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GROSS AND HISTOMORPHOLOGICAL STUDIES OF THE OVIDUCT OF NATIVE CHICKEN OF BANGLADESH

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ABSTRACT

The present study was carried out on the oviduct of laying native chicken of Bangladesh at the age range of 8-12 months old. After dissection, morphological parameters such as total length and weight of oviduct, length and weight at the age range of 8-11 months were determined. For the histological study, after preparation and staining with hematoxylin and eosin, histological layer of oviductal tissues were recognized. The mean length and weight of total oviduct of native chicken were 7.18 ± 4.22 cm and 24.45± 1.81 gm respectively. The mean length and weight of oviductal segments, infundibulum (7.18 ± 4.22 cm and 7.18 ± 4.22 gm), magnum (18.40 ± 6.75 cm and 18.40 ± 6.75 gm), isthmus (7.68 ± 3.46 cm and 7.68 ± 3.46 gm), uterus (6.10 ± 2.80 cm and 6.10 ± 2.80 gm) and vagina (6.83 ± 2.82 cm and 6.83 ± 2.82 gm) were measured. Both the length and weight of oviductal segment was progressively increasing from 8-10 months and was decreased at 11 months age. Histological features of oviductal segments varied in regards to the distribution of gland, connective tissues arrangement and mucosal folding. Particularly, the distribution of tubular glands among the segments of oviduct was significantly different. In the magnum and isthmus, populations of tubular glands were higher whereas other segments had limited glands.

Key words: Chicken, Oviduct, Gorss morphological study

INTRODUCTION

Chickens of Bangladesh are mostly indigenous type called deshi chicken and their body weight ranging from 1.0 to 1.4 kg. Reproduction in poultry is completely different from other farm animal species. In the poultry, there are two principle reproductive organs; ovary and oviduct; which are participated in the production of egg in laying hen. The oviduct of chicken is an egg producing organ, which convey the ovum to the cloaca and it successively adds the albumin from the glands of magnum. Finally, shell membrane added from isthmus, the hard calcite shells and shell pigments from uterus and the bloom or cuticle from the gland of vagina. Therefore, oviduct play vital role in the assembly of egg components after receiving ova from ovary. From the available literature it is observed that the anatomical study of oviduct was confirmed in hybrid chicken (Khan *et al.*, 1999). In deshi chicken developmental study of the oviduct was done by Istam *et al.* (2002), but research has not been carried out regarding the adult deshi chicken. Therefore, the present work has been carried to study on gross and histomorphological analysis of the adult deshi chicken.

MATERIALS AND METHODS

The present study was conducted in the Department of Anatomy and Histology; and Department of Surgery and Obstetrics, Bangladesh Agricultural University, Mymensingh during the period from January 2011 to May 2011.

Chickens

Adult female chickens of local breed (called native or deshi chicken- *Gallus domesticus*, n=4) were used. These chickens were purchased from the village farmers close to the Bangladesh Agricultural University, Mymensingh. These adult deshi chickens were selected from age 8 to 11 months old. The age of deshi chicken was estimated based on the farmers' informations. The oviducts which were free from gross pathological disorder were only used for both morphometrical and histological studies.

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Gorss morphological study of oviduct

In this study, deshi chickens were killed by cervical subluxation. Standard anatomical dissection of each bird was done as described previously. Total four deshi chickens were used from 8, 9, 10, 11 months of age (one from each month). The whole oviduct was quickly dissected out and stretched on tray. The morphometrical study included the color, length and weight of oviduct. Individual weight of each segment of oviduct was measured by balance weight machine. Length was measured by scale. Relative weights of the oviduct were also calculated adopting following formula according to Federova (1987).

$$\text{Relative weight of the oviduct} = \frac{\text{Weight of the oviduct}}{\text{Body weight}} \times 100$$

Preparation of tissues for histomorphological study

After collecting the oviducts, segments of the oviducts were separated. From each segment, tissues were cut into small pieces and fixed in the Bouins fluid (Gridly, 1960) for 24 hours. After fixation, the samples were dehydrated in the series of ascending grade of alcohol (70%, 80%, 90%, 95%, 100% I, 100% II and 100% III) for 2-3 hours each. Followed by clearing in three changes of xylene, each for 30 minutes interval and the tissues were infiltrated with paraffin. As soon as the infiltration was completed, the tissues were embedded in paraffin and finally the embedded paraffin blocks were attached with block holder.

