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Growth Performance of Grasscutters (Thryonomys Swinderianus) in Captivity Fed on Pelleted Forage and Cassava Tubers with the Peel in Ghana

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Abstract

The study was to investigate the growth performance and quality of the meat of grasscutters in captivity fed on two pelleted diets made of Elephant grass, gliricidia leaves and cassava with the peel with urea as ration 1 and with soy bean meal as ration 2. The control was feeding with only Elephant grass. Feed intake, feed wastage, weight gain were measured and feed conversion ratio was calculated. Feed intake and feed conversion ration were not significantly different at P> 0.05. Although the feed intake of the experimental animals was low on the pelleted feed their growth rate was numerically higher as compared to those fed on the Elephant grass (Pennisetum purpurenum) only. The final body weight of the animals fed on the pelleted feed were not significantly different but were significantly different to those fed on the control feed p>0.05. Grasscutters are noted for their feed wastage, in the study feed wastage of the three rations were significantly different p>0.05.with the control feed recording the highest feed wastage. The dressing percentage of carcass as well as the protein content of the meat of the animal fed on the pelleted diets were not significantly different but were significantly different to those of the control (p>0.05). It was also observed that it would cost GH₵ 21.70 for one kilogram weight gain feeding the grasscutter with Elephant grass whilst with the pelleted feed it would cost GH₵ 9.83 and GH₵ 6.85 for ration 1 and ration 2 respectively feeding the grasscutter. Grasscutter farmers in Ghana are encouraged to feed their grasscutters with pelleted combination of Elephant grass, gliricidia leaves and cassava with the peel with either urea or soy meal with other commercial ingredient as complete diets for sustainable grasscutter production in Ghana and countries south of the sub-Saharan region.

Keywords: Growth Performance; Grasscutters (Thryonomys Swinderianus); Ghana.

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1. Introduction

Grasscutter domestication is gaining grounds among most rural farmers and urban settlers in Ghana as well as most countries of the Sub-Saharan African Region as its meat is tasty, less fatty, popular and sells at very good price in both the local and foreign markets of the US and Europe.

Poor indigenous methods of hunting the grasscutters for their meat are almost to the point of extinction of the animal in most areas in Ghana. Rearing of the animal has become important because of the quality of its meats. It is considered a delicacy by both the rich and the poor alike and the most popular and perhaps the most expensive meat in Ghana. Studies by [1,2,3]. In Ghana revealed that 65% and 64%, respectively of traditional restaurant ("chop bar"), customers prefer grasscutter meat to all other meat. Reference [4] also observed that grasscutter meat sells at about 2 to 4 times higher than beef, mutton; chevon and chicken in the West African Sub-region. Domestication of grasscutter is therefore important to the economy of Ghana. The Ministry of Food and Agric in collaboration with the German Development cooperation (GTZ, DED), HEIFER International, Food and Agric organization (FAO) and the Council for Scientific and Industrial Research (CSIR), Ghana, since 2005 are promoting grasscutter farming as a viable option for income and improve in nutrition for a wide scope of people including the marginalized groups in rural areas to reduce poverty.

In 2010 the number of registered grasscutter farmers were 1,500 and the grasscutter population was also about 16,000 [5].Currently, Ghana can boost of over 250,000 of both registered and individuals who ventured into the business [6].

Although grasscutter farming has gained grounds in Ghana, their growth performance is very low. The low growth rate has been attributed to inadequate supply of balanced diets. At the moment most grasscutter farmers fed them on grasses and some household waste.

However, there are potential of feedstuff from local and available plants sources which are capable of supplying the nutritive requirement of grasscutter in captivity.

Forage and crop residues though inexpensive and easily available feedstuffs for feeding grasscutter in capacity are nutritionally, poor, not balance for optimum performance and therefore, require supplementation.

Most grasscutter farmers in Ghana feed the animal with guinea grass, elephant grass, maize, cassava tubers or peel and at times sugarcane stems and sweet potato. A combination of dried Elephant grass, Gliricidia leaves, cassava with the peel mixed with either urea or soy meal with some commercial ingredients were pelleted as Grasscutter; Growth performance; Feed intake; and meat quality. ration 1 and ration 2 and fed to grasscutters in captivity to determine their growth performance and quality of meat.

2. Materials and Methods

2.1 Feed component

Four week elephant grass (Pennisetum purpureum.) and Gliricidia leaves were harvested from the college cocoa plantation field while the cassava was purchased from a farmer. The selection of the material was based on the fact that they are the most used feed of the grasscutter and are common and available all year round. The elephant grass and cassava tubers were chopped into pieces of sizes between 2-4 cm whiles the gliricidia leaves were left whole. They were separately shade dried at a temperature of 25^{o}C and ground in a hammer mill of sieve size 2.0mm. The ground materials were mixed according to a feed formulated formula together with some industrial ingredients to obtain a crude protein level of 18% as stated by [7].

