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Research Article

Effects of Feeding Millet Meal Diet at Varying Levels of Inclusion on the Reproductive Performance of Breeder Snails *Archachatina marginata* Reared Intensively

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ABSTRACT

This research was conducted to determine the effect of millet meal fed to breeder snails at varying levels of inclusion 3.0, 3.2 and 3.4kcal/kg. The snails were eight (8) months old each as the experiment lasted for 10 weeks. Thirty-six (36) breeder snails were randomly selected into three (3) groups of twelve (12) snails per treatment, which were replicated three (3) times. The parameters measured were growths performance, feed intake, feed conversion ratio and reproductive characteristics. Data collected were subjected to one way analysis of variance in a completely randomized design. Significant differences among means of treatment were separated with Duncan's Multiple Range Test at 5% level of probability using (SAS 2011). The study revealed that snails fed 3.4 kcal/kg of millet meal supported higher final body weight (108.80±0.71), body weight gain (9.04±0.71), number of eggs laid (17.44±0.53), percentage egg hatchability (88.02±1.24), percentage egg fertility (78.64±2.11). There were no significant differences recorded in the final shell circumference, shell circumference gain, final shell length and shell length gain which could be attributed to the slow rate of snail.

Key words: Millet meal diet, Reproductive performance, Breeder snail

INTRODUCTION

Nigeria is currently faced with an acute shortage of animal protein for her teeming human population estimated at over 100 million (FAO 1986). This situation has led to unprecedented pressure on conventional source of animal protein. Recently, cats, dogs snakes and termites have been added to the traditional sources which have hitherto been limited to cattle, sheep, goats, pigs, poultry, fish, bush meat (Ogunfowora *et al.*, 1980). There is the need to bridge the gap between protein requirement and animal protein consumed by the people which are not sufficiently supplied by crop production (Ajibefun 2000).

Snail is one of such micro livestock that has recently attracted attention among farmers in Nigeria as an aftermath of the alarm raised by Food and Agriculture Organization (FAO) on animal protein deficiency among Nigerians (Adesope, 2000; Akinnusi 2000). FAO (1986) reported that the average animal protein intake in Nigeria is low and thus, calls for collective efforts towards alleviating the situation. Sadly, the conventional sources of Animal protein supply in the country such as beef, pork, goat meat and poultry are almost out of the reach of the common populace due to the economic recession, even though Nigeria is said to be technically out of recession but the rate is disappointedly very marginal at 0.6% which is very insignificant to make any meaningful impact on critical economic variable namely, growth and development (Welfare of the people), inflation rate and production. Ebenebe (2000) recommended that there is need for Nigeria to integrate ratio our farming system some non-conventional sources of animal protein supply. This falls on the use of the micro-livestock/mini livestocks which Nigeria is richly blessed with. Snail farming has numerous advantages which are stated below; Snailery can be cheaply established and maintained in terms of housing, feeding, health care etc. They reproduce rapidly during the rains, they are efficient producers of meat, they have high medicinal value and as such used in the prevention and cure of some ailments such as hypertension, anemia etc (Shogbola 1996) The bluish fluid from snails is used to reduce labour pain in women during child delivery (Akinnusi 1998 and Omole *et al.*, 2007).

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Snail meat compares favourably with other conventional sources of animal protein like beef, pork, goat meat and poultry meat (Nyameasem and Borketey-la 2014) it has a crude protein of about 19% (Fagunaro *et al* 2006). The low cholesterol and high iron content of the meat makes it a good cure for fat related ailments (Bright 1996). Due to the fact that snails are small, noiseless and easy to handle, they can be reared in urban areas without infringing on the peace of neighbours (Odunnaiye 1991)

Snail rearing can be done by the physically challenged, it can also be used as a secondary occupation and can be combined with other businesses as the management is simple and does not require much time. Snail mortality rate is very low. It is below 5% from hatching to adult. Snail feed can be sourced locally and it is readily available unlike in the other livestock production, where feeding constitutes about 70%-80% of the total cost of production (Omole *et al* 2007).

Snails are relatively scarce during the dry season, increasing in number towards the raining season and reduce towards the onset of the dry season, because of the availability of snails during the rainy season, many farmers can easily embark on large scale production of snails with the use of formulated feeds under intensive system of rearing so as to increase the supply of snails to meet up with the demand of the populace, protein, energy requirement and sources are the main focus of this study because as snail grow older they need higher energy for fast growth, as protein and mineral/vitamin are needed for faster reproductive and improved growth traits for better returns or investment (Ugwuowo *et al* 2011). Hence the need to access the growth performance and reproductive characteristics of African Giant Land Snail (Archachatina marginata) raised under an intensive system of management.

