

GROSS MORPHOMETRICAL ANALYSIS OF MUSCLES OF DIFFERENT BODY REGIONS OF ADULT WETHER (CASTRATED BLACK BENGAL GOAT) AND ITS CARCASS CHARACTERISTICS

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ABSTRACT

The morphometrical analysis of muscles of different body regions and carcass characteristics of adult wethers (castrated black Bengal goat) were studied. This experiment was conducted in the Department of Anatomy and Histology during the period from February to May 2005. Muscles of different body regions of wether were found to differ in length, breadth and thickness. Highest length (38.7 ± 0.7 cm) was recorded in rectus abdominis and followed by brachiocephalicus (38.5 ± 0.1 cm), sternomandibularis (30.5 ± 0.9 cm), sternohyoideus (29.7 ± 0.2 cm) and sternothyroideus (29 ± 1.5 cm) muscles. The abdominal muscles, especially the transversus abdominis muscle possessed highest breadth (13.7 ± 0.9 cm) were wider than the other muscles of the body. The cranio-lateral muscles of thigh had the highest thickness in comparison to other muscles of the body. Carcass characteristics regarding hot carcass weight, dressing percentage and percentage of lean, fat and bone were studied. Dressing percentage, lean, fat and bone percentages were 59.34 ± 0.5 , 60.91 ± 1.03 , 14.78 ± 1.13 and 24.30 ± 0.2 respectively. This study revealed that the length, breadth and thickness of muscles varied between the different groups of muscles, and also in the same group of muscle of the body and castrated Black Bengal goat had the lean percentage similar to the other breeds of world but a little higher bone percentage and lower fat percentage than the other breeds of the world.

Key words: Morphometry, muscles, wether, carcass

INTRODUCTION

Black Bengal goat is the heritage and pride of Bangladesh, found in all over the country. They have tremendous demand all over the world due to production of extraordinary quality meat and skin (Islam *et al.*, 1991). Due to requirements of small investment and management essentials, goat rearing can therefore be a source of cash income for landless farmer. This income of landless farmer comes mainly from the selling of goat "Poor man's cow" for meat purpose. Among the Black Bengal goat, castrated male goat has got more market demand. The value of wether is primarily determined by its meat yield and meat quality. Meat yield of wether depends on its muscular development i.e. the morphometry of muscles of the body. Although post natal development of muscle of Black Bengal goat in day 1, day 30 and day 90 was studied by Khan (1988), but there is no available literature regarding morphometry of muscles in adult wether. Carcass characteristic is another important factor in determining the value of wether. Carcass characteristics of Black Bengal goat regarding hot carcass weight and dressing percentage has been reported by Devendra and Burns (1983), Singh *et al.* (1986), Mishra (1983), but there is no report regarding distribution of lean, fat and bone and their percentage. So, the present work has been carried out to study the morphometry of muscles of different body regions of adult wether and its carcass characteristics in term of lean, fat and bone percentage and their ratio.

MATERIALS AND METHODS

Three castrated Black Bengal goats of 1 year age were used to study the gross morphometry of muscles of different body regions. The animals were purchased from the Muktagacha thana of Mymensingh district. The age was determined by dentition and asking owner and the body weight was taken by means of measuring tape applying the Shaeffer's formula:

$$\text{Live weight (W)} = \frac{L \times g^2}{300} \text{ Lb}$$

L = Length from the point of shoulder to pin (Hip joint), g = Heart girth.

The animals were bled to death by giving incision on carotid artery and dissection was carried out in the laboratory of the Department of Anatomy and Histology, Bangladesh Agricultural University, Mymensingh. Subcutaneous fat was collected carefully. After opening the thoracic and abdominal cavities, the fatty tissues surrounding the different organs such as peri-renal fat, peri-cardial fat, gut fat, scrotal fat were separated and then the visceral organs were removed and weighed. The muscles of the different regions (head, neck, forelimb, hind limb, thorax and abdomen) of the body were dissected out carefully and measured their length, breadth and thickness by using divider and scale (cm) in unfixed condition of the animals.

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RESULTS AND DISCUSSION

Morphometry of muscles of different body regions

In the present study muscles of the various regions of the body of wether were found to differ in length, breadth and thickness. Highest length was recorded in m. rectus abdominis (38.7 ± 0.7 cm) followed by m. brachiocephalicus (38.5 ± 0.1 cm), m. sternomandibularis (30.5 ± 0.9 cm), m. sternohyoideus (29.7 ± 0.2 cm), m. sternothyroideus (29 ± 1.5 cm) and m. sternomastoideus (23.8 ± 0.4 cm) (Table 1).

