

## Gross and Morphometrical Studies on the Soft Palate of Domestic Pig “(Sus scrofa domesticus)”

V Damini<sup>1\*</sup>, A Prasanth Babu<sup>2</sup>, M Santhi Lakshmi<sup>3</sup>, S Bharathi<sup>4</sup>,  
Department of Veterinary Anatomy, College of Veterinary Science, Tirupati- 517502

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### ABSTRACT

The present study was undertaken on the soft palate of the SVVUT-17 breed of domestic pig. The soft palate extended from the posterior margin of the hard palate caudally to about the middle of the epiglottis. It was nearly horizontal in position and consisted of two surfaces, the dorsal surface (nasal surface) and the ventral surface (oral surface). The mean length of the soft palate was  $5.7 \pm 0.6$  cm. The width was measured at the fixed border, at anterior pillar level, at posterior pillar level and at the free border of the soft palate and were recorded as  $5.0 \pm 0.4$  cm,  $4.4 \pm 0.3$  cm,  $5.2 \pm 0.5$  cm,  $3.7 \pm 0.4$  cm respectively. Four paired muscles, i.e., palatinus muscle, palatoglossus muscle, tensor veli palatini and levator veli palatini muscles were responsible for movement of the soft palate.

**Key words:** Soft palate, surfaces, domestic pig.

### INTRODUCTION

In recent years, the pig has gained considerable importance not only as a source of food but also as a valuable model for human health research and as a potential source of organs for transplantation (Rothschild, 2004). The soft palate is a musculo-mucosal shelf that forms the caudal continuation of the hard palate. It is a strong and movable fold that can be drawn upward during swallowing to close the nasopharynx, thereby preventing the passage of food into the nasal cavities (Ham, 1987). In addition, the soft palate plays an important role in several physiological functions, such as swallowing, salivation, taste perception, speech and immunological defense (Klein *et al.*, 1979). The literature available on the soft palate of domestic pigs is scanty. Hence, the present study was undertaken to elucidate the gross and morphometrical features of the soft palate in the domestic pig

### MATERIALS AND METHODS

In the present study, for gross and morphometrical studies of the soft palate, the heads of 12 adult domestic pigs were collected

immediately after slaughter. The upper and lower jaws were separated by dissecting at the temporomandibular joint level to visualize the soft palate clearly. 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 anatomical studies, the location of the soft palate and its relations with the epiglottis, tongue and pharynx were studied. For morphometrical studies, the length of the soft palate was measured along the midline from the rostral to the caudal end of the soft palate. The width of the soft palate was measured at the fixed border, at the anterior pillar level, at the posterior pillar level and at the free border of the soft palate. All recorded observations were subjected to statistical analysis (Snedecor and Cochran, 1994) using SPSS software version 17 and the results were expressed in Mean  $\pm$  SE in cm.

### RESULTS AND DISCUSSION

The soft palate was observed as a thick musculo-membranous curtain or fold located caudal to the hard palate, separating the oropharynx from the nasopharynx. It extended from the posterior margin of the hard palate to about the middle of the epiglottis caudally (Fig.1), which concurs with the findings of Sisson (1975) and

1\*M.V.Sc. Scholar, Department of Veterinary Anatomy, C. V. Sc., Tirupati, 2.Asst. Prof. C.V.Sc, Proddatur, 3. Professor and Head, C.V.Sc, Tirupati, 4. Professor, VCC, C.V.Sc, Tirupati.

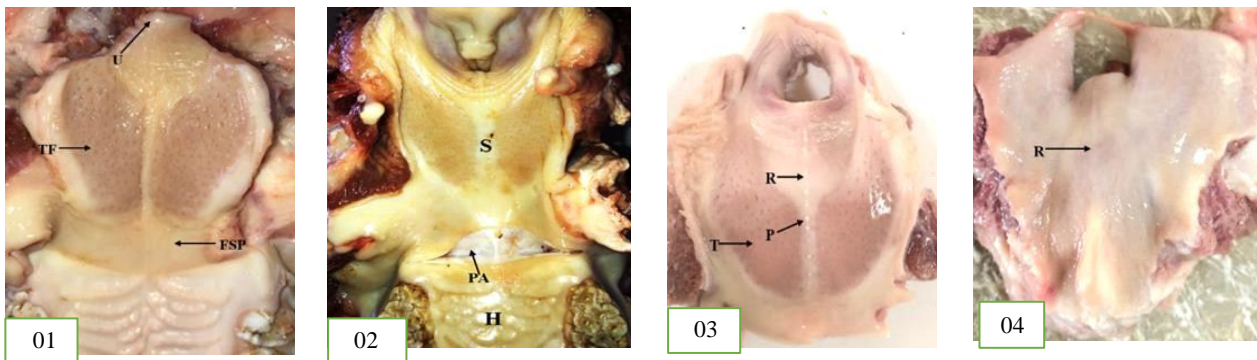
\*Corresponding author: vempallidaminee@gmail.com,

