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MORPHOLOGICAL INVESTIGATIONS ON THE DUODENUM IN SOUSLIKS (*SPERMOPHILUS XANTHOPRYMNUS*)

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In the present study six adult souslik duodenums were fixed in the formaldehyde solution. The trimmed parts were blocked in the paraffin and sectioned in 5 micrometers thick parts. The sections were stained with the methods of Haemotoxylin-Eosin and PAS in the Souslik duodenum, the main mucosal constituents villi intestinales, crypts and goblet cells were prominent. The average heights of the villi intestinales in the duodenum formed 76% of the whole transversal diameter of the first part (I), 82% of the middle part (II) and 65% of the last part (III) near the jejunum. The average height of the villi intestinales in the middle part (II) was 40% and 60% higher than the average heights of the part I and III. The goblet cells were stained by the PAS reaction excessively but Brush border and the duodenal glands were slightly stained by the PAS reaction.

Key words: Souslik, duodenum, morphology

Özkan, Z. E., Timurkaan, S. & İlgün, R.: Morfološko istraživanje duodenuma kod male azijske tekunice (*Spermophilus xanthoprymnus*). Nat. Croat., Vol. 18, No. 2., 279–285, 2009, Zagreb.

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Ključne riječi: tekunica, duodenum, morfologija

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INTRODUCTION

The souslik – ground squirrel (*Spermophilus xanthoprymnus*) belongs to the Sciuridae family, order Rodentia (VINOGRADOW & ARGIROPULO, 1941; DEMIRSOY, 1997). Sousliks are among the most serious agricultural pests and cause extensive damage to grain crop by eating green parts of plants and particularly their seeds (VINOGRADOV & ARGIROPULO, 1941). They are the food source for raptorial birds and carnivores, and they a have great importance in the ecological cycle (DEMIRSOY, 1997). Although there are numerous investigations on the duodenum in rats, order Rodentia (CLARKE, 1970; ÇALIŞLAR, 1978; FORRESTER, 1972; HOOPER, 1956; KRAUSE & LESSON, 1967; LEBLOND & WALKER, 1956; O'CONNORS, 1966; ÖZKAN *et al*., 1998; ROSS & MAYHEW, 1984) and on rabbits, order Lagomorpha (TOOFANIAN & TARGOWSKI, 1982), the information on sousliks is poor.

The aim of the present study is to investigate the morphology of the duodenum in sousliks and to contribute to the lack of information in this subject.

MATERIAL AND METHODS

In the present study six adult sousliks inhabiting their burrows in steppes in Aksaray, Anatolian region in Turkey were investigated. The dissecting of material and identification of investigated organs *in situ* was carried out by the method of WHITEHOUSE & GROVE (1958) and WELLS (1964). The investigated fresh souslik duodenums were fixed in the 10%-formaldehyde solution. Duodenums were trimmed near the pylorus (I), in the middle (II) and near the jejunum (III). After washing, dehydration with graded alcohols and removing the alcohols from the tissues with the xylol, the trimmed parts were blocked in the paraffin and sectioned in 5 μm thick parts. The sections were stained with Haemotoxylin-Eosin and PAS (LUNA, 1968). The height of the villi and diameters of the intestinal crypts were measured by the ocular micrometer. For the terminology Nomina Anatomica Veterinaria (4nd ed., 1994) and Nomina Histologica (revised 2nd ed., 1994) were used.

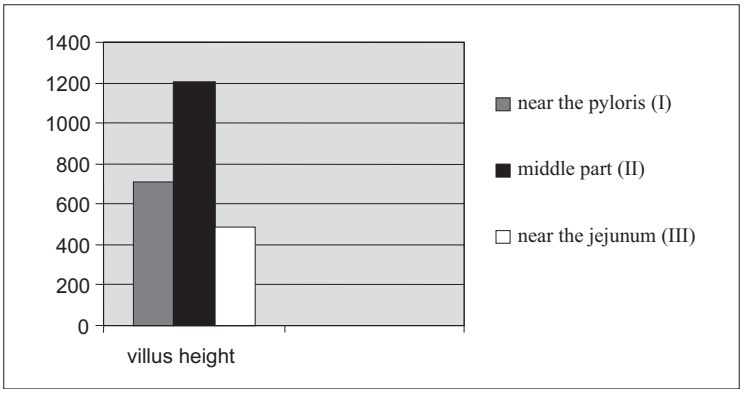
RESULTS

The duodenum is about 25 cm long and is mainly retroperitoneal, surrounding the head of pancreas. The wall of the duodenum consists of four layers; the mucosa, the submucosa, the muscularis and the serosa or peritoneum. In the investigated material, after the pylorus, the duodenum formed a craniodorsocaudal flexura duodeni cranialis of about 1 cm long, then it extended to the right and proximal part of the abdominal cavity as the pars descendens duodeni. After forming the flexura duodeni caudalis with a sharp flexion it formed the pars ascendens duodeni in the distal part. There was no pars transversa of the duodenum. After forming the flexura duodenojejunalis the duodenum joined the jejunum. The duodenum is mainly retroperitoneal and surrounds the corpus pancreatis.