2.2 Composition of pelleted feed rations

Table 1 gives a descriptive summary of the various levels of inclusion of feedstuffs in the two rations.

The calculated crude proteins for the two rations are 17.50% and 18.16% respectively. Our calculation was based on [7].who postulated that the crude protein required for optimal growth of grasscutters from weaning to puberty stage is 18%.

2.3 Proximate Analysis of the feed before and after pelleting

The proximate analysis of samples of the two feed rations were carried out to determine their nutrient values and other chemical properties they possed at the Animal Nutrition Laboratory of Kwame Nkrumah University of Science and Technology, KUST, Ghana.

Table 2 describe the level of nutrient of the composed feed before and after pelleting of the types of rations.

The initial crude protein content of 13.10 and 15.8 were higher than the levels of crude protein content (9.25%) of diets fed by farmers in most parts of Africa since they mostly fed the grasscutter with Panicum maximum and pennisetum puripuratum [8,9].

The proximate analysis of the pelleted feeds fed to the experimental grasscutters was carried out to determine the nutritional values for dry matter (%DM), ash (%DM), organic matter (%DM), crude protein (%DM), crude fibre (%DM), ether extract (%DM), Nitrogen free extract (NFE) (%DM), metabolizable energy (MJ/kg DM) at the animal nutritional laboratory of Kwame Nkrumah university of Science and Technology (Table. 2) above.

The table indicates most levels of the individual chemical components increased after pelleting. The crude protein for the ration 2 (soybean inclusive) increased from 15.8% (loose feed) to 20.6% and that of ration 1(urea inclusive) also increased from 13.5% (loosed feed) to 17.9%.

Ether Extract of the pellet increased from 2.00 % for both loosed ration to 3.00 %; moisture content increased from 5.00 % to 11.5 % and 14.50 % for ration 1 and ration 2 respectively; Metabolizable Energy increased from 1983.70 (kcal/kg) to 2344.85(kcal/kg for ration 1 and 2230.10(kcal/kg) to 2314.05(kcal/kg) for ration 2. The cellulose content for the loosed feed of rations 1and 2 (29g/100g and 28g/100g respectively) also increased to 30 and 36g/100g.

Table 1: composition of pelleted feed ration

Ration with Urea				Ration with soya bean meal			
Ingrdients	Inclusive level (%)	Crude protein (%)	Calculated crude protein (%)	Ingrdients	Inclusive level (%)	Crude protein (%)	Calculated crude protein (%)
Major Ingredient Elephant grass	45.0	7.40	2.96	Major Ingredient Elephant grass	40.00	7.40	2.96
Gliricidia leaves	29.0	19.70	5.52	Gliricidia leaves	28.00	19.7	5.52
Cassava with peel	22.0	4.4	0.96	Cassava with peel	10.00	4.4	0.44
Urea	2.8	44	8.05	Soya bean meal	21.00	44	9.24
Minor Ingredients				Minor Ingredients			
Dicalcium phosphate	0.28			Dicalcium phosphate	0.25		
Premix	0.35			Premix	0.25		
Common salt/table salt	0.44			Common salt/table salt	0.5		
Sodium sulphate	0.13						
Total	100.00		17.49	Total	100.00		18.16

According to [10,11], pelleting feed increases most chemical components of feed and makes them available to animal and thus improves their performance.

On the other hand the hemicelluloses content of the pelleted feed decrease for both rations while the lignin level of ration 2 increased from 14.29 to 18.18.

According to [12], in1998; urea decrease the resilience characteristics of the fibres, degrade the cell wall structure and separated lignin from the cellulose, this reaction has caused the low level of the lignin in the diet with the urea as one of it component.

On the tested minerals, (calcium, Magnesium and Phosphorus) had their values either increased or reduced. Calcium in ration 1 increased from 0.71 to 0.85 g/100g while that of ration 2 decreased; magnesium increased

from 0.51 to 0.72g/ 100g; and phosphorus increased from 0.10 to 0.30g/100g in ration 1 and ration 2 had the phosphorus also increased from 0.16 to 0.33. For ration 2 Calcium that was 0.76 in the raw mix before pelleting decreased to 0.52g/100g after pelleting; whilst those of magnesium increased from 0.51 to 0.72g/100g for ration 1 with that of ration 2 increasing from 0.63 to 0.64g/100g.

