

Comparative anatomical study on infundibulum of Pati and Chara-Chemballi ducks (*Anas platyrhynchos domesticus*) during laying periods

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Abstract

Aim: The present investigation was undertaken to establish anatomical norms on gross anatomical, histomorphological and histochemical parameters of infundibulum of Pati and Chara-Chemballi ducks.

Materials and Methods: In the present investigation, 12 (twelve) each Pati and Chara-Chemballi ducks in their laying period (42 weeks age) were utilized.

Results: The mean length, breadth, thickness and weight of infundibulum were significantly higher in Chara-Chemballi duck than Pati duck. Though most of the histological parameters are almost similar, but the mean height of lamina epithelialis mucosae was significantly higher in Chara-Chemballi duck ($30.234 \pm 0.389 \mu\text{m}$) than in Pati duck ($23.906 \pm 0.332 \mu\text{m}$). PAS reaction was moderate at apical part of lining epithelium in Chara-Chemballi duck whereas the same is weak in Pati duck.

Conclusion: Result obtained showed that the Chara-Chemballi duck revealed significant difference in all the parameters as compared to Pati duck.

Keywords: anatomy, Chara-Chemballi, duck, infundibulum, Pati.

Introduction

Duck husbandry plays an important role in the socio-economic upliftment of the rural poor of Assam and other states located in the coastal regions of India. It is one of the most important domesticated species of poultry next to chicken primarily reared for table egg production in India. The peculiar agro-climatic condition with marshy and waterlogged areas prevailing throughout the state provides a very congenial environment for rearing ducks in Assam. Duck husbandry provides an additional source of income to the rural women folk of these states. The 'Pati' duck population constitutes a major indigenous non-descript duck variety in the state of Assam and annual egg production per duck is 70-95 eggs [1]. However, Chara-Chemballi duck is an indigenous variety of Kerala but their production performance did not differ significantly and annual egg production per duck was 181.3 with an average egg weight of 71.6 ± 2.38 g at 72 weeks of age under free range condition of Assam [2].

Infundibulum plays an important role in capturing and transferring of ovum and formation of chalazae [3]. Although research works have been conducted on the infundibulum part of the oviduct in domestic fowl [4, 5, 6, 7], literature regarding the infundibulum of Pati and Chara-Chemballi ducks during laying periods is found to be very scanty.

Therefore, in the present investigation, it was envisaged to study the gross, histology and histochemistry (PAS) of infundibulum of Pati and Chara-Chemballi duck during laying periods.

Materials and Methods

Ethical approval: The prior approval from the Institutional Animal Ethical Committee was obtained for use of the animals in this study.

Experimental design: In the present investigation, 12 (twelve) each Pati and Chara-Chemballi ducks in their laying period (42 weeks age) were utilized. The Pati and Chara-Chemballi ducks were procured from Pathsala locality of Barpeta district and State Institute and Rural Development, Khanapara, Guwahati respectively. The infundibulums were collected immediately after sacrifice as per the standard method [8] and gross studies were made on it. After slaughter, the location and relative topographic in-situ position of the infundibulum were recorded. The infundibulums were taken out from the body of birds and weights of infundibulum were recorded with the help of electronic pan balance. The gross anatomical characteristics of infundibulum were studied and the different biometrical measurements viz., the length, breadth and thickness of infundibulum were recorded by Vernier callipers [9]. For histological, histochemical and micrometrical study infundibulum were collected from of 42 weeks age of Pati and Chara-Chemballi ducks. The tissue samples were fixed in 10 % neutral buffered formalin. Then tissues were processed for Paraffin embedding method.

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Table-1: Average of various traits of infundibulum of Pati and Chara-Chemballi ducks along with the results of 't' test.

