



Original Research Article

Nutrient content and palatability of captive bred and wild grasscutter meat

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There are claims of differences in palatability between captive bred and wild grasscutter meat. This study compared nutrient, mineral composition, and palatability of captive bred versus wild grasscutter meat. Eight young captive grasscutters were compared with six wild grasscutters. The animals were weighed, slaughtered, roasted on open fire, washed with water and sectioned. The heart, neck, chest, hip, shoulder, and stomach region were used for determination of proximate composition, while leftover carcasses were used for palatability test. Proximate and statistical analysis revealed that slaughter weight of captive and wild grasscutters was similar ($P > 0.05$). The crude protein, calcium, phosphorus and iron content were significantly higher ($P < 0.05$) in wild grasscutter meat while fat and moisture content were significantly higher ($P < 0.05$) in captive grasscutter meat. Wild grasscutter meat was also more palatable than that of the captive one owing to variations in protein, fat, moisture content and organoleptic properties. Therefore, feeding of captive grasscutters should be improved to compensate for nutrient deficiencies. Late weaning should be encouraged to enable young grasscutters acquire enough calcium and phosphorus from breast milk, and semi-intensive method of housing should be adopted to promote exercise, which could reduce fat in captive grasscutters.

Keywords: Nutrient content, palatability, captive bred, wild, grasscutter meat.

INTRODUCTION

Domestication of wild animals for meat production, improved protein supply and to prevent wildlife extinction in Africa dates back to 1848 (Surujally, 1987 cited in Ogunjobi, 2013). South Africa commenced this practice with the domestication of Elands and Buffalos but recorded huge success with the complete domestication of ostriches and camels, which are indigenous to Africa (Karikari and Nyameasem, 2009). There has also been large-scale domestication of crocodiles and other wild reptiles under semi-in situ conditions where the confined animals have limited access to their natural environment (Addo, 2002).

The popularity of wild animal domestication in the West African Sub-region is due to the importance of bush meat as part of the staple diet. Conservationists recommend domestication of some wild animal species in high demand

as bushmeat to reduce pressure on the wild population (African Center for Economic Transformation (ACET) (2014). According to ACET (2014), some of the wild animal species with domestication potentials in the West African Sub-region included the grasscutter (*Thryonomys swinderianus*), giant rat (*Cricetomys gambianus*), squirrel (*Anomalurus derbianus*), duikers (*Cephalophus monticola*) guinea fowl (*Numidameleagris*), porcupine (*Hystrix cristata*) and African giant snail (*Achatina achatina* and *Archachatina marginata*).

In Nigeria and other developing countries, there are major concerns of animal protein deficiency in daily diets (Ekenyem and Madubuike, 2006). Thus, meat from domesticated grasscutter serves as an alternative source of protein and many individuals, families and groups

widely embrace rearing of grasscutter (Casal, 2001).

Grasscutter domestication has high capabilities and potentials for bridging the animal protein gap and reducing pressure on wild population, which is threatened by excessive hunting and destruction of their wild habitat due to deforestation, forest degradation and habitat fragmentation. According to Poku et al. (2013) and Annor and Djang-Fordjour (2006), grasscutter domestication has been deterred by lack of improved breeding stock, inadequate technical know-how, poor management practices which result in high mortality rates and low productivity. Thus, consumers of grasscutter meat often complain that meat from domesticated grasscutter is not as palatable as meat from their wild counterparts. There was, therefore, a need to find out the deficiency, if any, in the domesticated grasscutter meat in order to improve upon the palatability of the meat.

The broad objective of this study was to compare the nutritive content and palatability of captive bred and wild grasscutter while the specific objectives were to determine the proximate and mineral content of captive and wild grasscutter meat and compare their palatability. These assessments will aid improvements in management strategies of captive bred grasscutters with an overarching improvement in nutrient content and palatability of the grasscutter meat.

