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# Histogenesis of Peyer's patches in Ovine foetus *(Ovis aries)*

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**Abstract**

Tissue pieces of jejunum and ileum from different prenatal age groups of sheep were collected from Corporation slaughter house, Perambur, Chennai. By three months of foetal age in sheep, the Peyer's patches appeared as an aggregation of lymphocytes in the propria submucosa of the jejunum and ileum. The lymphocytic aggregation appeared only in the antimesenteric part of the jejunum and ileum. By four months of foetal age, the circumscribed nodular aggregations of lymphocytes were found enlarged giving a follicle-like appearance. The capsular connective tissue was predominated by reticular fibres and a few collagen fibres. The dome area of the follicle consisted of closely packed small-sized lymphocytes which appeared darker than the basal area. The smooth muscle fibres of muscularis mucosae were not continuous throughout and were absent in the follicle having domes. In five months-old foetuses, the jejunal and ileal Peyer's patches were distinctly observed as follicles. The follicle showed a distinct outer cortex and an inner lighter medulla. Numerous small-sized lymphocytes were observed in the outer cortex and few lymphoblasts, medium sized lymphocytes and reticular cells were observed in the medulla.

**Keywords:** Histogenesis; Peyer's patches; Ovine foetus

## 1. Introduction

The gastro-intestinal mucosa absorbs critical nutrients and other molecules constantly across mucosal barriers. About 70 per cent of the body immune system is found in the digestive tract. This immune system often referred to as gut-associated lymphoid tissue and works to protect the body from invading pathogens (Ma *et al*., 2007). Gut-associated lymphoid tissue is made up of several types of lymphoid tissue that produce and store immune cells that carryout attacks and defend against pathogens.

Peyer's patches are the aggregations of lymphatic nodules in the mucosa and submucosa of the jejunum and ileum of mice (Rowinski *et al*., 1984). Peyer's patches are immunocompetent lymphoid organs primarily engaged in immune responses to antigens presented from the intestinal lumen in guinea pig (Jurg *et al*., 1975). The discrete lymphoreticular follicles located along the gastrointestinal tract of mammals represent the first line of defence to orally encountered environment antigens (Vetvicka *et al*., 1987).

Peyer's patches are the components of gut-associated lymphoid tissue that actively participates in the interaction with the intestinal contents and play an important role in the initiation of mucosal immune responses (Vetvicka *et al*., 1987). The secretions from the loops containing Peyer's patches exhibit a stronger early Ig A response to bacteria than the secretions from loops lacking Peyer's patches. The large number of lymphocytes in Peyer's patches increases the probability of an antigen encountering an immunocompetent cell (Keren *et al*., 1978).

A thorough knowledge of the histogenesis of Peyer's patches is very essential to gain a comprehensive knowledge on the gut immunology and to form a basis for the interpretation of various pathological conditions of the gut. Hence, the present work has been undertaken to explore the prenatal development of the Peyer's patches in sheep.

### *1.1 Materials and methods*

Tissue pieces of terminal part of jejunum and parts of ileum were collected from sheep. The tissues from six animals each from different age groups viz. three months, four months and five months in prenatal were procured from the Corporation slaughter house, Perambur, Chennai. The determination of age ascertained as described by Richardson *et al*. (1976) in prenatal age groups.

Tissue pieces collected were fixed in different fixatives viz., 10 per cent neutral buffered formalin, Bouin's fluid and Zenker's fluid. The fixed tissues were processed for routine paraffin embedding technique and sections of 3-5µm thickness were cut. The paraffin sections were subjected to routine and special histological staining methods.

*1.1.1 Results and discussion*

The Peyer's patches appeared as an aggregation of lymphocytes in the propria submucosa of jejunum and ileum in three months-old foetus of sheep (Fig.1). This is in agreement with the observations of Nicander *et al*. (1991) in sheep, where small groups of lymphocytes were recorded and interpreted as primordia in the ileum by 90-97 days of foetal age. Further, Vyas and Mariappa (1970) and Asari *et al*. (1987) reported the presence of ileal Peyer's patches in bovine foetuses of seven months and five to six months respectively.

The lymphocytic aggregations were noticed at regular intervals in circumscribed foci beneath the intestinal epithelium. In areas of lymphocytic aggregation, the intestinal mucosa was not thrown into long villi-like projections. The lymphocytic aggregation appeared only in the antimesenteric part of the jejunum and ileum. Among the lymphocytic accumulation, few lightly stained mesenchymal cells with processes formed a meshwork around the lymphocytes. Similar observations were made in the terminal ileum of the foetal pig (Binns and Licence, 1985). Reynolds and Morris (1983) reported that jejunal Peyer's patches developed before the ileal Peyer's patches in sheep foetus as it had a role in early generation of lymphoid cells.

Few large lymphoblasts with vesicular nuclei were also observed among the small lymphocytic aggregation and one or two small lymphocytes also appeared within the surface epithelium. In addition, few blood vessels were also noticed among the lymphocytic aggregation. Contrary to this, Nicander *et al*. (1991) recorded the presence of follicle with numerous small and medium-sized lymphocytes and absence of lymphoblasts in the same age group of foetus of sheep.

By four months of foetal age of sheep, the lymphoid follicles were distinct and comprised of a broad basal portion and a pyramidal apical portion, which formed a dome-like structure with thin strands of reticular fibres between the follicles (Fig.2). Similar observation was made by Nicander *et al*. (1991) in ileal Peyer's patches of 115-125 days-old sheep foetuses. Numerous small and medium-sized lymphocytes and few lymphoblasts were observed in the follicles and the reticular cells formed the stroma of the follicle which is in accordance with Nicander *et al*. (1991) in the ileal Peyer's patches of 123-125 days of sheep foetus.

