



Thermoregulatory Responses and Morphometric Characteristics of Cane Rats (*Thryonomys swinderianus*) Fed Graded Levels of Elephant Grass and Concentrate Diets

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Abstract: The experiment was carried out at the cane rat unit of the Institute of Agricultural Research and Training, Ibadan, to evaluate the thermoregulatory responses and morphometric measurement of cane rats fed graded level of elephant grass and concentrate diet. The experiment was designed to determine the optimal grass- to -concentrate ratio that supports growth and thermal adaptability in captive cane rats. A total of thirty weaned cane rat between the ages of 5-6 months, procured from a reputable farmer with weight ranging from 1342g to 1350g were used for the experiment. The cane rats were allotted into 5 dietary treatments in a completely randomized design. Each treatment was replicated two times with three animals per replicate. The allotted animals were given elephant grass and formulated feeds in ratio: Treatment 1 (T1) (25:75 % of mixture of elephant grass and concentrate), Treatment 2 (T2) (50:50 % of mixture of elephant grass and concentrate), Treatment 3 (T3) (75:25 % of mixture of elephant grass and concentrate), and Treatment 4 (T4) (100 % of concentrate) while Treatment 5 (T5) (100 % of elephant grass). The parameters measured were feed intake, weight gain and feed conversion ratio, which was calculated. Thermoregulatory parameters taken weekly were the rectal and head temperature. Also, the morphometric parameters which include body, tail and head length, heart-girth, and rump were also recorded. Data obtained were subjected to descriptive statistics and correlation analysis. It was observed that body weight gain and feed conversion ratio revealed significant ($P>0.05$) differences among the treatment means. The results indicated that cane rats on T1 with 75% concentrate had the highest feed conversion ratio while, highest feed intake and body weight gain was recorded in T4 (100% concentrate) followed by T3 (25% concentrate). The inclusion of 25% and 100% concentrate diets influenced morphological traits. It is, however, recommended that the optimum growth performance of cane rats was achieved at T3 (25% concentrate to 75%) elephant grass diet considering the growth response and feed conversion ratio obtained from the present study.

Keywords: Cane rat, Rectal Temperature, Morphometric traits, Elephant grass, Concentrate

INTRODUCTION

The cane rat (*Thryonomys swinderianus*), also known as the African great cane rat, is a wild hystricomorph rodent widely distributed in the African sub-region and exploited as a source of animal protein. Cane rat is known for its excellent taste, and higher nutritional

value (Asibey and Addo, 2000; Omole *et al* 2005). It is perhaps the most expensive of the preferred meats in West Africa and is therefore hunted aggressively. Thus, the excessive and uncontrolled decimation of this animal for consumption poses a threat to the ultimate survival of the species (Opara, 2010). Consequently, there is need to encourage domestication of cane rat by making breeding and fattening stock readily available for intending producers or farmers.

Captive rearing of the cane rat has been identified as a potential source of income and employment and an important source of animal protein for both rural and urban people. The intake of animal protein of an average adult in the sub-region is estimated at 15% of the total per capita protein intake as against average intake of 55% for his European counterpart. This is below the recommended minimum daily protein requirements of 70-80 g of which 50% should be of animal origin (Akinnusi *et al.*, 2009). To address this shortfall, households have undertaken food production which involves not only the cultivation of rice and corn which are basic staple food but also the production of food rich in protein to keep them healthy and resistant to disease. Cane rat meat is considered a delicacy and many West African sub-regions relish it. However, feeding the rodent remains a challenge since farmers apparently find it difficult to feed them especially during the dry season (Annor *et al.*, 2009). Physiological adaptations, particularly thermoregulatory responses, are important for optimizing management, welfare, and productivity under captive and semi-intensive production systems. Available evidence (Olorunghobunmi *et al.* 2024) suggests that cane rats can maintain relatively stable core body temperature under humid tropical conditions, indicating effective homeostatic control. Measurements of rectal temperature and in cane rats reared under wet-season conditions have shown minimal variation, implying tolerance to prevailing ambient heat loads (Akinyemi, *et al.*, 2018).

Morphometric measurements of body growth and performance in cane rats and other animals are essential for understanding their biology, health, and ecological interactions. These measurements contribute to scientific research, conservation efforts, and wildlife management strategies. The cane rat has thickest body, measuring up to 40 to 60 cm in addition to a 20-25 cm tail. Its average weight fluctuates between 2 to 4 kg in the females and 3 to 6 kg in the males (Taiwo *et al.*, 2009; Merwe, 2000). Its furs comprise a mixture of brown reddish and gray hairs that vary depending on its habitat (Jori and Chardonnet, 2001). Examples of body measurement parameters are body length, tail length, head length, ear length, heart girth, etc. Some other authors reported that skin and hair (fur) as well as limbs and tails are easily torn out. This makes the animal very difficult to catch and even more difficult to handle after capture (Akpan *et al.*, 2018).

