

MICROSCOPIC STUDY OF THE GALL BLADDER OF THE CHUKAR PARTRIDGE (*ALECTORIS CHUKAR*)

B. MOBINI

Faculty of Veterinary Medicine, Islamic Azad University, Shahrekord
branch, Shahrekord, Iran

Summary

Mobini, B., 2012. Microscopic study of the gall bladder of the chukar partridge (*Alectoris chukar*). *Bulg. J. Vet. Med.*, **15**, No 2, 73–78.

A study on the microscopic anatomy of the gall bladder was conducted in 8 female and 8 male twenty-week-old healthy Iranian chukar partridges (*Alectoris chukar*). The gall bladder was composed of tunica mucosa, tunica muscularis and tunica serosa or tunica adventitia. The tunica mucosa was mainly lined by simple columnar epithelium. All epithelial cells of the chukar gall bladder have reacted for acid and neutral mucopolysaccharides. The lamina muscularis mucosa was absent. The lamina propria-submucosa contained numerous diffuse or nodular lymphatic tissues. The tunica muscularis of the gall bladder showed a circular layer of smooth muscle fibers. The tunica serosa or adventitia presented no striking features.

Key words: chukar partridge (*Alectoris chukar*), gall bladder, microscopic anatomy

INTRODUCTION

The chukar (*Alectoris chukar*), is a central Eurasian species from the family Phasianidae of the order Galliformes, inhabiting the dry highlands of Europe through the Himalayas. It has been introduced throughout North America and its native range in Eurasia, from southeastern Europe to the west, to India, Pakistan and Afghanistan to the east. This partridge is also a valuable pet and popular game bird for people in the Middle-East. In recent years this species has been intensively reared in Iran and used for meat production. Regarding the progressive interest in this kind of meat among Iranians and large investments in this field, providing knowledge of the microscopic anatomy and biology of this species could be quite valuable.

For the elucidation of microscopic anatomy of gall bladder, some investigations have been carried out in different adult avian species, such as the ostrich (Abidu-Figueiredo *et al.*, 2006; Stornelli *et al.*, 2006), chickens (Yamada & Hoshino, 1972; Gheri *et al.*, 1988; Ciobotaru & Militaru, 2002), and guinea fowl (Sivagnanam & Geetha, 2008). However, no insight has ever been gained into the histological structures of the gall bladder in *Alectoris chukar*. Also, research on partridges in Iran has started very recently, which makes this study even more important as it is intended to be a reference for future studies.

The purpose of the present study was to investigate microscopic structures of gall bladder of five-month-old Iranian chukar partridges and to determine the

variation in these features compared to other bird species.

MATERIALS AND METHODS

Sixteen clinically healthy Iranian chukar partridges (*Alectoris chukar*) from both sexes were used to determine the histological structures of the gall bladder. They were reared in a floor-pen house from hatch to 20 weeks of age. The chukar chicks received feed and water *ad libitum*. The animals were euthanized. The gall bladders were removed from the donors, placed in physiological saline and cut open therein to expel intravesical bile which is injurious to the epithelial tissues. The gall bladders were fixed in 10% buffered formalin solution for 12 to 24 h, dehydrated and embedded in paraffin in routine manners. Tissue samples were stained by a variety of techniques for general observations and types of fibres in the connective tissues: 1) haematoxylin eosin, 2) Masson's trichrome, 3) Verhoeff's, 4) Gomori's method for reticulum (Luna, 1968), 5) alcian blue (pH 1.0), 6) Periodic acid-Schiff (PAS) (Cook &

Bancroft, 1984). Histological studies on stained sections were carried out by light microscopy.

RESULTS

The gall bladder in *Alectoris chukar* was composed of tunica mucosa, tunica muscularis and tunica serosa (for the free surface) and tunica adventitia (for the attached surface) in both sexes. The tunica mucosa of the gall bladder was mainly lined by non-ciliated simple columnar epithelium. However, in some regions it varied from cuboidal to tall columnar (Fig. 1). The apical cytoplasm of these cells was covered by a continuous striated border of microvilli (Fig. 2). No goblet cells were observed in epithelium. Tunica mucosa forms some simple folds lined with tall columnar epithelium, which appeared to be regularly distributed over the whole luminal surface of the gall bladder. The mucosal folds were almost isometric. Deep invaginations of the surface epithelium were observed to have grown down into the underlying loose connective tissue, showing a tubular gland like appear-

