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RESEARCH ARTICLE

MACROANATOMY OF FEMALE REPRODUCTIVE TRACT DURING LAYING AND NON-LAYING PERIOD IN ADULT EMU BIRDS (*DROMAIUS NOVAEHOLLANDIAE*)

Vijayakumar, K., Balasundaram, K., *Paramasivan, S., Kumaravel, A. and Madhu, N.

Department of Veterinary Anatomy and Histology, Veterinary College and Research Institute,
Tamilnadu Veterinary and Animal Sciences University, Namakkal – 637 002, India

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ABSTRACT

The female reproductive system of the emu consisted of an unpaired ovary appearing as bunch of grapes and an oviduct. The ovary is dark brown to black in colour with numerous ovarian follicles concentrated on the ventral surface, which was attached to the bodies of the lumbar vertebrae by the mesovarium and closely related to the ventral surface of the cranial and middle lobes of the left kidney. The ventral surface of the ovary is covered with developing ovarian follicles and by the spleen. The fully developed left oviduct of the emu appeared as a long, less convoluted, highly vascular tube. The infundibulum was composed of a cranial funnel shaped part and a caudal narrow tubular part or chalaziferous region. The funnel shaped part was opened towards the left ovary by a wide slit like opening, abdominal opening of the oviduct. The mucosal folds were distinct in the tubular region of the emu infundibulum. The magnum was the largest in size and diameter, most convoluted part of the oviduct in laying birds but short, straight region in non-laying emu birds. The wall of the magnum was relatively thick and consisted of 25 to 35 well developed primary longitudinally oriented folds. The isthmus was a narrow region while the shell gland region was an expanded pouch like structure. The uterus or shell gland was divisible into the narrow tubular part and the main pouch like part with mucosal folds running in slight spiral pattern or oblique in the pars minor uteri and longitudinal in the pars major uteri in non-laying birds. These folds were longitudinal throughout in the thick walled uterus in laying birds. The thick walled vagina was a straight tube with many regularly arranged taller parallel mucosal folds in non-laying emu birds.

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INTRODUCTION

The avian reproductive system has been studied extensively in some poultry birds, specially the domestic fowl. The general morphology and overall function of the female reproductive system in avian species, especially in *Gallus domesticus*, have been studied for many years. The study on the reproductive system of wild birds is necessary to improve their production and reproduction efficacy and to preserve their species. Review of literature reveals that extensive work had been done on the morphology and the physiology of the reproductive system of the domestic fowl and duck. Though preliminary work had been done on the gross and microscopic anatomical aspects of the reproductive organs in male and female emu, focus on certain aspects like the oviduct structural differences between the laying and non-laying birds need further study. Hence, an attempt has been made to study the morphology and

morphometry of the female reproductive system during breeding and non-breeding seasons in emu.

MATERIALS AND METHODS

The present study on emu bird was conducted at the Department of Veterinary Anatomy and Histology, Veterinary College and Research Institute, Namakkal. The materials for the study were collected from 12 female apparently healthy birds procured from a well organized farm in the neighborhood of Namakkal district of Tamilnadu. The study was carried out on six mature female birds at their non-laying stage and six female birds at their laying stage for recording the structural changes in these birds.

The body weights of the live birds were recorded. The tissues were collected immediately after slaughter from ovary and oviduct starting from infundibulum upto the cloaca. The collected samples were washed in normal saline and mopped in blotting paper. The gross morphological and morphometrical parameters viz., colour, length and weight of reproductive organs were recorded.

*Corresponding author: Paramasivan, S.,
Department of Veterinary Anatomy and Histology, Veterinary
College and Research Institute, Tamilnadu Veterinary and Animal
Sciences University, Namakkal – 637 002, India

RESULTS AND DISCUSSION

Ovary

The female reproductive system of the emu consisted of an unpaired ovary appearing as bunch of grapes (Fig.1.) and an oviduct in accordance with the findings of Gilbert, (1979) in birds and Rao, (1994) in domestic duck. The ovary is dark brown to black in colour with numerous ovarian follicles concentrated on the ventral surface as reported earlier by Reed *et al.* (2011). The fully developed right ovary reported to be rare in avian species was not encountered in this study.



Figure 1. The photographs showing the ovary of emu birds appearing as bunch of grapes

The left ovary was attached to the bodies of the lumbar vertebrae by the mesovarium and closely related to the ventral surface of the cranial and middle lobes of the left kidney and located dorsomedial to the spleen. The ventral surface of the ovary is covered with developing ovarian follicles and by the spleen. The relationship of ovary with the kidney and spleen was similar to the findings of Hodges (1974) in fowl. The length of the ovary was 28.63 ± 3.17 cm in laying birds and 18.02 ± 1.26 cm in non laying birds. The average weight of the left ovary in laying birds was 349.66 ± 42.70 gm which decreased to 103.66 ± 16.69 gm in non-laying birds.

