Meat Quality and Economic Analysis of Grasscutter (Thyronomys Swinderianus) Fed Mixture of Spear Grass and Sweet Potato Peels Supplemented with Moringa Oleifera Leaves

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Abstract

The study was conducted to assess the meat quality and economic analysis of grasscutter fed mixture of spear grass and sweet potato peels supplemented with Moringa oleifera leaves. Eighteen grasscutters with average weight of 1.00+0.23kg and aged between 2 and 3 months old were assigned to three dietary treatments with six animals per treatment in a complete randomized design. The compared diets were: Diet I (spear grass and fresh sundried sweet potato peels with concentrate), Diet II (spear grass and parboiled before sundried sweet potato peels with concentrate) and Diet III (spear grass and soaked before sundried sweet potato peels with concentrate). The combination of spear grass and sweet potato peels with concentrates were given to grasscutter in proportion of 30:50;20 respectively. 8 grams of moringa leaves powder was also supplemented to each of the three diets. Results showed that loin cooking loss (18.33%), average feed intake (11.06g/day), feed cost/kg grasscutter (N987.40), feed cost/kg weight gain (N206.09) and production cost/grasscutter (N1600.00) were significantly ($P<0.05$) highest with grasscutter on Diet I compared to those on other diets. Grasscutter on Diet II had the highest ($P<0.05$) in live-weight (5960.00g), dressed weight (4089.12g), dressing percentage (68.61%), loin chop weight (85.00g), loin cooking yield (83.53%), overall acceptability (6.73), average weight gain (790.00g), revenue/grasscutter (N2980.00) and gross margin (N1780.00). No significant ($P>0.05$) difference was observed in flavour, tenderness and juiciness. It is concluded that Diet II (spear grass and parboiled before sundried sweet potato peels with concentrate that was supplemented with moringa) improved meat quality and economic analysis of grasscutter.

Keywords: Sweet potato peels, moringa, meat quality, economic analysis, grasscutter

Introduction

The problem of inadequate animal protein consumption in most developing countries like Nigeria is a serious phenomenon that needs urgent attention.

This protein deficiency problem has necessitated the rural populace in particular to explore alternative sources of animal protein to complement the conventional livestock. Thus, the search for alternative animal protein sources has popularized attempts to rear wild animals (Byanet *et al*., 2008).

Grasscutter is one of such most aggressively hunted wild hystricomorphic rodents found in Nigeria (Opara *et al*., 2006). It possesses outstanding potentials that can be tapped because of its obvious advantages over other wide animals. Grasscutter production can serve as an alternative source of animal protein to mitigate the negative impacts of malnutrition prevalent in the developing countries. Grasscutter is considered as delicacy meat for many Nigerians, hence its acceptability cut across all the geographical regions because of the absence of cultural bias and religious hindrance to its consumption. It constitutes an important healthy food product, because of its high protein, good taste and low fat cholesterol content (Williams *et al*., 2011). It is comparable to domesticated animals that have the ability to subsist on domestic waste and succulent grasses (Henry, 2010).

The increase in feed prices with the scarcity of grasses during the dry season is one of the important constrains hampering grasscutter production in Nigeria. Therefore, reducing the production cost is the main objective of farmers to maximize their net revenue. Thus, the limitation imposed by high prices of feeds have geared many farmers effort towards employing of alternative feed sources that are relatively cheaper and available.

Sweet potato (*Ipomea batatas*) peels as an alternative energy source for livestock can have major influence on reducing the production cost of feeds with no inverse effect on meat quality of the animal. The processing of sweet potato peels before use as feeds for livestock have been reported by Okoereke (2012) to reduce their toxicity and sugaring content. Moringa leaves powder improves digestion and energy level of animals (Saduzama *et al*., 2013). The objective of this study was therefore to assess the effect of combining spear grass and sweet potato peels supplemented with *Moringa oleifera* leaves on meat quality and economic analysis of grasscutter.