MATERIALS AND METHODS

Location of the study

The study was carried out in the grasscutter research farm of the Department of Forestry and Wildlife Resources Management, University of Calabar, Calabar, Nigeria. The study area lies between latitude 4°93'08" and 4°93'10" North and longitude 8°33'81" and 8°33'92" East. The area is characterized by tropical rainforest climate with heavy annual rainfall ranging from 3,000 mm to 30,000 mm, relative humidity of 57.93%, and temperature ranging from 26°C in the dry season which lasts from November to February and 24 °C in the rainy season, which lasts from March to October (Wogar, 2013). The vegetation surrounding the study area consists mainly of swampy shrubs and grasses like elephant grass (*Pennisetumpurposeum*), water lettuce (*Pistiastratiotes*), water lilies (*Nymphaeanouchali*) and shrubs.

Source of experimental animals

Eight young domesticated grasscutters (either sex) three months old were purchased from a grasscutter farm and bred for eight months. Six adult wild grasscutters were purchased from a hunter at a local Market in Akpabuyo, Local Government Area of Cross River State, who used trenches and cannabis leaves to capture the animals alive

without injuring them. These were the wild grasscutter population used for comparison with the captive population.

Experimental design

Six captive grasscutters were randomly allotted to one cage each as Treatment One (T₁) using Completely Randomized Design (CRD) and reared for eight months. Six adult wild grasscutters were randomly purchased from a hunter that caught them alive and were tagged treatment two (T₂).

Management of domesticated population

The grasscutters were housed in concrete and wire mesh cages with dimension 0.75 × 0.38 × 0.40 m (L × W × H). The cages were designed with two compartments that had openings on the demarcating walls inside the cages to aid cleaning, feeding and provide security for the animals. These cages were placed in a cement walled house, roofed with zinc and asbestos ceiling to protect the animals from harsh climatic conditions.

The animals were fed with equal rations of feed materials such as wheat offal, yellow corn, leaves and stalk of elephant grass as recommended by Ogogo (2008). The wheat offal and yellow corn was served in feeding troughs while the leaves and succulent stem of elephant grass was served on the floor of the cages.

The animal cages were cleaned daily to ensure that the cages were hygienic and prevent diseases. Daily observation of the animals was done for the possible occurrence of diseases and sickness.

Data collection

Data on weight of the animals were collected with the aid of a spring balance. Weekly body weights of the captive grasscutters were collected for eight months. At the end of the experiment, the captive animals were palpated to rule out pregnancy. Six captive and six wild grasscutters were randomly selected for proximate and mineral analysis, and palatability test. The animals were then slaughtered, roasted on open fire, washed with water and butchered.

Data for the proximate analysis to determine organic nutrients and mineral analysis were obtained from the neck region, hearth, chest, hip, shoulder, and stomach region weighing 2 g each. These were collected from both the captive and wild grasscutters making a total of 12 samples.

Data for the palatability test were generated from the carcasses (meat) of captive and wild roasted grasscutters. The chest and arm region of the carcasses of captive and wild grasscutters were separately cut into 24 pieces (12 captives and 12 wild) weighing 500 g each. The sample was cooked in one litre of water for 30 minutes and afterwards allowed to cool. The captive grasscutter meat, labelled A, and the wild grasscutter meat, labeled B, were then served

Table 1. Final body weight of captive and wild grasscutters (kg)

	Treatments ¹		P-value ²
	T ₁ (Captive grasscutters)	T ₂ (Wild grasscutters)	
	3.40	3.30	
	3.00	3.20	
	2.80	2.90	
	2.60	2.80	
	2.80	3.50	
	3.10	3.10	
Total:	17.70	18.70	
Mean ± SEM:	2.95±0.12	3.12±0.11	0.315

Treatment means were not significantly different ($P > 0.05$) by unpaired Student's *t*-test

Table 2. Proximate nutrient composition of captive and wild grasscutter (%)

