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Histochemical studies of the adrenal gland of the large white Yorkshire pig

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Abstract

The present investigation was carried out on 12 pairs of adrenal glands from recently slaughtered pigs of both genders of 6-12 months age group. The adrenals were situated at the cranio medial aspect of the kidney embedded in perirenal fat. Parenchyma of adrenal composed of the cortex and medulla. Cortex was divided into three portions according to their cell arrangements in zona glomerulosa, zona fasciculata and zona reticularis. Intense PAS positive reaction was seen in the capsule and zona glomerulosa. Zona reticularis and fasciculata showed moderate positive reaction of PAS. The medulla showed the strong PAS positive reaction. The PAS Alcian blue stain differentiate the inner medulla from the outer medulla especially in pH 1.0 stain as the outer medulla was darkly stained comparative to the lightly stained inner medulla. The PAS positive reaction was seen in the adrenal area showed the glycogen presence as various hormones were secreted from the adrenal like glucocorticoids. The mucosubstances showed positive PAS Alcian blue reaction at various area in different amount.

Keywords: Histochemical, adrenal gland, Yorkshire pig

Introduction

The Large White Yorkshire, breed of swine was produced in the 18th century by crossing the large Indigenous white of Northern England with the smaller, fatter, white Chinese pig. It is registered in the 1884. Pig products such as pork, bacon, ham, sausages, lard etc. are increasingly in demand for both local consumption and export. Throughout the world, the secondary consumption of pig farming is the production of pig skin, bristles and manure (Banerjee, 2013) [3]. In India, the population of pig is 9.06 million according to 20th livestock census of India. It ranks fifth in the world. The adrenal gland is called the suprarenal gland because it is situated on the cranio-medial aspect of the kidney. It regulates many physiological functions both in foetal and postnatal life (Hill, 2007) [8]. The adrenal gland is an indispensable organ that takes part in the formation of hypothalamic pituitary adrenal axis (HPA) termed as body's stress system. HPA mainly controls the levels of cortisol and other important stress related hormones (Hu and Funder, 2006; Pippal and Fuller, 2008) [10, 16]. Each adrenal gland has two distinct structures, the outer adrenal cortex and inner medulla, both of which produce hormones. The adrenal cortex is subdivided into three (Dellman, 1993) [5] or four (Bacha and Wood, 1990) [2] distinct zones of epithelial cells. There are two types of chromaffin cells in the adrenal medulla. The granules of epinephrine cells are smaller and less electron-dense compared to 2 norepinephrine cells (Coupland and Weakley, 1968) [4]. The norepinephrine cells contain a large spherical nucleus while chromaffin cells contain a full complement of cytoplasmic organelles.

Material and Methods

12 pairs of adrenal glands from recently slaughtered pigs of both genders of 6-12 months age group was collected from local abattoir, Bikaner. The investigation of the organs was carried out in the Department of Veterinary Anatomy, CVAS, RAJUVAS, Bikaner.

For histochemical studies, the samples were fixed in 10% formalin for routine staining and in bouin's fluid for special staining 24-72 hours. After fixation, washing, dehydration, clearing, embedding in paraffin wax done and then preparation of block. Five to six-micron thick sections was cut by using rotary microtome then mounting of the section on albuminized slides and drying of section and then stain for general histomorphological and histochemical observation. Following staining methods were used.

1. Mc Manus method PAS stain.

2. PAS Alcian blue for mucosubstances method pH-2.5.
3. PAS Alcian blue method for mucosubstances pH-1.0.

Results and Discussion

Histochemical examination

The present study showed that the adrenal gland was divided in two parts stroma and parenchyma which simulated the observation of Hullinger (1978) [11] in the dog and Kour *et al.* (2017) [13] in Bakerwali goat. Parenchyma of adrenal composed of the cortex and medulla. Cortex was divided into three portions according to their cell arrangements in zona glomerulosa, zona fasciculata and zona reticularis.

Capsule

The capsule was showing intense PAS positive reaction which was also supported by the study of Hakeem *et al.* (1993) [7] in goat, Kour *et al.* (2017) [13] in Bakerwali goat. The mucosubstances were present in capsule showed strong PAS Alcian blue positive reaction also noticed by the Hakeem *et al.* (1993) [7]. The connective tissue trabeculae showed PAS Alcian blue positive reaction also observed by the Abubakar (2015) [1] in camel.

