IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 8, Issue 10 Ver. I (Oct. 2015), PP 69-73
www.iosrjournals.org

Performance and carcass characteristics of (*Archarchatina marginata*) fed graded levels of roasted defatted *Moringa oleifera* seed meal as partial replacement for soya bean meal.

Alikwe P.C.N, Okpeku M. and Nwakamma V. T.
Department Animal Science, Faculty of Agriculture, Niger Delta University, Wilberforce Island, Bayelsa State.

Abstract: *A study was conducted on the growth performance and carcass characteristics of Archachatina marginata fed graded levels of defatted roasted Moringa oleifera seed meal (0%, 3%, 6%, 9%, 12%) for 56days. The performance of Archachatina marginata was assessed on the basis of weight gain, shell length, shell thickness, shell width, feed intake and feed conversion ratio. Average feed intake, mean body weight, mean shell length, mean shell width and feed conversion ratio (FCR) were significant (P<0.05). Shell thickness, carcass weight, foot weight, crop weight, lungs weight, stomach weight, intestine weight were not significantly different (P>0.05) across the treatment groups. 3% replacement level yielded the best values for feed intake, average weight gain and feed conversion ratio (FCR). For optimal performance there is need to balance the energy-protein level of diets in which soya bean is replaces with M. oleifera seed meal.*

Key words: *Archarchatina marginata, carcass characteristics, growth performance, Moringa oleifera, weight gain.*

I. Introduction

A number of animals, both vertebrates and invertebrates referred to as mini-livestock (Hardoium, 1995) are becoming popular as protein boost to cushion the effect of low protein intake in Africa. To qualify as a mini-livestock, animals must have a potential benefit either nutritionally for food or economically for animal feed or revenue and are currently not being utilized to their fullest potentials (Hardoium, 1995).

Heliculture, is the process of farming or raising snails, has become very important in recent times because of increased demand for animal protein in Nigeria. Their popularity and acceptability nation-wide, the potential for export, including emerging technologies for their production have largely contributed towards the present renewed interest in snail farming (Amusan and Omidiji, 1998). In Nigeria protein consumption is below 67g recommended by the world health organization. Integrated snail farming has been identified as alternative to the present problem of protein malnutrition, prevalent in most developing countries of the world (Ebenebe, 2000).

Archachatina marginata is the most common breed of snail reared and available in the market throughout the South Western Nigeria (Amusan and Omidiji, 1999). 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 level of minerals in snail is higher when compared with beef, chicken, chevon, mutton and Pork (Akimusi, 1998). Snail farming can conveniently be done in our back yards. This is due to the fact that snail farming is environmentally friendly and can be done with little skill (Akinnusi 1998; N.R.C 1991).

Moringa oleifera belongs to a single genus family *moringaceae* which has fourteen species (Morton, 1991) locally known as Zogali among the Hausa speaking people of Nigeria. It is grown and widely cultivated in the Northern part of Nigeria and many countries in tropical Africa (Anjorin et al. 2010). The leaves, fruits, flowers and immature pods of this tree are edible and form part of traditional diets in many parts of the tropics and sub-tropics (siddhuraju & Becker, 2003). The plant seeds contain hypotensive activity, strong antioxidants and chelating property against arsenic toxicity (Arabshabi et al. 2007; Ghasi et al. 2000; Mehta et al. 2003; Santos et al. 2009). Seed flour from *M. oleifera* is widely used as natural coagulant for water treatment in developing countries (Santos et al. 2005). Different parts of this plant contain a profile of important minerals, and are a rich source of protein, vitamins, beta-caretene, amino acids and various phenolics (Anwar et al. 2007). *Moringa* has potential of improving nutrition, boost food security, foster rural development and support sustainable land care (National research council, 2006). This study was conducted to evaluate the influence of partial replacement of soya bean meal with *M. oleifera* in snail production.