Materials and Methods

Experimental site: The study was carried out at the Teaching and Research Farm (Grasscutter Unit) of the Ambrose Alli University, Ekpoma, Edo State, Nigeria.

Experimental diets: Young growing spear grass (*Imperata cydindrica*) was harvested from the Teaching and Research Farm. Sweet potato peels were purchased from their processing centre within Ekpoma and divided into three groups. The first group was sundried fresh (FSSP), the second group was parboiled before sundried (PSSP) while the third group was soaked in water at room temperature for 24 hours before sundried (SSSP). The three groups were crushed separately before used. Concentrate that included the following 36.50% maize, 34.00% soya bean meals, 10.00% palm cake, 15.00% wheat offal, 0.50% salt, 0.50% vitamin, 2.00% bone meal, 0.30% lysine and 0.2% methionine that calculated to be 24% crude protein and 2340kcal/kg metabolizable energy was formulated as well. The spear grass and differently processed sweet potato peels were used as basal diets while the concentrate and moringa leaves powder were served as supplementary diets. The three experimental diets that were prepared were:

Diet A (spear grass + FSSP + concentrate)
Diet B (spear grass + PSSP + concentrate)
Diet C (spear grass + SSSP + concentrate)

However, the combination of spear grass and sweet potato peels with concentrate in proportion of 30:50:20 respectively were offered as diet at the rate of 5% (DM basis) of thier body weight. Moringa leaves powder (8 grams) were also mixed to each of the three diets before they were given to the grasscutter.

Experimental animals and management: Eighteen young male grasscutter, between 2 and 3 months of age, weighing 1.00+0.23kg were randomly assigned to the three diets at the rate of six animals per treatment group, after 3 days adaptation period. Grasscutter were reared in individual cells using concrete floored hutch with cemented floor and iron cage to allow for enough ventilation. The experiment lasted for 12 weeks during which they were offered experimental diets once daily at 8.00am in the morning while water was given *ad libitum*.

Routine sanitation was carried out throughout the experimental period and prophylactic treatments were also given when necessary. The quantities of feed supplied were weighed every morning and the leftover were weighed as well to compute feed intake. Body weight of the animals were taken on weekly basis.

Meat quality evaluation: At the end of the experiment (12 weeks) three grasscutter from each treatment were taken, starved overnight and slaughtered.

The carcasses were washed and eviscerated with subsequent removal of the heads and legs. The dressing weights were taken which were subsequently used to determine dressing percentage for grasscutter. The carcasses were then divided into primal cuts viz, legs, loin, rack, shoulder, breast-flank and shank (Eniolorunda, 2010). Chop of meat samples were removed from the anterior side of the loin, weighed and then cooked into a plastic bag in a water bath at 75^0C until an internal temperature of 71^0C was achieved. After cooling, the samples were taken from the bags, dried with filter paper to remove cooking drip and reweighed. Thus cooking loss and cooking yield chop meat samples were calculated using these formula:

$$\text{Cooking loss}\left(\%\right) = \frac{\text{Initial weight - final weight}}{\text{Initial weight}} \times 100$$

$$Cooking\ \text{yield}\left(\%\right) = 100 - \text{cooking loss}$$

After the cooking loss and yield determination, samples for sensory evaluation were cut into sub-samples, transferred into a pre-warmed glass beaker and covered (Olafadehan, 2011). In order to assess the meat quality 12 panellists were randomly allocated to the three treatment groups. Meat samples were coded and served in randomised sequence. The panellists were made to rate each of the replicates of the meat samples per meat quality index per treatment. The panellists rated the sample on a 9-point hedonic scale for flavour, tenderness, juiciness and overall acceptability. Panellists were semi-trained before commencing the test and were supplied with craker biscuits and water in between the samples (AMSA, 1995).