Nickel *et al.* (1979) in pigs. In contrast, in rabbits the soft palate was reported to extend rostrally from the caudal border of the first molar or the middle of the second molar to the middle of the epiglottis caudally (Mahdy and Mohamed, 2021). The soft palate was attached to the hard palate by the palatine aponeurosis, which consisted of a thin fibrous lamella formed by the extended tendons of the tensor veli palatini muscles (Fig.2). The soft palate was nearly horizontal in position and consisted of two surfaces, the dorsal surface (nasal surface) and the ventral surface (oral surface) (Figs.3,4) as reported by Nickel *et al.* (1979) in pigs. The oral surface of the soft palate showed a median longitudinal ridge extending throughout its length and studded with papillae (Fig.3). Similarly, Cleaton-Jones (1975) and Klein and Schroeder (1979) in monkeys reported that close to the midline of the soft palate, numerous oval islands or papillae were observed. On either side of this ridge, soft palate tonsils were observed as reported by Prashanth *et al.*, (2017) in pigs. The nasal surface of the soft palate also showed a median longitudinal ridge but lacked papillae and tonsils on either side of the ridge (Fig.4). Contrary to this, the tonsils of the soft palate were located on the nasal surface of the soft palate in sheep (Casteleynet *et al.*, 2011) and goats (Indu *et al.*, 2021). On each side of the oral surface of the soft palate, a short and thick fold extended from the middle of the lateral border of the soft palate to the lateral border of the root of the tongue called the palatoglossal arch or anterior pillar of soft palate (Fig.5), that concurs with the findings of Habel (1975) in ruminants and Sisson (1975) in equines. This arch was composed of fibrous tissue and extended fibers of the palatoglossus muscle. The lining mucosa of soft palate continued into the pharyngeal cavity, to form another fold called the palatopharyngeal arch or posterior pillar, which extended on each side near the free border of the soft palate to the lateral wall of the pharynx (Fig.6) as reported by Habel (1975) in ruminants and Sisson (1975) in equines. Caudally, the lateral borders of the soft palate were also attached to the lateral margins of the epiglottis by mucosal folds. In five of the twelve specimens,

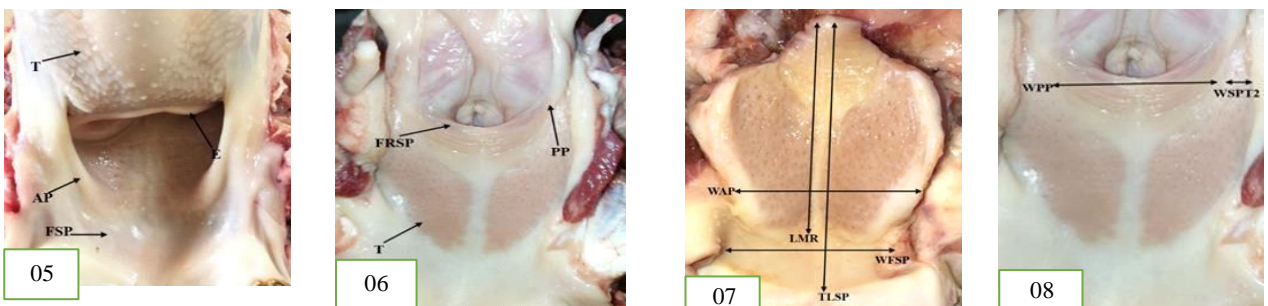
a small blunt median prolongation, the uvula, was observed at the free border of the soft palate (Fig.1) as reported by Sisson (1975) and Nickel *et al.* (1979) in pigs. In contrary to this finding, the uvula was reported to be absent in carnivores (Ellenport, 1975).

