Lymphoid Tissue of the Small Intestine of the New Born, Adolescent and Elderly Male Albino Rat

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To My Father
Mother
and Husband

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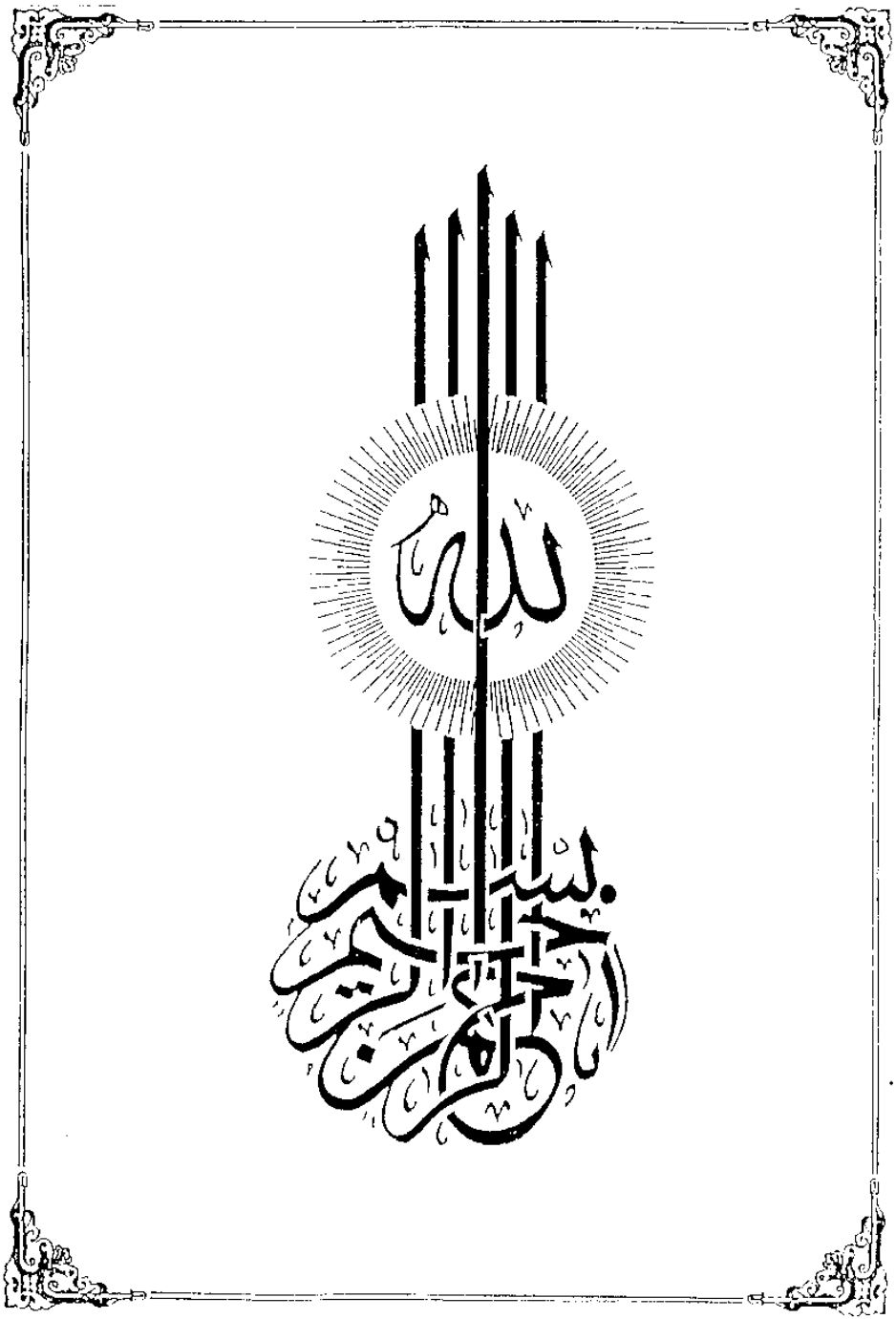

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INTRODUCTION

Last, (1978) stated that the gastrointestinal tract, throughout the greater part of its extent was associated with lymphoid tissue. In the oropharynx the well known Waldeyer's ring was found which included the lymphoid tissue in the posterior third of the tongue, the palatine tonsils, the tubal tonsils and the nasopharyngeal tonsil.