Economic analysis: Feed cost per grasscutter was computed from the total amount of feed eaten per grasscutter multiplied by feed cost/ $perKg$. Feed cost $perKg$ weight gain was calculated as feed cost $perKg$ multiplied by average weight gain of grasscutter. Cost of production per grasscutter was the variable cost of taking care of the grasscutter (cost of feeds, medication, transportation and other miscellaneous expenses). The cost of processing the sweet potato peels were included as the feed cost. Other costs that included labour, capital investment and housing were the same for all the treatment groups and assumed constant (fixed cost). Revenue per grasscutter was derived as cost of 1kg of life grasscutter multiplied by the final body weight. Gross margin per grasscutter was calculated as the difference between total revenue and total variable cost per grasscutter.

Chemical and statistical analysis: Samples of the experimental diets were analysed for proximate analysis using the procedure of AOAC (2002).

Data generated from the meat quality, cost and gross margin parameters were subjected to analysis of variance (ANOVA). Significant difference between treatment means were separated using Duncan's Multiple Range Test (SAS, 2003).

Results and Discussion

Proximate composition of test ingredients (spear grass, sweet potato peels with moringa leaves) and the formulated concentrate used are presented in Table I. The dry matter values that ranged from 42.10% in moringa leaves to 91.10% in FSSP were differed in contents. This could be due to the nature of the ingredient characteristics. Crude protein and ether extract values that ranged from 5.00 to 25.10% and 1.40 to 6.10%, respectively, confirmed that spear grass is not a good source of protein and oil. Crude fibre value was highest in spear grass (37.00%) and lowest in SSSP (3.96%).

Ash values ranged from 7.50% (FSSP) to 11.50% (moringa leaves). The highest total ash content values obtained in moringa leaves confirmed that the total mineral content in the leaves was high. The processed sweet potato peels (FSSP, PSSP and SSSP) can be ranked as energy rich diets due to their relatively high in nitrogen free extract content. However, the proximate composition values obtained in spear grass, sweet potato peels and moringa leaves in this study were similar to those reported by Akobundu *et al*. (2000); Malik *et al*. (2011); Saduzaman *et al*. (2013) respectively.

Table 1: Proximate Composition of Test Ingredients and Formulated Concentrate of the Experimental Diets (%)

Component	Test ingredients					Concentrate
	Spear grass	FSSP	PSSP	SSSP	Moringa leaves	
Dry matter	49.20	91.10	72.98	56.42	42.10	87.25
Crude protein	5.00	6.40	7.20	6.98	25.10	24.00
Crude fibre	37.00	4.00	3.99	3.96	21.90	5.42
Ether extract	1.40	6.00	6.10	5.98	5.40	3.78
Ash	8.80	7.50	8.00	7.83	11.50	8.62
NFE	47.80	76.10	74.71	75.25	36.10	59.82

FSSP = Fresh sundried sweet potato peels; PSSP = Parboiled sundried sweet potato peels; SSSP = Soaked sundried sweet potato peels.

