Global Scientific JOURNALS

GSJ: Volume 8, Issue 12, December 2020, Online: ISSN 2320-9186
www.globalscientificjournal.com

EVALUATION OF THE PERFORMANCE OF AFRICAN GIANT LAND SNAIL (*ACHATINA ACHATINA*) FED DRIED FLUTED PUMPKIN (*TELFAIRIA OCCIDENTALIS*) MARKET WASTE AMENDED WITH BOVINE BLOOD MEAL

[1]Maduekeh, E.C., [1]Onuoha, C.O., [1]Omoha, U.E., [1]Agbom, J. and [2]Bamidele, A.J.

[1]*Department of Science Laboratory Technology,*
Federal College of Agriculture, P.M.B. 7008, Ishiagu,
Ebonyi State, Nigeria.

[2]*Department of Agricultural Technology,*
Federal College of Agriculture, P.M.B. 7008, Ishiagu,
Ebonyi State, Nigeria.

** E mail: ebubechukwu.maduekeh@unn.edu.ng*

KeyWords
African giant land snail, bovine blood meal, fluted pumpkin, market waste, amendment, proximate analysis, growth response.

ABSTRACT

Performance of African Giant Land Snail (*Achatina achatina*) fed dried fluted pumpkin (*Telfairia occidentalis*) market waste amended with 20% bovine blood meal was determined. Thirty (30) snails were randomly assigned to three (3) treatment groups with two (2) replicates each in a completely randomized design (CRD). Treatment 1, 2 and 3 were fed with: only dried fluted pumpkin waste, dried fluted pumpkin market waste amended with 20% bovine blood meal and poultry starter feed respectively. The parameters measured were weight gain, feed intake, length and width of the experimental animals. From the data obtained, feed growth ratio (FGR) was determined. Proximate properties of the samples were also determined. All results were analyzed using one-way analysis of variance ($p \geq 0.05$). The result of the proximate analysis reveals that fluted pumpkin market waste was high in fiber (36.220 ± 0.006) and mineral composition (11.230 ± 0.006) but low in proteins (8.930 ± 0.006). On the other hand, bovine blood meal is very rich in proteins (76.250 ± 0.081). The result for the growth performance reveals that treatment 1, 2 and 3 had 1.250 ± 0.250g, 5.792 ± 0.342g and 17.875 ± 0.475g gain in weight respectively. The feed growth ratio (FGR) was also found to be 36.500 ± 8.500, 6.513 ± 0.643 and 2.649 ± 0.110 respectively for treatment 1, 2 and 3. This indicates that even though the control still had better growth performance, amending the dried vegetable market waste with 20% bovine blood meal improved the performance of the experimental animals very significantly.

1 INTRODUCTION

The three (3) macro nutrients needed to sustain and maintain a healthy metabolic state are carbohydrates, protein and fats. Of these three (3) nutrient classes, proteins are usually in short supply. Proteins can be obtained from either plants or animal sources. To meet daily dietary requirement for proteins, it is recommended that every adult consumes 65-70g of protein each day; out of this quantity of proteins, it is suggested that 35g should be of animal origin [1]. This is because the composition of amino acids in foods is very variable. While some protein sources usually of animal origin are rich in both the essential and non-essential amino acids, others are deficient in the essential amino acids. Aptly, the amino acids in animal protein are more balanced and readily available to meet human dietary requirements than those of plant origin [2]. In support of this, Akinnusi et al. [3] opined that animal proteins are known to be preferable and better when compared with plant proteins based on their balanced amino acid profile. From the fore-

going, it is therefore not only important to consume adequate quantity of proteins; it is equally valuable to ensure the wholesomeness of the consumed protein with regards to its amino acid profile.

Even though proteins of animal origin are not indispensable, their inclusion in the diet makes it easier to ensure a wholesome diet. A diet which contains appropriate amount of all the nutrients required by an organism including amino acids is considered a wholesome diet. Unfortunately, the diet of a significant percentage of the global populations is unable to meet this daily dietary requirement as revealed by the fact that according to the World Health Organization, more than 50% of all global childhood deaths can be linked to under nutrition [4, 5, 6]. Although malnutrition is not an exclusive burden for developing nations alone, children with primary protein energy malnutrition (PEM) are significantly more prevalent in developing countries as a result of inadequate food supply caused by socioeconomic, political, and occasionally environmental factors such as natural disasters [7].As a result, there is an acute malnutrition in these nations which are almost always developing nations like Nigeria leading to the observed stunted growth in approximately 43 percent of children in these developing nations [8].

