

## PE1.36 Effect of dietary Lysine levels on taste-active components of meat 240.00

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**Abstract** Regulation of meat taste is one the effective method for improvement of meat quality. In this study, effects of dietary Lysine (Lys) on taste-active components, especially free glutamate (Glu), in meat were investigated. Broiler chickens (28days old) were fed on diet with graded dietary Lys content (100 or 150% of Lys requirement in NRC) for 10days before marketing. Taste-active components of meat (free amino acids) and sensory score of meat soup were estimated. Free Glu content, the main taste-active component of meat, was significantly increased by dietary Lys. Compared with the Lys 100% group, free Glu was increased by 36% in the Lys 150% group. Sensory evaluation of meat soup from the Lys 100 and 150% groups showed that they had different meat tastes. A sensory score of overall preference was significantly higher in the Lys 150% group. These results suggest that dietary Lys content is a regulating factor of free Glu in meat. Addition of dietary Lys induces an increase in free Glu content of meat and improves meat taste.

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**Index Terms:** dietary Lysine, meat quality, meat taste, umami, Glutamic acid.

### I. INTRODUCTION

Meat quality is an important quality attribute for consumers. For example, breeding technique, dietary antioxidants and colors were mainly used for improving the meat quality in the world. However, there are few reports about improving the taste active components of meat by diet. Previously, main taste component, free glutamate (Glu), content of meat was regulated by dietary crude protein (CP) and some amino acids [2, 3, 4]. In experiment 1, we investigated the effect of dietary Lysine (Lys) on

the Glu contents and sensory score of meat. In addition, for the investigation of the mechanism of Glu regulation, Glu-related enzyme activities in muscle were measured. It is well known that nutritional antagonism occurs between Lys and Arginine (Arg). When animals consume an excessive amount of Lys from their diet, they have better consume same amount of Arg. Hence, in experiment 2, we examined the effect of the antagonism, dietary Lys and Arg, on taste-active components of meat.

### II. MATERIALS AND METHODS

#### Experiment 1

The 28d old female Chunky strain broiler chickens were allocated to two groups. Dietary Lys contents were 100 and 150% of NRC Lys requirement [5]. Each diet was given to chickens of each group for 10days. All chickens were allowed free access to feed and water. After the experiment, all chickens were slaughtered, and breast muscles were taken for analyses. Free amino acids concentration in meat extract was measured by HPLC. A sensory evaluation was conducted for tastes of meat soup to determine whether differences in meat taste reflected those in chemical compositions of meat extracts. It was carried out with 16 trained panelists using paired difference and comparison test [6]. For the investigation of the mechanism of Glu regulation, the muscle glutamate dehydrogenase (GDH), glutaminase (GA) and glutamine synthetase (GS) activities were measured by enzymatic methods [1].

#### Experiment 2

The 28days old female Chunky strain broiler chicks were allocated to four groups. Dietary Lys and Arg contents were of the ratios 100:100 (Control group), 150:100 (High Lys group), 150:150 (Antagonism group) and 150:200 (High Arg group) for Lys:Arg (% of the NRC (1994) requirements). Each diet was given to chickens of each group for 10d. All chicks were allowed free access to feed and water. After the experiment, all chickens were slaughtered, and breast muscles were taken for analyses. Free amino

acids concentration in meat extract was measured by HPLC.

### III. RESULTS AND DISCUSSION

**Experiment 1** Effect of dietary Lys level on taste-active components of meat From measurements of free amino acid contents in muscles, there were significant differences in Glu. Free Glu content significantly increased by 36% in the Lys 150% group compared to the Lys 100% group ( $P<0.01$ ). As a result, it was clear that Lys addition diet induced an increase in free Glu content in muscles. Sensory evaluation of meat A paired comparison test was carried out to evaluate differences of meat tastes. As a result, all 16 panelists answered that there was a statistically significant difference between the two groups ( $P<0.001$ ). Using a scheffe's paired comparison test, scores of overall preference in the meat soup of Lys 150% group was significantly higher than that in the Lys 100% group ( $P<0.05$ ). These results suggested that the meat taste of Lys 150% group was superior to that in the Lys 100% group. Effects of dietary Lysine level on Glu-related enzyme activities in muscles Glu-related enzyme activities were measured to investigate mechanisms of Glu regulation by dietary Lys concentration. GDH is the enzyme that catalyses the conversions of alpha-ketoglutarate and Glu. GA activity is the enzyme that generates Glu from glutamine (Gln). GS is the enzyme that catalyzes glutamate to form glutamine. There were no significant differences of dietary Lys levels on these activities. These results indicated that the other mechanism might largely contribute to the regulation of free Glu in muscles by dietary Lys level. **Experiment 2** Effect of dietary Lys-Arg antagonism on growth performance At the end of the experiments, body weight gain was similar among all groups. Feed intake and feed efficiency were also similar for all groups. From these results, there were no effects of Lys-Arg antagonism on growth performance. Effect of dietary Lys-Arg antagonism on taste-active components of meat Free Glu content significantly increased the entire group addition Lys in the diet (High Lys group (Lys:Arg=150:100), Antagonism group (150:150) and High Arg group (150:200)) compared to the control group ( $P<0.01$ ). However, there was no difference in Glu content among the group addition Lys in the diet. Therefore, there was no effect of dietary Arg levels on taste-active component of meat.

### IV. CONCLUSION

In order to clarify that the meat taste is able to improve by dietary components, we measured free amino acids, sensory score and Glu related enzyme activities by using Chunky strain female broilers. In addition, because it is well known that antagonism occurs between Lys and Arg metabolism, we investigated the effect of the antagonism on taste-active components of meat. In our study, free Glu contents were significantly increased in only Lys addition diet. And this increasing of Glu could recognize from sensory evaluations of meat soup. From the enzymatic analysis, it was suggested that there was no effect of dietary Lys on Glu related enzyme activities. Furthermore, we cleared that there was no effect of Arg levels on taste-active components of meat. We conclude that dietary Lys regulates the free Glu contents in muscle, and improve the meat taste.

### ACKNOWLEDGEMENT

Part of this research was financially supported by a Grant-in-Aid for Scientific Research (C), No.20580292, from the Ministry of Education, Science, Sports and Culture of Japan to S. Fujimura.

### REFERENCES

- [1] Bernt, E. & Bergmeyer, H.U. (1974) L-Glutamate, UV-assay with glutamate dehydrogenase and NAD, in: Bergmeyer, H.U. (Ed.) *Methods of Enzymatic analysis*, 2nd ed., pp. 1704-1708 (New York, Academic Press).
- [2] Fujimura, S., Muramoto, T., Do-Ura, I., Koga, H., Tone, N., Kadowaki, M. & Ishibashi, T. (1997) Effect of feeding area and feeding intake on meat composition and taste relating components of broiler chicken. *Japanese Poultry Science*, 34, 373-381.
- [3] Imanari, M., Kadowaki, M., Fujimura, S. (2007) Regulation of taste-active components of meat by dietary leucine. *British Poultry Science*, 48, 167-176.
- [4] Imanari, M., Kadowaki, M., Fujimura, S. (2008) Regulation of taste-active components of meat by dietary branched-chain amino acids; effects of branched-chain amino acid antagonism. *British Poultry Science*, 49, 299-307.
- [5] National Research Council. (1994) *Nutrient Requirements of Poultry*, 9th ed. Washington, DC, National Academy Press.
- [6] Stone, H. & Sidel, J.L. (2004) *Discrimination testing*, In Taylor, S.L. *Sensory Evaluation Practices*, 3rd ed., (pp. 145-200) San Diego, CA, Academic Press.