International Journal of Global Affairs, Research and Development (IJGARD), Vol. 1. N0. 2, 2023, 40-49, ISSN-2992-2488

EFFECTS OF REPLACEMENT OF SUGARCANE PEEL WITH CASSAVA PEEL MEAL ON THE CARCASS AND ORGANS CHARACTERISTICS OF GRASSCUTTERS

Gboshe. P. N.
Department of Animal Science, Faculty of Agriculture and Forestry, Cross River University of Technology, Obubra Campus, Cross River State, Nigeria.

***Corresponding Author: email, petergboshe72@gmail.com**

ABSTRACT

A 90 Day feeding trial was conducted to determine the effect of replacing cassava peel meal with sugarcane peel meal in the diets of grasscutters on the carcass characteristics. Twenty growing grasscutters with an average initial weight of 556 g were used for the experiment. Four grasscutters were allotted to each treatment in a completely randomized design. Five diets were formulated to contain 100, 75, 50, 25 and 0.0% of sugarcane meal and 0.0, 25, 50, 75 and 100% of cassava peel meal. Proximate analysis were carried out on the test ingredients and experimental diets. The results of proximate analysis of the experimental diets showed that crude protein ranged from 14.25-14.45%,while the Metabolizable energy values were 2710.232805.21 kcal/kg. The result of the experiment showed that, carcass characteristics parameters evaluated differed (P < 0.05) among the treatments except the singed weight. The visceral organs measured were not significantly (P > 0.05) different. The result of this experiment showed that cassava peel meal can replace sugarcane peel meal up to 100% in the diets of grasscutters without any deleterious effect on their carcass components. However, based on this study, 25% level of cassava peel replacement, though not significantly (P>0.05) different from others, is ideal from the point of view of the carcass characteristics of the grasscutters. Based on this present study, it is however, recommended that for optimum carcass yield, CPM could be included at 25%, considering the carcass response.

Key words: Ccassava Peel Meal, Cugar cane Peel Meal, Grasscutters, Carcass Characteristics.

1.0 INTRODUCTION

It has been observed that an average Nigerian cannot meet the minimum animal protein requirements despite the diversity in the consumption of the country's animal species. The importance of adequate protein intake (in terms of quality and quantity) in the nutrition of man cannot be over emphasized particularly in these globally challenging times. There is need, therefore, to attempt to bridge this animal protein gap for Nigerians to attain the FAO recommended daily animal protein intake of 35 g as well as attempt to reduce the under-five deaths commonly experienced by the provision of animal protein knowing its functions in the health status of the individual (Idufeko, 1984; Igben, 2000). This animal protein source should not only be available but affordable to the populace since poverty is not only tied to mal-nutrition but also to under-nutrition. In attempting to address this situation, therefore, we must think of animals from the wild with acceptable potentials, tractable and prolific and one of such animal is the grasscutter, a micro-livestock (Mbah, 1989). The urgent need to encourage

micro or mini-livestock (grasscutter) as a strategy for food security is important since micro or mini-livestock animals means a small amount of input per unit, which in turn means more flexible production. Grasscutter production provides an opportunity for supplementing animal protein and income to Nigerians. The grasscutter can be reared with minimal capital outlay and land. It is less affected by disease, devoid of noise and its food requirements are low in captivity. It can, therefore, serve as a considerable income earner for the small scale urban and rural mini-livestock producers. Grasscutter is desirable for domestication because of its excellent taste, acceptability, comparatively high nutritional value and meat yield than most species of livestock (Ntiamoah-Baidu, 1998). Asibey (1974) have earlier on reported that grasscutter meat has a protein content of 24.7%, and a low fat content of 1.2% which makes it better than beef with a protein content of 19.6% and fat content of 6.6% and pork with a protein content of 19.4% and fat content of 13.4%.

