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Morphometric Observations of the Brain of the African Grasscutter (*Thryonomys swinderianus*) in Nigeria

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Abstract: Morphometric studies were carried out on the brain of 10 African grasscutter. The mean brain weight was 10.5±0.31 g. The mean brain length (from the olfactory bulb to the medulla oblongata at the level of occipital condyles) was 5.95±0.12 cm. The mean brain height was 1.59±0.10 cm (measured from level of the hypothalamus to the top of the cerebrum). The mean cerebellar weight and length were 1.26±0.05 and 3.48±0.45 cm, respectively. The ratio of the brain to body weight was 0.01. This is bigger than 0.006 Red Sokoto sheep, but smaller than 0.02 of man. Increase in the body weight did not directly affect the brain weight.

Key words: Anatomy, brain, grasscutter, morphometric observations, body weight

INTRODUCTION

Grasscutter (*Thryonomys swinderianus*, Temminck) is a wild herbivorous rodent erroneously regarded as by some people as a larger version of the rat (Asibey and Addo, 2000). It is rather related to the African brush-tailed porcupine as, well as the chinchilla, the guinea pig and the capybara of South America (Wood, 1955; National Research Council, 1991). The grasscutter is found only in Africa (Baptist and Mensah, 1986). In West Africa, it is commonly known as the 'grasscutter', while, in south Africa, it is called the 'cane rat. It is being hunted aggressively in the wild leading to destruction of environment through setting of bush fires by hunters in these areas (Yeboah and Adamu, 1995).

In Nigeria today, an average citizen does not meet the protein requirements for humans (Chupin, 1992). Domestication of the wild life rodents has been recognized as another means of animal protein (Ajayi, 1971). Among the rodents, the grasscutter is the most preferred (Clottey, 1981) and its meat is the most expensive bush meat in the sub region (Asibey and Addo, 2000). The important of domesticating the species is underscored by the National Research Council (1991), which stated that successful domestication of the grasscutter species would make it an equivalent of the South America's guinea pig and will bring about a reduction of Africa's chronic protein shortage.

Studies have shown that grasscutter can be tamed and even used for laboratory animal (Addo, 1998). Development of an indigenous research animal such as grasscutter should be encouraged. Scientific and published works been documented in this animal in the areas of reproduction (Addo, 2002), housing and management system by the National Research Council (1991). It is therefore, important to intensified scientific and published work in all aspect of the grasscutter for the benefit of the breeders and researchers. This study sought to provide information on the brain morphometry of the grasscutter.

MATERIALS AND METHODS

Ten grasscutters (*Thryonomys swinderianus*) of matured ages with no sex variations were purchased from the local breeders in Makurdi town of Benue state, Nigeria. They were then transferred from these areas using the laboratory rat cages to the Department of Veterinary Anatomy laboratory, Ahmadu Bello University (ABU), Zaria. They were acclimatized 3 days prior to the experiment. They were fed with desired grasses and water was given *ad libitum*.

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The grasscutters were sedated using gaseous chloroform in a confined container and were then weighed using a balance (Mettler Balance, Model P 1210) with a sensitivity of 0.1 g. Their weights were recorded in grams (g) and the animals were later sacrificed. The method of brain removal from the cranium was according to Harper and Maser (1975). Morphologic and morphometric studies were at this stage conducted after being immersed in Bouin's solution. The weights of the brain were taken before being separated into its components. Brain separation into its major components like the olfactory bulb, the cerebral hemispheres and the cerebellum were done according to the method described by Fletcher (2006). Vernier calipers, thread and meter rule were used for the measurement of lengths, heights and widths of the brain and its components and recorded in centimeters (cm).

RESULTS AND DISCUSSION

The morphometric study in this research revealed that the mean weight was 10.50±0.31 g the mean weights of the cortex, olfactory bulb and cerebellum were 5.70±0.18, 0.51±0.99 and 1.26±0.05 g, respectively (Table 1). The mean brain length was 5.95±0.12 cm and the width 2.54±0.10 cm was greater than the mean brain height 1.59±0.10 cm. The cortex with mean length of 3.48±0.45 was the longest components of the brain (Table 2).

In the present study, the mean brain weight of the grasscutter was found to be 10.50±0.31 g this accounted for 1% of the total body weight. The mean brain weights of the cortex, olfactory bulb and cerebellum were 5.7±0.18, 0.51±0.99 and 1.26±0.05 g, respectively. These structures also accounted for 54, 14 and 12% of the total brain weights, respectively. The mean brain length was 5.95±0.12 cm, the olfactory bulb, 0.56±0.02 cm and cerebellum, 1.26±0.05 cm. These figures were less than those documented for Red Sokoto goats and West African dwarf sheep (Olopade and Onwuka, 2002; Onwuka *et al*., 2005), kangaroo, dog, cat and porcupine (Eric, 2006). They figure were larger than those for squirrel, guinea pig, rat, sparrow and viper (Eric, 2006) and African giant rat (Nzalak, 2002).

