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Research Article

Histochemistry of the Respiratory Systemin Kuttanad Ducks (*Anas platyrhynchos domesticus*)

D Firdous*, S Maya, M Khan, AR Choudhury, A Rafiq, MA John and A Quadir

Division of Veterinary Anatomy and Histology, FVSc and AH, Shuhama Alusteng, SKUAST, Jammu and Kashmir, India

***Corresponding Author:** D Firdous, Division of Veterinary Anatomy and Histology, FVSc and AH, Shuhama Alusteng, SKUAST, Jammu and Kashmir, India.

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Abstract

A study on the histochemistry of the respiratory system was carried out in female Kuttanad ducks. The material for the study was formed by 78 female Kuttanad birds from day-old to 24 weeks of age. The mucous glands and goblet cells over the respiratory system reacted positively to PAS and alcian blue. The intercellular matrix of the cartilages showed positive reaction for PAS, alcian blue and Safranine O. The nucleus and cytoplasmic granules of macrophages exhibited positive reaction for the acid phosphatase in the parabronchi.

Keywords: Alcian Blue; Histochemistry' Kuttanad Duck

Introduction

The factors determining the designs of the vertebrate respiratory systems include the physiochemical characteristics of the respiratory medium used, the nature of habitat occupied and the lifestyle pursued. This in turn reflects the structural variations in animals and birds residing in a particular area. Studies on the histochemical architecture of the respiratory system in waterfowl are very less; hence this work was carried out to investigate the histochemical composition of the respiratory system in Kuttanad ducks.

Materials and Methods

Histochemistry of the respiratory system in the Kuttanad duck was studied using 78 female birds from day-old to 24 weeks of age. The material was collected from six birds in each group at fortnightly intervals from a single hatch reared at the university poultry and duck farm, Mannuthy under semi-intensive system of management. After collecting, the material was fixed in 10 per cent neutral buffered formalin. The material was processed using routine procedures and paraffin sections of 5µm thickness were taken for histochemical studies. The sections were stained using Periodic acid Schiff's (PAS) and Alcian blue method for mucopolysaccharides, Best's carmine method for glycogen [1], Gomori's method for acid phosphatase [2] and Oil Red' O' in propylene glycol method for fat [3].

Results and Discussion

The respiratory tract in Kuttanad ducks consisted of conducting part viz. nostrils, nasal cavity containing conchae, larynx, trachea, syrinx, air sacs and respiratory part, the lungs. The conducting air was lined with pseudostratified ciliated columnar epithelium with goblet cells. The mucous cells were aggregated as intraepithelial glands in conchae, larynx and trachea.

The mucous glands and goblet cells in the epithelial lining over the conducting part of the respiratory system reacted positively to PAS and alcian blue (Figure 1 and 2). The parabronchi and airways distal to it showed mild reaction for PAS in the epithelium. Pal and Bharadwaj [4] said that tunica propria submucosa of respiratory epithelium in chicken contained simple mucous glands reacted positively to PAS, alcian blue and toluidine blue stains and showed the presence of acid mucopolysaccharides. PAS and Alcian Blue (pH 1.0 and 2.5) demonstrated the presence of neutral and sulphated mucins in trachea of domestic fowl secreted by goblet cells [5].

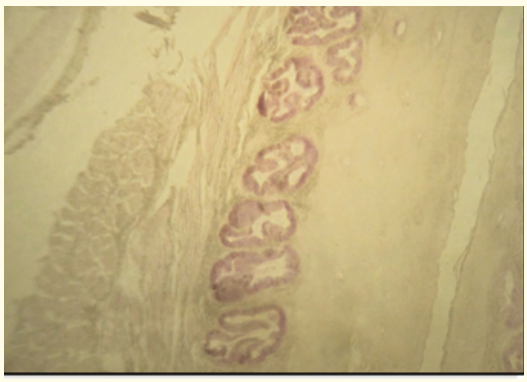

Figure 1: Mucous glands of nasal cavity showing PAS positive reaction x 400.

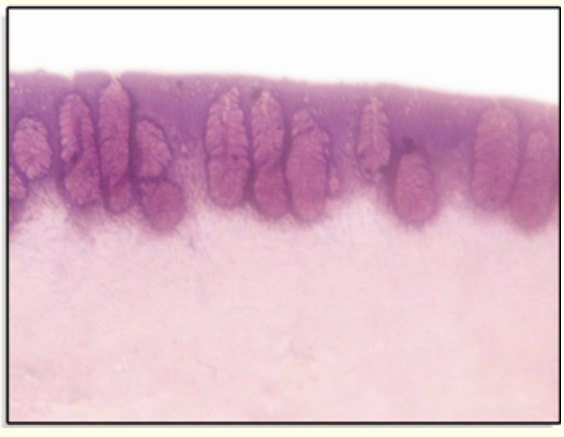

Figure 2: Mucous glands of larynx showing PAS positive reaction x 400.

The larynx and tracheal presented different layers as epithelial lining, propria-submucosa, cartilage and tunica adventia. The cartilages throughout the respiratory tract showed positive reaction for Safranine O initially indicating the presence of chondratin sulphate in the matrix. As the process of ossification started the cartilages became negative may be due to the reduction in the amount of cartilage matrix.

The nucleus and cytoplasmic granules of macrophages exhibited positive reaction for the acid phosphatase in the parabronchi. The surface of the epithelium lining the parabronchi exhibited scattered positive reaction for acid phosphatase (Figure 3). The acid phosphatase is the indication of phagocytic activity of macrophages as well as protective action of the lining epithelium of parabronchi. The epithelium lining the parabronchi also exhibited weak positive reaction for alkaline phosphatase. The luminal content of the parabronchi and atria contained small amount of fluid which showed a medium positive reaction for lipids indicative of the presence of the pulmonary surfactant. Harlan., *et al.* [6] demonstrated presence pulmonary phospholipid in birds similar in composition to mammals but occurring in lesser quantities. Tyler and Pearse [7] carried out histochemical analysis of the lung lobule in birds and found that the epithelia of the tertiary bronchi and the atria gave strong reactions for the enzymes of the TCA cycle, the glycolytic scheme and the pentose cycle and high concentration of phospholipid.

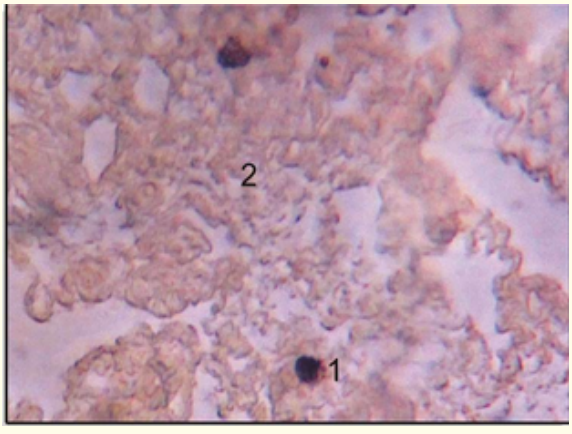

Figure 3: Acid phosphatase positive macrophages in lung x 400
1: Macrophages; 2: Lung parenchyma

Conclusion

Owing to the presence of large aggregates of mucous cells and intraepithelial glands in the upper respiratory system a high positive reaction to PAS and alcian blue was observed. As the mucous secreting cells decrease towards the terminal parts of the respiratory system, a moderate or low PAS and Alcian blue reaction was observed. The cartilages wherever present showed positive reaction for Safranine O which became negative on ossification of cartilages.

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