



GROSS MORPHOLOGICAL AND BIOMETRICAL STUDIES ON THYROID GLAND IN BAKERWALI GOAT (*capra hircus*)

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(Received 17 August, 2017; accepted 4 February, 2018)

ABSTRACT

The present study was conducted on 36 samples of thyroid glands of Bakerwali goat, divided into 3 groups based on the age of animals viz., prepubertal (<1 year), pubertal (2-3 years) and senile (>5 years). Thyroid gland was located on the dorsolateral aspect of trachea. The gland was bilobed, reddish brown in colour, elongated and elliptical in outline. The right lobe of gland extended from posterior extremity of larynx to 5th tracheal ring, while left lobe extended from posterior extremity of larynx to 7th tracheal ring. The two lobes were connected by isthmus around the ventral aspect of trachea and position varied between 5th and 6th tracheal ring. The mean length of left lobe was larger than right lobe in all the age groups. The biometrical parameters increased with the advancement of age. The isthmus connected the caudal poles of two lobes of gland. The isthmus was glandular in young animals and was becoming fibrous in older ones.

Key words: Bakerwali goat, isthmus, larynx, thyroid, tracheal ring

INTRODUCTION

The thyroid gland is one of the largest ductless gland. It is situated on the lateral aspect of trachea. In sheep and goat, it consists of two lateral lobes and a connecting isthmus (Jain *et al.*, 1984). The thyroid extends from posterior extremity of larynx to 5th to 7th tracheal ring and is situated on the dorsolateral aspect of trachea (Bhardwaj *et al.*, 2006) in Gaddi sheep and Gaddi goat. The lateral lobes are almond shaped (Bhardwaj *et al.*, 2006) and elongated oval (Jain *et al.*, 1984). Sisson (1953) reported thyroid in sheep were long elliptical. The thyroid gland is encapsulated by a connective tissue covering with rich plexus of capillaries. The gland is composed of a large number of follicles of various sizes. The follicles are lined by a single layer of simple cuboidal or short columnar epithelium depending upon the activity of gland. Between the follicles are parafollicular cells or C-cells. The presence of colloid and resorption vacuoles is indicative of secretory activity gland (El Sheikh *et al.*, 1966). The parafollicular cells derive from the neural crest cells. They usually occur as single cells enclosed within the basal lamina of follicles but may also form groups in the same location or outside the follicles especially in dog (Dellmann, 1993). The activity of thyroid gland is inversely proportional to the diameter of follicle (Banks, 1993). The Jammu and Kashmir State is bestowed with unique qualitative breeds of goat and one such goat breed is Bakerwali (*kaghani*). Less morpho-biometric studies have been conducted on this breed (Shazia Nissar *et al.*, 2014). Therefore, the present work was designed to study the gross morphological and biometrical parameters of thyroid gland in Bakerwali goat.

MATERIALS AND METHODS

The intact samples of thyroid gland of Bakerwali goat were collected from private slaughter houses located in and around the Jammu city and were divided into three groups based on the age of animals viz., prepubertal (>1 year), pubertal (2-3 years) and senile (>5 years) containing at least 12 animals in each group. The age of goats was estimated by examining their dentition (Solaiman, 2010). The study was approved by the Institute's Animal Ethics Committee. After collection, the samples were immediately brought to the laboratory in ice for further studies. The topographical and morphological studies were performed at the time of slaughter before taking out the samples from slaughtered animals. It included the recording of gross morphology and topography of thyroid gland in 3 age groups. The biometry of both right and left lobes was recorded and it included: length, width, thickness, weight and volume. All the recorded biometrical data was put to standard statistical procedures (Snedecor and Cochran, 1994).

RESULTS AND DISCUSSION

The thyroid gland in goat was located on the dorsolateral aspect of trachea. The gland was bilobed, reddish brown in colour, elongated and elliptical in outline, as also reported by Roy *et al.* (1975) in goat, Sisson (1953) in sheep and Jain *et al.* (1984) in sheep and goat. Evans (1993) described that the thyroid gland of dog was elongated and dark red mass. However, Sisson and Grossman (1962) described that in sheep thyroid gland was dark red in colour. In Bakerwali goat the thyroid gland was topographically related to parathyroid glands, esophagus and recurrent laryngeal nerve on its medial surface and carotid artery, internal jugular vein and vagus nerve on its lateral surface as earlier reported by Nabi (2015) in local sheep. In present study, the right lobe of gland extended from posterior extremity of larynx to 5th tracheal ring; while left lobe extended from posterior extremity of larynx to 7th tracheal ring. Similar observations were reported by Bhardwaj *et al.* (2006) in Gaddi goat. The lateral surface of gland was convex while medial surface was moulded on trachea and was concave. The two lobes were connected by isthmus around the ventral aspect

