PERFORMANCE AND PROFITABILITY OF GROWER GRASSCUTTERS FED DIETS CONTAINING CASHEW KERNEL PROCESSING WASTE

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Abstract: The study was conducted to investigate the performance and profitability of feeding growing grasscutters with diets containing graded levels of Cashew Kernel Processing Waste (CKPW). Twelve grasscutters were randomly allotted to four dietary treatments of three replicates each. Each replicate had one grasscutter with T_1 having a diet with no inclusion of cashew kernel processing nwaste and maize inclusion at 30%, while T_2 had CKPW inclusion of 10% and maize at 20%, T_3 had CKPW inclusion of 20% and maize at 10% and T_4 had CKPW inclusion of 30% and no inclusion of maize. Animals were fed and watered *ad libitum*. Performance parameters were not significantly (P>0.05) different in the daily weight gain 9.04 g (T_1) - 13.35 g (T_2), daily water intake 50.30 (T_3) – 64.51 ml (T_1) and feed conversion ratio of 4.05 (T_2) -5.48 (T_3). The profitability was analyzed for feed cost/kg, feed cost/kg gain, total cost, revenue, gross margin, cost benefits ratio, protein efficiency ratio, and energy efficiency ratio. There were no significant (P>0.05) differences in all parameters for economic yield. However, CKPW up to 10% inclusion and maize inclusion at 20% renders the production more economical. Inclusion of CKPW at 10% had a beneficial effect on performance of growing grasscutters. Optimal level of CKPW in the diets of growing grasscutters still needs to be ascertained.

Keywords: Cashew kernel, carcass characteristics, grasscutters, profitability

Introduction

Grasscutter (*Thryonomys swinderianus*)is a wild rodent measuring up to 60 cm and weighing 4 – 9 kg, with short stocky legs, found where there is dense grass especially guinea and elephant grasses. In Nigeria, it has penetrated the high forest where there is intensive cultivation of cassava, maize, sugar cane, pineapple, cocoa, coconut and oil palm etc (Arinze, 2015). Various crops of these farms supply some of the protein and other nutrient for grasscutters in the wild. In its natural environment, foraging is a critical factor in the development of the genetic potential of the wild grasscutter. Those reared in captivity on forages/grasses alone do not do well compared to those living in the wild. This is because they normally obtain balanced nutrients from a variety of feeds such as grasses/forages, tuber, grains, nuts, herbs etc in their natural habitats. The feed of grasscutter in captivity therefore must be balanced in nutrients to enable the grasscutter not only to have good health but also perform maximally in terms of growth and productivity.

Grasscutter domestication and production is another dimension in the livestock industry that has the potential to ensure regular and sustainable animal production to solve national protein deficiency problems and make good business options for individuals and the government (Adekola and Ogunsola, 2009; Owen and Dike, 2012).The meat of grasscutter fetches higher prices than meat of domestic animals. In Nigeria, the meat is highly acceptable. There is no restriction to its consumption (Martin, 1983; and Asibey, 1986). It is nutritionally superior to other bush meat because of its higher protein and greater mineral content and it contains no growth hormones unlike meat from domestic animals (Arinze, 2015). The meat is also appreciated because of its culinary properties (Ajayi, 1971; National Research Council, 1991; Anon, 1993). It is dark like the meat of wild-duck but resembles venison in flavour (National Research council, 1991). Apart from its excellent taste, like bush meat, it is nutritionally superior to some domestic meat (Table 1) because of its higher protein to fat ratio (Asibey, 1974a), and higher mineral content. The ultimate goal of animal production is to supply consumers with reasonably priced meat and meat products. But more often than not the general high cost of feed inputs in developing countries has defeated this objective. The cost of feeding has been reported to represent more than 50% of the total cost of pig production (Noblet and Perez, 1993) and that of poultry production ranging between 60 and 80% (Adesehinwa, 2007), with the energy component constituting the greatest portion. This situation is partly the result of competition between man and animals for feed ingredients, particularly energy sources such as maize leading to high prices of these ingredients at certain times of the year. The solution to the problem of escalating prices of animal products may, therefore, lie in the use of alternative feed resources that are not competed for by man and therefore cheaper (Okai and Aboagye, 1990).