A few smooth muscle cells of muscularis mucosae appeared above the follicles which were not continuous and were absent in the area of the follicles having domes. In five months-old sheep foetuses, the lymphoid follicles of jejunal and ileal Peyer's patches showed a distinct outer darkly stained area that formed the cortex and an inner light zone which formed the medulla (Fig.3). The zonation of lymphoid follicles has also been recorded in earlier age group of 130-135 days of sheep foetuses by Nicander *et al*. (1991). The cellular components resembled that of the earlier age groups in the present study.

The average length and width of the ileal follicles varied from 105.00±8.36µm and 75.00±7.41µm in four months-old foetus and 395.50±7.21µm and 215.00±8.23µm in five months-old foetus of sheep.

In conclusion it was observed that during prenatal histogenesis the Peyer's patches first appeared as aggregations of lymphocytes at three months. Distinct follicles with dome like structures appeared at four months and by five months the differentiation into cortex and medulla was observed. Hence, the lamb acquires immunity by birth itself due to the well developed Peyer's patches in the gut. These findings will contribute to detect the pathological conditions and ascertain the immune responses in neonatal sheep at birth.

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## FIGURE LEGEND

Fig.1 Photomicrograph of ileal Peyer's patch of three month-old foetus of sheep showing aggregation of small groups of lymphocytes beneath the mucosa.
L- Lymphocytic aggregation E- Epithelium of villi
Ps- Propria submucosa Tm- Tunica muscularis
Toluidine blue x 40

Fig.2 Photomicrograph of ileal Peyer's patch of four month-old foetus of sheep showing broad basal portion and pyramidal shaped apical domes of lymphoid follicles.
B- Basal portion of lymphoid follicle Ca- Capsule
D- Dome region of lymphoid follicle Tm- Tunica muscularis
Cf- Collagen fibres
Masson's trichrome x 200

Fig.3 Photomicrograph of jejunal Peyer's patch of five month-old foetus of sheep showing distinct outer darkly stained cortex and inner lightly stained medulla of the follicle.
Co- Cortex M- Medulla
Haematoxylin and Eosin x 400

Fig.1

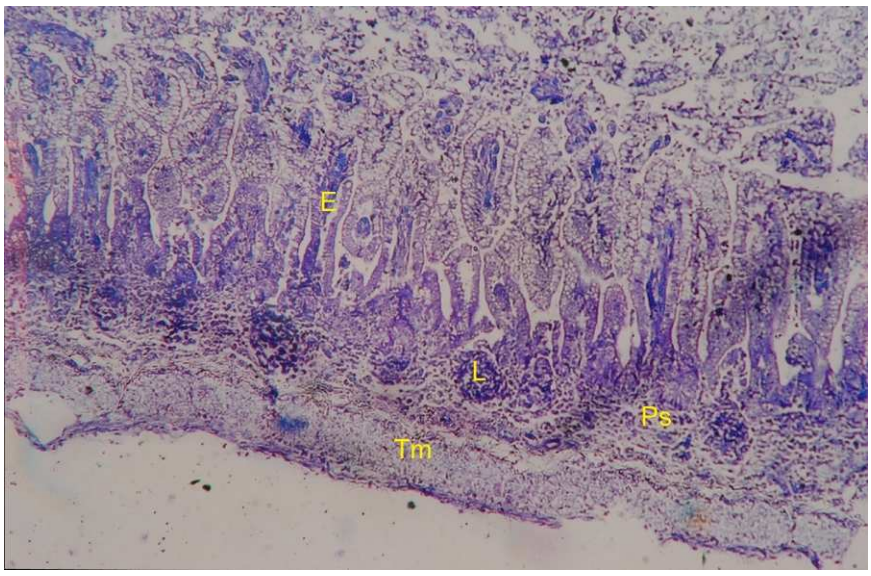

Fig.2

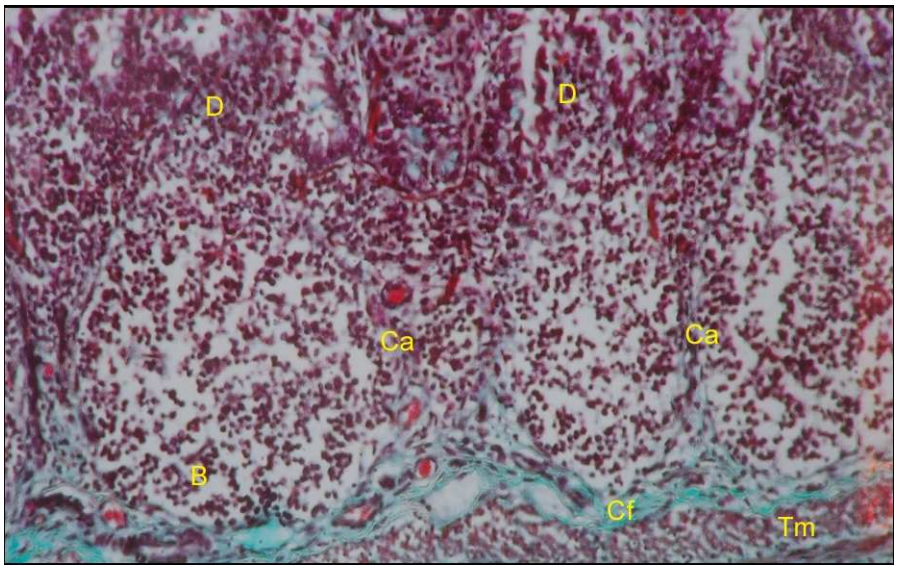


Fig.3