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Full Length Research Paper

Comparative performance of grasscutters (*Thryonomys swinderianus)* fed maize and rodent pellets as concentrate supplement under intensive management system in Cameroon

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In order to evaluate the productive performance of grasscutters (*Thryonomys swinderianus*) in captivity under intensive management, a study was carried out from the 11th of November 2008 to 23rd of March 2009 at the Institute of Agricultural Research for Development (IRAD) Ekona in the South West region of Cameroon. The objective was to assess the feeding value of the concentrate diets used as supplement. The diets were maize combined with rodent pellets (T1), maize alone (T2), and rodent pellet (T3). Elephant grass (*Pennisetum purpureum*) and water were given *ad libitum*. Using a complete randomized block design, 24 growing grasscutters (balanced for sex) were assigned to the three dietary treatments of eight animals each. There was no significant difference in both the final body weights and the fortnightly weights (P>0.05) between treatments. The initial mean weights of the animals were 1.021±0.087, 0.929±0.125 and 1.193±0.126 kg, for treatments 1, 2 and 3 respectively. The mean final body weights were 2.050±0.111, 1.786±0.156 and 1.771±0.094 kg for animals on T1, T2 and T3 respectively. The corresponding means for final body weight gains were 1.029±0.173, 0.857±0.172 and 0.579±0.175 kg body mass. The maize combined with the rodent pellet diet and the maize diets supported a high growth rate than the rodent pellet alone. It was therefore concluded that rodent pellets in combination with maize and the maize diet could be used as complete diets for sustainable grasscutter production.

Key words: Grasscutters, elephant grass, management performance, rodent pellet, maize.

INTRODUCTION

In Cameroon and most parts of West Africa, considerable research has been carried out on conventional animals such as ruminants (cattle, sheep and goat) and monogastric animals (pigs, poultry and rabbits) respectively. Very little attention has been paid to the nonconventional animals such as grasscutters, snails and giant rats. In Ghana, it has been reported that grasscutters contribute to both local and export earnings and dominates the bush meat trade (GEPC, 1995). Grasscutter farming in Nigeria has been gaining a lot of popularity because of its low capital input (Obi et al., 2004). The meat is a delicacy and there is no taboo against the rearing and consumption of grasscutter meat. One of the major factors that affect livestock production is that of the cost of feeding which constitutes 70 to 80% cost of production (Omole et al., 2007). Grasscutters utilize high fibrous feeds like the rabbit and both can utilize cellulose or fibre fraction of the feed more than poultry (NRC, 1991; Adeola, 1992; Asibey and Addo, 2000). The caecum, a specialized structure located at the end of the junction of the small and large intestine contains a lot of bacteria that enable the grasscutter to survive on low calorie and high fibre diets (Fayenuwo et al., 2003). The grassscutter (*Thryonomys swinderianus*) is a wild hystricomorphic rodent found only in Africa (Adoun, 1993). It is the biggest rodent after the crested porcupine (*Hystrix cristata*), weighing averagely 13 kg in AFRICA.

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About 40.000 tonnes of grassscutter meat is consumed in West Africa yearly of which only 0.2 kg is provided by domestication (Mensah et al., 2005). It is a herbivore and feeds mostly on grass. Its meat is said to resemble that of piglets, is preferred to the meat of any other domestic commercially available game (National Research Council, 1991). It is among several kinds of animals that are used locally and regionally for meat (Anonymous, 1993).

At a local market in Ghana, approximately 73 tonnes of grassscutter meat was sold in one year which represented more than 15000 animals (National Research Council, 1991). Unfortunately, its collection from the wild is attended by the destruction of the environment, through setting of bushfires by hunters (NRC, 1991; Yeboah and Adamu, 1998; Ntiamoa-Baidu, 1998). To address these problems, attempts are being made in the sub-region to domesticate the grassscutters (NRC, 1991; Anonymous, 1993), and make it more readily available, gain economic benefits and also reduce the environmental destruction that accompanies its collection from the wild (NRC, 1991; Ntiamoa-Baidu, 1998). Domestication of the grassscutters in Cameroon is therefore being encouraged to help address these problems. Progress has, however, been slow due to paucity of information on the biology of the species (Ewer, 1969; Yeboah et al., 1995), its nervous temperament and the difficulty of getting them acclimatized in captivity (Hemmer, 1993). The conventional feeds fed to grasscutters include: cassava tubers, guinea grass, elephant grass and sugar cane stems, maize, pineapple tops seat potatoes, and brewery by-products etc (Ayodele, 1988). Documentation of performance of grasscutters fed these aforementioned will serve as a reference point for further research work in nutrition.