Table 1. Length, breadth and thickness (mean \pm SE) of the muscles of different body region of wether (n = 3)

Body region	Name of the muscles	Length (cm)	Breadth (cm)	Thickness (cm)
Head region	Zygomaticus	5.5 ± 0.3	1.6 ± 0.2	0.13 ± 0.03
	Caninus	4.1 ± 0.4	0.2 ± 0.0	0.2 ± 0.02
	Malaris	6 ± 0.3	1.9 ± 0.1	0.1 ± 0.02
	Levator labii maxillaris	4.3 ± 0.09	0.1 ± 0.03	0.3 ± 0.04
	Depressor labii maxillaries	3.9 ± 0.2	0.4 ± 0.1	0.2 ± 0.03
Neck region	Brachiocephalicus	38.5 ± 0.1	5.6 ± 0.1	0.3 ± 0.03
	Sternomandibularis	30.5 ± 0.9	1.1 ± 0.2	0.3 ± 0.0
	Sternomastoideus	23.8 ± 0.4	1.5 ± 0.03	0.3 ± 0.03
	Sternothyroideus	29 ± 1.5	0.7 ± 0.1	0.2 ± 0.05
	Sternohyoideus	29.7 ± 0.2	0.6 ± 0.05	0.2 ± 0.03
Shoulder and arm	Tensor fasciae antebrachii	14.8 ± 0.2	1.4 ± 0.09	0.4 ± 0.1
	Teres major	15.2 ± 0.2	2.9 ± 0.3	0.9 ± 0.07
	Lateral head of triceps brachii	10 ± 0.1	6.3 ± 0.4	1.9 ± 0.2
	Biceps brachii	12 ± 0.2	1.8 ± 0.1	1.7 ± 0.9
	Biceps brachii	12 ± 0.1	2.7 ± 0.2	$0.7 \pm +0.1$
	Deltoidius	7.5 ± 0.3	2.7 ± 0.9	0.6 ± 0.1
Forearm	Extensor carpi radialis	13 ± 0.3	2.1 ± 0.4	1.3 ± 0.3
	Extensor digitorum communis	10.8 ± 0.3	1 ± 0.2	0.6 ± 0.06
	Extensor digitorum lateralis	11 ± 0.3	1.3 ± 0.3	0.4 ± 0.09
	Ulnaris lateralis	11.9 ± 0.1	2.2 ± 0.2	1 ± 0.07
	Flexor carpi radialis	10.3 ± 1.6	1 ± 0.2	0.7 ± 0.2
Thorax and abdomen	Levatores costarum	2.5 ± 3	0.9 ± 0.1	0.1 ± 0.01
	Pectoralis descendens	17.2 ± 1.5	2.9 ± 0.3	0.3 ± 0.03
	Pectoralis transverses	16.5 ± 0.9	3.5 ± 1	0.2 ± 0.06
	Rectus thoracis	8 ± 0.06	1.4 ± 0.09	0.3 ± 0.06
	Obliquus externus abdominis	19.2 ± 3	12.9 ± 1	0.2 ± 0.09
	Transversus abdominis	19 ± 1	13.7 ± 0.9	0.1 ± 0
	Rectus abdominis	38.7 ± 0.7	8.1 ± 0.9	0.2 ± 0.03
Hip and thigh	Semitendinosus	19.3 ± 0.2	2.6 ± 0.4	1.5 ± 0.1
	Semimembranosus	17.4 ± 0.07	5.1 ± 0.6	2.2 ± 0.6
	Gracilis	13.6 ± 0.4	6.7 ± 0.2	0.6 ± 0.1
	Adductor	13.0 ± 0	2.7 ± 0.4	1.4 ± 0.2
	Sartorius	13.0 ± 0.07	1.5 ± 0.2	0.2 ± 0.0
Leg	Gastrocnemius (lateral head)	14.0 ± 0.5	3.9 ± 0.3	1.2 ± 0.2
	Gastrocnemius (medial head)	14.0 ± 0.5	3.9 ± 0.2	1.0 ± 0.07
	Fibularis tertius	13.4 ± 0.9	2.2 ± 0.3	1.3 ± 0.3
	Fibularis longus	9.3 ± 0.3	1.7 ± 0.09	0.5 ± 0.01
	Extensor digitorum lateralis	12.2 ± 0.7	1.2 ± 0.1	0.6 ± 0.03
	Flexor digitorum superficialis	15.0 ± 0.6	2.5 ± 0.3	1.1 ± 0.1

