
THE RATIO BETWEEN ORGANS WEIGHT AND BODY WEIGHT IN MALE BLACK BENGAL GOATS

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AUTHOR'S CONTRIBUTION

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

Objective: Estimation of internal organ weight is an important parameter for post-mortem examination. Documentation on the relative weight of various organs in foreign breeds is accessible; however comparable research has not been done on Bangladeshi local varieties. This investigation intended to assist a field veterinarian during post-mortem by demonstrating the normal organ weight and body weight relationship of a male black Bengal goat.

Materials and Methods: The present study included 21 apparently healthy male black Bengal goats, The liver, spleen, and kidneys were the organs that are weighed. The age range was 10-15 months with 10-16 kg body weight.

Results: The data were then statistically and visually estimated. The mean age and body weight was 12.5 months and 13 kg accordingly. An increase in body weight causes changes in the organ weight and the relative organ weights of the liver, spleen and kidney are 2.81 percent, 0.12 percent, and 0.16 percent, respectively.

Conclusion: A relationship was found between internal organs weight and body weight in males whereas, in females, the organ weight relationship is yet to be determined.

Keywords: Body weight; goats; kidney; liver; organ weight; spleen.

1. INTRODUCTION

The contribution of livestock to Gross Domestic Product (GDP) during the period 2021-2022 was 1.9% while the share of livestock in Agricultural GDP during the same period was 16.52% [1]. Besides cattle, the contribution of goat to improve livelihood and food security is well established in Bangladesh. About 23 million goats are distributed throughout the country [2]. Department of Livestock Services (DLS) has already taken goat farming as a development program to generate income and reduce poverty in the rural population.

Among different breeds high prolificacy, low mortality rate, low cost of management along with high demand and variation of skin make black Bengal goat very popular for commercial and backyard goat farming in Bangladesh [3]. Moreover, black Bengal goat is the owned breed of Bangladesh and it has been estimated that about 90% goats of Bangladesh belong to this breed [4]. Department of Livestock Services (DLS) emphasizes on the production of black Bengal goats due to their ever-increasing value for skin and preservation of their originality. But this promising sector is on the way to being destroyed due to the high death rate as a result of different infectious, non-

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infectious and toxic causes like PPR (Peste Des Petits Ruminant), diarrhoea, parasite infestation, etc. [5].

Post- mortem examination is the only way to diagnose and differentiate these cases as relevant facilities are not available in field condition [6]. The weight of different organs plays a significant role for pathologists to compare post-mortem findings with normal conditions [7]. This study will provide a basis for identification along with differential diagnosis between infectious and toxicological cases as the relative weight of various organs varies under different environmental conditions [8].

Although there are several standard textbooks showing the normal internal organs weight of goats which are mostly referenced or from the foreign breed such as that of Bushara [8] and Hall [9] on Nigerian and Taggar goat breeds respectively. No such investigation is documented on black Bengal goat.

Our study aimed to investigate the relative weight of three vital abdominal organs (liver, spleen and kidneys) in male 21 healthy black Bengal goats and documented it to aid in the comparison of normal and abnormal organ weight by field veterinarians and pathologists. Changes in these organs, particularly hepatomegaly and splenomegaly, are frequently used to interpret and differentiate different diseases. For example, the liver, a vital abdominal organ, is in charge of detoxifying toxic ingredients and various drugs or food additives [10]. While the spleen frequently expands in response to a variety of hematologic or metabolic disorders [11] and Platelet count [12]. In addition, the size of kidney indicates the severity of renal disease [13].

So, the determination of abdominal organ weight in goat has potential clinical value.

2. MATERIALS AND METHODS

2.1 Study Location

To conduct this study, first, we had selected a black Bengal goat firm in Chawkbazar, Chattogram, Bangladesh. For 6 months (November 2021 to April 2022), we examined all the goats slaughtered on the farm and selected 21 male healthy goats.

2.2 Selection of Animals and Analysis of Samples

Selected animals were weighing from 10 to 16 kg and were within 10-15 months of age range. Then liver, spleen and kidneys were collected immediately after slaughter. Collected samples were thoroughly washed under running tap water then the liver was weighed in Camry digital weighing balance; whereas, spleen and kidneys were weighed in Shinko digital weighing machine (Model DJ-600A) at Department of Anatomy and Histology, Chattogram Veterinary and Animal Sciences University, Chattogram, Bangladesh.