Elephant grass (*Pennisetum purpureum* Schum) is one of the most important forages used in feeding cane rats in captivity. It plays a major role in their health, growth and digestive function. The sweet stem and soft leaves make it highly palatable, it provides structural fibre necessary for healthy hind gut fermentation, it helps prevent digestive problems such as bloating, constipation, diarrhea, also, it supports the microbial activity in the ceacum, which is essential for cane rat digestion. It is readily available and affordable. It is high in crude fibre, moderate in protein, stands out for being perennial and adapted forage to different soils and climate conditions (da Silva, 2021). However, it is rather low in energy and protein, due to its high cell wall content as reported by (Ogunjobi *et al.*, 2014) in their proximate analysis. They added that elephant grass is very sensitive to climatic conditions, maturity and regrowth days, with a decrease in crude protein content, an

increase in fibre, a decrease in dry matter and cell wall, as measured by in situ degradability and *in vivo* digestibility. There is no adequate information on baseline nutrient requirements and no particular feeding regime for concentrate has been established for its optimal performance.

METHODOLOGY

The study was carried out at the Cane-rat Unit of the Institute of Agricultural Research and Training, Ibadan, Nigeria and the experiment lasted 16 weeks. A total of thirty growing cane rat between the ages of 5-6 months with weight ranging from 1342g to 1350g were used. The cane rats were individually housed in clearly and properly labeled concrete cells measuring 90 x 75 x 40 cm (length x width x height). Each cell was provided with a feeder and a drinker. Elephant grass (*Pennisetum purpureum*) was cut and allowed to wilt for about 12 hours, weighed and served to the animals along with compounded ration (concentrates). The formulated diet was calculated to contain crude protein of 17.68 % and energy of 2244MEKcal/kg. The cane rats were allotted into five dietary treatments in a Randomized Completely Block Design. Each treatment was replicated two times with three animal per replicate. The animals were given elephant grass and compounded feeds in the following ratio:

T1: 25% Elephant grass +75% Compounded feed

T2: 50% Elephant grass + 50% Compounded feed

T3: 75% Elephant grass + 25% Compounded feed

T4: 100% Compounded feed

T5: 100% Elephant grass

Feed intake and body weight were recorded weekly while the feed conversion ratio was calculated at the end of the experiment. The thermoregulatory response parameters taken were the rectal and head temperatures which were recorded using an infrared thermometer. Morphometric measurements of cane rats' body parts taken include the following:

1. Body length: The distance from the tip of the nose to the base of the tail using tape rule in (cm).
2. Tail length: The length of the tail from the base to the tip using tape rule in (cm).
3. Head length: The distance from the tip of the nose to the back of the skull using tape rule in (cm).
4. Girth: The width of the body at its widest point using tape rule in (cm).
5. Rump: The length of the posterior to the loins and anterior to the tail using tape rule in (cm).

Statistical Analysis

Data obtained will be subjected to descriptive statistics, correlation and regression analysis using SPSS 20.

$$Y = a + bx$$

Y_i is body weight or dependent variable.

a is the constant of a regression equation

b , is the coefficient of regression or slope defined as the change in Y_i resulting from a unit change in X_i .

X_i is the independent variable represented by Body Length, Tail Length, Head Length, Body Girth or Rump.

Table 1 shows the gross composition of experimental diets; the calculated crude protein was 17.68% and the metabolize energy was 2244ME/Kcal.

Table 1: Gross Composition of Experimental Diets

Ingredients	Quantity (Kg)
Maize	50
Wheat offal	9
Rice Bran	20.25
Soya bean meal	10
Groundnut	5
Fish Meal	2
Bone Meal	2.50
Premix	0.25
Limestone	1
Total	100
Calculated Analysis	
Crude Protein (%)	17.68
Metabolizable Energy MEKcal/Kg	2244

RESULTS AND DISCUSSION

Table 2: Growth performance of cane rats fed diets containing varying levels of grass and concentrate (Popoola *et al.*, 2026).