Since Grasscutters have the potentials of reducing the wide animal protein demand gap and its production is becoming more popular in some part of Africa, the cost of production is also being affected like monogastric animals. This problem seems to be compounded by the fact that, we cannot afford to economically feed whole grains and tubers to animals in this country because of cost and the high demand by man for these produce.The lack of improvement in crop production and the competition between humans and animals for available grains and tubers make nutritional requirement at reasonable cost difficult to achieve, since a viable livestock industry is dependent on agro-products. Consequently, as animals are unable to meet both their protein and energy requirements, there is not only marked weight loss, lowered disease resistance, death and also seasonal anoestrus, reduced fertility but also slow growth rate (Osori 1996). Given the above scenario, the challenge is to search for inexpensive, readily available and nutritionally adequate feed materials especially those that are not in direct use by humans (Oyenuga 1999).

Some of the possible sources of cheap and available ingredients include the cassava peel meal (CPM) and the sugarcane peel meal (SPM). CPM is a cheap and readily available by-product of cassava processing, which contains 5% crude protein, 5.8% fat, 9.5% crude fibre, 7.2% ash and 2036Kcal/kg Metabolizable energy (Aduku 1993). While SPM is one of such usable by-product crop residue used as ruminant feed because of its nutritional components (Ademosun 1994). Sa'adullah (1984) reported that ruminants responded positively when fed diets based on crop residues and sugar-rich agro industrial by-products supplemented with small quantities of by-pass protein. Sugarcane peel is available in abundance during the dry season in the study area and in the sugarcane farming areas in Nigeria and the use of sugarcane peels as feedstuff will help in reducing the problem of feed shortage in Nigeria and reduce environmental pollution. According to Ayoade*et al.* (2007) exploitation of cheap feed resources for animal production would lower the market price of animals and their products in Nigeria. Since Grasscutters have the potentials of reducing the wide animal protein demand gap their production is becoming more popular in some part of Africa, and there is need to improve on their level of feeding both qualitatively and quantitatively to meet their nutrients requirement to enable them exhibit their potentials. Therefore, there is need for Animal Nutritionists to work towards the utilization of alternative cheap feed sources for the feeding of grasscutters. The findings will provide the baseline information for safe and effective usage of cassava peel meal and sugar cane peel meal needed by grasscutter researchers, Managers and Farmers. It was, therefore, the aim of the study to evaluate the performance in terms of carcass characteristics of Grasscutters

fed sugarcane peel meal partially replaced by cassava peel meal.

2.0 MATERIALS AND METHODS

2.1 Experimental Location

The study was carried out at a privately owned Standard Grasscutter Farm in Obubra, approved for research by the Department of Animal Science, Faculty of Agriculture and Forestry, Cross River University of Technology, Obubra Campus. Obubra has a latitude 6^0 5'8.47"$_N$ and longitude 8^0. 19'40.83"^0_E of the equator (GPS Coordinates of Obubra), with a warm weather and ambient temperature of about 21 – 30^0c and an annual rainfall of 500 – 1070 mm (Google Map).

2.2 Experimental Animals and Design

A total of Twenty (20) weaned grasscutters aged, 2 months obtained from a local farmer in Imo state, Nigeria were used for the feeding trials. The grasscutters were put into groups of similar body weights and were randomly assigned to five dietary treatments in a Completely Randomized Design. There were four replicates in each treatment with an animal serving as a replicate. The animals were given their respective formulated concentrate feed and water *ad libitum* throughout the period of the experiment.