Tissues were sectioned at 6 micrometer thickness using sliding microtome (MIC 509, Euromex, Japan). After sectioning, the sections were floated on lukewarm water floatation bath for stretching and then the paraffin sections were mounted on slides glass using an adhesive (egg albumins) and dried 6 to 24 hours on hot plate of slide warmer boxes.

In order to study the histological structures of oviduct, tissues sections were stained with Mayers Hematoxylin and Eosin method (Gridley, 1960). Finally, slides were mounted with DPX which was kept over the tissue section and dried for 24 hours. After all these preparation of slides, photographs were taken with microscope equipped with a camera (Nikkon, Japan).

Statistical analysis

In this study, mean±SD of total length and weight as well as individual segment data were analyzed. Statistic was carried out using ANOVA to compare the individual segment with the total length.

RESULT AND DISCUSSION

Morphology of the oviduct

General morphology of the oviduct

In the present study, only the left oviduct was found functional as described by several authors in different poultry breed (Kar, 1947).

Fig. 1. Photographs of left oviduct of deshi chicken after dissection

The left oviduct was extended from ovary to cloacae and had occupied the largest part of abdominal cavity. In the local deshi chicken of Bangladesh, oviduct was initially thin and fiber likes structure at one-day old, and highly coiled at 30 weeks. Similar result was observed in hybrid chicken (White Leghorn) at one-day old to 15 weeks old chicken by Kar (1947).

These authors showed the developmental changes in the oviduct from Day-1 to 30 weeks (5 month). In the present study, using the adult laying hen at 8-11 months old, oviduct was highly convoluted, and had clearly five segments (Fig. 1). The total length and weight of the oviduct was 46.18±9.49 cm and 24.45±1.81 gm respectively (Table 1). Therefore, the present study revealed the additional information of adult deshi laying hen at 8-11 months old.

Length of each segments of oviduct

Infundibulum

The present study revealed that the mean length of infundibulum of oviduct at 8-11 months old deshi chicken was 7.18 ± 4.22 cm (Fig. 2; Table 2). In the deshi chicken at 30 weeks (5 month), the length of infundibulum was 5.85 cm whereas Taylor and Hertelendy (1960) reported 9 cm; and Romanoff and Romanoff (1949) showed 7 cm in laying hen. In the previously reported deshi chicken, age of the poultry was less than the present study. Therefore, length of infundibulum of oviduct increases according to the progression of age.

Magnum

In the present study, the mean length of the magnum of oviduct at 8-11 months old chicken was 18.40 ± 6.75 cm (Fig. 2; Table 2). The length of 30 weeks old chicken was ranged from 20 to 48 cm (Giersberg, 1922) and differs with the report of Taylor and Hertelendy (1960), and Romanoff and Romanoff (1949) who reported in laying hen. These differences were probably due to age and breed variation of the chicken.

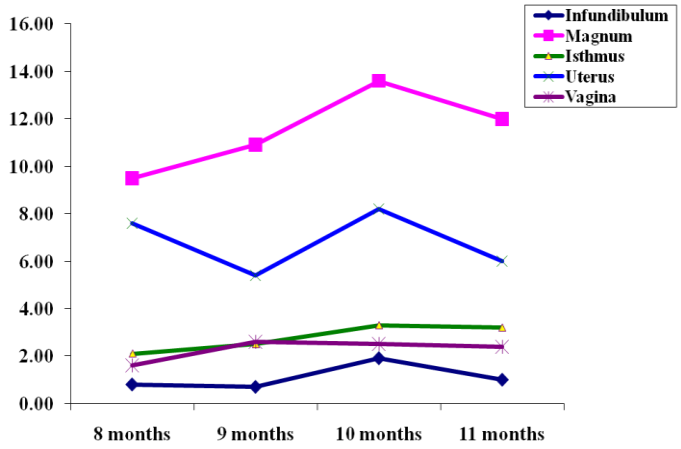

Fig. 2. Graph showing the length of different segments of the oviduct at 8, 9, 10 and 11 months of age

