



Histo-morphological study of Harderian gland on 7th day Sonali chicken

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ABSTRACT

The Harderian gland plays an important role in the immunological defense of different birds and animals. The present study was undertaken to investigate the gross and histological features of the Harderian gland of Sonali chicken on 7th day to observe its postnatal growth and development. A total of 10 Sonali chickens of 7-day-old were used to observe its characteristic features. The study was conducted at the Department of Anatomy and Histology, Bangladesh Agricultural University. The results showed that a bi-lobed, pinkish Harderian gland was located on the ventro-medial aspect of the eyeball in Sonali chicken. The average length, breadth, thickness, and weight of the Harderian gland were recorded as 11.95 mm, 2.9 mm, 1.03 mm, and 16.52 mg respectively on 7th day. The Harderian gland of 7th day Sonali chicken was a branched compound tubulo-acinar type and covered by a thin, connective tissue capsule. The connective tissue septa penetrated and divided the gland into numerous lobes and lobules and simple columnar epithelial cells were found there. In the present study, acini lumens were mostly elongated but some were rounded, and the cell boundaries were clearly visible. The lumen of the lobules was seen as irregular. The study will contribute to the understanding of the development and functional significance of the Harderian gland in this hybrid chicken breed, providing insights that could be relevant for both avian physiology and poultry health management.

Introduction

Among the poultry species, chicken is considered to be one of the important species for the provision of meat and eggs in Bangladesh. Thus, poultry farming can contribute as a great source of employment and livelihood for small-holding farmers and women in Bangladesh. It serves as the main and cheapest source of animal protein throughout the country. The rural people usually rear the chickens in a way so that no extra cost is required. Among the chickens, Sonali chicken is adaptive all over the country and is easier to rear than a broiler due to a suitable environment. Major constraints of poultry farming are the outbreak of numerous ocular, gastrointestinal, and respiratory diseases.

In avian species, the peripheral lymphoid organs include the Harderian glands, spleen, and all mucosa-associated lymphoid tissues (MALT) found in the respiratory tract, urinary tract, and alimentary tract (Nasrin et al., 2013). The Harderian gland, an ocular adnexal gland located in the orbit of most terrestrial vertebrates, plays a significant role in immune defense and maintenance of the ocular surface (Payne, 1994). In birds, it is particularly well-developed and is involved in the production of tear fluid and various immune functions (Hodges, 1974). Despite its importance, the Harderian gland's

development and morphology in different avian species, including chickens, remain under-explored.

The Harderian gland is present in terrestrial vertebrates having a nictitating membrane (Harder, 1694), and in aquatic amphibians and primates' orbits as a vestige (Burns, 1975). In birds, the usual functions of these glands are to lubricate the surface of the eyeball (Payne, 1994; Sakai, 1981) and act as a source of growth factors (Nasrin et al., 2011). The Harderian gland also plays an important role in the immunological defense of the para-ocular region (Burns, 1992b; Shirama et al., 1996). As well as accessory organs of the eye are also essential to understand normal eye physiology and pathogenesis related with these. Available studies (Baba et al., 1990; Caeho et al., 1993; Jeurissen et al., 1989; Rahman et al., 2003) revealed a lack of literature on the Harderian Gland in Sonali chicken, therefore, the present study has been proposed to investigate its postnatal growth, morphometry and characteristic features.

Understanding the histo-morphological characteristics of this gland in Sonali chickens can provide valuable insights into their health and immune status, which is crucial for improving poultry management practices.

Previous studies have shown that the Harderian gland undergoes significant developmental changes during the early stages of life in chickens (Burns, 1992a). These changes are critical for establishing the gland's functionality in tear production and immune response. Therefore, examining the histomorphological features of the Harderian gland in 7-day-old Sonali chickens can shed light on its developmental processes and potential implications for poultry health.

This study aims to investigate the histomorphological characteristics of the Harderian gland in 7-day-old Sonali chickens. By conducting a detailed histological analysis, we hope to contribute to the existing knowledge of avian anatomy and provide insights that may enhance the health management and productivity of this important poultry breed.

Materials and Methods

Animals and ethics approval

A total of ten 7-day-old Sonali chickens irrespective of sex were used in this study. The chicks were sourced from a local hatchery and were housed in a controlled environment with ad libitum access to feed and water. All experimental procedures were conducted in accordance with the guidelines approved by the local Ethical Committee of Bangladesh Agricultural University. The age of the bird was determined by the record available on the farm. The Harderian glands were collected carefully from the orbital cavity after cervical subluxation. For the gross study, their location, size, shape, and length, breadth, and weight were taken from the chickens.

