



Histology and Histochemistry of the Adrenal Medulla in Adult Bakerwali Goat

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ABSTRACT

The present study was conducted to record the histology and histochemistry of adrenal medulla in Adult Bakerwali goat. Two distinct zones were observed in adrenal medulla i.e. the outer zone and inner zone. In both zones of the adrenal medulla, two types of cells were observed i.e. the light cells and dark cells. These cells exhibited a strong reaction with Gomori stain (chromaffin cells) whereas the chromaffin granules stained red and pink with the same stain. The adrenal medulla showed mild reaction to carbohydrate and lipid whereas moderate reaction for cholesterol. Sympathetic ganglions were also observed in the adrenal medulla.

Keywords: Adrenal medulla, chromaffin cells, gomori stain, histochemistry, histology

The Bakerwali goat constitute about 50% of total population of goat population of J&K state. It is a migratory breed of goat which has habit to migrate over long distances on hills. Because of long hours of walking during the seasonal migration, these goats come under stress and the adrenal medulla plays an important role in maintenance of stress by secreting hormones like catecholamines from chromaffin cells during different seasons of the year. Knowledge of this gland contributes to an understanding of how these goats adapt to physiological and psychological trauma. Numerous studies have been conducted on the adrenal medulla of large animals but scanty knowledge is available on the adrenal medulla of Bakerwali goats

The aim of the present research was to study the histology and histochemistry of adrenal medulla in adult Bakerwali goat.

MATERIALS AND METHODS

This study was conducted on fifty adrenal glands of adult Bakerwali goat in the Division of Veterinary Anatomy, SKUAST-Jammu. The adrenal glands were collected, cleaned and fixed in 10% neutral buffered formaline

(Singh and Sulochana, 1978) and in Zenker's fixative (Luna, 1968). The samples were processed by alcohol-benzene schedule (Luna, 1968) to prepare blocks and 5-micron thick sections were taken. Hematoxylin and Eosin, Gomori stain and Von gieson and Verhoeff's stains were used to study the histomorphology. Schmorl's stain and Gomori's stains were used to demonstrate chromaffin cells of adrenal medulla. Whereas PAS and Schulz methods were utilized to study histochemistry.

RESULTS AND DISCUSSION

The adrenal medulla was located at the center of the gland, being surrounded by the adrenal cortex (Fig. 1). The Medulla composed of parenchyma of large, pale-staining irregularly shaped epithelioid cells called chromaffin cells or medullary cells, sympathetic ganglion cells and numerous sinusoidal blood capillaries (Fig. 2). Sethi and Roy (2007) described that the adrenal medulla consisted of sympathetic migratory cells and two types of chromaffin cells. Collagen fiber was also seen in medulla. Inner and outer medulla were clearly demarcated and composed of light and dark cells, which exhibited blue reaction with

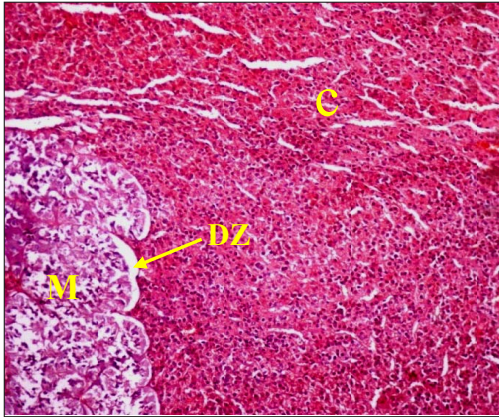


Fig. 1: Adrenal gland of adult Bakerwali goat showing demarcation zone(DZ) between the cortex and medulla (H&E $\times 100$)

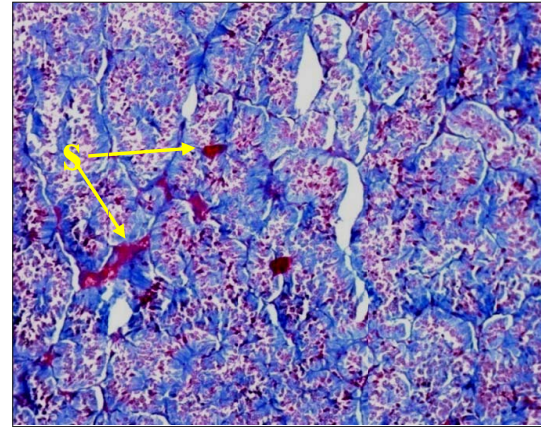


Fig. 2: Adrenal gland of adult Bakerwali goat showing presence of sinusoids(S) in between the chromaffin cells (Gomori For Chromaffin $\times 100$)

