Histogenesis of the Abomasum in One-Humped Camel (Camelus dromedarius)

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Abstract: Histogenesis of the abomasum was studied in the one-humped camel (Camelus dromedarius). According to histodifferentiation of the abomasum in fetuses of the camel, they 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 as well increased throughout prenatal life as the abomasum developed. However, its prenatal developing was later than the abomasum in cow, sheep and goat.

Key words: Histogenesis, abomasum, one-humped camel, muscularis mucosa, parental development

INTRODUCTION

The abomasum is the fourth and final gastric compartment of the ruminant stomach and is glandular portion, too. 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-shape 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). This study on the histogenesis of camel’s abomasum during prenatal development is as a continuation of the studies carried out on the development of the abomasum of ruminants during intra uterine life. The aim of this study was to provide a sequential description of the histology of camel’s abomasum during fetal stage until the birth day.

MATERIALS AND METHODS

The present study was carried out on 33 fetuses 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 fetuses, they were collected and fixed in 10% formalin and ranged from 50-110 cm Crown-Rump Length (C-RL, approximately 50-392 days of gestation). The fetuses were fixed in 10% formalin for 1-2 week (sec). After fixing in formalin, the abomasums were separated and small pieces of the tissue of abomasums were dissected from the cardiac, fundic and pyloric regions of the abomasum of each fetus. The specimens of the regions were dehydrated in graded alcohol series, cleared in methyl benzooate, embedded in parafin and 5 µm thick sections were cut with microtome. The sections were prepared and stained with Haematoxylin and Eosin (HaridS) stain for histological studies. The stained sections were examined under light microscope (Pousty and Adibmoradi, 2006).

RESULTS AND DISCUSSION

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

Group I: 5-24 cm C-RL; 50-140 days of gestation
In this group, the abomasal wall consisted of four layers: epithelial layer, lamina propria-submucosa, tunica
Fig. 1: Photomicrograph of transversal section of the abomasal wall at 5 cm C-RL. Epithelium (ep), lamina propria-submucosa (ls), internal (circular) layer of tunica muscularis (arrow), external (longitudinal) layer of tunica muscularis, serosa (se) 120x

Fig. 2: Photomicrograph of transversal section of the abomasal wall at 24 cm C-RL. Muscularis mucosa (arrow), internal (circular) layer of tunica muscularis (tm1), external (longitudinal) layer of tunica muscularis, (tm2) 82x

Fig. 3: Photomicrograph of transversal section of the abomasal wall at 30 cm C-RL. Epithelium (ep), primary lymphatic nodule (arrow) 150x

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 epithelial cells were pseudostratified, the lamina propria and submucosa were formed by connective tissue with mesenchymal and a large amount of fibroblasts.

From 140 days to the birth day, the submucosa was separated from the lamina propria by the muscularis mucosa. 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 appeared the primary lymphatic nodules which contained many lymphocytes. The lymphatic nodules were observed at 160 days 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 vascularization in this stage.
**Group III:** 30-36 cm C-R.L; 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 pseudostriated at 178 days (Fig 4). The simple columnar cell with nuclei were arranged along the basal or middle of the cells.

The lamina propria and the submucosa were formed by loose connective tissue with an amount larger than the 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 have been observed. The connective tissue was absent between the oblique and the circular layer of the tunica muscularis. Such this reason, the oblique layer was 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; 178-360 days of gestation

In this group, the abomasal folds in comparison with the previous groups showed a strong increase in size and number. The epithelial 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 vascularization 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 shown intense vascularization.

In 178 days to birth, the epithelial of the mucosa of abomasum was covered by simple columnar cells. This important modification has been reported in cow at 87 days of gestation (Asari 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 birth day. These instructions are absent in the stomach of the ruminants (Alzo 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 (Panchamuki 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 of two layers: longitudinal and circular layers that were arranged by myoblasts. In the pernatal development of the 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 About 140 days an intense vascularization was apparent.
CONCLUSION

We can deduce from the findings that the fetuses of the camel are less precocious than small and large domestic ruminants. As well, the presence of the lymphatic nodules in cardiac region of the abomasum did show a high level immunity in the camel's abomasum in comparing with ruminants.

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REFERENCES