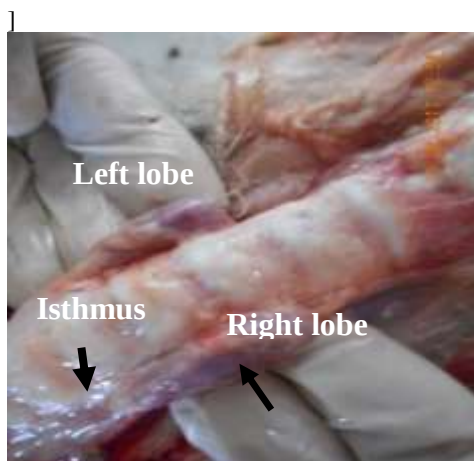


Fig. 1: Photograph showing right and left lobe of thyroid gland connected by isthmus in Bakerwali goat (arrow)

Of trachea and the position varied between 5th and 6th tracheal ring as reported by Jain *et al.* (1984) in sheep and goat (Fig. 1). Bhardwaj *et al.* (2006) have reported that in Gaddi sheep the isthmus is connected to the two lobes about half cm above the posterior end. Frandson *et al.* (2003) reported that the thyroid gland of farm animals is associated with the proximal part of trachea near the thyroid cartilage of larynx. Panahi and Yousefi (2012) reported that the thyroid gland of one-humped camel was situated on the lateral surface of trachea. The right lobe was located slightly cranial to the left one lying on the caudal aspect of larynx while both lobes were connected together by isthmus on the ventral surface of trachea.

In Bakerwali goat the left lobe of thyroid gland was 3.44 ± 0.2 cm long while right lobe was 2.82 ± 0.08 cm long in prepubertal group. In pubertal and senile groups, the left and right lobes were 4.5 ± 0.026 and 3.80 ± 0.39 and 4.7 ± 0.22 and 4.07 ± 0.09 cm in length, respectively (Table 1). The average mean length of left lobe was found

Table 1: Biometrical observations of thyroid gland in Bakerwali goat (mean±SE)

Parameters	Prepubertal		Pubertal		Senile	
	Right lobe	Left lobe	Right lobe	Left lobe	Right lobe	Left lobe
Length (cm)	2.82±0.08 ^{ax} (2.47-3.02)	3.44 ±0.20 ^{Ay} (2.71-3.98)	3.80±0.39 ^{bm} (3.31-4.39)	4.50±0.26 ^{Bn} (3.85-5.69)	4.075±0.09 ^{bp} (3.74-4.31)	4.70±0.22 ^{Bq} (4.29-5.31)
Weight (g)	1.88±0.20 ^{ax} (1.10-2.40)	2.26±0.31 ^{Ax} (1.20-3.20)	3.38±0.30 ^{bm} (2.40-4.30)	3.51±0.33 ^{Bm} (2.50-4.90)	4.70±0.56 ^{bp} (3.60-5.60)	5.88±0.75 ^{Cp} (3.90-6.80)
Volume (cm ³)	1.66±0.19 ^{ax} (1.00-2.10)	2.00±0.28 ^{Ax} (1.20-2.90)	3.20±0.33 ^{bm} (2.20-4.10)	3.48±0.35 ^{Bm} (2.50-3.90)	4.46±0.61 ^{bp} (3.00-5.50)	5.60±0.89 ^{Cp} (3.50-6.20)

*Mean with different superscripts differ significantly ($P \leq 0.05$) within row

to be larger than right one in all the groups. Pardehi (1981) has reported the length of right and left lobes in buffalo as 3.92 and 3.78 cm, respectively. In present study the size of thyroid gland increased with the advancement of age which is in line with Ali (1982) in case of Egyptian buffalo and Roy *et al.* (1978) in case of goat.

The mean width in prepubertal, pubertal and senile group were 1.02±0.03, 1.07±0.05 and 1.37±0.05 cm, respectively, in right lobe and 1.04±0.17, 1.17±0.11 and 1.49±0.11 cm in left lobe of thyroid gland. Bhardwaj *et al.* (2006) reported that the mean width of right and left lobe of thyroid gland in Gaddi sheep were 1.28±0.10 and 1.28±0.09 cm, respectively. Venzke (1975) reported that the length and width of thyroid gland in dog was 3 cm and 7 mm, respectively, and in case of horse the values for length were 5.0 cm, 1.5-2.0 cm at its greatest width and 2.7 cm in height. In present study, the mean width decreased from anterior to posterior position in both the lobes of gland. The mean width showed a significant increase from prepubertal to senile group (Table 2).

