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Research Article

SCANNING ELECTRON MICROSCOPIC STUDIES ON THE INTESTINE OF ADULT GUINEA PIGS

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ABSTRACT

Six adult guinea pigs of 16-32 weeks' age irrespective sex were procured from the Department of Laboratory animal medicine, TANUVAS as per ethical committee approval. Animals were euthanized as per the CPCSEA norms and mid segment of duodenum, jejunum, ileum, caecum and colon were used for the scanning electron microscopic studies. Villi of the guinea pig were leaf shaped, tongue shaped and irregularly leaf or tongue shaped, respectively. Corrugations were observed on the all the segments of the small intestine. Surface topography of the caecum showed the irregular mounds and crevasses. However, in the colon they had many crowded folds with crypts.

Keywords: Guinea pig, Intestine, Scanning electron microscopy, Villi

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Guinea pigs are excellent experimental subjects for physiological, toxicological and histological studies because of their rapid adaptability in laboratory situations in addition to their smaller body weight and size (Rowlands and Weir, 1974). Guinea pigs (*Cavia porcellus*) are small laboratory animals which constitutes a small suborder (Hystricomorphic) from the order Rodentia. This type of rodent was probably first introduced approximately 400 years ago into Europe from South America (Wagner and Manning, 1976).

Intestine has an important role to absorb the nutrients and provides protection against all the bacteria, viruses, toxins and different antigens present in the gut. The experimental animals like guinea pigs, mouse, rats, pigs and monkeys play an important role in human medicine since the anatomical structure of the organs of experimental animals is similar to anatomical structure of the organs of humans (Al-Sharoot, 2014). The small intestine of the guinea pig was observed as a musculo-membranous tube extended from pylorus of the stomach to the ileo-caecal orifice. It was supported by the mesentery to the dorsal body wall (Raja *et al.*, 2022). Large intestine of guinea pig started from the ileo-caecal orifice and ends in the anus (Raja *et al.*, 2020).

Scanning electron microscopic studies on the intestine gives a chance to observe the surface of the gut epithelium in three dimensions (Skrzepek *et al.*, 2005). Scanning electron microscopic studies of small intestine shows the finger shaped structures which protrude markedly above the surface. The villi have several types of surface marking including the creases which runs in various directions around the villi (Carr *et al.*,1967). There is paucity of literature on the scanning electron microscopic study on the intestines of adult guinea pigs. Hence, the present research work is carried out to observe the three-dimensional aspect of theintestines in adult guinea pigs.

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MATERIAL AND METHODS

For conducting the experiment the institutional animal ethics committee of the Madras Veterinary College, TANUVAS, Chennai, India had permitted to the collection of the lab animals and handling as per ethical committee approval (Lr. No1467/DFAB/IAEC/2018 dated 13 July, 2018). The methods were performed in accordance with guidelines of the IAEC of the TANUVAS, India. All the procedures were done in accordance with the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) norms (Pereira *et al.*, 2004). The segments from the mid part of duodenum, jejunum, ileum, caecum and colon of adult (16-32 week-old) guinea pigs irrespective of sex were pre fixed in 2.5% glutraldehyde-PBS at 4 ºC for two hours. The samples were washed in PBS and post-fixed in 2% Osmium tetroxide –PBS for 2 hours. Then, the samples were washed and dehydrated through the grades of alcohol. The samples were mounted on the stubs and coated with gold by a sputter coater (Karahan *et al.*, 2007). The Scanning electron microscopic images were observed by a Phenom Pro scanning electron microscope CATERS facility in Central Leather Research Institute, Chennai, India.

