

Gross and Histological Studies on the Soft Palate Tonsil in Domestic Pig (*Sus scrofa domestica*)

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ABSTRACT

The present study describes the gross and microanatomical features of the soft palate tonsil in domestic pigs. Grossly, the tonsils appeared as elongated oval plaques with numerous fossules on the mucosal surface of the soft palate. Histologically, the tonsil was lined by non-keratinized stratified squamous epithelium with numerous crypts extended deeply into the lymphoid tissue of the tonsil. Each crypt consisted of a neck formed by epithelial invagination and a body by lymphoepithelium.

Key words: Soft palate tonsil, crypt, lymphoepithelium.

INTRODUCTION

Pig is a highly prolific animal and is widely used in experiment model specifically in immune system (Kumar *et al.*, 2017). In pigs, the primary lymphoid tissues in the pharyngeal region are concentrated in the soft palate and are referred to as the tonsils of the soft palate (Nickel *et al.*, 1979). Along with other tonsils it constitutes to form a ring of lymphoid tissue known as Waldeyer ring (Waldeyer-Hartz, 1884; Perry and Whyte, 1998), which is well developed in swine (Liebler-Tenorio and Pabst, 2006). Owing to its strategic location at the junction of the respiratory and digestive tracts is of great immunological significance, as it is continuously exposed to a wide range of antigens during respiration and ingestion of food (Brandtzaeg, 1984 and Bernstein *et al.*, 1999). Despite its functional importance, the available literature on the gross anatomy and histology of the soft palate tonsil in domestic pigs is scanty. Hence, the present study was undertaken to study the gross and microanatomical features of the soft palate tonsil in the domestic pig.

MATERIALS AND METHODS

In the present study, fresh specimens of the

soft palate tonsil were collected from 12 adult domestic pigs of the SVVU-T-17 breed immediately after slaughter at AICRP (All India Coordinated Research Project on Pigs), SVVU, Tirupati. To facilitate clear visualization of the soft palate, the upper and lower jaws were separated by dissection at the temporo-mandibular joint level. The research protocol was approved by the Institutional Animal Ethics Committee vide Ref. No. 281/go/Rebi/S/2000/CPCSEA/CVSc/TPTY/001/Veterinary Anatomy/2023 dated 08.05.2023. For gross and morphometrical studies, the location of the soft palate tonsil was recorded. The length of the soft palate tonsil was measured along the midline from the anterior pillar to the posterior pillar, while the width was measured at the levels of the anterior and posterior pillars of the soft palate. All morphometrical data were subjected to statistical analysis (Snedecor and Cochran, 1994) using SPSS software version 17 and expressed as Mean \pm SE in cm. For microanatomical studies, tissue samples from the soft palate tonsil were fixed in 10% Neutral Buffered Formalin, washed thoroughly, dehydrated through graded alcohols and cleared in xylene (Bancroft and Gamble, 2008 and Singh and Sulochana, 1997). The tissues were then impregnated with paraffin wax (59-60°C) using a hot air oven and embedded in paraffin blocks. Sections of 5 μ m thickness were cut using a Leica

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semi-automatic microtome (Leica RM2125RTS) and mounted on clean, adhesive smeared glass slides. The sections were stained with Haematoxylin and Eosin method for routine histological examination, Crossman's trichrome for Connective tissue and Gomori's method for reticular fibres, (Singh and Sulochana, 1997, Bancroft and Gamble, 2008). The stained sections were examined under a light microscope to study the normal histomorphological features of the soft palate tonsil.

RESULTS AND DISCUSSION

Gross Anatomy and Morphometry

Well-developed soft palate tonsils were located in the tonsillar fossa between the palatoglossal and the palatopharyngeal arches, which concurs with the findings of Sisson (1975) and Casteleyn *et al.* (2011) in equines. The tonsils appeared as elongated oval or elliptical plaques located on either side of the median palatine ridge on the oral surface of the soft palate (Fig.1) as described by Prashanth *et al.* (2017) in pigs. The tonsils extended rostrally from the anterior pillar of the soft palate and terminated caudally along the border of the posterior pillar of the soft palate. The tonsillar mucosal surface was pitted by 130 to 160 evenly distributed fossules with circular or oval-shaped openings (Fig.2), that was in agreement with the reports of Belz (1998) and Casteleyn *et al.* (2011) in pigs.

