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Histochemical Study of the Mucosal Neck Cells of the Third Compartment in One-Humped Camel (*Camelus dromedarius*) During Prenatal Development

E. Salimi Naghani

Department of Veterinary Anatomy, Sanandaj Branch,
Islamic Azad University, Sanandaj, Iran

Abstract: Mucins of the gastric are secreted by the mucous neck cells, which located in epithelium of gastric mucosal layer. Developmental studies have demonstrated that mucous neck cells can arise from undifferentiated gastric epithelium. The aim of this study was to investigate the carbohydrate composition of mucins from this region of the third compartment in one-humped camel (*Camelus dromedarius*) during prenatal development. Toward that end, paraffin sections from 33 dromedary camel were stained by haematoxylin and eosin (H and E) and carbohydrate histochemistry techniques (Periodic acid-schiff's (PAS) and Alcian blue (AB) (pH 2.5)). The results of this study revealed that the whole epithelium of the third compartment is simple columnar at 180 days of gestation and on this time the surface epithelium was positively to PAS and AB. The positive PAS reaction indicated the presence of neutral carbohydrates, while positive AB indicated the presence of acidic sulphated components. The results of this study are similar to other studies but histogenesis time of the epithelium of gastric glandular portion in other domestic ruminants is earlier than of one-humped camel.

Key words: Histochemical · Mucosal neck cells · Third compartment · One-humped camel

INTRODUCTION

The epithelial cells that line the gastrointestinal tract of mammals are protected in part from the somewhat harsh environment of acid, proteolytic enzymes and abrasives in the lumen by a mucus layer [1]. The stomach of the camel differs from the stomach of ruminant such as the bovine, in that it comprises three compartments. The third compartment consisted of wide cardiac glands, narrow gastric glands and pyloric glands [2, 3]. Abdel-magied and Taha, [4] considered that the third compartment of the dromedarian camel to be divided into three region; they regarded the first region is similar to cardiac region of other ruminants with thick mucosal layer and deep pits. They reported the second region is thick mucosal layer such as the gastric pits and so the third region of the third compartment is thick mucosal layer and the gastric pits are deeper than elsewhere. The pyloric region of the third compartment in one-humped camel shows the histological and histochemical characteristics of pyloric region of other ruminants [2]. Mucin in the gastric is in mucous neck cells, which is located in the epithelium of mucosal layer in all mammalian.

Histochemical characterization of the mucous neck cells of the third compartment in one-humped camel (*Camelus dromedarius*) during prenatal development has not been studied. The aim of this study was to investigate the histological and histochemical of the mucous neck cells of the third compartment in one-humped camel during prenatal development. Histological and histochemical techniques were used to achieve this aim. It is anticipated that this will constitute histologic basis essential for a better understanding of the gastric development in camel.

MATERIALS AND METHODS

Camel fetuses (n=33) from the initial fetal stages until birth were studied. The specimens were collected from the slaughterhouse in semi-desert provinces of Iran. After measuring the crown-rump length (C-RL) for determining the age of fetuses, small pieces of tissue were dissected from the cardiac, fundic and pyloric region of the third compartment of each camel fetus. The specimens were fixed in %10 formalin for 1-2 week(s). They were dehydrated in graded alcohol series, cleared in xylene,

Corresponding Author: Dr. E. Salimi Naghani, Department of Veterinary Anatomy, Sanandaj Branch, Islamic Azad University, Sanandaj, P.O. Box: 618, Iran.
Tel: +98-871-7287216, Fax: +98-871-6387117.

embedded in paraffin and 5-µm-thick section were cut with microtome. The sections were treated with haematoxylin and eosin (H and E) stain for histological studies. The specimens for histological analysis were viewed through a microscope (Optiphot, Nikon Inc; Tokyo, japan). Two histochemical sequential staining techniques, periodic acid-Schiff's (PAS) and Alcian blue (AB) (pH 2.5), which differentiate neutral from sulfated and non-sulfated acid mucous substances [5, 7].

PAS Technique: The sections were oxidized for 5 min in 1% aqueous periodic acid, washed under running tap water for 5min, rinsed in distilled water and then treated with Schiff's reagent for 15 min. After wards, the sections were washed under running tap water for 10 min. Finally, the sections were dehydrated in alcohol, cleared in xylene and mounted in a resinous mountant.

Alcian Blue (AB) Method (pH 2.5): For the pH 2.5 method, the sections were stained in freshly filtered 1% Alcian blue 8GX in 3% acetic acid (pH 2.5) for 30 min and washed in water. The sections were dried with fine filter paper. The sections were dehydrated in alcohol, cleared in xylene and mounted in a resinous mountant.