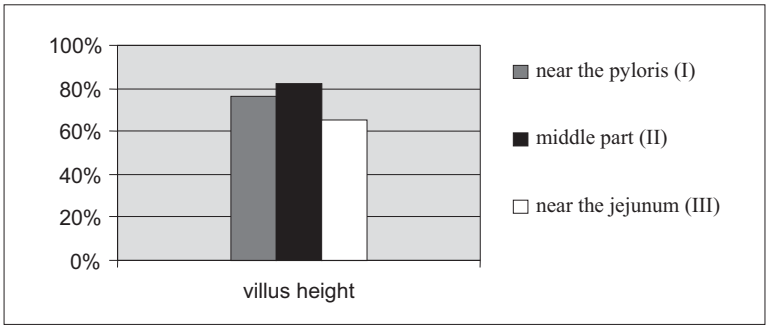
The villi intestinales in the duodenum of sousliks were leaf-shaped. The average villus heights near the pylorus (part I), in the middle part (part II) and near the je-

Tab. 1. Measurements of the parts I, II and III in the souslik duodenum (μm)

Parts	the villus height (ave.)	the whole transversal diameter (ave.)	the intestinal crypt diameter (ave.)
near the pylorus (I)	709.6	933.6	58.66
in the middle (II)	1201.71	1450.5	49.2
near the jejunum (III)	484.8	747	52



Tab. 2. The villi heights in the parts I, II, III of the souslik duodenum (μm).



Tab. 3. Proportions of the villi height to the whole intestinal diameter in the souslik duodenum.

junum (part III) were determined as 709.6 μm, 1201.7 μm and 484.8 μm respectively (Tabs. 1–2). It was observed that the average height of the villi intestinales in the middle part (II) was 40%–60% higher than the average heights of the part I and III. The villus heights measured 76% of the whole transversal diameter of the duodenum in part III (Tab. 3). It was determined that the average intestinal crypt diameters were 58.7 μm, 49.2 μm and 52 μm respectively in the parts I, II, III (Tab. I).

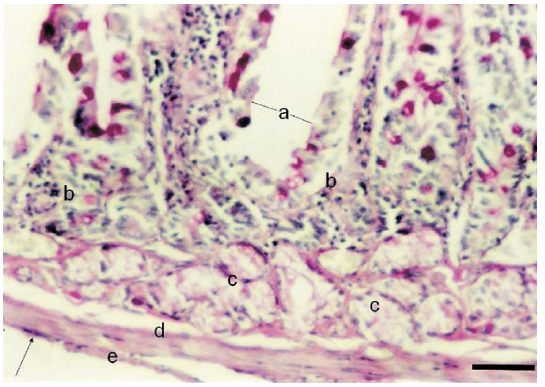


Fig. 1. Part I of the duodenum (near the pylorus) in sousliks. a – villi, b – intestinal glands, c – duodenal glands, d – the inner circular layer of the *tunica muscularis*, e – the outer longitudinal layer of the *tunica muscularis*, f – the ciliar margin. Arrow: *tunica serosa*. PAS, ×114; scale bar = 50 µm.

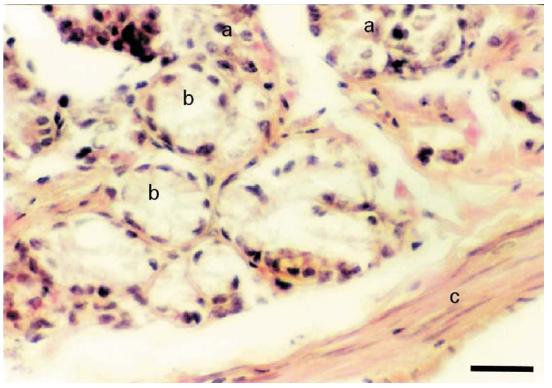


Fig. 2. Part I of the duodenum (near the pyloris) in sousliks. a – intestinal gland, b – duodenal gland, c – *tunica muscularis*. Haematoxylin – Eosin, ×128; scale bar = 25 µm.

The brush border of the absorbing cells forming the epithelium layer and goblet cells was PAS positive. The goblet cells were stained by the PAS reaction excessively but brush border and the duodenal glands were slightly stained by the PAS reaction (Figs. 1, 3, 5). The intestinal glands and the submucosal duodenal glands were prominent (Figs. 1, 2, 3, 5). Number of the goblet cells was low in the part I and much higher in the part III.

Eosinophilic Paneth cells were observed at the bottom of the crypts (Fig. 4d). Low number of undifferentiated matrix cells was found on the bottom of of intestinal glands. Lamina muscularis beneath the intestinal glands was slightly prominent. The inner circular layer of the tunica muscularis was markedly thick (Fig. 1d).

