Journal of
Advanced Veterinary Research
Volume 2 (2012) 86-90
Original Research

Organ Body Weight Relationship of Some Organs in the Male African Grasscutter (*Thryonomys swinderianus*)

Itopa Etudaye Ajayi[1*], James Clinton Shawulu[1], Wesley Daniel Nafarnda[2]

[1]*Department of Veterinary Anatomy, University of Abuja, Nigeria*
[2] *Department of Public Health and Preventive Medicine, University of Abuja, Nigeria*

(Recieved 30 September 2011/ Accepted 28 February 2012)

Abstract

Studies were conducted to examine the relationship between the organ-body weights. Six apparently healthy adult grasscutters were used for the study. Organ weights considered were the liver, lungs, kidneys, spleen and testes, all of which were recorded as mean ± SEM. A highly positive correlation existed between the right testis and the body weight ($r = 0.950$, $p < 0.05$). The left testis and the body weight also exhibited high positive relationship ($r = 0.904$, $p < 0.05$). Bilateral asymmetry of paired organs was observed, very high positive relationships existed between the right and left lungs ($r = 1.000$, $p < 0.05$), the right and left kidneys ($r = 0.968$, $p < 0.05$) and also the right and left testes ($r = 0.985$, $p < 0.05$). For cases of significant relationships, we infer that the variables or their combinations could provide a good estimate for predicting live weights of the African grasscutter.

*Keywords:*Internal organ weights; body weights; correlation; African grasscutter

Introduction

The African grasscutter (Thryonomys swinderianus) is found in countries like Nigeria, Cameroon, Sudan, Uganda and Ethiopia (National Research Council, 1991). It is a genus of the rodent and the only member of the family Thryonomyidae and the suborder, Hystricomorpha (Byanet *et al*., 2009). The animal may weigh up to 9 kg or more and may have a head-and-body length of up to 60 cm (Igbokwe, 2010). Indeed, the grasscutter is the second largest African rodent after the Porcupine (National Research Council, 1991). Attempts to domesticate this rodent have been on the increase (Eben, 2004). However, these efforts have not been successful in the recent past (Opara *et al*., 2006) due to the high demand of the animal as a delicacy in some West African countries, including Nigeria, Togo, Benin, Ghana and Cote d'voire (Baptist and Mensah, 1986; Asibey and Addo, 2000).

It has been documented that the grasscutter can be tamed and used as a suitable laboratory model (Igbokwe, 2010). However, paucity of information on the biology of the species still lingers. Consequently, there have been various researches on the animal including studies of the fore brain and cerebellum (Byanet *et al*., 2009), haematology and plasma biochemistry (Byanet *et al*., 2008), histomorphometric studies of the kidneys (Ajayi *et al*., 2010), gross studies of the medulla oblongata (Ajayi *et al*., 2011), the thyroid gland (Igbokwe, 2010) and the lower respiratory system (Ajayi *et al*., 2009). All of these studies have been in a bid to explore the anatomy and understand the adaptive physiology of the animal as this may proffer explanations to questions that may arise in the course of research, domestication and breeding of the grasscutter may be provided.

Two basic methods of organ exploration have been recognised; radiology such as ultrasound or computer tomography, and weighing the organs of research animals. However, there are both positive and negative effects for each method (Mathuramon *et al*., 2009). Organ weight can be the most sensitive indicator of the effect of an experimental compound (Michael *et al*., 2007), as significant differences in organ weight between treated and untreated animals may occur in the absence of any morphological changes (Bailey *et al*., 2004). Observations from toxicological studies have reported complications often due to differences in body weights between groups. Therefore, other parameters that are commonly used for analysis of organ weight are the ratio of the organ weight to body weight (to account for differences in body weight) and the ratio of the organ weight to the brain weight

*Corresponding author: Itopa E. Ajayi
*Address:*Department of Veterinary Anatomy, University of Abuja,Nigeria
E-mail address: mailitopa@yahoo.com

(Bailey *et al*., 2004) which are generally classified as relative ratios.

Base line information on organ-body weight data is very important in various spheres of veterinary medicine and biological science (Gangrade, 2009) as any deviation from the normal weight is suggestive of the presence of some pathology (Tanna *et al*., 2011). The present study is an attempt to provide information on the internal organ weight (IOW)-body weight (BW) relationship of some organs in the African grasscutter (Thryonomys swinderianus) as well as bilateral organ weight relationship of some paired organs.

