

学位論文要旨 Dissertation Abstract

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学位論文題目 : Study on the development of whole paddy feed rice as a poultry
feed ingredient
Title of Dissertation (家禽の飼料原料としての飼料用粳米全粒の開発に関する研究)

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Cereal grains are generally ground for poultry diets. There has recently been an increasing interest in using whole grain in diet in order to decrease feed cost by removing the grinding step. Moreover, feeding whole grains to poultry also meets consumer demands for a natural feeding system. In Japan, corn has been the major ingredient for farmer. However, this became expensive as corn was imported and used extensively by other livestock and humans. This situation has led to development of whole-grain paddy rice (WPR) as a new source of local poultry feed ingredients.

Considering the above points, the research in this thesis focused on the utilization of local alternative feed ingredients is likely to offer reducing poultry feed supply problems as well as to evaluate how alterations would be induced in the growth performance and intestinal histology of chickens after feeding WPR.

At first, the chemical composition, nutrient digestibility, and the metabolizable energy (ME) of WPR were determined in order to confirm nutritional values of WPR and to provide information on accurate formulation of poultry diets (**Experiment 1**). The results reviewed that the chemical composition of WPR had values close to those of corn. The apparent ME and true ME of WPR were 2.79 and 3.02 kcal/g air-dried, respectively.

Dietary dilution is one of management practice to reduce poultry feed cost for farmer. Therefore, this experiment was carried out to study the growth performance and intestinal histology in chickens fed diets diluted with WPR (**Experiment 2**). The growth performance, the relative length of intestines and relative weight of visceral organs did not change except that the weight of gizzard increased in both the 20 and 40% WPR groups. In addition, the surface of the villus tip was not damaged after feeding WPR. This suggests that chickens can be fed a basal diet diluted with WPR up to a level of

40% without negative effects on growth performance or intestinal histology.

Experiment 1 suggested that WPR can be used as a good alternative cereal grain source in poultry diets, and can replace corn. However, the use of WPR seems to cause severe problems due to its high crude fiber and non-starch polysaccharides (NSP). This problem may be overcome by dietary enzyme supplementation. Therefore, the effects of WPR replacement with or without enzyme addition on broiler performance and intestinal morphology were determined (**Experiment 3**). The finding that broilers fed on diets replacing corn with WPR without enzyme showed hypertrophy in duodenal and ileal villi and in duodenal and jejunal epithelial cells, especially in the 50WPR group, without negatively affecting growth performance. These findings suggest that WPR can replace corn up to a level of 50% (283.0 g/kg, starter, and 250.0 g/kg, finisher) in broiler diets without enzyme supplementation.

Based on the results of **Experiment 3** that enzyme addition is not beneficial to the WPR-based diets, **Experiment 4** was carried out to study the effect of replacing corn in laying hen diets with WPR up to a level of 100% on egg production performance and quality without enzyme supplementation. It reveals that WPR can totally replace corn in laying hen diets without harming egg production performance and quality.

In the above experiments, the rations were made isocaloric by increasing the level of animal fat to elevate the WPR level in the diets, resulting in oily diet. Therefore, whole-grain brown rice (BR) was supplemented to reduce animal fat in the diet. The aim of this study was to investigate replacing corn in the diets with different levels of WPR and its effect on growth performance and intestinal histological structures of broiler chickens (**Experiment 5**). The results showed that replacing corn in broiler diets with WPR and BR led to the increased size of gizzard in addition to few changes in intestinal morphology. These findings suggest that WPR and BR can totally replace corn in broiler diets without negatively affecting growth performance.

Finally, the results from this thesis demonstrate that WPR can use as a feed ingredient in poultry diets. This development of WPR as a new alternative for poultry feed ingredients would be highly evaluated for poultry industry.