The mean cerebellar weight of 1.26 g in this study was lower than the 6.0 g of dog, 2.3 g of cat, 1.9 g of rabbit and 1.5 g of squirrel, but heavier than 0.9 g of guinea pig, 0.4 g of pigeon and 0.09 g of mouse (Sultan and Braitenberg, 1993). Sultan and Braitenberg (1993) had a comparative study of the cerebellar weights and body weights of man, mouse, squirrel, rabbit, cat and dog. The average brain weight of various species has been documented. These include cow 435-458 g; lion 240 g; pig 180 g; sheep 140 g; cat, 30 g; rabbit 10-13 g; porcupine, 25 g; dog (beagle) 72 g; rat (400 g body weight) 2 g; guinea pig, 49 g; squirrel, 7.6 g and house sparrow, 1.0 g (Eric, 2006). The olfactory bulb of the small brain insects and rodents were considered to be comparatively larger than the large brain of apes, including man.

In this research, the ratio of the brain to the body weight was 0.01. This is bigger than 0.006 documented for Red Sokoto sheep (Olopade and Onwuka, 2002), but smaller than the 0.02 reported for man (Dyce *et al*., 1996). This can be ascribed to a relatively low brain weight of the small ruminants (Olopade and Onwuka, 2002). A direct relationship of the body weight increase to the increase in

Table 1: The body and brain weights of the grasscutter (Mean±SEM, n = 10)

	Animal number										
Weight (g)	1	2	3	4	5	6	7	8	9	10	Mean±SEM
BW	2050	1600	1500	1500	1400	930	530	470	440	380	1080±19.04
BRW	11	10	11	10	12	12	10	10	9	10	10.50±0.31
CCW	5.70	6.20	5.00	6.00	5.20	6.50	5.20	6.30	5.04	6.20	5.70±0.18
OBW	0.50	0.50	0.50	0.40	0.40	0.55	0.40	0.57	0.66	0.65	0.51±0.99
CBW	1.40	1.50	1.20	1.10	1.40	1.40	1.20	1.20	1.00	1.20	1.26±0.05

BW: Body Weight; BRW: Brain Weight; CCW: Cerebral Cortex Weight; OBWL Olfactory Bulb Weight; CBW: Cerebellar Weight

Table 2: Brain biometry of the grasscutter (Mean±SEM, n = 10)

	Animal number										
Length (cm)	1	2	3	4	5	6	7	8	9	10	Mean±SEM
BL	6.60	6.40	6.20	6.10	6.00	5.70	5.80	5.70	5.40	5.55	5.95±0.12
BW	2.80	1.80	2.50	2.80	2.65	2.80	2.80	2.50	2.40	2.30	2.54±0.10
BH	2.00	1.80	1.85	1.80	1.65	2.00	1.30	1.20	1.20	1.10	1.59±0.10
OBL	0.55	0.40	0.57	0.66	0.65	0.50	0.60	0.55	0.60	0.50	0.56±0.02
CL	3.80	3.75	3.70	3.80	4.00	3.20	3.20	3.15	3.00	3.15	3.48±0.45
CBL	1.36	1.18	1.22	0.94	1.20	1.40	1.40	1.40	1.20	1.30	1.26±0.05

BL: Brain Length; BW: Brain Width; BH: Brain Height; CCL: Cerebral Cortex Length; OBL: Olfactory Bulb Length; CBL: Cerebellar Length

brain weight was not observed by this data. That is, increase in the body weight is far from being proportional to the brain weight. This agreed with the findings of Rudolf and Stromberg (1976) for rat. Lack of significant differences in the brain heights (from the hypothalamus to the roof of the cerebrum) of these animals with different body weights suggest that full growth in these areas is quickly achieved in the grasscutte. These findings fit in with that documented for sheep (Olopade and Onwuka, 2002).

The results obtained in this study can be used as a research base line data for pharmacology and in animal psychiatry (Benloucif and Mark, 1995). It can also be used in controls, when comparing with pathological cases like scrapie, encephalomyelitis, cerebellar hypoplasia and neoplastic conditions. It can also be useful in comparative neuroanatomy among the rodents in Africa and regional anatomy of the head of the species.

CONCLUSION

The result of this study showed that the ratio of the brain to body weight is bigger than that of the sheep, but smaller than that of man. We also established that the increase in body weight has no proportional increase in the brain weight. This result can be useful in comparative neuroanatomy for the rodent in documented in the literature.

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