Traits	Genetic groups		't' value
	Pati duck	Chara-Chemballi duck	
Length(cm)	5.28±0.10	7.84±0.23	9.905**
Breadth(cm)	0.70±0.02	0.95±0.00	8.176**
Thickness(cm)	0.45±0.03	0.56±0.01	2.896**
Weight(g)	0.79±0.02	1.20±0.07	5.236**
Height of lamina epithelialis mucosae of infundibulum (µm)	23.906±0.332	30.234±0.389	12.35**

** Highly significant (P<0.01)

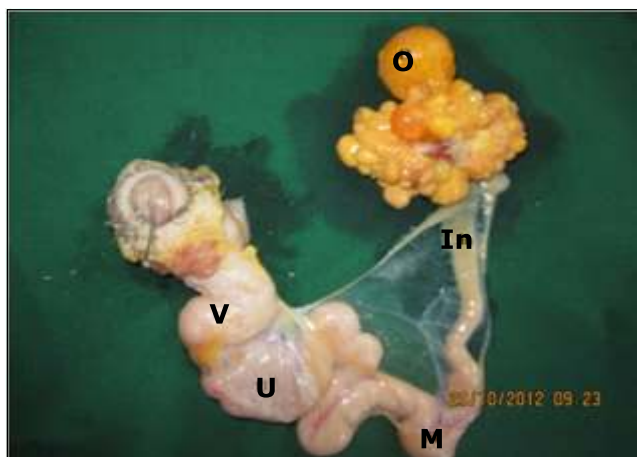


Figure-1: Photograph showing the ex-situ position of female reproductive system of Pati duck showing ovary (O), infundibulum (In), magnum (M), uterus (U) and vagina (V).

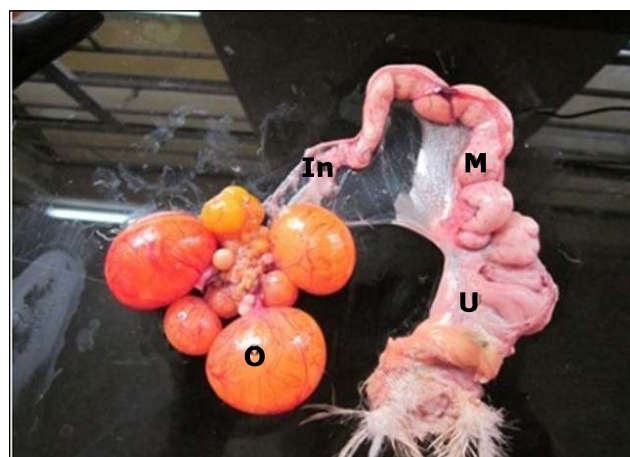


Figure-2: Photograph showing the ex-situ position of female reproductive system of Chara-Chemballi duck showing ovary (O), infundibulum (In), magnum (M) and uterus (U).

Paraffin sections were cut in five micron thickness and stained with Hematoxylin and Eosin method for histomorphological study, Van Gieson's method for collagen fibre, Gomori's method for reticular fibre, Hart's method for elastic fibre, Bielschowsky's method for axis cylinder and dendrites and Mc.Manus method for glycogen [10]. After staining, histological characteristics of infundibulum were recorded. Different micrometrical parameters were recorded on Hematoxylin and Eosin stained section by means of standard method of micrometry using Nikon E 200 camera mounted microscope and Image Pro Express Ver-2.0 Software.

Statistical analysis: The data were analyzed as per 't' test method described by Snedecor and Cochran [11].