MATERIALS AND METHODS

Before the commencement of the study forty grower snails of the species *(Archachatina marginata)* were purchased from the Songhai Farms Amukpe, Sapele in Sapele Local Government of Delta State, Nigeria. These snails were quarantined for two (2) weeks before the commencement of the experiment. This was to allow for the acclimatization of the snails. During this period the snails were fed with herbages such as Pawpaw leaves *(Carica papaya)* and Water Leaf *(Talinium triangulae)*, Clean water was sprinkled every morning and evening. The duration of the experiment was for ten (10) weeks

Experimental animals

A total of thirty-six (36) breeder snails of the species *Archachatina marginata* were selected from the forty (40) snails reared in the pre-experimented period and were randomly divided into three (3) groups of twelve (12) Snails each per treatment which were replicated three times, with four snails in each replicate. Snails were fed with Millet meal at varying levels of inclusion 3.0, 3.2 and 3.4 kcal/kg. These snails were Eight (8) months old.

Experimental diet

Grains of Millet were purchased from the Asaba main market, these seeds were sundried and milled into powder and mixed with other ingredients and stored in a container for use.

Table 1: Composition of the experimental diet for breeder snails fed millet at varying levels of inclusion 3.0, 3.2, 3.4 kcal/kg

Ingredients	Millet meal		
Levels of Inclusion	3.0	3.2	3.4
Millet	55	49	44.5
Wheat bran	16	16	16
Blood meal	12	12	12
Groundnut cake (GNC)	13	19	23.5
Bone meal	3	3	3
Vit premix	1	1	1
Total	100	100	100
Calculated analysis			
Energy (kcal/kg) (Metabolizable Energy)	1424.88	1644.69	1816.72
Crude protein (%)	24.43	26.44	27.95
Calcium (%)	0.74	0.74	0.75
Crude Fibre (%)	6.00	5.83	5.71

Housing and management

The Cages containing the experimental snails were constructed under a roofed shade to prevent direct sunlight on the snails. These wooden cages were suitable for backyard snail production. The cages used measured 15cm x 60cm x 30cm. These snails were weighed individually and randomly distributed into the cages ensuring similar average weight. The floor of the cages were filled with loamy soil to a depth of fifteen (15cm) centimeters, the soil before use was exposed to sunlight to get rid of harmful soil micro-organisms. Weighted quantities of the experimental diet (Millet meal at varying levels of inclusion 3.0, 3.2 and 3.4 kcal/kg) were placed in flat containers inside the cages and the left over feed at all times were carefully collected and weighed before fresh feed was introduced on daily basis, this was to calculate the amount of feed intake while clean water was sprinkled every morning and evening, water was also put in shallow flat plastic plate for the snails to have access to water all the time. Droppings were removed every morning so as to maintain a clean environment inside the cage.

Data collection

Data were collected on growth performance, feed intake, feed conversion ratio and reproductive characteristics.

Body weight (BW): Body weight was taken at the commencement of the experiment and on weekly basis. This was done on replicate basis for ten (10) weeks

Shell length (SL): This was done by measuring the long axis of the snail on an individual basis with the use of measuring tape. This was done on a fortnight basis.

Shell Circumference (SC): This was done using a venial caliper around the largest circumference of the shell on individual basis. This was done fortnightly too.

Feed Intake (FI): This was obtained daily as difference in weight between the feed given and feed remaining, this was done through the entire period of the experiment.

Feed Conversion Ratio (FCR)

This was calculated using the following formula.

$$FCR = \frac{\text{Feed intake}}{\text{Body weight again (g)}}$$

Reproductive Performance: these were calculated using the following formulas.

$$\text{Fertility Percentage} = \frac{No\ of\ fertile\ eggs}{No\ of\ eggs\ incubated}$$

$$\text{Embryo mortality} = \frac{No\ of\ dead\ in\ shell}{Total\ no.\ of\ fertile\ eggs}$$

$$\text{Percentage mortality} = \frac{No\ of\ \ eggs\ hatched}{Total\ number\ of\ fertile\ eggs}$$

This was done on replicate basis at the end of the experiment.

Statistical analysis

All data collected were subjected one way analysis of variance in a completely randomize design. The means that are significantly different were separated using Duncan Multiple Ranged Test (DMRT) at 5% level of probability (SAS 2011).

RESULTS

The results of the growth performance of the breeders snail fed millet meal at varying level of inclusion was presented in table 2. The results indicated that the initial body weight (IBW) of the snail were not significantly different (P>0.05). However, there was significant difference (P<0.05) in the final body weight (FBW) with snails in treatment group of 3.4Kcal/kg having highest final body weight of 108.80±0.71 and the results of body weight gain (BWG) were significantly different (P<0.05) with snails in the same treatment group of 3.4Kcal/kg having the highest BWG of 9.04±0.71. The results of feed conversion ratio (FCR) is equally significantly different (P<0.05) and the snails in group 3.4Kcal/kg have a better feed utilization of (53.68±4.40). The results however, showed that there were no significant difference (P>0.05) in Initial shell circumference, Final shell circumference, Shell circumference gain, Initial shell Length, Final shell Length, Shell Length gain and total feed intake.