Table 1. Total length and weight of oviduct

Age groups	Total length (cm)	Total weight (gm)
Age groups ranging from 8 months to 11 month (n = 4)	46.18 ± 9.49	24.45±1.81

Table 2. Length and weight of different segment of oviduct

Parameters	Infundibulum (cm)	Magnum (cm)	Isthmus (cm)	Uterus (cm)	Vagina (cm)
Length (cm)	7.18 ± 4.22	18.40 ± 6.75	7.68 ± 3.46	6.10 ± 2.80	6.83±2.82
Weight (gm)	1.10 ± 0.548	11.50 ± 1.73	2.78± 0.574	6.80 ± 1.32	2.28±0.457

Isthmus

The mean length of the isthmus at 8-11 months old chicken was 7.68 ± 3.46 cm (Fig. 2; Table 2). The result was differed from Giersberg (1922), Taylor and Hertelendy (1960), and Romanoff and Romanoff (1949). They reported that the length of the isthmus in laying hen were 4 to l0 respectively. These variations in the length range of the present study in comparison with hybrid were due to strain differences.

Uterus

The present study revealed that the length of uterus was 6.10±2.80 cm (Fig. 2; Table 2). The length of magnum at 30 weeks old chicken of the present study was similar in range from 4 to 12 cm that was reported by Giersberg (1922) in laying hen, but it was not in agreement with the report of Taylor and Hertelendy (1960), and Romanoff and Romanoff (1949) that was 11 cm and 8 cm, respectively. These authors had used hybrid chicken breed.

Vagina

The length of vagina of oviduct at 8-11 months old chicken was 6.83±2.82 cm (Fig. 2; Table 2). In laying hen, the length of vagina of the present data is in agreement with the length range (4 to 12cm) that was reported by Giersberg (1922) but it was not in agreement with the report of Taylor and Hertelendy (1960), and, Romanoff and Romanoff (1949).

Weight of the segments of oviduct

Infundibulum

The present investigation revealed that the weight of infundibulum of oviduct was 1.10 ± 0.548 gm (Fig. 3; Table 2). The weight of the infundibulum in present study was similar to previous study by Warren and Scott (1935).

Magnum

The results of the present study was 11.50±1.73 gm (Fig. 3; Table 2). The report of the present study was inconsistent with the report of Warren and Scott (1935) where they found 17.6 gm magnum in hybrid chicken.

Isthmus

The present study revealed that the weight of isthmus was 2.78±0.574 gm (Fig. 3; Table 2) which was differed with Warren and Scott (1935) who reported that it was 4.4 gm because deshi chicken lay their eggs.

Uterus

The present study revealed that the weight of uterus was 6.80±1.32 gm (Fig. 3; Table 2). It was not in agreement with report of Warren and Scott (1935) where they noticed 13.8 gm in hybrid chickens, however, they did not mention ages of chickens. This difference was probably due to strain differences and body weight of individual bird.

Vagina

The present investigation observed that the weight of vagina was 2.28±0.457gm (Fig. 3; Table 2). Whereas, Warren and Scott (1935) reported that the weight of vagina of laying hen was 8 gm. The lower weight of present study was due to the indigenous low egg producing breed.

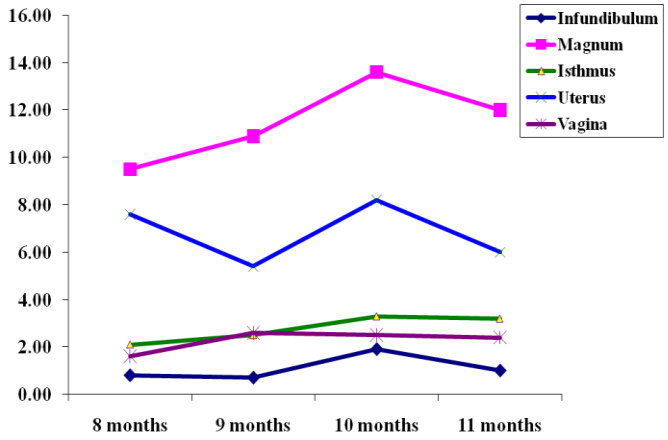

Fig. 3. Graph showing the weight of different segments of the oviduct at 8, 9, 10 and 11 months of age

Histological study of oviduct

Oviduct of laying deshi chicken had luminal epithelium, gland, connective tissues, muscle layer and outer serosa as described by several authors in different breed (Khan *et al.*, 1999; Islam *et al.*, 2002). However, the structure of these components varied according to the segment of oviduct in the present study.