Results and Discussion

In the current study, the gross anatomical relationship and length, breadth, thickness and weight of infundibulum of Pati and Chara-chemballi ducks were recorded. The infundibulum of Pati and Chara-Chemballi duck consisted of a wide funnel shaped membranous part and a short tubular part. The wide funnel part opened immediately caudal to the ovary and had no direct attachment to the ovary (Figure-1 and Figure-2). The demarcation was in consonance to the finding of Fujii [12] in fowl, Saber *et al.* [13] in ostrich, Sharaf *et al.* [14] in ostrich, Balasundaram *et al.* [15] in Emu. The tubular part of infundibulum was connected to the magnum by a constricted junction. In present study the mean length, breadth, thickness and weight of

infundibulum were 5.28±0.01 cm, 0.70±0.02 cm, 0.45 ± 0.03 cm and 0.79±0.02 g respectively in *Pati* ducks. Corresponding values for the Chara-Chemballi ducks were 7.84±0.23 cm, 0.95±0.00 cm and 0.56±0.01 cm and 1.20±0.07 g (Table-1). Contrary to the present findings, Romanoff and Romanoff [16] recorded the length of infundibulum in laying hen to be 7 cm while Khokhlov [17] marked that its length and weight was 9.7±0.8 cm and 1.0±0.3 g respectively in sexually matured hen. However, Parto *et al.* [18] reported that the length of infundibulum was 7 cm in laying turkey. These might be due to difference in size and age of the birds.

Histologically, the tunica mucosa of infundibulum of both *Pati* and Chara-chemballi duck was highly folded and numerous slender folds extended towards the lumen of infundibulum. The folds were of three types *viz.*, primary, secondary and tertiary types (Figure-3 and Figure-4). Similar finding were also reported by Bacha and Bacha [19] in fowl. The lamina epithelialis mucosae of infundibulum consisted of simple ciliated columnar with some goblet cells in both *Pati* and Chara-Chemballi ducks. These results were in accordance with the findings of Moraes *et al.* [20] in *Ana Bochas* female ducks, Mehta and Guha [21] in laying hen, Patki *et al.* [22] in Kuttanad duck and Mirhish and Nsaif [23] in turkey hen. Lamina propria-submucosa contained areolar connective tissue with branched tubular glands. This finding was corroborated with the finding of Lucy and Harshan [24] in Japanese quail. This layer contained large amount of



Figure-3: Photomicrograph showing the infundibulum of Pati duck along with primary (A), secondary (B), tertiary folds (C), glandular grooved (D), tunica muscularis (E) and tunica serosa (F). H&E, 100X

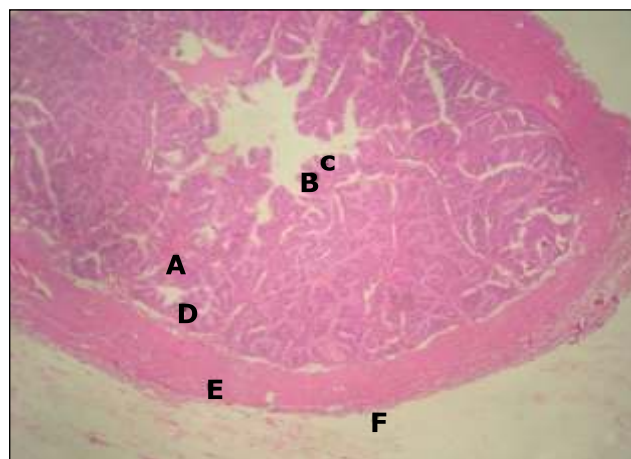


Figure-4: Photomicrograph showing the infundibulum of Chara-Chemballi duck along with primary (A), secondary (B), tertiary folds (C), glandular grooved (D), tunica muscularis (E) and tunica serosa (F). H&E, 100X

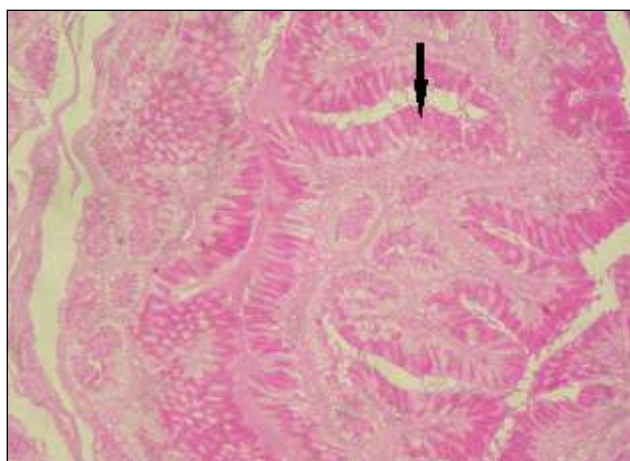


Figure-5: Photomicrograph showing the moderate PAS reaction in the lining epithelium (arrow) of infundibulum of Chara-Chemballi duck. Mc. Manus Method for Glycogen (PAS), 400X.

