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HISTOLOGICAL STUDY OF THE THIRD COMPARTMENT IN ONE-HUMPED CAMEL (*Camelus dromedarius*) DURING PRENATAL DEVELOPMENT

E. Salimi Naghani
Faculty of Veterinary Medicine, Islamic Azad University, Sanandaj Branch, Iran

ABSTRACT

Histological study of the third compartment (abomasum) was studied in foetuses of one-humped camel (*Camelus dromedarius*). According to histodifferentiation of the abomasum in foetuses of the camel, these were divided into four groups: group I (5-24 cm crown-rump length (C-RL); 50-140 days); group II (24-30 cm C-RL; 140-160 days); group III (30-36 cm C-RL; 160-178 days); group IV (36-108 cm C-RL; 178-390 days). At 50 days, the abomasum consisted of four layers: the epithelial layer (pseudostratified), lamina propria-submucosa, tunica muscularis and serosa. The muscularis mucosa was observed from 140 days between lamina propria and submucosa in the abomasum to the birth day. The primary lymphatic nodules appeared in lamina propria of cardiac region of the abomasum at 160 days. The epithelium of the abomasum was a mixture of simple columnar and pseudostratified at 176 days in the third group. The whole epithelium was simple columnar in the last group. The abomasal folds in size, number and in thickness of tunica muscularis layer were increased with abomasum development. However, its prenatal development was slow as compared to abomasum in cow, sheep and goat.

Key words: Abomasum, histological, one-humped camel, third compartment

The abomasum is glandular portion, in the fourth and final gastric compartment of the ruminant stomach. In contrast to the compound stomach of typical ruminants that comprised of four compartments, the camel's stomach has only three compartments. The first compartment is huge and saccular, the second, small kidney-shaped and the third, tubular with its distal part slightly distended. The third compartment (abomasum) in the camel's stomach is glandular and the abomasum wall comprises of four tunics: mucosa, submucosa, muscularis and serosa (Abdel-Majied and Taha, 2003). The aim of this study was to provide a sequential description of the histology of camel's abomasum during foetal stage until the birth day.

Materials and Methods

The present study was carried out on 33 foetuses of the one-humped camel, which were collected from the slaughterhouses in Yazd province, Iran. After measuring the crown-rump length (C-RL) for determining the age of foetuses, these were collected and fixed in 10% formalin and ranged from 5-108 cm crown-rump length (C-RL), approximately 50-390 days of gestation. The foetuses were fixed in 10% formalin for 1-2 week (s) and the abomasums were separated and small pieces of the tissue were dissected from the cardiac, fundic and pyloric regions of the abomasum of each foetus. The specimens of the regions were dehydrated in graded alcohol series, cleared in methyl benzoate, embedded in paraffin and 5-µm-thick sections were cut with microtome. The sections were prepared and stained with haematoxylin and eosin (H&E) for histological studies under light microscope (Pousty and Adibmoradi, 2006).

Results and Discussion

The abomasum was histologically differentiated into 4 stages during prenatal development of the camel. The foetuses of the camel were divided in 4 groups according to histodifferentiation of the abomasum in the foetuses:

Group I (5-24 cm C-RL; 50-140 days of gestation)

In this group, the abomasal wall consisted of 4 layers: epithelial layer, lamina propria-submucosa, tunica muscularis and serosa. The epithelial layer was pseudostratified and located on a basal lamina. The surface of the abomasum began to display a series of undulations, representing the first outlines

SEND REPRINT REQUEST TO E. SALIMI NAGHANI email: vet_anatomy@iausdj.ac.ir

of the abomasal folds. In this group, these folds, that were not numerous and increased as the abomasum developed. The lamina propria-submucosal layer was separated from the epithelium by a clearly defined basal lamina and was formed by connective tissue with mesenchymal or undifferentiated cells and extracellular matrix. The tissue entered into the primitive abomasal folds. At 45 days of gestation, the tunica muscularis composed in two layers of myoblasts: an internal circular layer and an external longitudinal layer. The internal circular layer wasn't complete in this group. The serosa was formed by a subserosa that was covered by a mesothelium (Fig 1).