RESULTS AND DISCUSSION

Scanning electron microscopic study of the duodenum of 16-32 week-old guinea pig revealed that shape and size of the villi were varied as earlier observed in

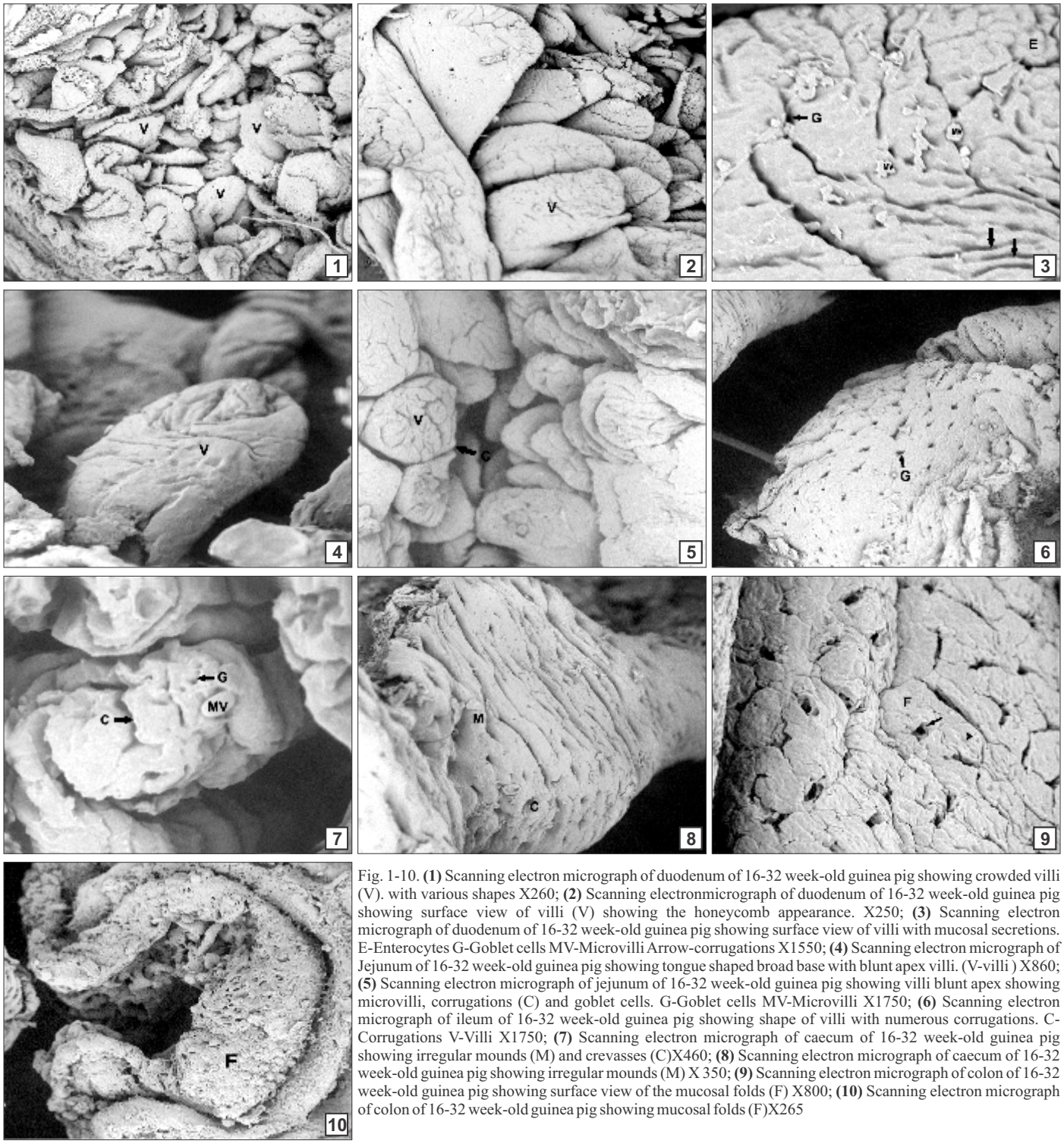

Fig. 1-10. **(1)** Scanning electron micrograph of duodenum of 16-32 week-old guinea pig showing crowded villi (V). with various shapes X260; **(2)** Scanning electronmicrograph of duodenum of 16-32 week-old guinea pig showing surface view of villi (V) showing the honeycomb appearance. X250; **(3)** Scanning electron micrograph of duodenum of 16-32 week-old guinea pig showing surface view of villi with mucosal secretions. E-Enterocytes G-Goblet cells MV-Microvilli Arrow-corrugations X1550; **(4)** Scanning electron micrograph of Jejunum of 16-32 week-old guinea pig showing tongue shaped broad base with blunt apex villi. (V-villi) X860; **(5)** Scanning electron micrograph of jejunum of 16-32 week-old guinea pig showing villi blunt apex showing microvilli, corrugations (C) and goblet cells. G-Goblet cells MV-Microvilli X1750; **(6)** Scanning electron micrograph of ileum of 16-32 week-old guinea pig showing shape of villi with numerous corrugations. C-Corrugations V-Villi X1750; **(7)** Scanning electron micrograph of caecum of 16-32 week-old guinea pig showing irregular mounds (M) and crevasses (C)X460; **(8)** Scanning electron micrograph of caecum of 16-32 week-old guinea pig showing irregular mounds (M) X 350; **(9)** Scanning electron micrograph of colon of 16-32 week-old guinea pig showing surface view of the mucosal folds (F) X800; **(10)** Scanning electron micrograph of colon of 16-32 week-old guinea pig showing mucosal folds (F)X265

the small intestine by Marsh and Swift (1969) and Cormack (1987) in human beings, Skrzypek *et al.* (2005) in newborn pig and Chandan *et al.* (2017) and Gahlot and Kumar (2018a and b) in goats. Leaf shaped villi in the duodenum is in concurrence with the observations of Hassan and Moussa (2015), Chandan *et al.* (2017) and Gahlot and Kumar (2018a) in goats. Tall slender villi with narrow tips were also observed in present findings. Folded appearances of villi were frequently noticed. Simultaneously, short broad villi with blunt apex were also observed. Similar findings were given by Hassan and Moussa (2015) in goats. Villi were dense and crowdly packed in duodenum (Fig. 1). The surface view showed the honeycomb appearance and each honeycomb unit showed the openings of crypts (Fig. 2) as reported by Marsh and Swift (1969) in human, Hassan and Moussa (2015) and Gahlot and Kumar (2018b) in goats.

