

Original Research Article

**PERFORMANCE OF GROWING GRASSCUTTERS FED A CONCENTRATE DIET WITHOUT
SUPPLEMENTATION WITH FORAGE**

ABSTRACT

Aim: To determine the effect of feeding growing grasscutters a concentrate diet without forage.

Study design: The experiment involved three treatments with three replicates per treatment in a Completely Randomized Design.

Place and duration of study: The study was carried out in the Research Farm of the University of Calabar, Nigeria, between November, 2013 and March, 2014.

Methodology: Eighteen 10-weeks old male grasscutters of equal weight (850g) were allocated randomly to three treatments (T_1 , T_2 , T_3), with six grasscutters per treatment and two grasscutters per replicate. The grasscutters were fed a concentrate diet containing 23.00% crude protein, 7.00% crude fibre, and 2300.00kcalME/kg with elephant grass (*Pennisetum purpureum*) as forage. This study involved three feeding regimes, in which all animals were fed a concentrate diet *ad libitum*. Varying levels of forage including 24, 12, and nil, hours access to forage were allowed animals in treatment 1, 2, and 3 respectively. Water was supplied *ad libitum*. Weights of animals were taken at the beginning of the study and every week thereafter. Records of feed intake were taken daily.

Results: Findings show that forage intake (239.90g) was significantly ($P=0.05$) higher among grasscutters fed concentrate with *ad libitum* supply of forage, while concentrate intake (49.50g) and total feed intake (69.40g) were significantly ($P=0.05$) higher among grasscutters fed concentrate with *restricted* supply of forage. Average daily weight gain (11.20g) was significantly

($P=0.05$) higher, while the best feed conversion ratio (4.22) and cost to gain ratio (0.40) were obtained, among grasscutters fed concentrate without forage.

Conclusion: It is concluded that the performance of growing grasscutters fed a concentrate diet without forage is superior to the performance of growing grasscutters fed a concentrate diet with forage. The indication is that commercial feeds containing the right amounts of nutrients, including fibre, and offering a low cost to gain ratio, can be packaged for the convenience of grasscutter farmers.

Keywords: Grasscutters; feeding; concentrate; without forage, weight gain.

1. INTRODUCTION

Wildlife animal species are an important source of animal protein in the diets of rural and urban populations in Sub-Sahara African countries (1). In Nigeria, this widely accepted and highly priced meat from the wild is marketed as “bushmeat”. With growing populations in these countries and a corresponding annual decline (estimated at 2% for Nigeria (2)) in the production of conventional livestock, there is compelling need for increased supply of animal protein in human diets (3). Given the high cost of protein from conventional livestock, wildlife animal species, including the grasscutttter, provide a less expensive source of animal protein (4).

Most of the “bushmeat” is obtained from game species , which include rodents (grasscutters, porcupine), the apes (monkeys, baboons, chimpanzies), snakes, and big game (duickers, buffaloes, deers, etc). Of these, only the grasscutter has presently been successfully reared as a farmed animal (5). To effectively source animal protein from the grasscutter as an alternative, the cost of production of grasscutter must be considerably lower than the cost of production of conventional livestock. A major factor in animal production is the cost of feeding, which constitutes 70-80% of the cost of production (6).

The nutrient content of feed used in the rearing of grasscutter determines the cost of feed and level of performance in terms of growth (7) and reproduction (8,9). Grasscutter should be raised on feeds, which are rich and balanced in nutrients (10). The farming of grasscutters, therefore, requires that rations include forage and concentrate diets, which should be formulated to satisfy the requirements for health and productive activity (11). Though forage is the dominant constituent of its diet in the wild, the grasscutter cannot live on a forage-only diet. In the wild it relies on wild and cultivated roots, berries, nuts, and various fruits and seeds as sources of energy and protein to supplement its high fibre diet. Studies (12,13) have shown that concentrates can be used along with various fibre sources in the rearing of grasscutter in captivity.

The specialized digestive system, which incorporates the caecum, enables the grasscutter to survive on a low calorie and high fibre diet (14). Forages are sources of fibre, and are less expensive feedstuffs than concentrates. Fibre undergoes microbial digestion in the caecum of the grasscutter, with the release of volatile fatty acids, which are substrates for the synthesis of protein and energy stores of the body (15).

The use of forage in grasscutter farms is associated with tedium, bulk, and increased cost, during harvesting and feeding. These difficulties could be avoided if formulated concentrate diets supply the required level of fibre in grasscutter rations. Further, the prospects of formulating commercial diets containing the required level of fibre for the desired level of productivity in grasscutters would obviate the need for the use of forage, while expanding interest in grasscutter farming. The objective of this study, therefore, is to evaluate the performance of growing grasscutters fed a concentrate diet without forage.