RESULTS

In the present study, the third compartment epithelium of one-humped camel before of 180 days of gestation was pseudo stratified and this time the epithelium surface was positively to PAS and AB staining. At 180 days of gestation, the third compartment epithelium was divided into four layers: mucosal, lamina propria, submucosal, tunica muscularis and serosal layer. The mucosal layer was formed by the simple columnar cells with folds and numerous gastric pits formed by the invagination of the mucosal layer into the lamina propria (Fig. 1). The lamina propria was separated from the submucosa by the muscularis mucosa. The tunica muscularis was consisted of external (longitudinal) and internal (circular) layers and an (oblique) inside the circular layer. The serosa had a loose connective tissue that had been covered by a mesothelium and was observed an intense vascularization in this time of gestation. At this period of gestation of dromedary camel The epithelium mucous cells were stained with PAS in the total part of the mucosal fold, but stained with AB in the upper part of the mucosal folds, indicating the presence of neutral and acidic (carboxyl and sulphate groups) glycoprotein (Fig. 2, 3).

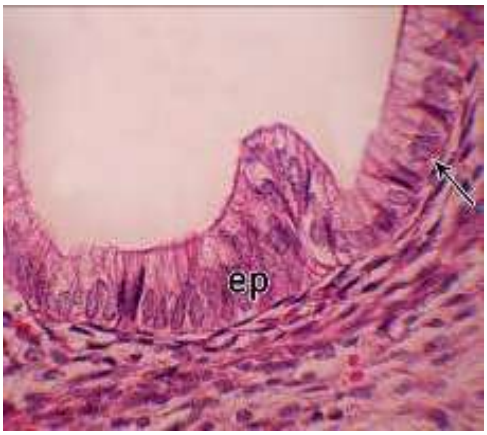

Fig. 1: Transverse section of the third compartment at 180 days of gestation showing simple columnar epithelium (ep and arrow), (H and E - × 240).

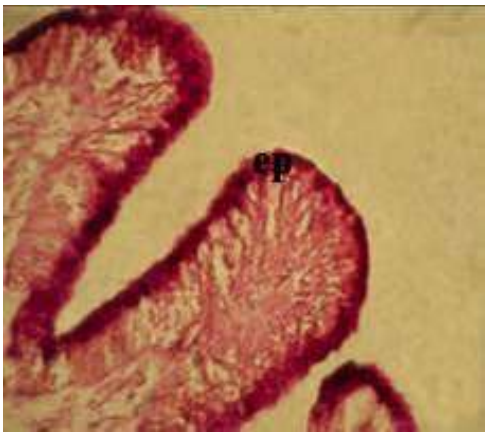

Fig. 2: Transverse section of the third compartment at 180 days of gestation. Epithelium (ep), (PAS+, ×180)

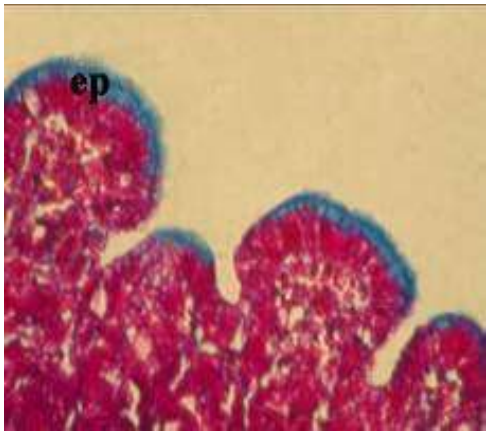

Fig. 3: Transverse section of the third compartment at 180 days of gestation with Alcian blue (AB) (PH 2.5) staining. Epithelium (ep), (AB+, ×160)

DISCUSSION

In classic carbohydrate histochemistry, a positive PAS reaction indicates the presence of neutral carbohydrates, while positive Alcian blue reactions at pH 2.5 indicate the presence of acidic sulphated and acidic carboxylated residues, respectively [7]. In the present study, the results of classic carbohydrate histochemistry demonstrated variation in the staining properties of the third compartment during prenatal development. In addition, the results showed that the mucous neck cells in the third compartment epithelium produced with the formation of simple columnar cells epithelium at 180 days of gestation. These findings are in agreement with study of dromedary camel during postnatal by Dougbad and Berg [2], which showed that mucous neck cells in the mature dromedary camel contain both neutral carbohydrates and acidic sulphated mucosubstances [8-10]. The results of this study are agreement the other studies results that showed mucous neck cells in the other ruminants contain both neutral carbohydrates and acidic sulphated mucosubstances [11-13]. The reaction positively to PAS and AB was increased with age increasing of camel's fetuses that similar to domestic ruminants. In 180 days to birth, the epithelium of the mucosa of the third compartment was covered by simple columnar cells. This important modification has been reported in cow at 87 days of gestation [14] and 73 days of gestation [15], in sheep at 65 days of gestation [16], but in the other histochemical studies reported that the mucous neck cells in ruminants during prenatal development produced with the formation of columnar cells epithelium that are agreement to these study results [17-20]. This variation between of dromedary camel and ruminants about of the mucous neck cells formation time could be attributed to gestation period that in camel is more than of the ruminants (12-13 months in camel). The existence of natural and sulfated mucin in the ruminant's stomach show that mucous from mucous neck cells could be attributed to the diet of the ruminants and their protecting activities adjacent to microorganisms. The mucin secreted from these cells protected stomach's mucosa against of the food's mechanical damage effects. These histochemical observations make available a uniform comparative basis for the normal distribution of mammalian gastrointestinal mucosubstances which should facilitate their study in diverse pathological and physiological conditions.

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