The high incidence of protein energy malnutrition in developing nations is not often as a result of food preferences but due to inadequate supply of animal proteins aggravated by rapid increase in population and other socioeconomic, political, and occasionally environmental factors. As a result of the shortfall in the supply of animal protein in these developing nations, efforts are being channeled at increased production of animal proteins. This has led to increased livestock production. Even though this is not yet adequate, increased awareness of the impact of human activities on the ecosystem is not encouraging further increases in production. This is because increased environmental awareness has revealed that raising traditional livestock like poultry, cattle and pigs has negative effect on the biosphere. Thus raising concerns on environmental sustainability. For instance, agriculture was estimated to have contributed almost 80% to the anthropogenic emissions of N_2O in the 1990s [9]. Further emission inventories show that livestock production contributed 70–80% of the anthropogenic NH_3 emission in Denmark and Europe [10]. These revelations are changing premiums from just increasing productivity in animal husbandry to ensuring that such increases do not jeopardize the earth's ability to sustain present and future generations. In pursuant of this, it will therefore not be out of place to encourage and support the rearing of animals that are highly prolific, highly desirable and with minimal effect on the ecosystem. A good example of such animal is snail.

Heliculture is the act of raising snails. Although man has eaten snail across the globe since pre-historic times when people gather them from the wild for food, the act of domesticating snail in the West African sub-region is still relatively new [11]. Interest in snail farming in Nigeria is growing. This growth may not be unconnected to the availability of edible snail species, their popularity, acceptability and the potential for export; including the emergence technologies for their production [2]. Also, due to its nutritional composition, highly prolific nature and environmentally friendly production process, snail farming is a viable option for bridging the protein energy supply gap presently prevailing in many countries.

In order to make snail supply sufficient, its rearing is very vital. Snail rearing will supplement the supply by picking snails from the wild which is significantly affected by seasons. This is more so as todays demands have long far exceeded supply by this method. Snail farming is thus a veritable means of increasing animal protein supply and consumption by the average Nigerians. The Romans introduced snails farming at about 50 BC with some species of snail raised in special fattening units called "cochlear" gardens; thus heralding the domestication of snails [12]. Today, different structures are being designed to suit the species of snails being reared and the purpose of rearing. One obvious fact remains that snail rearing can conveniently be done in the back yards. This is due to the fact that snail farming is environmentally friendly and can be done with little skill [13, 14]. Their faecal matter neither produces foul smell nor pollutes the environment. Snails are also good converter of vegetables to animal protein [15]. They are thus a source of high quality animal protein for human consumption that is within the reach of the majority of the human population. This is more so because heliculture requires much less capital to commence when compared to other forms of animal farming.

Achatina achatina is an indigenous West African snail that produces large number of eggs which could be between 100-500 eggs per clutch. It is known to be the tropical specie of snail that is most accepted in the world [2]. The global preference for *Achatina achatina* may not be unconnected to its size, economic nature, high adaptability and survivability [2].

Irrespective of the incentives in the form of increasing demands, feed remains a major concern for every livestock farmer. Snails have a limitless array of food choices. This generally includes both plant materials like leaves, fruits, tubers, kitchen waste and compounded feed. The nutritional composition and safety of kitchen waste cannot be guaranteed; purchasing compounded feed is expensive while plant materials are seasonal. This is not to mention competition with humans for feedstock. Therefore, there is need for sourcing locally available and cheap sources of feed ingredients; particularly, those that do not attract competition in consumption between humans and livestock. In this regard, crop production ventures readily come to mind. This is because crop production and processing generates enormous volume of organic wastes. Hence, there is the prospect of a symbiotic relationship between livestock farmers and crop farmer. The challenge of managing crop wastes could be taken cared of readily if it can be channeled into animal husbandry in the form of replacement of conventional feedstock which are limited in supply. This will also reduce competition between humans and livestock for conventional feed stocks while also promoting green livestock farming.

Therefore, this study tends to investigate effect of dried fluted pumpkin (*Telfairia occidentalis*) market waste amended with 20% bovine blood meal as a feed for *Achatina achatina*. Over 50 percent of fluted pumpkin (*Telfairia occidentalis*) vegetable harvested and sold in markets is made up of the vines and leaf stump which are fibrous and not very tender. These are hence considered as waste to be disposed after the leaves have been plucked.