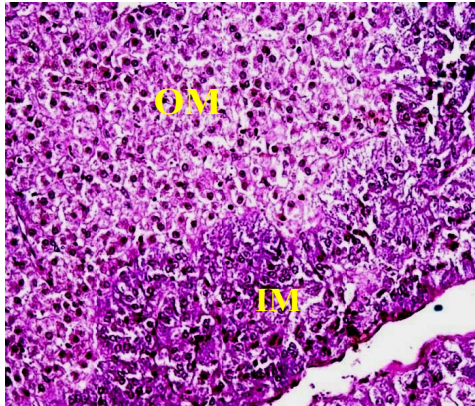


Fig. 3: Adrenal gland of adult Bakerwali goat showing presence of light and dark cells in inner(IM) and outer medulla (OM) (PAS $\times 100$)

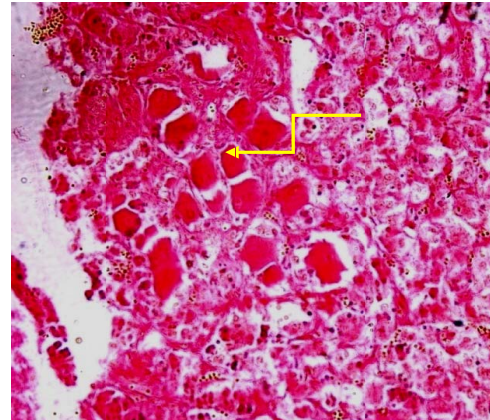


Fig. 4: Adrenal gland of adult Bakerwali goat showing presence of ganglion (G) in the adrenal medulla near to central vein (Schmorl's Method $\times 100$)

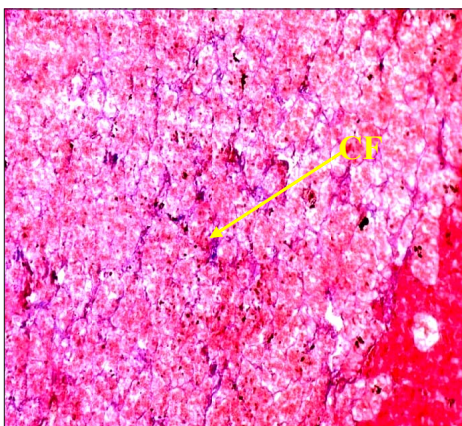


Fig. 5: Adrenal gland of adult Bakerwali goat showing presence of collagen fibers(CF) in the adrenal medulla (Masson's Trichrom $\times 100$)

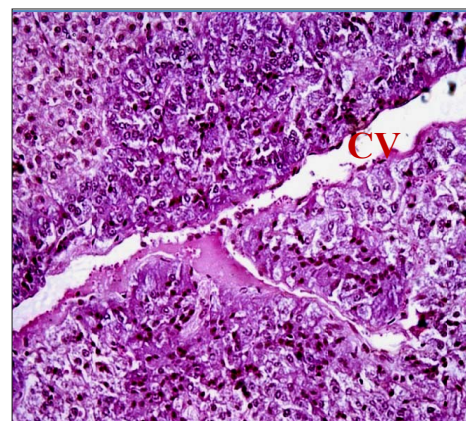


Fig. 6: Adrenal gland of adult Bakerwali goat showing discharge of medullary cells into the central vein(CV) (PAS $\times 100$)

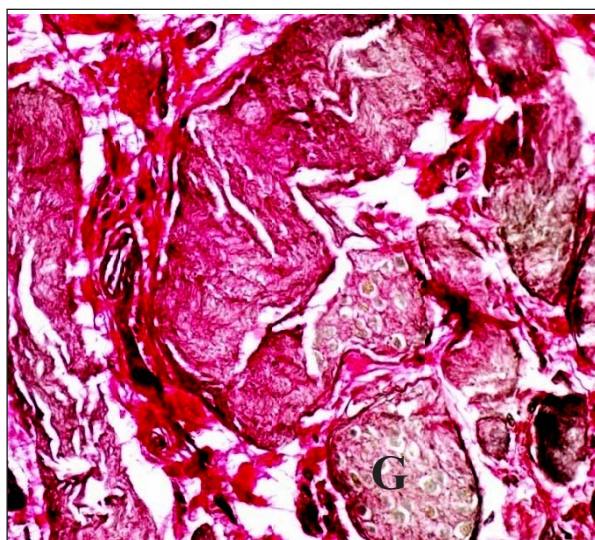


Fig. 7: Adrenal gland of adult Bakerwali goat showing presence of ganglion (G) outside the capsule (Vongieson & Verhoeff $\times 100$)