Table 1: Approximate composition (%) and mineral content (Mg/100g) of grasscutter in relation to that of some domestic animal meat

Meat	Moisture	Ash	Fat	Protein	Iron	Calcium	Phosph.
Beef	73.8	1.0	6.6	19.6	5.1	3.9	57
Mutton	78.5	1.0	2.9	17.2	3.1	9.0	80
Pork	64.8	0.8	13.4	19.4	3.1	3.0	73
Grasscutter	72.3	0.9	4.2	22.7	2.8	83.0	111

Source: Asibey, 1974.

Cashew (*Anarcadium occidentale* L.) kernel processing waste also referred to as cashew nut rejects, is one of the by-products of the cashew processing industries. Cashew nut residue (full-fat cashew nut) is particularly useful in feeding monogastric animals, being a moderate source of protein and an excellent energy source because of its high fat content (Onifade *et al.,* 1999). Full-fat cashew nut reject has been utilized in broiler diets without deleterious effects (Sogunle *et al.*, 2005).

Thus, the objectives of the study were to determine the effects of CKPW on the growth performance grasscutters and to evaluate the economics of production of grasscutters fed the feed.

Materials and Methods

Experimental location

The experiment was conducted at the Teaching and Research Farm of Kogi State University, Anyigba. The study site is located on latitude 7^0 15'N and 7^0 29'N longitude 7^0 11'E and 7^0 32'E and with an average altitude of 420 metres above sea level. The area falls within tropical wet and dry climate region and the guinea savannah with average annual rainfall of 1600 mm. The daily temperature range is about 25 – 35^0C (Ifatimehin *et al.*, 2011).

Experimental design and grasscutter management

Twelve (12) growing grasscutters were purchased from Ibadan, Oyo state and were allocated in a completely randomized design (CRD) to four dietary treatments with three replicates each. Each replicate had one grasscutter. Four dietary treatments were compounded on-farm using conventional methods of mixing feed (Table 2), 200 g sugar cane tops were fed to the animals 30 min before the concentrate was given. The pens were thoroughly cleaned and disinfected before the arrival of the grasscutters. On arrival, grasscutters were weighed and housed in cages. Feed and water were offered *ad libitum.* The same quantity of water offered to the animals was always put in an empty pen every morning and measured every evening to check for evaporation of water from drinkers. An adjustment period of 1 week was given to allow the grasscutters acclimatise to the new environment. The cages, feeders and drinkers were cleaned on a daily basis. The experiment lasted for a period of 8 weeks.

Table 2: Composition of the experimental diets (%)

Ingredients	T_1	T_2	T_3	T_4
CKPW	0.00	10.00	20.00	30.00
Maize	30.00	20.00	10.00	0.00
BDG	35.00	35.00	35.00	35.00
BNW	12.00	12.00	12.00	12.00
RO	2.00	2.00	2.00	2.00
PKC	16.00	16.00	16.00	16.00
Palm Oil	3.00	3.00	3.00	3.00
Bone meal	1.00	1.00	1.00	1.00
Methionine	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Salt	0.50	0.50	0.50	0.50
Total	100	100	100	100
Energy (Kcal/kg)	2763.79	2871.45	2979.11	3086.78
Crude Protein (%)	15.43	16.32	17.20	18.09
Crude Fibre (%)	10.79	11.75	12.71	13.67

CKPW = Cashew kernel processing waste, BDG =Brewers' Dried Grain, BNW = Bambara Nut Waste, RO = Rice offal, PKC = Palm kernel cake.

Source of cashew kernel processing waste and other feed ingredients

The CKPW was obtained from Kogi State University Cashew Processing Factory, Anyigba. Cashew seeds were first cleaned to remove dirt and then separated into different sizes and soaked in water to facilitate oil roasting and shelling stages. Cashew nut shell liquid was extracted and nuts were shelled. Kernels were separated from shells, dried to facilitate peeling stage and protect them from pest and fungal attack, then peeled to remove testa. The testa mixed with broken pieces of cashew kernel is what was used for this experiment while the other feed ingredient was gotten from Anyigba, Makurdi and their environs. Proximate composition and energy value of CKPW are presented on Table 3.

Data collection

The following parameters were evaluated for performance:

Daily feed intake

Water intake = Water supplied – water left over– water evaporated

Body weight gain: the grasscutters were weighed at the beginning of the experiment. The average weekly weight of the grasscutters was taken and the amount of weight gained per week measured the growth rate.