Domestication of grasscutters, being a relatively new initiative and undertaking as a micro-livestock in Cameroon, has areas which need research, so as to provide answers to the following:

1. What is the feed intake of grassscutters?
2. What is the growth rate of the grassscutters under captivity?
3. What is the nutritional value of the feed fed to the grassscutters?
4. What are the main pathologies associated with grassscutters domestication?

This study was therefore designed to determine the growth performance with respect to feed intake, weight gain, nutritional value of the experimental diets and other pathologies associated with the growing grasscutters.

MATERIALS AND METHODS

Study site and its climatic facts

The study was carried out at the Regional Research Center – IRAD Ekona located in the South West Region of Cameroon with a humid tropical climate characterized by high temperatures and high rainfall with average annual rainfall of 2284 mmHg. Ekona has an altitude of about 400 mm and has rich volcanic soils. The mean temperature in the dry season is 24.4°C while in the rainy season it is 23.7°C.The rainy season is usually from March to September and the dry season from October to March.

The major activity in this region is agriculture which includes plants (major cash crops produced - coffee, cocoa and oil palm while the major food crops - cocoyams, yam and plantains) and animal (poultry, small ruminants, non-conventional livestock grasscutter, quails and snails).

Experimental animals and housing

The study was carried out from October 2008 to March 2009. The month of October was used to acclimatize the animals to the housing conditions and the experimental diets. The study comprised of 24 weaned grassscutters of three months old, randomly selected from the stock of the IRAD Ekona. There were 17 females and 7 males which were kept in a four tier superimposed enclosure measuring 46 cm (L) × 50 cm (H) × 63 cm (W). The cages were located in the cane rat stable which measures 3.58 m (L) × 0.6 m (W) × 2.35 m (H). Housing conditions involved an ambient temperature of 25 to 30°C, relative humidity of 60 to 90%, light and dark cycle of 12 and 12 h respectively and 24 h natural ventilation. This study lasted for a period of 6 months with, an acclimatization period of one month inclusive.

Experimental design

The animals were randomized into 3 groups on live weight basis, 1.021±0.087, 0.929±0.125, and 1.193±0.126 representing respectively Treatment one, consisting of equal mixed proportions of maize and rodent pellet, (T1, M+P). Treatment two consisting of maize alone (T2M), and treatment three consisting of rodent pellet alone (T3P) respectively. Each treatment group comprised of eight animals divided into four replicates of two animals each. Elephant grass or napier grass (*Pennisetum purpureum*), weighing averagely between 2.50 to 3.00 kg per treatment was fed to the animals (as basal diet). The concentrate feed weighing between 200 to 250 g and 300 g of the pelleted ration and maize (experimental diet) were progressively fed per treatment per day (after every single day). The daily feed consumption rates were estimated indirectly by the method of difference which involved subtracting the quantity of leftover feed from the measured amount earlier served to the animals at the beginning of each feeding day.

The growth rates of the individual animals were measured every 2 weeks as recommended by Morrison (2008), and the average daily and weekly growth rates per treatment were calculated from the individual values. Cow jaw bone and water were served to the animals *ad libitum.* The jaw bone was prepared by soaking fresh bones into a salt solution (Sodium Chloride) to which has been added Calcium Carbonate, and allowed to stand in the solution for one week in order to sterilize it. It was then fire dried before feeding to the animals, it served to control teeth growth which is a typical rodent characteristic and also as a source of minerals calcium and phosphorus, to the grassscutters. During each weighing period the animals were administered an anti-stress comprising of a lemon sugar water solution. This was prepared by squeezing four lemons into one litter water container and adding eight cubes of sugar into it. This quantity of the mixture, according to the experience and recommendations of IRAD Bambui, Mankon and Ekona was served to four animals. It also served as a dewormer and as an appetizer.

Health case involved improving the health statues of the animals by routine physical observations of animals in each experimental unit, appropriate harvesting, wilting and bundling of the forage (*P.*

Table 1. Chemical composition of the experimental diets and faeces inclusive.