In the present study, mucosal surface revealed very

faint corrugations as recorded in humans by Marsh and Swift (1969) and Cormack (1987) and in new born pigs by Skrzypek *et al.* (2005). Dense mat of microvilli could be observed on the surface of villi as earlier recorded by Gahlot and Kumar (2018a) in goats. Enterocytes and the goblet cells were seen on the villi surface (Fig. 3) as recorded by Cormack (1987) in human and Hassan and Moussa (2015) in goats.

Scanning electron microscopic studies of the jejunum of guinea pigs of 16-32 week-old revealed that shape of the villi were tongue shaped with broad base and blunt apex (Fig. 4) as noted by Marsh and swift (1969) in human and Skrzypek *et al.* (2005) in new born pigs. Goblet cells were noticed as white pinheads on the villus surface between the enterocytes (Fig. 5) as recorded by Cormack (1987) in human small intestine. Microvilli were observed on the surface of villi as stated by Gahlot and Kumar (2018b) in goats.

Scanning electron microscopic studies of the ileum revealed that shape of the villi was irregular leaf shape or tongue shaped with numerous corrugations which divided the mucosal surface into separate islands (Fig. 6). Similar findings observed by Skrzypek *et al.* (2005) in new born pigs, Hassan and Moussa (2015) and Gahlot and Kumar (2018a) in goats.

Scanning electron microscopic studies of caecum of guinea pig revealed that surface topography consisted of irregular mounds and crevasses (Fig. 7). An irregular mound consisted of round contoured elevated ridges often forming loop configurations or circular profiles with central depressions (Fig. 8). Crypts of Lieberkuhn appeared as regularly arranged pores and goblet cells were found to be irregularly scattered on the caecal mucosa along with columnar cells of the caecum of guinea pigs as recorded by Kazuyuki (1980) in rats.

Scanning electron microscopic studies of colon of guinea pig had many crowded folds with crypts. Surface views of the mucosal folds showed the crypt openings with mucous cells (Fig. 9 and 10). Openings were clearly visible with small depressions radial stings corresponding to scanty folds of colon. The openings were round or appeared as thin clefts as observed by Fabbrini *et al.* (1966) in human colon.

CONCLUSION

The present work revealed the surface topography of the various parts of the intestine in adult guinea pigs. Corrugations were observed in the duodenum, jejunum and ileum as caecum showed the irregular moulds and colon shows the crowded folds with crypts.

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