II. Materials and Methods

Location and duration of the experiment

The experiment was carried out at the teaching and research farm of the faculty of Agriculture Niger Delta University, Amassoma, Bayelsa State for a duration of eight (8) weeks

Housing and management

Juvenile snails were bought and into perforated baskets of 41 cm x41cm x21cm; holes were made at the bottom of the baskets to allow for water drainage. The baskets were filled with wet loamy soil to a depth of about 4cm, dried plantain leaves were also put into the baskets to serve as shade for the snails. Feed and water were provided adlibitum on daily basis. Water was also sprinkled in the basket twice a week to maintain a moist environment for the snails.

Experimental design

The experiment was arranged in a completely Randomized design (CRD) having five (5) treatments with three (3) replicates and with each replicate containing 10 snails. A total of one- hundred and fifty (150) snails (Archachatina marginata) were purchased from snail sellers at Ogobiri Town. Healthy snails without shell damage were acclimatized for one (1) week and fed with paw-paw leaves. After one (1) week of acclimatization, one hundred and fifty (150) grower snails were weighed individually and randomly distributed into baskets labelled according to the different treatments and replicates.

Experimental diet

Defatted *Moringa oleifera* seed meal (DMSM) was obtained from a Moringa oil processor in Borno State, North East of Nigeria. Based on the experimental design, DMSM was roasted locally using a frying pan, tripod stand and firewood. Afterwards, it was thoroughly mixed with other feed ingredients. Five (5) experimental basal diets were throughout the experiment. Graded levels of defatted roasted *Moringa oleifera* seed meal was used as a replacement for soya bean at the inclusion rate of 3%, 6%, 9% and 12% in the dietary treatments designated as T_2, T_3, T_4, and T_5 while treatment one (T_1) which served as the control diet contained 0%. The defatted roasted *Moringa oleifera* seed meal (DMSM) was thoroughly mixed with other feed ingredients in formulated ration as shown below. The snails were provided with feed daily for eight (8) weeks. The feed was weighed to be fifty (50) grams before feeding to each replicate; the left over feeds were weighed and thrown away before fresh feeds were provided. The drinkers were provided with foam inside of it to prevent the snails from entering into the water and spilling it

Table 1. Gross composition of experimental diets

Ingredient	T_1	T_2	T_3	T_4	T_5
Maize	50	50	50	50	50
Wheat offal	6	6	6	6	6
Soya bean meal	17	14	11	8	5
Groundnut cake	15	15	15	15	15
Palm kernel cake	7	7	7	7	7
Bone meal	4.7	4.7	4.7	4.7	4.7
Premix	0.3	0.3	0.3	0.3	0.3
DRMSM	0	3	6	19	12
Total	100	100	100	100	100

Data Collection

Data were collected on the growth performance and feed intake by measuring the following parameters.

Body Weight: The individual weight of the snails was taken on a weekly basis using a weighing balance.

Shell Length and Width: Five (5) snails were randomly selected from each replicate to measure the shell length increment and width with the use of a digital venire caliper.

Feed intake: This was done by deducting the left over feed from the initial feed given to the snails on daily basis.

Feed Conversion Ratio (FCR): This was attained by dividing the average weekly feed intake by the average weekly weight gain.

Carcass characteristics: On the last day of the experiment, one snail was randomly selected from each replicate and the weights of the live snails were recorded. All the snails were eviscerated from the shell. The eviscerated snail parts/ organs were weighed individually and recorded. They include; the shell, carcass, meat content and the gut content. A digital vernier caliper was used to measure the foot length, foot thickness, shell length and the width of the snails.

Statistical Analysis

The data obtained from all parameters were subjected to statistical analysis. The analysis of variance was used according to the method of Steel and Torrie (1981). The means were separated by using Duncan's multiple range test (Duncan, 1995)

III. Results and Discussion

Growth performance of *Archachatina marginata* fed varied levels of *M. oleifera* as partial replacement for soya bean meal is shown in table 2. Averages of feed intake, weight gain, shell length, shell width and FCR (7.85-10.36, 50.00-75.33, 84.87-90.65, 48.20-52.69 and 0.14-1.51 respectively) were significantly different across treatment groups ($P<0.05$). T_2 had the best values for feed intake and weight gain; suggesting that maximum and profitable replacement of soya bean meal can be achieved at 3% replacement for maximum performance. Beyound this point additional inclusion will be unprofitable, evident by the decline in values for these parameters above 3% replacement.