Samples	Dry matter (%)	Ash (% DM)	Organic matter (% DM)	Crude protein (5% DM)	Crude fibre (5% DM)	Ether extract (% DM)	NFE (% DM)	Metabolizable energy (MJ/Kg DM)
Maize pellet (T1)	95.57	12.68	87.32	10.74	12.81	4.42	54.89	2538.8
Maize (T2)	95.232	4.38	95.61	8.72	7.85	6.36	67.90	3421.93
Pellet (T3)	93.91	12.14	87.86	7.70	35.00	1.70	41.89	1654.27
P. purpureum	91.14	12.21	87.78	9.01	37.40	3.66	28.84	333.81
Faeces	93.91	12.14	87.86	7.70	35.00	1.70	37.36	443.55

purpureum), cleaning of husbandry equipment on a daily basis, and microbial observation with veterinary interventions where possible. General mortality and diseases incidence during the entire study period were closely observed.

Feed intake

The feed intake was determined by giving the animals a known weight of the concentrate feed, starting from 200 g of the feed per two animals and was progressively increased to 250 and 300 g during the study. The apparent feed intake was measured indirectly by weighing the leftover feed the following feeding day from the quantity that was fed and the difference taken to represent the feed intake. The following formulae were used as required:

The weight gain= Final weight – Initial weight

Apparent feed conversion ratio= Weight of feed / Live weight gain.

Feed intake = Feed dispensed – Feed leftover.

Chemical composition of the experimental diet and faeces

The proximate analyses of the four different feeds fed to the grassscutters was carried out to determine their nutritional values for dry matter (%), ash (%DM), organic matter (%DM), crude protein (%DM), crude fiber (%DM), ether extract (%DM), NFE (%DM), metabolisable energy (MJ/Kg DM) at the Nutritional Laboratory of the University of Dcshang, Cameroon using the AOAC (1990) official methods of analysis.

Statistical analyses

Statistical analysis was conducted with the Statistical Package for Social Sciences (SPSS) Standard version, Release 12.00 (SPSS Inc. 1989-2003).

RESULTS

Proximate analysis of the feed samples

Table 1 shows the results of the chemical composition of the experimental diets with that of the basal diet, elephant grass (*P. purpureum)* and that of the faeces inclusive. The levels of the NFE differs between treatment groups, thus T2>T1>T3 and this similar trend was respected for the metabolisable energy of the experimental diets, and ether extractives thus signifies a direct relationship between ME, EE, and NFE. The levels of crude fibre, crude protein, dry matter (dry weight basis) and organic matter of all the experimental diets respected the order T3>T1>T2. This also indicates highly positive correlations between the three independent variables. It can be seen that the rodent pellet expressed higher values than the other two experimental diets though the animals in this group did not actually perform the best.

Feed intake

Comparison of fortnightly feed intake within treatment

There was a significant difference in fortnightly feed intake within treatments and weeks (P<0.001), and this correlates with the fortnightly increase in weight gain within treatments (r=1.000, 0.983 and 0.996) for T1, T2 and T3 respectively. The lowest mean feed intake of the animals was recorded at week 0 (0.164±0.009 kg), week 2 (0.131±0.004 kg) and week 0 (0.161±0.006 kg) respectively for treatments 1, 2 and 3, and the maximum feed intake was recorded in week 12 (0.257±0.013 kg), week 14 (0.243±0.013 kg), and week 16 (0.3000±0.0001 kg) for treatments 1, 2 and 3 respectively (Table 2).

Comparison of fortnightly feed intake between treatments

There was a significant difference in fortnightly feed intake between treatments for weeks 0, 2, 4, 12 and 16 (Kruskal Wallis Test, P=0.002, P=0.001, P=0.002, P=0.047 and P<0.001) respectively. Generally, there was a progressive increase in feed intake between treatments (Table 2).

Growth rate

Comparison between treatments

There was no significant difference in fortnightly weight

Table 2. Comparison of fortnightly feed intake between treatments.

Period (days)	Mean fortnightly feed intake per group of animals(kg)			
	Treatment 1	Treatment 2	Treatment 3	Kruskal Wallis test
	Maize + Rodent pellet(n=7) (mean ± SEM)	Maize alone(n=7) (mean ± SEM)	Rodent pellets(n=7) (mean ± SEM)	
0	0.164[a] ±0.009	0.136[b] ±.0.003	0.161[a]±.0.006	χ^2=12.460, P=0.002
0-14	0.179[a]±.0.010	0.131[b]±0.004	0.189[a] ±0.003	χ^2=12.340, P=0.001
15-28	0.200[a] ±.0.000	0.174[b]±.0.010	0.191[a] ±.0.001	χ^2=12.340, P=0.002
29-42	0.191[a]±.0.007	0.180[b]±.0.004	0.197[b]±.0.003	χ^2=7.480, P=0.024
43-56	0.224[a]±.0.009	0.214[a]±.0.009	0.229[a]±.0.010	χ^2=1.270, P=0.531
57-70	0.243[a]±.0.007	0.236[a]±.0.009	0.250[a]±.0.000	χ^2=1.270, P=0.531
71-84	0.257[a]±.0.013	0.236[a]±.0.009	0.279[a]±.0.010	χ^2=6.120, P=0.047
85-98	0.243[a]±.0.007	0.243[a]±.0.013	0.271[a]±.0.010	χ^2=3.810, P=0.148
99-114	0.243[a] ±.0.001	0.221[a]±.0.221	0.300[b]±0.000	χ^2=16.250, P<0.001

[a,b,c,d,e,f,g,h,i] Mann-Whitney U test: pairs with the same letters are significantly different at the 0.05 level.