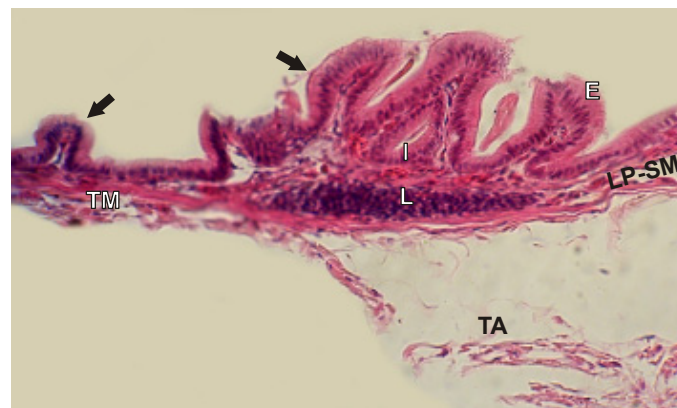


Fig. 1. The gall bladder of twenty-week-old Iranian chukar partridges: epithelium (E), simple fold (arrows), epithelial invaginations (I), lymphatic aggregations (L), lamina propria (LP-SM), tunica muscularis (TM), tunica adventitia (TA). Haematoxylin eosin, $\times 400$.

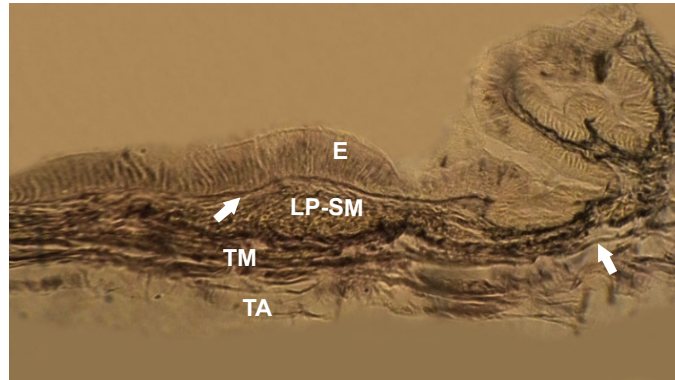


Fig. 2. Reticular fibres (arrows) in lamina propria-submucosa (LP-SM), and tunica serosa (TA) of chukar gall bladder, epithelium (E), tunica muscularis (TM). Gomori's staining for reticulum, $\times 400$.

ance (Fig. 1). The surface cells and those lining folds and the epithelial invaginations exhibited an oval nucleus located in the basal cytoplasm. However, in some regions with cuboidal epithelium, the nucleus was more spherical.



Fig. 3. PAS-positive material is present in the apical part of the cytoplasm of the epithelial cells (arrows), epithelium (E), lamina propria-submucosa (LP-SM), tunica muscularis (TM). PAS, $\times 1000$.

All epithelial cells reacted positively to periodic acid Schiff (PAS) (Fig. 3), and alcian blue stains (Fig. 4).

The lamina muscularis mucosa was absent. The thin lamina propria-submucosa contained loose connective tissue which consisted of reticular (Fig. 2), collagenous (Fig. 5) and elastic fibres (Fig. 6), and numerous diffuse or nodular lymphatic tissues, but no glands were observed (Fig. 1). The tunica muscularis was composed of a layer of circularly arranged muscle fibres (Fig. 1).

The outermost tunica of the free surface of the gall bladder was the serosa, which loose connective tissue invested by mesothelium, whereas in attached surface adventitia and mesothelium were absent. The loose connective tissue was made up of adipose tissues, blood vessels (Fig. 6), parasympathetic ganglia with nerve bundles (Fig. 1), reticular, collagenous and elastic fibres, but glands were absent in tunica serosa (Fig. 2, 5, 6).

DISCUSSION

The wall of the gall bladder in *Alectoris chukar* was composed of tunica mucosa,

lamina propria-submucosa, tunica muscularis and tunica serosa or adventitia, which was similar to those of guinea fowl (Sivagnanam & Geetha, 2008). Although some variations were observed in the epithelium of tunica mucosa, it was mainly lined by non-ciliated simple columnar cells similarly to the findings of Yamada & Hoshino (1972) in chickens and Sivagnanam & Geetha (2008) in guinea fowl.

The apical cytoplasm of epithelial cells, which was covered by a continuous striated border of microvilli agree with the results obtained from Yamada (1974) and Dellmann (1993). The simple isometric folds were regularly distributed over the whole gall bladder luminal surface, which was similar to the previous findings (Yamada & Hoshino, 1972; Gheri *et al.* 1988).