The mean thickness in prepubertal, pubertal and senile group were 0.55±0.02, 0.63±0.04 and 0.79±0.06 cm, respectively, in right lobe and 0.60±0.05, 0.71±0.04 and 0.97±0.05 cm in left lobe of thyroid gland. In all the three age groups, the mean thickness of left lobe at anterior, middle and posterior positions were found to be larger than right one (Table 2). It was also found that the mean thickness of both the lobes declined from anterior to posterior position, irrespective of the age groups. Bhardwaj *et al.* (2006) reported that the mean length, width and thickness of right and left lobe of thyroid gland were 3.2±0.21 and 2.97±0.21, 1.3±0.05 and 1.33±0.03, and 0.8±0.03 and 0.8±0.05 cm, respectively, in Gaddi goat. Jain *et al.* (1984) measured the length, width and thickness as 2.3, 0.4 and 0.27 cm, respectively, in goats of the plain region. Kausar and Shahid (2006) reported the mean

Table 2: Biometrical observations of thyroid gland of Bakerwali goat (mean ± SE in cm) in different age groups

Parameters Groups	Width (cm)			Thickness (cm)		
	Anterior	Middle	Posterior	Anterior	Middle	Posterior
Prepubertal	Right 1.20±0.04 ^a (1.05-1.37)	1.16±0.04 ^a (1.01-1.31)	0.71±0.02 ^a (0.67-0.91)	0.66±0.03 ^a (0.52-0.72)	0.62±0.03 ^a (0.56-0.72)	0.37±0.02 ^a (0.30-0.41)
	Left 1.24±0.05 ^A (1.09-1.45)	1.18±0.03 ^A (1.10-1.31)	0.72±0.09 ^A (0.30-0.91)	0.74±0.08 ^A (0.54-1.14)	0.68±0.05 ^A (0.51-0.91)	0.39±0.02 ^A (0.31-0.51)
Pubertal	Right 1.23±0.04 ^a (1.09-1.40)	1.17±0.06 ^a (1.18-1.59)	0.81±0.04 ^a (0.61-0.80)	0.76±0.03 ^a (0.42-0.82)	0.74±0.05 ^a (0.53-0.91)	0.41±0.05 ^a (0.30-0.62)
	Left 1.43±0.07 ^A (1.22-1.72)	1.22±0.01 ^A (0.92-1.30)	0.86±0.03 ^A (0.75-0.95)	0.86±0.06 ^A (0.62-1.02)	0.82±0.03 ^A (0.71-1.21)	0.46±0.03 ^A (0.38-0.45)
Senile	Right 1.60±0.03 ^b (1.34-1.50)	1.50±0.07 ^b (1.20-1.68)	1.01±0.05 ^b (0.83-1.21)	0.96±0.07 ^b (0.69-1.20)	0.86±0.08 ^b (0.82-1.41)	0.57±0.03 ^b (0.51-0.69)
	Left 1.71±0.10 ^B (1.50-1.69)	1.53±0.19 ^B (0.63-1.98)	1.23±0.04 ^B (1.09-1.40)	1.18±0.07 ^B (0.92-1.42)	1.07±0.08 ^B (0.93-1.31)	0.66±0.01 ^B (0.41-1.80)

*Mean with superscripts (a,b,c) differ significantly ($P < 0.05$) within column for right lobe, while mean with superscripts (A,B,C) differ significantly ($P < 0.05$) within the column for left lobe.

diameters of thyroid gland in one-humped camel in two age groups as 0.97 ± 0.13 and 1.05 ± 0.14 cm, while the mean length was 5.36 ± 0.46 and 6.36 ± 0.33 cm and mean width was 3.35 ± 0.29 and 3.53 ± 0.21 cm.

The mean weight of left and right lobes in prepubertal group were 2.26 ± 0.31 and 1.88 ± 0.20 g, in pubertal group the respective values were 3.51 ± 0.33 and 3.38 ± 0.30 g and in senile group 5.88 ± 0.75 and 4.7 ± 0.56 g (Table 1). Bhardwaj *et al.* (2006) reported that the mean weight of right and left lobes as 2.21 ± 0.22 and 2.14 ± 0.33 g in Gaddi goat. The weight of thyroid gland in adult cattle has been reported to be between 20 and 35 g by Marvan *et al.* (1992) and between 15 and 65 g by Cada (1998); whereas Kratochvil (1998) reported the weight of organ around 12 to 35 g in calves and young cattle. Jain *et al.* (1984) recorded the weight as 2.9 g in the goats of plain region. The biometrical values (length, width and weight) of both lobes of thyroid gland of Bakerwali goat showed higher values as compared to the biometrical values in Gaddi goat and goat of plain region.