Table 3. Comparison of mean fortnightly weight changes between treatments.

Period (days)	Mean weight changes of the grasscutters (kg)			
	Treatment 1	Treatment 2	Treatment 3	ANOVA
	Mean± SEM (n=7)	Mean± SEM (n=7)	Mean± SEM (n=7)	
Week 0	1.021±0.087	0.929±0.125	1.193±0.126	F=1.385, P=0.276
Week 2	1.250±0.109	0.950±0.084	1.200±0.135	F=2.093, P=0.152
Week 4	1.321±0.096	1.221±0.126	1.286±0.131	F=0.183, P=0.835
Week 6	1.421±0.101	1.279±0.161	1.420±0.126	F=0.394, P=0.680
Week 8	1.479±0.101	1.479±0.169	1.421±0.117	F=0.062, P=0.940
Week 10	1.693±0.098	1.621±0.178	1.536±0.109	F=0.349, P=0.710
Week 12	1.779±0.119	1.671±0.201	1.571±0.105	F=0.492, P=0.619
Week 14	1.793±0.113	1.814±0.206	1.721±0.091	F=0.112, P=0.895
Week 16	2.050±0.111	1.786±0.158	1.771±0.094	F=1.604, P=0.228

changes between treatments (Table 3). Results show that though there was no significant difference between treatments in terms of weight changes, the weight changes of the grasscutters on the maize and rodent pellets performed far better than those on maize alone and rodent pellets alone (T1>T2>T3).

Performance of growing grasscutters during the study

There was a significant difference in average daily feed intake, average weekly feed intake and average total feed intake at P=0.001 during the study period (Table 4).

Feed intake and weights of grasscutters

The feed intake and the growth response of the twenty one grasscutters fed maize in combination with rodent pellet, maize alone and rodent pellets alone are respectively illustrated by Figures 1 and 2. Generally, feed intake was directly related to weight changes, though there was a general fluctuation in the feed intake and the weight gain per treatment during the entire study period, there were some major significant differences at P<0.005 with respect to feed intake and weight changes.

Correlation between feed intake and weights

Figures 3, 4, and 5 show that there was a highly significant positive correlation between the fortnightly feed intake and the fortnightly weights of grasscutters fed with supplemented diets in between the three treatments and all were statistically significant at P<0.001. Figure 6: show that there was no significant correlation between the average total feed intake and average total weight gain. These figures show a direct relationship between the average feed intake and the weight gains though not

Table 4. Performance of growing grasscutters.

Parameter	Treatment 1	Treatment 2	Treatment 3	Kruskal Wallis Test
	Mean ± SEM	Mean ± SEM	Mean ± SEM	
Average Initial weight, kg	1.021±0.087	0.929±0.125	1.193±0.126	χ^2=2.105, P=0.349
Average Final weight, kg	2.050±0.111	1.786±0.158	1.771±0.094	χ^2=3.659, P=0.161
Average Total weight gain, kg	1.029±0.173	0.857±0.172	0.579±0.175	χ^2=2.615, P=0.270
Average Weekly weight gain, kg	0.064±0.011	0.536±0.011	0.036±0.011	χ^2=2.615, P=0.270
Average Total feed intake	0.079^{a}±0.010	0.086^{b}±0.009	0.009^{ab}±0.001	χ^2=13.051, P=0.001
Average Weekly feed intake	0.005a±0.001	0.006^{a} ±0.001	0.009^{ab} ±0.0001	χ^2=13.051, P=0.001
Feed conversion ratio	0.089±0.015	0.133±0.038	-0.357±0.364	χ^2=0.955, P=0.620
Daily weight gain	0.009±0.001	0.008±0.001	0.005±0.001	χ^2=2.615, P=0.270
Daily feed intake	0.0007^{a} ±0.0001	0.0008^{b} ±0.0001	0.0012^{ab} ±0.0001	χ^2=13.051, P=0.001

[a,b,c,d ,e,f] Mann-Whitney U test: pairs with the same letters are significantly different at the 0.05 level.