2. MATERIALS AND METHODS

69 This study was carried out at the Grasscutter Research Farm of the Department of Animal
70 Science, University of Calabar, Nigeria, between November, 2013 and March, 2014.

71 2.1. Experimental diets

72 The experimental diet was formulated to supply 23.00% crude protein, 7.00% crude fibre, and
73 2300kcalME/kg. Soybean was used as the main source of protein, while cassava flour was used
74 as the main source of energy and binding agent. The pelleted concentrate diet was produced
75 from a thick paste of the compounded ingredients. The gross composition of the experimental
76 diet is shown in table 1, while the proximate composition, which was determined using the
77 AOAC (16) method is shown in table 2.

78 The grasscutters were fed elephant grass (*Pennisetum purpureum*) as forage and a concentrate
79 diet formulated to contain 16% crude protein, 7% crude fibre, and 2300kcalME/kg. Three
80 feeding regimes (Treatments (T)) used were as follows: 24 hours *ad libitum* supply of both
81 concentrate diet and forage (T1); 24 hours *ad libitum* supply of concentrate diet and 12 hours
82 (*restricted*) supply of forage (T2); 24 hours *ad libitum* supply of concentrate diet, but without
83 forage (T3). The 12 daylight hours supply of forage from 6.00 am to 6.00 pm is predicated on
84 the knowledge that the period of 12.00 noon to 6.00pm, is part of that 18-hour period of the day,
85 during which time feed intake is highest among grasscutters (17).

86 **Table 1: Gross Composition of Experimental Diet for Feeding Growing Grasscutters with**
87 **and without Supplementation with Forage.**

Ingredients	Composition (kg)
Soybean	16.40

Wheat offal	30.00
Palm kernel cake	20.00
Cassava flour	30.70
Salt	0.40
Bone meal	2.00
Vitamin premix	0.50
Total	100

88

89 **2.2. Digestibility trial**

90 A digestibility trial was carried out at the end of the 12th week of the feeding trial and lasted for
 91 10 days. No faeces were collected during the first 3 days of digestibility study. Records of feed
 92 intake and faecal samples collected were taken during the last 7 days of the study. Samples of
 93 faeces collected daily for 7 days from each of the grasscutters were oven-dried at 65⁰C, packed
 94 in plastic bags and stored in a refrigerator. At the end of 7 days, faeces collected from each
 95 replicate were pooled, and samples were taken for proximate analysis using the AOAC (16)
 96 methods. The apparent digestibility coefficients (%) of the nutrients of the experimental diet are
 97 shown on table 3.

98 **2.3. Research animals**

99 Eighteen 10-weeks old male grasscutters of equal weight (850g) were allocated randomly to the
 100 three treatments (T₁, T₂, T₃), with six grasscutters per treatment and two grasscutters per
 101 replicate. The eighteen grasscutters were randomly selected from six does, which had kindled
 102 on the same day and had been weaned of pups on the same day.

103 **2.4. Management of Research Animals**

The grasscutters were housed individually in concrete cells, each of which was fitted with one door. The provision of just one door had the effect of reducing the loss of heat from the cell, thus enhancing a warm environment for the grasscutter, which is easily susceptible to pneumonia. Temperatures in the cells fluctuated between 22.6 – 29.0°C during the experimental period. Grasscutters were housed in sanitary and humane conditions.

The grasscutters were given dewormers and anti stress drugs in drinking water at the beginning of the experiment. The experimental diet was fed with or without elephant grass (*Pennisetum purpureum*) depending on the requirement of the treatment. The elephant grass was allowed to wilt for two days before it was fed daily as a supplementary diet. Water was supplied *ad libitum* to all the animals. The experimental diet and forage were served for seven days before commencement of record taking in order to allow for adjustment to the experimental diet. The animals were weighed at the beginning of the study and every week thereafter. Records of feed intake were taken daily.

2.5. Statistical analysis

Data collection involved observations of daily forage intake, forage dry matter intake (which was estimated as 12% of elephant grass consumed), daily diet intake, and daily weight gain. The Completely Randomized Design was used for the study. Data was analysed using the Genstat (18) software method of the analysis of variance. The Least Significant Difference Method of the same software (18) was used to separate significant means.