Table 2: Chemical composition feed components in the two rations before and after pelleting

Feed Chemical Composition (g/100g)				
Constituent	Ration with Urea inclusive		Ration with Soy meal Inclusive	
	Before Pelleting	After pelleting	Before Pelleting	After Pelleting
Dry matter	95.00	85.00	95.00	88.50
Crude Protein	13.10	17.90	15.80	20.60
Ether Extract	2.00	3.00	2.00	3.00
Crude fibre	32.18	16.67	24.14	19.79
Ash	9.00	7.00	10.00	6.00
Moisture content	11.00	13.50	10.50	10.50
Nitrogen free Extract	38.72	40.93	43.06	39.11
Acid detergent fibre	37.00	42.00	39.00	30.00
Neutral detergent fibre	69.00	43.00	57.00	37.00
Cellulose	29.00	36.00	28.00	28.00
Hemi-cellulose	32.00	1.00	18.00	18.18
Lignin	14.29	8.57	14.29	7.00
Calcium	0.71	0.85	0.76	0.82
Phosphorous	0.10	0.30	0.16	0.33
Magnesium	0.51	0.72	0.63	0.64
ME(MJ/kg)	1983.70	2314.05	2230.10	2340.85

Laboratory – KNUST, Department of Animal Science, 2014

2.4 Performance of grasscutters fed on experimental pellets

2.4.1 Feed and water Intake

The average daily feed intake, feed conversion efficiency (FCE), water intake and feed wastage recorded for the three dietary treatments are shown in Table 3.

Treatment means with the same letters within the same row are not significant at $p<0.05$.

2.5 Growth performance of Grasscutters on dietary treatments

Table 4 is a descriptive summary of the growth performance of the grasscutters fed on the dietary treatments.

2.5.1 Mean biweekly feed intake of experimental grasscutters fed on the three diets (kg)

Fig 1a indicates the mean biweekly feed intake of the different diets fed on each experimental group of grasscutters. The lowest feed intake was recorded in grasscutters fed with pelleted ration 1 (urea inclusive) and the highest feed intake was the control feed (pennesetum purpureum with concentrates at albeit) followed by the pelleted ration 2 (soymeal inclusive). It could be realised that from the fourth month to the six month the rate of feed intake was almost constant with the control feed and slightly increased in the pelleted feeds, this could be attributed to coincide with their period for mating as stated by [13].

Table 3: Mean feed intake, Water Intake, Feed conversion Efficiency (FCE), and Feed Wastage.

Parameter	Control	Ration 1 (Urea inclusive)Pelleted	Ration 2 (soymeal inclusive) Pelleted	LSD
Mean Feed intake (g/day)	96.93a	88.65a	87.67a	2.047
Mean Water intake (g/day	100.69c	107.20a	104.60b	0.88
Mean feed wastage (%)	15.30a	8.13b	6.74c	0.02
Feed converversion Efficiency (%)	12.28a	8.87a	8.12a	16.11

2.5.2 Biweekly mean weight gain of animal fed on the three diets (kg)

Figure 1b illustrates the growth performance of the experimental animal with respect to the type and form of feed. The gain in weight of the animals feed on the pelleted feed did not show much differences as compared with those feed the elephant grass (control) even though much of the control feed was eaten by the animals.

2.6 Biweekly feed intake and weight gain of grasscutters fed on the three diets. (kg)

Figures 1b, 1c, 1d. and1e, indicates the feed intake and weight gain of the grasscutters fed on the three deitary feeds. It was realised that the feed intake of the animal fed on the control diet did not commensurate the weight gain hence they had to eat more to gain weight. On the other hand the grasscutters fed on the pelleted feed showed increases in weight gain with increased in feed intake as observed by [13].

Table 4: Growth Performance of Grasscutter on dietary Treatment

Diet	Control	Ration 1 Pelleted	Ration 2 Pelleted	LSD
Initial Body weight (kg)	0.66a	0.65a	0.67a	1.68
Final Body weight (kg)	1.96b	2.43a	2.77a	2.69
Total weight gain (kg)	1.30b	1.78a	2.10a	2.46
Daily weight gained (g/day)	6.75a	9.97a	10.65a	9.12
Mortality	2	3	2	

Treatment means with the same letters within the same row are not significant at $p<0.05$.