2.3 Collection of experimental ingredients and processing:

The experimental ingredients, cassava peels (CP) and sugarcane peels (SCP)were sourced within the premises of the campus's environs. These ingredients were sun dried intensively on a concrete slap separately for a period of 3 days and finally SCP were milled with a forage chopping machine while the CP were roughly milled using a hammer mill to produce the peel meals that were used in their various levels in the experimental diets and samples sent for proximate analysis (AOAC, 2010). Based on the results of the chemical analysis, five diets were formulated to contain 100, 75, 50, 25 and 0.0% of sugarcane meal and 0.0, 25, 50, 75 and 10 0% of cassava peel meal

Table 1. **Composition of the experimental diets and calculated nutrients**

	Dietary levels of the peel meals, %				
Ingredients %	**T1**	**T2**	**T3**	**T4**	**T5**
	100 SPM	**75 SPM**	**50 SPM**	**25 SPM**	**0.0 SPM**
	0.0 CPM	**25 CPM**	**50 CPM**	**75 CPM**	**100 CPM**
Sugarcane peel meal	30.00	22.5	15.00	7.5	0.00
Cassava peel meal	0.00	7.5	15.0	22.5	30.00
Maize	10.55	10.55	10.55	10.55	10.55
Maize offal	20.00	20.00	20.00	20.00	20.00
Full-fat-soya bean	15.00	15.00	15.00	15.00	15.00
Palm kernel cake	20.00	20.00	20.00	20.00	20.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Common Salt	1.00	1.00	1.00	1.00	1.00
Vit-min-premix+	0.25	0.25	0.25	0.25	0.25
Methionine	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
	Calculated nutrients				
Crude protein%	14.35	14.36	14.36	14.38	14.38
Crude Fibre %	13.72	12.60	11.48	10.35	9.23
ME(Kcal/kg	2,650.02	2,691.09	2,732.16	2,773.22	2,814.29

CPM: Cassava Peel Meal, SPM= Sugarcane peel meal, ME/kcal/kg: calculated from Pauzenga equation (1985) ME= (37 X %CP)+(81 X %EE)+(35 X %NFE) NFE: Nitrogen Free Extract,

2.4 Experimental Procedure

At the commencement of the experiment, all the animals were provided with antistress (Vitalyte) agents 2 g each. They were also dewormed and given cocciodiostat using piperazine citrate and proccox, respectively. The experimental diets and water were served *ad libitum*. The grasscutters were individually weighed using Camry top loading weighing scale, grouped into five in such a way as to ensure uniformity of initial body weights in all the groups and allotted to different treatments in agreement with the design of the study.

2.5 Data collection:

2.5.1 Carcass evaluation

At the end of the feeding trial, three grasscutters per treatment, with live weights which approximate their treatment mean live weight, were selected for slaughter and their carcasses were evaluated. The grasscutters were starved for 18 hours before slaughter to reduce the volume of the gut contents and therefore reduce the risk of contamination of the carcasses during dressing. Each grasscutter was weighed and then slaughtered by cutting transversely across the trachea, oesophagus, large carotid arteries and jugular veins with a sharp knife and allowing the grasscutters to bleed to death under gravity. The carcasses were eviscerated and singed and weighed. The visceral organs which includes; the heart, lung, kidney, liver, pancreas, intestines and spleen were carefully removed and weighed using an electronic balance. The visceral organs weight was expressed as percentage of the live weight. The length of the carcasses was also measured.

2.6 Statistical analysis:

All data obtained were subjected to one way Analysis of variance (ANOVA) using mini-tab statistical software. Where significant differences occurred, means were separated using Fisher's least significant difference (LSD) as contained in the statistical package.

3.0 RESULTS AND DISCUSSION

3.1 Carcass characteristic of grasscutters fed sugarcane peel meal replaced by cassava peel meal expressed as percentage live-weight:

The results of grasscutters fed sugarcane peel meal replaced by cassava peel meal expressed as percentage live-weight is presented in Table 2.

The slaughter weight of the grasscutters used for the study ranged from 1452-1760 g while the slaughter % of the carcass evaluated ranged from 96.31-98.17%. Grasscutters fed 50 % cassava replacement T_3 had the highest percent though this did not differ significantly ($P>0.05$) among other treatments and the lowest value was on animals with 0% replacement. This did not follow any definite order, making it difficult to be attributed to the various levels of replacement with the cassava peel meal (CPM) of the sugar cane peel meal (SCPM).

