



## REGULATION OF TASTE-ACTIVE COMPONENTS OF MEAT BY DIETARY BRANCHED-CHAIN AMINO ACIDS

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### Background

Regulation of taste active components of meat is important for the improvement of meat quality. It has been generally believed that it is possible to regulate aroma and storage stability by diet, while regulation of meat taste is difficult. In previous study (2001), we suggested that the main taste-active component of meat, free glutamate (Glu) content, could be controlled by dietary restriction and metabolizable energy. However, there were no reports about the effects of other dietary factors on the taste components of meat.

Zhou and Thompson (1996) reported that glutamate dehydrogenase (GDH) activity in the muscle was regulated by branched-chain amino acids (BCAA) *in vitro*. BCAA, leucine, valine and isoleucine, are known as essential amino acids, and mainly metabolized in the muscle, not in the liver. Therefore, we considered that dietary BCAA may affect the Glu contents of meat *in vivo*.

### Objectives

In this study, the effect of dietary BCAA, especially leucine (Leu), level on meat quality was studied. The meat quality was estimated by free amino acids, ATP metabolites and sensory evaluation. As a result, the Glu level and sensory score were changed by dietary Leu level. Then, the Glu-related enzyme activities in muscle were measured to elucidate the regulatory mechanism of Glu in the muscle.

### Materials and methods

28-day-old female Cobb strain broiler chickens were divided into 4 groups. Leu contents of experimental diet were 70, 100, 130 (control) and 150% of the NRC (1994) requirement of Leu. Because commercial diet include 130-150% of NRC requirement, we considered Leu130% as control. The 4 groups of chickens were kept on these diets *ad libitum* for 10 days. On day 11, all chickens were slaughtered, and breast muscles (*M. Pectoralis superficialis*) were taken for analyses. Concentrations of free amino acids and ATP metabolites in meat extract were measured by HPLC. Sensory evaluation was carried out with 12 trained panellists using paired difference test and Scheffe's paired comparison test. For the investigation of the mechanism of Glu regulation, the muscle GDH, glutaminase (GA) and glutamine synthetase (GS) activities were measured by enzymatic methods (Bergmeyer, 1978).

### Results and discussion

On the Leu70% diet, growth performance, weight gain, feed intake and feed efficiency of chicken decreased significantly compared to those on the other diets ( $P < 0.05$ ). Therefore, we considered that Leu70% diet was inappropriate in meat production.

The muscle amino acid analysis showed that free Leu contents increased with an increase in dietary Leu level. On the other hand, free Glu contents of the Leu100% diet increased by 34% compared to that of the control (Leu130%) ( $P < 0.05$ ). With a decrease in dietary Leu levels, free Glu of muscle tended to increase. There were no differences in the 5'-inosinic acid contents of muscle in all groups.

In sensory evaluation, all panellists found a difference in meat taste between Leu100% and the control ( $P < 0.01$ ) in the paired difference test. Furthermore, compared to the control, the Leu100% group got a significantly higher score in overall preference, chicken like taste and umami taste in Scheffe's paired comparison test ( $P < 0.01$ ). On the other hand, there were no differences between groups in aroma and taste intensity. These results suggest that the taste of meat in Leu100% group was superior to that in the control group.



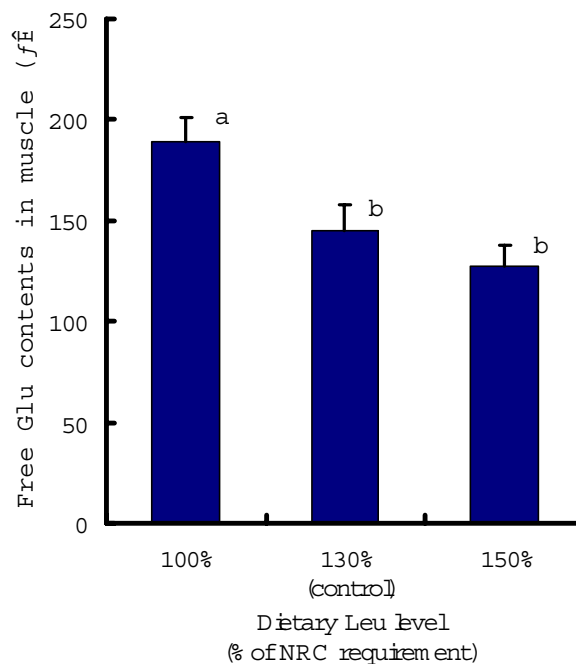
The GDH activity of Leu100% and 150% groups was lower than that of control ( $P < 0.05$ ). In contrast, the GA activity decreased with an increase in dietary Leu level ( $P < 0.05$ ). There were no differences in the GS activity in each group. From these results, we considered that the GDH and GA activities contribute to the regulation of the free Glu content of muscle by dietary Leu level.

## Conclusions

From these results, we conclude that the dietary Leu level affected the free Glu contents in muscle. The decrease in dietary Leu induced an increase in the free Glu of muscle. In sensory evaluation, the taste of meat improved with low dietary Leu level. The muscle activities of GDH and GA were also affected by the dietary Leu level. We conclude that dietary Leu level regulates the free Glu content in muscle, and the taste of meat can be improved by low dietary Leu level.

## References

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**Figure 1.** Effect of dietary Leu levels on free Glu contents in chicken breast muscle. Values expressed as means  $\pm$  SEM ( $n = 6$ ). Bars with different superscripts<sup>a,b</sup> are significantly different,  $P < 0.05$ .