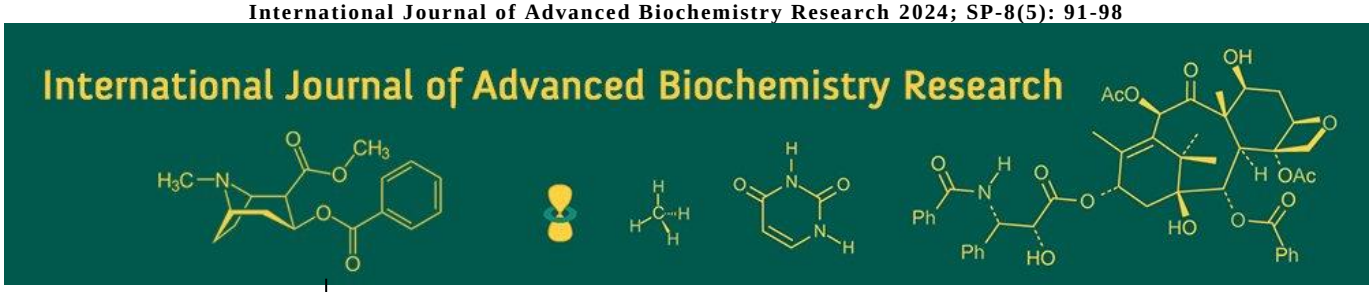

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Age related micro anatomical changes in stomach of Indian domestic pig (*Sus scrofa domesticus*)

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Abstract
Stomach wall of domestic pig had four layers *i.e.*, tunica mucosa, submucosa, muscularis and serosa in all four regions. Non-glandular region was lined by non-keratinized stratified squamous epithelium. In Group-I lymphatic infiltration appeared in diffuse form but in Groups II and III lymphatic nodules were scattered at oesophageo-cardiac junction. In cardiac region, gastric pits were wide in group-I, narrow in group-II and wide and shallow in group-III. Cardiac glands were simple, branched, coiled tubular glands whose branching increased up to 21st day piglet beyond which it ceased. Parietal cells increased in number in group-I but decreased in higher groups. Diffuse lymphatic infiltration was seen in group-I followed by lymphatic nodules in groups-II and III. Thick lamina muscularis comprised smooth muscle. Tunica submucosa with loose connective tissue and fat cells seen in group-III. Tunica muscularis consisted of inner circular and outer longitudinal layers of smooth muscle fibres and outer tunica serosa covered by mesothelium. In fundic region, mucosa exhibited rugae with gastric pits opening between them. Fundic glands were branched long tubular glands that increased in length with age and were closely packed together and had thin glandular portions compared to cardiac glands. Parietal cells, chief cells and mucous cells were present in all age groups. Mucous cells became predominant in groups-II and III. Lamina propria was a thin layer with irregular tubes of fundic glands. In pyloric region gastric pits deepened with increasing age from group I to III. Parietal cells were more in 6th day piglets and decreased in older animals.

Keywords: cardiac, fundic, pyloric, parietal cells, chief cells

Introduction
The stomach of the pigs is structurally and functionally divided into four different regions - pars oesophagea, cardiac, fundic and pyloric parts (Rouchey 2009) [31]. The oesophagus opens into the stomach by a wide infundibulum. The squamous epithelium of the oesophagus changes abruptly to simple columnar epithelium at the junction of oesophageal and fundic portions of stomach (Mac Lean, 1948) [26]. Non-glandular region of the mucosa was small in pigs. The cardiac gland region covered nearly a half of the stomach including the diverticulum in pigs, the fundic region occupied one fourth of the stomach mucosa and the pyloric gland region is small representing approximately one fourth of the mucosa. (Eurell and Frappier, 2006) [13].

Gastric glands in cardiac region of stomach of pig were simple tubular glands with one or two branches which opened into shallow gastric pits through a wide lumen. In this region many large lymphoid nodules were distributed with regularity (Imai *et al*., 1988) [18]. The proper gastric glands were simple tubular and longer than cardiac glands and the pyloric glands were simple branched coiled tubular glands and relatively shorter compared to other gastric glands. (Ghoshal and Bal, 1989) [15].

A feature unique to pig stomach among domestic species is the presence of conical diverticulum projecting caudally from its fundus. A second feature is a very prominent torus narrowing the pyloric canal at the point of its exit into the duodenum (Dyce *et al*., 2010) [11]. Cardiac gland region consists of three cell types *viz.*, mucous neck, chief and thecal cells but lacks parietals cells. Fundic region consists of four distinct cell types *viz.*, mucous neck cells, chief cells, parietal cells and enterochromaffin cells. Porcine stomach contains more triangular parietal and argentaffin cells. (Roy, 1974) [32].

