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Histochemical studies on gut associated lymphoid tissue of pig (*Sus scrofa*)

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Abstract

In the present study, in the duodenum, goblet cells and glands of lamina propria showed strong reaction for PAS-AB whereas glands of lamina propria and submucosa showed strong PAS reaction and the connective fibers of submucosa and lamina propria showed moderate reaction for PAS-AB. In the jejunum, the goblet cells of villous epithelium showed strong positive reaction for PAS and PAS-AB whereas glands of lamina propria also showed strong PAS-AB reaction. In ileum, goblet cells showed strong reaction to PAS and PAS-AB whereas glands of lamina propria, connective tissue of lamina propria and inter follicular connective tissue of submucosa showed strong positive reaction for PAS-AB and moderate reaction to PAS. In ileocaecal patch, colon, rectum, the glands of lamina propria showed strong reaction for PAS and PAS-AB and the connective tissue of lamina propria and submucosa of ileocaecal patch and connective tissue of submucosa of rectum showed moderate reaction for PAS-AB. But, other areas were devoid of acid mucopolysaccharides in the colon in the present study.

Keywords: intestine, lymphoid follicles, mucopolysaccharides, pig

Introduction

Gut associated lymphoid tissue is a major component of the immune system which plays an important role in protecting the animal body from the invasion of pathogens through the gut. The pigs are mostly fed on garbage and other waste materials. But pigs are more resistant to many of the viral and bacterial diseases when compared to other domestic animals. In pigs, the major component of gut associated lymphoid tissue is Peyer's patches (Nickel *et al.*, 1979)^[1]. These Peyer's patches contain secondary lymphoid tissue that mounts the immune responses against the ingested antigens (Binns and Licence, 1985)^[2]. A thorough knowledge of the Gut Associated Lymphoid Tissue (GALT) 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 histochemistry of the GALT in pigs.

Materials and Methods

The present study was conducted on gut associated lymphoid tissue of 18 exotic pigs and 15 desi pigs. The tissue samples were collected from pigs which were slaughtered at AICRP on pigs, Tirupati and also from local slaughter houses in Tirupati. The tissue samples were fixed in 10% Neutral Buffered Formalin. Later these samples were processed for paraffin sections (Singh and Sulochana, 1997)^[3]. About 5-6 µm thick paraffin sections were obtained and subjected to PAS method for neutral mucopolysaccharides and PAS-AB for acid mucopolysaccharides (Singh and Sulochana, 1997)^[3].

Results and Discussion

In the present study, neutral mucopolysaccharides were noted in the duodenum, the glands of lamina propria and submucosa and they showed strong PAS reaction (Fig.1). Similarly, Parveen *et al.* (2017)^[4] noted strong PAS activity in the crypts especially in the goblet cells in the duodenum of goat. Ohwada and Suzuki (1992)^[5] in goat, sheep and cattle, Maruti (2017)^[6] in sheep and goat, also noted strong PAS reaction in goblet cells of villi and in Brunner's glands.

Similarly, Andleeb *et al.* (2009) [7] noted strong reaction for PAS in the Brunner's glands of duodenum of gaddi goat and moderate PAS reaction in crypts.



Fig 1: Photomicrograph of duodenum showing PAS reaction in the glands of lamina propria and glands of submucosa (arrow). (PAS X 40)

LPG - Lamina propria glands, SM - Submucosa, SMG - Submucosal glands, TM - Tunica muscularis.

In jejunum and ileum, the goblet cells of villous epithelium showed strong positive reaction for PAS which is an indicative of presence of neutral mucopolysaccharides (Fig.2). Further, the inter follicular region showed moderate quantities of neutral mucopolysaccharides. Similarly, Parveen *et al.* (2017) [4] in goat, Maruti (2017) [6] in sheep and goat noted strong PAS activity in the crypts and goblet cells of villi epithelium of jejunum. Kapoor and Singh (2015) [8] noted that the villous epithelium just above the dome had strong activity for neutral mucopolysaccharides in the ileum of sheep.