Trait	Treatment ¹		P-value ²
	T ₁ (Captive grasscutter meat)	T ₂ (Wild grasscutter meat)	
CP	20.602 ± 0.303 ^a	25.145 ± 0.420 ^{****}	0.0001
EE	1.402 ± 0.147 ^a	0.977 ± 0.064 ^{**}	0.0242
CF	0.163 ± 0.022 ^a	0.315 ± 0.164 ^{ns}	0.3799
Ash	0.903 ± 0.196 ^a	1.010 ± 0.085 ^{ns}	0.6290
NFE	2.393 ± 0.285 ^a	2.258 ± 0.243 ^{ns}	0.7257
MC	74.537 ± 0.426 ^a	70.295 ± 0.315 ^{****}	0.0001

Statistical significance was set at $P < 0.05$

with matching parts (i.e., in pairs of chest regions or arm regions) to 12 individuals to assess their palatability. With the aid of structured questionnaires, each sample pair was analysed using Likert scale based on their juiciness, flavour, chewability, colour, tenderness and aroma.

Chemical and statistical analysis

The chemical analysis followed the procedure given by the Association of Official Analytical Chemists (AOAC) (2005) to determine the nutritional composition of grasscutter meat for crude protein (CP), ether extract (EE), crude fiber (CF), ash, nitrogen free extract (NFE), moisture content (MC). Mineral composition of the samples was determined with the Atomic Absorption Spectrophotometer for calcium (Ca), magnesium (Mg), potassium (K), phosphorus (P) and iron (Fe) at the Faculty of Agriculture Central Laboratory, University of Calabar.

Data on body weight were analysed using unpaired Student's *t*-test, while data on proximate and mineral composition of animal meat were analysed using Analysis of Variance (ANOVA) and means (Mean ± SEM) were separated using Fisher's Least Significant Difference. STATVIEW version 5.0.1 was used for data analysis.

RESULTS

The final body weight of both captive and wild grasscutters

is shown in Table 1. The captive grasscutters reached slaughter mean weight of 2.95 ± 0.12 kg while the wild grasscutters had a mean weight of 3.12 ± 0.11 kg. The slaughter weight of captive bred and wild grasscutters was similar ($P > 0.05$).

The proximate nutrient composition of captive and wild grasscutter is presented in Table 2. The results indicated higher percentages of crude protein in wild grasscutters than captive bred grasscutters ($P < 0.05$) and higher percentages of fat and moisture content in captive grasscutters than in wild grasscutters ($P < 0.05$). There were similar percentage compositions of crude fiber ($P > 0.05$), ash ($P > 0.05$) and carbohydrate ($P > 0.05$) in captive bred and wild grasscutter meat.

Table 3 shows the mean mineral composition of captive and wild grasscutter meat. It was revealed that the Ca, P and Fe content were higher ($P < 0.05$) in wild grasscutter meat than that of the captive bred grasscutter, while there was similarity ($P > 0.05$) in the Mg and K content in meat of both captive bred and wild grasscutters.

Table 4 indicates the palatability comparison between captive and wild grasscutter meat. The results indicated that for best category, wild grasscutter meat had higher values for flavour, chewability, tenderness and aroma, and lower value for juiciness than that of captive bred grasscutter. Also, under very good level, captive grasscutter meat was graded higher than wild grasscutter meat for juiciness, chewability, and aroma, and lower values for colour, and tenderness than that of wild grasscutter meat.

Table 3. Mean mineral composition of captive and wild grasscutter meat (mg/g)

Trait	Treatment ¹		P-value ²
	T ₁ (Captive grasscutter meat)	T ₂ (Wild grasscutter meat)	
Ca	0.320 ± 0.007 ^a	0.360 ± 0.007 ^{***}	0.0025
Mg	0.210 ± 0.006 ^a	0.210 ± 0.007 ^{ns}	1.0000
K	0.520 ± 0.010 ^a	0.540 ± 0.011 ^{ns}	0.1943
P	0.330 ± 0.012 ^a	0.390 ± 0.016 ^{**}	0.0133
Fe	1.290 ± 0.014 ^a	1.610 ± 0.028 ^{****}	0.0001

