



## MORPHOMETRIC LAYERS STUDY OF THE GASTROINTESTINAL TRACT IN NEW ZEALAND RABBITS

### INTRODUCTION

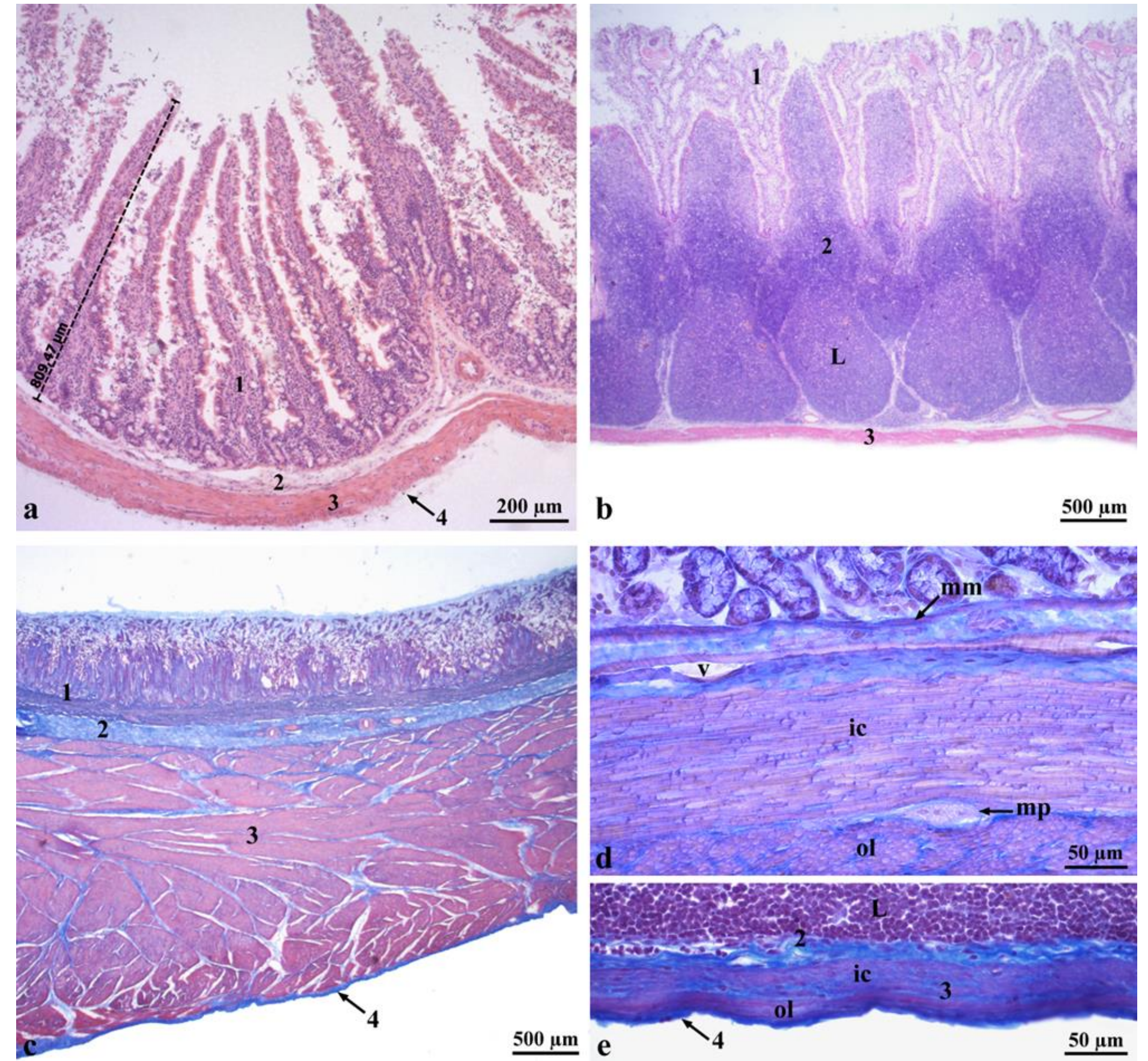
Research on the normal histology should be an important topic in veterinary medicine as the gastrointestinal (GI) diseases in rabbits represent a common disorder seen in veterinary practice. However, the normal histology of the rabbit GI tract has not been well defined.