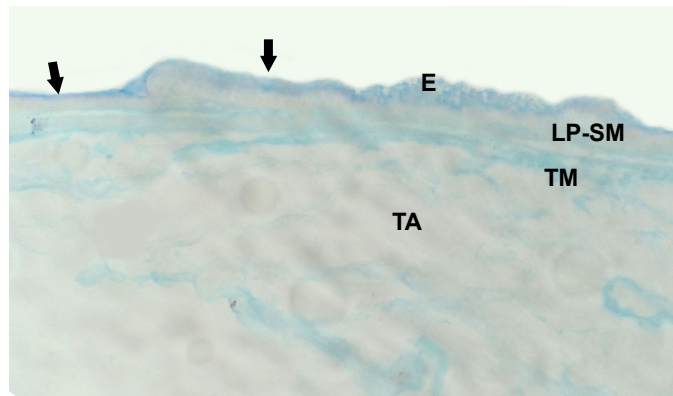


Fig. 4. Acidophilic mucosubstances are present in all surface epithelial cells (arrows), epithelium (E), lamina propria-submucosa (LP-SM), tunica muscularis (TM), tunica adventitia (TA). Alcian blue, $\times 400$.

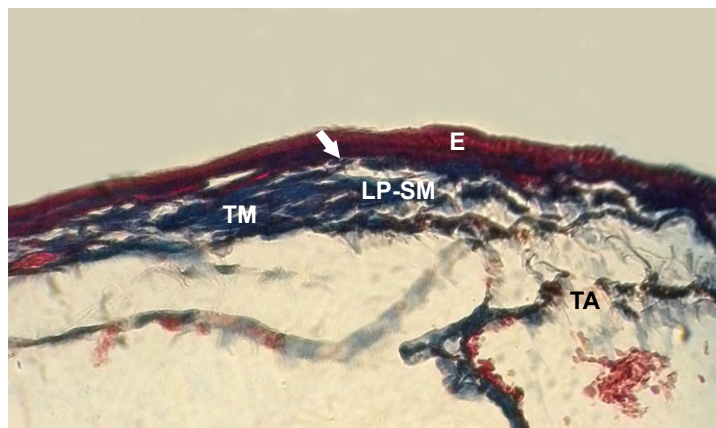


Fig. 5. Collagenous fibres (arrows) in lamina propria-submucosa (LP-SM) and tunica serosa (TA) of chukar gall bladder, epithelium (E), tunica muscularis (TM). Masson's trichrome, $\times 400$.

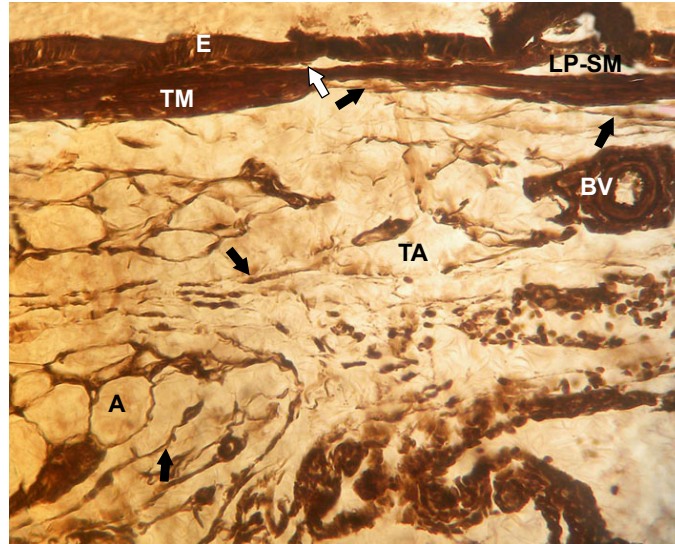


Fig. 6. Elastic fibres (arrows) in lamina propria-submucosa (LP-SM) and tunica serosa (TA) of chukar gall bladder. epithelium (E), tunica muscularis (TM), adipose tissue (A), blood vessels (BV). Verhoeff's, $\times 400$.

In tunica mucosa, downgrowths of the surface epithelium which exhibited a tubular gland like appearance were in agreement with those reported previously (Yamada & Hoshino, 1972; Gheri *et al.*, 1988). All epithelial cells containing an oval nucleus were situated basally. Similar results were also reported by Yamada & Hoshino (1972) in chick embryo and Gheri *et al.* (1988) in adult fowl.

