

## 学位論文要旨 Dissertation Abstract

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学位論文題目 :  
Title of Dissertation Study on the development of natural substances to improve pig growth performance due to activated digestive and immune systems (活性化された消化器系および免疫系による豚の成長を改善させるための天然物質の開発に関する研究)

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The most important point during the pig breeding is diarrhea of piglets due to the stress and changes of feeding method by the isolation with the mother pig at weaning. Additionally, disease infection found until the grower pig period is also important problems. To solve these problems, the management to keep piglets healthfully due to activating instinctive homeostatic functions is important. On the other hand, the immune system is fundamental system to keep healthy body, and the intestine is also the most important organ for improving animal growth. Thus author tried to improve the supplementation to activate these immune and digestive system in addition to mineral in basal diets. Besides, to effectively produce pigs the breed improvement has been carried out. However, suitable diets for crossbred pigs are not improved. At the beginning, new mineral supplementation was developed for piglets. As final results, the following 6 kinds of natural feed additive were obtained as effective supplementation for improved growth performance due to elevated immune and intestinal function.

First, dietary newly developed *Bacillus subtilis* MP9 and MP10 from fermented soybean have a growth promoting activity of piglets, due to their suppressing diarrhea during the new-born to weaning period in piglets by competing with pathogenic gut flora, and by stimulating effective microorganisms. The *Bacillus subtilis* MP9 and MP10 are promising alternatives to antibiotics for use as a feed supplement in piglet diets.

Next, dietary sugar cane extract (SCE) could hypertrophy the intestinal villus and cellular functions of piglets, especially at the 0.05%, inducing a 6% increase in body weight gain over the control.

Third, dietary turmeric (*Curcuma longa* Linn.) improved nutrient digestibility and blood composition, as well as hypertrophied morphological alterations of the intestine in piglets. This suggests suggest that turmeric stimulates the function of the intestine and the immune system, resulting in better body weight gain due to healthy intestinal condition.

Fourth, dietary *Centella asiatica* L. Urban significantly reduced serum interleukin-10 and reduced, but not significantly, serum interferon-gamma levels at three months of feeding period in piglets. These results indicate that *C. asiatica* has the potential to suppress both anti-inflammatory and pro-inflammatory cytokines.

Fifth, dietary *Centella asiatica* Linn Urban (*C. asiatica* (L.); pennywort in English) diets were fed on piglets from 15 body weight kg of piglets. At 35 kg body weight, piglets were vaccinated with *Mycoplasma hyopneumoniae*. The result that *C. asiatica* (L.) could not improve growth performance but increased values of serum hematocrit and white blood cells, and mycoplasma immunity to *M. hyopneumoniae* might suggest that *C. asiatica* (L.) has no function to elevate body weight but has the potential to enhance innate immunity.

Finally, dietary mixed minerals (MM) can stimulate functions of epithelial cells with increasing levels of MM in piglets, but that they have no power to improve body weight gain resulting from increased villus activity, and that MM has no function to affect growth performance but might affect other biochemical functions, such as immunity processes in the body.

These results in series of the present feeding experiments suggest that each supplementation might activate the functions of immune and digestive systems, enhancing piglet healthy growth performance. This would contribute to pig industry by production for safety pig meats.