Materials and methods

Six adult (6-18 months old) male apparently healthy African grasscutters (Thryonomys swinderianus) were used. They were purchased from local farmers in Otukpo Local Government Area (6º 49´ N, 8º 40´ E) of Benue State, Nigeria. They were transported to Zaria by road in standard grasscutter cages. The animals were stabilized for about 2 weeks prior to the start of the study during which they were given access to fresh elephant grass (Pennisetum purpureum) and water ad libitum.

The live weight of each rat was taken using a sensitive balance (Mettler Balance, Model P1210, AG, Switzerland) and recorded in grams. The animals were then anaesthetized with chloroform in a closed container. After complete anaesthesia was achieved the brain was extracted using the method described by Ajayi *et al*. (2011). The brain was freed of its meninges and weighed using a Mettler® balance with a sensitivity of 0.01 g. The thorax and abdomen were also dissected and the lungs, liver, spleen, kidneys and testes removed. Blood present on the surface was removed by rinsing with tap water. Peritoneal fat or any other attached tissues present with the organ were removed by careful dissection and rinsing. Thereafter, the organs were weighed using the Mettler® balance.

The data obtained were recorded and analysed for mean, standard error of the mean and correlation using the SPSS for Windows version 19.0. Pearson’s correlation coefficient was used to establish the relationship between BW and IOW ($p < 0.05$). Simple linear regression was performed using the fitted equation; ($y = bx + a$) between the internal organs (dependent) and body weight (independent) variables. – y axis depends upon three values: a is a ‘constant’ and is the value of y when x is zero; b is the ‘slope’ of the line, the amount by which the y value increases (or decreases, for negative slope) for each unit of increase in the x value; x is, the value of x itself.

Results

The results of the data collected and subjected to statistical analysis are summarized in tables 1, 2, 3 and 4. Scatter plots of organ weights to body weights and organ to organ weights of some paired organs are presented in Figures 1and 2. A solid line represents the best fit line to the data based on simple linear regression with the R^2 values showing the high levels of positive linear correlation.

Table 1. Weights of the various parameters considered in grams

Organ	Weights (Min. – Max.)	Mean ± SEM	Range of % BW
Live body	1500.00 – 3500.00	2366.67 ± 290.88	100
Liver	17.02 – 81.48	46.39 ± 10.42	0.65 – 3.31
Right lung	6.82 – 20.82	10.14 ± 2.22	0.26 – 0.93
Left lung	5.07 – 15.49	7.54 ± 1.65	0.20 – 0.69
Right kidney	3.22 – 6.71	5.00 ± 0.56	0.16 – 0.30
Left kidney	3.25 – 6.03	4.59 ± 0.43	0.14 – 0.27
Spleen	1.34 – 4.79	3.17 ± 0.50	0.08 – 0.19
Right testis	0.61 – 3.76	2.12 ± 0.47	0.04 – 0.12
Left testis	0.69 – 3.49	2.08 ± 0.45	0.05 – 0.11
Fixed brain	9.39 – 13.75	11.71 ± 0.72	0.36 – 0.75