The grossly visible small to medium sized follicles were light grey in colour in both laying and non-laying emu and the larger follicles were filled with yolk and appeared as yellowish and were attached to the ovary by a pedicle. The cranial end of the ovary was located at the level of ninth thoracic rib. The middle portion of the ovary is located along the ventral surface of the cranial lobe of the left kidney. The caudal end of the ovary was located in the groove along the ventral surface of the kidney between the cranial and middle lobes. The lateral side of the ovary was covered by the infundibulum and the dorsal and ventral ligaments of the oviduct. The ventral surface of the ovary is covered with developing ovarian follicles and by the spleen.

Oviduct

The fully developed left oviduct of the emu appeared as a long, less convoluted, highly vascular tube. The presence of right oviduct was not reported in ratites. In contrast to the present findings, Rao, (1994) identified a moderately developed right oviduct measuring 4 cm in length in domestic duck and Nickel *et al.* (1977) reported rudimentary right oviduct with infundibulum and magnum alone in fowl.

The oviduct in laying bird was 762.18 ± 48.41 gm in weight, which decreased to 485.03 ± 21.70 gm in non-laying emu birds. The oviduct was a divided into five segments in succession from cranial to caudal namely the thin infundibulum, largest magnum, narrow isthmus, expanded uterus (shell gland) and thick walled vagina (Plate.1). The length of the oviduct in laying birds was 133.18 ± 9.45 cm and in non-laying birds the length decreased to 114.25 ± 14.35 cm. Khokhlov and Kuznetcov (2007) reported that the oviduct of the hen was well-developed at the left side, atrophied at the right side and consisted of all five regions described in the present study. The biometry of ovary and oviduct is presented in the table.

In the present study, the infundibulum (Fig.2.) was composed of a cranial funnel shaped part and a caudal narrow tubular part or chalaziferous region. The funnel shaped part was opened towards the left ovary by a wide slit like opening, abdominal opening of the oviduct. This is in accordance with the previous descriptions made of the ratite oviduct by Drenowatz and Elrod, (1995) and the domestic fowl oviduct by Fowler, (1991). Both of these reports indicated that the infundibulum opened by an ostium that lead into the first portion of the oviduct. The mucosal folds were distinct in the tubular region of the emu infundibulum. Similar pattern and orientation was also reported in domestic fowl (Getty, 1975). In addition, these folds were most distinct in the tubular region of the emu infundibulum that has also been described in the domestic fowl.



Figure 2. The photograph showing the ovary and oviduct of emu birds. Cr- Cranial infundibulum, Cd – Caudal infundibulum, white arrow – Magnum, red arrow – Isthmus, black arrow - Uterus

Biometry of Ovary and Oviduct

| Category | Ovary | | Oviduct | |
|------------|------------------|--------------------|--------------------|--------------------|
| | Length (cm) | Weight (gm) | Length (cm) | Weight (gm) |
| LAYING | 28.63 ± 3.17 | 349.66 ± 42.70 | 133.18 ± 9.45 | 762.18 ± 48.41 |
| NON-LAYING | 18.02 ± 1.26 | 103.66 ± 16.69 | 114.25 ± 14.35 | 485.03 ± 21.70 |

The magnum (Fig.2.) was the largest in size and diameter, most convoluted part of the oviduct in laying birds as also reported in domestic fowl (Gopinath, 1974). However, it was not coiled but appeared as a short, straight region in non-laying emu birds as previous reports of Reed *et al.* (2011) in this species. The wall of the magnum was relatively thick. There were about 25 to 35 well developed primary longitudinally oriented folds. In contrast to the present finding Sharaf *et al.* (2012) reported that the mucosal folds in laying ostrich were extremely tortuous. However, the free borders of these folds were wavy in laying emu birds. King and McLelland, (1984) observed a spiral pattern of mucosal folds in the magnum of domestic fowl.

The isthmus was a narrow region while the shell gland region was an expanded pouch like structure. The mucosal folds of this region in emu were not as prominent as those of the magnum resulting in the narrowness of the folds in this compartment. Similar findings were also reported in domestic duck (Rao, 1994) and fowl (Gopinath, 1974). The less prominent mucosal folds and the lack of spiral pattern in the isthmus region was also revealed by King and McLelland (1984) and Baumel, (1993) in domestic fowl. The boundary between the isthmus and the magnum was described by King and McLelland, (1984) as zonula translucens in domestic fowl. This area was a glandless zone at the beginning of the isthmus and was usually visible macroscopically (Baumel, 1993). In the present study the distinct zonula translucens was not observed in any of the emu oviducts as also reported by Reed *et al.* (2011) in emu birds.