Tissue collection

On the 7th day, the chickens were killed humanely followed by cervical dislocation. The orbits were carefully dissected to expose and remove the Harderian glands. The collected glands were immediately fixed in Bouins fluid (Gridley, 1960) for 24 hours.

Histological preparation

After fixation, the samples were dehydrated, cleared in xylene, and infiltrated with paraffin. Finally, the small embedded paraffin blocks were sectioned at 5µm thickness using a rotary microtome (Slee, CUT 2062, Germany). The sections were then stained with the standard H & E method (Gridley, 1960) to reveal their histological features.

Microscopic examination

The stained sections were examined under a light microscope (Lx 400, LABOMED) at 100X/400X. Images were captured using a digital camera attached to the microscope.

Morphometric analysis

The morphometric parameters, including length, breadth, thickness were measured using vernier caliper, and weight was measured using digital weighing balance. The data were recorded into a spreadsheet of MS Office Excel 2019 and further analysis was carried out by the same software.

Table 1: Sizes of the Harderian gland on day 7th Sonali chicken

SL no.	Length (mm)	Breadth (mm)	Thickness (mm)	Weight (mg)	Color
1	13	3	1	18	Pinkish
2	12	3	1	15	
3	11	3	1	19	
4	13	2	1	17	
5	12	3	1	14	
6	11	2	1	16	
7	14	4	1	19.5	
8	13.5	3.5	1	17.5	
9	10	3	1.3	15	
10	10	2.5	1	14.2	
Average	11.95	2.9	1.03	16.52	

Results and Discussion

Gross study

Location

In the present study, the Harderian gland was located on the ventro-medial aspect of the eyeball. This observation was similar to Nasrin et al. (2011) and Ashok et al. (1998). In contrast, Jahan et al. (2006) reported that the Harderian gland was situated in broiler and native chickens on the dorsal posterior surface of the eyeball occupying a considerable part of the orbit. On the other hand, Wight et al. (1971) and Burns (1975) described that the Harderian gland was located on ventral and postero-medial to the eyeball.

Size

The size of the Harderian gland varied among different ages of chickens. The present study found that the average length, breadth, thickness, and weight of the Harderian gland were 11.95 mm, 2.9 mm, 1.03mm, and 16.52 mg respectively on day 7th Sonali chickens (Table 1).

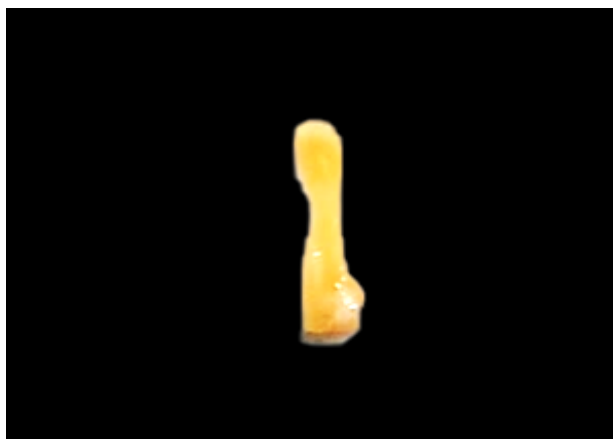


Figure1: Harderian gland on 7th day Sonali chicken

Color

The color of the Harderian gland appeared pinkish in its fresh condition (Table 1 and Figure 1) which was different (somewhat brownish) in native chickens (Jahan et al., 2006).

Shape

The shape of the Harderian gland was bi-lobed, with a narrower body and wider ends on the 7th day in the present study (Figure 1). This observation was

almost similar to Jahan et al. (2006) where the author declared that the Harderian gland was bi-lobed, and triangular in both broiler and native chickens. Ashok et al. (2000) observed the hourglass-shaped Harderian gland in the White Leghorn, suggesting variation in the shape of Harderian gland in between and among different species of birds.