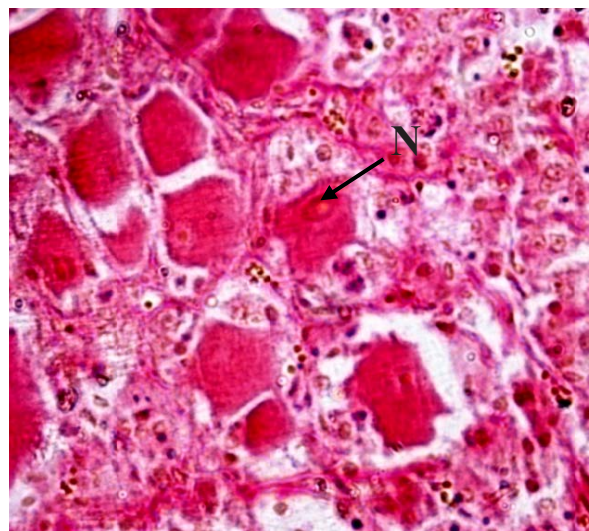


Fig. 8: Adrenal gland of adult Bakerwali goat showing presence of ganglion (G) with eccentric nuclei (N) in adrenal medulla close to central vein (Schmorl's Method $\times 200$)

Table 1: Micrometry of cells of adrenal medulla (irrespective of zones) in adult Bakerwali goats (Mean \pm SE)

Parameters		Right (μm)	Left (μm)
Cell size	Light cell	20.20 \pm 0.25 ^a (18.00-23.00)	26.85 \pm 0.42 ^b (22.00-29.00)
	Dark cell	19.20 \pm 0.34 (15.00-22.00)	24.94 \pm 0.76 (20.00-34.00)
Nuclear diameter	Light cell	11.64 \pm 0.26 ^a (10.00-15.00)	17.94 \pm 0.41 ^b (15.00-25.00)
	Dark cell	11.70 \pm 0.36 (9.00-15.00)	13.23 \pm 0.20 (12.00-15.00)

Values with different superscript (a, b) differ between the left and right adrenal glands significantly ($P < 0.05$).

Gomori stain. Similar findings were given by Nama *et al.* (2009a) in Marwari sheep. The total thickness of adrenal medulla was greater in left adrenal gland (2892.14 \pm 49.78 μm) than in right adrenal gland (2784.76 \pm 14.68 μm).

The inner zone was having polyhedral cells with centrally placed nucleus and basophilic cytoplasm (Fig. 6) which were arranged in clusters. These findings were in accordance with the findings of Nama *et al.* (2009a) in the inner adrenal medulla of Marwari goat. The chromaffin positive reaction was more prominent in inner medullary cells than outer medullary cells (Fig. 3). Ganglionic cells and collagen fiber was reported in inner medulla (Fig. 4

and Fig. 5). Inner medulla mostly composed of the dark cells. The cell size and nuclear diameter of dark cells was greater in left adrenal gland of adult Bakerwali goat (24.94 \pm 0.76 μm and 13.23 \pm 0.20 μm).

The thickness of inner medullary zone (2380.88 \pm 19.94 μm) was greater than the outer medullary zone (730.94 \pm 14.90 μm) in right adrenal gland. The thickness of this zone was significantly more in left adrenal gland (2596.35 \pm 10.24 μm) than the right adrenal gland (2380.88 \pm 19.94 μm). Inner medulla showed mild reaction for carbohydrate and lipid and moderate reaction for cholesterol.

The outer medulla was located at the peripheral portion of



the adrenal medulla. Many small blood vessels (medullary veins) were reported in inner medulla of Bakerwali goat as also reported by Trautmann and Fiebiger (2002) in domestic animals.

The outer medullary cells were arranged in follicular pattern. Similar outer medullar cell pattern was observed in the adrenal gland of Buffalo by Sethi and Roy (2007). The cells of the outer medulla stained lightly with PAS. The light and dark cells were clearly differentiated by Periodic acid–Schiff (PAS) staining method (Fig. 6). Sinusoids were distinguished in outer medulla. The cell size of light cells and dark cells of the adrenal medulla was higher in the left adrenal gland as compared to the right one (Table 1). The nuclear size was greater in light cells of outer medulla ($17.94 \pm 0.41\mu\text{m}$) than in cells of inner medulla ($13.23 \pm 0.20\mu\text{m}$) in left gland (Table 1). In present study, outer medulla showed mild reactivity for mucopolysaccharide. The sudanophilic lipids and cholesterol were mildly present in outer medullary zones of adrenal medulla as was also reported by Kumar *et al.* (2011) in buffalo.

In the present study at some places patches of adrenal medulla were present in the adrenal cortex and vice versa. Nama *et al.* (2009b) also recorded that few cords of cortical cells were observed in the adrenal medulla of Marwari sheep.

The ganglions were present in the adrenal gland at two locations, outside the capsule and in the adrenal medulla near to central vein (Fig. 7 & 8). Bacha and Bacha (1990) and Trautmann and Frappier (2002) also recorded the ganglion cells in the adrenal medulla of sheep and domestic animal respectively. The ganglions were arranged in clusters. The ganglionic cells were having eccentric nuclei with scanty cytoplasm (Fig. 7). The cytoplasm of the ganglion was lightly stained whereas the nuclei were darkly stained. The ganglion size and the nuclear size were $27.41 \pm 0.60 \mu\text{m}$ and $20.46 \pm 0.49 \mu\text{m}$ respectively.

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