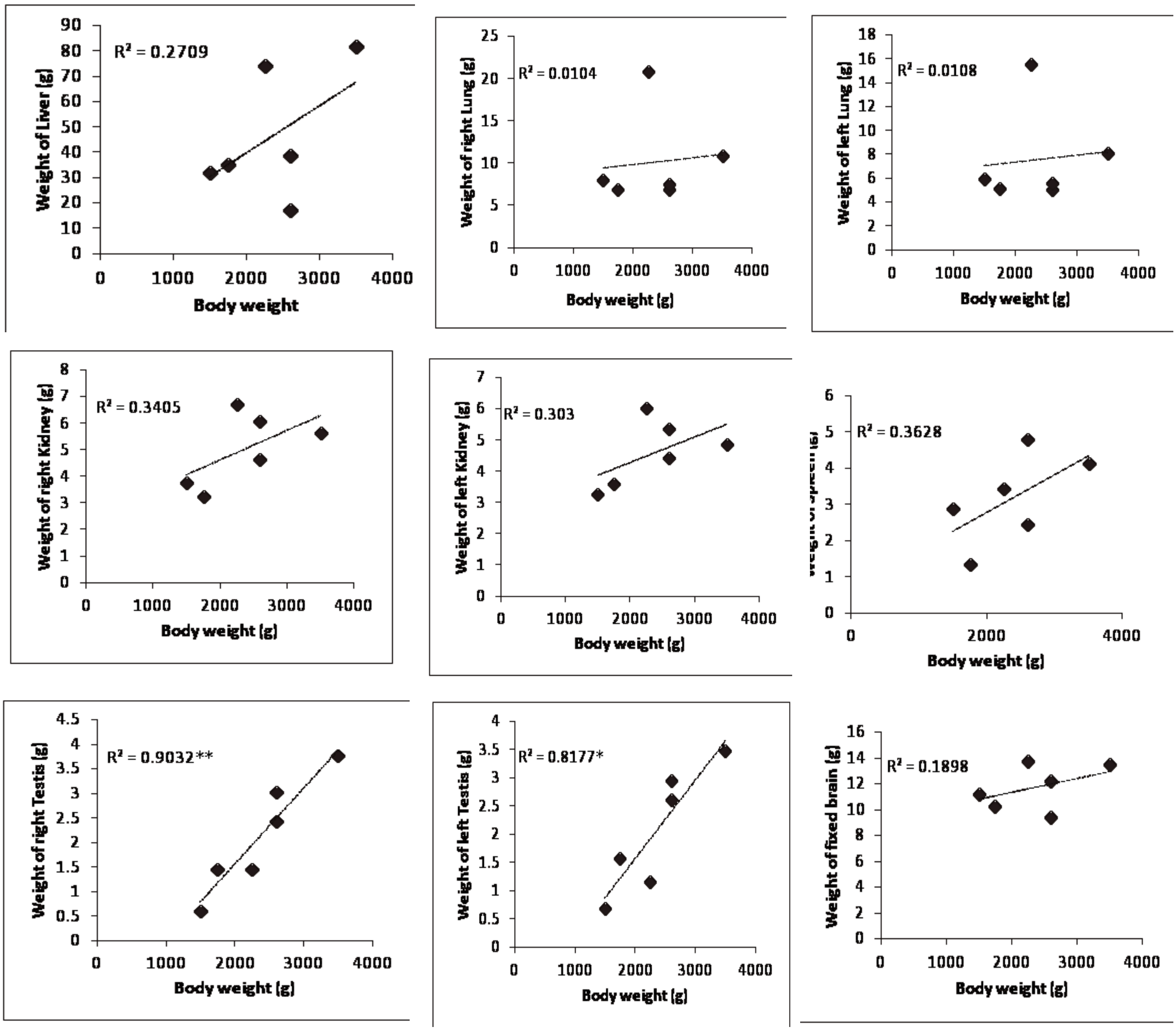

Fig.1. Scatter plots showing the relationships between the various internal organs and body weights.

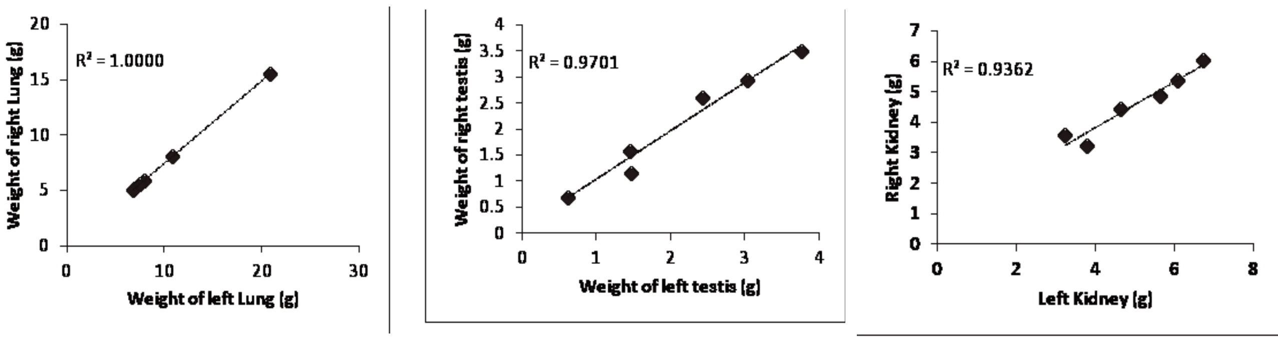

Fig. 2. Scatter plots showing the relationships between bilateral paired organs

Discussion

Studies to establish base line data on the weights and morphometric parameters of internal organs are still on going by various researchers. Body weight and organ weight parameters are of primary importance in experimental biology (Burger *et al.*, 1962). In this study, the values of the right and left testicular weights were found to be highly positively correlated with body weight ($p < 0.05$) (Table 2 and 3). This finding is in agreement with similar studies on testicular biometry and relationship with body weights in caprine (Raji *et al.*, 2008; Kabiraj *et al.*, 2011) and indicates that eitherof these variables or their combinations could provide a good estimate for predicting live weights of the African grasscutter. However, the mean weight of the right testis was higher than that of the left testis contrary to the observation of Kabiraj *et al*. (2011) on the testicular weight of black Bengal bucks in Bangladesh. This may have been due to inter species differences.