Statistical significance was set at $P < 0.05$

Table 4. Palatability taste of captive and wild grasscutter meat (%)

Parameter	Best		Very Good		Good		Fair	
	Captive	Wild	Captive	Wild	Captive	Wild	Captive	Wild
Juiciness	50	10	50	30	0	50	0	10
Flavour	20	50	40	40	10	10	30	0
Chewability	20	80	60	20	20	0	0	0
Colour	30	30	30	70	40	0	0	0
Tenderness	10	30	50	70	40	0	0	0
Aroma	30	70	60	30	0	0	10	0
Total	160	270	290	260	110	60	40	10

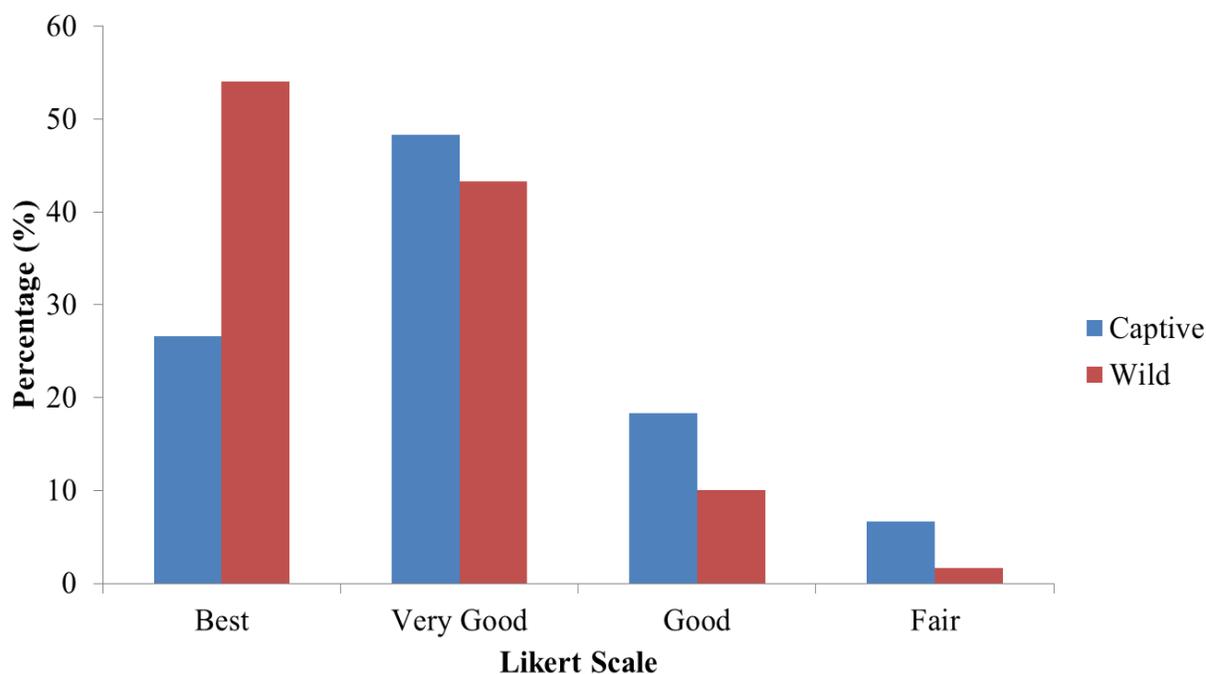
**Figure 1:** Percentage palatability comparison between captive and wild grasscutter meat

Figure 1 reveals the percentage palatability comparison between captive and wild grasscutter meat. The results submit that wild grasscutter meat had a higher average in the best level and a slightly lower average in the very good category totalling up to 88.3 % for wild and 75.0 % for captive grasscutter meat.

DISCUSSION

From the results, the similarity in slaughter weight of captive bred and wild grasscutter suggests that the comparison between captive and wild grasscutters was carried out with animals of similar sizes and weight.