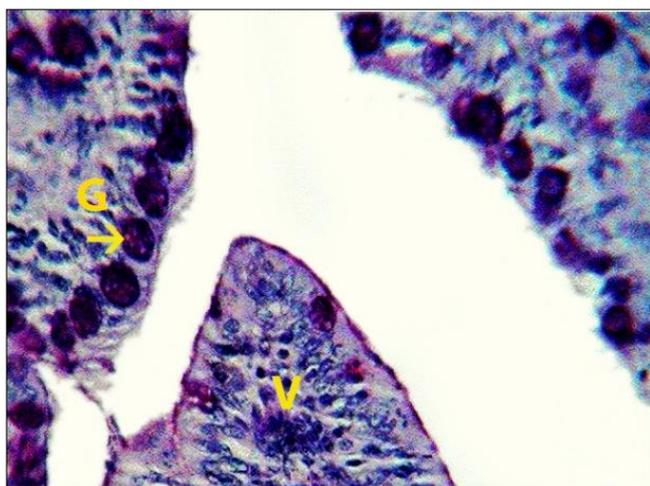


Fig 2: Photomicrograph of ileum showing PAS reaction in the goblet cells of the villous epithelium (arrow). (PAS X 400)

G-Goblet cells, V-Villi.

In caecum, colon and rectum, the goblet cells and the glands of lamina propria showed strong reaction for PAS (Figs. 3, 4.). The above results indicates the presence of neutral mucopolysaccharides but their presence was almost negligible in the submucosa and the other parts.

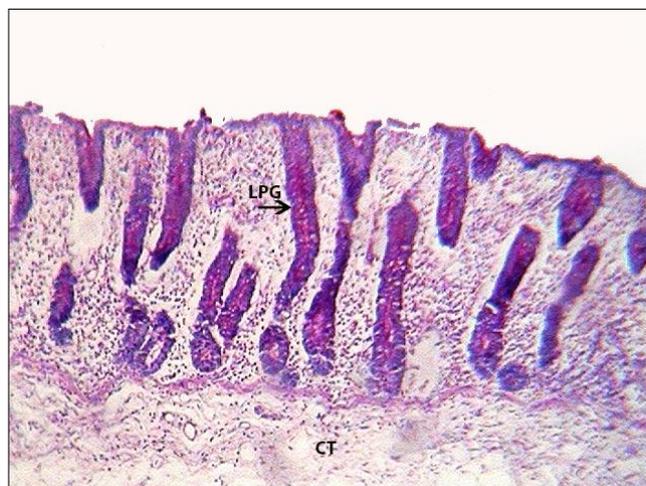


Fig 3: Photomicrograph of caecum showing PAS reaction in the glands of the lamina propria (arrow). (PAS X 40) LPG – Lamina propria gland, CT – Connective tissue. Propria.

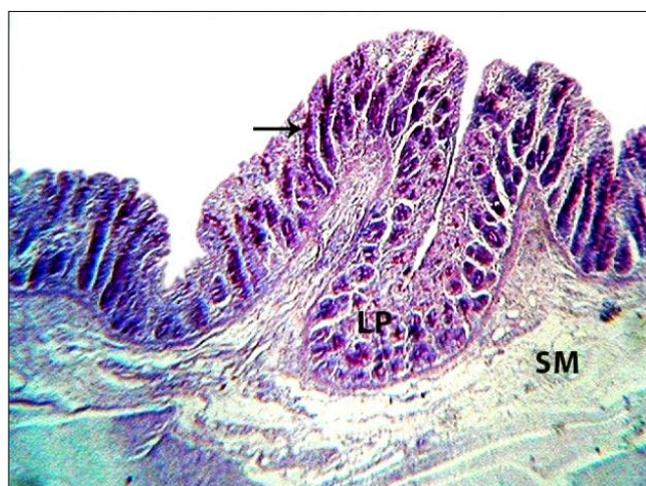


Fig 4: Photomicrograph of colon showing PAS reaction in the goblet cells of the lamina propria (Arrow). (PAS X 40) LP-Lamina propria, SM-Submucosa.

In the present study, in duodenum and jejunum, the goblet cells of the villi and the glands of lamina propria consisted of acid mucopolysaccharides and showed strong reaction for PAS-AB. The connective tissue fibers of submucosa and lamina propria also showed moderate reaction for PAS-AB. Andleeb *et al.* (2009) [7] observed mild reaction for alcian blue in the crypts of duodenum in gaddi goat. Parveen *et al.* (2017) [4] stated that the goblet cells of villous epithelium showed PAS-AB activity but columnar cells showed weak reaction towards the PAS-AB in the duodenum of goat. Kapoor and Singh (2015) [8] in jejunum of buffalo calves noted strong PAS-AB reaction in goblet cells of villi and in intestinal glands, whereas capsule and germinal centre of lymphoid follicle were weakly positive for PAS-AB.

