The Influence of Different Glutaminase Preparations on Taste and Texture of Cooked, Cured Model Ham Systems

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Background ; The enzyme glutaminase (EC 3. 5. 1. 2.) catalyzes the reaction L-glutamine into L-glutamic acid (Glu) plus ammonia. Okayama et al. reported the effects of purified glutaminase (1994) and the glutaminase preparation containing proteases (Glutaminase Daiwa) (1998) on sensory evaluation of processed meat products. These results suggested that the palatability of taste of processed meat products was improved by the addition of the purified glutaminase and the glutaminase together with proteases, but the former had a economical problem and the latter had a rheological problem caused by the protease fraction in Glutaminase Daiwa.

Objectives ; This study was conducted to test different glutaminase preparations on taste and texture of cooked, cured model ham systems.

Methods ; Purification and characterization of glutaminase : Extracellular glutaminase of Bacillus subtilis GT strain has been purified by Shimizu et al. (1991). The enzyme preparation was most active at pH 6.0, and stable in a pH range 5.0-8.0. Preparation of model ham and addition of glutaminase solution : The model ham was prepared as follows ; a 15 ml pickle and 0.1 g each enzyme preparation except for the control, was injected into 100 g pork loin. The sample was then cured at 7 C for 5 days in 50 ml pickle. The sample was soaked for 10 min in 200 ml cold water after curing, then stuffed into a fibrous casing. It was dried at 60 C for 2 hr, and cooked at 75 C for 35 min, and then cooled down with running tap water for 10 min. Determination of Glu, ammonia and free amino acid : Glu was examined using a Yamasa L-Glu Assay Kit (Japan). Ammonia was determined using a Boehringer Mannheim Urea/Ammonia Assay Kit. Determination of free amino acids was carried out by the method of biological analysis with Hitachi L-8500 Amino Acid Analyzer. Sensory evaluation : It is very difficult to carry out a sensory evaluation of enzyme preparation No. 0-10 samples (Table 1) simultaneously. Therefore, Experiment I was performed with No. 0, 1, 2, 3, 4, Experiment II was carried out with No. 0, 1, 5, 6, 7, and Experiment III was performed with No. 0, 1, 8, 9, 10. Sensory evaluation was carried out by the ranking method (Institute of Food Technologists, 1981). We used 5 samples, each ranked by 6-8 panelists. Score 1 is the best sample from the standpoint of umami flavour and score 5 is the worst sample. The results were analyzed with Kramer's method (1963). Measurement of hardness : Hardness was measured using a creep meter (YAMADEN Co. LTD., Tokyo, RE-3305) with a No. 6 plunger, 8 mm in diameter. Hardness (g) of samples was presented by the required force for 30% pressure of ca. 1.6 cm^3 sample.

Results and discussions ; Glu, ammonia and total free amino acid content : The effect of the addition of glutaminase preparation on Glu content in model hams is shown in Fig. 1. The production of Glu in samples to which No. 2, 3 and 4 glutaminase preparations was added, significantly increased by 1.4, 1.5, and 1.7 times to that of the control, respectively. On the other hand, the production of Glu in samples to which No. 5, 6 and 7 glutaminase preparations was added, significantly increased by 1.9, 2.0 and 2.1 times to that of the control, respectively. The production of Glu in samples No. 8, 9 and 10 was the almost same as that of the samples No. 5, 6 and 7, respectively. These results suggested that activity of neutral protease was higher that of alkaline protease, under these conditions the pH about 6.0 after curing. The effect of the addition of glutaminase prepara-