The mucosal histochemical reactions of the chukar gall bladder were similar to that of other poultry (Yamada & Hoshino, 1972; Gheri *et al.*, 1988; Madrid *et al.*, 1989), which indicated that the mucosubstances consist of acid and neutral glycosaminoglycan complexes (Yamada & Hoshino, 1972). While some investigators have reported that the presence of mucous secretion might be of importance in relation to the water absorbing function of the gall bladder epithelium (the mucus might form a water-absorbing surface gel) for

the concentration of the bile (Hayward, 1968), others have noticed that they appear to play significant roles for maintaining functionally important properties of membranes such as morphological configurations, structural rigidity and permeability (Quinton & Philpott, 1973). This finding indicated that the epithelium of the gall bladder had a secretory function (Dellmann, 1993) and suggested an association of neutral mucopolysaccharides with acid mucins (Gheri *et al.*, 1988).

In our study, no lamina muscularis, goblet cells and gland were observed in gall bladder mucosa of the chukar partridges, which is in agreement with the results of a previous study (Sivagnanam & Geetha, 2008).

Reported lymphatic aggregations of the lamina propria-submucosa in chicken gall bladder were in agreement with our results (Ciobotaru & Militaru, 2002).

The tunica muscularis of gall bladder in guinea fowl was composed of an outer longitudinal layer and an inner layer that consisted of an outer circular and an inner longitudinal muscle fibres (Sivagnanam & Geetha, 2008). In chukar partridges however, there was a layer of circularly arranged muscle fibres.

The tunica serosa and adventitia of gall bladder in chukars are in agreement with the results obtained from Sivagnanam & Geetha (2008).

In conclusion, the microscopic anatomy of the gall bladder of the Iranian chukar partridge (*Alectoris chukar*) was similar to that in chickens and guinea fowl.

REFERENCES

- Abidu-Figueiredo, M., B. Xavier-Silva, F. V. C. Bath, M. A. Babinski & M. A. Chagas, 2006. Morphological and topographical aspects of the ostrich (*Struthio camelus*) liver. *Revista Portuguesa de Ciências Veterinárias*, **101**, 41–43.
- Ciobotaru, E. & M. Militaru, 2002. Researches regarding the structure and reactivity of lymphoid formation associated to gall bladder in chicken. *Revista Romana de Medicina Veterinara*, **12**, 117–127.
- Cook, H. & J. Bancroft, 1984. Manual of Histological Techniques. Churchill Livingstone Edinburgh, London, pp. 102–103, 111–112.
- Dellmann, H. D., 1993. Textbook of Veterinary Histology. 4th edn, Lea and Febiger, Philadelphia, pp. 189.
- Gheri, G., S. Gheri Bryk & G. E. Orlandini, 1988. Histochemistry of mucosubstances in the gallbladder epithelium of the chick embryo. *Histochemistry*, **88**, 519–524.
- Hayward, A. F., 1968. The structure of gallbladder epithelium. *International Review of General and Experimental Zoology*, **3**, 205–239.
- Luna, L. G., 1968. Manual of Histological Staining Methods of the Armed Forces in Statute of Pathology. 3rd edn, McGraw-Hill, New York, pp. 87–88, 94–95, 158–160, 163–164.
- Madrid, J. F., J. Ballesta, T. Galera, M.T. Castells & R. Perez-Tomas, 1989. Histochemistry of glycoconjugates in the gallbladder epithelium of ten animal species, *Histochemistry*, **91**, 437–443.
- Quinton, P. M. & C. W. Philpott, 1973. A role for anionic sites in epithelial architecture. Effects of cationic polymers on cell membrane structure. *The Journal of Cell Biology*, **56**, 787–796.
- Sivagnanam, S. & R. Geetha, 2008. Histological studies on the gall bladder and biliary system in Guinea fowl. *Indian Journal of Veterinary Anatomy*, **20**, 60–61.
- Stornelli, M. R., M. P. Ricciardi, E. Giannessi & A. Coli, 2006. Morphological and histological study of the ostrich (*Struthio camelus* L.) liver and biliary system. *Archivio Italiano Di Anatomia Ed Embriologia*, **111**, 1–7.
- Yamada, K. 1974. Acid mucosaccharide-containing structures in the gall bladder epithelium of the rabbit as seen with the electron microscope. *Histochemistry*, **39**, 351–360.
- Yamada, K. & M. Hoshino, 1972. Morphochemical analysis of the epithelial mucosubstances in the gall bladder of the fowl (*Gallus domesticus*). *Histochemie*, **29**, 120–128.

Paper received 21.12.2011; accepted for publication 23.04.2012

Correspondence:

Behzad Mobini DVM, PhD
Associate Professor of Anatomical Sciences,
Faculty of Veterinary Medicine,
Islamic Azad University, Shahrekord branch,
P.O.Box 166 Shahrekord, Iran
e-mail: dr.mobini@iaushk.ac.ir