Group II (24-30 cm C-RL; 140-160 days of gestation)

The abomasal wall in this group was made of four layers: mucosa, submucosa, tunica muscularis and serosa. Mucosa was formed by the epithelial, lamina propria and muscularis mucosa. The epithelia cells were pseudostratified, the lamina propria and submucosa were formed by connective tisse with mesenchymal and a large amount of fibroblasts.

The submucosa was separated from the lamina propria by the muscularis mucosa from 140 days to the birth day. The muscularis mucosa consists of two, three and more cells of smooth muscle originating from the internal circular layer of the tunica muscularis and protruding into the greater folds (Fig 2). At 160 days, the lamina propria in cardia region of abomasum had the primary lymphatic nodules which contained many lymphocytes. The lymphatic nodules were observed at 160 days up to the birth time in the lamina propria of cardia region (Fig 3).

The tunica muscularis, as in the previous stage, consisted of two layers. The serosa had a loose connective tissue that had been covered by a mesothelium and was observed an intense vascularisation in this stage.

Group III (30-36 cm C-RL; 160-178 days of gestation)

The abomasal folds were increased more than the previous groups. The epithelial cells of the mucosa was a mixture of the simple columnar cells and pseudostratified at 178 days (Fig 4). The simple columnar cell, with nuclei were arranged along the basal or middle row of the cells.

The lamina propria and the submucosa were formed by loose connective tissue with an amount larger than blood vessel from the previous group. The submucosa was separated from the lamina propria, the same as the previous group, by the muscularis mucosa.

The tunica muscularis consisted of external (longitudinal) and internal (circular) layers and an (oblique) smooth muscle layer inside the circular layer has been observed. The connective tissue was absent between the oblique and the circular layer of the tunica muscularis. This reason, the oblique layer was therefore not distinguished from the internal circular layer. The internal circular layer of the tunica muscularis in pyloric region of the abomasum had greater thickness than the other regions. The serosa did not show significant variation with respect to the previous group.

Group IV (36-108 cm; 178-390 days of gestation)

In this group, the abomasal folds in comparison with the previous groups showed a remarkable increase in size and number. The epithelium of the mucosa was formed by the simple columnar cells and the lamina propria was separated from the submucosa by the muscularis mucosa which appeared better than the previous groups (Fig 5). The vascularisation of this layer was greater than the previous groups.

The tunica muscularis was observed by clearly defined bundles arranged in the manner commonly found in the digestive system as a whole and the serosa in comparison with previous groups showed intense vascularisation.

At 178 days to birth, the epithelium of the mucosa of abomasum was covered by simple columnar cells. This important modification has been reported in cow at 87 days of gestation (Aasri *et al,* 1985) and 73 days of gestation (Vivo *et al,* 1990), in sheep at 65 days of gestation (Franco *et al,* 1993).

The lymphatic nodules were shown in cardia region of abomasum from 160 days of gestation until the day of birth. These anatomical peculiarities are absent in the stomach of the ruminants (Alzola *et al,* 2004).

The muscularis mucosa was formed by longitudinal projection of the internal circular bundle of the tunica muscularis that was placed between the lamina propria and submucosa. It was estimated at around 140 days of gestation in camel. In the ruminants, the appearance was placed in perinatal stages in buffalo (Panchamukhi and Srivastava, 1980) and in sheep, at approximately 114 days of gestation (Franco *et al,* 1993) or during postnatal development (Kitamura *et al,* 2003).