Cortex

Zona glomerulosa

The present study revealed the presence of mucopolysaccharide in the zona glomerulosa. This was also in uniformity with the finding of Kumar *et al.* (2011) in buffalo who observed that the cortical cells of the gland contained moderate amount of the cholesterol which favoured the observation of Kour (2017) [13] in zona glomerulosa of Bakerwali goat showed intense reaction for mucopolysaccharide.

Zona glomerulosa showed positive PAS Alcian blue reaction for sulfated mucosubstances which was similar to the observation of Hakeem *et al.* (1993) [7] in goat.

Zona fasciculata

Slightly PAS positive reaction was noticed in the zona fasciculata, which was in close agreement with the reports of Idelmann (1978) [12] in ox, Roy and Saigal (1987) [17] in sheep, Hakeem *et al.* (1993) [7] in goat, Kour *et al.* (2017) [13] in Bakerwali goat. The zona fasciculata appeared foamy due to presence of lipid droplets. This finding resembled to that of Holmes (1961) [9] in ferret, Greep (1966) [6] in mammals, Kumar *et al.* (2011), Kour *et al.* (2017) [13] in Bakerwali goat. They found abundant lipid in zona fasciculata. However, Greep (1966) [6] noticed the cholesterol content was high in outer fasciculata of adrenal gland in cows and donkeys. Zona fasciculata showed the PAS Alcian positive reaction in moderate amount which was also similar findings with the Hakeem *et al.* (1993) [7] in goat.

Zona reticularis

This zone showed weak PAS positive reaction it was in accordance with Hakeem *et al.* (1993) [7] in goat, Kumar *et al.* (2011) in buffalo, Kour *et al.* (2017) [13] in Bakerwali goat. The present study revealed that mucosubstances showed mild PAS Alcian blue positive reaction in zona reticularis also noticed by the Hakeem *et al.* (1993) [7] in goat.

Medulla

The medulla showed the mild PAS positive reaction that was also observed by the Nicander (1957) [15] in dogs, Roy and

Saigal (1987) [17] in sheep, Hakeem *et al.* (1993) [7] in goat. The PAS alcian blue reaction was very intense in the adrenal medulla and the related sinusoidal spaces. This finding was in consonance with the reports of Hakeem *et al.* (1993) [7] in goat and Abubakar (2015) [1] in camel.

Table 1: Histochemical reactions exhibited by the different components of the adrenal glands of Large White Yorkshire pig

| Histochemical reaction | Location in the adrenal gland | Intensity |
|------------------------|-------------------------------|-----------|
| PAS | Capsule | +++ |
| | Trabeculae | + |
| | Cortex | ++ |
| | Zona glomerulosa | +++ |
| | Zona fasciculata | + |
| | Zona reticularis | + |
| | Medulla | + |
| | Inner medulla | + |
| | Outer medulla | + |
| | Central vein | + |
| Alcian blue pH 1.0 | Capsule | ++ |
| | Trabeculae | + |
| | Cortex | + |
| | Zona glomerulosa | + |
| | Zona fasciculata | - |
| | Zona reticularis | - |
| | Medulla | ++ |
| | Inner medulla | + |
| | Outer medulla | +++ |
| | Central vein | + |
| Alcian blue pH 2.5 | Capsule | ++ |
| | Trabeculae | + |
| | Cortex | + |
| | Zona glomerulosa | + |
| | Zona fasciculata | - |
| | Zona reticularis | - |
| | Medulla | ++ |
| | Inner medulla | + |
| | Outer medulla | +++ |
| | Central vein | + |

Note +++ = Intense or Strong, ++ = Moderate, + = Weak and - = Negative.

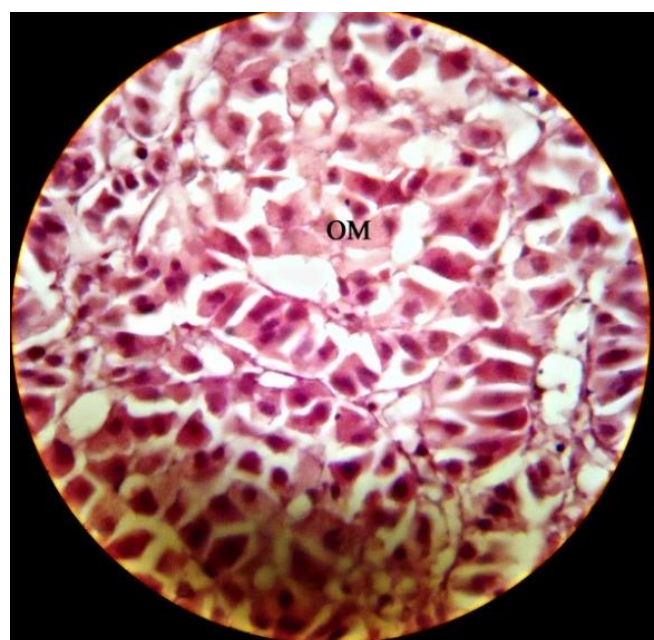


Fig 1: Photomicrograph of adrenal of pig showing positive PAS reaction in outer medulla. OM-Outer medulla. (Mc Manus PAS for glycogen, 1000X)