2 Materials and Method

2.1 Study Area

This study was carried out at the Federal College of Agriculture, Ishiagu, Ivo Local Government Area of Ebonyi State, South-Eastern Nigeria. The study area is located at latitude $5^0$41-$5^0$5'W and longitude $7^0$29-$7^0$33E.

2.2 Sample Collection

Thirty (30) African giant land snails (*Achatina achatina*) were purchased from a snail farm located in Afikpo, Ebonyi State.

Fluted pumpkin waste was obtained from Eke market in Ishiagu, Ivo Local Government Area of Ebonyi State, South Eastern Nigeria. Blood meal was prepared using bovine blood samples collected immediately after the slaughtered of cattle at Ishiagu slaughtered slab located in Ishiagu. The blood samples were collected between 6:30-7:00am in a plastic container.

2.3 Proximate Nutrient Analysis

The proximate analyses of the samples were done. Parameters measured include; moisture content, ash content, crude fat, crude protein, crude fiber and carbohydrate. Each parameter was determined in duplicates according to the methods outlines below for the assay.

2.3.1 Moisture content

Moisture content was determined using the conventional method outlined in Association of Official Analytical Chemists (AOAC) Methods of Analysis [16]. Two (2) moisture cans were dried in the oven and then put into desiccators to cool before weighing. Exactly 5g of each sample was put in each of the moisture cans, placed in the oven and dried at 105^{o}C for 2 hours. After the 2 hours, the cans were removed from the oven and placed in a desiccator again to cool before weighing. The cycle of heating, cooling and weighing was repeated until constant weight was attained. The moisture content was then determined by the difference in weight and expressed as a percentage of the initial sample weighed. This is given by the formula;

$$\%\ Moisture\ Content = \frac{W_2 - W_3}{W_2 - W_1}\ X\ \frac{100}{1} \quad (1)$$

W1 = Weight of the empty moisture can
W2 = Weight of the can and sample before drying
W3 = Weight of can and sample after drying

2.3.2 Ash Content

The furnace incineration gravimetric method recommended by AOAC [16] was used in the determination of the ash content. The crucible was dried in the oven and cooled in the desiccator before weighing. Approximately 5g of the sample was weighed and put into the crucibles, covered and placed in a muffle furnace at a temperature of 550^o C. The temperature was maintained for 2 hours until a whitish ash was obtained. After 2 hours, the muffle furnace was switched off and the crucibles were removed and placed in sample desiccator to cool. The crucibles containing the samples were weighed and the percentage ash content was determined using the formula below;

$$\%\ Ash\ Content = \frac{W_2 - W_3}{W_2 - W_1}\ X\ \frac{100}{1} \quad (2)$$

W1 = Weight of the empty crucible
W2 = Weight of the crucible and sample
W3 = Weight of crucible and ash

2.3.3 Crude fat

The fat content was determined by the continuous solvent extraction in a soxhlet reflux apparatus [17]. Exactly 2g of the sample was weighed and placed in the thimble. The thimble containing the sample was then carefully placed inside a soxhlet reflux flask. The reflux was mounted on a weighed extraction flask containing 200ml of ether on an electro-thermal heating mantle. The setup was connected to a condenser so that when switched on, the petroleum ether will boil, vapourize, condense and fill up the reflux flask. The solvent will reflux, carrying along with it the oil extract to the boiling flask. The process of boiling, vapourization, condensation and subsequent oil extraction was allowed to go on continuously for 4 hours. After the 4 hours, the solvent was recovered and the extraction flask with its oil content was dried in the oven at 60^o C for 30 minutes. After cooling in a desiccator, the flask was re-weighed. The fat content was given by;

$$\%\ Fat\ Content = \frac{W_2 - W_1}{W_3}\ X\ \frac{100}{1} \quad (3)$$

W1 = Weight of the empty flask
W2 = Weight of the flask and the oil extract

W3 = Weight of the sample used

2.3.4 Crude Protein

This was determined by the micro-kjeldahl method described by James [17].