Table 2. Correlation values between internal organs considered and live body weights of the animals

Organ	R	p-value
Liver-BW	0.520	0.29
Right Lung-BW	0.102	0.85
Left Lung-BW	0.104	0.85
Right Kidney-BW	0.583	0.22
Left Kidney-BW	0.550	0.26
Spleen-BW	0.602	0.21
Right Testis-BW	0.950*	0.00
Left Testis-BW	0.904*	0.01
Brain-BW	0.436	0.39

The weight of the right lung (10.14 ± 2.22 g) was found to be greater than the left lung (7.54 ± 1.65 g) (Table 1). This fits the inference that the left-positioned heart impedes left lung growth (Barr, 2001). The relative percentage of lung weights was found to be lower than what was documented for humans (Tanna *et al*., 2011). This may be due to the lesser demand of oxygen by the species, evident by the hypo-ventilated burrows where they inhabit in the wild. The relative weights of the spleen appeared higher than that of laboratory hamsters (0.11 %) (Gatterman *et al*., 2002) but lower than that of laboratory rats (0.2 %) (Losco, 1992). These differences may not be suggestive as a number of species differences in the gross appearance of the spleen have been documented (Cesta, 2006). Our findings revealed that the relative kidney weights fell within the range of relative kidney weights documented by Tanna *et al*. (2011). The relative weight of the right kidney was slightly higher than the left contrary to the observation of Tanna *et al*. (2011). However, when bilaterally correlated, a highly significant positive correlation was observed ($r = 0.968$, $p < 0.01$) (Table 4). This finding may be useful in predicting a kidney weight in cases of unilateral kidney damage.

Table 3. Regression equation of internal organ weight and body weight of the African grasscutter (*Thryonomys swinderianus*)

	$y = bx + a$	R^2
Liver-BW	$y = 0.019x + 2.274$	0.27
Right lung-BW	$y = 0.001x + 8.295$	0.01
Left lung-BW	$y = 0.001x + 6.144$	0.01
Right kidney-BW	$y = 0.001x + 2.355$	0.34
Left kidney-BW	$y = 0.001x + 2.658$	0.30
Spleen-BW	$y = 0.001x + 0.710$	0.36
Right testis-BW	$y = 0.002x - 1.552$	0.90*
Left testis-BW	$y = 0.001x - 1.225$	0.81*
Fixed brain-BW	$y = 0.001x + 9.166$	0.82

y = Internal organ weight, x = Body weight

Table 4: Regression equation of bilateral internal body organs showing the relationships between organ pairs

Organ-organ pairs	$y = bx + a$	R^2	p
Right lung-left lung	$y = 0.7445x - 0.0035$	1.0000**	0.000
Right kidney-left kidney	$y = 0.7486x + 0.1035$	0.9362**	0.002
Right testis-left testis	$y = 0.9308x + 0.1035$	0.9701**	0.000

y = weight of right pair of internal organ, x = weight of left pair of internal organ

**Correlation is significant at $p < 0.01$

References

Ajayi, I. E., Ojo, S. A., Ayo, J. O., Ibe, C. S., 2010. Histomorphometric Studies of the Urinary Tubules of the African grasscutter (Thryonomys swinderianus). Journal of Veterinary Anatomy, 3(1), 17 - 23.

Ajayi, I. E., Ojo, S. A., Onyeanusi, B. I., George, B. D. J., Ayo, J. O., Salami, S. O., Ibe, C. S., 2011. Gross observations and morphometry of the medulla oblongata of the African grasscutter (Thryonomys swinderianus). Veterinary Research, 4 (1), 5 - 8.

Ajayi, I. E., Salami, S. O., Ayo, J. O., Ibe, C. S., Danjuma, F. A., Ojo, S. A., Onoja, I. I., 2009. Morphologic and morphometric studies of the lower respiratory system of the grasscutter (Thryonomys swinderianus). Book of Abstracts, 46th Annual Conference of the Nigerian Veterinary Medical Association (NVMA) 46, 5.