As shown in Table 2 is the physical properties of meat samples of grasscutter fed experimental diets. Live weight of grasscutter fed diet I (4990.00g) was significantly (P<0.05) lower than other experimental diets, which implies that diet I possibly depressed the final weight of the experimental grasscutter. This could probably be attributed to the relatively poor utilization of the diet by the grasscutters, which have been implicated for reduced growth rate (Oteku and Igene, 2006; Olafadehan, 2011). Dressed weight values of 3025.29, 4089.12 and 3505.82g were obtained for grasscutters on diet I, II and III respectively. Significant differences (P<0.05) were observed among treatment effects with grasscutter on diet II recording the highest and those on diet I the lowest. The dressing percentage that ranged between 60.63% (diet I) and 68.61% (diet II) showed the same trend as the dressed weight. The significant (P<0.05) differences in the dressed weight and dressing percentage of the carcasses could be attributed to variation observed in the live weights. This is in consonance with the report of Adesehinwa *et al*. (2011) who fed cassava peels based diet supplemented with or without farmazyme 3000 proenx to growing pigs. Loin chop weight was significantly (P<0.05) differed between treatment groups with grasscutter loin on diet II (85.00g) being the heaviest, followed by those on diets III (82.00g) and diet I (79.00g) was the least. The variation in loin chop weight could be ascribed to disparity in the nutrition, live weights and dressing percentage of the experimental grasscutter. The cooking loss was highest (P<0.05) in loin chop from grasscutter fed diet I (18.33%) and least in loin chop from grasscutter fed diet II (16.47%) while loin chop from grasscutter fed diets I (18.33%) and III (18.29%) had almost the same (P>0.05) cooking losses. The results of cooking loss obtained in this study were within the values (10.00+20.00%) reported by Eniolorunda *et al*. (2010) for cooking loss of ram but higher than the values reported by Omojola and Adesehinwa (2006) for cooking loss of rabbits. This variation could be due to differences in breeds, feed quality, age at slaughter as well as the cooking method employed. Loin cooking yield was also significantly (P<0.05) influenced by the treatment groups with grasscutter on diet II (83.53%) recorded the highest while those on diets I (81.33%) and III (81.71%) had the lowest with almost the same (P>0.05) values. This observed difference could be as a result of different levels of loin cooking loss attributed to the loin chop weight and dietary treatments variation. The pronounced (P<0.05) effect of loin, chop weight and loin cooking loss on cooking yield agrees with the findings of Ogunsipe and Agbede (2010) but contradicts the earlier report of Amaefule *et al*. (2007) who assessed the effect of feeding graded levels of palm kernel meal diets on performance, carcass quality and organ characteristics of pigs.

Table 2: Physical and Organoleptic Properties of Meat Samples from Grasscutter Fed Experimental Diets

Parameter	Diets			
	I	II	III	SEM±
Live weight (g)	4990.00[c]	5960.00[a]	5400.00[b]	1.29
Dressed weight (g)	3025.29[c]	4089.12[a]	3505.82[b]	1.16
Dressing (%)	60.63[c]	68.61[a]	64.92[b]	0.47
Loin chop weight (g)	79.00[c]	85.00[a]	82.00[b]	0.50
Loin cooking loss (%)	18.33[a]	16.47[b]	18.29[a]	0.21
Loin coking yield (%)	81.33[b]	83.53[a]	81.71[b]	0.83
Sensory variables				
Flavour	6.37	6.98	6.64	0.62
Tenderness	6.23	6.50	6.32	0.31
Juiciness	6.41	6.72	6.52	0.10
Overall acceptability	5.72[b]	6.73[a]	6.54[a]	0.28

[a, b, c] = Means along the same row with different superscripts are significantly (P<0.05) different from each other.

Presented in Table 2 is also the effect of the dietary treatments on the organoleptic properties of meat samples of experimental grasscutter. The results revealed that there was no significant (P>0.05) difference in all the sensory variables tested by the panellists with the exception of overall acceptability that was significantly (P<0.05) differed. Meat sample from grasscutter fed diets II (6.73) and III (6.54) respectively were highly (P<0.05) accepted while those from grasscutter fed diet I (5.72) was least (P<0.05) preferred by the taste panellist.

However, the result of the sensory variables indicated that values for flavour, tenderness, juiciness with overall acceptability were numerically highest in meat samples from grasscutter fed diet II closely followed by diet III before diet I in that ranked order. This suggests that the efficacy of processing methods in sweet potato peels detoxification and the used of moringa leaves in the experimental feeds had no negative effect on the meat quality. Nevertheless, this observation correspond with the report of Eniolorunda *et al*. (2010) who observed no significant (P>0.05) effect of feeding levels of biscuit waste meal on the sensory variables (flavour, tenderness and juiciness) except overall acceptability of the experimental rams.

The result of economic analysis of grasscutter fed experimental diets is shown in Table 3. The average feed intake of grasscutter showed significant (P<0.05) reduction of 11.06, 10.74 and 9.35g from the diets I, III and II respectively. The higher values observed in diets I and III compared with diet II could be due to the inability of the grasscutter meeting up with their nutrient requirement on time. Isikwenu *et al*. (2012) reported that poor nutrient intake increased average feed intake of animals.