Materials and Methods

Stomach samples for this study were procured from eighteen (18) apparently healthy pigs irrespective of their sex immediately after slaughter at regular weekly intervals from local slaughter houses in and around Hyderabad. These specimens were divided into three groups *i.e.,* Group I (piglets), Group II (weaners) and Group III (adults) as per their approximate age based on dentition pattern (Sastry and Thomas, 2021) [34]. Soon after collection, the specimens were cleaned and washed thoroughly with normal saline to remove blood stains and were immediately packed neatly in polythene bags kept in ice box for transportation to the laboratory for necessary studies. For histological studies the tissue pieces of stomach were collected immediately after slaughter and fixed in 10% Neutral Buffered Formalin and Bouin's fluid (Singh and Sulochana, 1997) [38]. The fixed specimens were processed for routine paraffin embedding technique and sections of 4-5µm thickness were obtained and subjected to the following histological staining methods: Haematoxylin & Eosin (H&E) technique (Singh and Sulochana, 1997) [38], Masson's Trichrome method (Singh and Sulochana, 1997) [38], Van-Gieson's (Singh and Sulochana, 1997) [38], Wilder's method (Singh and Sulochana, 1997) [38], Verhoeff's method (Culling, 1974) [9].
The present investigation and its experimental design were approved by the Institutional Animal Ethics Committee (IAEC), vide Cir. No.15/26/C.V.Sc,/Hyd./ IAEC: Dt. 26.06.2023.

Results and Discussion

In present investigation non-glandular region of the stomach of domestic pig was lined by non-keratinised stratified squamous epithelium. These findings are similar to the observations made by several authors, *viz.*, Kurohmaru *et al.* (1981) [22] in golden hamster, Dellmann and Brown (1982) in pig, Suckow *et al.* (2006) [40] in rats, Chandana *et al.* (2013) [8] in albino rats, Samreen (2016) [42] in guinea pig and Sujana *et al.* (2017) [39] in pig. There was partial similarity to Langer (1977) [23] in collared peccary and Shoeib *et al.* (2015) [37] in kangaroo, who reported that the mucosa of non-glandular region consisted of keratinized stratified squamous epithelium. Lamina propria of pig stomach studied showed that it was made up of thin layer of dense connective tissue with collagen and reticular fibres which increased with age. This aligns with the results of Shoeib *et al.* (2015) [37] in kangaroo and Sujana *et al.* (2017) [39] in pig. Lamina propria was devoid of glands and it projected as pointed folds into the epithelium of non-glandular part of stomach in which lymphatic nodules were scattered and less in group I. These observations are similar to reports by Fayed *et al.* (2010) [14] in monkeys. Lamina muscularis was thick and composed of smooth muscle fibres which continued as a relatively thin layer into cardiac region of stomach similar to reports by Shoeib *et al.* (2015) [37] in kangaroo. The tunica sub mucosa was thick and composed of collagen fibres, few blood vessels and nerve fibres. This finding is in partial agreement with Samreen (2016) [42] who stated that tunica submucosa was thin and consisted of loose connective tissue. Tunica muscularis was made up of inner circular and outer longitudinal layers of smooth muscle fibres. Collagen fibres were seen in between muscle layers similar to the reports of Leus *et al.* (1999) [24] in Babirusa pigs.
Stratified squamous epithelium of non-glandular region abruptly changed to simple columnar type at the oesophageo-cardiac junction in pig stomach in this study. This organ was simple glandular type with three regions *i.e.*, cardiac, fundic and pyloric regions. These observations are in accordance with the findings of Sherwood (2002) [35] in mammalian stomachs and Khaleel and Ghafi (2012) [20] in rabbits. Each region had some characteristic features which differed from other regions, similar to the reports of Hussein and Khalid (2019) [17] who reported the same ion Mangoose stomach. In this study gastric mucosa was lined with typical simple columnar epithelia without goblet cells. Between the glands, particularly between their middle and lower thirds, more connective tissue was observed, with very fine fibers and some amount of adipose tissue found in all age groups. Our findings are similar to the observations made by Samreen (2016) [42] and Raja *et al.* (2022) [29] in guinea pig. Additionally, Bobomurodov (2022) [7] reported that glandular region had a larger area of location at larger curvature of the organ than that of small curvature which had the glandular region from the place of confluence of the esophagus into the stomach to pyloric canal. Lining epithelium of tunica mucosa in cardiac region in stomach of pig in this study consisted tall columnar cells resting on basement membrane with basal nuclei. Our observations are similar to the findings of Khaleel and Ghafi (2012) [20] in rabbits and Samreen (2016) [42] in guinea pigs. Gastric mucosa formed shallow gastric pits that continued into simple ducts of cardiac glands in all age groups which is fairly in accordance with the reports of Imai *et al.* (1988) [18] in pig, Goshal and Bal (1989) [15] in rat, mice and guinea pig and Ranjan and Das (2018) [30] in rabbits. In contrast to our observations the findings of Leus *et al.* (1999) [24] in dogs, Shibata *et al.* (1988) [18] in Babirusa pigs, Adimoradi and Sheibani (2006) [1] in Caspian pony and Fayed *et al.* (2010) [14] in monkeys stated that gastric pits of cardiac region were deep and lined by simple columnar epithelium.
Cardiac glands were simple branched coiled tubular glands loosely distributed throughout connective tissue of lamina propria. These findings are akin with the reports of Leus *et al.* (1999) [24] in Babirusa pigs, Khaleel and Ghafi (2012) [20] in rabbits and Chandana *et al.* (2013) [8] in rats. Greenwood (1885) [16] and Samreen (2016) [42] stated that cardiac glands were simple tubular units with one or two branches. These findings are contrary to the observations made by Adibmoradi and Sheibani (2006) [1] who stated that the gastric glands in Caspian pony were located in submucosa of fore stomach and lamina propria of posterior part of the stomach. In group I the branching of the glands increased from day old pig to sixth day piglet but in twenty-one-day piglet branching of cardiac glands ceased. Further branching was not seen in group II and group III. This observation aligns with Archer (1962) [3] who stated that glands reached their maximum branching in all regions of the stomach by the third week of age in pigs. Cardiac glands were composed of mucous cells, parietal cells and occasionally chief cells. In all age groups, mucous cells were primarily located at the neck of the gland and comprised cuboidal cells with basal nuclei and mucin at their apical portion. These findings are in accordance with the observations by Ranjan and Das (2018) [30] who stated that in rabbit stomach mucous cells were observed near the surface in the lining epithelium and in neck region of the glands that lined the gastric pits.
Glandular units comprised primarily of cuboidal mucous cells with basal nuclei which is similar to the observations