All the parameters measured in this carcass characteristics were significantly ($P<0.05$) different among the feeding trial except singed % and bled % and it was also observed that, all the values recorded did not follow any particular order so as to be attributed to the various levels of the replacement of SPM with the CPM. Different researchers have reported different experimental eff3.0 ects on carcass characteristics of grasscutters. For instance, in a feeding trial by Karikari and Nyameasem (2009) to assess the effect of feeding grasscutters concentrate diet containing varying levels of guinea grass, these authors reported significant ($p<0.05$) differences in carcass characteristics of

grasscutters. Gboshe *et al*. (2019) also reported significant ($p<0.05$) differences in carcass characteristics of grasscutters.

The dressing percentage obtained in this study were higher than reported values of 54% (Jori*et al*., 1995), 50.41 -55.26%, (Annor*et al.,* 2008) and less than 88.33- 89.07% (Henry *et al.*, 2012), 71.80 -82.30% (Henry and Njume 2008) for grasscutters but are comparable to the range of 65 to 80% (Fayenuwo*et al.,* 2003) and similar to 55.00 - 60.30% (Karikari&Nyameasem, 2009). These dressing percentages for grasscutters compared favourably with those of rabbits, cockerel and broilers with dressing percentage ranging from 60 to 77% (Ajayi and Tewe 1983; Martin 1985; Olomu*et al.,* 2003, and Hon *et al.,* 2009). This variation of the dressing percentage would have been influenced by several factors some of which included; amount of gut fill, slaughter weight, degree of muscling, slaughter age, degree of fatness, what the researcher considers as a carcass and nutrition of the animal (Gillespie 1988 and Kebede*et al*., 2008). Even Osei and Twumasi (1989) reported that poor tissue deposition resulting from poorly digested feed could also affect carcass characteristics of an animal as well as its dressing percentage.

The bled weight expressed as percentage of live weight in all treatments was not significantly ($P<0.05$) affected. It ranged from 93.44-95.88% with the highest on animals fed 75% replacement of CPM. The bled weight is a measure of the weight of the animal after bleeding. Signed weight of the grasscutters on 0.0% replacement diet (74.29%) was the highest though significantly did not differ ($p.>0.05$) among treatments, which is an indication that grasscutters in all treatments had similar fur on their skin. The visceral fat weight 0.87- 3.01% was significant ($P<0.05$) and similar to Olomu*et al.* (2003) value range of 1.8-2.6%. The highest level was in those fed 50% replacement. The high fat weights recorded in those treatments can be attributed to the fact that, the grasscutters had consumed enough energy hence, there was a conversion of excess after meeting the dietary requirement into fat, which is stored around the visceral and some major organs in the body. The abdominal fat weight was also affected by the feeding trial. The highest value 0.82% expressed as percentage live weight though did not differ ($P>0.05$) to that of T_4 and T_3. The highest values shows that more energy was available for consumption and the lowest of 0.35% in those replaced with 100% of CPM. The carcass length in this study 28.50-46.00 cm fell within the range recorded by Olomu*et al.,* (2003) which is 20-75 cm (from head to the end of the tail) and Gboshe *et al.* (2019) 28.-45 cm. This did not differ ($P>0.05$) significantly among the treatments implying that there was a similar skeletal development of the growing grasscutters as they were growing to maturity. It also shows that bones develop earlier than other tissues thus the grasscutters usually have similar carcass length irrespective of the differences in their live weights. The highest carcass length 46 cm was recorded in T_4 and the lowest 28.50 cm was in T_1 which was significant ($P<0.05$) and actually shows that the feeding regime had influenced the carcass length of the grasscutters.

