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**Research Article**

# GROSS AND HISTOLOGICAL STUDIES ON BURSA OF FABRICIUS OF CARI SHYAMA AND VANARAJA BREEDS OF POULTRY

PAYAL JAIN, S. P. INGOLE[1] and UPAN DANG
Department of Veterinary Anatomy and Histology, College of Veterinary Science and Animal Husbandry
Indira Gandhi Krishi Vishwavidyalaya, Anjora, Durg (C.G.)

## ABSTRACT

The present work was undertaken to study bursa of Fabricius of chicks, growers and layers of Vanaraja and CARI Shyama breeds. Grossly, the organ was black in colour in CARI Shyama breed. Significantly more height was noticed in chicks and growers of CARI Shyama as compared to Vanaraja breed. Epithelium of mucosal folds was simple columnar in chicks and layers, while pseudostratified columnar in growers. Degeneration of lymphoid follicles and mucosal folds was observed in pullets. Number of mucosal fold was significantly more in chicks of Vanaraja and growers of CARI Shyama. Collagen fibers in the mucosal folds exhibited branching tree pattern. Elastic and reticular fibers were observed in outer wall and interfollicular septae. Pattern of distribution of carbohydrate and acid mucopolysaccharides was also studied.

**Key words:** Bursa of Fabricius, Vanaraja, CARI Shyama

CARI Shyama and Vanaraja are two hybrids, developed to improve the livelihood of tribal peoples. These birds have better productivity than desi breeds and have good disease resistance than the exotic birds. In poultry, bursa of Fabricius along with thymus play a major role in the establishment of immunity. The present study was conducted to evaluate the gross, histomorphological and histochemical structure of bursa of Fabricius in CARI Shyama and Vanaraja breeds, as no literature is available on the status of this organ in these recently developed hybrid birds.

## MATERIALS AND METHODS

The present study was conducted on ten apparently healthy chicks (0 day old), growers (8 weeks old) and layers (16 weeks old) of CARI Shyama and Vanaraja breeds of poultry. Bursa of Fabricius was collected and fixed in 10% neutral buffered formalin. The tissue samples were processed, cut and stained with Haematoxylin and Eosin for normal histological structure, Van Gieson for collagen fibers, Gomori's for reticular fibers, periodic acid Schiff (PAS) for mucopolysaccharides and AB-PAS for acid mucopolysaccharides (Singh and Sulochana, 1997).

## RESULTS AND DISCUSSION

The bursa of Fabricius was a blind, oval, sac like diverticulum situated on the dorsal aspect of cloaca as reported earlier (Hodges, 1974; McLelland, 1975; Nickel *et al.,* 1977; Akter *et al.,* 2006). It was gray black in CARI Shyama which may be due to breed character of its parent breed Kadaknath. Height was significantly more in CARI Shyama with an average value of 0.41 cm and 4.51 cm in chicks and growers, respectively. However, in chicks and growers of Vanaraja breed, these values were recorded as 0.35 cm and 4.05 cm, respectively (Table 1). In pullets of both breeds, involution of bursa was indicated by decrease in height and width.

Bursa of Fabricius was composed of tunica serosa, tunica muscularis, tela submucosa and tunica mucosa as reported by Hodges (1974), Purushotham *et al.* (1989) and Gulmez and Aslan (1999). The tunica serosa was made up of mesothelium and subserosal loose connective tissue. Tunica muscularis was composed of variably oriented smooth muscle fibers. Thickness of outer wall comprising tunica serosa, muscularis and submucosa was significantly more in chicks of CARI Shyama (with an average 50.08 µ) than Vanaraja (37.76 µ) and growers of Vanaraja (with an average 194.5 µ) than CARI Shyama (128.6 µ). Lumen of bursa was obliterated with small and large sized mucosal folds.

The histomorphometrical observations of bursa of Fabricius in both the breeds are presented in Table 2. Different shape of mucosal fold like elongated, leaf, club, sessile and pyramidal with secondary branches was observed. Number of mucosal folds varied from 8-16 as compared to 12 as reported by Hodges (1974).

