

Morphometrical Analysis of Harderian Gland of Dove and Native Chickens

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Received: 2024, 15, Mar

Accepted: 2025, 21, Apr

Published: 2025, 29, May

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Annotation: An important part of eye lubrication and immunological protection, the Harder's gland is a specialized tissue connected to the orbital region of birds. The local chicken (*Gallus domesticus*) and the laughing dove (*Spilopelia senegalensis*) are the two bird species whose Harder's gland morphological and morphometrical features are examined in this work.

Gross analyses of the Harderian gland were performed on 20 chickens, adult roosters and 20 of which were adult male doves. The current investigation found that the rooster and doves have different bibbed Harderian gland sizes. It was discovered that the male rooster and doves have a larger Harderian gland in both length and width than the male rooster. Both the dove and the rooster had irregular lobule lumens. The rooster male's small acini were lined by low simple columnar epithelium, and their lumen was spherical. Still, only a few of them were elongated, and the cell boundaries were clearly visible.

INTRODUCTION

The Swiss physician Johann Jacob Harder originally reported the gland in the deer species *Dama vulgaris* in 1694. Since then, a lot of information has been revealed about these glands, also referred to as Harder's or Hardian glands. Bats and terrestrial carnivores are said to lack the Harderian gland, although monkeys are known to have a primitive form of it (1). Some animals have larger, more developed Harderian glands than lacrimal glands (2).

An endocrine function of the gland is possible (3). The gland plays an important part in how birds react to vaccinations and infections (4,5). The primary exocrine paraocular gland in

domestic poultry is the Harderian gland. It is located in the orbits of the eyeball, ventral and posteromedial. Its duct emerges from its anterior extremity and extends rostrally from the area of the optic nerve. It then passes inferior to the origins of the superior and inferior oblique muscles. Because of its loose attachment to the periorbital fascia, the eye typically stays in the orbital cavity after it is removed (6).

All vertebrates, with the exception of fish, fully aquatic amphibians, and primates, have Harderian glands in their orbits (7). According to (8,9), it is associated with the third eyelid and its secretion enters the conjunctiva bulbar on the third eyelid's surface. The Harderian gland is the primary exocrine paraocular gland of domestic poultry and is located behind the eyeball in the ventral and posterior-medial regions of the orbit (10).

The purpose of the relatively larger, Harderian gland in birds is to lubricate the nictitating membrane and the surface of the eyeball. It is significantly larger than the lacrimal gland (2, 11,12).

Material and Methods

Birds collection

The study's HGs came from twenty local chicken and dove birds that appeared to be in good health. They were split into two equal groups, with the first subgroup of each species being utilized for anatomical research and the second group being used for histological, histochemical, and ultrastructural examinations. Between September and March of 2024–2025, these birds were bought from regional vendors in the Aldwiynia province's common marketplaces(13).

Morphological study

Every bird under study was weighed before being put to sleep by inhaling chloroform (14).

In order to examine the eye and, in the case of two species, the left and right Harderian glands, each bird was dissected by mounting it on an appropriate dissecting board. After making a mid-line incision in the skull wall, the left and right HD were located and captured on camera using a digital camera (Sony Dsc-H90). The position and relationships of each component were determined. Samples were extracted, rinsed with normal saline to get rid of blood and adherent debris, and then cleaned once more using normal saline (15,16).

A sensitive digital scale (Notebook series-Digital scale) was then used to measure the weights of the organs under study in grams. The electronic Vernier caliber was used to perform macroscopic measurements (length, thickness, and diameters) of the gathered segments in centimeters and millimeters.

RESULTS

The morphological finding of the Harderian gland of male native chicken (rooster) & male Dove

The results of the current investigation showed that the adult male dove and chicken's Harderian glands had two tiny glands, the left and right, both of which were located in an orbital cavity (Fig.1,2). They were typically found in the inferior caudal region of the eyeball in chickens (Fig. 1). whereas the dove is located at the eyes' medial ventral angle to the posterior part (Fig.3) (table .2) The Shape & Color of The Harderian gland of male native chickens(rooster) was a bi-lobed and triangular to longitudinal ocular gland (fig. 5). In the present study it was situated on the dorsal posterior surface of the eyeball occupying a considerable part of the orbit (Fig. 2,3,4,5).