2.3 Statistical Analysis

The obtained results were calculated and analyzed in Microsoft Excel- 2016 and represented graphically.

3. RESULTS

External parameters including age (months) and body weight (kg) of goats are shown in Table 1. Internal organs weight (gm) is shown with the mean and standard deviation (SD) in Table 2.

Table 3 displays the relationship between internal organ weight and body weight as a ratio and percentage (percent) of body weight (BW). As shown in Table 3, the liver, spleen, and kidney account for approximately 2.81 percent, 0.12 percent and 0.16 percent of total body weight (BW) respectively.

The results revealed that as body weight increases, so does the weight of the organs as shown in Figs. 1 & 2. Though this change did not follow any specific pattern.

4. DISCUSSION

The weight of normal internal organs is usually estimated by two methods, radiology such as ultrasound or computed tomography (CT) and the weight of organs from post-mortem examination [14]. However, there are not only positive but also negative effects for each method. Field veterinarians and pathologists are interested in the weighing method as it is directly from the carcass and a part of routine

Table 1. Mean, standard deviation, age (month) and body weight (kg) range in Black Bengal goat

Parameter	Mean± SD	Range (Max. – Min.)
Age (months)	12.5±1.47	10- 15
Body weight (kg)	13±1.43	10-16

Table 2. Internal organs weight (gm) is shown in the form of the mean± standard deviation (SD)

Internal organ	Mean± SD
Liver	367.71±63.53
Spleen	15.73±2.75
Kidney (right)	22.81±3.78
Kidney (left)	19.88±3.81
Kidney (Mean)	21.35±3.80

Table 3. Correlation between internal organ weight and body weight

Parameter	Ratio	Percentage (%) of BW
Liver weight: BW	0.028	2.81
Spleen weight: BW	0.001	0.12
Kidneys: BW	0.001	0.16