The uterus or shell gland (Fig.2.) was divisible into the cranial narrow tubular part called as pars minor uteri and the main pouch like part called as the pars major uteri. This is in accordance with the findings on the ratite that described the uterus as expanded segment of the female reproductive tract (Patak and Baldwin, 1993; Bronneberg and Taverne, 2003). The mucosal folds of the uterus in the emu were continuous with a slight spiral pattern and orientation or oblique in the pars minor uteri and longitudinal in the pars major uteri in

non-laying birds. These folds were longitudinal throughout in the thick walled uterus in laying birds. This is in agreement with the findings of Reed *et al.* (2011) in emu birds. In contrast King and McLelland, (1984) described that the mucosal folds run longitudinally but were intersected by transverse furrows or grooves which give the folds a leaf like lamellae appearance. In domestic fowl (Baumel, 1993) and domestic duck (Rao, 1994) the vagina was described as a short muscular s-shaped tube connecting the uterus to the cloaca. In contrast, the thick walled vagina was a straight tube with many regularly arranged taller parallel mucosal folds in non-laying emu birds.

Conclusion

The female reproductive system of the emu consisted of an unpaired ovary and an oviduct on the left side of the abdominal cavity. The ovary was irregular, dark brown to black in colour with numerous ovarian follicles concentrated on the ventral surface appearing as bunch of grapes. The average weight of the left ovary in laying birds was 349.66 ± 42.70 gm which decreased to 103.66 ± 16.69 gm in non-laying birds.

The oviduct was a divided into five segments in succession from cranial to caudal namely the thin infundibulum, largest magnum, narrow isthmus, expanded uterus (shell gland) and thick walled vagina. The length of the oviduct in laying birds was 133.18 ± 9.45 cm and in non-laying birds the length decreased to 114.25 ± 14.35 cm. The thin infundibulum was further divided into a cranial funnel shaped part and a caudal narrow tubular part or neck or chalaziferous region. The magnum was the largest in size and diameter appeared as a purplish, most convoluted part of the oviduct in laying birds. The uterus or shell gland was divisible into the cranial narrow tubular part called as pars minor uteri and the main pouch like part called as the pars major uteri. The thick walled vagina was a straight tube with many regularly arranged taller parallel mucosal folds. The vagina was fixed in position by the medial ligament that extended from the medial side of the vagina to the descending colon.

REFERENCES

- Baumel, J.J., 1993. Handbook of Avian Anatomy. Nomina Anatomica Massachusetts: Club, Cambridge.
- Bronneberg, R. G. and Taverne, M. A. 2003. Ultrasonography of the female reproductive organs in farmed ostriches (*Struthio camelus*). *Theriogenol*, 60: 617-633.
- Drenowatz, C. and Elrod, C. 1995. The Ratite Encyclopedia. San Antonio: *Ratite records*,
- Getty, R. 1975. Sission and Grossman's The Anatomy of domestic Animals, Philadelphia: W.B. Saunders Co.
- Gilbert, A.B. 1979. Female genital organs. Chapter 5 in "Form and function in birds". Eds. A.S.King and J.McLell and. Vol.I, Academic press, London.
- Gopinath, S. 1974. Morphological and histological studies of oviduct of Desi fowl (*Gallus domesticus*). M.V.Sc. Thesis, A.P. Agricultural University. Andra Pradesh.
- Hodges, R.D. 1974. The Reproductive System. Chapter 6 in "*The histology of the fowl*", Academic press, London.
- Khokhlov, R.Y. and Kuznetcov, S.I. 2007. Morphogenesis of a tunica mucosa of oviduct of the hens, *Int. J. Morphol.*, 25: 329-333.
- King, A.S. and McLelland, J. 1984. Birds their structure and function. London and Philadelphia, Bailliere Tindalli.
- Nickel, R., Schummer, A. and Seiferle, E. 1977. Anatomy of the domestic birds. Verlag Paul Parey, Berlin, Hamburg.
- Patak, A. and Baldwin, J. 1993. Structural and metabolic characterization of the muscles used to power running in the emu (*Dromaius novaehollandiae*), a giant flightless bird. *J. Exp. Bion.*, 175: 233-249.
- Rao, T.S.C. 1994. Microanatomical studies on the reproductive system of the domestic duck (*Anas Boschus domesticus*). Ph.D Thesis, Tamil Nadu Veterinary and Animal Sciences University, Madras.
- Reed, R. B. Jr., Cope, L.A. and Blackford, J.T. 2011. Macroscopic anatomy of the reproductive tract of the reproductively quiescent female emu (*Dromaius novaehollandiae*). *Anat Histol Embryol*, 40: 134-41.
- Sharaf, A. Eid, W. and Abuel-Atta, A.A. 2012. Morphological aspects of the ostrich infundibulum and magnum. *Bulgarian J. Vet. Med.*, 15: 145-159.