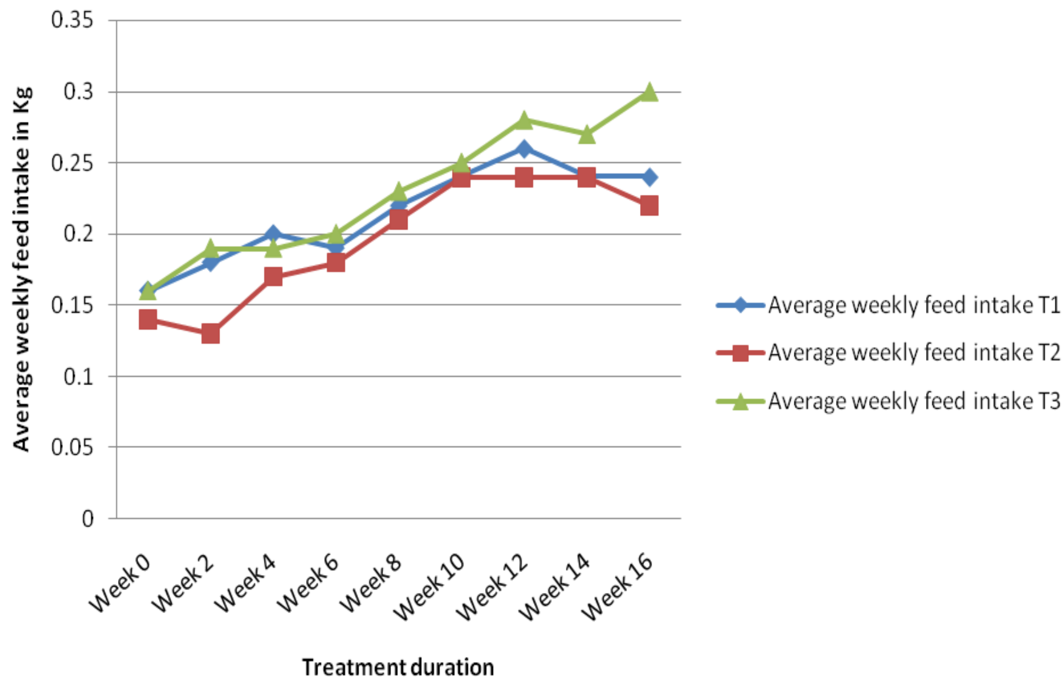


Figure 1. Mean feed intake of the grasscutters on different diets under intensive management.

very consistent in the general patterns. There was a significant difference in terms of average feed intake with respect to average weight gain of the a animals at P<0.001

DISCUSSION

The chemical composition of the experimental diets compared favourably with the recommended diets found in the literature. The level of the ether extractives in the T1 and T3 diets were found to be within the range of 2.5 to 4.5% dry matter basis recommended for adult grasscutters (Mensah, 1993, 1995) meanwhile that of maize(T2) was far higher than the recommended value. Furthermore, the crude fibre of the diets was all lower than the 25 to 45% recommended for adult grasscutters (Mensah, 1993, 1995). Finally the crude protein of T3 was within the recommended range as well as the ash content of T2. Results from this study showed that with the same level of feeding there was no significant difference in the mean final body weights (P>0.05), though there was a difference in final body weights in animals on treatment 1 over treatments 2 and 3. Feed consumption is always affected by level of crude fibre of the diet. The higher the crude fibre of the feed, the lower