Exactly 2g of the sample was digested by mixing with 10ml of concentrated tetraoxosulphate (VI) acid (H_2SO_4) in a kjeldahl digestion flask. A tablet of selenium catalyst was added to it and the mixture was heated under fume cupboard. The digest was transferred into a 100ml volumetric flask and made up with distilled water. Exactly 100ml of the digest was mixed with equal volume of 45% sodium hydroxide (NaOH) solution and poured into a kjeldahl distilled apparatus.

The mixture was distilled and the distillate was collected into a 4% boric acid solution containing 3 drops Zuazaga indicator (mixture of methyl red and bromocresol green) to obtain a total of 50ml distillate.

The distillate obtained was titrated against 0.02N tetraoxosulphate (VI) acid (H_2SO_4) solution. Titration was done from the initial green colour to a deep red or pink end point.

The total nitrogen was calculated and multiplied with the factor 6.25 to obtain the crude protein content.

$$\%\ Crude\ Protein = \%N\ X\ 6.25 \quad (4)$$

$$\%\ N = \frac{100\ x\ N\ x\ 14\ x\ V_F\ x\ T}{W\ x\ 1000\ x\ V_A} \quad (5)$$

W = Weight of the sample
N = Normality of the filtrate (H_2SO_4)
= 0.02N
VF = Total volume of the digest
= 100ml
VA = Volume of the digest distilled
T = Titre volume

2.3.5 Crude fibre determination

This was measured by the Weende method described by James [17]. Approximately 5g of each sample was defatted (during fat analysis). The defatted sample was treated with 200ml of 1.25% H_2SO_4 and boiled under reflux for 30 minutes. The resultant mixture was filtered by washing with several portions of hot water using a two-fold muslin cloth to trap the particles. The washed samples were carefully transferred to a beaker and boiled for 30 minutes with 200ml of 1.25M NaOH solution. The digested samples were washed severally with hot water. The washed samples were carefully scrapped into a weighing porcelain crucible and dried in the oven at 105^{o} C for 3 hours, cooled in a desiccator and weighed. After which the cooled sample was ashed in a muffle furnace at 550^{o} C for 2 hours, cooled in a desiccator and re-weighed.

The crude fibre content was determined thus;

$$\%\ Crude\ Fibre = \frac{Loss\ in\ Weight}{Weight\ of\ Sample}\ X\ \frac{100}{1} \quad (6)$$

$$\%\ Crude\ Fibre = \frac{W_2 - W_3}{W_2 - W_1}\ X\ \frac{100}{1} \quad (7)$$

W1 = Weight of the crucible
W2 = Weight of the crucible and sample after washing and drying in oven
W3 = Weight of the crucible and sample ash

2.3.6 Carbohydrate determination

The carbohydrate content of the test sample was determined by estimation using the arithmetic difference method described by James [17]. The carbohydrate was calculated and expressed as the Nitrogen Free Extract (NFE) as shown below;

% CHO=% NFE=100-%(a+b+c+d+e) (8)

a = % protein content
b = % fat content
c = % ash content
d = % crude fibre content
e = % moisture content.

2.4 Feed Preparation

The fluted pumpkin waste collected was sun dried. The particle size was subsequently reduced by grinding the dried fluted pumpkin leaves waste.

Similarly, the bovine blood collected was first heated in a pot to coagulate and reduce its moisture content. The coagulated bovine blood was afterwards sun dried. The particle size was then reduced by grinding the dried cattle blood to get the blood meal.

In order to form the experimental diet, the fluted pumpkin waste was amended with graded levels of the bovine blood meal. Treatment 1 (group 1) had only dried fluted pumpkin waste. Treatment 2 (group 2) had 20% bovine blood meal. Treatment 3 (control) served as the control .Poultry starter feed mash bought form Eke market in Ishiagu served as the control feed..

2.5 Experimental Design

Thirty (30) snails were randomly assigned to three (3) treatment groups with two replicates each in a completely randomized design (CRD). Six (6) plastic pens were used and each pen had five (5) snails. Each pen constituted an experimental unit.

A week before the assignment of the snails, the pens were thoroughly washed, disinfected and dried under the sun. The floor of the pens was then covered with loamy soil to about 6cm high from the bottom. The feeders and drinkers were thoroughly washed and dried. Seven (7) days trial feeding was done before the commencement of the experiment to allow for physiological adjustments.

The snails were weighed at the onset of the experiment and subsequently on a weekly basis. Water was provided ad libitum and each treatment group was fed with a particular diet daily for four weeks.