made by Eurell and Frappier (2006) [13]. Mucous cells in general had increased in number in group I, however a whole section of gland was made entirely of parietal cells which were more in group I but their number decreased in group II and III. This finding is similar to the reports made by Barros Moraes *et al.* (2002) [5] in capybara stomach lined by glandular epithelium with cardiac glands containing great number of parietal cells. Similarly, Archer (1962) [3] reported that the cardiac glands were made up exclusively of parietal cells which was observed in three-week-old piglet and in adult appearance by shedding parietal cells and an increase in the population of mucous cells. Similarly, Alaa and Luay (2022) [2] reported that in neonatal cats the principal cell type of the cardiac glands was the mucous secreting cell and also had few numbers of parietal cells, while chief cells were absent.

Mucous cells were found at the base of the glands in groups II & III with their population increasing from group II to III. Our observations are akin with the findings of Khalel and Ghafi (2012) [20] in adult local rabbits who stated that mucous cells were predominant cell type in cardiac region with few parietal cells which were present either singly or mixed with mucous neck cells along the periphery of the glands. Lymphatic nodules were observed at oesophageo-cardiac junction but in cardiac region diffuse lymphatic infiltration was seen in all age groups. Lymphatic nodules were occasionally observed in group II and III which was also reported by Sujana *et al.* (2017) [39] in adult pig. Mucosal depth increased across age groups studied which is akin to the observation made by Archer (1962) [3] that the depth of the mucosa in glandular zones in pig increased in different ages. Lamina muscularis was thick and made up of smooth muscle bundles in continuation with lamina muscularis of non-glandular part as stated by Raja *et al.* (2022) [29] in guinea pigs in all age groups. This is contrary to the observations made by Samreen (2016) [42] who stated that muscularis mucosa was thin and consisted of circularly arranged smooth muscle fibres in guinea pigs.

Tunica sub mucosa made up of loose connective tissue with numerous small and large blood vessels similar to Khaleel and Ghafi (2012) [20] in rabbits and Samreen (2016) [42] in guinea pigs. Fat cells were observed in group III. Lymphatic infiltrations were high so the lymphoid nodules located in sub mucosa in group III are similar with the reports made by Samreen (2016) [42] in guinea pigs. These glands were absent in sub mucosa of cardiac region in all age groups studied. These finding are in disagreement with the observations made by Adibmoradi and Sheibani (2006) [1] reported the presence of gastric glands in sub mucosa of Caspian pony.

The tunica muscularis comprised of inner circular and outer longitudinal layers of smooth muscle fibres arranged in bundles, similar to the observations by Khaleel and Ghafi (2012) [20] in rabbits. Large amount of connective tissue containing collagen fibres, reticular fibres separated the smooth muscle bundles in this layer are akin with the observations made by Samreen (2016) [42] in guinea pigs. In most of the domestic animals like dogs, cats, ruminants and horses, Eurell and Frappier (2006) [13] mentioned that these two layers of muscles were separated by moderate amount of connective tissue. The tunica serosa forms the outer most layer of the stomach which was made up of loose connective tissue, blood vessels, nerves and was covered by mesothelium externally are akin with the observations made by Khaleel and Ghafi (2012) [20] in rabbits, Samreen (2016) [42] and Raja *et al.* (2022) [29] in guinea pigs.

Lining epithelium of fundic region in pig stomach consisted of tall columnar cells in this study unlike that in sheep fundic mucosa reported by Poonia *et al.* (2012) [28] who stated that the lining was simple columnar epithelium. Mucosa at this region showed rugae between which the gastric pits opened and these pits were relatively shorter than those in cardiac region. This is similar to the observations of Khaleel and Ghafi (2012) [20] in rabbits, Samreen (2016) [42] and Raja *et al.* (2022) [29] in guinea pigs, who reported that the fundic glands were branched long tubular glands with thinner glandular portions than cardiac glands which is in agreement with Khaleel and Ghafi (2012) [20] in rabbits. Samreen (2016) [42] stated that fundic glands were simple tubular glands. as reported by Imai *et al.* (1988) [18] in pigs and Fayed *et al.* (2010) [14] in monkeys, Eurell and Frappier (2006) [13] stated that gastric pits were deep with short tortuous glands in dogs.

In present study the glands increased in length as age advanced which is in accordance with the reports of Archer (1962) [3] who stated that from 4th week onwards the glands increased in length bringing about an increase in depth of the mucous membrane. Lamina propria was reduced to a thin layer between the glands which is similar to reports of Samreen (2016) [42] in guinea pigs. However, in contrast Greenwood (1885) [16] stated that connective tissue was more in between fundic glands. Fayed *et al.* (2010) [14] stated that lamina propria was completely occupied by fundic glands with very little amount of connective tissue.