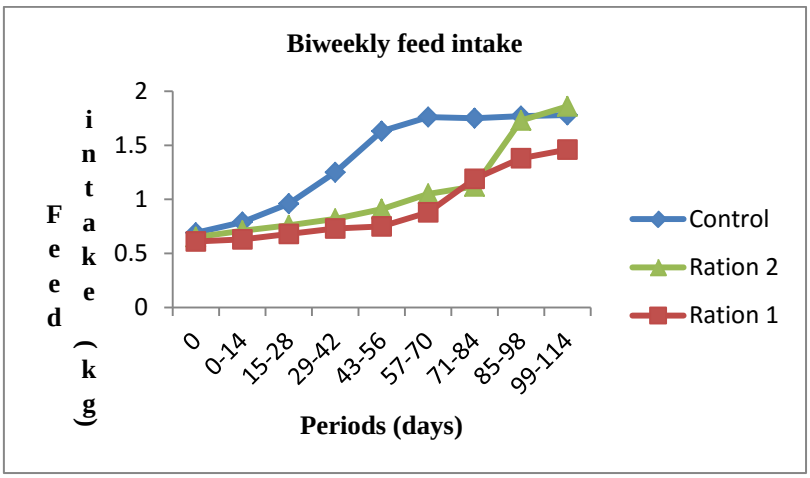

Figure 1a: Mean weekly feed intake (kg).

Figure 1e: Weekly feed intake and weight gain (kg); Ration 2 pelleted fee

2.7 Mortality

A total of seven (7) animals, (two each of the control feed and of pelleted ration 2 feed and three animals of the pelleted ration 1 feed) died during the first two weeks due to stress. According to [8].one major cause of mortality in grasscutters in captivity is stress. After the two weeks there was no more mortality recorded because stress was duly managed. The distance of the farm to other facilities also contributed to reduce noise. Pawpaw seeds were fed to the animal after the third month as against worms, a factor that has been identified to be responsible for high mortality of captive grasscutters by [14].

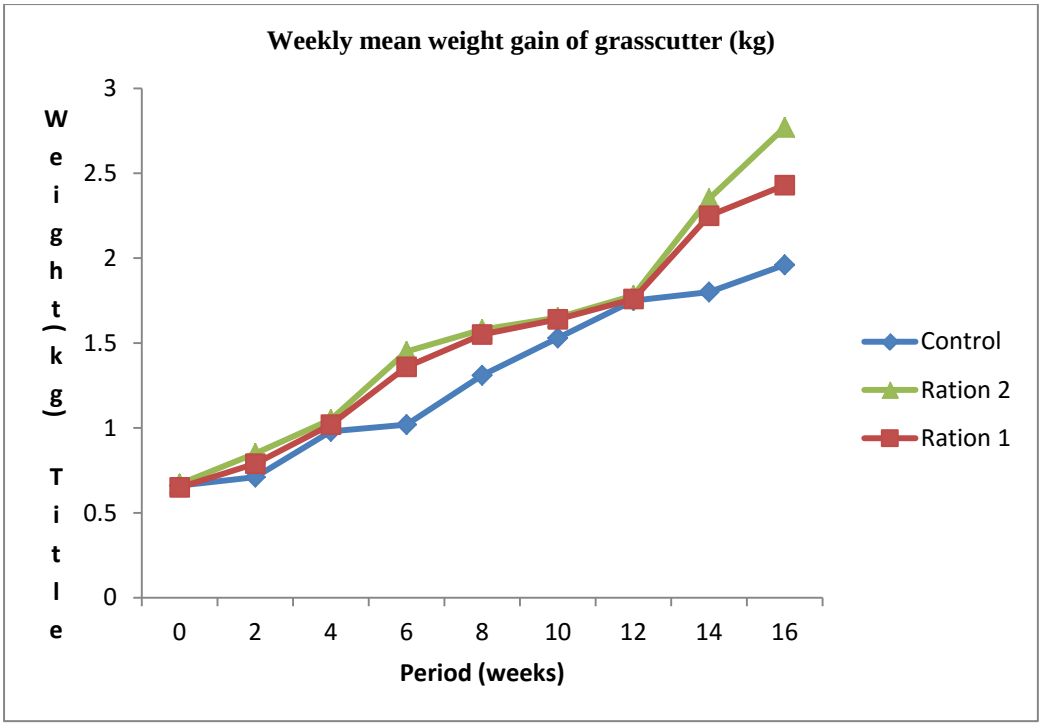

Figure 1 b: Biweekly weight gain (kg)