The parameters measured were weight gain (growth response), feed intake, length and width of the experimental animals. The weight was determined by using digital sensitive weighing balance while the length and width was measured on weekly basis using Vennier Caliper. The feed intake was determined daily by a weigh back technique. This means that a known quantity of fresh feed given to each experimental unit. In the morning of the next day, the left over in the feeder as well as feed wasted on the floor was collected, weighed and recorded. In this way, the quantity of feed consumed was calculated as (quantity given – quantity left over).

This was the routine for feeding the snails throughout the experimental period, which lasted for four weeks.

The drinkers and feeders were emptied and washed on daily basis before new feed and water was served. Water was also sprinkled on the floor (soil) on daily basis to maintain adequate humidity and temperature in the pen. At the end of the third week, the soil was removed and replaced to prevent any pathogenic manifestation in the pen.

2.6 Statistical Analysis

Results obtained were analyzed using one-way analysis of variance at 95% confidence interval. Significant means were separated using Duncan multiple correlation. All results are expressed as mean ± SEM.

3 Results

3.1 Proximate Analysis

Proximate analysis of the dried vegetable market waste and bovine blood meal were determined. The proximate properties of the dried vegetable market waste, bovine blood meal and the poultry starter feed used is as contained in table 1 below. The results shows that the dried vegetable market waste, bovine blood meal and the poultry starter feed had moisture content of 3.570 ± 0.006, 5.520 ± 0.081 and 8.610 ± 0.381, crude protein of 8.930 ± 0.006, 76.250 ± 0.081 and 17.120 ± 0.456, crude fat of 0.160 ± 0.006, 1.7250 ± 0.202 and 2.470 ± 0.350, crude fiber of 36.220 ± 0.006, 0.050 ± 0.008 and 6.290 ± 0.237, ash of 11.230 ± 0.006, 3.010 ± 0.081 and 6.130 ± 0.543, carbohydrate of 39.890 ± 0.006, 3.420 ± 0.081 and 59.050 ± 0.497 percent respectively.

TABLE 1: PROXIMATE PROPERTIES OF THE VEGETABLE MARKET WASTE, BLOOD MEAL AND POULTRY STARTER FEED

PARAMETERS	VEGETABLE MARKET WASTE	BOVINE BLOOD MEAL	STARTER POULTRY FEED
MOISTURE CONTENT (%)	3.570 ± 0.006^{a}	5.520 ± 0.081^{b}	8.610 ± 0.381^{c}
CRUDE PROTEIN (%)	8.930 ± 0.006^{a}	76.250 ± 0.081^{c}	17.120 ± 0.456^{b}
CRUDE FAT (%)	0.160 ± 0.006^{a}	1.7250 ± 0.202^{b}	2.470 ± 0.350^{b}
CRUDE FIBER (%)	36.220 ± 0.006^{c}	0.050 ± 0.008^{a}	6.290 ± 0.237^{b}
ASH (%)	11.230 ± 0.006^{c}	3.010 ± 0.081^{a}	6.130 ± 0.543^{b}
CARBOHYDRATE (%)	39.890 ± 0.006^{b}	13.420 ± 0.081^{a}	59.050 ± 0.497^{c}

Means in the same row with the same letter(s) are not statistically significant (p≥0.05).

3.2 Growth Performance

The experimental animals were weighed on weekly bases. Prior to the commencement of the experiment, the initial weight of the animals was noted. From the data obtained, the average weekly weight was determined. Growth in weight was thus determined as a difference in weight of animals at the end of the last week of treatment and the initial weight of the animals. This is as contained in

table 2 below. From the result obtained, after four (4) weeks, treatment 1, 2 and 3 had growth performance of 1.250 ± 0.250g, 65.792 ± 0.342g and 17.875 ± 0.475g respectively.

TABLE 2: AVERAGE WEIGHT GAIN (GRAMS) OF THE SNAILS

PARAMETERS	TREATMENT		CONTROL
	1	2	
INITIAL LIFE WEIGHT (g)	30.500 ± 0.522[a]	30.500 ± 0.500[a]	30.600 ± 0.636[a]
TERMINAL LIFE WEIGHT (g)	31.833 ± 0.601[a]	36.143 ± 0.814[b]	48.333 ± 0.624[c]
DIFFERENCE (GROWTH) (g)	1.250 ± 0.250[a]	5.792 ± 0.342[b]	17.875 ± 0.475[c]

Means in the same row with the same letter(s) are not statistically significant (p≥0.05).