Cell types of gastric glands observed in this study resemble the reports of Eurell and Frappier (2006) [13] in carnivores, horses and pigs who stated that secretory epithelium of gastric glands comprised four distinct cell types *viz.*, mucous neck cells, chief cells, parietal ells. Our studies are also similar to findings of Raja *et al* (2022) [29] in guinea pigs who reported that simple tubular glands composed of mucous neck cells, parietal cells and chief cells. In six-day old piglets mucous neck cells were more in the neck region of the gland but in twenty-one-days old piglets the number of mucous cells at neck of the gland reduced. In group II and III, mucous cells were located at the base of the gland and they were predominant cell population than other cell types. These findings are in accordance with observations made by Archer (1962) [3] who stated that mucous cells from ninth week onwards seemed to be predominant element of cell population.

Mucous cells were scattered between parietal and chief cells and there was no discernible pattern of distribution between parietal and chief cells in group II and III. These findings are akin to Archer (1962) [3] who noticed that fundic zone did not display a specific or consistent pattern regarding arrangement of the cells in age related study of pig gastric mucosa. Similarly, Enas *et al.* (2023) [12] reported that lamina propria in neonatal mice did not show well-demarcated parietal and chief cells.

The parietal cells were large, triangular to spherical in shape with a fairly large spherical nucleus whereas the chief cells were irregular in shape with a round nucleus located at the basal portion with granules towards the periphery. Parietal cell population decreased as the age advanced and chief cells were located at the bottom of the gland in group I. Their population increased with age and the same was continued in groups II and III. These findings are related to

Kametaka and Imai (1956) [19], who found that the chief cells increased in number from neck through the body to fundus in pigs. The lamina propria was occupied by heavily irregular tubes of fundic glands, thin layer of loosely arranged fibro-elastic connective tissue, blood vessels and nerves similar to Raja *et al.* (2022) [29] in guinea pigs. In group I, occasional lymphatic nodules were seen in lamina propria while other groups showed diffused form Lamina muscularis was thin and was made up of smooth muscle fibres. similar to Samreen (2016) [42] and Raja *et al.* (2022) [29] in guinea pigs.

The sub mucosa was relatively thick with dense connective tissue populated with collagen, reticular fibres, small and large sized blood vessels, similar to Samreen (2016) [42] and Raja *et al.* (2022) [29] in guinea pigs. Poonia *et al*. (2012) [28] s42tated that sub mucosa in fundic region of sheep was made up of loose irregular connective tissue with fine blood capillaries and a few isolated nerve bundles. Fat cells were observed in group II and group III. Collagen fibres increased in number and thickness as age advanced. Tunica muscularis was made up of extremely thin inner circular layer of muscle and a very thick outer longitudinal layer of smooth muscle bundles. In between muscle bundles collagen and reticular fibres are seen in all groups studied which is similar to Khallel and Ghafi (2012) [20] in rabbits and Samreen (2016) [42] in guinea pigs. An additional oblique layer at some places was also reported by Poonia *et al.* (2012) [28] in sheep. Tunica serosa was same as in cardiac region in all age groups but was relatively thick at some places with small fat cell aggregations in group III specimens. This is similar with Khallel and Ghafi (2012) [20] in rabbits, Poonia *et al*. (2012) [28] in sheep, Samreen (2016) [42] and Raja *et al* (2022) [29] in guinea pigs who stated that the tunica serosa forms the outer most layer of fundic region consisting areolar and adipose connective tissue, blood vessels and nerves.

Tunica mucosa was thicker than cardiac and fundic region which is in partial agreement with findings of Ghoshal and Bal (1989) [15] and Leus *et al*. (1999) [24] who stated that the tunica mucosa of pyloric region was thinner than gastric and thicker than cardiac regions in Babirusa pig stomach. Epithelium was lined by tall columnar cells in pyloric portion of stomach unlike Mahdi *et al*. (2013) [27] who stated that pyloric region of stomach was covered by low columnar to cuboidal epithelium in rabbits and lamina propria contained delicate reticular fibres.

Pyloric glands were simple branched tubular glands unlike Eurell and Frappier (2006) [13] who noted that pyloric glands were simple branched coiled tubular glands in pigs. Gastric pits were deeper in pyloric region which is in concurrence with findings of Leus *et al*. (1999) [24] who stated that gastric pits were deep in Babirusa pigs. Eurell and Frappier (2006) [13] stated that gastric pits were deeper in pyloric region than in cardiac and proper gastric gland region of ruminants and pigs, Berghes *et al.* (2011) [6] in guinea pigs, Khaleel and Ghafi (2012) [20] in rabbits and Samreen (2016) [42] in guinea pigs who stated that gastric pits were longer than other two regions.

In group I, six-day old piglet exhibited few mucous cells at the base of the gland, whereas in twenty-one-day piglet it showed an increase in number of mucous cells. Groups II and III had higher count of mucous cells. These observations are in concurrence with the observations of Eurell and Frappier (2006) [13] in domestic animals, Ranjan and Das (2018) [30] and Khalel and Ghafi (2012) [20] in rabbits who stated that the mucous cells were predominant with flat basal nucleus and basophilic cytoplasm.

Similarly, Alaa and Luay (2022) [2] reported in neonatal cats that pyloric glands had predominant mucous-secreting cells with few parietal cells and no chief cells. The pyloric zone in group I had fewer parietal cells when compared to cardiac region. The parietal cells were less in pyloric glands which is contrary to Kirk (1910) [21] and Mac Lean (1948) [26] who stated that parietal cells were absent in pylorus of pigs whereas Roy (1974) [32] cited that porcine stomach had triangular parietal cells.