The mean midline length of the soft palate tonsil measured was 2.5 ± 0.4 cm (Fig.3), while the length along the lateral margins was recorded as 3.2 ± 0.3 cm, whereas the length of the palatine tonsil was 2.5cm in carnivores (Ellenport, 1975), 3-4 cm in horses (Casteleyn *et al.*, 2011), 5cm in pigs (Belz, 1998 and Casteleyn *et al.*, 2011) and 6.16 ± 0.05 cm in Large White Yorkshire pigs (Prashanth *et al.*, 2017). The width of the soft palate tonsil at the levels of anterior and posterior pillars were recorded as 2.4 ± 0.5 cm and 1.0 ± 0.4 cm respectively (Fig.3), whereas the same was measured as 2-3 cm in horses (Casteleyn *et al.*, 2011) 3cm in pigs (Belz, 1998 and Casteleyn *et al.*, 2011) and 2.85 ± 0.05 cm in Large White Yorkshire pigs (Prashanth *et al.*, 2017).

Histology

The soft palate tonsil was located within the tonsillar sinus between the anterior and posterior pillars and was confined to the oral surface of the soft palate. Lymphocytic aggregations were also present on the nasal surface and at the free end, similar to the reports of Belz and Heath (1996) in pigs. In contrast, the tonsil has been reported to be located on the nasal surface in goats (Indu *et al.*, 2021) and ovine (Cocquyt *et al.*, 2005).

Numerous deeply extending and highly branched crypts (Fig.4) were observed which concurs with observations in pigs (Belz and Heath, 1996), horses (Kumar and Timoney, 2006) and young pigs (Ranjit and Singh, 2016). Each crypt consisted of a neck formed by invagination of the surface epithelium and a body lined by lymphoepithelium (Fig.6), as described by Belz and Heath (1996) in pigs. The crypt lumina contained degenerating epithelial cells and lymphocytes (Fig.5), although comparable reports in the literature are limited.

The soft palate tonsil was lined by non-keratinized stratified squamous epithelium, similar to the oral surface epithelium, consistent with findings in pigs (Belz and Heath, 1996; Kumar *et al.*, 2017), horses (Kumar and Timoney, 2006), young pigs (Ranjit and Singh, 2016) and buffaloes (Girgiri and Pawan, 2018). In goats, however, the rostral portion of the tonsil has been reported to be lined by pseudostratified ciliated epithelium, while the caudal portion is lined by stratified squamous epithelium (Indu *et al.*, 2021). The oral epithelium continued into the crypt neck and consisted of tightly packed layers of non-keratinized squamous cells with flattened, pyknotic nuclei (Fig.6), as reported by Belz and Heath (1996) in pigs. The crypt body was lined by lymphoepithelium composed of two to five layers of cell. Lymphocytic infiltration caused interruptions in the basement membrane, over which cuboidal or columnar epithelial cells were present. The intermediate layers consisted of polyhedral cells, while the superficial layers were composed of squamous or polygonal cells. Intraepithelial lymphocytes and goblet cells were also observed (Fig.7), aligning with Belz and Heath (1996) and Kumar *et al.* (2017) in pigs.

The tonsillar parenchyma was consisted of well-defined of lymphatic nodules and diffuse lymphatic tissue. Lymphatic nodules of varying sizes with prominent germinal centers and dense cortices were observed (Fig.4), containing small, medium and large lymphocytes. The lymphoid tissue was separated from adjacent glandular,

muscular and adipose tissue by thick bundles of collagen fibers and sparse reticular fibers (Figs.8,9), similar to reports of Kumar and Timoney (2006) in equines and Ranjit and Singh (2016) in young pigs. The parafollicular and interfollicular regions contained dense reticular fibers with few collagen fibers and blood vessels, similar to observations reported in goats (Indu *et al.*, 2021).

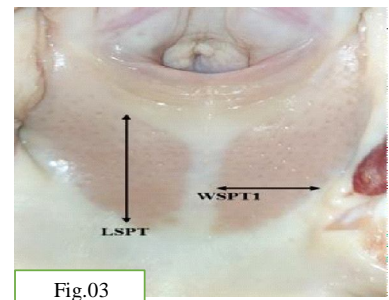


Fig.1 Photograph showing the soft palate tonsil (T) on the oral surface of the soft palate in the domestic pig. **Fig.2** Photograph of the soft palate in the domestic pig showing the soft palate tonsil with tonsillar fossules (TF). **Fig.3** Photograph showing the length of the soft palate tonsil (LSPT) and the width of the soft palate tonsil in the domestic pig.