Figure 2: Histological section of Harderian gland of Sonali chickens on 7th day. [1. capsule (C), 2. lumen of the lobule (L), 3. connective tissue septa (CS)] \times 100X. H & E stain. Scale bar = 100 μ m

Histological study

The Harderian gland of 7th day Sonali chicken was a branched compound tubulo-acinar type having acini towards the periphery and tubules at the center of the gland (Figure 2). The finding was similar to the observation with Ashok et al. (1998) wherein White Leghorn bird. However, Mobini et al. (2012) stated that the Harderian gland in native chicken was compound tubulo-alveolar type and its duct was lined by columnar epithelial cells of varying height, and goblet cells were not found there. Burns (1992b) noted that in fowl, the Harderian glands are relatively large and more developed than the lacrimal gland. The present study showed that the Harderian gland was covered by a thin, connective tissue capsule (Figure 2). The connective tissue septa from the capsule penetrated the gland and divided the gland into numerous lobes and lobules (Figure 2, Figure 3). The finding was similar to the observation of Burns (1975) in rook. Each lobule consisted of numerous acini which were lined by simple columnar epithelial cells (Figure 4). Acini lumens were mostly elongated but some were rounded and the cell boundaries were clearly visible. Whereas, in native chickens, the acini were lined by tall simple columnar epithelium, and the lumen of

the acini was elongated, irregular, and narrow, and the cell boundaries were not distinctly visible (Jahan et al., 2006). This luminal variation along with shape among the Sonali chickens is possibly due to strain differences. The lumen of the lobules was chiefly irregular (Figure 5). Sometimes both irregular and regular lumen were present in one Harderian gland. This variation in the size of the histological lobule of the Harderian gland of chicken may be due to age, hormonal or growth factors differences.

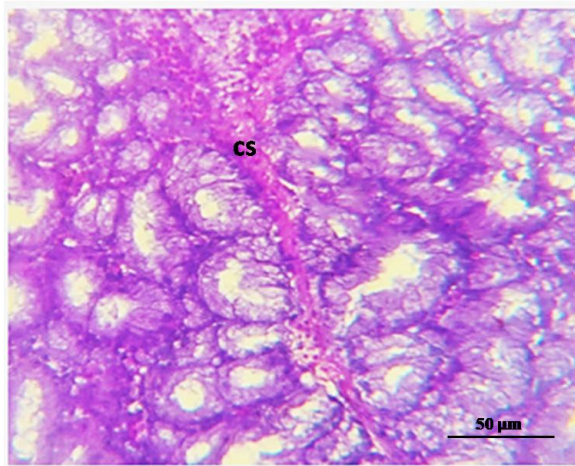


Figure 3: Histological section of Harderian gland of Sonali chickens on 7th day (connective tissue septa, CS) ×400X. H & E stain. Scale bar = 50 μm

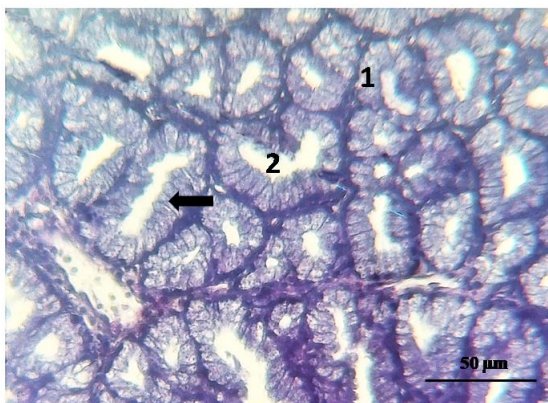


Figure 4: Histological section of Harderian gland of Sonali chickens on 7th day [1. acini, 2. lumen of acini, simple columnar epithelium (single arrow, black)] ×400X. H & E stain. Scale bar = 50 μm

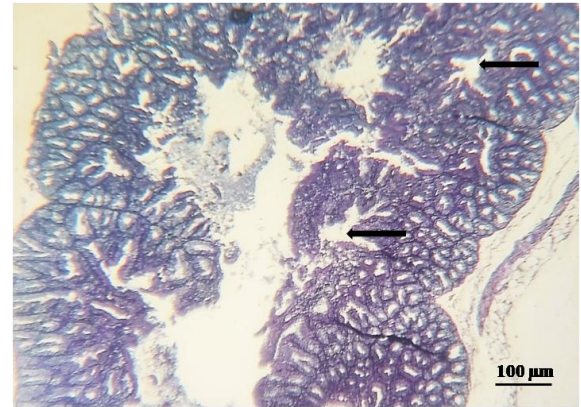


Figure 5: Histological section of Harderian gland of Sonali chickens on 7th day [Lumen is irregular (single arrow, black)] ×400X. H & E stain. Scale bar = 100 μm

Conclusion

The Harderian gland is considered as an important orbital gland. From this study, the knowledge of the basic histological and histochemical structure of the Harderian gland will help in the diagnosis and treatment of ocular diseases as well as upper respiratory tract diseases.

Competing interest

The authors declare that they have no competing interests.

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