3. RESULTS AND DISCUSSION

3.1. Proximate composition

The results of the chemical analysis (Table 2) show the composition of nutrients (crude protein, crude fibre, ether extract, ash and nitrogen free extract) of the experimental diet, which was fed

to the grasscutters. The crude protein content of 23.108% was higher but close to the target of 23% crude protein envisaged in the gross composition. Similarly, the crude fibre content of 7.7% was within the target of 7% envisaged in the gross composition. This study assumes that the nutrients of the experimental diet were equally available to all the experimental animals.

Table 2: Proximate Composition of Experimental Diet for Feeding Growing Grasscutters with and without Supplementation with Forage.

Nutrient	Composition (%)
Dry matter	86.646
Crude protein	23.108
Crude fibre	7.700
Ash	5.304
Ether extract	5.020
Nitrogen free extract	45.514

3.2. Apparent Digestibility Coefficients

There were significant ($P=0.05$) differences between treatments in the apparent digestibility coefficients (ADC) of all nutrients (Table 3) of the experimental diet.

Apparent digestibility coefficients for dry matter was significantly ($P=0.05$) higher (93.80%) among grasscutter with unrestricted access to forage than the ADC for dry matter among grasscutters with restricted access (93.60%) to, or without access (93.50%) to, forage. Apparent digestibility coefficients for crude protein was significantly ($P=0.05$) higher (90.80%) among grasscutter with restricted access to forage than the ADC for crude protein among grasscutters with unrestricted access (89.50%) to, or without access (85.50%) to, forage. This finding

indicates that increased digestion and utilization of crude protein among grasscutters was enhanced by restricted access to forage. It has been found that increase in the dietary component of fibre decreased digestibility (19).

Apparent digestibility coefficients for crude fibre (85.60%), ash (86.20%), and nitrogen free extract (98.50%) were significantly ($P=0.05$) higher among grasscutters fed concentrate without forage than among grasscutters fed concentrate with forage. The ADC for ether extract (96.40%) among grasscutters fed concentrate without forage was significantly ($P=0.05$) higher than ADC for ether extract (94.60%) among grasscutters with restricted access to forage. It has been reported (20) that the digestibility of protein, fat, and crude fibre were reduced by high dietary fibre,

Table 3. Apparent Digestibility Coefficients (%) of Nutrients of the Experimental Diet for Feeding Growing Grasscutters with and without Supplementation with Forage.

Nutrients	Treatments			SEM
	T1	T2	T3	
Dry matter	93.80 ^a	93.60 ^b	93.50 ^c	0.09
Crude protein	89.50 ^b	90.80 ^a	85.50 ^c	1.06
Crude fibre	84.50 ^b	82.80 ^c	85.60 ^a	0.82
Ash	85.10 ^b	83.50 ^c	86.20 ^a	0.80
Ether extract	96.70 ^a	94.60 ^b	96.40 ^a	0.65
Nitrogen free extract	98.20 ^b	98.10 ^b	98.50 ^a	0.12

^{a, b, c} means on the same row with different superscripts are significantly ($P=0.05$) different.

3.3. Growth Performance

The performance of growing grasscutters fed a concentrate diet with and without forage is shown in table 4.

3.3.1. Feed intake

There were significant ($P=0.05$) differences between treatments in respect of forage, concentrate, and total feed intake by grasscutters. Forage intake was higher (239.90g/day) among grasscutters with 24 hours access to forage, while concentrate intake was highest (49.50g/day) among grasscutters on restricted (12 hours) access to forage. This observation suggests that grasscutters with unrestricted access preferred forage, which is a bulkier feed, to concentrate, which offers higher nutrient utilization by the animal (21). Grasscutters on restricted access struck a more beneficial balance between forage and concentrate intake. While concentrate intake (49.50g/day) among grasscutters on restricted access to forage was significantly ($P=0.05$) higher than concentrate intake (39.10g/day) among those with unrestricted access, it was not different from concentrate intake (47.30g/day) among grasscutters deprived of forage. Results indicate that restricting forage intake enhances concentrate intake among grasscutters. This finding has a behavioural and physiological basis, which permits the grasscutter to satisfy its requirement for forage, after a period of restriction, while enhancing a higher rate of digestion and utilization of both forage and concentrate. The significantly ($P=0.05$) higher total feed intake (69.40g/day) among grasscutters on restricted forage intake, than among those on other treatments, is consistent with the suggested higher level of feed digestion and utilization due to the probable balance in the consumption of concentrate and forage on this treatment. This finding indicates that grasscutters adjust their feed intake according to the energy content of the feed in order to satisfy their energy needs. (22) reported that rabbits eat to satisfy their energy requirements.