The tunica muscularis containing two layers: longitudinal and circular layers were arranged by myoblasts. In the prenatal development of the

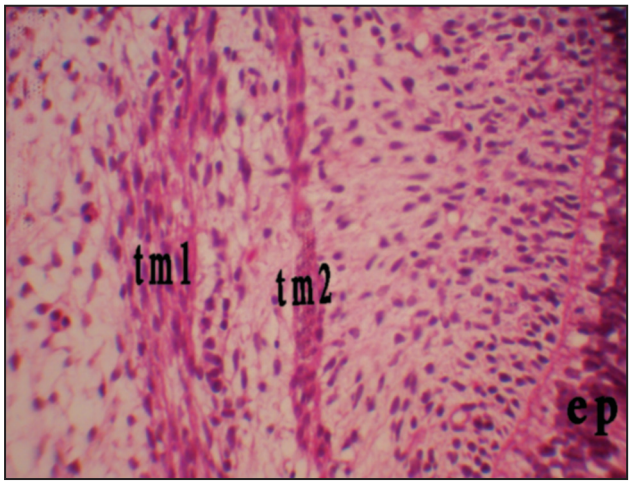

Fig 1. Photomicrograph of transverse section of the abomasal wall at 5 cm C-RL. Epithelium(ep), internal (circular) layer of tunica muscularis (tm1), external (longitudinal) layer of tunica muscularis (tm2). 120x

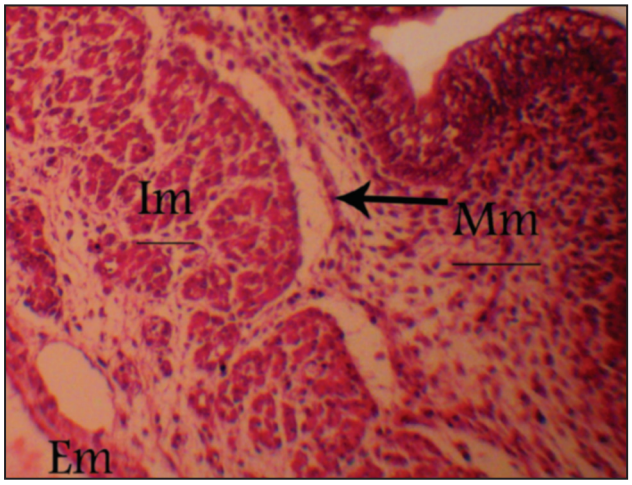

Fig 2. Photomicrograph of transverse section of the abomasal wall at 24 cm C-RL. Muscularis mucosa (Mm), internal (circular) layer of tunica muscularis (Im), external (longitudinal) layer of tunica muscularis, (Em). 82x

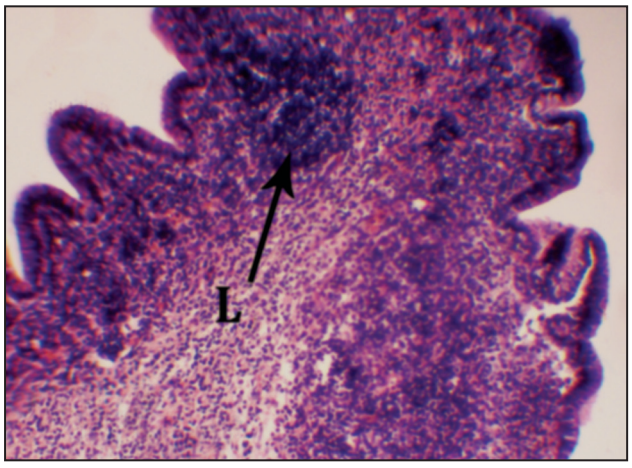

Fig 3. Photomicrograph of transverse section of the abomasal wall at 30 cm C-RL. Primary lymphatic nodule (L). 150x

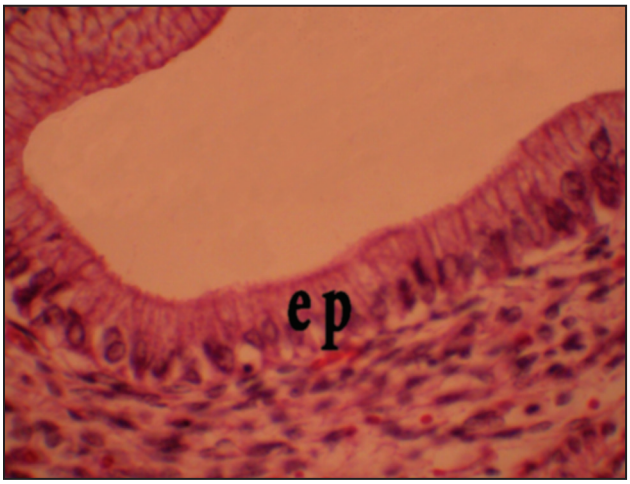

Fig 4. Photomicrograph of transverse section of the abomasal wall at 36 cm C-RL. Epithelium (simple columnar cells) (ep). 440x