Results in table 3, which is on the Reproductive characteristics of breeder snails fed millet meal at varying levels of inclusion shows that there were significant differences (P<0.05) among the Reproductive parameters measured. Snails in treatment group 3.4Kcal/kg energy inclusion showed highest numbers of egg laid, percentage fertility, percentage hatchability and percentage embryo mortality at (17.44±0.53, 78.64±2.11, 88.02±1.24 and 11.98±0.94) respectively.

DISCUSSION

The results of table 2 indicates that there were increase in growth of the breeder snails among the treatment groups However the effect of the inclusion levels on the final body weight and body weight gain varied as indicated by the significant (P<0.05) differences recorded, snails fed 3.4 kcal/kg of millet meal had higher final body weight and body weight gain than snails fed 3.0 and 3.2 kcal/kg of the diet. This was as a result of the higher dietary energy feed fed to the snails. This is in agreement with the report of Zhong *et al*., (2008) that body weights were higher when fed higher energy diet than the ones fed lower energy diets.

However, no significant (P>0.05) differences were observed in the final shell circumference, shell circumference gain, final shell length, shell length gain and total feed intake. Significant difference was recorded in the feed conversion ratio, as snails fed 3.0 kcal/kg of the millet meal had higher feed conversion ratio than snails fed 3.2 and 3.4 kcal/kg of the diet. This could be as a result of the better utilization of the feed and higher body weight gain by the snails fed higher levels of the energy sources.

Table 3 results revealed that significant differences were recorded in all the parameters considered. Breeder snails fed 3.4 kcal/kg of the millet meal recorded greater number of eggs laid, higher percentage fertility and percentage hatchability as well as the least percentage embryo mortality than others, while snails fed 3.0 kcal/kg of the millet meal had the lowest percentage fertility, hatchability and highest percentage embryo mortality. It was likely that the inclusion level of the energy source at 3.4kcal/kg must have affected the number of eggs laid, fertility and hatchability percentages of the eggs with reduced mortality of the embryo. This was in line with the findings of (*Harns et al 1957)* that hens fed higher energy diet had higher rate of production than hens fed low energy diet. (*Eniolorunda et al 2007)* and *(Oyeagu et al 2015)* also reported that diets with better ingredient combination were utilized more efficiently when fed to animals. Reginatto *et al* (2000) discovered that energy and protein diets should be in a balanced ratio to improve growth.

Table 2: Growth Performance of Breeder snails fed millet meal at varying levels of inclusion 3.0, 3.2, 3.4kcal/kg

Parameters	Levels of inclusion		
	3.0 Kcal/kg	3.2 Kcal/kg	3.4 Kcal/kg
Initial Body weight (g)	99.75±0.00	99.76±0.00	99.76±0.00
Final Body weight (g)	106.81±0.73^{c}	107.49±0.84^{b}	108.80±0.71^{a}
Body weight gain (g)	7.06±0.73^{c}	7.73±0.84^{b}	9.04±0.71^{a}
Initial shell circumference (cm)	16.09±0.00	16.09±0.00	16.09±0.00
Final shell circumference (cm)	17.06±0.00	17.06±0.00	17.07±0.00
shell circumference gain (cm)	0.97±0.00	0.97±0.00	0.97±0.00
Initial shell Length (cm)	9.05±0.00	9.06±0.00	9.06±0.00
Final shell Length (cm)	10.01±0.00	10.01±0.00	10.02±0.00
Shell Length gain (cm)	0.96±0.00	0.95±0.00	0.96±0.00
Total feed Intake (g)	490.46±2.06	489.21±2.80	485.23±2.44
Feed Conversion Ratio	69.47±8.05^{a}	63.29±6.05^{b}	53.68±4.40^{c}

a,b,c: Means with row bearing same superscript are not significantly (P>0.05) different

Table 3: Reproductive characteristics of breeder snails fed millet meal at varying levels of inclusion.

Parameters	Inclusion Level		
	3.0Kcal/kg	3.2Kcal/kg	3.4Kcal/kg
No. of eggs laid	15.33±0.17[b]	16.11±0.56[b]	17.44±0.53[a]
Percentage Fertility	70.89±2.35[c]	72.88±0.74[b]	78.64±2.11[a]
Percentage Hatchability	81.30±2.13[c]	85.09±1.17[b]	88.02±1.24[a]
Percentage embryo mortality	18.70±2.05[a]	14.91±1.66[b]	11.98±0.94[c]

a, b, c: Means within row bearing same superscript are not significantly (P>0.05) different.

Conclusion

The result of the present study revealed that millet meal diet at 3.4 kcal/kg level of inclusion supported higher final body weight, body weight gain, no of eggs laid, percentage fertility, percentage hatchability with low percentage embryo mortality. However, breeder snails fed 3.0 kcal/kg of the millet meal had the highest feed conversion ratio and percentage embryo mortality.

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