reticular fibres with scanty amount of collagen and elastic fibers as well as nerve fibres in Chara-Chemballi duck as compared to Pati duck. Similar findings were recorded by Ghule *et al.* [25] in Japanese quail. These probably might be due to different varieties of ducks. The tunica muscularis was composed of inner circular and outer longitudinal smooth muscle layers and tunia serosa was formed by loose connective tissue, blood vessels, lymph vessels and nerve fibres. The tunica serosa layers contained large amount of reticular and elastic fibres and less amount of collagen fibers along with nerve fibers in Chara-Chemballi duck as compared to Pati duck. These results were corroborated with Geetha *et al.* [26] in Japanese quail. The mean height of lamina epithelialis mucosae was significantly higher in Chara-Chemballi duck $30.234 \pm 0.389 \mu\text{m}$ than Pati duck was $23.906 \pm 0.332 \mu\text{m}$ (Table-1). Khokhlov [17] reported that the height of lamina epithelialis mucosae to be $12.9 \pm 0.8 \mu\text{m}$ in hens at 150 days of age. These might be due to size and age of the birds. However, Mohammadpour and Keshtmandi [27] found that the length of mucosal fold of infundibulum in pigeon was

$500.47 \pm 57.7 \mu\text{m}$ Whereas Bansal *et al.* [28] reported that the height of epithelium of caudal part of infundibulum in Panjab white quail was $37.43 \pm 11.24 \mu\text{m}$.

Histochemically, PAS reaction was moderate at apical part of lining epithelium, weak in central part of folds and in lamina propria-submucosa in Chara-Chemballi duck (Figure-5). However, in Pati duck, PAS positive reaction was weak in the apical part of lining epithelium, central part of folds and in lamina propria-submucoa. This was in accordance with the findings of Joaquim *et al.* [29] in Muscovy ducks. These might be due to more amount of glycogen in infundibulum of Chara-Chemballi duck than Pati duck.

Conclusion

The results from the present study suggests that grossly the infundibulum of Pati and Chara-Chemballi ducks consisted of a wide funnel shaped membranous part and a short tubular part. The wide funnel part opened immediately caudal to the ovary and had no direct attachment to the ovary. All the parameters like length, breadth, thickness and weight of infundibulum

of Chara-Chemballi duck were significantly higher than Pati duck. Histologically, the tunica mucosa of infundibulum of both Pati and Chara-Chemballi duck was highly folded and numerous slender folds extended towards the lumen of infundibulum. The folds were of three types *viz.*, primary, secondary and tertiary types. The mean height of lamina epithelialis mucosae was significantly higher in Chara-Chemballi duck than Pati duck. Histochemically, PAS reaction was moderate at apical part of lining epithelium in Chara-Chemballi duck whereas in Pati duck PAS positive reaction was weak in the apical part of lining epithelium.

It might, therefore be concluded that the observations in the present study established a major role in recording the anatomical norms in respect of gross, histology and histochemistry (PAS) of infundibulum of both Pati and Chara-Chemballi ducks. These will help physiologist, pathologist and poultry scientists for effective production strategies as well as disease control regime in duck husbandry.

Authors' contributions

AD and GB designed and planned the study. The experiment was done by AD. KS and MB analyzed the data. All authors participated in draft and revision of the manuscript. All authors read and approved the final manuscripts.

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Competing interests

The authors declare that they have no competing interests.

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