

**REGULATION OF TASTE-ACTIVE COMPONENTS OF MEAT BY DIETARY
PROTEIN LEVELS: EFFECT OF SHORT-TIME FEEDING OF HIGH PROTEIN
DIET**

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Introduction

Dietary nutrients play a significant part in determining growth rate and meat yield. It is known that the compositions of protein and total amino acids of meat are invariable by feeding treatments, hence the meat taste is considered to be invariable. However, the relationship of taste components of meat with nutrients is not fully elucidated, and there have been few reports on the effect of feeding treatments on taste-active components of chicken meat. Previously, restricted feeding and dietary low metabolizable energy levels decreased the free Glu contents of meat, and the meat taste was deteriorated (Fujimura et al., 1997, 2001). While, dietary protein and leucine levels increased the Glu content of meat, and improved the meat taste (Fujimura et al., 2004, Imanari et al., 2004). Therefore, meat taste can be affected by dietary components. In this study, the increase in free Glu and sensory score of meat by the diet was studied.

Objectives

In this study, the relationship of dietary crude protein (CP) levels with taste components in chicken meat extract was studied, focusing in particular on the taste-active components. As a result, meat taste was improved by the dietary protein levels, and then Glu regulation mechanism was studied by Glu-relate enzymes in muscle. Three experiments were conducted, Experiment 1: meat type chickens were fed graded CP level diets for 10 days, and the meat composition, free amino acids and ATP metabolites were measured at 0, 3, 5 and 10 days. Experiment 2: meat taste was evaluated by sensory evaluation. Experiment 3: Glu-related enzymes of meat were measured at 0, 3, 5 and 10 days.

Methodology

Experiment 1: The 14-day-old female Cobb strain broiler chickens were divided into four groups with twelve chicks in each group. The chicks were fed CP 17.6, 26.3, 30.7 and 35.1% diet. All the chickens were kept in individual wire cages. Free amino acids and ATP metabolites of the pectoral meat extract were measured at 0, 3, 5 and 10 days. Experiment 2: Two sensory evaluations, paired comparison test and Scheffe's paired difference test, were conducted between meats of CP17.5% and 30.7% groups.

Experiment 3: The 14-day-old broiler chicks were fed CP 30.7% diet for 10 days. At 0, 3, 5 and 10 days, Glu-related enzymes in muscle were measured. For the investigation of Glu regulation mechanism, glutamate dehydrogenase (GDH), kidney type glutaminase (KGA), glutamine synthetase (GS) and alanine transaminase (ALT) activities were measured by enzymatic methods (Bergmeyer, 1974).

Results & Discussion

In Experiment 1, free Glu of muscle after 3 and 5 days feeding of high CP diet was higher than that of 0 day ($P < 0.01$), and tended to decrease after 5 day, while 5'-inosinic acid (IMP) was invariable. Because free Glu contents of meat were above the taste threshold value of Glu, these variations were considered to have affected the meat taste. In the sensory evaluation (Experiment 2), a significant difference showed that in the paired comparison test ($P < 0.01$). The result of the paired comparison test, the taste of the meat in the high CP diet group was superior to that in the control group, especially overall preference, thickness and umami taste. These results suggested that, dietary CP levels could affect taste-active components, especially free Glu. In experiment 3, at 3 day, KGA activity in muscle of CP 30.7% diet was lower than that of control ($P < 0.05$). GDH activity in CP 30.7% diet was tended to increase after 5 days. There were no differences in GS and ALT activities. KGA was considered to contribute to the free Glu increase. And feedback inhibition of KGA activity by high Glu concentration at 5 day may have affected the free Glu concentration of muscle at 10 day. As a result of this study, we concluded that short-time feeding of high CP diet was appropriate to increase the free Glu and sensory score of meat.

Conclusions

In order to elucidate the factors affecting the taste of chicken meat, the effect of dietary CP levels before marketing on broiler meat composition, i.e., free amino acids, and ATP metabolites, and regulation mechanism were studied using Cobb strain female broilers. As a result of this study, free Glu and sensory score in meat were increased by dietary CP levels for 3 to 10 days. Because the variation of the taste component improves the meat taste, the feeding condition is one of the important factors affecting the meat taste of chickens. Muscular KGA and GDH activities were changed by the dietary proteins. Functional feedback regulation affected the Glu in muscle after 5 day, therefore, the Short-time feeding of high CP diet, especially for 3 to 5 days, is more appropriate to improve the meat taste.

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Tables and Figures

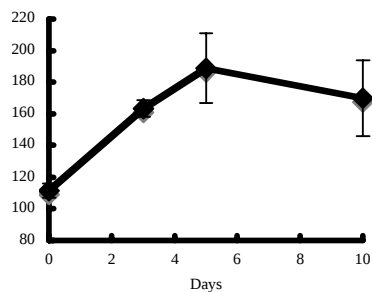


FIGURE 1 Effect of CP 30.7% diet on free Glu contents of pectoral meat extract. Values are means+SE, n=6 chicks per each group. (P<0.01)

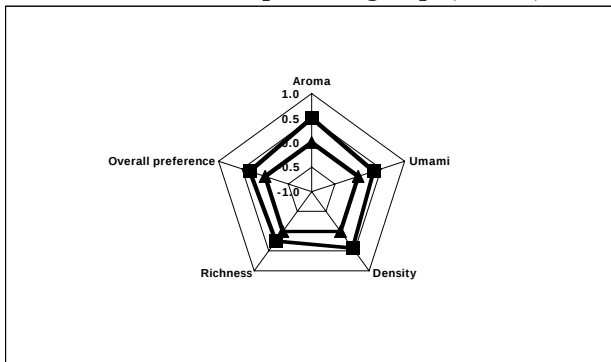


FIGURE 2 Scheffe's paired difference test between pectoral meat extracts of CP 17.6 and 30.7% diets.

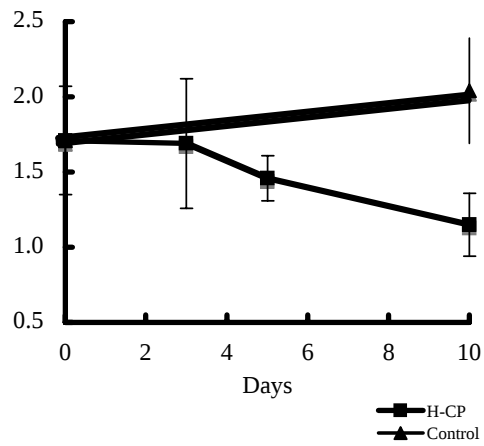


FIGURE 3 Effect of dietary CP levels on glutaminase activity of pectoral muscle. Values are means+SE, n=6 chicks per each group. ($P<0.01$)

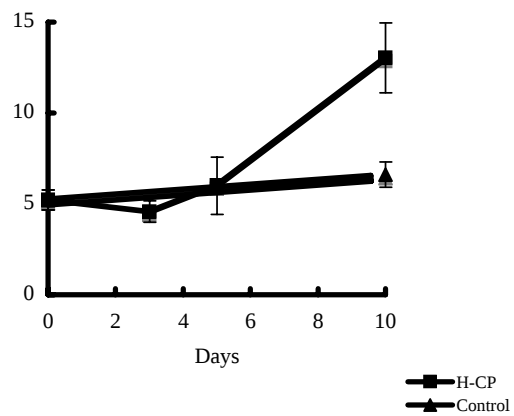


FIGURE 4 Effect of dietary CP levels on GDH activity of pectoral muscle. Values are means+SE, n=6 chicks per each group. ($P<0.01$)