Table 2: Effect of sugarcane peel meal replaced by cassava peel meal on the Carcass characteristic of grasscutters (expressed as percent of live weight)

Carcass Indices	T1 100% SPM 0% CPM	T2 75% SPM 25% CPM	T3 50% SPM 50% CPM	T4 25% SPM 75% CPM	T5 0% SPM 100% CPM	SEM
Slaughtered (%)	98.00	98.17	97.50	96.31	97.42	0.30
Bled (%)	95. 50^{a}	95. 88^{a}	94. 82^{ab}	93. 44^{b}	95. 55^{a}	0.38
Eviscerated (%)	73. 40^{b}	72. 97^{b}	78. 99^{ab}	75. 21^{ab}	84. 93^{a}	6.47
Singed (%)	66.98	71.17	73.40	69.88	74.29	1.31
Dressing percent. (%)	59. 98^{ab}	59. 68^{ab}	67. 24^{a}	55. 04^{b}	62. 36^{a}	1.37
Visceral fat (%)	0. 87^{c}	1. 91^{b}	3. 01^{a}	2. 19^{ab}	2. 98^{a}	0.28
Abdominal fat (%)	0. 65^{c}	0. 35^{bc}	0. 57^{ab}	0. 61^{ab}	0. 82^{a}	0.09
Carcass Length (cm)	28. 50^{c}	31. 50^{bc}	44. 00^{ab}	46. 00^{a}	45. 50^{a}	3.59

a, b, c; means within rows with similar superscripts are not significantly different (p>0.05), SEM= Standard Error of mean, SCPM= Sugarcane peel meal, CPM=Cassava peel meal

3.2 Effect of sugarcane peel meal replaced by cassava peel meal on the visceral organ weights of grasscutters:

The results of grasscutters fed sugarcane peel meal replaced by cassava peel meal on the visceral organ weightsis presented in Table 3.The weights of all the visceral organs evaluated in this study; liver, paired kidney, lung, heart, spleen, pancreas, spleen and gall bladders expressed as percentages of live body weight were not significantly (P>0.05) different.

The weight of the liver obtained in this study, 2.13-2.60% is higher than 1.19-1.63% reported by Gboshe (2022), 1.42-1.47% (Henry *et al.*, 2012) and 1.7-1.8% (Olomu*et al.,* 2003). The differences could be attributed to the residual effect of cyanide in the cassava peel since the liver is known as the organ that accumulates anti-nutritional factors in the system thereby getting it enlarged. It may also be attributed to the age and sizes of the animals slaughtered. The paired kidney weights 0.55-0.64% and was higher than 0.25-0.34% reported by Gboshe (2022), 0.28%-0.33% (Olomu*et al.,* 2003) and 0.38-0.49% (Henry *et al.,* 2012). The values of weight of the lungs 0.43-0.50% is less than 0.52 to 0.87% (Gboshe 2022), 0.56-0.69% (Henry *et al*., 2012) and 0.62 to 0.67% (Olomu*et al.*, 2003). The heart weights recorded in the study 0.210.24% is less than 0.39% - 0.48% reported by Gboshe (2022), 0.44-0.501% (Olomu*et al.*, 2003), and 0.56 to 0.67% (Henry *et al.,* 2012).

The Pancreas weight which ranged in this study from 0.06-0.13% is higher than 0.03-0.05% reported by Gboshe (2022). The spleen weights 0.05-0.07% recorded here is less than 0.08-0.155% reported by Gboshe (2022) and 0.27-0.34% (Olomu*et al.,*

2003). The weight of the gall bladder obtained, 0.04-0.08%, is similar to 0.04-0.07% reported by Gboshe (2022). These results implies that none of the visceral organs in the experimental grasscutters, were damaged by the feeding regimes since most organs were comparable to other researchers' findings and some, the feeding trail did not have effect on them negatively by enlargement . It is known that these organs help to ascertain the health status of farm animals. It was observed in this study that, this feeding trial up to the replacement of 100% SPM with CPM did not compromise the health status of the grasscutters. There was no record of loss of any grasscutters in any treatment neither was there any sign of distress among the grasscutters.