The aim of the present study is to establish and quantify the specific different normal layers of thickness in the GI tract and to provide accurate reference values useful for clinical examination and experimental studies.

### MATERIALS AND METHODS

Whole sections of GI tract were obtained from five White New Zealand rabbits (8-14 months), 3 male and 2 female, with an average weight of  $5.24 \pm 1.04$  Kg. All the animals were checked (blood analysis, stool test and ultrasound exam) and euthanised for reasons other than GI disorders. Samples of stomach (pars cardiac, fundus, pylorus), duodenum, jejunum, ileum, sacculus rotundus, caecum, apex ceci, ansa spiralis coli, colon descendens were removed at defined sites for each segment of digestive tract, examined and fixed. The samples were frozen, cut with a cryostat into sections of  $10 \mu\text{m}$  and stained with two histological methods, hematoxylin-eosin and Masson's trichrome.

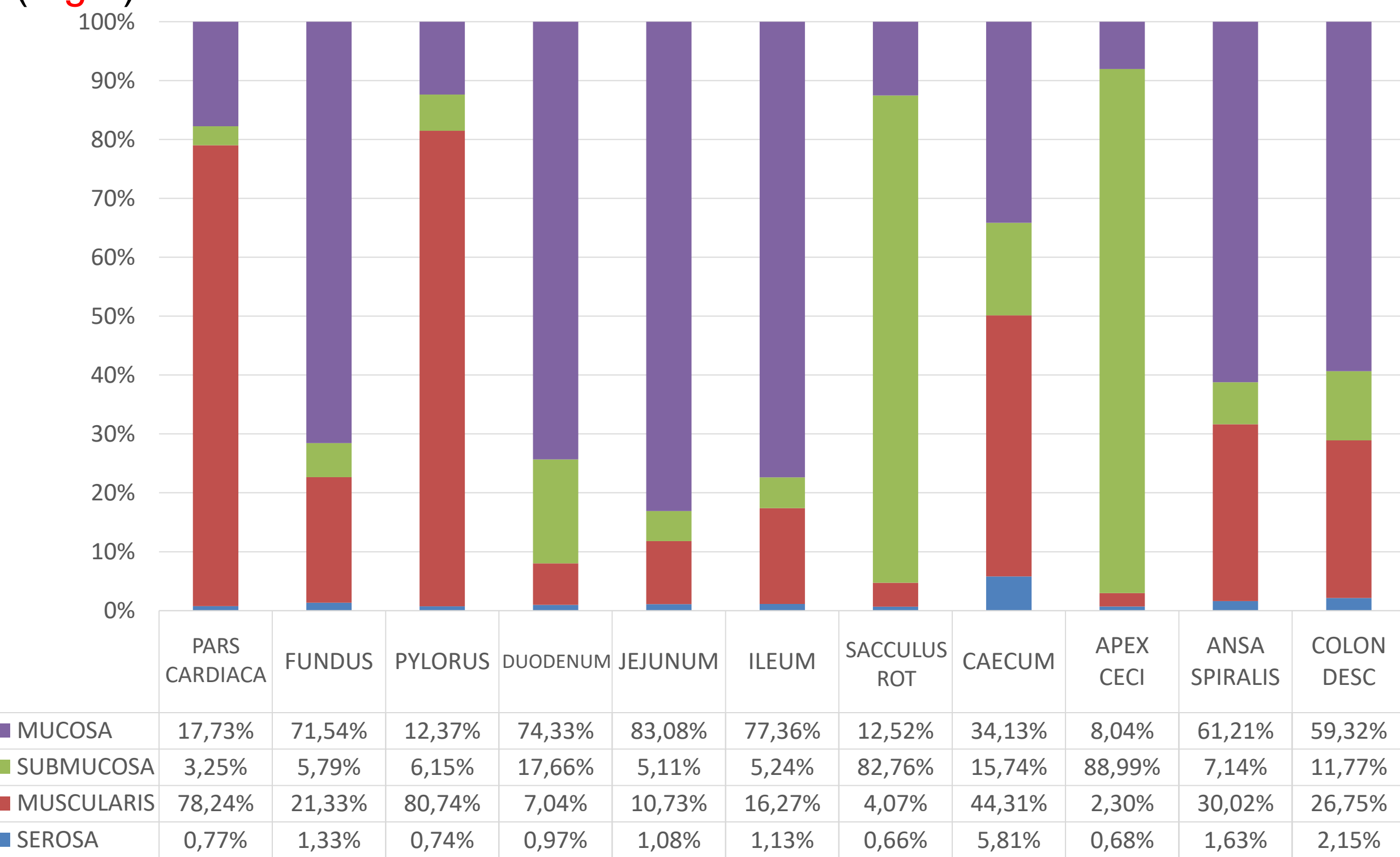
For each examined section, we recorded 10 sample thickness measurements, measuring 4 tunics individually (serosa, muscularis, submucosa and mucosa) and the total thickness, to obtain average representative morphometric values (Fig.1).



