

## Observations on the morphology of the uterus of the porcupine (*Hystrix cristata*)

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### ABSTRACT

The uterine structure of the porcupine (*Hystrix cristata*) was examined grossly and microscopically. The uterus is composed of two narrow and convoluted uterine horns, separated by the velum uteri, a small uterine body and a long cervix. Following routine histological procedures, uterus tissue specimens were examined under light microscopy. The endometrial lining of both uterine horns and body was a pseudostratified, columnar ciliated epithelium. The endometrium contained sparse simple tubular glands. The animals in the luteal phase showed a more developed hyperplasia of the endometrial simple tubular glands than females in the follicular phase. The cervix presents interdigitated rows of mucosal prominences that project into the lumen.

**Key words:** *Hystrix cristata*, porcupine, uterus, endometrial epithel

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### Introduction

Rodents comprise the largest and most diverse group of mammals with over 1700 different species (BESSELSSEN, 2002). The porcupine belongs to the Hystricidae family, which constitutes a small group of the order Rodentia (DEMIRSOY, 1992; KURU, 1987).

Although some morphologic studies on the organs of the porcupine (ATALAR et al., 2004; AYDIN et al., 2005; OZDEMIR, 2004 and 2005; OZDEMIR et al., 2005; OZDEMIR et al., 2006; YILMAZ et al., 1998) have been investigated, no work on the morphology of the uterus of the porcupine has been reported in the literature. In this study, the uterine structure of the porcupine (*Hystrix cristata*) was examined grossly and microscopically.

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### Materials and methods

Seven adult porcupines (*Hystrix cristata*) of different ages were used, which were trapped in Eastern Anatolia. The animals were anesthetized with a mixture of ketamine and xylazine (9:1 mg/kg).

Histological findings were related to the ovarian structures observed in four non-pregnant females in the follicular phase, three non-pregnant females in the luteal phase. The presence of large antral follicles and lack of corpora lutea in the ovaries were taken to indicate that a female was in the follicular phase. Females considered being in the luteal phase showed corpora lutea in the ovary. Corpora lutea were considered active in the presence of a pregnancy or as indicated by luteal cell morphology (JORI et al., 2002). After removal, each uterus was immediately immersed in 10% formalin and it was subsequently cut open and washed with running water. After complete inspection of the uterus, which needed to be whole, small uterine wall samples were removed with a scalpel (2 cm). Each segment removed was then put back into 10% formalin, where it remained for 24 hours. The segments were then embedded in paraffin blocks. Following this, sections of five micrometers in thickness were cut and stained with haematoxylin and eosin, periodic acid-Schiff and Van-Gieson stain. The specimens were observed by light microscope.

### Results and discussion

The macroscopic and microscopic features of the uterine of the porcupine (*Hystrix cristata*) have been described in this study. The uterus of the porcupine was bicornuate and encompassed a small uterine body and cervix. It was observed that both horns were connected through an intercornual ligament. The horns were laid cranial to the pelvic inlet and were suspended by extensive broad ligaments. Because of the existence of velum uteri, the uterine horn length was internally prolonged. The uterine cervix showed a firm papilla projecting into the vagina as an enfolding structure. The cervix wall was thicker than that of the horns. Similar macroscopically findings of the uterus were recorded by MAYOR et al. (2002) in the brush-tailed porcupine.

In histological examination, the wall of the uterine horns and body was composed of the endometrium, myometrium and perimetrium (Fig. 1). The endometrium consisted of the lamina epithelialis and the lamina propria mucosae. In the animals in the follicular and luteal phase, the endometrial lining of the uterine horns and body was a thin pseudostratified, columnar ciliated epithelium. The endometrial cells of the uterine horns were cylindrical, tall and columnar with an oval nucleus in the basal position and did not appear to have cilia or microvilli (Fig. 2). SARUHAN et al. (2006) demonstrated in their study on the rat uterus, that covering the epithelial cells of the uterine epithelium were a mixture of ciliated and secretory simple columnar cells and the connective tissue

of the lamina propria was rich in fibroblasts and contained abundant amorphous ground substance. Connective tissue fibers were mostly reticular.

The endometrium contained sparse simple tubular glands. The cells of the glandular epithelium were cylindrical in shape with oval, basal nuclei (Fig. 3). All animals showed primary and secondary longitudinal folds throughout the endocervical mucosa in the cervical canal, almost closing the cervical lumen. A stratified squamous epithelium covered the outer surface of the vaginal portion of the cervix.

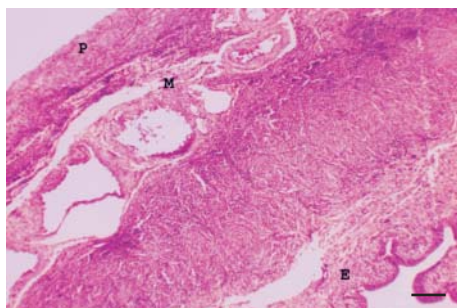


Fig. 1. Section of the complete wall of the uterus was shown, E = endometrium, M = myometrium, P = perimetrium. H&E,  $\times 66$ , scale bar = 130  $\mu\text{m}$ .