tion on the ammonia content in model hams is shown in Fig. 2. Ammonia content in all samples with added glutaminase, except glutaminase preparations No. 1 and 8, was significantly higher compared to that of the control. The content of ammonia in the samples were raised with the increase of alkaline protease and both of these proteases. The effect of the addition of glutaminase preparation on total free amino acids content of model hams is in Table 2. In this case, the total amino acid content of the control is 100, all other samples except No. 1 sample were higher than 100. Especially, total amino acid content of sample No. 7 containing neutral protease of 20,000 PU/g increased by about 3 times to that of the control. Sensory evaluation : Table 3 shows the number of superior or inferior results judged significantly by the sensory evaluation of 5 times, except control and No. 1 of 15 times. The control was judged 2 times within 15 examinations as inferior significantly. The samples No. 2, 6, 9, the samples No. 3, 4, 7 and the sample No. 10 were evaluated as superior significantly, 1, 2 and 3 times within 5 examinations, respectively. The samples containing proteases showed higher palatability on sensory evaluation of taste than these of the control and sample No. 1. Hardness of model ham : The effect of the addition of glutaminase preparation on hardness of model hams is shown in Table 4. The control and sample No. 1 were similar in hardness, but sample containing each protease resulted in a lowering of the hardness. The samples No. 2 and 5 contained 5,000 PU/g of alkaline and neutral proteases were about 60% of the hardness of the control. The samples No. 3, 6 and 9 contained 10,000 PU/g of each protease and both of these proteases were about 40% of the hardness of the control. And then the relative values of under thirty percent were obtained by the samples No. 4, 7 and 10 containing 20,000 PU/g of each protease and both of these proteases. These results suggested that raising the concentration of proteases results in a softer texture.

Conclusions ; From the standpoint of the effective utilization of very poor meat, these results suggested that the possibility of the conversion of hard and unpalatable meat to tender and delicious meat may be presented by using glutaminase containing some proteases preparations.

Literature ; Institute of Food Technologists, Sensory Evaluation Division, Food Technol., 35, 50 (1981). A. Kramer, Food Technol., 17, 1596 (1963). T. Okayama, M. Yamanoue, I. Nishikawa, Y. Shimizu, K. Goto, and M. Numata, Proc. 40th ICoMST., Hague, Netherlands, S-VIB.19. 1 (1994). T. Okayama, Y. Nabae, M. Yamanoue, I. Nishikawa, Y. Shimizu, K. Goto, M. Numata and K. O. Honikel, Fleischwirtschaft, 78, 41 (1998). Y. Shimizu, A. Ueyama and K. Goto, J. Brew. Soc. Japan, 86, 441 (1991).

Data in the form of tables and figures ;

Table 1. Composition of glutaminase preparation

Enzyme preparation NO.	Glutaminase (GTU/g)	Alkaline protease (PU/g)	Neutral protease (PU/g)
0 (Control)	0	0	0
1	100	0	0
2	100	5,000	0
3	100	10,000	0
4	100	20,000	0
5	100	0	5,000
6	100	0	10,000
7	100	0	20,000
8	100	2,500	2,500
9	100	5,000	5,000
10	100	10,000	10,000

Table 2. Total free amino acid content of ham

Sample No.	Total free amino acid (%)
0 (Control)	100
1	98
2	118
3	154
4	197
5	196
6	254
7	293
8	148
9	182
10	207

Table 3. Sensory evaluation of model ham

Sample No.	Superior(time)	Inferior(time)
0 (Control)	0	2
1	0	0
2	1	0
3	2	0
4	2	0
5	0	0
6	1	0
7	2	0
8	0	0
9	1	0
10	3	0

Table 4. Effect of glutaminase preparation on hardness of model ham

Sample No.	Hardness (g)	Relative value (%)
0 (Control)	1,730	100
1	1,770	102
2	1,000	58
3	600	35
4	450	26
5	1,000	58
6	670	39
7	450	26
8	1,500	87
9	650	38
10	460	27

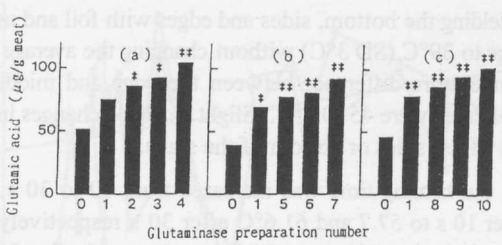

Fig. 1. Effect of glutaminase preparation on glutamic acid content in model ham. (a) : Experiment I, (b) : Experiment II, (c) : Experiment III. ‡ : P<0.05, ‡‡ : p<0.01

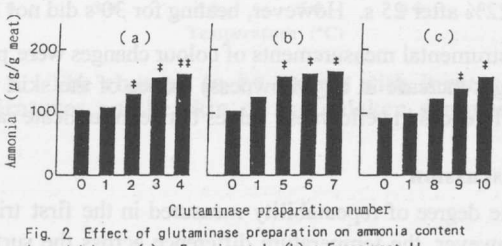

Fig. 2. Effect of glutaminase preparation on ammonia content in model ham. (a) : Experiment I, (b) : Experiment II, (c) : Experiment III. ‡ : P<0.05, ‡‡ : P<0.01.