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Growth Performance and Carcass Characteristics of Captive Reared Grasscutter (*Thryonomys swiderianus*) under Three Feeding Diets.

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Abstract

The unsustainable use of natural resources has led to the destruction of habitats and the disappearance of some fauna species. These have encouraged the captive rearing and domestication of wildlife with huge potentials for meeting the food and nutrition security through an adequate supply of animal protein. The success of grasscutter (*Thryonomys swiderianus*) rearing relies on an adequate supply of nutritious diets. This experiment was conducted to evaluate the growth performance and carcass characteristics of three colonies of grasscutters fed with three different diets. The diets consisted of basal 10% cassava root meal and 0, 50, and 90% of elephant grass (*Pennisetum purpureum*) and labeled Diets A, B, and C respectively and arranged in a completely randomized design. The animals were (4) four weaners (6 weeks old) each with an initial mean weight of 1172±7.82, 1178±8.52, 1171±9.14 g respectively for Diet A, B, and C. The final body weight and daily body weight gain of the animals differed significantly ($p<0.05$) between the treatments being 2362±9.01, 2288±3.06 and 1821±10.08 g; and 5.5±0.03, 5.3±0.04 and 3.9±0.06 g body mass in Diets A, B and C respectively. The mean cold carcass weights were 1477±6.56, 1287±5.57 and 1037±7.55 g for the animals fed Diets A, B, and C respectively, which differed significantly ($p<0.05$). Diets A and B supported the highest growth rate and carcass weight and were the most efficiently utilized by the animals leading to the production of the cheapest per unit carcass and can be recommended for the rearing of grasscutter in captivity.

Keywords: Grasscutter, captive, carcass, diets, treatment.

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Introduction

Nigeria's main sources of animal protein are fish and livestock whose scarcity and high cost necessitate the development of other sources of acceptable meat. Surveys by Asibey (1971) and Ntiamoa-Baidu (1998) have shown that most Africans, irrespective of their educational, economic, or social status, would eat 'bushmeat' (the common term for game animals) when available. For over 30 years, it has been evident that harnessing the production of bushmeat can partly solve the problem of Nigeria's animal protein shortage (Opara, et al., 2010). Besides, the animals are part of the resources used to provide food security, job opportunities, and income generation for the rural and urban poor.

Grasscutter (*Thryonomys swinderianus*) is bushmeat readily acknowledged as one of the most preferred throughout Nigeria and in the West African sub-region (Asibey, 1978;

Falconer, 1992; Ntiamoa-baidu, 1998; Baptist and Mensah, 1986). The meat is appreciated because of its culinary properties (Ajayi, 1971; NRC, 1991) such that the National Research Council (USA) included grasscutters in the list of "micro livestock: little-known small animals with a promising economic future" (Addo, 1998). The grasscutter is available throughout Nigeria where its savannah habitat has expanded as a result of the encroachment on forest lands by crop farmers. The demand for grasscutter meat has been met through hunting from the wild, usually by the use of traps, chase dogs, baiting with chemicals which have potentially harmful effects on consumers and other untargeted species and bush burning that can result in bushfires and the destruction of natural habitats and resources (Yeboah and Adamu, 1995).

The potentials of grasscutter farming, as a means of poverty alleviation and its contribution to keeping environmental health, has long been recognized in Nigeria, Ghana, and other African countries (Yeboah and Adamu, 1995; Adu, 2002). The rural dwellers, whose main sources of income are from smallholder farming activities, can use grasscutter farming to create additional employment to supplement their income, especially during the periods of low labour requirements on the farms. This is more so as grasscutter rearing does not require much labour, time, and space which makes it an important avenue for supplementing the household income of the urban and peri-urban inhabitants. But, despite its practice for several decades, grasscutter farming remains an enterprise in the hands of resource-poor smallholder farmers with neither the institutional nor economic power (Anandajayasekeram, 1999; Opara, et al (2010) without any impact in the national food security development agenda.