The Harderian gland of present study was brownish in color in native chicken (Fig. 6) and somewhat pinkish in color in dove (Fig. 7)

The study revealed that the external feature of the chicken's Harderian gland was elongated, with

two ducts toward the nasal cavity and one connected to the translucent third eyelid membrane (Fig. 8). In contrast, the dove appeared coma-shaped, with its duct open in the nick tining membrane (Fig. 9). The chicken's right and left harderian glands were both smooth, soft, crusty, elongated and pink (Fig. 8). whereas the dove displayed a brownish, straight duct that communicates with the nictitating membrane (Fig. 7).

Morphometric Finding of Harderian gland of male The Laughing dove and rooster

The length of left and right hardian glands in rooster and dove morphometric measurements were 1.76 ± 0.09 , 1.36 ± 0.08 , 1.42 ± 0.05 and 1.28 ± 0.08 cm as follows where the weight of glands left and right in rooster and dove were 0.69 ± 0.09 , 0.51 ± 0.09 , 0.03 ± 0.003 and 0.02 ± 0.004 gm as follows, while the width in left and right harderian glands in rooster and dove were 0.69 ± 0.09 , 0.51 ± 0.09 , 0.62 ± 0.06 and 0.48 ± 0.05 cm as follows there are significates difference high in left than in right in rooster and dove (table 1)

Table 1. the mean and standard error of the morphological measurement of the harderian glands in local chicken and dove

	Local chicken (rooster)		Male dove		
	left	right	left	right	LSD value
Length (cm)	1.76 ± 0.09	1.36 ± 0.08	1.42 ± 0.05	1.28 ± 0.08	0.2747
Weight of glands(gm)	0.69 ± 0.09	0.51 ± 0.09	0.03 ± 0.003	0.02 ± 0.004	0.2258
Weight of birds(gm)	1786 ± 66.6		75.2 ± 2.001		171.8
Relative weight	0.03%	0.028%	0.039%	0.026%	
Width(cm)	0.69 ± 0.09	0.51 ± 0.09	0.62 ± 0.06	0.48 ± 0.05	0.216
Thickness(mm)	1.6 ± 0.11	1.5 ± 0.12	0.4 ± 0.03	0.3 ± 0.03	0.29

Table 2: Species differences in gross parameters of Harderian gland of ROSSTER AND DOVE

parameter	Local chicken rooster	dove
location	Doral posterior to eyeball	Ventromedial part of eyeball near angle of eye
shape	Triangular to elongated	Tear drop
Size	Larger	small
Color	Brown to pink	brownish

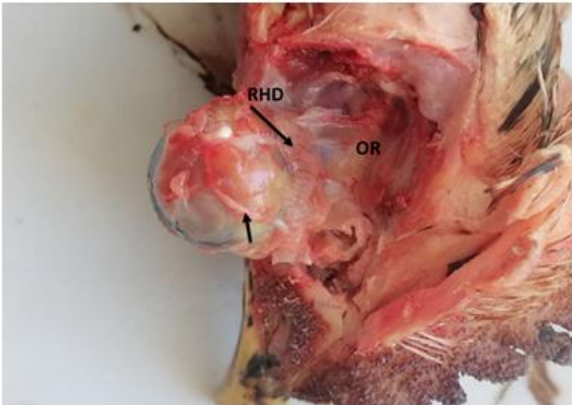


Fig.1 dorsal view image of the harderian glands in rooster showed harderian gland(RHD) in orbital cavity (OR) and optic nerve (black arrow).

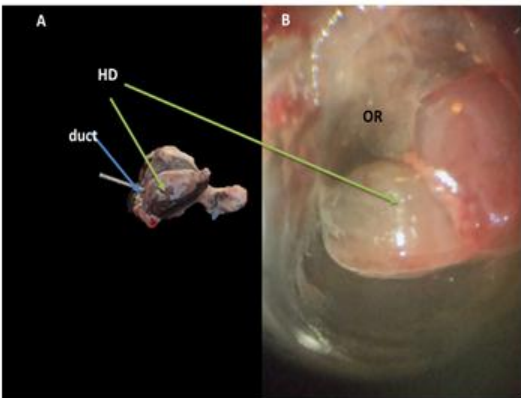


Fig.2 dorsal view image of the harderian glands in male dove showed harderian gland (HD) in orbital cavity (OR).

