1.830	1.746
Palm kernel cake	12.500	11.997	11.493	10.988	10.484
Lysine	0.250	0.250	0.250	0.250	0.250
Methionine	0.250	0.250	0.250	0.250	0.250
Bone meal	4.000	4.000	4.000	4.000	4.000
Limestone	3.250	3.250	3.250	3.250	3.250
Vitamin premix	0.250	0.250	0.250	0.250	0.250
Moringa leaf meal	0	2.500	5.000	7.500	10.000
Total	100	100	100	100	100
Crude Protein	22.00	22.00	22.00	22.00	22.00
Energy:	2.46	2.43	2.41	2.38	2.36
Fibre:	6.12	6.17	6.23	6.28	6.33