Parietal cell count was highest in the early ages of group I and decreased as the animals grew older in groups II and III. This is similar to Khaleel and Ghafi (2012) [20] in rabbits and Archer (1962) [3] reported that the parietal cells decreased in number as the animal became older. Lymphatic aggregation extended in between the pyloric glands. Lamina muscularis was a thick layer comprising layers of smooth muscle bundles which is in accordance with the findings of Mahdi *et al*. (2013) [27] in rabbits who stated that muscularis mucosa in pyloric region had two layers of smooth muscle fibres.

Submucosa appeared similar to the fundic region which is akin to reports of Khaleel and Ghafi (2012) [20] in rabbits and Samreen (2016) [42] in guinea pigs who stated that it comprised loose connective tissue, collagen fibres, blood vessels and lymphocytes. In group III fat cells were more than other groups. It was unlike the tunica sub mucosa of rabbits which was simple loose connective tissue without lymphatic infiltrations (Mahdi *et al*., 2013) [27]. Tunica muscularis was same as in other regions but was relatively thicker than in any other region of stomach. It was made up of inner circular and outer thick longitudinal layer of smooth muscle fibres. Similar observations were made by Eurell and Frappier (2006) [13] in pyloric stomach of domestic animals, Khaleel and Ghafi (2012) [20] in rabbits and Samreen (2016) [42] in guinea pigs. Tunica muscularis was relatively thicker than in any other portion of the stomach which resembles the observations made by Eurell and Frappier (2006) [13] in pyloric stomach of domestic animals wherein mucosa and submucosa were bulged with thickened layer of tunica muscularis which formed a pyloric sphincter called 'torus pyloricus'. Tunica serosa was thick and composed of loose fibro-elastic connective tissue enclosed by a single layer of mesothelial cells which is similar to reports of Mahdi (2013) [27], Khaleel and Ghafi (2012) [20] in rabbits and Samreen (2016) [42] in guinea pigs.

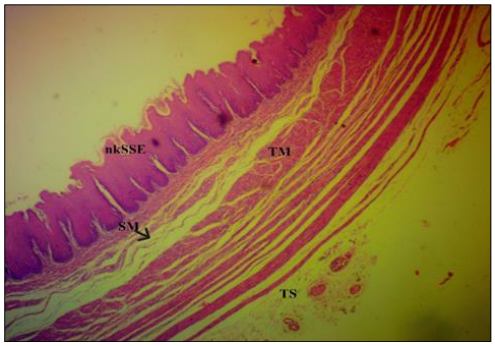

Fig 1: Photomicrograph of G-I (6 day) piglet stomach showing non-glandular region lined by non-keratinized stratified squamous epithelium (nkSSE), submucosa (SM), tunica muscularis (TM) and tunica serosa (TS). H&E 4x

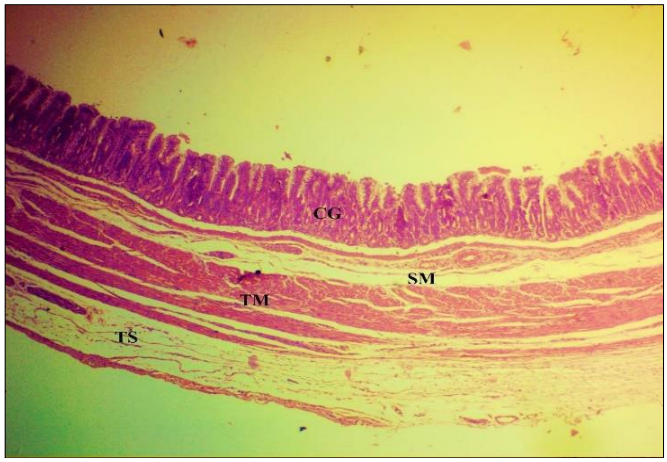

Fig 2: Photomicrograph of G-I (6 day) piglet stomach showing cardiac region with cardiac gland (CG), submucosa (SM), tunica musularis (TM) and tunica serosa (TS). H&E 4x

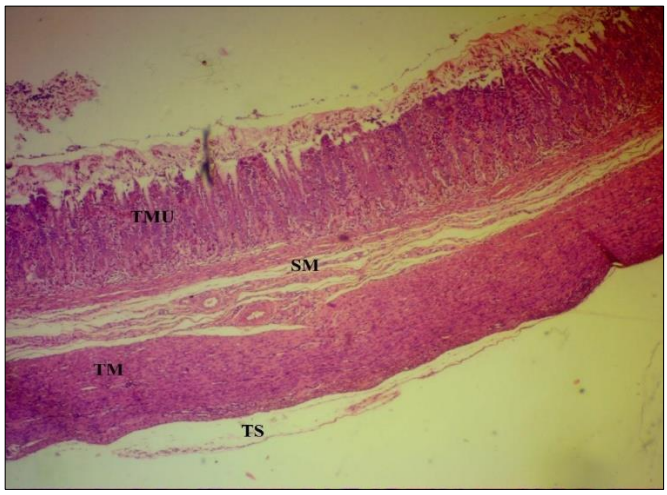

Fig 3: Photomicrograph of G-I (21 day) piglet stomach showing fundic region with tunica mucosa (TMU), submucosa (SM), tunica muscularis (TM) and tunica serosa (TS). H&E 4x