Table 3: Effect of sugarcane peel meal replaced by cassava peel meal on the visceral organs weight expressed as percentage live weight (%LW)

Visceral organs Indices	T1 100% SPM 0% CPM	T2 75%SPM 25%CPM	T3 50%SPM 50% CPM	T4 25%SPM 75%CPM	T5 0%SPM 100%CPM	SEM
Liver	2.60	2.40	2.40	2.49	2.13	0.06
Paired Kidney	0.56	0.55	0.59	0.64	0.56	0.02
Lungs	0.50	0.44	0.43	0.44	0.50	0,09
Heart	0.21	0.22	0.24	0.23	0.21	0.01
Pancreas	0.13	0.12	0.09	0.08	0.06	0.01
Spleen	0.07	0.05	0.05	0.06	0.06	0.00
Gall bladder	0.08	0.05	0.04	0.05	0.08	0.01

CPM=Cassava peel meal, SCPM= Sugarcane peel meal, SEM= Standard Error of mean

3.3 Effect of sugarcane peel meal replaced by cassava peel meal on the length of GIT and its components as percent (%) of GIT length of grasscutters:

The results of grasscutters fed sugarcane peel meal replaced by cassava peel meal on the length of GIT and its components as percent (%) of GIT length of grasscutters is presented in Table 4. The average length of the gastrointestinal tract (GIT) of the grasscutter in this study varied from 408.33 to 457.00 cm and did not differ significantly ($p>0.05$). The longest length was on the grasscutters fed 100% replacement of sugarcane peel meal (SPM) with cassava peel meal while the shortest was on those replaced with 50% CPM.

The average length of the gastrointestinal tract (GIT) of the grasscutter in this study varied from 408.33 to 457.00 cm and it was not significantly ($P>0.05$) different. The longest length was on the grasscutters fed 100% replacement of Sugarcane peel meal (SPM) with Cassava peel meal (CPM) while the shortest was on those replaced with 50% CPM. The length was longer than 343.1 cm (Olomu*, et al.,* 2003) but slightly

similar to 335.00-411.00 cm reported by Gboshe (2022). The measurements of each of the GIT constituents namely, small intestine, colon/rectum and caecum were not significantly (P>0.05) different among the treatments. The morphometric percentage value of the small intestine ranged from 63.07-64.00% with the highest on animals fed 100% replacement with CPM. It was slightly higher than 44.71-50.21% reported by Gboshe (2022) and 50-52.6% (Olomu*, et al.,* 2003) Caecum ranged from 9.22-9.89% with the highest from those replaced with 75% CPM and lowest with the grasscutters fed 0% replacement. It was similar to the upper value range of 4.39-9.57% reported by Gboshe (2022) but less than 5.5-7.8% reported by Olomu*, et al.* (2003). Colon/rectum ranged from 25.79-27.53% with the highest in 50% replacement and lowest in 75% replacement with CPM, when compared with the Colon/rectum 33-38.4% and 33.6240.40% recorded by Olomu*, et al.* (2003) and Gboshe (2022) respectively. They were also higher than the values recorded by Byanet*et al.* (2008) apart from the caecum length (19-22%) which was similar to 8-17% recorded by them when they studied the macroscopic structure of the grasscutter gastrointestinal tract. It was however, observed that, the morphometric indices recorded in this study did not present a definite picture of the extent to which the feeding trial affected this organ based on the different levels of replacement of SPM with CPM. These findings generally suggested that the feeding trial had no significant effect (P>0.05) on the morphometric traits of the grasscutter GIT.