According to Wogar (2011) and Ogogo (2008), there is a rapid increase in weight of grasscutters from 5 month which peaks at puberty or towards maturity and then at maturity, growth (usually eight months) becomes constant with little development. Growth in grasscutters is majorly a function of the level of crude protein in their dietary feed, which influences their appetite, digestibility of dry matter and body weight, particularly when the crude protein content of feed falls below 8 % (Omole et al., 2005; Onyeansi et al., 2008; Poku et al., 2013). According to Poku et al. (2013), crude protein concentrations of 10 % and above did not exhibit any significant difference in the weight/growth of grasscutters.

The high percentage of crude protein in wild grasscutters than in captive bred grasscutters, revealed in the results, was due to the rich variety of feeding materials in the natural environment, which is usually present in ample supply (see Table 2). While captive bred grasscutters on the other hand, totally depended on the food materials given to them. In the captive environment, grasscutters have limited space to run around and exercise whereas, in the wild, there is ample field as grasscutters explore the bushes in search of food, playing, escaping from prey, and mating. These activities cause them to exercise. Thus, in the process, wild grasscutters burn off some fat making their meat leaner than those of the captive. This accounted for the higher percentage fat in captive bred grasscutter than in wild grasscutter (see Table 2).

In addition, wild grasscutters are also exposed to extreme temperatures of cold and heat particularly from the direct rays of the sun resulting in dehydration. Captive grasscutters, on the other hand, are usually protected by artificial housing materials, and cages where they spend major part of their lives, and are provided drinking water *ad libitum*. Therefore, there is a minimal level of dehydration in captive grasscutters which was evident in the percentage moisture content difference between captive and wild grasscutter meat (see Table 2). Poku et al., (2013) reported similar results for proximate analysis of captive grasscutter carcasses in response to different crude protein feed concentrates.

From the results in Table 3, the high presence of Ca and P could be as a result of late weaning of young grasscutters, which provide ample supply of Ca and P contained in the milk (colostrum). Also, the types of food materials available in the wild environment further contribute to the variation in Ca, P and Fe observed in the two types of meat. According to Soetan et al., (2010) Ca, Mg, K, P and Fe as well as Cu, Mo, and Na are essential nutrients that play vital roles in human and animal metabolism. Increased composition of calcium, phosphorus and iron can be obtained from feed constituents rich in these nutrients and other mineral supplements.

The results from the palatability analysis showed that wild grasscutter meat is more palatable than captive bred grasscutters (Table 4 and Figure 1). The variation in the

organoleptic characteristics of their meat was due to the differences in the percentage composition of their crude protein, fat and moisture content resulting from variations in feeding materials and breeding environment.

CONCLUSIONS AND RECOMMENDATIONS

Meat from captive bred and wild grasscutter differ in protein, fat, and moisture content as well as in organoleptic properties (aroma, colour and texture) which sum up to the variation in palatability. These variations are responsible for consumer's preference of wild grasscutter meat over that of captive grasscutters.

Although, grasscutter farming has been reported to have potentials for improving the problem of protein deficiency in Nigeria (Adekola and Ogunsola, 2009; Owen and Dike, 2012), efforts must be made to breed captive grasscutter stock that can compete with those of the wild in terms of proximate composition (crude protein, fat and moisture content) and mineral composition (calcium, phosphorus and iron content) of their meat.

From the results obtained in this study, the following recommendations were made:

- Feeding of captive grasscutters should be improved to make up for the deficiencies as compared to that of wild grasscutters especially percentages of crude protein, fat, calcium, iron, phosphorus and moisture content.
- Late weaning should be encouraged so as to enable young grasscutters suckle enough milk to make up for their calcium and phosphorus deficiencies.
- The housing of grasscutters should be improved to provide enough space and enriched environment for more exercises which help burn out the accumulated fat in captive grasscutters.