3.3 Shell Length

Growth in shell length of the experimental animals was determined. It is as contained in table 3 below. The experimental animals were found to have a similar growth in shell length. Precisely, growth in shell length was found to be 0.550 ± 0.030, 0.586 ± 0.019 and 0.543 ± 0.003 cm for treatment 1, 2 and 3 respectively.

TABLE 3: AVERAGE LENGTH OF THE SNAIL SHELLS (CM)

PARAMETERS	TREATMENT		CONTROL
	1	2	
INITIAL LENGHT (cm)	5.150 ± 0.054[a]	5.210 ± 0.048[a]	5.260 ± 0.056[a]
FINAL LENGHT (cm)	5.700 ± 0.058[a]	5.800 ± 0.044[a]	5.800 ± 0.055[a]
DIFFERENCE (GROWTH) (cm)	0.550 ± 0.030[a]	0.586 ± 0.019[a]	0.543 ± 0.003[a]

Means in the same row with the same letter(s) are not statistically significant (p≥0.05).

3.4 Shell Width

Growth in shell width of the experimental animals was also determined. The above result is as contained in table 4 below. Growth in shell width was found to be 0.265 ± 0.005, 0.460 ± 0.100 and 0.830 ± 0.010 cm for treatment 1, 2 and 3 respectively.

TABLE 4: AVERAGE WIDTH OF THE SNAIL SHELLS (CM)

PARAMETERS	TREATMENT		CONTROL
	1	2	
INITIAL LENGHT (cm)	3.160 ± 0.060[a]	3.190 ± 0.082[a]	3.190 ± 0.062[a]
FINAL LENGHT (cm)	3.433 ± 0.033[a]	3.686 ± 0.106[a]	4.011 ± 0.063[b]
GROWTH (cm)	0.265 ± 0.005[a]	0.460 ± 0.100[a]	0.830 ± 0.010[b]

Means in the same row with the same letter(s) are not statistically significant (p≥0.05).

3.5 Feed Growth Ratio (FGR)

The result of the feed intake is as contained in table 5. It reveals that the organisms had an estimated average feed consumption 43.500 ± 1.500g, 37.500 ± 1.500g and 47.300 ± 0.700g respectively for treatment 1, 2 and 3. Feed growth ratio was also found to be 36.500 ± 8.500, 6.513 ± 0.643 and 2.649 ± 0.110 for treatment 1, 2 and 3 respectively. Also, the number of mortality was taken note of; and thus, the percentage mortality is arrived at.

TABLE 5: AVERAGE FEED INTAKE (GRAMS)

PARA-METERS	TREATMENT		CONTROL
	1	2	
TOTAL WEIGHT GAIN (g)	1.250 ± 0.250[a]	5.792 ± 0.342[b]	17.875 ± 0.475[c]
ESTIMATED AVERAGE TOTAL FEED INTAKE / SNAIL (g)	43.500 ± 1.500[ab]	37.500 ± 1.500[a]	47.300 ± 0.700[b]

FEED / GROWTH RATIO (FGR)	36.500 ± 8.500[b]	6.513 ± 0.643[a]	2.649 ± 0.110[a]
MORTALITY (%)	70.000 ± 10.000[b]	30.000 ± 10.000[ab]	10.000 ± 10.000[a]

Means in the same row with the same letter(s) are not statistically significant (p≥0.05).