Table 4: Effect of sugarcane peel meal replaced by cassava peel meal on the length of GIT and its components as percent (%) of GIT length of grasscutters

Gastro-Intestinal tracts parts Indices	**T1 100% SPM 0% CPM**	**T2 75% SPM 25% CPM**	**T3 50% SPM 50% CPM**	**T4 25% SPM 75% CPM**	**T5 0% SPM 100% CPM**	SEM
Full GIT (cm)	456.00	442.00	408.33	425.00	457.00	9.17
Small Intestine (%GIT)	63.30	63.95	63.07	64.32	64.50	0.32
Caecum (%GIT)	9.22	9.50	9.40	9.89	9.44	0.15
Colon/Rectum (%GIT)	27.49	26.61	27.53	25.79	27.10	0.36

SEM= Standard Error of mean, GIT= Gastrointestinal tract, SPM= Sugarcane peel meal, CPM=Cassava peel meal

4.0 CONCLUSION AND RECOMMENDATION

4.1 Conclusion

The results of this experiment showed that cassava peel meal can replace sugarcane peel meal up to 100% in the diets of grasscutter without any deleterious effect on the carcass characteristics of the grasscutters. Though, the best level of replacement based on dressing percentage was 50%, though it did not differ significantly (P>0.0) from replacement levels except 75%.

4.2 Recommendations

Based on this present study, it is however, recommended that for optimum carcass yield, CPM could be included at 50%, considering the carcass response.

REFERENCES

Ajayi, S. S, Tewe, O. O. (1983). A quantitative assessment of wildlife and their nutritive Value as a source of food in Nigeria; In :Akinyele, I. and Atome, T. Nutrition and Food Policy in Nigeria (pp. 138-148). Ibadan, Nigeria; National Institute for policy and Strategic studies (NIPSS).

Ademosun, A. A. (1994). Constraint and prospects of small ruminant research and development in Africa. CTA Publication series S.H.B and E.K.Irugun (Eds). Book of proceeding of Int. Cont. of the Africa Sm. Rum. Res. Network, Tanzannia, 266p.

Aduku, A.O. (1993). Tropical Feedstuffs Analysis Table, A.B.U Zaria, Pages: 4.

Annor, S. Y., Kagya-Agyemang, J.K., Abbam, J.E.Y., Oppon, and Agoe, S.K. (2009). Growthperformance of grasscutter (*Thryonomysswinderianus*) eating leaf and stem fractions of Guinea grass (*Panicum maximum*)*Livestock Research for Rural Development* 20 (8) 2008 *sayannor@yahoo.com*

AOAC (2010). Official Methods of Analysis (15th edn). Association of Official Agricultural
Chemists, Arlington Virginia, USA, pp. 807-809

Asibey, E.O.A. (1974). Wildlife as a source of protein in Africa South of the Sahara. Biological Conservation, 6(1): 32-399.

Ayoade, J. A., Carew, S. N., and Ameh, A. E. (2007). The feeding of sugar scrapping meal for weaner rabbits; Growth, meat yield and cost of production; Proceedings of the 3rd annual conference of the Nigerian Society for Animal Production, University of Calabar March 1821, 2007, Pp. 227-299.

Byanet, O., Adamu, S., Salami, S.O. and Obadiah, H. L. (2008). Haematological and plasma Biochemical parameters of the young grass cutter (*Thyronomysswinderianus*) northern Nigeria .*Journal of cell and Animal Biology vol. 2 (10). Pp, 177-181*

Fayenuwo, J. O., Akande, M., Taiwo, A. A., Adebayo, A. O., Saka, J. O., Lawal, B. and Oyekan, P. O. (2003). Guidelines for grass cutter Rearing. Technical Bulletin. Institute of Agricultural Research and Training, ObafemiAwolowo University, Ibadan, Nigeria

Gboshe, N. P. (2022). The Effects of concentrate feed supplementation on the visceral organs weights of grasscutters fed Elephant Grass as basal feed. In;
Proceedings of the 47th annual conference of the Nigerian Society for Animal Production, University of Joe, March 18-21, 2022, Pp. 1873-1876.

Gboshe, N. P. (2022). The study of gastrointestinal tract and the visceral organs of grasscutters fed Elephant as basal feed with concentrate feed supplementation regimes. *Unicross Journal of Science and Technology*, UJOST. 162-171.