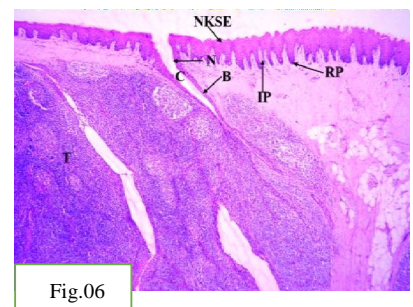
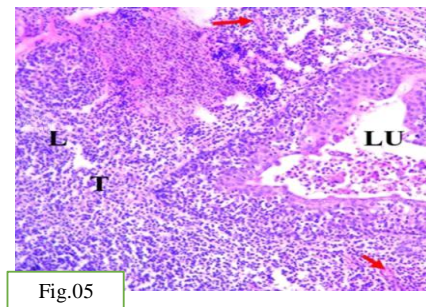
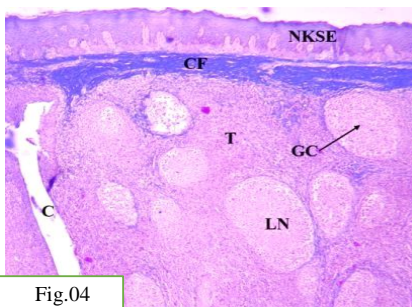


Fig.4 Photomicrograph of the oral surface of the soft palate of pig showing tonsil (T), tonsillar crypt (C) and lymphatic nodule (LN).CF- Collagen fibers, NKSE- Non-keratinized stratified squamous epithelium, GC- Germinal centre of Lymphatic nodule. Crossman's Trichrome method x40, **Fig.5** Photomicrograph of the tonsil of the soft palate showing the tonsillar crypt with degenerating cells in the lumen (LU) and showing blood vessels (Red arrows) in the tonsillar parenchyma. L- Lymphocytes and T- Tonsil. Haematoxylin and eosin method x400, **Fig.6** Photomicrograph of the tonsil of the soft palate of pig showing the tonsillar crypt (C) with neck (N) and body (B) extending into the lymphoid tissue. NKSE- Non-keratinized stratified squamous epithelium, IP- Interpapillary pegs, RP- Rete pegs, T- Tonsil. Haematoxylin and Eosin method x 40.

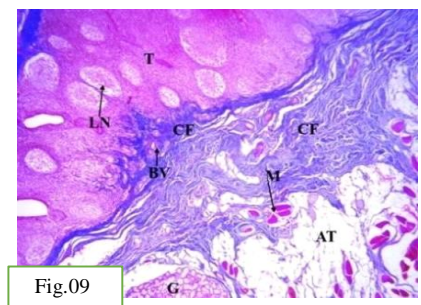
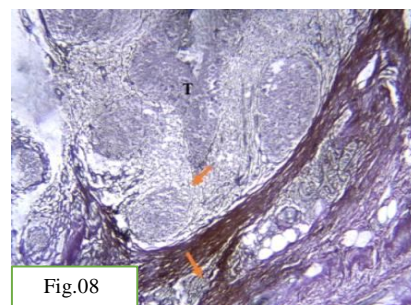
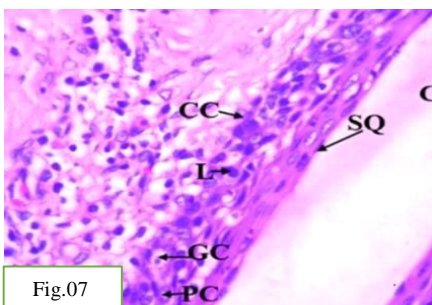


Fig.7 Photomicrograph of the tonsil of the soft palate of pig showing the cells in different layers of the lymphoepithelium lining the body of crypt (C). CC- Cuboidal cells, PC- Polyhedral cells, SQ- Squamous cells, GC- Goblet cell, L- Lymphocyte. Haematoxylin and Eosin method x 400, **Fig.8** Photomicrograph of the tonsil of the soft palate of pig showing the reticular fibers (Orange arrows) in and around the tonsil (T). Gomori's Reticulum method x 100, **Fig.9** Photomicrograph of the tonsil of the soft palate of pig showing collagen fibers (CF), separating the tonsil (T) from adipose tissue (AT), glands (G) and muscle fibers (M). BV- Blood vessel, LN- Lymphatic nodule. Crossman's Trichrome method x 100

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