Feed conversion ratio (FCR) = $\dfrac{total\ feed\ consumed\,(g)}{total\ weight\ gained\,(g)}$

Protein efficiency ratio (PER) = $\dfrac{total\ protein\,gain}{total\ protein}$

Energy efficiency ratio (EER) = $\dfrac{total\,body\ weight\ gain}{total\,energy}$

The following parameters were evaluated for profitability:

Feed cost/kg

Total feed cost = Total feed consumed x cost of feed per kg

Feed cost / kg gain = FCR x feed cost per kg

Total variable cost = cost of feed intake + cost of grasscutter

Revenue

Gross margin = Revenue – Total variable cost of production

Cost benefits ratio = Revenue/Total variable cost of production

Protein efficiency ratio (PER) = Total Body Weight gain/Total Protein consumed

Energy efficiency ratio (EER) = Total Body Weight gain/Total Energy consumed

Statistical analysis

Data collected was subjected to One Way Analysis of Variance (ANOVA) procedure of Statistical Analysis System (SAS, 2002). Significant means were separated using Least Significant Difference (LSD).

Results and Discussions

Proximate composition of cashew kernel processing waste

The chemical composition of cashew kernel processing waste (Table 3) observed in this study [dry matter (93.8%), crude protein (17.85%), moisture content (6.20%), ash (2.50%), crude fibre (11.60%), nfe (26.85%), ether extract (35.00%)] was quite different from that observed by Sogunle *et al.* (2005), who observed cashew nut rejects to have the following proximate composition: protein, 20.36%, ether extract, 45.49%, crude fibre, 2.10%, ash, 3.65% and nitrogen free extract, 28.40%. The variations in the proximate composition may be due to the soil conditions of the sources of the cashew kernel processing waste and also, the one used in the course of this study contained broken pieces of cashew kernel.

Table 3: Proximate composition and energy value of cashew kernel processing waste

Nutrients	(%)
Dry matter	93.8
Crude protein	17.85
Moisture content	6.20
Ash	2.50
Crude fibre	11.60
NFE	26.85
Ether extract	35.00
ME (kcal/kg)	4476.63

CKPW= Cashew kernel processing waste, NFE = Nitrogen Free Extract, ME = Metabolizable Energy (37 x %CP) + (81.8 x %EE) + (35.5 x %NFE)

Table 4: Proximate composition of experimental diets

Nutrients (%)	T_1	T_2	T_3	T_4
Moisture	7.62	7.35	9.75	8.32
Ash	6.48	7.50	8.08	8.20
CF	13.07	16.28	17.07	17.89
EE	7.52	11.05	14.30	16.12
CP	18.49	22.01	22.38	23.28
NFE	44.83	35.82	26.61	26.20
ME (kcal/kg)	2891.00	2990.00	2943.00	3110.00

Metabolizable Energy = (37x%CP) + (81.8 x %EE) + (35.5 x %NFE), CF = crude fibre, EE = ether extract, CP = crude protein, NFE = Nitrogen Free Extract

Proximate composition of experimental diets

Moisture content appeared to increase with increase in CKPW (Table 4). This may be due to the higher moisture content of CKPW than maize since CKPW replaced 33.33, 66.66 and 99.99% of maize in treatments 2, 3 and 4, respectively. Similarly, the Ash, CF, EE and CP contents of the diets increased with increase in CKPW in the diets. This could be due to the difference in nutritional composition of maize and CKPW.

Comparing the proximate composition of experimental diets with those found in literatures, the level of ether extracts in this experiment for all the treatments were far above the range of 2.5 to 4.5% recommended for adult grasscutters by Mensah (1995, 2005). The crude fibre levels of the diets in this experiment also lower than the range of 25 to 45% recommended for growing grasscutters by Mensah (1995, 2005), while the crude protein was within the range for T_1 and above the range for the other treatments recommended for adult grasscutters by the same author.

Effect of experimental diets on the performance of grasscutters

Table 5 shows the performance of growing grasscutters as affected by the experimental diets. All parameters showed no significant difference (p>0.05), however, there were variations within and between treatments for all the parameters. The range of the parameters are as follows: Initial body weight (IBW); 1016.67 g (T_1) to 1103 g (T_4), final body weight (FBW); 1333 g (T_1) to 1528.3 g (T_2), daily weight gained (DWG); 9.04 g (T_1) to 13.35 g (T_2), total weight gained (TWG); 316.33 g to 467.33 g (T_2), daily feed intake (DFI); 45.75 g (T_1) to 61.50 (T_3), total feed intake (TFI); 1601 g (T_1) to 2152.8 g (T_3), daily water intake (DWI); 50.30 ml (T_3) to 64.51 ml (T_1), total water intake (TWI); 1760.60 ml (T_3) to 2257.70 ml (T_1), feed conversion ratio (FCR); 4.05 (T_2) to 5.48 (T_3).