Gboshe P. N., Enaku, O.O. and Shaahu, D. T. (2019). Effect of graded levels of maize cob meal as replacement for dietary maize on the carcass characteristics of growing rabbits *Nigerian J. Anim. Sci., 21 (1) 204-213.*

Gillespie, J. R. (1988).*Animal Science*. Albang; Delmar Publishers. Pp 67

Henry, A. J., Ibe, S. N. and Asuquo, B. O. (2012). Effect of weaning Age on the Growth and Slaughter Characteristics of Grass cutters (*Thryonomysswinderianus*) Raised under Intensive Management in the Humid Tropics. *Journal of Agricultural Science* Vol. 4, No.12; 2012.

Henry, A. J. and Njume, G. N. (2009). Effect of varied energy levels on the carcass characteristic of grasscutters (*Thyonomysswinderianus*). Proc. 33rd Ann. Conf. of Nig. Soc. Anim. Prod. Pp. 168-170, Ogun State.

Hon, M. F., Oruremi, I. O. A. and Anugwa, F. O. I. (2009). The effect of dried sweets orange

(*Citrus sinensis*) fruit pulp meal on the growth performance of rabbits. *Pakistan Journal of Nutrition 8(8):* 1150-1155.

Idufeko, A. (1984). Sufficiency in Animal Production Supply under Changing Economic Fortunes,

Nigerian Journal of Animal Production, 1 (1), 14-21

Igben, M. S. (2000). Livestock Production in a Depressed Economy; required adjustment, Proc. of the 5th Ann. Conf. of Animal. Science. Association of Nigeria. (Pp 195-197) Port Harcourt, Nigeria.

Jori, F., Mensah, G. A. and Adjanohoun, E. (1995). Grasscutter production. A model of Rational

Exploitation of Wildlife. Biodiversity Conservation 4:257-265

Karikari, P. K. and Nyameasem, J. K. (2009). Productive performance and carcass characteristics of captive grasscutters (*Thryonomysswinderianus*) fed concentrate diets containing various

levels of guinea grass. *World Applied Science Journal, 6*(4), 337-363.

Kebede, T., Lemma, T., Dinka, H., Guru, M. and Sisay, A. (2008). Growth performance and carcass characteristics of Arsi-Bale goats castrated at different ages. *World Applied Science Journal, 4(4), 545-533*

Martin, G. H. G. (1985). West Africa; carcass composition and palatability of some animals commonly used as food. World Animal Review, 53: 40-44.

Mbah, L. A. K. (1989). The influence of season and age on the nutritive value of elephant Grass

(*Pennisetumpurpureum*) fed to the cane rat (Thyronomisswinderianus). MSc. Dissertation, University of Ibadan, Nigeria.

Mini-tab statistical package (1991), version 16

Ntiamo-Baidu, Y. (1998). Sustainable use of bush meat. Wildlife Development Plan (1998-2003)

Wildlife Department Accra, 6: 78-79.th Prod., 26: 239-240

Olomu, J. M., Ezieshi, V. E., Orheruata, A. M. (2003). *Grasscutter Production: Principles and Practice*. A Jachem Publication, Benin, Nigeria. Pp 61.

Onyeanusi, A. E., Akinola, O. O. and Babadoye, A. O. (2008). Performance of grasscutter

(*Thryonomysswinderianus*) fed Varying Levels of Dietary Protein. *Journal of Innovation and Development Strategy,* 2(3): 1-4.

Osei, J. A. and Twumasi, I.k. (1989). Effects of oven-dried cassava peel on the performance and

Carcass characteristics of broiler chickens. Animal Feed Science Technology, 24,247-252.

Pauzenga, U. (1985). Feeding parent-stock. Zootecncia International, December 1985, pp.: 22-24.

Sa'adullah, M. (1984). Studies on utilization of rice straw by Cattle, Ph.D Thesis, Royal Veterinary University, Copenhagen