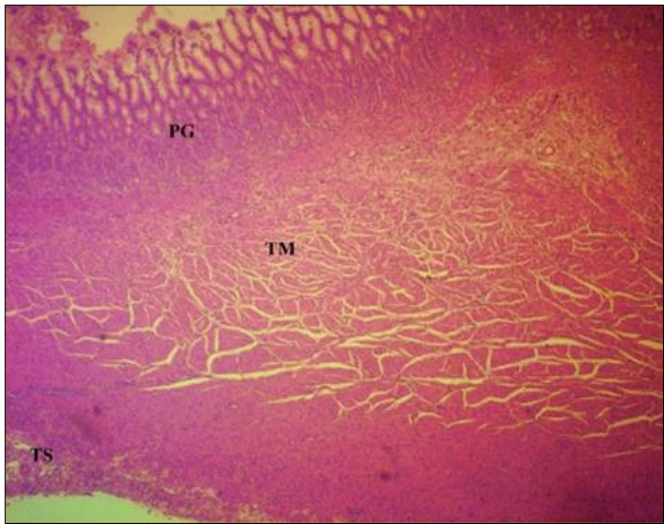

Fig 4: Photomicrograph of G-I (6 day) piglet stomach showing pyloric region with pyloric gland (PG), tunica muscularis (TM) and tunica serosa (TS) H&E

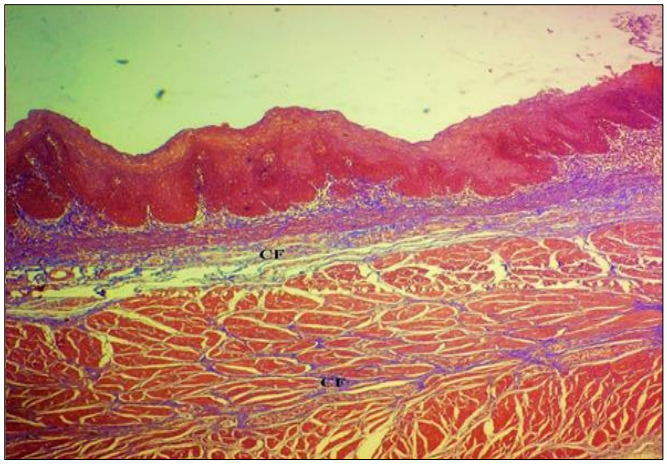

Fig 5: Photomicrograph of G-I (6 day) piglet stomach showing non glandular region with collagen fibres (CF) and tunica muscularis (TM) Masson's Trichrome 10x

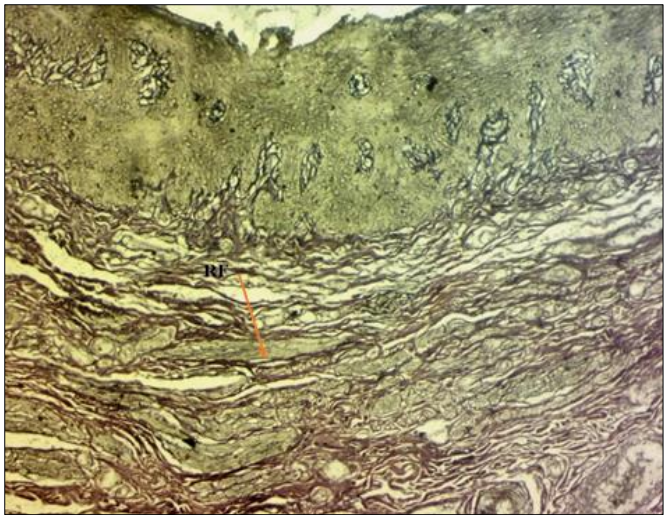

Fig 6: Photomicrograph of G-III pig stomach showing non glandular region with reticular fibres (RF). Wilder's 10x

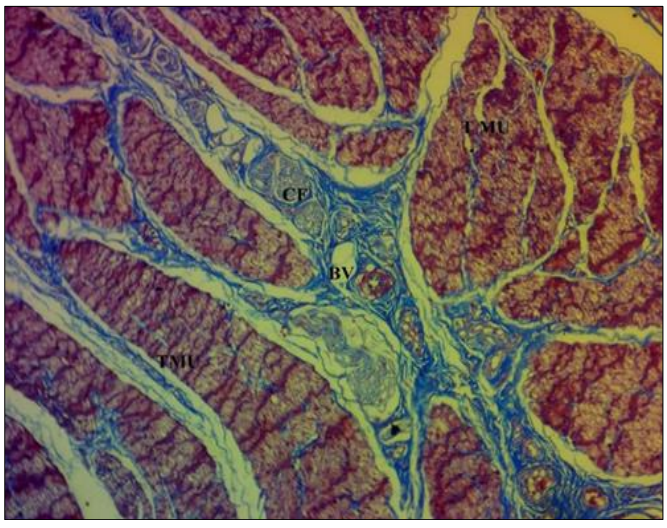

Fig 7: Photomicrograph of G-III pig stomach showing non glandular region with collagen fibres (CF), blood vessels (BV) in tunica muscularis (TM). Masson's Trichrome 10x