Parameter	T1	T2	T3	T4	T5	SEM
Initial weight (g)	1345	1340	1350	1342	1348	1.84
Final weight (g)	2603 ^{ab}	2655 ^{ab}	2760 ^a	2505 ^b	2310 ^c	76.22
Total weight gain (g)	1258 ^b	1315 ^b	1410 ^a	1163 ^c	968 ^d	75.26
Total Feed intake (g)	6213.80 ^b	6373.51 ^a	6260.32 ^b	6154.33 ^c	6010.55 ^d	59.95
FCR	4.9 ^c	4.8 ^b	4.6 ^a	5.2 ^d	6.2 ^e	0.28
Mortality	0	0	0	0	0	

^{a,b} Means with same letter (s) in a column are not significantly different at 5 % level of probability by Duncan Multiple Range Test (DMRT)

The results of growth performance of cane rat fed diets containing varying level of grass and concentrate as shown in Table 2 above, the highest total feed intake of 6373.51g was recorded in T2, T4 had mean value of 6154.33g, T3 had 6260.32g while least value was

recorded in T1 (6213.80g), The mean total body weight gains of cane rat were significantly different across the treatment and followed same pattern with feed intake. This agrees with (Swallah Abudul Majid Marani (2018). which shows that forages are viable option for cane rat production as it improves economic gains without adverse effects on the animal's health and carcass quality.

The highest weight gain ($P < 0.05$) was recorded in T3(1410g) the diet containing 75% grass and 25% compounded feed and the lowest weight gain was recorded in T5 (968g). This agrees with Ghoshe (2021), that supplementing forages with formulated concentrate to improve health productivity of cane rat.

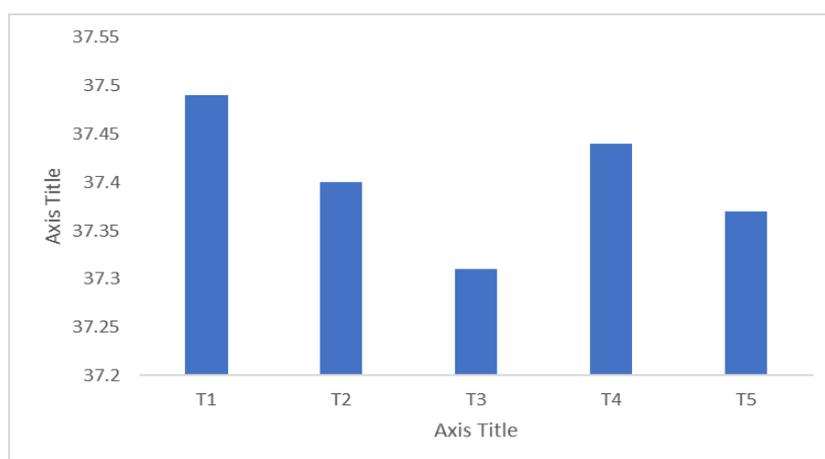


Figure 1: Rectal Temperature of cane rats diets containing varying levels of grass and concentrate

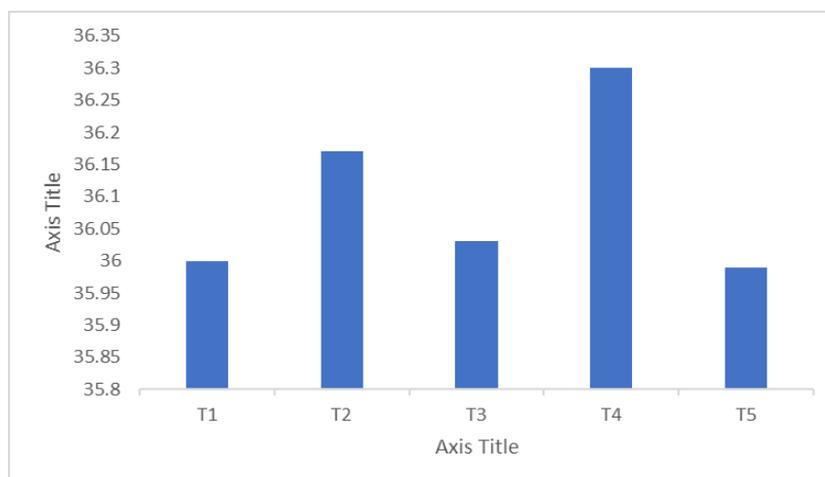


Figure 2: Head Temperature of cane rat's diets containing varying levels of grass and concentrate

Temperature serves as a critical indicator of thermoregulatory efficiency and homeostasis in mammals. The maintenance of optimal body temperature is essential for sustaining metabolic activities, feed utilization, reproductive efficiency and overall performance. In the present study, there was no significant difference in the values

recorded for the rectal temperature among the different treatments, the values ranged between 37.31°C to 37.49°C. the values obtained for the head temperature followed the same trend. The animals were observed to be stable, thus they can be said to have maintained homeostasis. Similar values were recorded from the study of Fayenuwo *et al* (2019) where ranges of 36.5°C - 39.5°C were recorded. The value reported was similar to the normal range of rabbit's temperature according to MSD manual which ranges from 38.6°C- 40.1°C.