The majority of farmers in developing countries are poor and avoid taking risks in adopting any new technology until they are sure about its benefits. Studies by Baptist and Mensah (1986) observed that most setbacks hitherto associated with the captive breeding and management of grasscutter can be overcome which engendered intensive production of grasscutter in Benin and Togo while the agricultural extension services in Cameroon, Cфte d'Ivoire, Gabon, Ghana, Nigeria, Senegal, and Zaire promoted the rearing in rural and peri-urban areas.

The adequate supply of nutritious feeds constitutes more than 75% of the total cost in modern livestock production. Grasscutters are herbivores and can survive on plant materials applicable to them in the natural environment such that the feeding is cheap and can be done with little or no cash input. The paper aims at determining the growth performance and carcass characteristics of grasscutters under three feeding diets.

Materials and Methods

Location and period of study

The study was carried out at the Grasscutter Domestication Unit of the College of Agriculture, Ejigbo. The campus is on latitude 7º52′32″ N and longitude 4º17′56″ E and located in Ejigbo, the headquarters of Ejigbo Local Government Area, Osun State, Nigeria.

Experimental animals

Twenty-four (24) weaned six-week-old grasscutters obtained from the Benin Republic were used for the study. The animals were acclimatized for three weeks and their initial weights were recorded before the commencement of the experiment. The animals were randomly selected, picked, housed and divided into 3 groups to represent the treatments: Diets A, B and C. Two cages (3-tier cages) measuring 1.60 m (l) Ч 1.60 m (h) Ч 0.06 m (w) were used to house the animals. Each room in the different cages contained 4 animals and 8 animals in each treatment.

Diets and feeding regime

The animals were fed *ad libitum* three times daily: at 7:00 am, serving of 400 g of fresh elephant grass (*Pennisetum purpureum*) which was collected at the waterlogged area within the College of Agriculture, Ejigbo Campus; at 12:30-1:00 pm, serving of 100 g

sliced cassava tubers; and 7.45 pm, 120 g of compounded ration. Water was served twice a week inside the concrete bowl in recognition of the high moisture content of the animal feeds (Opara, et al (2010).

Hygiene: All the compartments of the cage were cleaned every morning and leftover foods weighed and completely removed. The cages and house floor were regularly washed with a dilute solution of disinfectant.

Experimental design and treatment

The experiment lasted for 32 weeks. The animals were randomly allocated to the three treatment groups: Diets A, B, and C with each treatment containing eight (8) animals, as replicates. The three diets were 0% grass, 50% diets, and 90% grass. The 0% grass diet consisted of the compounded ration and cassava root meal; the 50% grass diet consisted of an equal percentage of *Pennisetum purpureum* and compounded ration with cassava root meal, and the 90% grass diet treatment consisted of *Pennisetum purpureum* and cassava root meal (10%). The diets were formulated to contain similar crude protein (CP), calcium, phosphorus, and energy. The details of the three diets and their chemical compositions are given on Tables 1 and 2.

Results and Discussion

Data collection and statistical analysis

The initial weights of the animals were 1172±7.82, 1178±8.52, 1171±9.14 g for Diets A, B, C respectively. The animals were weighed weekly to determine body weight and average weight gain week^{-1}. The feed utilization rate (FCR) was calculated as the amount of feed taken daily *ad-libitum* minus the number of droppings (Opara, et al (2010). Three grasscutters from each treatment group were randomly selected and slaughtered at the end of the feeding trial for carcass analysis. Before slaughtering, the animals were fasted overnight but had access to water. After slaughter (a cut throat process of killing and bleeding the animal), the carcasses were eviscerated, weighed, and chilled at 4°C for 24 h to obtain the cold carcass weight. The distance between the first rib and the anterior edge of the pubic symphysis was measured as the carcass length.

Data on body weight (weight gain on weekly basis), feed intake (measurement of feeds before being served), and carcass characteristics (these were determined by measuring various body parts) were subjected to one-way ANOVA using the SPSS statistical package. The Fisher's least significant difference (LSD) was used to separate treatment means at 5% significant level.