Biweekly feed intake and weight gain of grasscutters fed on (Control feed) kg

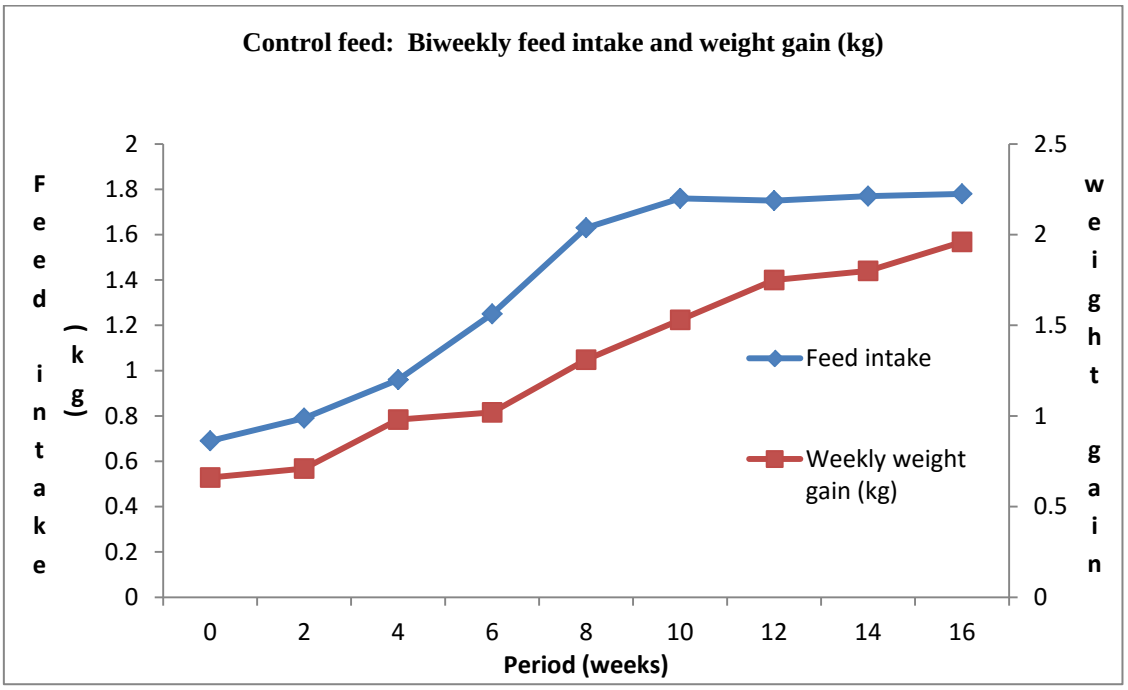

Figure 1c: Weekly feed intake and weight gain (kg); Control feed

Biweekly feed intake and weight gain of grasscutters fed on ration 1 (pelleted) kg.