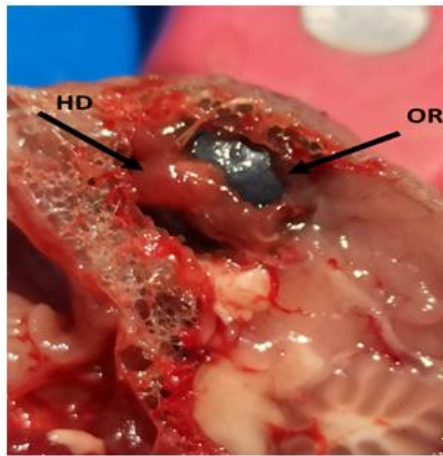


Fig.3: longitudinal median view image of the Harderian glands in male dove showed Harderian gland (HD) in orbital cavity (OR) located median ventral angle to posterior part.

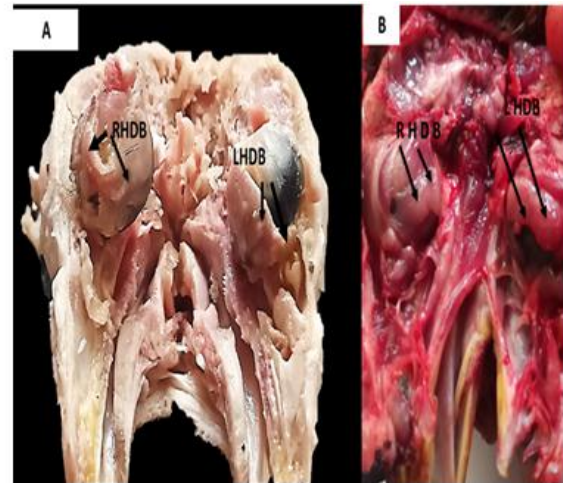


Fig. 4: A & B: median dorsal view photograph of Harderian gland (HD) in male chicken birds show: Bi lobed (arrows blacks) of left (LHDB) and right Harderian gland body (RHDB) left Harder's gland is slightly larger than the right one

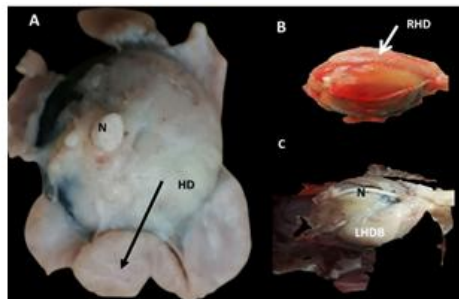


Fig. 5: A, B, & C: dorsal view photomicrograph of Harderian gland (HD) in Rooster show: left and right bi lobed Harderian glands (LHD) (RHD) that ranged in hue from light brown to pink, optic nerve (N) pass upper through glands.

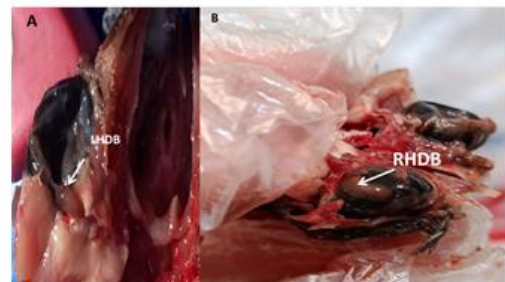


Fig. 6: A & B: photomicrograph of Harderian gland (HD) in dove birds show: Harderian gland body left and right (LHDB & RHDB) the size difference between the left and right glands may be less pronounced.

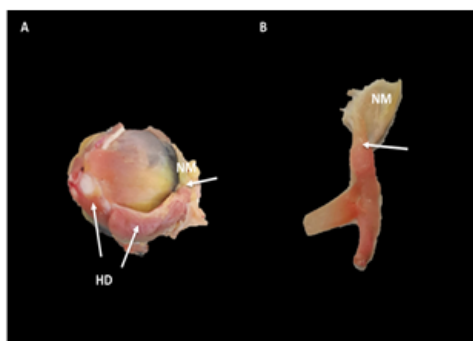


Fig. 7: A & B: photomicrograph of Harderian gland (HD) in ROOSTER show: Bi lobed Harderian gland body (HD) attached with nicktining membrane (NM) by duct (white arrows)

