Differences in Intestinal Length between Specific-Pathogen-Free (SPF) and Conventional Swine

Shozo MOCHIZUKI1 and Takashi MAKITA1,2

Saijo Central Health Center, Ehime Prefecture, Saijo, Ehime 793, and 1Department of Veterinary Anatomy, Faculty of Agriculture, Yamaguchi University, Yamaguchi 753, Japan

(Received 26 August 1997/Accepted 16 December 1997)

ABSTRACT. The length of the small intestine, cecum, and the rest of the large intestine of specific-pathogen-free (SPF) swine was compared with that of conventional swine. The average length of the small intestine of SPF swine was shorter than that of conventional swine. The difference was significant for female SPF swine. There was no difference between SPF and conventional swine in the length of the cecum, colon and rectum. — KEY WORDS: intestine, length, SPF, swine.


As typically reflected by the short intestine of carnivores and the long intestine of herbivores, intestinal length can be an index of the functional condition of the alimentary canal [3, 7, 8, 24, 25]. In addition to our previous publications on the regional anatomy of swine [9–19], this brief report compares the intestinal length of SPF swine with that of conventional swine. Thus, it is examined in animals of the same species whether the intestinal length is dependent on the environmental condition they were raised. To our knowledge, no comparison of the length of intestinal subdivisions between specific-pathogen-free (SPF) and conventional swine has been published.

MATERIALS AND METHODS

A total of 14 SPF swine (7 males and 7 females, 6 months old, approximately 100 kg in body weight and 1 m in body length) and 21 conventional swine (10 males and 11 females, 6 months old, approximately 100 kg in body weight and 1 m in body length) were randomly selected in the same district. SPF swine were “secondary SPF swine” raised in a windowless house certified by the Japan SPF Swine Association. In this case, specific pathogens were intended for the causes of the following diseases: mycoplasmal pneumonia of swine, swine dysentery, swine atrophic rhinitis, Augeszyk disease and toxoplasmosis. Conventional swine of the same strain were also selected from ordinary farms. Both SPF and conventional swine were fed with the identical diets (Table 1).

Following sacrifice the intestine of each swine was cut off its mesentery and measured its length as soon as possible. The cecum and the colon were demarcated by the junction of ileum when they were measured.

RESULTS

The duodenum of both SPF and conventional swine was comparatively short, and not well demarcated from the jejunum. The jejunum and the ileum were arranged in closed windings, which lay against right and caudal part of the abdominal wall. The ileum was slightly slender and its wall was thicker than that of the jejunum. It ran dorsocaudally and connected obliquely with the cecum and colon. The total length of the small intestine was approximately 15–22 m (Table 2, Figs. 1 and 2). The cecum was cylindrical, and was about 20–30 cm long and 8–10 cm wide (Table 2, Figs. 1 and 2). Its caudal end joined the coiled part of the colon. There was no clear demarcation between the cecum and the colon. The colon had three bands of teniae coli, and the total colon length was approximately 4–6 m (Table 2, Figs. 1 and 2). The ascending colon was arranged in a circular-cone-like structure with three double spiral coils. Connective tissue bound the adjacent coils of the colon. On reaching the stomach, it turned to the left as part of the transverse colon and then caudally as the descending colon. Its terminal part was the continuation of the rectum.

It was evident that the average length of the small intestine of SPF swine (1,757.8 ± 133.9 cm) was shorter than that of conventional swine (1,911.0 ± 121.9 cm) (Table 2). The length ratio of SPF swine small intestine to conventional one was approximately 92:100. The reduction in the length of the small intestine of SPF swine was significant in females (p<0.001), but not in males. The length ratio for females being about 88:100. On the other hand, there was no difference between SPF and conventional swine in the length of the cecum and the total length of the colon and rectum.

DISCUSSION

It was reported that germ-free chick had shorter intestine compared to conventional chick [5]. The present data of
the shorter length of the small intestine of SPF swine than that of conventional swine are in accordance with that report. The intestinal length may regulate the number and growth of microflora in the lumen. However, it remains to be elucidated why the difference was significant only in females.

One of the reasons why there was the difference in the length of the small intestine but not in the large intestine might be related to the anatomical features of the two subdivisions. The small intestine is suspended comparatively freely with mesentery, whereas the large intestine is rather fixed in spiral coils with teniae. The adjacent coils of the large intestine are connected not only with mesentery but also connective tissues. The whole cone-like colon is covered with serous membrane [1, 2, 4, 6, 20–23]. The total length of the colon and rectum was approximately 5 m, which is longer than that so far described (3 to 4 m [1, 2, 4, 6, 20–23]).

Specimens used in this survey were animals of the same strain and age. Besides, they were about the same body weight and were fed with identical diets. Therefore, the above mentioned difference might be due to SPF conditions. Whether or not the small intestine increases its length upon reversal of SPF to conventional conditions is one of the fundamental experiments that need to be conducted to confirm the present results.

ACKNOWLEDGEMENTS. The authors are indebted to Mr. Hiroaki Azuma (Ozu Health Center of Ehime Pref.), Mr. Mamoru Otake (AI-PAX Co., Ltd.) and Mr. Takashi Kubo (Ehime Economic Federation of Agricultural Cooperative) for their cooperation and assistance in this study.

REFERENCES

INTESTINAL LENGTH OF SPF SWINE

Fig. 1. An example of the whole intestine from a SPF female swine. S: stomach, C: cecum, arrow: junction between ileum and colon. Bar=20 cm.

Fig. 2. An example of intestine from a conventional female swine. S: stomach, C: cecum, arrow: junction between ileum and colon. Bar=20 cm.