181 **Table 4. Effect of Feeding Growing Grasscutters a Concentrate Diet with and without**
 182 **Forage.**

Parameter	Treatments			SEM
	T1	T2	T3	
Initial weight (g)	8.50	8.50	8.50	0
Final weight (g)	1267.90	1340.50	1346.40	25.70
Average daily weight gain (g)	9.03 ^b	11.10 ^a	11.20 ^a	0.72
Average daily forage intake (g)	239.90 ^a	165.70 ^b	NA	37.48
Average daily forage dry matter intake (g)	28.80 ^a	19.90 ^b	NA	4.50
Average daily concentrate intake (g)	39.10 ^b	49.50 ^a	47.30 ^a	3.25
Average daily total feed intake (g)	67.80 ^a	69.40 ^a	47.30 ^b	7.25
Feed conversion ratio	7.51 ^a	6.30 ^b	4.22 ^c	0.28
Average daily cost of concentrate intake (N.K)	3.80 ^b	4.70 ^a	4.50 ^a	0.28
Cost to gain ratio (N.K/g)	0.42	0.42	0.40	0.01

183 ^{a, b, c} means on the same row with different superscripts are significantly ($P=0.05$) different.

184 NA = Not Applicable (i.e. grasscutters not fed forage).

185 3.3.2. Daily weight gain of growing grasscutters

186 Daily weight gain (DWG) of growing grasscutters was significantly ($P=0.05$) different between
 187 treatments. Grasscutters, which were not fed forage, had significantly ($P=0.05$) higher ADG

(11.20g/day) than those allowed unrestricted (9.03g/day) and restricted (11.10g/day) supply of forage. Elephant grass is high in fibre and, therefore, bulky. The high intake of forage among grasscutters with unrestricted access resulted in lower intake of concentrate, which has higher nutrient value and is more easily utilizable by the animals. Nutrient content and utilization is lower in bulkier forage feeds than in concentrate diets, which offers higher nutrient utilization (21) for the enhancement of growth. This finding is consistent with the report of (20) that animals fed high fibre diet had reduced digestibility of dry matter, protein and fat, with lower growth rate than animals fed low fibre diet. The consumption of high fibre has also been associated with low fat deposition (23), which reduces the rate of weight gain.

The finding that grasscutters, which were not supplied forage, had the highest ADG indicates that the fibre content (7.70%) of the experimental diet was consistent with higher weight gain among grasscutters on this treatment. While ADG among grasscutters on restricted supply of forage was higher than ADG among grasscutters on unrestricted supply, it was lower than ADG among grasscutters not fed forage. This finding indicates that, in the context of total fibre content of forage and concentrate fed and consumed by grasscutters, weight gain decreased with increase in fibre intake. This observation corroborates the finding (20) that a high fibre diet is associated with reduced growth rate.

Further, findings suggest that dietary content of the various nutrients of the experimental diet, including crude fibre content of 7.70%, were adequate to balance nutrient availability to requirements resulting in enhanced weight gain among growing grasscutters fed the diet without forage. It has been reported (24) that proteins which are directly available to the herbivorous animal increase the efficiency of anabolism of absorbed nutrients in growth, pregnancy, lactation, and work.

3.3.3. Feed conversion ratio

The feed conversion ratio indicates that ADG varied inversely with the duration of exposure of grasscutters to forage. This is due to increased forage/fibre intake with increased duration of exposure to forage.

3.3.4. Cost to gain ratio

The superiority of performance of grasscutters fed a concentrate diet (containing an adequate (7.7% crude fibre)) without forage, over the performance of grasscutters fed the concentrate diet with forage, is further indicated in the lowest (0.40) cost to gain ratio observed among grasscutters fed concentrate without forage.

4. CONCLUSION

Findings show that forage intake was significantly ($P=0.05$) higher among grasscutters fed rations with *ad libitum* supply of grass, while concentrate intake and total feed intake were significantly ($P=0.05$) higher among grasscutters fed rations with *restricted* supply of grass. However, the average daily weight gain was significantly ($P=0.05$) higher, while the best feed conversion ratio and cost to gain ratio were obtained among grassby cutters fed rations without grass.

From the above findings, it is concluded that the performance of growing grasscutters fed a concentrate diet without forage is superior to the performance of growing grasscutters fed a concentrate diet with forage. Findings further indicate that commercial feeds containing the right amounts of nutrients, including fibre, and offering a low cost to gain ratio, can be packaged for the convenience of grasscutter farmers.

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