Table 3: Morphometric traits of cane rats fed diets containing varying levels of grass and concentrate

Morphometric traits	T1	T2	T3	T4	T5	±SEM	Remark
Head length (cm)	8.00	7.00	7.50	7.50	7.50	0.158	NS
Tail length (cm)	16.00	14.00	14.00	13.75	16.00	0.512	NS
Body length (cm)	25.00 ^a	25.00 ^a	25.50 ^a	24.50 ^b	19.50 ^c	1.111	S
Rump length (cm)	24.00 ^b	22.00 ^c	29.00 ^a	28.00 ^{ab}	23.00 ^{bc}	1.393	S
Body Girth (cm)	25.00 ^b	23.00 ^c	27.50 ^a	24.00 ^{bc}	18.00 ^d	1.565	S

Means with same letter (s) in a column are not significantly different at 5 % level of probability by Duncan Multiple Range Test (DMRT).

Dietary treatments had no significant effect ($P > 0.05$) on head length and tail length, indicating that these traits are relatively stable and less responsive to dietary manipulation. In contrast, body length, rump length, and body girth differed significantly ($P < 0.05$) among treatments. Cane rats fed T1, T2, and T3 recorded comparable and higher body lengths, while T5 produced the lowest value, suggesting suboptimal growth under higher grass inclusion. Rump length was significantly greater in T3 and T4, indicating enhanced hindquarter development at these diet combinations. Body girth was highest in T3 and lowest in T5, reflecting superior overall body development and tissue deposition in animals fed T3.

Overall, the results indicate that diets with balanced grass and concentrate levels, particularly T3, promote improved growth-related morphometric traits in cane rats, whereas excessive grass inclusion may limit growth performance.

Table 4: Correlation between body weight (g) and morphometric traits of cane rats fed diets containing varying level of grass and concentrate

Control Variables			Head	Tail	Body	Rump	Girth
Body Weight (g)	Head	Correlation	1.000				
		Significance (2-tailed)	.				
		Df	0				
	Tail	Correlation	.248	1.000			
		Significance (2-tailed)	.001	.			
		Df	177	0			
	Body	Correlation	.233	-.124	1.000		
		Significance (2-tailed)	.002	.099	.		
		Df	177	177	0		

	Rump	Correlation	.001	.054	.091	1.000	
		Significance (2-tailed)	.989	.476	.224	.	
		Df	177	177	177	0	
	Girth	Correlation	.151	.123	.165	.111	1.000
		Significance (2-tailed)	.044	.100	.028	.139	.
		Df	177	177	177	177	0

Table 5: Regression analysis between body weight and morphometric traits of cane rats fed diets containing varying level of grass and concentrate

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.524	.090		-5.792	.000
	Head	.035	.015	.123	2.237	.027
	Tail	.003	.003	.036	.749	.455
	Body	.012	.003	.228	4.004	.000
	Rump	.001	.001	.060	1.275	.204
	Girth	.028	.003	.556	9.615	.000

a. Dependent Variable: Body Weight (g)

Adjusted R² - 0.652

Correlations among body traits are very important in the study of morphometric characters because they serve as indicators of the magnitude and direction of change in one trait as affected by another. The result obtained from table 4 showed that there was no significant correlation between body weight and morphological traits measured as head length, body length, rump length and body girth had positive co-efficient with the body weight except tail length which was negatively correlated though not significantly different. This agrees with results of Annor *et al.*, (2011) who stated that the correlation among linear measurement in cane rats was positively very high and significant. This suggests that morphometric traits could be used as predictors of weight of mature cane rat. This implies that morphological traits have direct or positive relationships with body weight and implies that, increase in morphological traits across the treatments is as results of increase in body weight across the period of the study as indicated in table 4. On the other hand, tail length had negative co-efficient implying that there is inverse relationship between these variables. Similarly, regression analysis indicates no significant correlation ($p < 0.05$) between the body weight and morphological traits as shown in table 5. The adjusted R² was 0.652 indicating that about 65.20% of the morphological variation in effect of determinants of growth performance of cane rat fed with varieties of concentrate diet.

CONCLUSION

It was concluded from the research that the animals were stable and maintained homeostasis throughout the experiment. The estimation of body weight using morphometric parameters is very important for cane rat farmers who rarely keep records. The inclusion of 75% Elephant grass and 25% Compounded feed had a better FCR and optimum growth performance.

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