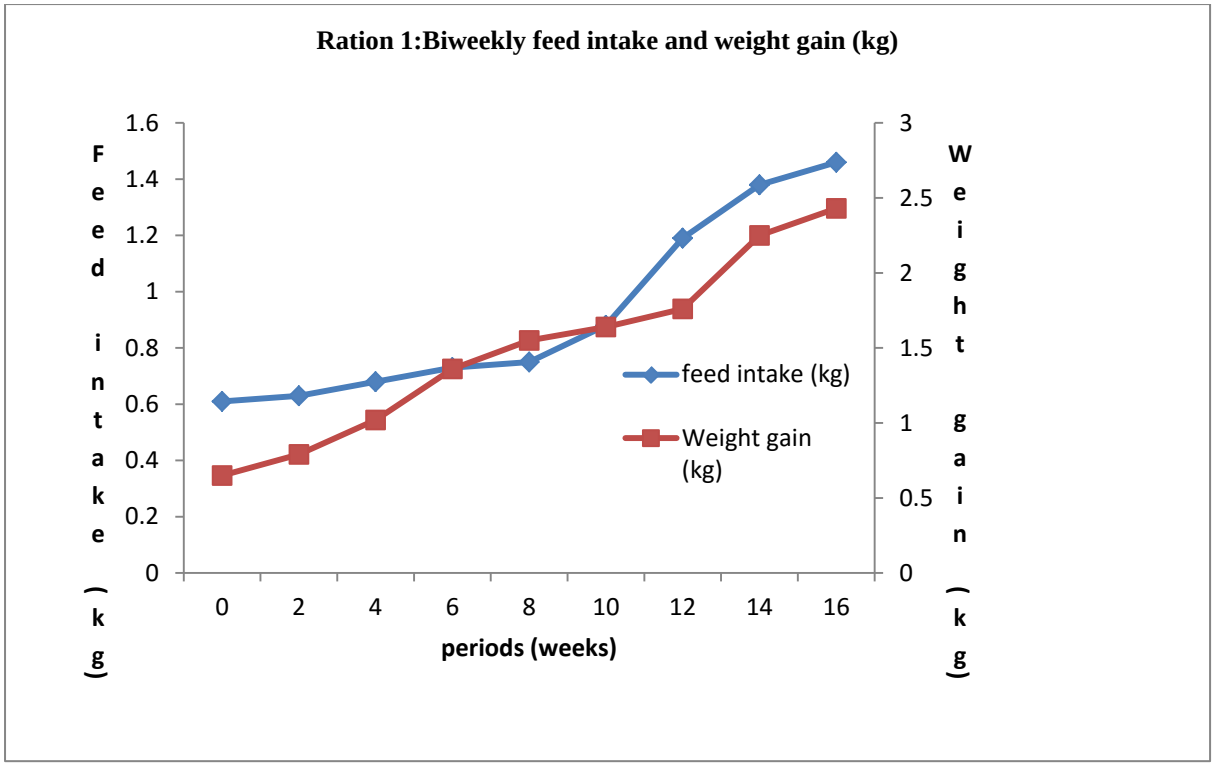

Figure 1 d: Weekly feed intake and weight gain (kg); Ration 1pelleted feed

Weekly feed intake and weight gain on pelleted ration 2. (kg)

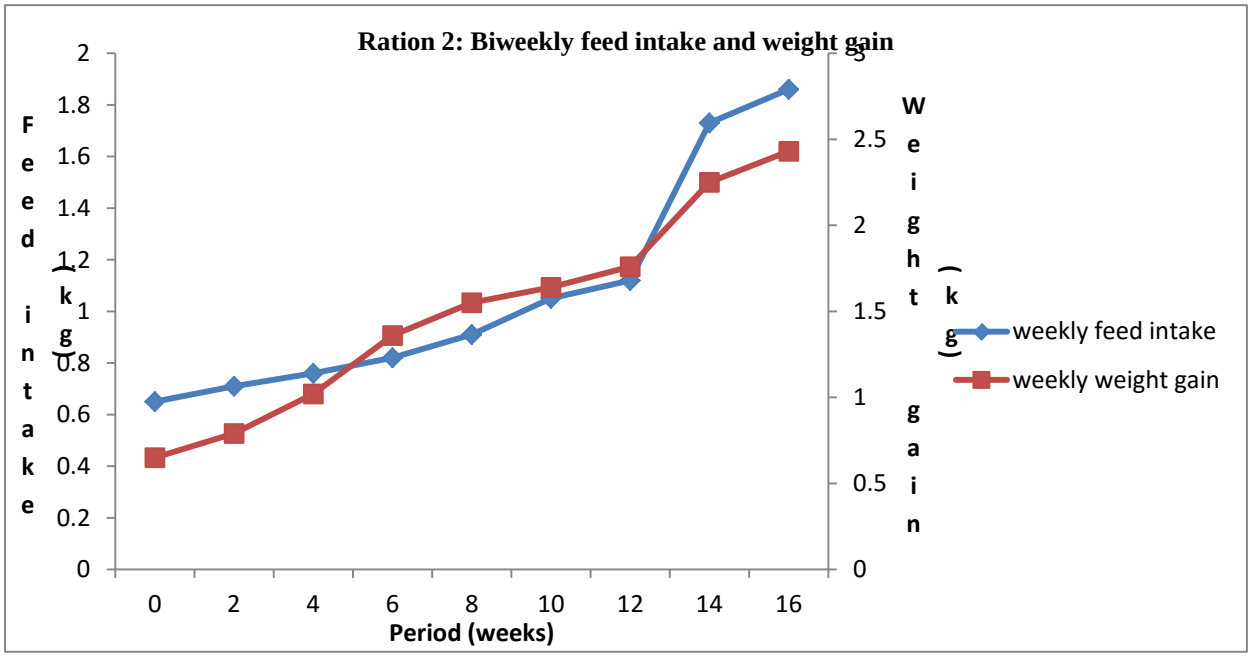

Figure 1e: Weekly feed intake and weight gain (kg); Ration 2 pelleted fee

2.8 Carcass Characteristics

Table 5 is a descriptive summary of the carcass characteristics of the slaughtered grasscuttesr of each treatment.

Table 5: Carcass Characteristics

Variable	Control	Ration 1 Pelleted	Ration 2 Pelleted	LSD
Dressing percentage (%)	65.12a	71.78a	75.42a	109
Trimmable fat (g)	0.22c	4.32b	6.52a	0.07
Mean Heart (g)	15.45a	19.10a	21.45a	53.24
Mean liver (g)	26.53b	45.45a	46.52a	12.9
Mean kidney g)	8.23b	13.34a	14.23a	2.5
Mean lung (g)	12.30b	17.53a	18.35a	1.10
Mean spleen (g)	3.83a	4.43a	5.34a	14.68

Treatment means with the same letters within the same row are not significant at $p<0.05$.