Lamina epithelia were small to large in height depends on the segments of the oviduct (Fig. 4A-E). The lamina propria was consisted of diffused fibroblast and collagen fibers. Sub-mucosa of oviduct was continued directly with the lamina propria at all stages of postnatal development of deshi chicken until the adult age. This was followed by the tunica muscularis highly developed in adult deshi chicken. This layer was very thin at one-day old chicken, moderately developed at 12 weeks and similar results were also observed by Curtis (1910). The oviducts consisting of an outer longitudinal and an inner circular layer with connective tissues. The outer most layer of the oviduct was serosa and this was thin in the infundibulum, magnum and isthmus, developed in uterus and vagina of deshi chicken. Previously, Islam *et al.*, (2002) reported that, the mucosal folds of laying hens were short and tongue shaped at one-day old deshi chicken. With the aging, the infundibular folds were increased in height at 12 and 19 weeks old, and become highly developed at 30 weeks of age. In contrast, the mucosal folds in the magnum and isthmus were medium sized at 12 weeks and well developed at 19 and 30 weeks old deshi chicken. On the other hand, uterine mucosal folds were dome shaped at 12, weeks, elongated at 19 and 30 weeks old deshi chicken in the uterus and vagina. The report concerning the development of mucosal folds of the oviductal segments was not observed in the available literature. In the present study, mucosal fold highly coiled and folded during 8-12 months of gestation.

Infundibulum

It is the first part of oviduct, possesses long spiral folds with few glands (Fig. 4A). At the beginning of magnum, the epithelial folds become smaller and the glandular grooves disappear before the typical broad longitudinal folds of the magnum develop. This result is similar to that of the other fowl (Richardson, 1935).

Magnum

The magnum; albumin secreting region, was lined with columnar epithelium and consists of huge number of glands (Fig. 4B). The tubular glands in the magnum are highly developed and open to the epithelial surface. This feature is similar in other fowls. Developments of this segment have been reported previously. The albumen-producing gland in the magnum was observed at 30 weeks old (Islam *et al.*, 2002) however, Khan *et al.* (1999) observed these glands at 19 weeks old in White Leghorn chicken. That is why, the White Leghorn chickens were laying their eggs earlier, in comparison to our deshi chickens. In the present study, laying bird was mature enough so gland was clearly observed. This is due to strain differences.

Isthmus

It starts immediately after the magnum and have some histological similarities from magnum. Isthmus showed numerous glands for secreting of the shell membrane (Fig. 4C). Compare to the magnum, isthmus contains more glands and is in agreement with previously reported in deshi laying hen (Islam *et al.*, 2002) and in other fowls (Madekurozawa, 2002). The glands of the isthmus and the shell gland of the uterus were also found at 19 weeks old chicken (Islam *et al.*, 2002). These results of the present study were in agreement with Johnston *et al.* (1963) and Breen and Bruyn (1964).