Decline in growth performance beyound 3% inclusion can be attributed to elevated fiber content. High dietary fiber is known to limit the availability of nutrients, especially energy and protein (Maynard and Loosli, 2000). In terms of weight gained per feed intake, values recorded in this study compare favourably with values for weight gain of *Archachatina marginata* fed varied levels of *M. oleifera* leaf meal (Ani et al. 2014), *Archachatina marginata* fed *Asplenium barteri* Leaf Meal Supplement (Alikwe et al. 2013) and *Archachatina marginata* fed Soya Bean Milk Residue/Cassava Sievate Meal Mixtures (Ojebiyi et al. 2011).

Among the treatment groups, T_2 also showed the best value for FCR (0.14), which makes it comparatively a better diet than the rest, since lower values of feed conversion ratio indicates superiority of the diet (Rashid et al. 2002). FCR range observed in this study agrees with reports of Ani et al. (2014) on snails fed *M. Oleifera* leaf meal. Zero mortality recorded in this study suggests that *M. oleifera* contain no toxic element that is detrimental to snail development. Snails are very sensitive creatures the presence of toxic alkaloids can affect their performance negatively. Absence of mortality in any of the treatment group indicates that *M. oleifera* is free of harmful alkaloids and toxins. This confirms the report of Ani et al. (2014) and supports Akinnusi (1998) report that, under proper management, the mortality rate in snails is lower than that of other conventional livestock.

Table 2. Performance of *Archachatina marginata* fed varied levels of *M. oleifera* as partial replacement for soya bean meal.

Parameters	T_1 (Mean±SD)	T_2 (Mean±SD)	T_3 (Mean±SD)	T_4 (Mean±SD)	T_5 (Mean±SD)
Feed intake (g)	9.57 ± 5.56^{ab}	10.36 ± 6.14^{b}	9.54 ± 5.19^{ab}	8.70 ± 5.78^{bc}	7.86 ± 5.10^{ab}
Weight gain(g)	50.00 ± 45.436^{ab}	75.33 ± 22.12^{ab}	60.33 ± 34.24^{ab}	50.67 ± 12.66^{ab}	60.33 ± 22.68^{b}
Shell length (mm)	90.65 ± 4.75^{ab}	88.94 ± 3.46^{ab}	87.00 ± 5.67^{b}	95.45 ± 0.97^{a}	84.87 ± 5.46^{b}
Shell thickness (mm)	0.82 ± 0.14	$1.21. \pm 0.39$	$0.82. \pm 0.37$	$0.92. \pm 0.45$	1.05 ± 0.35
Shell width (mm)	52.69 ± 0.52^{a}	49.65 ± 81^{ab}	48.20 ± 2.81^{b}	51.55 ± 3.34^{ab}	50.53 ± 3.53^{ab}
FCR	0.19 ± 0.12^{ab}	0.14 ± 0.28^{a}	1.51 ± 0.15^{c}	0.17 ± 0.46^{ab}	1.24 ± 0.22^{bc}
Mortality	0	0	0	0	0

T_1, T_2, T_3, T_4 and T_5 = Treatment 1,2,3,4 and 5 respectively; FCR= conversion ratio
Means with different superscripts in each row are significantly different ($P<0.05$)

Table 3 shows the carcass characteristics of *Archachatina marginata* fed varying dietary levels *M. oleifera* as partial replacement for soya bean meal. Only live weight and empty shell weight were significantly different at $P<0.05$ among the treatment groups with a range of 79.33-102.33 and 2.58-3.21 respectively. All other parameters measured were not significantly different ($P>0.05$). The significant variation in live weight is an indication that the different treatment diets contributed to the final live weight in this study. Live weight determines the market weight and price of livestock. T_2 yielded the best weight gain and FCR but live weight for T_2 was not the best. This implies that there are more to growth performance than just a single meal. While *M. oleifera* may compare favorably with soya bean meal for protein, the energy content of soya bean is higher. This may account for the better value for live weight observed in T_1.