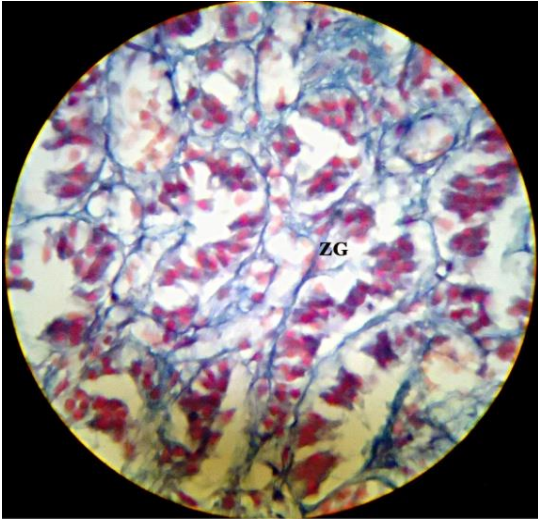


Fig 2: Photomicrograph of adrenal of pig showing the positive PAS Alcian blue reaction in the zona glomerulosa. ZG-Zona glomerulosa. (PAS Alcian blue for mucosubstances method pH-2.5, 1000X)

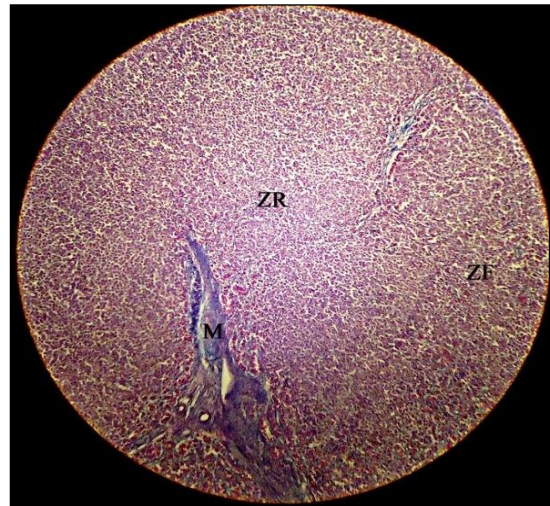


Fig 5: Photomicrograph of adrenal of pig showing PAS Alcian blue positive reaction in cortex and medulla. ZF-Zona fasciculata, ZR-Zona reticularis, M-Medulla. (PAS Alcian blue method for mucosubstances pH-1.0, 400X)

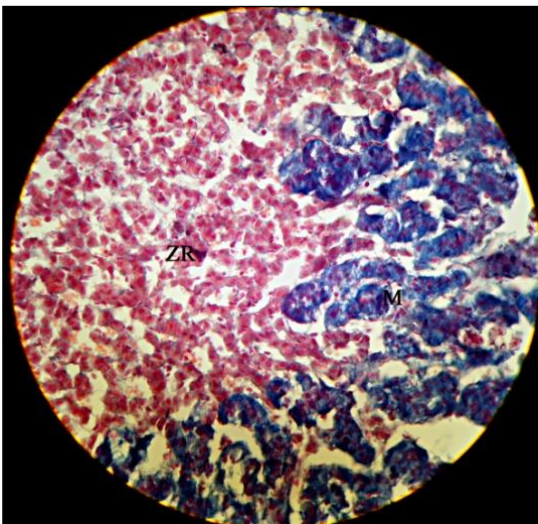


Fig 3: Photomicrograph of adrenal of pig showing the positive PAS Alcian blue reaction in the medulla and cortex zones. M-Medulla, ZR-Zona reticularis. (PAS Alcian blue for mucosubstances pH 2.5, 400X)