The average daily feed intake (45.75 – 61.51 g) was lower than the values reported by Mensah (1995) and Wogar (2012). This discrepancy could be due to difference in feed forms. The researchers fed pelleted feed while mash was fed to grasscutters in this study. Detailed comparison with literature for these parameters was not feasible due to paucity of literature on effect of CKPW on grasscutters. However, the results of no difference across dietary treatments showed that the nutritional requirements of the grasscutters were met by the treatments and the possibility of substituting or replacing maize with CKPW had no negative impact on growth performance.

Daily water intake ranged from 50.30 to 64.51 mls, while the total water intake ranged from 1760.60 to 2257.70 mls. It was not significantly affected (P>0.05) by dietary treatments. Grasscutters fed T_1 diet had numerically higher water consumption (64.5 ml/day) and was similar to grasscutter fed T_4 diet (60.17 ml/day). A similar consumption pattern was recorded for grasscutters fed T_2 diet (55.56 ml/day) and T_3 (50.30 ml/day). This can be possibly attributed to the moisture content of the diets given to the grasscutters (Table 4). This observation is consistent with that of Ward (2007) who reported that the type of feed and the moisture content of the diet given to grasscutters affect the quantity of water intake.

Table 5: Effects of experimental diets on the performance of grasscutter

Parameters	T_1 (0%CKPW)	T_2 (10%CKPW)	T_3 (20%CKPW)	T_4 (30%CKPW)	SEM	LOS
Initial Body Weight(g)	1016.67	1061.00	1045.00	1103.00	122.89	NS
Final Body Weight(g)	1333.00	1528.30	1437.70	1428.00	109.15	NS
Total Weight Gained(g)	361.33	467.33	392.67	325.00	43.11	NS
Daily Weight Gained(g)	9.04	13.35	11.22	9.29	1.23	NS
Total Feed Intake(g)	1601.22	1894.00	2152.80	1741.80	162.17	NS
Daily Feed Intake(g)	45.75	54.11	61.50	49.77	4.63	NS
Total Water Intake(ml)	2257.70	1948.00	1760.60	2106.00	258.32	NS
Daily Water Intake(ml)	64.52	55.56	50.30	60.17	7.39	NS
Feed Conversion Ratio	5.06	4.05	5.48	5.36	1.27	NS

SEM = Standard error of mean, LOS = Level of significance, NS = Non significance

Table 6: Profitability of feeding experimental diets to grasscutters

Parameters	T_1 (0%CKPW)	T_2 (10%CKPW)	T_3 (20%CKPW)	T_4 (30%CKPW)	SEM	LOS
Feed cost/kg (₦)	67.82	59.32	50.82	42.32	2.87	NS
Feed cost/kg gain(₦)	723.30	350.07	407.35	531.78	141.23	NS
Feed Conversion Ratio	5.06	4.05	5.48	5.36	1.27	NS
Total Feed Cost (₦)	108.59	112.35	109.41	73.71	10.15	NS
Total Cost(₦)	8996.00	8999.11	8996.20	8960.50	10.18	NS
Revenue (₦)	9500	9500	9500	9500	0.00	NS
Gross Margin (₦)	504.65	500.89	503.83	539.60	10.15	NS
Cost Benefit Ratio	1.05	1.06	1.06	1.06	0.001	NS
Protein Efficiency Ratio	2.05	2.91	1.55	1.20	0.37	NS
Energy Efficiency Ratio	0.01	0.01	0.01	0.01	0.002	NS

SEM = Standard error of mean, LOS = Level of significance, NS = Non significance

Profitability of feeding experimental diets to grasscutters

Feed cost/kg ranged from ₦42.32 to ₦67.82k, feed cost/kg gained ranged from ₦350.07 to ₦723.32k etc as presented on Table 6. The profitability of feeding the experimental diets to grasscutters were not significantly (P>0.05) different. T_3 had the lowest value and T_1 had the highest value for feed cost/kg. The feed cost/kg gain was lower in T_2 and highest in T_1. Highest feed cost/kg gain recorded in T_1 could be as a result of high cost of maize and the high inclusion in the diet and in T_4 might be as a result of low weight gained by the animals.