Muscles and carcass characteristics of goat

The abdominal muscles were wider than the other muscles of the body. The *m. transversus abdominis* had the highest breadth (13.7 ± 0.9 cm) followed by *m. obliquus externus abdominis* (12.9 ± 1 cm) and *m. rectus abdominis* (8.1 ± 0.9 cm) (Table 1).

In the present study the total length of the muscle varied in the same group of muscles of wether. This finding is in agreement with the observation of Khan (1988). The flexor muscles of stifle were longer than that of elbow. The length, breadth and thickness also varied among different groups of muscles; the extensor muscle of carpal joint, extensor carpi radialis was higher in length, breadth and thickness than the flexor muscle, flexor carpi radialis (Table 1).

The cranio-lateral muscles of thigh- *gluteus*, *quadriceps femoris*, *semitendinosus* and *semimembranosus* were the highest in thickness of all other muscles of the body (Table 1).

Carcass characteristics

Dressing percentage

In the present study dressing percentage based on live weight of wether was 59.34 ± 0.5 (Table 2). In some previous studies the dressing percentage based on live weight had been reported to be around 46-48% in different goat breeds (Mishra, 1983). He also observed that a lower dressing percentage in entire male than in wether. The present study revealed higher dressing percentage of castrated Black Bengal goat (wether) than that of other breeds.

Distribution of fat

In the present study it was observed that goat contain more internal and less subcutaneous and inter and intra muscular fat and, this lean meat could be consumed as a nutritional alternative to other meat species such as beef and chicken which is in agreement with the report of Babiker *et al.* (1990) and Johnson *et al.* (1995). The leanness of goat meat may be disadvantageous in promoting goat meat products since goat meat lacks juiciness, and takes a long time to tenderise during cooking. Less amount of subcutaneous and intermuscular fat was responsible for drying out during hanging.

Table 2. Live weight and carcass characteristics

Parameters	Mean \pm SE
Live weight (kg)	18.6 \pm 1
Hot carcass weight ^a (kg)	11.04 \pm 0.7
Dressing percentage ^b (based on live weight)	59.34 \pm 0.5
Tissues in carcass (%)	
Lean	60.91 \pm 1.03
Bone	24.30 \pm 0.2
Fat	14.78 \pm 1.13
Tissue ratios in carcass	
Ratio of lean and fat	4.18 \pm 0.4
Ratio of lean and bone	2.5 \pm 0.06
Ratio of Lean plus fat and bone	3.11 \pm 0.03

^aReduction of weight of skin, head, organs of thoracic, abdominal and pelvic cavity from the total carcass; ^bRatio of hot carcass weight and live body weight.

Partitioning of lean, fat and bone

In the present study it has estimated 60.91% lean, 24.30% bone and 14.78% fat in the carcass of castrated Black Bengal goat (wether) at 18.6 kg body weight. Warmington and Kirton (1990) estimated 64.5% lean, 21.8% fat and 12.6% bone at 17 kg male goat of Boer breeds. They reported 60.1% lean, 14.0% fat and 21.5% bone at 20 kg male goat while 59.7% lean, 17.6% fat and 19.2% bone at 50 kg male goat of Saanen breeds. They observed linear increase in percent lean and fat with body weight and a decrease in percentage bone; in carcasses of dairy goats of 18-48 kg empty body weight. In comparison to previous study, the present study indicated that castrated Bengal goat (wether) had lean percentage similar to other breeds but a little bit higher bone percentage and lower fat percentage than that of other breeds.

The present study has estimated lean:bone = 2.5 and lean:fat = 4.19 in 18.6 kg castrated Bengal goat (wether). Warmington and Kirton (1990) reported lean:bone = 5.12 and lean:fat = 2.95 in 17 kg of Boer male goat while lean:bone = 2.80 and lean:fat = 4.29 in 20 kg of Saanen male goat. In comparison to the previous report, the castrated Bengal goat (wether) has a little higher lean:fat ratio whereas a little lower lean: bone ratio.

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