Table 1: Composition of three diets fed to growing captive grasscutters in the morning, afternoon and evening

Ingredients	Diet A	Diet B	Diet C
Pennisetum purpureum	0.00	50.00	90.00
Palm kernel meal	18.25	18.25	0.00
Cassava root meal	10.00	10.00	10.00
Soybean meal	20.00	8.25	0.00
Maize	25.00	7.00	0.00
Wheat bran	25.00	5.25	0.00
Dicalcium phosphate	1.00	1.00	0.00
Common salt	0.50	0.50	0.00
*Vitamin/mineral premix	0.25	0.25	0.00

**Vitamin/mineral premix composition: vit A (800 IU), vit D (3000 IU), vit E (8 IU), vit K (2mg), vit B1 (1 mg), vit B2 (2.5 mg), vit B12 (5 mg), Niacin (10 mg), Panthothenic acid (5mg), Antioxidant (6 mg), Folic acid (0.5 mg), Choline (150 mg), Iron (20 mg), Manganese (80 mg), Zinc (50 mg), Cobalt (0.22 mg), Iodine (2 mg) and Selenium (0.1 mg).*

Table 2: Chemical compositions of three diets fed to growing captive grasscutters

Constituent	Diet A	Diet B	Diet C
Dry Matter, g 100 g^{-1} wet mass	89.5	88.4	88.7
Crude Protein (g)	19.2	19.2	9.2
Ether Extract (g)	1.7	2.8	1.6
Crude Fibre (g)	7.7	9.4	19.7
Ash (g)	9.2	5.8	8.9
Nitrogen Free Extract (g)	62.2	62.8	58.6
Acid Detergent Fibre (g)	16.3	17.2	25.4
Neutral Detergent Fibre (g)	42.9	51.6	54.5
Calcium (g)	3.0	2.7	3.2
Phosphorus (g)	1.4	1.5	1.00
*ME (MJ kg^{-1})	12.6	13.1	12.1

*Estimated by the equation; ME (kcal kg^{-1}) = (35 Ч percent crude protein) + (81.8 Ч percent ether extract) + (35.5 Ч percent nitrogen free extract) (Pauzenga 1985)

Table 3: Growth performance of growing grasscutters fed treatments A, B, and C.

Variable	Treatment A	Treatment B	Treatment C
Initial body weight (g)	1172 ± 7.82^{b}	1178 ± 8.52^{a}	1171 ± 9.14^{b}
Final body weight (g)	2362 ± 9.01^{a}	2288 ± 3.06^{b}	1821 ± 10.08^{c}
Total body weight gain (g)	1190 ± 6.45^{a}	1110 ± 7.46^{b}	650 ± 11.76^{c}
Total body weight gain (g kg^{-1} body mass)	503.8 ± 2.36^{a}	485.2 ± 3.43^{b}	356.9 ± 5.35^{c}
Weight gain (g $head^{-1}$)	13.1 ± 0.07^{a}	12.2 ± 0.08^{b}	7.1 ± 0.13^{c}
Weight gain (g kg^{-1} body mass $head^{-1}$)	5.5 ± 0.03^{a}	5.3 ± 0.04^{b}	3.9 ± 0.06^{c}
Feed conversion ratio	5.1 ± 0.03^{b}	4.8 ± 0.04^{c}	7.5 ± 0.14^{a}
Cost kg^{-1} of feed (₦)	0.2427	0.12415	0.0335
Feed cost kg^{-1} live weight gain (₦)	12.30^{c}	12.00^{b}	17.60^{a}

Data on the same row with different superscripts are significantly different ($p<0.05$)