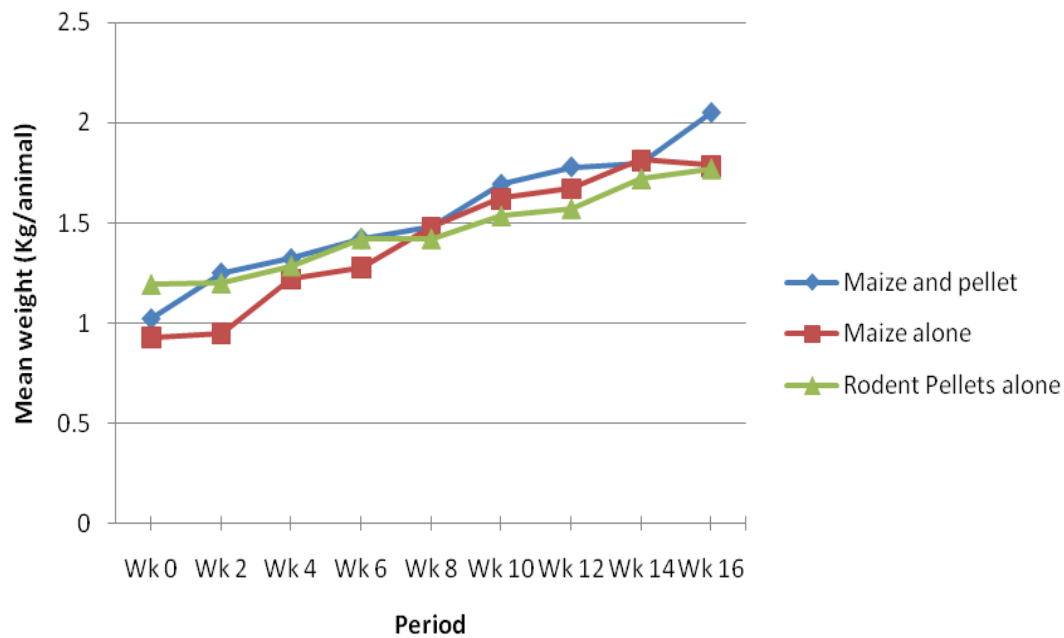


Figure 2. Mean weight changes of grasscutters on different diets under intensive management.

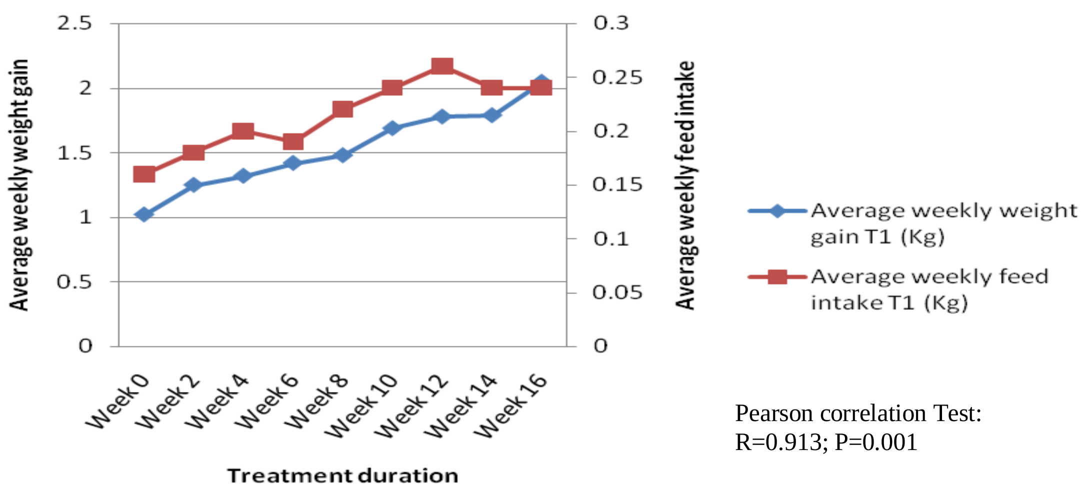
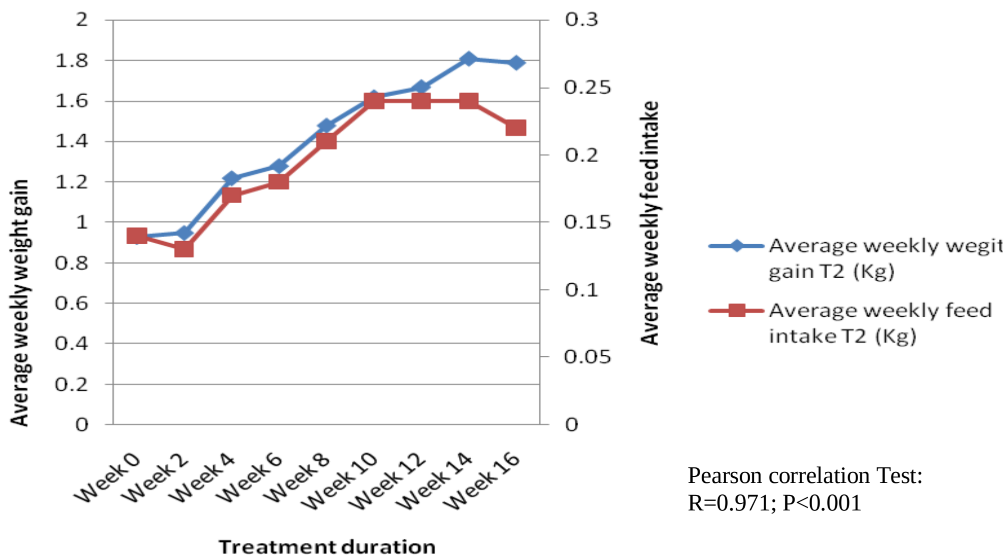


Figure 3. Correlation between feed intake and weight of grasscutters fed maize and rodent pellet diet as supplement (Treatment 1).

the feed consumed (Arthur, 1975). The initial weight of the grasscutters was relatively the same, so as to reduce error in the feeding trial and to obtain unbiased results.