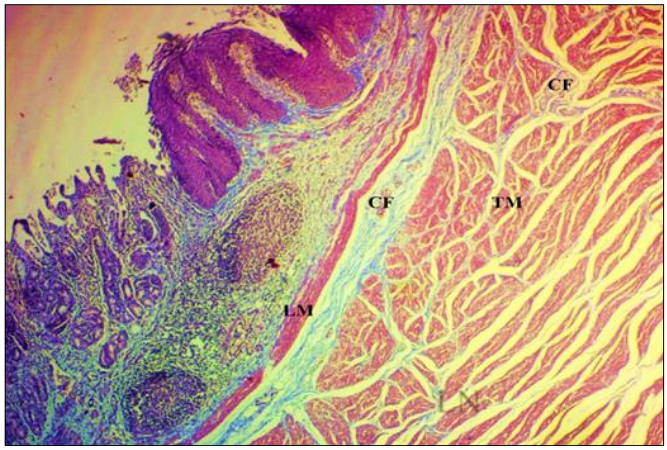

Fig 8: Photomicrograph of G-II pig stomach showing oesophageal-cardiac junction with lymphatic nodule (LN), lamina muscularis (LM), collagen fibres (CF) and tunica muscularis (TM). Masson's Trichrome 4x

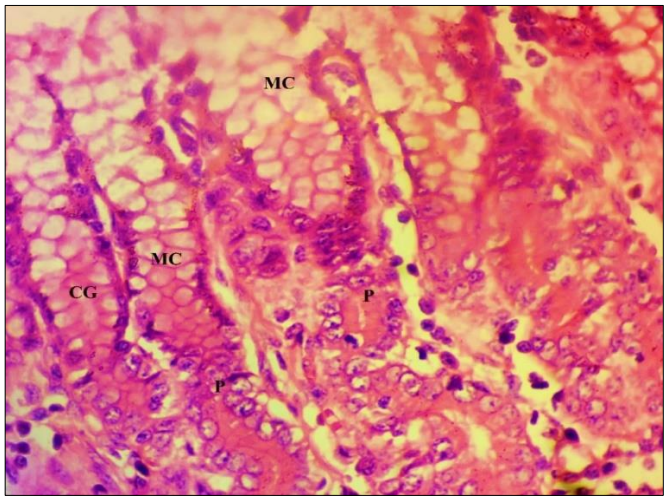

Fig 9: L/S Photomicrograph of G-I (6 day) piglet stomach showing cardiac region with cardiac gland (CG), mucous cells (MC) and parietal cells (P). H&E 40x

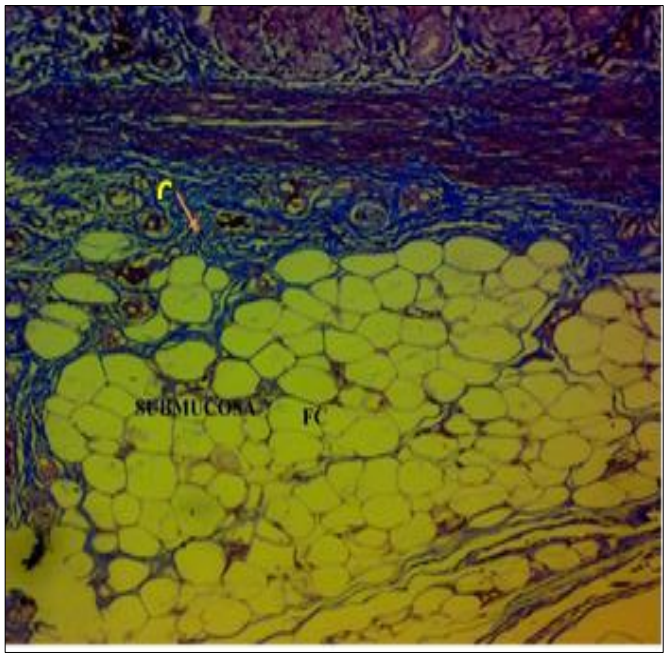

Fig 10: C/S Photomicrograph of G-III pig stomach showing cardiac region with submucosa made up of collagen fibres (CF) and adipocytes (FC). Masson's Trichrome 10

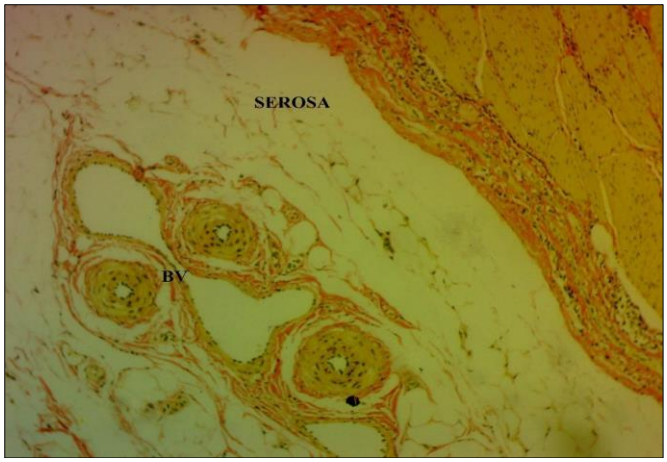

Fig 11: Photomicrograph of G-III pig stomach showing cardiac region with serosa made up of blood vessels (BV). Vangieson's 40x