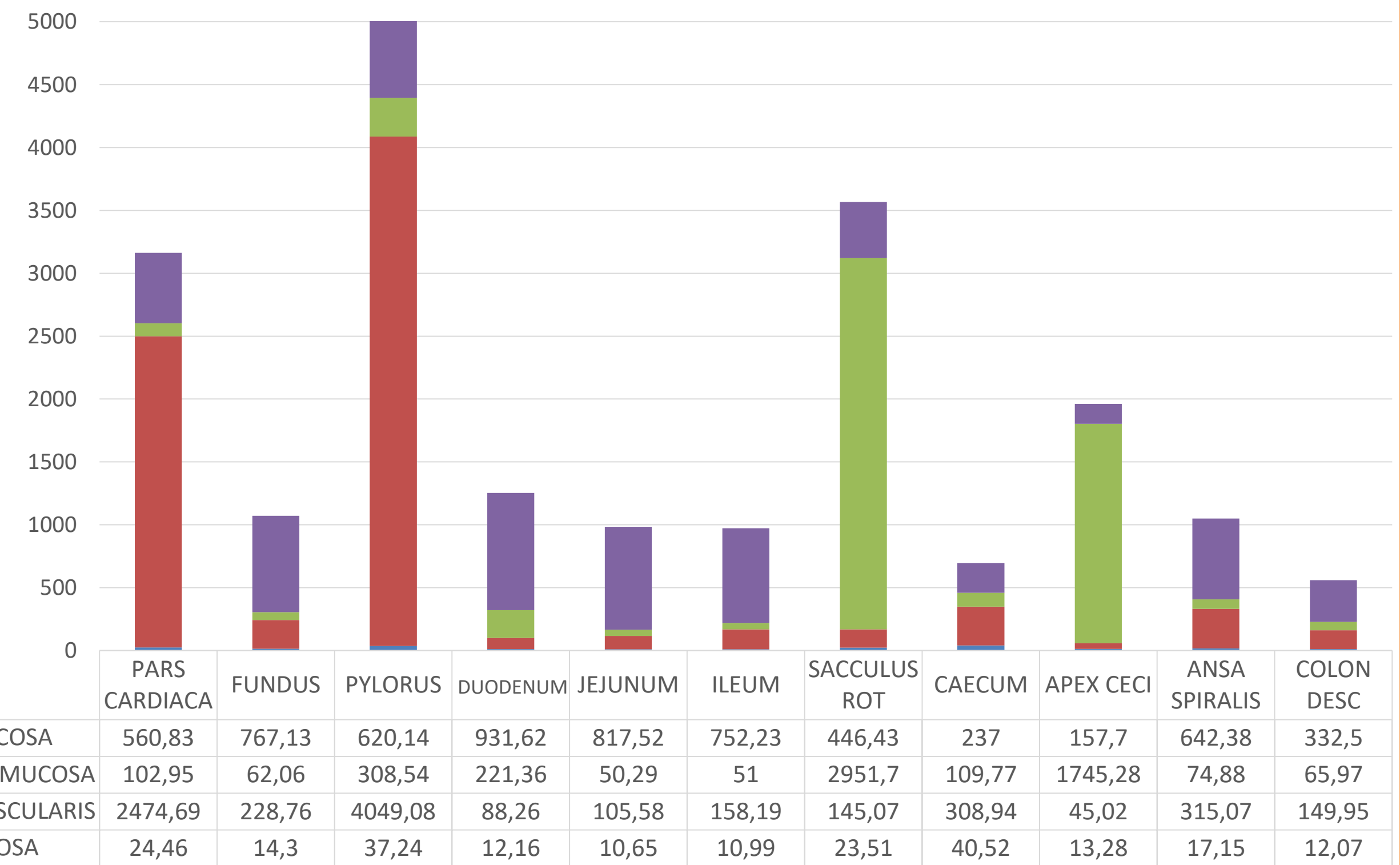
**Figure 1.** Photomicrograph in transverse sections of representative GI tracts from a rabbit. 1. mucosa; 2. submucosa; 3. tunica muscularis; 4. serosa. a. Ileum. The measured mucosa thickness is shown as it is recorded by means of the camera and related software (hematoxylin and eosin). b. Sacculus rotundus. Note the abundant lymphoid aggregates (L) in the submucosa (hematoxylin and eosin). c. Pylorus. The wall thickness is due mainly to the tunica muscularis (Masson's trichrome). d. Ansa spiralis. High magnification showing the muscularis mucosae (mm) and a blood vessel (v) in longitudinal section. The tunica muscularis is composed of an inner circular (ic) and an outer longitudinal (ol) muscle. Note the myenteric plexus (mp) between the two muscle layers (Masson's trichrome). e. Apex ceci. High magnification showing the thin serosal layer. ic, inner circular muscle; L, lymphoid tissue; ol, outer longitudinal muscle (Masson's trichrome).