Williams and Warwick, (1980) mentioned that in the stomach, especially in early life, collections of lymphoid tissue were observed resembling the solitary follicles of the intestine and were termed the gastric lymphatic follicles. Throughout the intestine, lymph follicles were present. In the duodenum and jejunum lymph follicles were few and solitary, while in the ileum, they occurred in groups, forming aggregated lymphatic nodules known as Peyer's patches.

In the appendix the lymphoid tissue was extensive, also in the rest of the large intestine, there were solitary lymphatic follicles placed at intervals between the glands and bulging on the surface. The lymphoid tissue was traceable even to the anal canal.

Sawicki and Rowinski, (1980) mentioned that the gut associated lymphoid tissue (G.A.L.T.) or the intestine associated lymphoid system (I.A.L.S.) was suspected to play an important role in the defensive mechanism of the

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gastrointestinal tract and even the whole body. The intestinal wall was continuously exposed to a wide variety of antigens as macromolecules, chemicals, irritants in food, bacteria and fungi. Such antigens could start the immune response by the lymphoid tissue.

Marsh, (1981) mentioned that the mucosa of the small intestine was armed with a large battery of defending cells, the most important of which was the lymphocytes. The lymphocytes might be situated either in the epithelium or in the connective tissue of the lamina propria and in many regions might extend through the muscularis mucosa into the submucous coat.

Other important defending cells were present in the intestinal mucosa, such as macrophages, plasma cells, eosinophilic leucocytes, and mast cells. Such cells, together with lymphocytes contributed to the production of antibodies, and the development of cellular and humoral immune responses.

Physiological variations in the small intestine of suckling rats from adults were observed.

Halliday, (1955) mentioned that the transmission of antibodies from the maternal milk to the general circulation was limited to the first 21 days after birth and beyond that time the uptake ceased.

Clark, (1959) mentioned that the intestinal mucosa of newborn rats and mice differed from adults in its

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morphological features. Koldovsky, Sunshine and Kretchmer, (1966) reported that the migration of epithelial cells in the newborn and suckling rats, along the villi of the small intestine, was slower than that of weaned rats.

Altmann and Enesco, (1967) noticed that during weaning the cellular proliferation and cellular migration along the villi reached the levels seen in the adult. After weaning, the growth of the small intestine was gradual.

Weaning usually occurred in the third week, and at this stage the gastrointestinal tract was flooded with various antigens which required the full maturation of its defensive mechanisms.

Thus, it became the aim of the present work to study the effect of weaning on the structure and maturation of the lymphoid tissue in the small intestine.

Moreover careful attention was paid to the changes occurring in Peyer's patches in relation to age and whether it coincided with the same line of growth and atrophy as that observed in other lymphoid tissues as the thymus, spleen, and lymph nodes in general.

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REVIEW OF LITERATURE

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REVIEW OF LITERATURE

GENERAL HISTOLOGICAL STRUCTURE OF THE SMALL INTESTINE

Williams and Warwick, (1980) described four layers forming the wall of the human small intestine, namely serosa, musculosa, submucosa, mucosa.

The serosa was derived from visceral peritoneum and it consisted of loose connective tissue covered by mesothelium. The musculosa consisted of two spiral layers, a thin outer longitudinal layer which was less spiral and a thick inner circular layer which was more spiral. Between the two layers was found the myenteric plexus of nerve cells and fibres.

The submucosa consisted of connective tissue fibres containing blood vessels, lymphatics, fibroblasts, lymphocytes, plasma cells and submucous nerve plexus.

The mucosa was adapted to its function and the mucous lining consisted of simple columnar epithelium.

The mucous membrane consisted of three layers namely:

- The muscularis mucosa, which consisted of a thin outer longitudinal layer of muscle fibres and an inner circular layer of muscle fibres.
- The lamina propria contained reticular cells, fibres, lymphocytes, eosinophils, mast cells, macrophages, capillaries, lymphatics, nerve cells and fibres.

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- The basement membrane and an epithelium which consisted of tall columnar cells.