Although carcass weight, foot weight, lungs stomach and intestine length were not significantly different, it is worthy of note that T_1 has the highest value which suggests that a diet with high protein content is vital for foot formation which is the most important edible portion of the snail.

Table 3. Carcass characteristics of *Archachatina marginata* fed varied levels of *M. oleifera* as partial replacement for soya bean meal.

Parameters	T_1 (Mean±SD)	T_2 (Mean±SD)	T_3 (Mean±SD)	T_4 (Mean±SD)	T_5 (Mean±SD)
Live weight (g)	102.33 ± 12.47^{a}	84.66 ± 9.57^{ab}	89.33 ± 7.36^{ab}	85.33 ± 14.27^{ab}	79.33 ± 13.69^{b}
Carcass Weight (g)	29.66±3.93	28.93±1.78	30.23±3.20	29.03±4.58	26.10±4.83
Foot Weight (g)	2.17±2.62	1.75±0.89	1.64±3.51	1.64±3.42	1.75±4.94
Lungs Weight (g)	0.33±0.33	0.63±0.63	0.83±0.83	0.23±0.23	0.50±0.50
Stomach Weight (g)	0.70±0.08	0.70±0.00	0.70±0.08	0.73±0.09	0.66±0.05
Intestine Weight (g)	12.93±2.54	12.80±0.73	13.00±1.96	11.83±2.32	12.73±2.49
Empty shell weight (g)	2.60 ± 1.91^{ab}	$2.87. \pm 5.47^{ab}$	$2.85. \pm 2.52^{ab}$	$3.21. \pm 3.79^{a}$	2.58±3.91

Means with different superscripts in each row are significantly different ($P<0.05$)

IV. Conclusion

Moringa oleifera seed meal is rich in protein and can adequately support the growth of snails, it is best included at 3% of the final diet. Although *M. oleifera* is a good source of protein, it may not support the production of heavy snails at market weight. However, *M. oleifera* is free of anti nutritional factors that can depress growth performance its high fiber content and low energy when compared with soya bean meal may limits its use as protein replacement for soya bean meal. More so the cost of *M. oleifera* seed is relatively on the high side presently in Nigeria. Its medicinal usage places a high demand on it and hence high cost, thus it is not recommended for commercial production of snails until sometimes in future when increased production might force down the cost of purchase.

V. Acknowledgements

The authors appreciate the support given by the Niger Delta University teaching and research farm.
This project was supported in part from Dr. Okpeku's senate research TETFUND grant.

References:

[1]. Akinnusi O. (1998). A practical Approach to back yard snail farming. *Nigeria journal of Animal production* 25:193-197.
[2]. Alikwe, P.C.N., Okpeku, M. and Ndukari, S. (2013). Response of African Giant Land Snail (*Archachatina marginata*) to Graded Levels of *Asplenium barteri* Leaf Meal Supplement. *IOSR Journal of Agriculture and Veterinary Science. 6(1). 32-35*
[3]. Amusan, J.A; Omidiji, M.O (1998). Edible land snails: A technical guide to snail farming in the tropics. Varity printers Ltd. Ibadan. Pg 60.
[4]. 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*. 8(2). 184-190.
[5]. Ani, A.O., Ogbu, C.C. and Okonkwo, A.M. (2014). Growth Response of African Giant Land Snails (Archachatina marginata) to Varying Dietary Levels of Moringa Oleifera Leaf Meal. *Advances in Life Science and Technology*. 27; 22-27
[6]. Anjorin, T.S, P.Ikokoh and S.Okolo, (2010). Mineral composition of Moringa Olefera leaves pods and seeds from two regions in Abuja, *Nigeria. International Journal of Biology* .12:431-434.
[7]. Anwar, F, Latif .S, Ashraf .M Gilani. A. H. (2007). Moringa oleifera a food plant with multiple medicinalu uses. *Phytother Res*.2007 Jan;21(1):17-25.
[8]. Arabshahi D.S., Devi D.V., Urooji A. (2007). Evaluation of antioxidant activity of some plant extracts and their heat, PH and storage stability. *Food chemistry* 100: 1100 – 1105.
[9]. Ebenebe, C.I, (2000) mini livestock production in Nigeria. The present and future proceedings of 5th annual conference.
[10]. Ghasi, Nwobodo. E., Ofili J.O (2000) Hypo-cholesterolemic effects of crude extract of leaf of moringa oleifera. *Journal of Ethnopharmacol 69: 21 – 5*
[11]. Hardoium J. (1995). Mini-livestock farm *gath*ering to controlled production. *Biodiversity and conversion;* 4(3):220-232.
[12]. Hodasi, J.K.M. (1986): Effect of different types of food on the growth of Archachatina. proceeding of the 12th international malacological congress, vigo. Span, edited by Guerra A. Rolace and kochaf.PP. 488-489.
[13]. Imevbore E.A; Ademosun A.A (1988). The nutritive value of the Giant African land snail (Archachatina marginata). *Journal of Animal Production Research*; 8(2):76-87.
[14]. Maynard, L. A. and Loosli, J. K. (2000). Animal Nutrition, 11th edition. McGraw Hill Book Co. New York. Pp 542
[15]. Mehta L.K, Balaraman R., Anim A.H., Bafna P.A, Gulati O.D (2003). Effect of moringa Oleifera on the lipid profiles of normal and hypercholesterolaemic rabbits. *Journal of Ethnopharmacol* 86: 191 – 5
[16]. Morton J.f (1991).The horseradish tree, moringa Pterigosperma (moringaceae). A boon to arid lands. *Economics of botany* 45(3), 318
[17]. NRC (1991) micro-livestock, little known snail. Animals with a promising economic future.National Academy press Washington D.C
[18]. National Research Council (2006). "Moringa". Lost Crop of Africa: volume ii: vegetables. *National Academic press* p 247.
[19]. Obi O.O, O.I Ayodeji, F.O.Adetoro and F.I ogundola (2001). An assessment of Bacterial and fungal loads in snails (A.marginata) procured from different locations within Ibadan metro polis proc.26th Annual NSAP conf vol. 26, 2000).
[20]. Ojebiyi, O.O., Jejelola, O.O., Oladunjoye, I.O. and Shittu, M.D. (2011). Performance Characteristics of African Giant Land Snail (Archachatina marginata) Fed Diets Containing Soya Bean Milk Residue-Cassava Sievate Meal Mixtures. *World J Life Sci. and Medical Research* 1(5):105-110
[21]. Orisawuyi Y.A (1989) practical guide to snail rearing Gratitude Enterprise, Lagos, pp: 27
[22]. Rashid U., Anwar .F., Moser .B. Knothe .G. (2008). "Moringa oleifera oil: a possible source of biodiesel. *Bioresources Technology* 99 (17): 8175-9. PMID 18474424.

[23]. Santos, A. F. S., Luciana A., Adriana C .C. A, Teixeira, J.A, Paiva P.M.G, Coelho. L.C.B.B (2009). Isolatron of a seed coagulant moringa Olerfera lectin. *Process Biochemistry* 44 (2009) 504-508.

[24]. Santos A.F, Argolo A.C., Coelho L.C and Paiva P.M (2005) detection of water soluble lectin and antioxidant component from moringa oleifera seeds. *Water resources*. 39 (6): 975-80.

[25]. Siddhurai, P. and Becker.k. (2003). Antioxidant properties of various solvent extracts of total phenolic constituents from three different agro climatic origins of drumstick tree moringa Olefera Lam.) *Journal of Agriculture food chemistry*, 15, 2144-2155.