4 Discussion

Proximate analysis of the dried vegetable market waste and bovine blood meal were determined. The proximate properties of the dried vegetable market waste, bovine blood meal and the poultry starter feed used as contained in table 1 was analysed using one-way analysis of variance (ANOVA) and the significant means separated using Duncan multiple correlation (p≥0.05). The results reveal that the dried fluted pumpkin market waste has a statistically significant lower amount of proteins (8.930 ± 0.006). It has about fifty per cent (50%) of the protein content of the poultry starter feed (17.120 ± 0.456) and just about eleven per cent (11%) of the protein content of the blood meal (76.250 ± 0.081). The blood meal thus has more than four times the protein content of the poultry starter feed and over nine times the protein composition of the fluted pumpkin market waste. However, the dried fluted pumpkin market waste was found to be higher in carbohydrates (39.890 ± 0.006) and fiber (36.220 ± 0.006) than the blood meal which had fiber and carbohydrate concentrations of 0.050 ± 0.008 and 13.420 ± 0.081 respectively. However, even though the carbohydrate content of the market waste was significantly higher than that of the blood meal, it was still significantly lower than that of the poultry starter feed. Precisely, it was about 66% of the carbohydrate content of the poultry starter feed. Although, this result indicates the suitability of the fluted market waste to serve as carbohydrate source, it also reveals the indispensable place of synergistic amendment between the fluted pumpkin market waste and the blood meal. This need for amendment is underlined by the fact that the bovine blood meal is very rich in protein and can thus serve as a good source of protein. This is further supported by the mineral composition of the samples. Precisely, vegetable market waste had a statistically significant higher mineral composition (11.230 ± 0.006) which is almost twice that of the poultry starter feed (6.130 ± 0.543) and more than three times that of the blood meal (3.010 ± 0.081). However, there is need to identify an optimum level of amendment for the fluted pumpkin market waste with the blood meal in other to attain a nutritional composition similar to that of the poultry starter feed which served as the control.

The experimental animals were weighed on weekly bases. Also, the initial weight of the animals was noted prior to the commencement of the experiment. From the data obtained, the average weekly weight was determined. The growth in weight was determined as a difference in weight of animals at the end of the last week of treatment and the initial weight of the animals. This is as contained in table 2. From the result obtained, after four (4) weeks, treatment 1, 2 and 3 had growth performance of 1.250 ± 0.250g, 5.792 ± 0.342g and 17.875 ± 0.475g respectively. The growth performance of control was significantly better than that of the two treatments. Growth performance of the control was more than three times better than that of the best performing treatment which was treatment 2. However, the result reveals that amending vegetable market waste with blood meal improved the performance of the experimental animals significantly. This is more so as the growth performance of treatment 2 which was amended with 20% blood meal was more than four times better than that of treatment 1 whose feed was not amended with blood meal. This occurrence may not be unconnected to the nutrient composition of the feeds. Precisely, from the result of the proximate analysis as contained in table 1 above, it was observed that the blood meal had adequate amount of protein to bring the protein concentration to an optimal level in the treatment feed; however, it had insufficient amount of carbohydrate. The vegetable market waste was supposed to make up for the deficiency in carbohydrate. Nevertheless, the proximate properties of the feeds reveal that the vegetable market waste had significantly higher amount of fiber and a significantly lower concentration of carbohydrate than the poultry starter feed. It can easily be assumed that the experimental animals would produce adequate cellulase to digest the high fiber content of the vegetable market waste in order to meet their carbohydrate needs. Apparently, doing this may have contributed in diminishing their growth performance significantly.

Growth in shell length for the treatments was not statistically significant after four (4) weeks.

On the other hand, while the growth is shell width for treatment 1 and 2 were found to be statistically similar, treatment 3 which served as control had a slightly statistically significantly higher growth in shell width. Shell development data seems more similar than varied. This similarity in shell development data as revealed by the shell widths and lengths of the treatments may be an indication of adequate supply of minerals in the diet. This is more so as the result of the proximate analysis reveals that the fluted pumpkin market waste is very rich in minerals, about twice the mineral content of the poultry starter feed and about three times the mineral composition of the blood meal.

The result of the feed intake as contained in table 5 reveals that the organisms did not find the dried fluted pumpkin market waste less palatable. As a result, they consumed quantities of the fluted pumpkin market waste statistically similar to the poultry starter feed. However, amendment with blood meal slightly diminished the palatability of the feed. This is revealed by the fact that treatment 2 which was fed fluted pumpkin market waste amended with 20% blood meal consumed quantities of feed which is slightly lower than the quantity consumed by the control, even though this quantity of feed was statistically similar to the quantity of feed consumed by treatment 1. Nevertheless, even though, treatment 1 consumed quantities of feed similar to that of the control, it did not translate to similar growth performance. This can be as a result of the variation in nutrient composition. Feed growth ratio as determined from the growth performance and feed intake data revealed that amendment with blood meal improved the feed performance of the treatment by up to six-folds even though the control still had better performance. Similarly, amendment reduced the mortality of the treatment significantly although the control still performed better. The ability of any organism to survive is significantly enhanced by proper nutrition. Hence, deficiency in nutrition may not be unconnected to the high mortality observed in the

treatments.