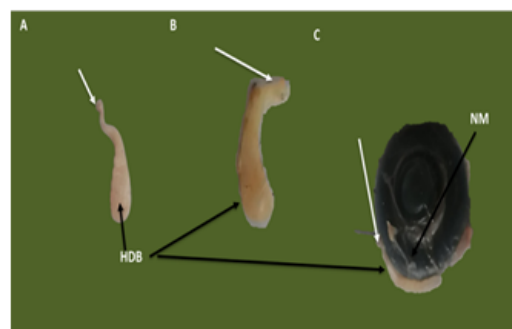


Fig. 8: A, B & C: photomicrograph of Harderian gland (HD) in ROOSTER show: Bi lobed Harderian gland body (HDB) attached with nicktining membrane (NM) by duct (white arrows)

Morphological Discussion of Harderian gland of male native chicken (rooster) & male Dove

The study reveals that the Harderian gland in roosters and male doves consists of two small glands within the orbital cavity, consistent with previous research. The gland, typically in the inferior caudal region of the eyeball in roosters, aids in the drainage of glandular secretions, providing protection against dehydration and environmental pollutants.

The Harderian gland in male doves is located at the medial ventral angle and extends toward the posterior eyeball, possibly due to differences in skull shape or orbital organization. This variation is linked to the gland's functional adaptations to the animal's environment and visual activity.

The Harder's gland's location in roosters and male doves may be due to evolutionary, anatomical, and physiological differences, emphasizing its role in bird visual defense mechanisms.

Shape & Color

The study reveals differences in the morphology, color, and structure of the Harderian gland between domestic rooster and male laughing dove. The rooster's gland is triangular to elongated, with two bilobed lobes, and is located on the posterior dorsal surface of the eyeball. This is consistent with previous research.

The gland in a dove is smaller and comma-shaped, concentrated towards the inferior medial corner of the eyeball. Its color varies between rooster and dove, possibly due to differences in blood vessel density, lipid and mucus concentration, or local immune activity, and is usually related to glandular cell function.

The study found that rooster and dove have distinct glandular drainage systems, with rooster having three excretory ducts and dove having a single duct. The rooster's gland is smooth, soft, elongated, and scaly, while the dove's is more compact, with a distinct excretory duct and smooth, brown surface, reflecting differences in histological structure and secretion type.

Morphometric Discussion

1. Length

It is noted that the Harder gland in the local rooster is significantly taller (1.76 cm Yusra, 1.36 cm Yemeni) compared to the cabinet (1.42 and 1.28 cm).

This difference in size may be attributed to:

The differences in the total body size between the two types.

Various immune and optical functions of the Harder gland according to the environment and animal behavior (17).

2. Weight of Glands

The weight of the rooster in the rooster is significantly higher (0.69 and 0.51 grams) compared to the choice (0.03 and 0.02 grams), which shows a difference of more than 20 times.

Although the relative weight of the body of the dove is slightly higher (0.039% compared to 0.03%), but:

o The absolute value of the gland is much lower, indicating an economy in the structure of the gland in small birds.

This may be associated with the varying degree of immune activity or tear secretion between the two types, as indicated by it (18).

3. Weight of Birds

The big difference in weight (1786 g for the rooster compared to 171.8 g for the dove) has a direct impact on the size of the gland.

This is in line with what (19) That the mass of the gland is appropriate to the total physical mass in the birds.

4. The width and thickness (Thickness)

The width of the gland and its thickness was higher in the rooster (0.69 cm and 1.6 mm) compared to my cabinet (0.62 cm and 0.4 mm).

This indicates: A more sophisticated and clear structure in the rooster gland. , The possibility of more cellular ingredients or higher convenience, as indicated by KEMPF et al. (2020) On the relationship between the size of the gland and the histological activity.

5. The border value of the difference (Least Significant Difference))

The border values indicate that the differences in weight, length, and thickness between the two types are statistically significant, especially since the differences exceed or rapprochement of the value of LSD (for example 0.29 per toxic against a actual difference of 1.2 mm).

Conclusion

- ✓ The results indicate that the Harder gland in the local rooster is larger, heavier and more sophisticated in terms of structure compared to dove.

The difference in immune activity.

- ✓ Eye size and role in the secretion of fats and immune materials.
- ✓ environmental and behavioral differences between poultry and wild birds.

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