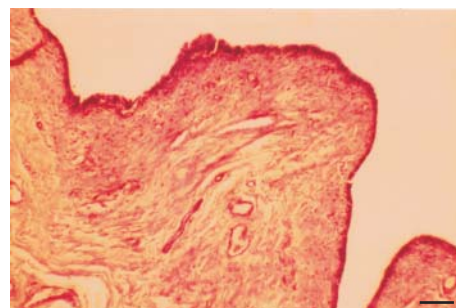


Fig. 2. Endometrial cells of the uterine horns were cylindrical, tall and columnar with an oval nucleus in basal position. Periodic acid-Schiff,  $\times 66$ , scale bar = 130  $\mu\text{m}$ .

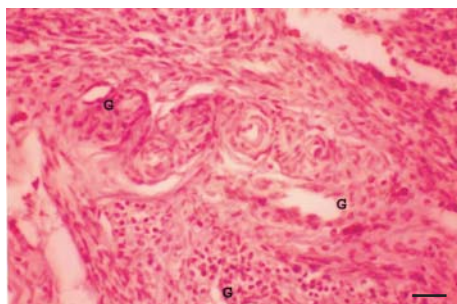


Fig. 3. Uterine glands (G) are seen in the lamina propria mucosae. Van-Gieson,  $\times 132$ , scale bar = 65  $\mu\text{m}$ .

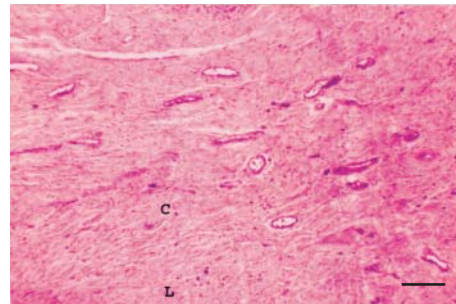


Fig. 4. Myometrium was shown, an inner layer mainly composed of circular (C) smooth muscle cells and an outer layer of longitudinal (L) smooth muscle cells. H&E,  $\times 132$ , scale bar = 65  $\mu\text{m}$ .

MAYOR et al. (2002) reported that female brush-tailed porcupine in the luteal phase presented a thicker endometrium than those in the follicular phase. This finding corresponds with our results.

As reported previously in domestic mammals (LEESON and LEESON, 1985; BANKS, 1993; BLOOM and FAWCETT, 1994; BURKITT et al., 2000; DELLMANN and CARITHERS, 1996), endometrial gland morphology varies throughout the oestrus cycle of the porcupine. Animals in the luteal phase showed a greater hyperplasia with enlargement and branching of the endometrial glands than animals in the follicular phase of the oestrous cycle.

The uterine cervix of the porcupine was a muscular, thick-walled firm tube, similar to that observed in the agouti (WEIR, 1971).

The myometrium consisted of an inner layer mainly composed of circular smooth muscle cells, and an outer layer of longitudinal smooth muscle cells (Fig. 4). The myometrium of the cervix was well developed. Lamina propria of the uterine was composed of loose connective tissue. Collagenous fibres, fibroblasts and lymphocytes constantly appeared among the cells of the connective tissue. These findings have been given by several authors (BANKS, 1993; FAWCETT, 1986; GARTNER and HIATT, 1997; JUNQUEIRA and CARNEIRO, 2004; LEESON and LEESON, 1985; PRIEDKALNS, 1993).

The perimetrium was composed of connective tissue and showed numerous blood vessels.

In conclusion, the different structural features observed in the tunica mucosa of the uterine horns suggest correlations with the reproductive state of the female porcupine. This study will make a contribution to filling the gap of knowledge in this field.

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**OZDEMIR, D., O. ATALAR: Morfologija maternice dikobraza (*Hystrix cristata*).  
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**SAŽETAK**

Građa maternice dikobraza (*Hystrix cristata*) bila je istražena makroskopski i mikroskopski. Ustanovljeno je da je građena od dva uska zavojita maternična roga podijeljena materničnom pregradom, zatim kratkoga trupa maternice i dugačkoga vrata. Uzorci materničnoga tkiva bili su pretraženi mikroskopski. Endometrij oba maternična roga i materničnoga trupa bio je građen od pseudovišeslojna trepetljikava epitela. U njemu su ustanovljene rijetke jednostavne tubularne žlijezde. U ženki u lutealnoj fazi ustanovljena je jača hiperplazija tubularnih žlijezda nego u ženki u folikularnoj fazi. U vratu su ustanovljeni sluznični izdanci koji prodiru u lumen.

**Ključne riječi:** *Hystrix cristata*, dikobraz, maternica, endometrijski epitel

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