The mean volume of left and right lobes was 2.00 ± 0.28 and 1.66 ± 0.19 cm³, respectively, in prepubertal group; 3.48 ± 0.35 and 3.2 ± 0.33 cm³ in pubertal group and 5.6 ± 0.89 and 4.46 ± 0.61 cm³ in senile group. The mean volume was found more in left lobe than right one among all the groups (Table 1). Bhardwaj *et al.* (2006) reported that the mean volumes of right and left lobes were 2.08 ± 0.08 and 2.12 ± 0.42 cm³ in Gaddi goat. The mean volume in Gaddi goat were comparable with the values in prepubertal group of Bakerwali goat in present study whereas the pubertal and senile groups showed significantly higher values. The biometrical values (length, width, thickness, weight and volume) increased with the advancement of animal age. These observations are in agreement with Ali (1982) who reported that there was relative increase in length, height, width and thickness of thyroid and pituitary gland in Egyptian buffalo. Roy *et al.* (1978) reported gradual increase in weight, volume, thickness, length and width of thyroid gland with the advancement of age.

The isthmus connected the caudal poles of two lobes of gland. The isthmus was glandular in young animals and was fibrous in older ones. Similar observations were also reported by Roy and Yadava (1975) in Indian buffalo. In camel, the isthmus was glandular (Taha and Abdel-Magied, 1994). In bovine, the isthmus was distinctly glandular (Jelinek *et al.*, 2003) but in old cattle it might be reduced to a fibrous band (Habel, 1989). The isthmus was reduced to a fibrous band or altogether absent in sheep and goat (Habel, 1989). Roy *et al.* (1978) stated that the glandular isthmus of goat was replaced by fibrous tissue. In present study, the isthmus was a glandular band connecting the lateral (right and left) lobes of thyroid gland. In prepubertal it was thin and narrow and resembled in morphology like lateral lobes of gland. Hamad (2008) reported that the isthmus in kid and adult goats was glandular. Similar findings were also reported by Taha and Abdel-Magied (1994) in camel and Venzke (1975a) in bovine. Habel (1989) stated that the isthmus might be reduced to a fibrous band in old cattle.

The mean length of isthmus in prepubertal, pubertal and senile groups were measured as 1.81 ± 0.15 , 2.18 ± 0.05 and 3.15 ± 0.14 cm, respectively. The length of isthmus increased with the advancement of age. The mean width of isthmus in prepubertal, pubertal and senile groups were measured as 0.21 ± 0.01 , 0.34 ± 0.01 and 0.48 ± 0.05 cm, respectively (Table 3). Raghavan (1964) reported in ox that the isthmus connecting the lobes of thyroid gland measured above 6 to 12 mm in

Table 3: Biometrical study of isthmus of thyroid gland of Bakerwali goat (mean $\pm$ SE) in different age groups

Parameters	Prepubertal	Pubertal	Senile
Length (cm)	1.81 ± 0.15^A (1.2-1.9)	2.18 ± 0.05^B (1.9-2.36)	3.15 ± 0.14^C (2.7-3.4)
Width (cm)	0.21 ± 0.01^A (0.19-0.27)	0.34 ± 0.01^B (0.29-0.38)	0.48 ± 0.05^C (0.33-0.74)
Thickness (cm)	0.06 ± 0.01^A (0.03-0.09)	0.22 ± 0.02^B (0.11-0.31)	0.32 ± 0.01^C (0.28-0.37)
Weight (g)	0.22 ± 0.01^A (0.19-0.27)	0.25 ± 0.02^A (0.19-0.32)	0.32 ± 0.01^B (0.29-0.37)
Volume (cm ³)	0.18 ± 0.01^A (0.15-0.22)	0.21 ± 0.02^{AB} (0.12-0.28)	0.26 ± 0.01^B (0.21-0.32)

*Mean with different superscripts differ significantly (P<0.05)

breadth and extended across the inferior face of trachea. In sheep, the presence of isthmus was variable and, when present, it was 0.25 to 0.5 cm wide and 2 cm long (May, 1970).

Acknowledgements: Authors are highly thankful to the Department of Science and Technology (DST), Director Research, SK University of Agricultural Sciences & Technology-Jammu (SKUAST-J), Dean Faculty of Veterinary Sciences SKUAST-J and Head, Department of Veterinary Anatomy, Faculty of Veterinary Sciences and animal Husbandry, SKUAST-J, R.S. Pura, Jammu.

Ethical statement: This study was conducted keeping all ethical and animal welfare issues under consideration and it was approved by Institutional Animal Ethics Committee registered by CPCSEA vide No. P62/ac/04/cpcsea.

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