Himachal Journal of Agricultural Research 37 (1):85-90, 2011

Studies on enterochromaffin cells in the intestine of *Gaddi* sheep

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Manuscript Received: 03.07.2010; Accepted: 21.10.2010

Abstract

Enterochromaffin cells were abundant in the duodenum and jejunum in *Gaddi* sheep. In the ileum, caecum, colon and rectum these were present in small number. With the Fontana-Masson's technique, the granules of the enterochromaffin cells gave black reaction against a pinkish background. In the present study eight different types of enterochromaffin cells have been classified on the basis of difference in the location, size, shape of the cells and number, size and distribution of the granules.

Key words: Enterochromaffin cells, intestine, sheep, Fontana Masson silver.

Introduction

Enterochromaffin cells have been reported in sheep (Oomori *et al.*, 1980), horse (Sato *et al.*, 1976), herbivores (Rutschke, 1976) and mammals (Copenhaver *et al*, 1978). Present study was undertaken to localize the enterochromaffin cells in the intestine of *Gaddi* sheep.

Materials and Methods

The intestines from ten *Gaddi* sheep were collected from slaughter houses. The segments of the intestine from where tissues were to be collected were cut and ligated at both ends after washing with running tap water. Then these were infused with the neutral buffered formalin using syringe and needle without applying too much pressure to avoid damage to the intestinal wall. This method allowed maximum preservation of the mucosa as reported by Fenwick and Kruckenberg (1987). Thin pieces of tissues of 3-5 mm size were collected from cranial, mid and caudal regions of the duodenum, jejunum, ileum, caecum, and rectum and were kept in the neutral buffered formalin fixative in small vials for further processing. The tissues of colon were collected from the proximal loop, centripetal gyri, centrifugal gyri, transverse colon and descending colon.

After the fixation the tissues were processed with alcohol-benzene schedule and subsequent infiltration was done in paraffin. Then blocks were made in paraffin (melting point 60^0C). The paraffin sections (5-7 µm thick) were stained by Fontana-Masson silver method (Lillie, 1948).

Results and Discussion

Enterochromaffin cells were present throughout the intestine but were abundant in the duodenum and jejunum in *Gaddi* sheep. In the ileum, caecum, colon and rectum these were present in small number. Oomori *et al.* (1980) have reported that in sheep, the endocrine cells were more numerous in the duodenum. Copenhaver *et al.* (1978) have described that although the cells were present throughout the small intestine and colon, they were more numerous in proximal duodenum and appendix in mammals. Rutschke (1976) has observed that the enterochromaffin cells existed frequently in

herbivores species, scarcely in carnivorous. Sato *et al.* (1976) have observed that the enterochromaffin cells were most numerous in the duodenum, jejuno-ileum and rectum, but rarely found in the caecum and colon of horse intestine.

Enterochromaffin cells stained poorly with the routine haematoxylin and eosin and Masson's trichrome stains as described earlier by Stinson and Calhoun (1993). However in the Fontana-Masson's technique, the granules of the enterochromaffin cells gave black reaction against the pinkish background. Helmstaedter *et al.* (1977) have also identified these cells by the Masson-Fontana silver stain.

In the present study eight different types of enterochromaffin cells have been identified. Calingasan *et al.* (1984) have revealed eleven types of endocrine cells in the gastrointestinal tract and pancreas in sheep. Whereas, Kitamura *et al.* (1985) and Ito *et al.* (1987) have demonstrated thirteen and twelve kinds of immuno-reactive endocrine cells in the cow and swine intestine, respectively. Bolling (1989) reported eight types of endocrine cells in small intestine of calves. Stinson and Calhoun (1993) have described twelve types of endocrine cells in gastrointestinal tract. Kitamura *et al.* (1985) have found that out of thirteen types of cells, nine types were more numerous in the duodenum whereas the remaining four types have highest frequency in the ileum. Kostiukevich (2003) has reported four types of endocrine cells in epithelium of colon mucosa of cow.