Chemical Composition and pH of the raw meat of the slaughtered grasscutters

The table 6 shows the levels of protein, fat, Ash, moisture and pH of the raw meat of the slaughtered grasscutters fed on each feed treatment.

Table 6: Chemical Composition and pH of raw meat

Variable	Control	Ration 1	Ration 2	LSD
Protein (%)	16.32a	19.63a	22.03a	9.81
Fat (%)	1.6a	3.12a	3.02a	5.86
Ash (%)	0.50a	0.61a	0.63a	Ns
Moisture (%)	67.87a	64.43a	63.05a	22.34
pH (%)	6.24a	6.10a	6.18a	11.34

Treatment means with the same letters within the same row are not significant at $p<0.05$.

2.9 Mean feed Wastage

The amount of feed wasted during the experimental period of six months ranged between 6.74% and 15.30%. Animals fed on the control diet had the highest percentage feed wasted followed by the grasscutters fed on ration 1. The least feed wastage (6.74%) was recorded on the grasscutters fed on ration 2 (soy meal inclusive).

The results indicated that there were significant differences between the amounts of feed wasted by the animals under the various diets. The level of wastage observed in the study was however lower than the 70% reported by [15]. The low wastage level could also be attributed the depth of the feed containers (larger tomatoes tins of 11cm depth) as compared with earth pots of 5cm depth used by [15]. The solid nature of the pelleted feed also made it impossible for the grasscutter to scatter them with their fingers.

2.10 Feed conversion efficiency (FCE)

From Table 3, animals fed on the pelleted feed that had high crude protein level were more efficient in converting feed into body weight than those fed with diet with low protein content (13.5%) the control feed. There were significant difference ($p<0.05$) between animals fed on the pelleted diet and the control diet. The different protein levels have contributed to the differences in FCE. [14], gave FCE of grasscutters as 16:1 for animals fed fodder and supplementary feed concentrates of (77.9DM). However, FCE of 7:1 was reported for animal fed ration with 17% crude protein [14]. (This is to say animals put on rations higher in protein content, the ability of the animal to convert the feed into body weight increases compared to animals put on low protein diets. [16].in his assertion the ability of utilization of dietary nitrogen for protein deposition decreases when low quality diet is fed because such diets lack the essential amino acids needed for the synthesis of body proteins, hence the differences in FCE realised in the study.

2.11 Mean Water Intake

The mean water intake ranged from 100.69 g/day to 107.20g/day. With the higher mean water intake recorded by the grasscutters fed on ration 1 and the least recorded on those on the control feed. The mean water intake of 104.16ml/animal/day recorded in this present work is relatively higher than 90ml/animal/day reported by [14]. This was expected for according to [19], water content of animal's diet influences its drinking habits. The mean moisture content 8.5 of the diet used in the study were relatively lower than 22.1% as postulated by [14]. Furthermore the diet fed by them was supplemented with grass that contained about 70% moisture. Currently, some Ghanaian grasscutter farmers are of the view that grasscutter do not drink water. Their assertion could be attributed to the fact that the animals are fed with fresh grasses that have moisture contents of about 70% [9]. They either refuse water or drink very small amount of water in a day.

2.12 Mean Growth Rate

The growth performance of the grasscutter on the three diets is represented in Table 4 and Figures 1a to 1e. The result shows that though there was no significance differences between treatment in terms of weight changes, the weight changes of the grasscutters fed on pelleted feed (ration 2, soymeal inclusive) performed better than the pelleted feed ration 1(urea inclusive) and the control feed (T3>T2>T1).

The feed intake and growth responses of the twenty eight grasscutters fed the three feeds are respectively illustrated/represented in Figures 4.15 and 4.16. Generally weight changes was directly related to feed intake though there were fluctuations in the feed intake and weight gain per treatment during the study period

The analysis of variance shows significant different (P<0.05) between animals fed on the pelleted diet and the control, but there was no significant difference (p<0.05) between the mean growth of animals fed on the pelleted feed. The mean growth rate (daily weight gain) as shown in the table showed no significant difference P<0.05 as well as the total weight gain. The differences observed in weight gain per day between the animal on the three diets could be attributed to the difference in the quantity of dietary protein because protein aid in apparent digestibily of dry matter [17]. (The results obtain in this study compared favourably with the values of 8.8 to 12.1 g/day as reported by [18] and 4.8 to 11.2 g/day reported by [15] when the animals were fed with freshly cut Panicum maximum supplemented with concentrates with varying levels of crude protein from 12 – 17%.