Leeson and Leeson, (1981) mentioned that the mucosa of the small intestine presented two important features, namely the circular folds and the intestinal villi.

The circular folds "valves of Kerckring" were permanent folds in the mucosa which extended around the tube for 2/3 or 1/2 of its circumference. They often formed complete circular folds or bifurcated and pursued a spiral direction. They began to appear one inch from the pylorus and were prominent in the jejunum. In the distal part of the ileum they were absent.

The intestinal villi were vascular finger-like processes 0.5-1.5 mm in length, which projected from the mucous membrane. They were large and broad in the duodenum, tall and leaf-like in the jejunum, finally getting small and few in the ileum. Both circular folds, and intestinal villi increased the surface area of absorption from the small intestine.

Krause and Cutts, (1981) stated that the two distinct units of the mucosa of the small intestine were the villi and the crypts which differed markedly from each other in structure and function. The crypts were simple tubular glands lying perpendicular to the surface. They opened on the surface by small circular apertures between the villi. The

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cells lining the intestinal glands consisted of argentaffin, Paneth, and the undifferentiated cells.

Specian and Neutra, (1982) stated that crypt cells had a secretory function and as it ascended into the villi, during its migration, it assumed an absorptive and digestive function.

Different Types of Cells in the Mucosa of the Small Intestine

Messier and Leblond, (1960) described a continuous, single-cell-thick layer of epithelium which covered the villi and lined the crypts in the mouse. The cells were the columnar absorbing cells, goblet cells, oligomucous cells, Paneth cells, enterochromaffin cells and undifferentiated columnar cells.

A. The Columnar Absorbing Cell

Messier and Leblond, (1960) mentioned that they were highly differentiated tall columnar cells, found in the regions of the villi and apical parts of the crypts. They had an oval nucleus basely situated. Their cytoplasm contained the usual components as granular and agranular endoplasmic reticulum, mitochondria, Golgi apparatus and lysosomes.

Granger and Baker, (1960) first demonstrated that the brush border was made up of numerous, finger like projections the microvilli.

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Millington, (1964); Palay and Karlin, (1964) estimated from various calculations that the microvilli increased the surface of the absorptive cells 14 to 39 folds.

Phelps, (1978) stated that the cells covering the villus tip were known to have maximal absorptive capacity and that might be related to the structure and the enzyme content of their microvilli.

Gutschmidt, (1982) determined disaccharidase activity of the brush border along the villi of normal human jejunal biopsies by a quantitative histochemical study. He found that the disaccharidase increased significantly from the villus base to the transition zone between the medium and apical villus thirds.

The Goblet Cell

Moe, (1955) stated that they were found between the columnar cells over the villi and in the superficial parts of the crypts. They were more plentiful in the crypts than in the villus and at the base of the villus than on its free end.

Freeman, (1962) described the fine structure of goblet cells, in mouse, rat and human small intestine, the general structure was similar. The typical goblet cell was distended with mucous granules they were shaped like a brandy goblet. The microvilli on its apical surface were similar to those of absorptive cells but less abundant and more irregular in

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shape and length. The nucleus was basally located and its upper portion often appeared flattened by the mucous granules. An extensive well organized accumulation of Golgi material was seen in the supranuclear portion, few mitochondria and a well organized network of granular endoplasmic reticulum filled the remainder of the cytoplasm mostly below the nucleus.

Trier, (1963) demonstrated that in human the goblet cells delivered their contents into the lumen by merocrine secretion. In the secretory mechanism, the membranes surrounding the mucous granules fused with the apical cell membrane and the mucus was discharged into the gut lumen.

Thomas, (1964) suggested that the small intestinal goblet cells secreted their mucus by apocrine secretion. During this mode of secretion, mucus was discharged from apical surface of the cell together with parts of the apical plasma membrane.

Cheng, (1974) studied the fate of goblet cells in small intestine of mice and noticed that the maturing goblet cells migrated upward from the crypt to the villus and were finally shed.

Bastie, Balas and Laval, (1983) noticed defects in maturation of goblet cells after hypophysectomy in the rat at the age of 15 days. This might indicate that goblet cells were under hormonal control.

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