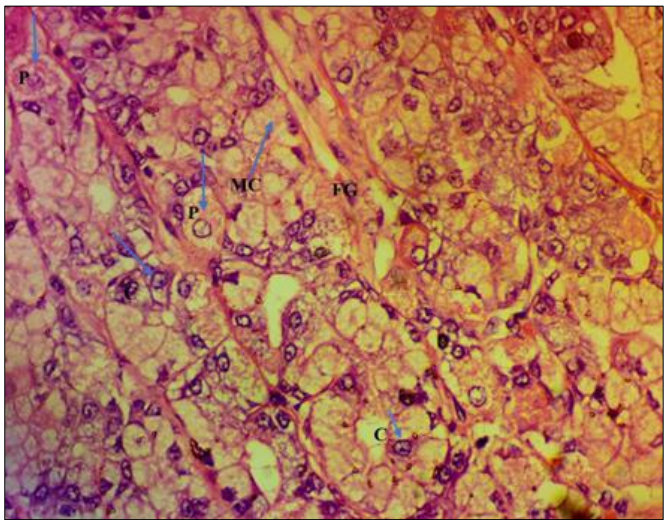

Fig 12: C/S Photomicrograph of G-II pig stomach showing fundic region with fundic glands (FG), mucous cells (MC), chief cells (C) and parietal cells (P). H&E 40x

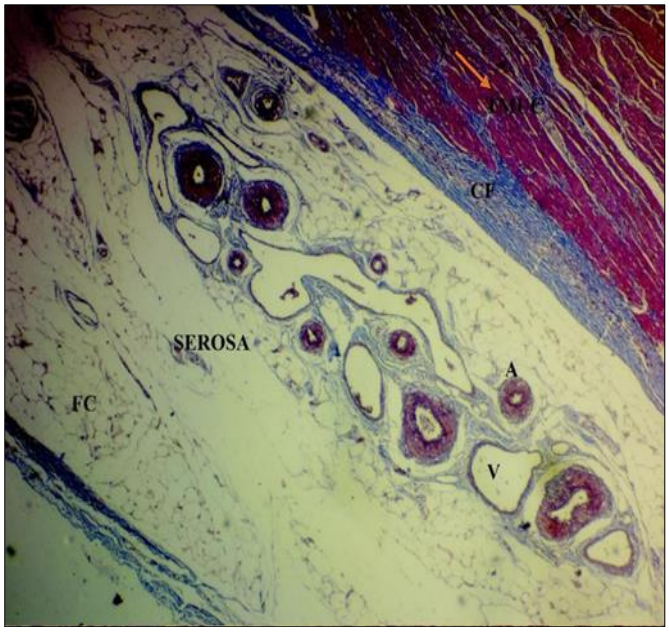

Fig 13: Photomicrograph of G-II pig stomach showing fundic region with tunica muscularis (TMUC) and serosa made up of artery (A), vein (V), fat cell (FC) and collagen fibres (CF). Masson's Trichrome 40x

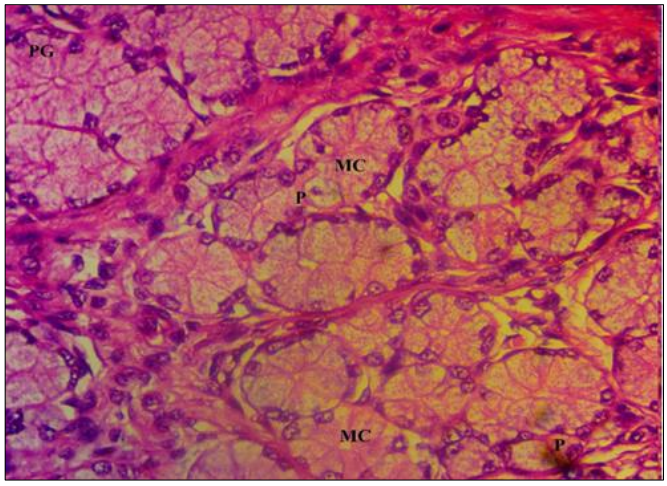

Fig 14: C/S Photomicrograph of G-III pig stomach showing pyloric region with pyloric gland (PG), parietal cells (P) andmucous cells (MC). H&E 40x

Fig 15: Photomicrograph of G-III pig stomach showing pyloric gland region with elastic fibres (arrow) and lymph node (LN). Verhoeff's 10x

Conclusion

The present study provides a detailed histological examination of the stomach of domestic pigs, focusing on the non-glandular, cardiac, fundic, and pyloric regions. The non-glandular region was lined by non-keratinised stratified squamous epithelium, consistent with previous observations in various mammalian species. The lamina propria of the stomach showed age-related changes, with an increase in collagen and reticular fibers. The lamina propria also exhibited lymphatic nodules, particularly at the oesophageo-cardiac junction.

In the cardiac region, gastric mucosa transitioned to a simple columnar epithelium. Cardiac glands were found to be simple branched coiled tubular glands distributed throughout the lamina propria. The population of mucous cells varied with age, with an increase observed in older age groups. Parietal cells were present in all age groups but decreased in number with age. The fundic region displayed deeper gastric pits and longer glands compared to the cardiac region. Mucous cells predominated in the fundic glands, with an increase observed in older age groups.

In the pyloric region, gastric pits were deeper, and mucous cells were predominant, with fewer parietal cells compared to other regions. The thickness of the tunica muscularis was relatively greater in the pyloric region, forming a pyloric sphincter.

Overall, the histological characteristics of the stomach varied across regions and age groups, providing insights into the structural adaptations of the gastric mucosa in domestic pigs. These findings contribute to our understanding of gastric physiology and provide a basis for further comparative studies across mammalian species.

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