Prenatal development of rectal patch in large intestine of goats

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ABSTRACT
Prenatal development of rectal patch was studied in 30 goat fetuses ranging from 1.4 cm CRL (24 days of gestation) to 38.0 cm CRI (Crown ramp length). Rectal patch first appeared in goat foetuses by 60 days of gestational age as a continuous band of small to medium–sized lymphocytes in the lamina propria of rectum. During fourth month of gestation, the primordia differentiated into large lymphoid nodules which had an oval basal portion and a pyramidal apical portion, which formed a dome-like structure within the intestinal ridges below the surface epithelium and was surrounded by an irregular capsule. During fifth month, an increase in the number and size of the lymphoid nodules and primordial dome region was noticed. The lymphoid nodules were histologically mature with a prominent germinal center, its corona, a wide dome area and an inter-nodular area with few high endothelial venules. The rectal patch was histologically mature at birth with both primary and secondary nodules in it.

Key words: Goat, Prenatal development, Rectal patch.

INTRODUCTION
The gut associated lymphoid tissue (GALT) represents the active immunological defense of the intestinal mucosa. The lymphoid patches in rectum (RC patch) is a part of GALT in large intestine (Leibler et al., 1988). Recently studies were conducted on development of Peyer’s patches in ileum of buffalo fetus (Kapoor and Singh, 2015). The distribution and morphology of the GALT in large intestines of buffalo were described in detail by Alboghobeish (2005). However these studies did not include the details of RC patch in large intestine. Hence the present work was undertaken to study the prenatal development of RC patch in goat fetuses.

MATERIALS AND METHODS
Prenatal development of RC patch was studied using 30 goat foetuses ranging from 1.4 cm CRL (24 days of gestation) to 38.0 cm CRL (Crown ramp length). The studies were conducted on the embryos available in the department museum and collected from clinics and farms. Immediately after collection, body weight and crown rump length (CRL) of the embryos were recorded. The age of the fetuses were calculated from the formula derived by Singh et al. (1979). The embryos were fixed as such and serial sections were taken. From fetuses, tissue pieces from the rectum were collected and fixed in 10 per cent neutral buffered formalin and were processed to obtain 5-6 μm thick serial paraffin sections. The sections were stained by Haematoxylin and Eosin (Luna, 1968), Gomori’s rapid one step trichrome method for collagen fibres (Luna, 1968), Verhoeff’s method for elastic fibres (Singh and Sulochana, 1996) and Gordon and Sweet’s method for reticular fibres (Bancroft and Gamble, 2003).

RESULTS AND DISCUSSION
Rectal patch first appeared in goat foetuses by 60 days of gestational age as a continuous band of small to medium–sized lymphocytes in the lamina propria of rectum (Fig. 1). A few lightly stained mesenchymal cells with their processes formed a meshwork around the lymphocytes. Few collagen fibers and blood capillaries were also seen. In sheep fetuses, the Peyer’s patch (PP) precursors could be identified in the large intestine by 70 days (Aleksandersen et al., 1991). However, in the PP of buffalo fetuses, the first primordial lymphoid follicle and dome was observed at 195 days (Kapoor and Singh, 2015).

In the fetuses belonging to the fourth month of gestation, the primordia differentiated into large ovoid lymphoid nodules below the surface epithelium. In sheep fetuses, Reynolds and Morris (1983) observed vigorous lymphopoiesis in the lymphoid follicles from 100 days of gestation. The aggregated patches of lymphoid nodules were arranged in a single row and consisted of lymphoid nodules, the subepithelial dome area and inter-nodular area. An irregular capsule made of collagen and reticular fibers was noticed surrounding the nodules from this stage onwards (Fig.2). The primordial dome epithelium forming the follicle associated epithelium (FAE) was composed of cuboidal cells.
which were more eosinophilic than the adjacent enterocytes. Similar pattern of lymphoid nodules was observed by Asari et al. (1989) in PP of seven month-old bovine fetuses and Nicander et al. (1991) in PP of four month-old sheep fetuses. During fifth month, an increase in the number and size of the lymphoid nodules and primordial dome region was noticed (Fig.3.). The lymphoid nodules were histologically mature with a prominent germinal center, its corona, a wide dome area and an internodular area with sparse HEVs. A continuous capsule was seen around each nodule which was made of collagen and few reticular fibers. Elastic fibers were not seen in any of the stages of development. The epithelium lining the FAE changed from cuboidal to columnar and became more eosinophilic. There was an increase in the number of intraepithelial lymphocytes. Similar observations were made by Reynolds and Morris (1983) in sheep fetuses and Beyaz and Asti (2004) in PP of bovine fetuses. During the prenatal period germinal centre was first observed in sheep fetuses at 130-135 days (Nicander et al., 1991), in bovine fetuses at 271 days (Beyaz and Asti, 2004) and in buffalo fetuses at 231 days (Kapoor and Singh, 2015).

According to Asari et al. (1989), morphological and functional differentiation of the FAE cells was closely associated with lymphoid development in the submucosa. The FAE cells matured just before birth and formed a system of local defence against harmful substances from the extrauterine environment after birth. The impermeability of bovine placenta and the prenatal development of PP suggested the presence of intrinsic factors that initiated lymphopoesis in the follicles (Beyaz and Asti, 2004). Tenorio and Pabst (2006) suggested that initially GALT develops independent of antigen exposure.

**Histochemistry:** In the goat foetuses of fifth month of gestation, weak PAS-alcian blue reaction appeared within the goblet cells in between enterocytes (147 days fetus). PAS-alcian blue method x 100

1. Lymphoepithelium
2. Lymphoid nodule
3. Goblet cells showing PAS-alcian blue reaction

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synthesis. Since the acquired immune system was not fully functional in the neonatal intestine, the presence of acidic mucins in early life stages might be of particular importance as an innate defence barrier as reported by Cebra (1999) in human.

CONCLUSION

In goats, the rectal patch was well developed at birth suggesting that they could be exploited as targets for rectal vaccines for the induction of mucosal immune response in this species.

REFERENCES