The mean length of the soft palate was recorded as  $5.7 \pm 0.6$  cm (Fig.7), while it was measured as 15 cm in equines (Sisson, 1975), 8-12 cm in carnivores (Nickel *et al.*, 1979) and approximately 5 cm in porcine (Sisson, 1975 and Nickel *et al.*, 1979). The width of the soft palate measured at the fixed border, anterior pillar level, posterior pillar level and free border were recorded as  $5.0 \pm 0.4$  cm,  $4.4 \pm 0.3$  cm,  $5.2 \pm 0.5$  cm,  $3.7 \pm 0.4$  cm, respectively (Figs.7,8), while in rabbits the width was gradually decreased from  $16.7 \pm 0.7$  mm at cranial part to the  $11.9 \pm 1.4$  mm at caudal part (Mahdy and Mohamed, 2021). The length of the median longitudinal ridge was  $5.5 \pm 0.5$  cm on the oropharyngeal surface (Fig.7) and  $4.5 \pm 0.5$  cm on the nasopharyngeal surface.

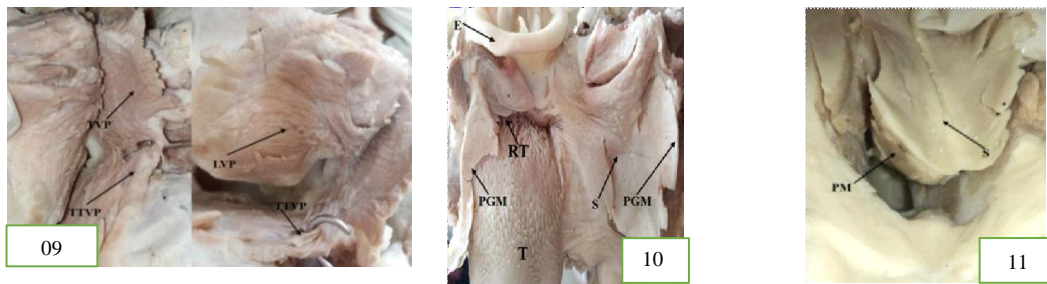
Four paired muscles, i.e., palatinus muscle, palatoglossus muscle, tensor veli palatini and levator veli palatini muscles were responsible for the movements of the soft palate. The palatinus muscle was observed as a small, bright red fasciculus lying along with its fellow in the midline of soft palate as reported by Sisson (1975) in equines. This muscle originated from the posterior border of the bony palate and terminated in the aponeurosis near the caudal border of the soft palate (Fig.11), which was in agreement with the findings of Habel (1975) in ruminants and Sisson (1975) in equines. The palatoglossus muscle arose from the lateral border of the soft palate and terminated in the root of the tongue (Fig.10) as reported by Habel (1975) in ruminants. The tensor and levator veli palatini muscles originated from the muscular process of the temporal bone and spread into the soft palate, which concurs with the findings of Clair (1975) in carnivores. The tendon of the tensor veli palatini muscle ran along the side of hamulus of the pterygoid bone (Fig.9) as reported by Habel (1975) in ruminants.



**Fig.1** Photograph of the soft palate of pig showing the Uvula (U), Tonsillar fossules (TF) and Fixed border of the soft palate (FSP). **Fig.2** Photograph showing the Palatine aponeuosis (PA), Soft palate (S) and Hard palate (H). **Fig.3** Photograph showing the Papillae (P) on the Mid-palatine ridge (R) of the oral surface of the soft palate of pig and Tonsil of the soft palate (T) **Fig.4** Photograph showing the Mid-palatineridge (R) on the nasal surface of the soft palate.



**Fig.5** Photograph of the oral surface of the soft palate of pig showing the Posterior pillar (PP), Free border of the soft palate (FRSP) and Tonsil(T). **Fig.6** Photograph of the oral surface of the soft palate of pig showing the Anterior pillar (AP), Epiglottis (E), Fixed border of the soft palate (FSP) and Tongue (T). **Fig.7** Photograph of the soft palate of pig showing Total length of the soft palate (TLSP), Length of mid- palatine ridge (LMR), Width of the soft palate at anterior pillar level (WAP) and Width of soft palate at fixed border (WFSP). **Fig.8** Photograph of the soft palate of pig showing Length of soft palate tonsil (LSPT), Width of soft palate tonsil at anterior pillar level (WSPT1), Width of soft palate tonsil at posteriorpillar level (WSPT2) and Width of soft palate at posterior pillar level (WPP).



**Fig.9** Photograph showing the Levator veli palatini muscle (LVP)Tensor veli palatini muscle (TVP) and Tendon of tensor veli palatini muscle (TTVP) in soft palate of pig. **Fig.10** Photograph showing the Palatoglossus muscle (PGM) of soft palate (S) of pig, Epiglottis (E), Root of tongue (RT) and Tongue (T). **Fig.11** Photograph showing the Palatini muscle (PM) of soft palate (S) of pig.

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