Asibey, E. O. A., Addo, P. G., 2000. The Grasscutter, Promising animals for meat production. In: Turnham D. (Ed.). African perspectives, practices and supporting sustainable development. Scandinavian seminar policies college, Denmark, in association with weaver press, Harare, Zimbabwe. pp. 120.

Bailey, S. A., Zidell, R. H., Perry, R. W., 2004. Relationships Between Organ Weight and Body/Brain Weight in the Rat: What Is the Best Analytical Endpoint?. Toxicologic Pathology 32, 448 - 466.

Baptist, R., Mensah, G. A., 1986. The Cane rat farm Animal of the future in Benin and West Africa. World Animal Review 60, 2 - 6.

Burger, R. E., Lorenz, F. W., Gates, C. E., 1962. Relationships of Organ Weight to Body Weight. Poultry Science 41, 1762 - 1773.

Byanet, O., Nzalak, J. O., Salami, S. O., Nwaogu, I. C., Bosha, J. A., Umosen, A. D., Ojo, S. A., Obadiah, H. I., 2008. Macroscopic studies of the gastrointestinal tract of the African grasscutter (Thryonomys swinderianus). Veterinary Research 2, 17-21.

Byanet, O., Onyeanusi, B. I., Ibrahim, N. D. G., 2009. Sexual Dimorphism with Respect to the Macro-Morphometric Investigations of the Forebrain and Cerebellum of the Grasscutter (Thryonomys swinderianus). International Journal of Morphology, 27(2), 361-365.

Cesta, M. F., 2006. Normal Structure, Function, and Histology of the Spleen. Toxicologic Pathology, 34(5), 455 -465.

Eben, A. B., 2004. Grasscutter: Importance, Habitat, Characteristics, feed and Feeding, Breeding and Diseases. Kumasi, Ghana, Programme organized by Centre for Biodiversity Utilization and Development (CBUD), pp.1-6.

Gangrade R. P., 2009. Organ Weights and its Correlation with Body Weight-A Post Mortem Study. Journal of Forensic and Toxicology 26, (2).

Gattermann, R., Fritzsche, P., Weinandy, R., Neumann, K., 2002. Comparative studies of body mass, body measurements and organ weights of wild derived and laboratory golden hamsters (Mesocricetus auratus). Laboratory Animals 36, 445-454.

Igbokwe, C.O., 2010. Gross and microscopic anatomy of thyroid gland of the wild African grasscutter (Thryonomys swinderianus, Temminck) in Southeast Nigeria. European Journal of Anatomy 14 (1), 5-10.

Kabiraj, S. K., Hoque, S. A. M., Yahia Khandoker M. A. M., Husain, S. S., 2011. Testicular biometry and its relationship with body weight and semen output of black Bengal bucks in Bangladesh. Journal of Cell and Animal Biology, 5 (2), 27-32.

Losco, P., 1992. Pathobiology of the Aging Rat, Normal Development, Growth, and Aging of the Spleen. Eds Mohr U, Dungworth DL, Capen CC (ILSI Press, Washington, D.C), 1, pp 75-94.

Mathuramon, P., Chirachariyavej, T., Peonim, V., Rochanawutanon, M., 2009. Correlation of Internal Organ Weight with Body Weight and Length in Normal Thai Adults. Journal of the Medical Association of Thailand, 92 (2), 250-258.

Michael, B., Yano, B., Sellers, R. S., Perry, R., Morton, D., Roome, N., Johnson, J. K., Schafer, K., 2007. Evaluation of organ weights for rodent and non-rodent toxicity studies: A review of regulatory guidelines and a survey of current practices. Toxicologic Pathology 35,742–750.

National Research Council, 1991. Microlivestock. Little known small Animal promising economic future, National Academy Press. Washington D.C., pp 449

Opara, M. N., Ike, K. A., Okoli, I. C., 2006. Haematology and Plasma Biochemistry of the Wild Adult African Grasscutter (Thryonomis swinderianus, Temminck). The Journal of American Science 2, (2).

Raji, A. O., Igwebuike, J. U., Aliyu, J., 2008. Testicular Biometry and Its Relationship with Body Weight of Indigenous Goat in a Semi-Arid Region of Nigeria. Journal of Agricultural and Biological Science 3(4), 6-9.

Tanna, J. A., Patel, P. N., Kalele, S. D., 2011. Relationship between organ weights and body weight in adult population of Bhavnagar region. A post mortem study. Journal of Indian Academy of Forensic Medicine 33 (1), 57-59.