The values obtained for gross margin was lowest in T_2 and highest in T_4, the lowest gross margin recorded in T_2 could be as a result of high feed intake and low weight gained by the animals and in T_4 might be as a result of the low cost of CKPW and its high inclusion in the T_4 diet. The highest protein efficiency ratio was highest in T_2 and lowest in T_4, while the energy efficiency ratio was highest in T_3 and lowest in T_4, this could mean that the grasscutters in T_2 were more efficient in protein utilization while T_3 were more efficient in energy utilization

Conclusions

From the results of this study, performance parameters of growing grasscuters fed CKPW showed that it contained no toxic substances. They also showed that the varying levels of CKPW used had no significant effects on the performance characteristics of the growing grasscutters.

Recommendation

Subsequent studies should use pelleted feed as this may help to reduce wastage and also help to determine the actual feed intake of grasscutters.

References

Adekola AG & Ogunsola DS 2009. Determinants of productivity level of commercialgrasscutter farming in Oyo State. Proceedings of International Conference on Global Food Crisis, Owerri, Nigeria, pp. 15 - 21.

desehinwa AOK 2007. Utilization of palm kernel cake as an energy source by growing pigs:

effects on growth, serum metabolites, nutrient digestibility and cost of feed conversion. *Bulgarian J. Agric. Sci.*, 13: 593 – 600.

Ajayi SS 1971. Wildlife as a source of protein in Nigeria: Some Priorities for Development. *The Nigerian Field*, 36(3): 115-127.

Anon 1993. The grasscutter: An African Delicacy. In: *Livestock for the Landless Spore* 46: 1 - 4.

Arinze O 2015. Grasscuter: Little Known Rodent that brings Progress. Available from:

www.punchng.com/business/am-business/grasscutter-little-known-rodent-that-brings-progress/. Accessed on 29th April, 2015.

Asibey EOA 1974a. Wildlife as a source of protein in Africa South of the Sahara. *Biology*

Conservation, 6: 32-39.

Asibey EOA 1986. Wildlife and Food Security. Paper Prepared for the Forestry Department, FAO, Rome, Italy, Unpublished.

Ifatimehin OO, Musa SD & Adeyemi JO 2011. Managing land use transformation and

land surface temperature change in Anyigba Town, Kogi State Nigeria. *J. Geogr. and Geolog.*, 3: 77-85.

Martin GHG 1983. Bushmeat in Nigeria p as natural resources with environmental implications. *Environmental Conservation*, 10: 125-132.

Mensah GA 1995. Feed intake and digestibility in grasscutters. *Tropiculture*, 13: 123-124.

Mensah GA & Okeyo AM 2005. Continued Harvest of The Divers African Animal Genetic Resources from the Wild Through Domestication as a Strategy for Sustainable Use: A Case of the Larger Grasscutter (*Thryonomys swinderianus)*. International Livestock Research Institute, Nairibi, Kenya. Available from: http//agtr.ilri.cigar.org/Casestudy/Mensah/Mensah.htm Accessed on 29th April, 2015.

National research council USA 1991. Microlivestock: Little known small animals with promising economic future. National Academic Press, Washington, DC, p. 449.

Noblet J & Perez JM 1993. Prediction of digestibility of nutrients and energy values of pig diets from chemical composition. *Journal of Anim. Sci.*, 71(12): 3389-3398.

Okai DB & Aboagye J 1990. The effects of mango seed kernel meal (MSKM) on the performance of growing rats. *Biological Wastes*, 34(2): 171-175.

Onifade AA, Abu OA, Obiyan RI & Abanikannda OTF 1999. Rabbit production in Nigeria: Some aspects of current status and promotional strategies. *World Rabbit Science,* 7(2): 51-58.

Owen OJ & Dike UA 2012.Grasscutter (*Thryonomys swinderianus*) husbandry in Nigeria: A review of the potentialties, opportunities and challenges. *J. Envtal. Issues Agric. Devt. Countries*, 4(1): 104 – 111.

Sogunle OM, Fanimo AO Biobaku WO & Bamgbose AM 2005. The feeding value of full fat cashew nut (*Anacardium occidentale Linn)* rejects and low cereal diets for broiler chickens. *Nig. J. Animal Production,* 32(1): 46-53.

SAS 2002. Statistical Analysis System (SAS), Computer Software, Version 9: statistics SAS institute Inc Cary, NC 27513, USA.

Ward D 2007. Water requirements of Livestock. FACT SHEET ISSN. 1198-712x. Queens

Printer Ontario, Canada. pp.23-25.

Wogar GSI 2012. Performance of Growing Grasscutters on Different Fibre Sources. *Pak. J. Nutr.*, 11: 51-53.