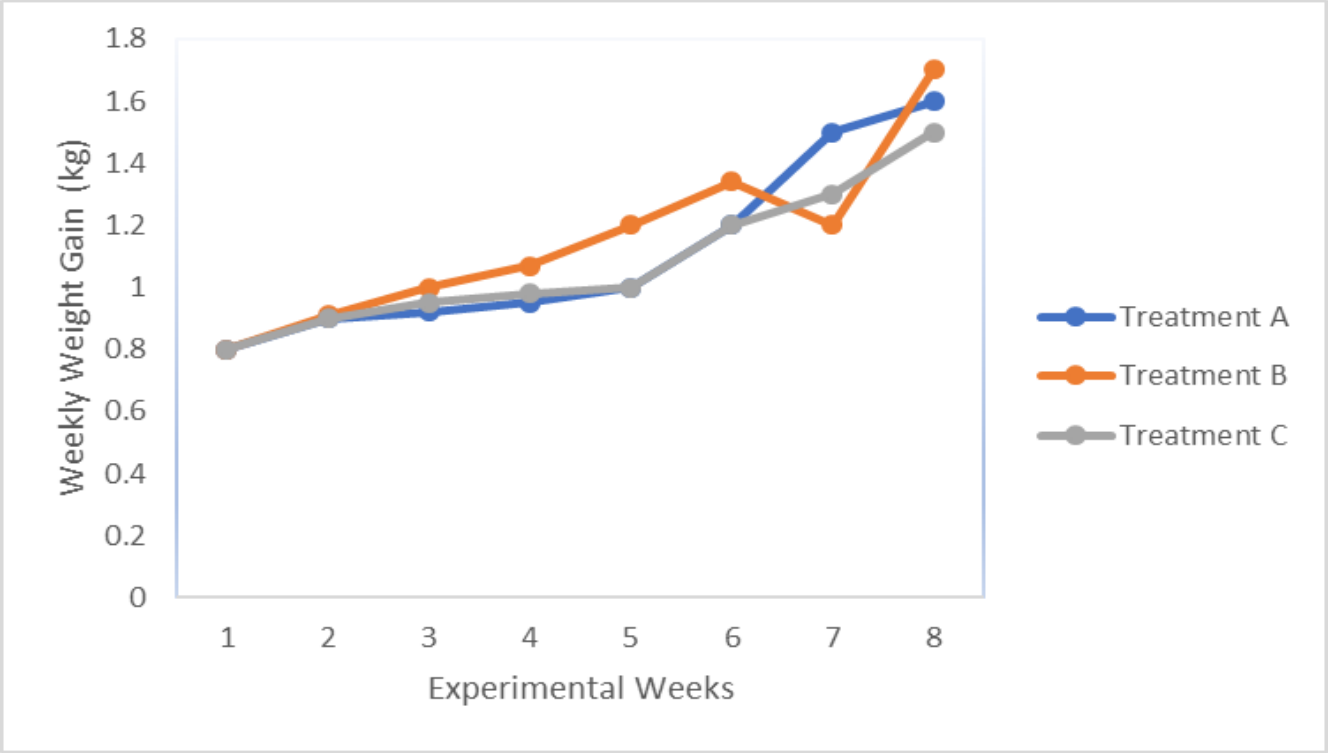

Fig. 1: Growth curve of grasscutter (weaners) in eight weeks.

Table 5: Carcass characteristics of grasscutter fed with different diets

Variable	Diet A	Diet B	Diet C
Slaughter weight (g)	2450±8.09[a]	2223±7.55[b]	1887±7.55[c]
Hot carcass weight (g)	1513±3.61[a]	1319±6.66[b]	1064±5.29[c]
Cold carcass weight (g)	1477±6.56[a]	1287±5.57[b]	1037±7.55[c]
All edible parts (g)	1974±5.70[a]	1779±5.15[b]	1477±6.89[c]
Dressing percentage (hot carcass)	61.8±0.07[a]	59.3±0.43[b]	56.4±0.08[c]
Dressing percentage (cold carcass)	60.3±0.08[a]	57.9±0.39[b]	55.0±0.18[c]
Dressing percentage (all edible parts)	81±0.05[a]	80±0.35[b]	78±0.18[c]
Carcass length, cm	27.8±0.70[a]	27.3±1.60[b]	25.6±0.52[c]
Head, % of slaughter weight	10.2±0.05[a]	10.9±0.06[b]	12.3±0.07[c]
Tail, % of slaughter weight	1.1±0.07[a]	1.2±0.07[b]	1.2±0.08[ac]
Offal*	497.2±2.11[a]	491.7±3.30[b]	440.1±3.73[c]

Data on the same row with different superscripts are significantly different (P<0.05);
**Made up of liver, heart, kidneys, empty gut and dressed head and tail*