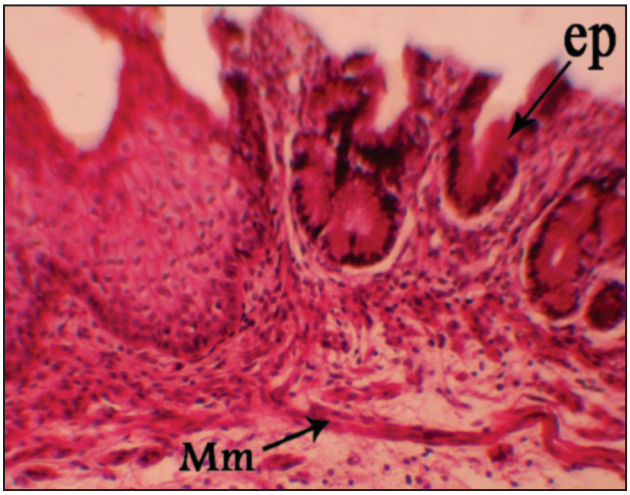

Fig 5. Histological structure of cross section of primary (PF) and secondary fold (SF) of the she camel's cervix showing epithelium (EP) and lamina propria (LP), (H&E X 160).

abomasum of sheep, its appearance is described at 33 days (Duncan and Phillison, 1955; Franco *et al,* 1993) and at 50 days (Fath-El Bab *et al,* 1983). The serosa, meanwhile, showed continuity in growth as well as differentiation. An intense vascularisation was apparent at bout 140 days.

References

Abdel-Majied EM and Taha AAM (2003). Morphological, morphometric and histochemical characterisation of the gastric mucosa of the camel (*Camelus dromedarius*). Anatomia, Histologia, Embryologia 32:42-47.

Alzo RH, Ghezzi MD and Lupido MC (2004). Topography and morphology of the Llama (*Lama glama*) stomach. International Journal of Morphology 22(2):155-164.

Asari M, Oshige H, Wakui S, Fukaya K and Kano Y (1985). Histological development of bovine abomasum. Anatomischer Anzeiger 159(1-5):1-11

Duncan DL and Phillison AT (1955). The development of motorresponses in the stomach of the foetal sheep. Journal of Experimental and Biology 28:32-40.

Fath-El Bab MR, Schwarz R and Ali AM (1983). Micromorphological studies on the stomach of sheep during prenatal life. Anatomia, Histologia, Embryologia 12:139-153.

Franco A, Robina A, Guillen MT, Mayoral AL and Rendondo E (1993). Histomorphometric analysis of the abomasum of sheep during development. Annales of Anatomy 175:119-125.

Kitamura N, Yoshiki A, Sasaki M, Baltazar ET, Hondo E and Yamamoto S (2003). Immunohistochemical evaluation of the muscularis mucosa in the ruminant forestomach; Anatomia, Histologia, Embryologia 32(3):175-178

Panchamuki BG and Srivastava HC (1980). Histogenesis of the reticulum of the buffalo (Bubalus bubalis) stomach. Indian. Journal of Animal Science 50:1064-1070.

Pousty I and Adibmoradi M (2006). Histotechnique, 1st Edn; University of Tehran Press, Iran 2806:34-50.

Vivo JM, Robina A, Regodon S, Guillen MT, Franco A and Mayoral AL (1990). Histogenetic evolution of bovine gastric compartments during prenatal period. Histology and Histopathology 5:461-476.