5. Conclusion

Fluted pumpkin market waste is high in fiber and carbohydrate content. However, its carbohydrate content is not adequate to meet the carbohydrate need of the organisms as revealed by the fact that it is significantly less than the carbohydrate content of the poultry starter feed. To surmount this carbohydrate limitation, there is need for an alternative source of carbohydrate. To this end, the rich carbohydrate store embedded in the high fiber content of the fluted pumpkin market waste readily comes to mind. For this fiber composition to serve any meaningful purpose, it must be broken down to forms which the organisms can readily make use of. This requires the enzyme cellulase since the substrate of contention is made up of large amount of cellulosic polymers. Apparently, from the experimental results, the experimental animals may not have been able to produce adequate quantity of this required enzyme or the production of this enzyme significantly hampers the performance of the experimental animals. Hence, efforts can be channeled towards the use of cellulase to optimize the growth performance of snails fed dried fluted pumpkin market waste amended with blood meal.

References

[1]. B. C. Nweze, "Snailery: A means to Family Poverty Alleviation",Journal of Home Economics Research (JHER), vol. 8, pp. 190-195, 2007

[2]. J.A. Amusanand M.O. Omidiji, Edible Land Snail: A Technical guide to Snail Farming in the Tropics. Ibadan: Varity Printers Limited, 1999.

[3]. O. Akinnusi,Comparative effect of different animal protein concentrates on Carcass quality of Rabbits. Paper presented at Annual Conference of the Nigeria Society for Animal Production,Calabar, 2007.

[4]. D. L. Pelletier, E.A. Frongillo Jr. and J.P. Habicht, "Epidemiologic evidence for a potentiating effect of malnutrition on child mortality", American Journal of Public Health, vol. 83, issue 8, pp. 1130–1134, 1993.

[5]. D. L. Pelletier, E.A. Frongillo Jr. and J.P. Habicht,"The effects of malnutrition on child mortality in developing countries", Bulletin of the World Health Organization, vol. 73, pp. 443–448, 1995.

[6]. D. L. Pelletier and E.A. Frongillo Jr. and J.P. Habicht,"Changes in child survival are strongly associated with changes in malnutrition in developing countries",Journal of Nutrition, vol. 133, p. 107, 2003.

[7]. Z. Grover, and L.C. Ee,"Protein energy malnutrition",Pediatric Clinics of North America, vol. 56, issue 5, pp. 1055-1068, 2009.

[8]. M. de Onís, C.Monteiro, J.Akre and G. Glugston, "The Worldwide Magnitude of Protein-Energy Malnutrition: An Overview from the WHO Global Database on Child Growth", Bulletin of the World Health Organization vol. 71, issue 6, pp. 703-712, 1993.

[9]. M.A.K. Khalil, and R.A. Rasmussen,"The global sources of nitrous oxide", Journal of Geophysical Research, vol. 97, pp. 14651–14660, 1992.

[10]. N.J. Hutchings, S.G. Sommer, J.M. Andersen, and W.A.H. Asman, "A detailed ammonia emission inventory for Denmark", Atmospheric Environment, vol. 35, pp. 1959 – 1968, 2001.

[11]. B. A. Chinwuko,Tropical Approach to Snail Farming on land. Awka: Joanee Educational publishers Ltd, 2007.

[12]. A.F. Akinyemi, S.O. Ojoand T.O. Akintomide, Tropical Snail farming. Abeokuta, Ogun State: Oak Ventures, 2007.

[13]. O. Akinnusi,"A practical Approach to back yard snail farming", Nigeria Journal of Animal Production, vol. 25, pp. 193-197, 1998.

[14]. National Research Council, Micro-Livestock: Little- known snail animals with a promising economic future. Washington D.C.: National Academy Press, 1991.

[15]. O.O.Obi, O.I.Ayodeji, F.O.Adetoro and F.I.Ogundola, "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, p. 2000, 2001.

[16]. Association of Official Analytical Chemists (AOAC), Official Method of Analysis, 18th Edition. Association of Official Analytical Chemists, Washington DC, Method 935.14 and 992.24, 2005.

[17]. C.S. James, Analytical Chemistry of Foods. New York: Blackie Academic and Professional, 1995, pp. 128 – 143.