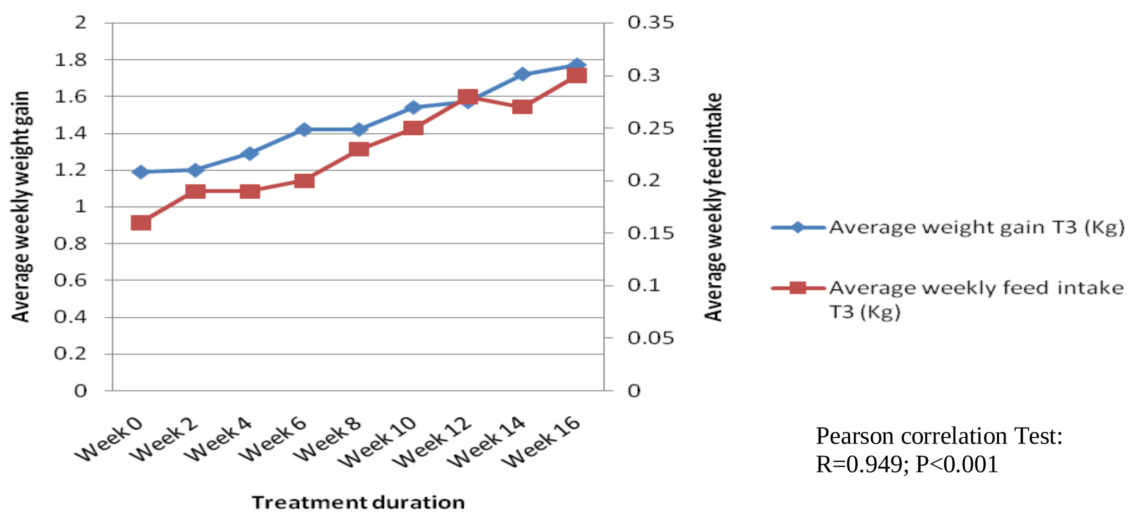
No significant differences (P>0.05) were observed in the mean total weights of the grasscutters. The highest weights was recorded for grasscutters fed maize combined with rodent pellets (2.05±0.11) closely followed by that of maize alone (1.79±0.16) and finally rodent pellets alone (1.77±0.09). This work agrees with the works of Karikari et al. (2009), and slightly differs from the works of Annor et al. (2008), carried out in Nigeria and Ghana, respectively. The mean total feed intake was significantly (P<0.05) influenced by the feed given as observed in Table 2. It was observed that the lowest feed intake was recorded in grasscutters fed maize alone and the highest feed intake was recorded in grasscutters fed rodent pellets and followed closely by the maize combined with the rodent pellets diets(P<0.05). It has been reported that grasscutters prefer feeds rich in fibrous materials than any other feed and feeds that have been pelleted also increase feed intake by most farm animals.

At the mean weight of 1.5 kg, there was a stability in the general growth pattern of the grasscutters and this



Pearson correlation Test:
R=0.971; P<0.001

Figure 4. Correlation between feed intake and weight of grasscutters fed maize diet as supplement (Treatment 2).



Pearson correlation Test:
R=0.949; P<0.001

Figure 5. Correlation between feed intake and fortnightly weights of grasscutters fed rodent pellet diet as supplement (Treatment 3).

could have been due to the fact that at this average weight, the animals attain sexual maturity and most of the energy of the feed consumed is now used for gamete formation and other sexual developments of the animals and maintenance instead of being used for growth, this assertion confirms with similar studies conducted by Schrage and Yewadan (1995). Though there was a highly positive correlation between feed intake and time, there was marked variations between the three treatments in terms of feed intake. Figure 1 further shows that animals placed on treatment 3 had a higher feed intake followed closely by those of treatment 1 and lastly those of treatment 2. Also, it can be seen from Figure 1 that there was a higher feed intake for treatment 3 from week 6 up to the last week of the study as compared to those of treatments 1 and 2. As illustrated in Figure 6, animals on treatment 2 had a higher average total feed intake but rather had a lower average total weight gain as opposed to the animals on treatments 1 and 3. This could be justified by the fact that animals on treatment 1 (Maize and rodent pellet based diet), though their average total feed intake was relatively low, the nutritional quality of their feed was very high on the nutrients analyzed.

