# 博 士 論 文 の 内 容 の 要 旨

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| 論文題目 | Effects of dietary nutrients on structure and function of the chicken intestinal mucosa.<br>(ニワトリ腸管粘膜の構造及び機能に対する食餌中栄養素の影響) |

（博士論文の内容の要旨）

The present dissertation study was carried out to reveal the significance of dietary nutrients intervention on the formation and function of the chicken intestinal mucosa. In order to achieve the objectives of this dissertation, three experiments were performed.

The first experiment was designed to determine the effect of dietary carbohydrate (CHO) on the microvilli of enterocytes in the chicken ileum. It is believed that microvilli, which are tiny finger-like protrusions on the surface of epithelial enterocytes (absorptive cells), which cumulatively are referred to as brush broader region, increase the mucosal absorptive surface area by approximately 9 to 16 times while also boosting digestion and absorption by residing in various types of nutrient transporters, channels, and receptors. This experiment revealed that microvilli were loosely packed, fragmented, and had a gap spacing between each neighbor in the lower carbohydrate (CHO) groups. The length, width, and linear density of microvilli were significantly lower in the lower CHO groups. Thus, β-actin and villin may modulate the steady-state of enterocytes microvilli. Villin and β-actin fluorescence intensities were reduced in the lower CHO groups. Additionally, the frequencies of glucagon-like peptide (GLP)-2 immunoreactive cells and cells expressing proglucagon (PG) mRNA were significantly decreased when the level of CHO was decreased, indicating that enterocyte microvilli were maintained through a GLP-2 dependent manner.

The second experiment examined the effect of dietary protein (CP) on Neurotensin (NT)-immunoreactive cells. NT has been noticed in the central and peripheral nervous systems, as well as the gastrointestinal tract, of a variety of animal species. It has been shown to perform a

wide range of physiological functions in the gastrointestinal tract, including the regulation of gastric and intestinal motility, as well as the stimulation of mucosal development and growth. The findings demonstrated that the NT-immunoreactive cells in the control groups had a long cytoplasmic process in the epithelium of villi that could detect nutrients as a chemical signal. Interestingly, the frequency of NT-immunoreactive cells was substantially higher in the groups with increased CP levels. Additionally, a statistically significant association was observed between the frequency of NT-immunoreactive cells and daily protein ingestion. These data suggest that dietary CP is a potent activator of intestinal N cells.

The third experiment demonstrated the effects of dietary CHO on the colocalization pattern of GLP-1 with NT in the ileum. Numerous hormones have been shown to be colocalized in the same endocrine cells. A previous study observed that GLP-1 and NT are both stored in the same endocrine cell in the ileum of the chicken. These two peptides are released in response to the ingestion of food. The findings revealed that there were differences in the morphology of colocalized cells that corresponded to variations in the CHO levels. The ratio of endocrine cells expressing both GLP-1 and NT was considerably higher in the control group and declined as the CHO level of the diets decreased. In addition, the number of cells expressing PG and NTP mRNA appeared to be higher in the control group. These data indicate that dietary CHO is an effective stimulator for increasing the number of endocrine cells expressing GLP-1 and NT in the chicken distal ileum.

The above findings support the hypothesis that dietary nutrients are a potent stimulator for modifying intestinal mucosal structure and function in chicken, as demonstrated by the research presented in this dissertation.