They have been classified on the basis difference in the location they were found, their size and shape (Table 1). The number, size and distribution of the granules present in the different enterochromaffin cells were also variable. Stinson and Calhoun (1993) have described that these cells were more frequently wedged between the basement membrane and chief cells and do not reach the surface of the epithelium. Leeson and Leeson (1976) found these cells in the villi and crypts of Lieberkuhn. Lalitha (1990) has reported that argentaffin cells were present in the lamina propria forming the core of villi, lamina interglandularis and the Brunner's glands of the duodenum. Yamada *et al.* (1981) have reported the Sagi's cap, a huge aggregation of argyrophil endocrine cells on the top of intestinal villi in cattle and pig foetuses. Enterochromaffin cells were spherical or pyramidal in shape with numerous small membrane-bounded granules, mostly within the basal cytoplasm (Leeson and Leeson, 1976; Stinson and Calhoun, 1993)

Type I enterochromaffin cells (Fig. 1) were largest in size. These were oval in shape and were encountered mostly in the connective tissue of the lamina propria. The cytoplasmic granules in these cells were largest among the all types of enterochromaffin cells present in the intestine. The cytoplasmic granules in these cells were prominent and invariably fill the cytoplasm, thereby masking the nucleus.

The type II enterochromaffin cells (Figs. 2 & 3) were medium-sized. These were oval in shape and were present in the lamina epithelialis of the crypts of Lieberkuhn.Type II enterochromaffin cells contained abundant small cytoplasmic granules present in the supranuclear zone. The type III enterochromaffin cells (Fig. 4) were large in size, located in the lamina epithelialis of the crypts. They were somewhat wedge shaped, broad at base and

Table 1. Various types of enterochromaffin cells (EC) present in the wall of intestine

Type of EC	Size	Shape	Location	Granules		
				Number	Size	Distribution
Type I	Largest	Oval	C.T. of Lamina propria	Abundant	Largest	Throughout
Type II	Medium	Oval	Lamina epithelialis	Abundant	Small	Supranuclear zone
Type III	Large	Wedge	Lamina epithelialis	Abundant	Very fine	Supranuclear zone
Type IV	Small	Round or oval	C.T. of Lamina propria	Abundant	Medium	Supranuclear zone
Type V	Medium	Round or oval	C.T. of Lamina propria	Abundant	Medium	Throughout
Type VI	Small	Triangular	C.T. of Lamina propria	Abundant	Medium	Throughout
Type VII	Small	Elongated	C.T. of Lamina propria	Less	Medium	Throughout
Type VIII	Medium	Round, oval or ongated	C.T. of Lamina propria	Less	Medium	Throughout

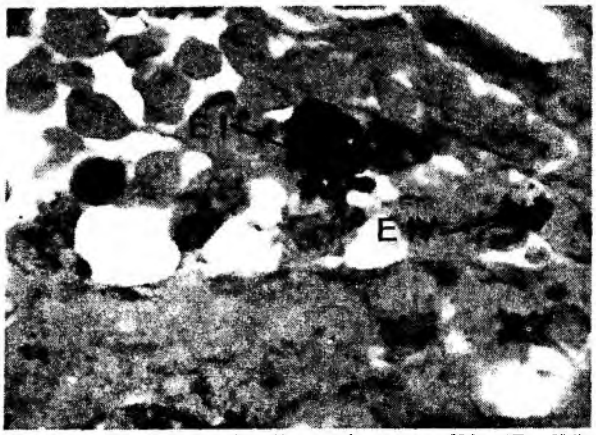


Fig. 1. Type I (E I) and type IV (E IV) enterochromaffin cells in the connective tissue of Lamina propria. Duodenum. Fontana-Masson silver method x 1000

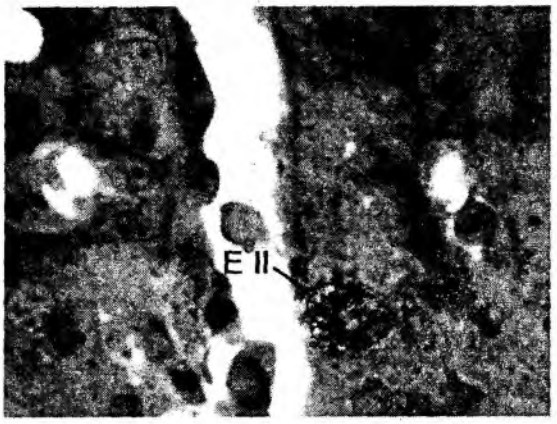


Fig. 2. Type II (E II) enterochromaffin cell in the Lamina epithelialis of crypts. Duodenum. Fontana-Masson silver method x 1000