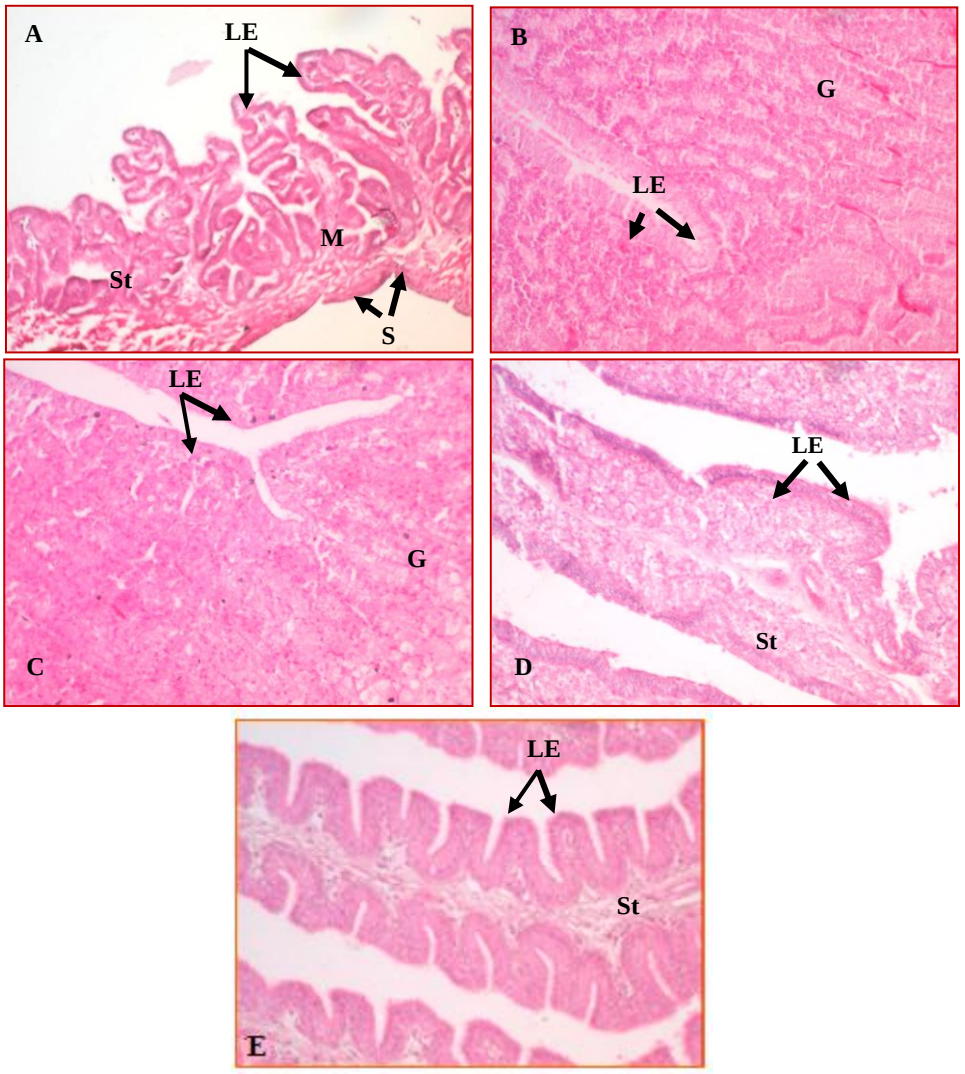

Fig. 4. Histological photographs of infundibulum (A), magnum (B), isthmus (C), uterus (D) and vagina (E) stained with Hematoxylin and Eosin. Photographs were taken at 20X objectives. LE; luminal epithelium, G; Gland, M; muscle, St; stroma, S; Serosa

Uterus

Uterus was characterized by longer and more complex mucosal folds are than the isthmian ones. Luminal epithelium was pseudostratified and is intermittently ciliated (Fig. 4D). The propria sub-mucosa contains branched tubular glands. Loose and well vascularized connective tissue is sparse between the glands. Similar observation was detected by other researcher (Johnston *et al.*, 1963, Breen and Bruyn 1964 and Islam *et al.*, 2002).

Vagina

The mucosa of the vagina forms longitudinal ridges or folds carrying secondary fold which are particularly regular in arrangement (Fig. 4E). Luminal epithelium of the vagina was lined by pseudostratified epithelium with columnar shaped. There was no tubular glands in the mucosal fold that seen for isthmus. Similar results were observed by Fuji (1963), in White Leghorn chicken and local deshi at postnatal development. The great part of the thickness of the vaginal wall is composed of the muscular layers. The inner circular layers are strongly developed and form the vaginal sphincter. The outer longitudinal layer is consists of bundles of muscle fibers scattered throughout a connective tissue stroma.

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