Table 3: Economic Analysis of Growing Grasscutters Fed Experimental Diets

Parameter	Diets			SEM±
	I	II	III	
Average feed intake (g/day)	11.06[a]	9.35[b]	10.74[a]	0.04
Average weight gain (g)	630.00[c]	790.00[a]	700.00[b]	0.31
Feed cost/kg weight gain (₦)	987.40[a]	704.14[c]	846.71[b]	0.29
Feed cost/kg weight gain (₦)	206.09[a]	163.57[c]	189.58[b]	0.07
Production cost/grasscutter (₦)	1600.00[a]	1200.00[c]	1450.00[b]	0.82
Revenue/grasscutter (₦)	24995.00[c]	2980.00[a]	2700.00[b]	1.60
Gross margin (₦)	895.00[c]	1780.00[a]	1250.00[b]	0.98

[a, b, c] = Means along the same row with different superscripts are significantly (P<0.05) different from each other.

Average weight gain values of 630.00, 790.00 and 700.00g for diets I, II and III respectively were significantly (P<0.05) highest in grasscutter on diet II compared to those on diets I and III. This could probably be due to high utilization of the parboiled sweet potato peels in the diet. This suggestion agrees with the findings of Okereke (2012) who reported that heat treatment apply to tuber peels destroy or inactivate heat labile toxic compounds and other enzyme inhibitors present in the peels. This could probably improves the texture, palatability and nutritive value of the tuber peels. Feed cost per kilogramme grasscutter indicates that diet II (₦704.14) was cheaper feeds, while diet I (₦987.40) was the most expensive one, this could be as a result of the cost of higher consumption of feeds that were used for the fattening of grasscutter (Onyimonyi and Ugwu, 2007). Feed cost per kilogramme weight gain showed significant (P<0.05) reduction in the following rank order in diet II (₦163.57) < diet III (₦189.58) < diet I (₦206.09).This is probably due to improve feed utilization and weight gain of the grasscutter in diet II compared to diets I and III. Earlier reports (Isikwenu *et al*., 2012) have attributed that reduction of feed cost per kilogramme gain of animal enhanced feed utilization and weight gain. Diet II (₦1200.00) was better and significantly (P<0.05) lower than diets I (₦1600.00) and III (₦1450.00) in terms of production cost per grasscutter. However, the lower production cost with significant (P<0.05) higher weight gain at reduced cost in diet II was therefore an evidence of the efficiency with which the feed was utilized.

However, this is importance in the economy of livestock production. Hence, the use of cheaper feeds and reduction in variable cost of producing livestock is known to reduce the total cost of livestock production (Onyimonyi and Ugwu, 2007). The report of Olafadehan (2011) have also shown that reduction of feed cost per kilogramme gain is not only dependent on the cheaper feed but also dependent on the production result obtained with cheaper feed, precisely the higher weight gain at reduced cost. Thus, it was economic advantage to grasscutter on diet II for having the least production cost. Revenue per grasscutter and gross margin do not showed parallel trend and they were significantly (P<0.05) varied among the dietary treatments.

The lower (P<0.05) revenue per grasscutter and gross margin recorded for grasscutter raised on diet I (₦2495.00 and ₦895.00) could be due to the higher production cost per grasscutter. However, this reason for higher production cost with corresponding lower revenue and gross margin in diet I were attributed to the cost of feeds consumption and orthodox drugs such as antibiotics and anthelminth which were higher than diets II and III.

Conclusion

The present study confirms the aim of using alternative feeds in feeding of grasscutter which reduce the cost of production and benefits accruable to farmers without compromising any negative effect on the meat quality. It is therefore expected that such alternative feeds would help in making animal protein available and affordable to an average Nigerian and at the same time reducing the competition between man and animal for feeds.

The results from this study therefore show that mixture of spear grass and sweet potato peels supplemented with *Moringa oleifera* leaves enhanced meat quality and economic analysis of grasscutter. However, this was more pronounced in grasscutter on diet I compared to those on diets II and III.

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