Competing interests

The authors declare that they have no competing interests

REFERENCES

- Addo PA (2002). Detection of mating, pregnancy and imminent parturition in the grasscutter (*Thryonomys swinderianus*) Livest. Res. Rural Dev., 14: 8-13.
- Adekola AG, Ogunsola DS (2009). Determinants of productivity level of commercial grasscutter farming in Oyo State. Proc. International Conference on Global Food Crisis, 19th - 24th April, Owerri, Nigeria, pp: 15 - 21.
- African Center for Economic Transformation (ACET) (2014). Bushmeat and the future of protein in West Africa. West Africa Trends Newsletter, 9: 2-6.
- Annor SY, Djang-Fordjour KT (2006). From the Rearing of

- Large and Small ruminants to a relatively tiny grasscutter *Thryonomys swinderianus*. Problems and prospects of grasscutter rearing in Ghana. Proceedings of Sunyani Polytechnic Lecture Series, September 24-27. Sunyani Polytechnic Conference Hall, Sunyani, Ghana, pp: 49-58.
- Association of Official Analytical Chemists (AOAC) (2005). Official Methods of Analysis of the Association of Analytical Chemists International. 18th Edn., Gathersburg, MD U.S.A. Official Methods, August 2005.
- Casal LA (2001). Linking biodiversity and agriculture: challenges and opportunities for sustainable food security. World Resources Institute, London, pp: 72-75.
- Ekenyem J, Madubuike SA (2006). Community participation in natural resources management in Niger Delta, Nigeria: A case study of Bonny Island, Rivers State. A paper presented at the international conference on sustainable development, Ebitimi Banigo Auditorium, University of Port-Harcourt. 9-12 February, 2010, pp: 16-21.
- Karikari PK, Nyameasem JK (2009) Productive performance and carcass characteristics of captive grasscutters (*Thryonomys swinderianus*) fed concentrate diets containing varying levels of guinea grass. World Appl. Sci. J. 6(4): 557-563.
- Ogogo AU (2008). Wildlife management in Nigeria: objectives, principles and procedures. Second edition. Unical Press, Calabar, 280 pp.
- Omole AJ, Ayodeji O, Ashaye IOA, Tihamiyu AK (2005). Effect of scalding and flaming methods of processing on physio-chemical and organoleptic properties of grasscutter meat. J. Appl. Sci. Res., 1(2): 249-252.
- Onyeanus AE, Akinola OO, Babadoye AO (2008). Performance of grasscutter (*Thryonomys swinderianus*) fed varying levels of dietary protein. J. Innovat. Dev. Strat., 2(3): 1-4.
- Owen OJ, Dike UA (2012). Grasscutter (*Thryonomys swinderianus*) Husbandry in Nigeria: a review of the potentialities, opportunities and challenges. J. Environ. Issues Agric. Dev. Countries, 4(1): 104-111.
- Poku Jnr PA, Annor SY, Djang-Fordjour KT (2013). Growth, reproduction and carcass characteristics of grasscutters (*Thryonomys swinderianus*) fed on different levels of protein supplement. World J. Zool., 8(2): 175-184.
- Soetan KO, Olaiya CO, Oyewole OE (2010). The importance of mineral elements for humans, domestic animals and plants: A review. African J. Food Sci., 4(5): 200-222.
- Surujally RS (1975). Game farming is a reality. In: Ogunjobi JA, Adu BW, Onadeko SA, Jayeola OB (2013). Development of captive juvenile male grasscutters (*Thryonomys swinderianus*. Temminck 1827) fed with two common forage grass species in Nigeria. J. Bio-Sci. 21: 89-98.
- Wogar GSI, Ufot ML, Henry AJ, Inyang IE, Efe EE (2013). Composition and emulsifying characteristics of grasscutter meat from varying dietary energy levels. J. Agric. Sci., 5(1): 314-318.
- Wogar GSI (2011). Performance of gestating grasscutters (*Thryonomys swinderianus*) fed cassava-based diets with graded protein levels. Asian J. Anim. Sci., 5(6): 373-380.