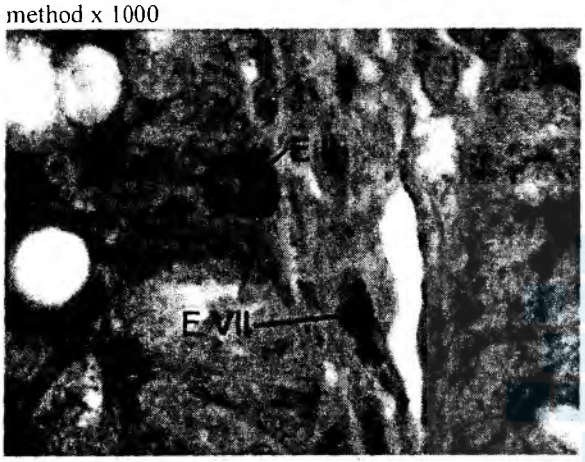


Fig. 3. Type II (E II) and type VII (E VII) enterochromaffin cells. Duodenum. Fontana-Masson silver method x 1000

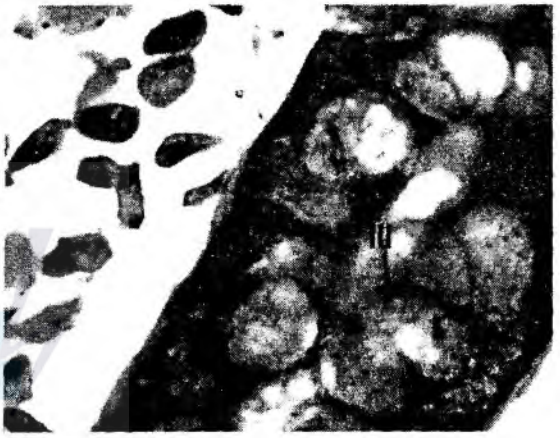


Fig. 4. Type III (E III) enterochromaffin cells in the connective tissue of Lamina epithelialis of crypts. Duodenum. Fontana-Masson silver method x 1000

pointed at the apex. The nucleus was presentat the base and very fine cytoplasmic granules were present in the pointed supranuclear zone. The cytoplasmic granules in these cells were smallest among the all types of enterochromaffin cells present in the intestine.

The type IV enterochromaffin cells (Figs. 1, 5 & 6) were small in size. These were round or oval in shape located in the connective tissue of the lamina propria. The medium sized cytoplasmic Granules filled in their supranuclear zone of the cytoplasm.

The type V enterochromaffin cells (Figs. 5 & 6) resembled type I enterochromaffin cells, but were medium in size. The cytoplasmic granules of these were also medium sized than the type I enterochromaffin cells which contained larger granules. The type VI enterochromaffin cells (Fig. 5) were small in size and were present in the connective tissue of the lamina propria. They had abundant small cytoplasmic granules present throughout their cytoplasm thereby masking the nucleus.

The type VII enterochromaffin cells (Fig. 3) were small in size and were found in the connective tissue of the lamina propria. These were elongated oval in shape having medium sized cytoplasmic granules. The number of cytoplasmic granules was less which were scattered throughout the cytoplasm.

The type VIII enterochromaffin cells (Fig. 6) which were medium in size were found in the connective tissue of the lamina propria. These cells were round, oval or elongated in shape. Their cytoplasm stained very lightly. They contained medium sized granules scattered throughout the cytoplasm.

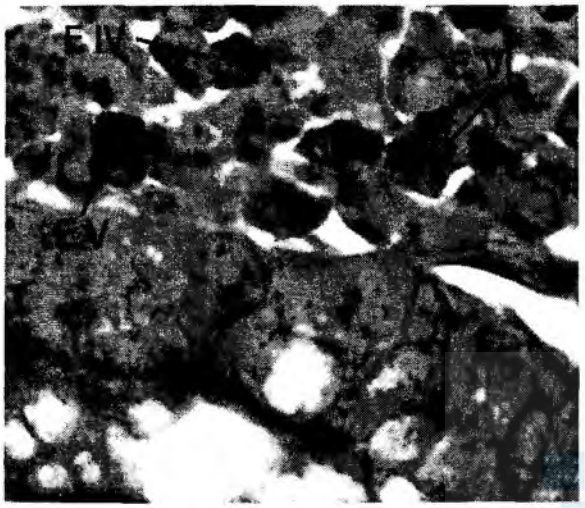


Fig. 5. Type IV (E IV), type V (E V) and type VI (E VI) enterochromaffin cells in the connective tissue of Lamina propria. Duodenum. Fontana-Masson silver method x 1000



Fig. 6. Type IV (E IV), type V (E V) and type VIII (E VIII) enterochromaffin cells in the connective tiss ue of Lamina propria. Duodenum. Fontana-Masson silver method x 1000

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