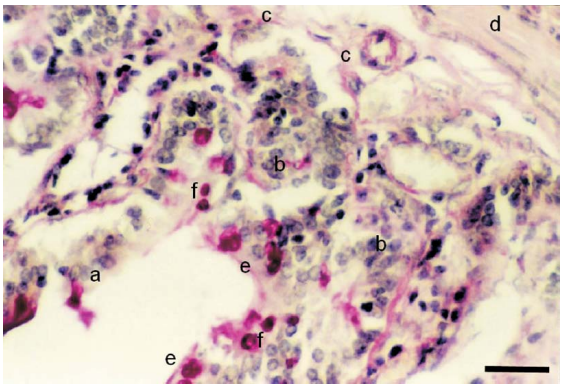


Fig. 3. Part II of the duodenum (middle part) in sousliks. a – villus, b – intestinal gland, c – *lamina muscularis*, d – *tunica muscularis*, e – the brush border, f – the goblet cell, PAS, ×128; scale bar = 25 μm.

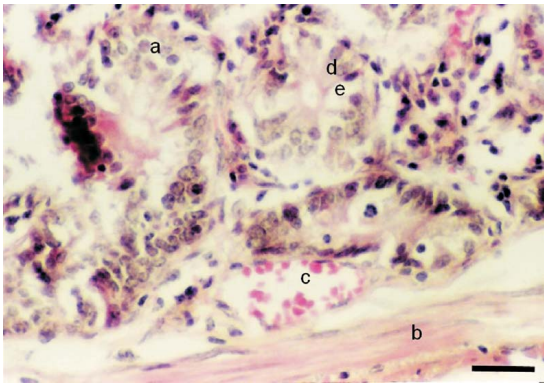


Fig. 4. Part II of the duodenum (middle part) in sousliks. a – intestinal glands, b – *tunica muscularis*, c – the little vessel, d – Paneth cell, e – matrix cell. Haematoxylin-Eosin, ×128; scale bar = 25 μm.

DISCUSSION

There are two main parts of the duodenum in sousliks, pars descendens duodeni in the proximal and pars ascendens duodeni in the distal part as in rats (WELLS, 1964). In rats the duodenum traces the liver's facies visceralis in S-shape (ÇALIŞLAR, 1978). In the present study, by tracing the visceral face of the liver, pars descendens duodeni was joined with pars ascendens duodeni with a sharp flexion and there was no pars transversa of the duodenum. The villi intestinales stated in the newborn and advanced ages in rats (FORRESTER, 1972; ÖZKAN *et al*., 1998) were observed prominently in the duodenum of the souslik. The villi intestinales in the duodenum of the souslik were leaf-shaped as cited in the literature (HOOPER, 1956; CLARKE, 1970; MADGE, 1975; KENT & CARR, 2001; ÖZKAN *et al*., 1998).

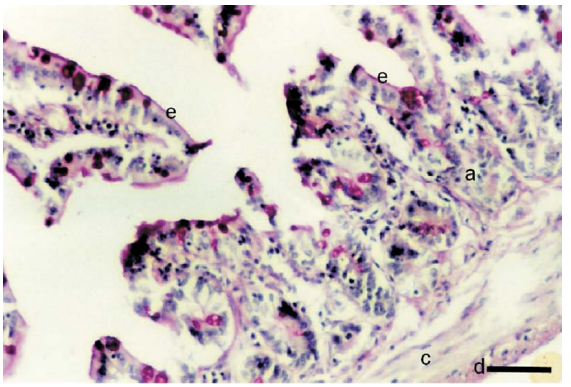


Fig. 5. Part III of the duodenum (near the jejunum) in sousliks. a – intestinal glands, b – villi, c – the inner circular layer of the *tunica muscularis*, d – the outer longitudinal layer of the *tunica muscularis*, e – the brush border, PAS, ×114; scale bar = 50 μm.

While the average height of the villi was expressed as 585±25.5 μm (ROSS & MAYHEW, 1984), the average villus height in 25 days old rats was stated as 547±35.4 μm, forming the 89.5% of the average villus height in adult rats (ÖZKAN *et al.*, 1998). In this study, the average villus height of the parts I, II and III in souslik duodenums were 709.6, 1201.7 and 484.8 μm respectively.

LEBLOND & WALKER (1956) mentioned that the goblet cells were placed in the epithelium layer. In the present study the PAS positive goblet cells were observed in the epithelium layer and epithelial crypts. The duodenal glands stated in the newborn rats (KRAUSE & LESSON, 1967; ÖZKAN *et al.*, 1998) and in rabbits (TOOFANİAN & TARGOWSKİ, 1982) were observed also in the submucosa of the souslik duodenums. The prominently deepened crypts in three weeks old mice (O'CONNORS, 1966) were observed in the present material similarly as in STANOJEVIĆ *et al.* (1982) in the lamina propria mucosae. As a result, the main mucosal costituents such as the intestinal and duodenal glands, villi intestinales, crypts and goblet cells were markedly observed in sousliks as in rats.

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