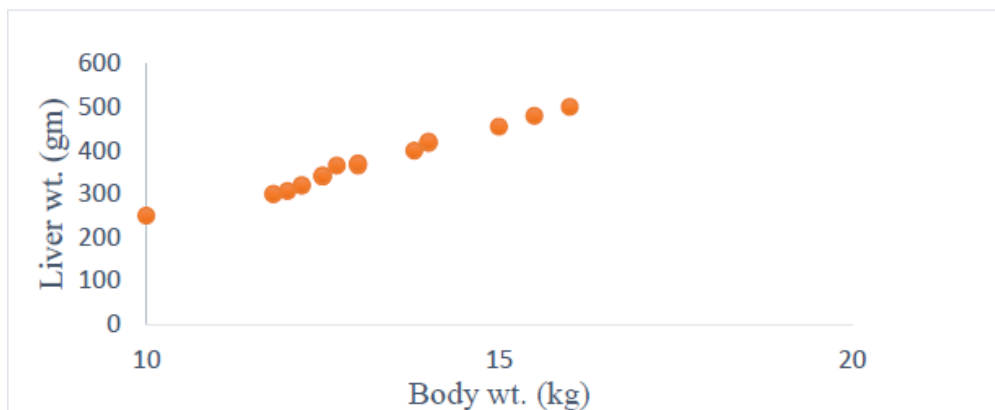


Fig. 1. Liver weight- body weight

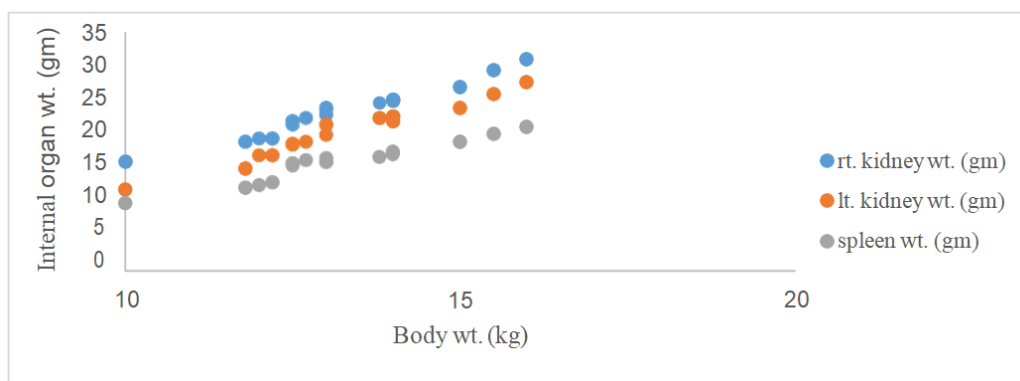


Fig. 2. Internal organ weight- body weight

work. There were studies showing causes of death have an effect on the weight of the internal organs, such as hemorrhagic shock; which makes it decrease [15].

Liver which is the largest solid gland of the body located in the right side of the abdominal cavity from the lumbocostal angle to 7th rib [16]. The present study found that it weighs about 2.81% of the total

body weight (Table 3). This result does not match the findings of [17]. Maybe it is due to the differences in breed, age, body weight and environmental variation among the animals. But the value is closer to the values of rats, dogs, humans and swine which were reported at 3.66%, 3.29%, 2.57% and 2.04% respectively [18]. But lower than the value of 1.23% in cattle and sheep 1.66% [19,17]. It was also found, that the relative weight of liver also has a positive

correlation with body weight (Fig 1). This finding is similar to the findings of Bailey et al., [7]. A study on mature female goats reported the same [20].

The spleen is approximately triangular and extends obliquely from the last rib to the middle of the 10th intercostal space [21]. We found the relative weight of the organ is 0.12% (Table 3) in male black Bengal goat. This matches with the result of Bhatnagar et al., [22] and Li et al., [17] which is 0.15% and 0.19% respectively. This finding is also comparable with the values in adult cattle at 0.18% [19]. The spleen weight: body weight commonly called splenic weight index showed an increasing trend in relation to body weight (Fig 2). However, several investigations discovered variance in the relative weight of the spleen, with the increasing weight of the spleen being limited to a certain body weight before gradually declining [23].

The kidneys of goat are bean-shaped and they were placed in the sublumbar region; the right kidney is placed slightly anterior to the left kidney [11]. The calculated related weight of kidney is 0.16% (Table 3). The value is comparable to the reported value of 0.21% for adult cattle [24]. But much lower than the value in goat and sheep, reported at 0.38% and 0.29% respectively [19]. This variation may be due to the disparity in breed, age, body weight and dissimilation in the environment of growth among the animals. The present study also showed that the right kidney was slightly heavier than the left kidney (Table 2) and the weight of kidneys are positively correlated with body weight (Fig 2). These findings are similar to the findings of Yoldas and Dayan [25].

5. CONCLUSIONS

This study found a positive correlation between normal organ weight and body weight of male black Bengal goats. More research is needed to find a correlation between the relative organ weight of male and female black Bengal goats. It is hoped that the results of the present study will encourage further research in this field.

COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. DLS (Directorate of Livestock Services). General information related to livestock. Monthly Fisheries and Livestock Bulletin, published by Fisheries and Livestock Information Office (2021). Khamarbari, Farmgate, Dhaka, Bangladesh.
2. BER (Bangladesh Economic Review). Ministry of Planning, Government of the People's Republic of Bangladesh; 2019.
3. Chowdhury SA, Shill BK, Hossain SMJ. Chagal palon manual. Bangladesh Livestock Research Institute, Savar, Dhaka. 2003;2nd ed.
4. Akhtar A, Hoque MA, Bhuiyan AKFH, Amin MR, Habib MA. A Study on Morphological characterization of Black Bengal Goat at three Villages under Bhaluka upazila in Mymensingh district of Bangladesh. International Journal of Livestock Production. 2021;12(2):86-97.
5. Rahman MH, Akther S, Ali MZ, Hassan MZ. Incidence of diseases in goats in Bangladesh. The Bangladesh Veterinarian. 2020;37(1-2):14-20.
6. Balabanova VI, Kudryashov AA. Differential postmortem diagnostics of the diseases of goats and sheep raised on the farms. International Bulletin of Veterinary Medicine. 2016;9(4):10-16.
7. Bailey S, Zidell RH, Perry RW. Relationships Between Organ Weight and Body/Brain Weight in the Rat: What Is the Best Analytical Endpoint?. Toxicologic Pathology. 2004;32(4):448-466.
8. Bushara I, Abdelhadi OMA, Elemam, MB, Idris AO, Nikhiala AM. Effect of environmental factors on body condition score of Taggar goats under dry land farming in western Sudan. Online Journal of Animal and Feed Research. 2011;1(5):231-234.
9. Hall S. Body dimensions of Nigerian cattle, sheep and goats. Animal Science. 1991; 53(1),61-69.
10. Klein B. Cunningham's Textbook of Veterinary Physiology. 2019; 6th ed., Saunders.
11. Dyce KM, Sack WO, Wensing CJG. Textbook of veterinary anatomy. 2010; 4th ed., Saunders/Elsevier.
12. Usende IL, Okafor CL, Aina OO, Onyiche TE, Durotoye TI, Omonuwa AO, Jarikre TA, Maina MM, Falohun OO. Comparative studies and clinical significance of the spleens of Nigerian indigenous pig (*Sus scrofa*) and goat (*Capra hircus*). Journal of Veterinary Advances. 2014;4(7):604-612.
13. Murawski IJ, Maina RW, Gupta IR. The relationship between nephron number, kidney size and body weight in two inbred mouse strains. Organogenesis. 2010;6(3):189-194.
14. Jackowski C, Thali MJ, Buck U, Aghayev E, Sonnenschein M, Yen K, Dirnhofer R, Vock P. Non invasive estimation of organ

- weights by postmortem magnetic resonance imaging and multislice computed tomography. *Investigative Radiology*. 2006;41(7):572-578.
15. Sato T, Kamiyama Y, Kamano T, Rutkowski J, Adams Cowley R, Trump BF, Jones RT. Pathophysiology of hemorrhagic shock. A model for studying the effects of acute blood loss in the rat. *Virchows archiv. B Cell Pathology Including Molecular Pathology*. 1985;48(4):361-375.
 16. Sisson S, Grossman J. *The anatomy of domestic animals*. 1975; 1(5), Saunders.
 17. Li M, Wang YS, Cuddy T. Physiological parameter values for physiologically based pharmacokinetic models in food-producing animals. Part III: Sheep and goat. *Journal of Veterinary Pharmacology and Therapeutics*. 2021;44:456-477.
 18. Brown RP, Delp MD, Lindstedt SL, Rhomberg LR, Beliles RP. Physiological parameter values for physiologically based pharmacokinetic models. *Toxicology and Industrial Health*. 1997;13(4):407-484.
 19. Lin Z, Li M, Wang YS, Tell LA, Baynes R E, Davis JL, Vickroy TW, Riviere JE. Physiological parameter values for physiologically based pharmacokinetic models in food producing animals. Part I: Cattle and swine. *Journal of Veterinary Pharmacology and Therapeutics*. 2020;43(5):385-420.
 20. Schultze AB, Turner CW. Relation of Endocrine Gland Weight to Body Weight in Growing and Mature Female Dairy Goats. *Research Bulletin, University of Missouri College of Agriculture Agricultural Experiment Station*; 1980.
 21. Dukes HH. *Dukes' Physiology of Domestic Animals*. 2019; 13th ed., John Wiley Blackwell.
 22. Bhatnagar VK, Sapra KL, Kalia ML. Spleen weight in relation to body weight, age and sex in goats. *Indian Veterinary Journal*. 1969; 46(4):306-311.
 23. Webster SH, Liljegren EJ. Organ: Body weight ratios for certain organs of laboratory animals. II. Guinea pig. *American Journal of Anatomy*. 1949;85(2):199-230.
 24. Lautz LS, Dorne JLCM, Oldenkamp R, Hendriks AJ, Ragas AMJ. Generic physiologically based kinetic modeling for farm animals: Part I. Data collection of physiological parameters in swine, cattle and sheep. *Toxicology Letters*. 2020;319:95-101.
 25. Yoldas A, Dayan MO. Morphological characteristics of renal artery and kidney in rats. *The Scientific World Journal*. 2014; 2014(468982):1-7.