[1]Corresponding author

**Table 1**
**Gross morphometrical observations of bursa of Fabricius**

| Age group | Parameter | Breed | |
|---|---|---|---|
| | | CARI Shyama | Vanaraja |
| 0 day | Height (cm) | 0.41±0.002* | 0.35±0.003 |
| | Width (cm) | 0.33±0.004 | 0.32±0.002 |
| 8 weeks old | Height (cm) | 4.51±0.14* | 4.05±0.11 |
| | Width (cm) | 2.76±0.23 | 2.29±0.13 |
| 16 weeks old | Height (cm) | 1.20±0.13 | 1.50±0.16 |
| | Width (cm) | 1.90±0.45 | 2.05±0.35 |

Mean values with * are significant (P< 0.05)

Number of mucosal folds was significantly more in chicks of Vanaraja (10.9) than CARI Shyama (8.5) and in growers of CARI Shyama with an average (16.9) than Vanaraja (13.8). Height of mucosal folds also increased from chicks to grower stage. Surface epithelium of the mucosal folds was simple columnar in chicks (Fig. 1), while it was pseudostratified columnar in growers as also reported by Purushotham *et al.* (1989). However, simple columnar epithelium (epithelial tuft), was also noticed at apex and side of apex of some folds, which confirmed the findings of Hodges (1974) and Akter *et al.* (2006). Height of epithelium was significantly more at the base in CARI Shyama chicks (54.24 µ) than Vanaraja (35.84 µ).

The core of the fold was filled with lymphoid follicles, which were separated by interfollicular septae (Fig. 3). These septae were highly vascular. Number of lymphoid follicles per fold was significantly higher in chicks and growers of CARI Shyama (21.55 and 25.14, respectively) than in Vanaraja (14.03 and 18.98, respectively) (Table 2). In chicks, the diameter of follicle was significantly more in Vanaraja (mean value 89.5 µ) than CARI Shyama (mean value 77.5 µ). In growers as per the maximum and minimum diameter, follicles were elongated in CARI Shyama and more broad in Vanaraja. The maximum and minimum diameter recorded in the present study were not in agreement to findings of Akter *et al.* (2006), in which maximum diameter was 468.83 µ and minimum diameter was 240.70 µ. Each follicle was divided into cortex and medulla by the presence of a layer of blood vessels and undifferentiated epithelium. The distinction between cortex and medulla was more apparent in Vanaraja, as reported in broiler chicken (Akter *et al.,* 2006).

In pullets, follicles were disintegrated and were present in the form of small collection of lymphocytes. Most of the bursal wall was made up of dense fibrous connective tissue, however, reticular network containing lymphocytes surrounded the lumen.

Collagen fibers were noticed in the wall and inter follicular septae of bursa of Fabricius of chicks and growers as reported earlier (Vaish, 2005). Fibers entered between the follicles like branches of tree. Concentration of fibers was more in chicks of Vanaraja and in growers of CARI Shyama. In pullets, increased density of fibers was seen in outer wall of involuted

**Table 2**
**Histomorphometrical observations of bursa of Fabricius (Mean±S.E.)**

| Group | Breed | Thickness of outer wall (µ) | Number of mucosal folds | Height of mucosal folds (µ) | Height of epithelium (µ) | | | Number of follicles per fold | Diameter (µ) of follicles | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Base | Middle | Apex | | Maximum | Minimum |
| 1 | Vanaraja | 37.76±1.12 | 10.9±0.31* | 800±20.5 | 35.84±0.64 | 31.36±0.32 | 22.72±0.48 | 14.03±0.64 | 89.5±1.2* | 60.2±0.85 |
| | CARI Shyama | 50.08±0.8* | 8.5±0.5 | 850±25 | 54.24±1.76* | 32±0.16 | 24.64±1.6 | 21.55±0.60* | 77.5±1.1 | 58.6±0.8 |
| 2 | Vanaraja | 194.5±19.04* | 13.8±0.77 | 2280±45 | 42.56±2.4 | 29.12±1.92 | 38.72±2.88 | 18.98±2.34 | 346.7±5.5 | 168.3±4.5 |
| | CARI Shyama | 128.6±1.76 | 16.9±0.69* | 2200±40.6 | 48±2.56 | 29.12±1.6 | 30.08±2.72 | 25.14±0.05* | 377.2±4 | 144.8±5.5 |
| 3 | Vanaraja | 191.0±12.16 | 12±0.55 | 1700±20.5 | 32±2.1 | 32±1.5 | 22.4±2.1 | 17.8±0.65 | 330.6±3 | 135.4±4.5 |
| | CARI Shyama | 181.1±5.76 | Nil | Nil | Nil | Nil | Nil | Nil | Nil | Nil |

Nil - mucosal folds and follicles were not present
Mean values with * in a column are significant (P< 0.05)