Thus, animals on treatment 2 that exhibited a higher average total feed intake had a lower average total weight gain and it could be justified that performance of

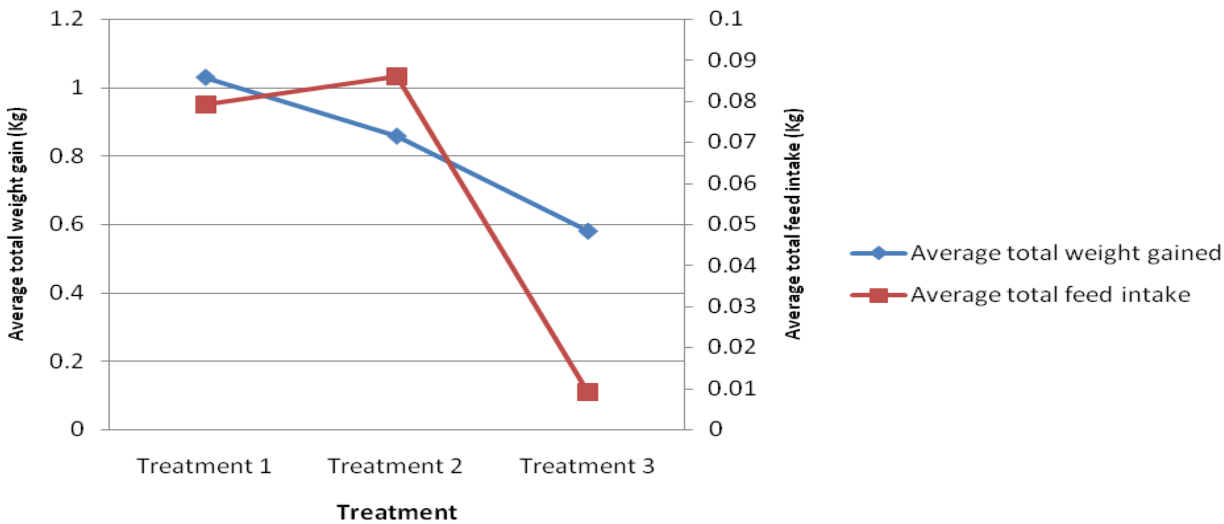


Figure 6. Correlation between mean total feed intake and mean total weights.

animals depends mostly on the nutritional value of the feed and not on the quantity of the feed consumed. This could be due to the fact that maize is relatively very low in its crude fibre contents which the animals make maximum use of than any other feed component, thus the higher metabolisable energy exhibited by the maize was not fully utilized by the grasscutters just due to the simple fact that they can perform more on a low calorie feed (Fayenuwo et al., 2003). All the animals progressively followed a similar weight change between the treatments up to week 14, where animals on treatment 1 started having weight changes different from those of treatments 2 and 3 but this was not significantly different (P>0.05). The mean final weights of animals fed T1 were higher than those on T2 and T3 (Table 4). However, there was no significant difference in the total weight gain (P>0.05). Similarly, the mean daily live weight gain of animals fed MP was higher than those fed M and P (P>0.05).

The trend of performance in mean total weight gain and daily weight gain follows the reverse of the trend of crude fibre content of the treatment diets but similar to that of the crude protein content of the treatments. The high fibre levels and low crude protein content of rodent pellets and maize compared to that of rodent pellet combined with maize might have caused the reduction in performance. An increase in fibre levels in the diet of grasscutters has been found to be associated with a decrease in the digestibility of dry matter, protein and fat in these animals leading to reduction in growth rate. Studies in grasscutters have also shown this positive relationship between amount of protein in grass and dry matter digestibility.

Animals fed pellet were more efficient to convert feed into muscle than those fed maize and rodent pellets combined and maize, and those fed maize and rodent pellets were also more efficient than those on maize (Table 4) (P>0.05). However, this was not reflected in their total weight gains. Comparing the feed intake values, the results of the feed conversion ratio could not be explained by the differences in weight gain resulting from feed intake. The order of performance in weight gain was T1>T2>T3.

Conclusion

It was therefore concluded that rodent pellets in combination with maize and the maize diet, could be used as complete diets for sustainable grasscutter production.

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