In ileum, the goblet cells of villi showed the presence of acid mucopolysaccharides (Fig.5). The glands and connective tissue of lamina propria and inter follicular connective tissue of submucosa showed strong positive reaction for acid mucopolysaccharides. But, other areas were devoid of acid mucopolysaccharides in the intestinal wall of pig. Parveen *et al.* (2015) [9] noted PAS-AB positive reaction in the goblet cells of villi but the lamina muscularis did not showed any reaction

in ileum of sheep. Kapoor and Singh (2015) [8] noted that the intestinal glands were strongly positive for acid mucopolysaccharides, whereas capsule and centre of lymphoid follicles were weakly positive in ileum of buffalo calves.

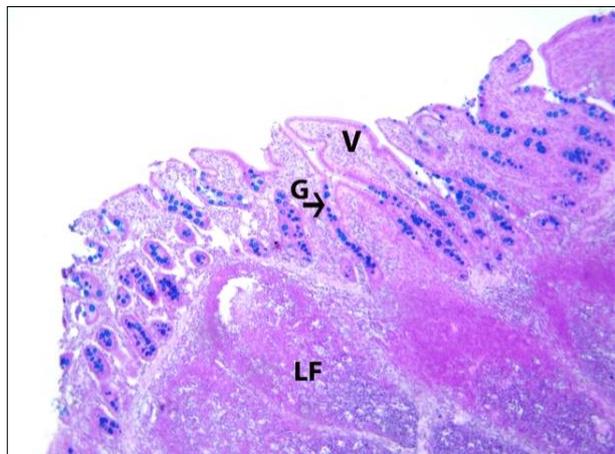


Fig 5: Photomicrograph of ileum showing intense PAS-AB reaction in the goblet cells of the villous epithelium (arrow). (PAS-AB X 40)

V - Villi, LF - Lymphoid follicle, G - Goblet cell.

In the ileocaecal junction, colon and rectum, the glands of lamina propria showed strong positive reaction for acid mucopolysaccharides (Fig.6). The connective tissue of lamina propria and submucosa of ileocaecal junction and connective tissue of submucosa of rectum showed moderate reaction for PAS-AB. But, other areas were devoid of acid mucopolysaccharides in the colon in the present study. Kapoor and Singh (2016) [10] noted that the glands within lymphoid tissue were strongly positive for acid mucopolysaccharides whereas, centre of the lymphoid tissue showed weak to negligible alcinoophilic reaction in colon of buffalo calves.

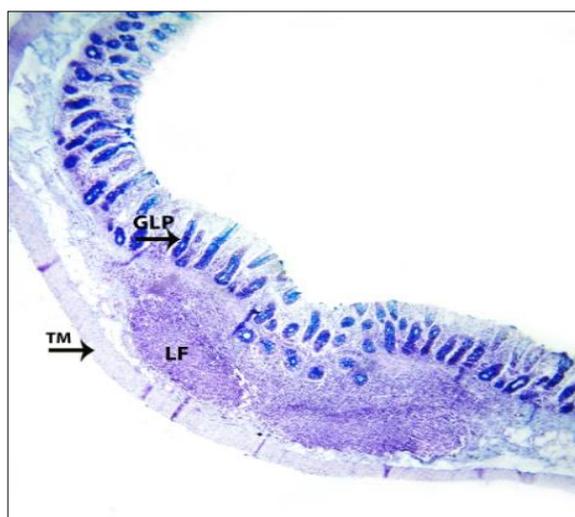


Fig 6: Photomicrograph of colon showing intense PAS-AB reaction in the glands of lamina propria (arrow). (PAS-AB X 40)

GLP - Lamina propria glands, LF - Lymphoid follicle, TM - Tunica muscularis.

Conclusion

The above findings, suggested that the high concentration of neutral mucopolysaccharides were present in the glandular regions of the small intestine of the pig. The presence of high

concentration of neutral and acid mucopolysaccharides in duodenum, jejunum and ileum, was indicative of role of small intestine in digestion and absorption of carbohydrates.

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