Table 6: Primal cut-up parts of grasscutters fed with different diets

Trait	Treatment A	Treatment B	Treatment C
Cut-up parts:			
Two shoulders (g)	226.0±2.65[a]	214.0±2.65[b]	178.3±2.04[c]
Thorax (g)	431.3±3.46[a]	372.7±3.25[b]	276.3±2.04[c]
Loin, g	232.0±3.80[a]	210.0±1.10[ab]	181.3±1.28[b]
Two thighs (g)	579.7±0.98 [a]	483.3±3.56[b]	392.3±2.15[c]

Data on the same row with different superscripts are significantly different (P<0.05)

Discussion

Food is very essential to any living thing. The survival of and ability of animal to compete favourably depends on the food and feeding regime and also access to some key nutrients in the food.

Captive bred grasscutter depends solely on the farmer to supply the diets, with the needed various chemical compositions. The chemical composition of feeds in each Treatment followed the recommended experimental diets that are found in the literatures that support reasonable growth performance of captive breed grasscutter (Table 1).

The growth performance of the grasscutters fed the experimental diets is presented in Table 3. The initial body weight was highest in animals allocated to Diet B and similar for animals in Diets A and C. The final body weight, body weight gain, body weight gain body mass^{-1}, weight gain head^{-1} and weight gain body mass^{-1} head^{-1} was highest in animals fed Diet A which differed significantly ($p<0.05$) from Diet B while animals fed Diet C had the least values of these performance indicators. The animals fed Diet C had the highest feed conversion ratio (FCR=7.5) which decreased significantly ($p<0.05$) to 5.1 and 4.8 in Diets A and B respectively. It was cheapest to maintain the animals on Diet C as the feed cost was ₦0.0335kg^{-1} compared to ₦0.2427 and 0.12415 kg feed^{-1} in Diets A and B.

The research shows that the acid detergent fiber in Diet C was higher than the 13-17% level recommended by Pond *et al.* (1995) but the neutral detergent fiber levels were within the range of 42-64% recommended by Mensah and Okeyo (2005) for adult grasscutters (Table 2). Table 5 and 6 shows the result from Treatment A, B and C. The available data shows that grasscutters may not grow well when diet-fed contains fibre beyond 17% as observed in the research. The crude protein levels of Diets A and B were higher with Diet A within the minimum of 17% suggested by Pond *et al.* (1995) for herbivores in captivity. The energy content of Diet C was slightly lower than in the Diets A and B. It is known that fibre protects constituents of feed metabolizable energy (ME) levels (Woods, 2004). The three experimental diets were high enough to support at least a moderate growth rate as was seen in the present study. The energy contents of the three experimental diets compared favourably with the 9.3-13.9 MJ kg^{-1} suggested by Karikari *et al.* (2009) for the species. The performance indicated by Diets A and B suggests that concentrate-fed animals do not need to eat so much because the feed is richer compared to Diet C as shown by the growth curve and weight gain week^{-1}.

Slaughter weight, hot carcass weight, and cold carcass weight followed the same trend with the animals fed Diet A having the highest values than animals fed Diet B which, in turn, gave higher values than animals fed Diet C. From an economic viewpoint, the animals on Diets A and B are most efficient as they produced the cheapest per unit carcass. It was, therefore concluded that the two diets could be used as complete diets to rear grasscutters in captivity.

The dressing percentages obtained in this study are slightly lower than the 64% previously reported by Jori *et al.* (1995) but are comparable to the 50-55% reported by Annor *et al.* (2008). Dressing percentage is influenced by several factors including the amount of gut fill, slaughter weight, degree of muscling, slaughter age, degree of fatness, and nutrition of the animal. Poorly digested feed results in poor tissue deposition and this study may explain why animals on Diet C had inferior carcass characteristics.

Conclusion and Recommendation

The essence of good nutrition in making more carcass available to the market has been demonstrated in this study as the animals fed Diets A and B which contained less than 52% neutral detergent fibre and 17% acid detergent fibre produced good growth performance and carcass quality in captive grasscutters. It, however, appears that concentrate feeds of high neutral detergent

fibre (55%) content may not support the rapid growth desired in captive grasscutter.

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