2.13 Mean Final Weight and Total Weight Gain

The mean final body weight of grasscutter increased with increased dietary protein level as shown in Table 4. No significant difference was observed (P>0.05) between mean final body weight of grasscutters fed on the two pelleted feed. However, there was significant difference (P<0.05) between the final body weight of grasscutters fed on the pelleted diet and the grasscutters fed on the grass with supplemented concentrates (control). The highest weight of 2.77kg was recorded for grasscutters fed on the pelleted feed of ration 3 followed by the pelleted ration 2 weighing 2.34kg and the control feed grasscutters weighed 1.96kg at the end of the study

Similarly, the total body weight gain of the animals on the treatment diets increased with increasing crude protein. Total weight gain of animals fed on the pelleted fed were significant (p<0.05) from the animals fed on the control diet.

The high protein levels might have increased breakdown and digestibility of the fibre contained in the pelleted feed since microbes which are responsible for breakdown of fibre are basically protein [21]. and would need dietary protein to build body protein for effective breakdown of fibre. [18]. observed in grasscutters that, low protein levels in diets tend to decrease digestibility of nutrients leading to poor growth performance. High protein levels might have also increased the digestibility of nutrients contained in the diets fed since the enzymes responsible for digestion are protein. For instance, proteases are responsible for digestion of proteins whiles amylase and lipases are responsible for the digestion of carbohydrates and fats respectively. Secondly, since protein forms the greatest portion of muscles, nails, hairs and hooves of farm animals [20], increased levels of protein in diets could be associated with an increase in total weight gain.

The total weight gain recorded for the animal fed on the pelleted feed with protein levels of 20.6% and 18.01%) in this study compares favourably with the suggestion made by [18] that crude protein requirement of captive grasscutters should be more than 17%. The study therefore suggest that the minimum crude protein level required for growing grasscutters in captivity for optimum growth should be 18% [7].

3. Conclusion and Recommendation

Although the feed intake of the experimental animals was low on the pelleted feed their growth rate was numerically higher as compared to those fed on the Elephant grass only. The final body weight of the animals after the six months period were; 1.96 kg, 2.43 kg and 2.77 kg for the control feed, pelleted ration 1 and

pelleted ration 2 respectively, with the pelleted feed having the soy meal having the highest weight of 2.77kg. Feed wastage was low in the pelleted feed (8.13% and 6.74% for pelleted feed ration 1 and 2 respectively) while feed wastage of 15.30% was recorded on the control feed, Elephant grass only.

The dressing percentage of carcass was observed to be 65.12% for the control feed (Elephant grass), 71.70% and 75.42% for the pellet ration feed and pelleted ration 2 feed respectively.

Protein content of the meat of the slaughtered experimental animals was 16.32 % for those fed on the elephant grass (control feed); 19.63% and 22.03% respectively of the meat of the grasscutter fed the pelleted ration 1 and ration 2.

It was observed that it would cost GH₵ 21.70 for one kilogram weight gain feeding the grasscutter with elephant grass whilst with the pelleted feed it would cost GH₵ 9.83 and GH₵ 6.85 for ration 1 and ration 2 respectively feeding the grasscutter. It was therefore concluded that elephant grass pelleted with gliricidia leaves and cassava with the peel could be used as complete diets for sustainable grasscutter production in Ghana and countries south of the sub-Saharan region using the pelletizer without any precondition with either steam or hot water and without the use of commercial binders

4. Recommendations

Grasscutter farmers in Ghana could therefore successfully feed their animal with pelleted feed made of a combination of dried Elephant grass leaves and stem, gliricidia leaves, cassava with the pee andl either with urea or soy meal with other commercial ingredient as complete diets for sustainable grasscutter production in Ghana and countries south of the sub-Saharan region using the locally constructed pelletizer without any precondition with either steam or hot water and without the use of commercial binders.

Grasscutter farmers are therefore advised to pellet the feed to reduce cost of transportation, handling and storage.

Pelleting minimize feed wastage feeding grasscutters with the bulky raw material.

The pelleted feeds supported high growth rate than the control feed of *pennisetum purpurenum* with occasional supplement of concentrates. The cost of the constructed pelletizer is Eight Hundred and Ninety Ghana Cedis as compared to the imported ones exported from China that cost between US$600 and US$2000 depending on their capacity

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