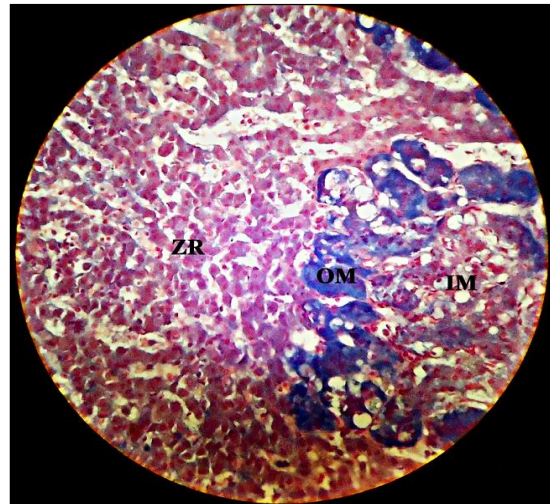


Fig 6: Photomicrograph of adrenal of pig showing positive PAS Alcian blue reaction in the medulla. ZR-Zona reticularis, IM-Inner medulla, OM-Outer medulla. (PAS Alcian blue method for mucosubstances pH 1.0, 400X)

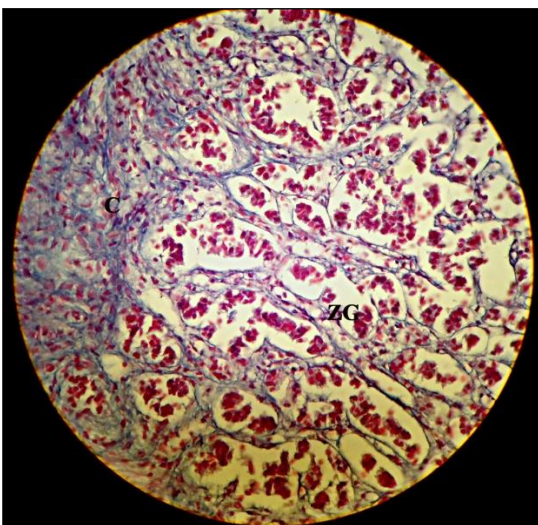


Fig 4: Photomicrograph of adrenal of pig showing the positive PAS Alcian blue reaction in the adrenal capsule and cortex. C-Capsule, ZG-Zona glomerulosa. (PAS Alcian blue for mucosubstances pH 2.5, 400X)

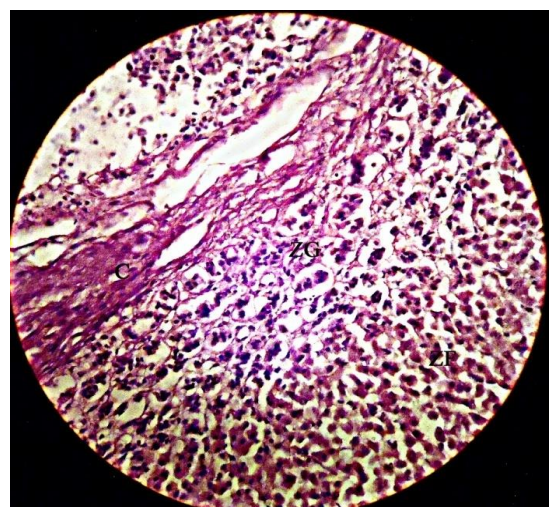


Fig 7: Photomicrograph of adrenal of pig showing positive PAS reaction in capsule and zones of cortex. C-Capsule, ZG-Zona glomerulosa, ZF-Zona fasciculata. (McManus method PAS stain, 400X)

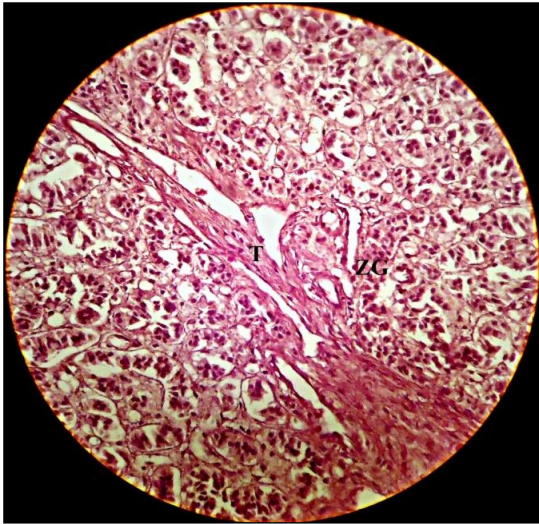


Fig 8: Photomicrograph of adrenal of pig showing positive PAS reaction in adrenal cortex. ZG-Zona glomerulosa, T-Trabeculae, (McManus method PAS Stain, 400X)

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