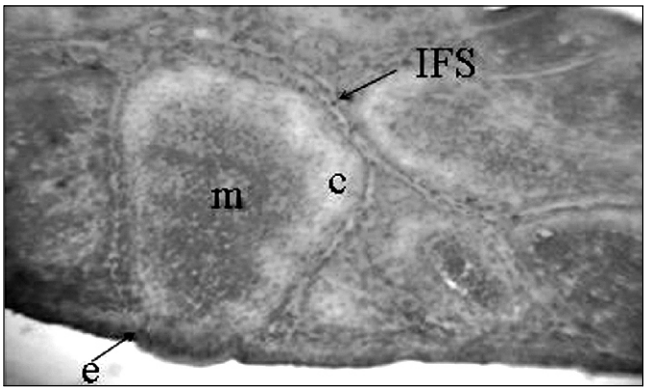


Fig 1. Photomicrograph of bursa of Fabricius of Vanaraja (Group 1) showing simple columnar epithelium (e), cortex (c), medulla (m) and interfollicular septa (IFS). (H. & E. x 400)

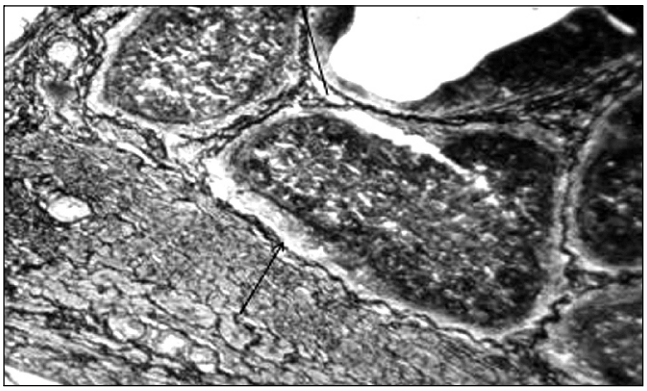

Fig 2. Photomicrograph of bursa of Fabricius of Vanaraja (Group 3) showing reticular fibres (arrow) in the wall and interfollicular septa. (Gomori's method x 100)

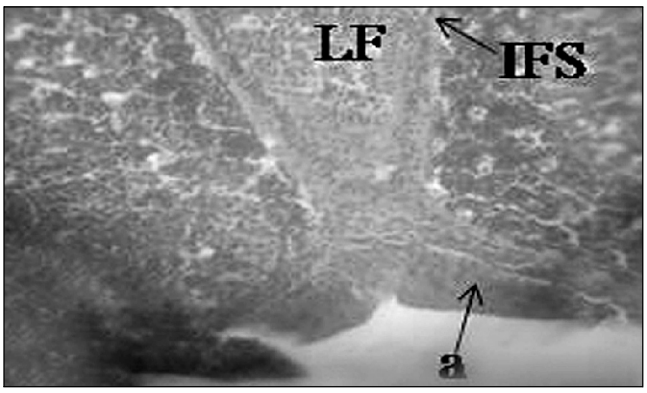


Fig 3. Photomicrograph of bursa of Fabricius of CARI Shyama (Group 2) showing epithelium (a), lymphoid follicle (LF) and interfollicular septa (IFS). (H. & E. x 400)

bursa. Collagen fiber strands also ascended in the cores of the involuted folds. Density of fibers was more in CARI Shyama except the core of folds, where it was more in Vanaraja. In three pullets of Vanaraja in which developed bursa was noticed, the fiber distribution was similar to growers. Higher density of collagen fibers in CARI Shyama pullets may be concurrent to early involution of bursa in this breed.

Scanty elastic fibers were present in outer wall and interfollicular septae of chicks. In growers, fibers were observed in the core of the mucosal folds ascending from the outer wall. In pullets, very scanty fibers were present in the peripheral areas of outer wall of involuted bursa. Reticular fibers were noticed in the wall and in interfollicular connective tissue as reported earlier (Vaish, 2005). Reticular fibers also formed network in cortex and medulla of follicles and provided support to lymphocytes. Density was more marked in chicks of Vanaraja and growers of CARI Shyama. In growers, fibers were marked at corticomedullary junction of the follicles. In involuted bursa of pullets, fine fiber network was noticed throughout the wall of the bursa which also extended in the mucosal folds. Three pullets of Vanaraja had active bursa which showed fiber distribution like growers (Fig. 2).

PAS activity was observed in outer wall and in the epithelium of mucosal folds of bursa of Fabricius and it confirmed the findings of Vaish (2005). The activity was mild to moderate in chicks of both breeds, moderate in growers of CARI Shyama and mild in Vanaraja. Mild activity was noticed in involuted bursa of pullets of both breeds, however, intensity was mild to moderate in developed bursa in three pullets of Vanaraja. AB-PAS positive material was observed in surface epithelium. Activity was less in chicks of Vanaraja as compared to chicks of CARI Shyama. Activity was very mild in growers of both breeds and pullets of CARI Shyama and was mild in pullets of Vanaraja.

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