### RESULTS

The average absolute and relative (%) values of intestinal thickness at the different tracts are shown in Figs 2 and 3, respectively. From the measurements of the four tunics for each sample, it appears that: the total thickness of the intestinal wall was highest in the pylorus, which was related to the maximum thickness of the muscularis, and lowest in the colon descendens. The mucosa was highest in the duodenum, the submucosa in the sacculus rotundus, and finally the serosa in the caecum. In each section, except the caecum, it has been noted the prevalence (> 50%) of a single tunic (Fig.1).



**Figure 2.** Percentage of the different tunics to total thickness.



**Figure 3.** Average thickness ( $\mu\text{m}$ ) of layers in different segments of the GI tract.

### DISCUSSION

In this study, 5 White New Zealand rabbits were used to obtain accurate values of the GI tract thickness of the different layers in specific points. Proceeding from the duodenum to the ileum a progressive reduction of the total and mucosa thicknesses and an increase in the muscular layer was observed. Concerning to the relative thickness (%) of each intestinal layer, it was undeniable that the mucosa represents the greater percentage in the fundus, duodenum, jejunum, ileum, ansa spiralis coli and colon descendens; the submucosa in the sacculus rotundus and apex ceci, this related to the high amount of lymphoid tissue; the muscularis in the pars cardiaca, pylorus and caecum; finally the serosa none (Fig. 2).

No previous studies have correlated sex with intestinal thickness in rabbits; although considering the low number of subjects and high intraspecific variation, our studies did not reveal any statistically detectable values ( $P < 0.05$ ) with the exception of the pylorus ( $P = 0,027$ ). Finally, no clear correlation emerged with the sex of the subjects, although some differences do appear.

### CONCLUSION

Our data, although preliminary, should improve the knowledge of the physiological/pathological condition of the GI tract. Furthermore, it could assist in the diagnosis of GI diseases by means of diagnostic imaging, in particular the ultrasonography, since the latest generation of ultrasound transducer allow the identification of the majority of the layers in small animals, as we preliminarily demonstrated with a simultaneous study through real-time ultrasound machine with a high frequency (17-5 MHz) linear array transducer.