THE EFFECT OF SALT COMPOSITION ON TASTE DEVELOPMENT IN PROSCIUTTO

H. KOHATA, M. NUMATA, M. KAWAGUCHI, T. NAKAMURA and N. ARAKAWA *

Itoham Central Research Institute, 1-2 Kubogaoka, Moriya, Ibaraki 302-01, Japan

*Department of Food and Nutrition, Ochanomizu, 2-1-1 Otuka, Bunkyoku, Tokyo 112, Japon

SUMMARY

To investigate the effect of salt composition on taste development of prosciutto, five types of salt mixtures (involved microcomponents, at levels of 0, 3.5, 8, 16 and 32%) were used as a curing agent. No effect of salt composition on changes of pH, moisture, protein, salt and ATP-related compounds in prosciutto was observed during curing, aging and drying process. The amounts of free amino acids and peptides tended to increase with the increase of microcomponents in salt and this tendency was noticeable in later term of drying.
Unami and aftertaste of final products became stronger depending on the increases of free amino acids and peptides. Microcomponents in salt enhanced the protein extractability but didn't affect the proteolytic enzyme activities in prosciutto.
The increases of free amino acids and peptides by microcomponents could be explained as the enhancement of proteolysis caused by the change of meat structure, and subsequently, the enhancement of protein degradation wtih endogenous enzymes.

INTRODUCTION

Salt is basic to all curing mixtures and is the only ingredient necessary to maintain shelflife, water holding capacity and flavor in processed meat products (WIRTH, 1988). It is emprically said the food-grade salt should be used in curing, since impure salt can cause flavor and color problems. But the effect of components in salt excepting sodium chloride on the quality of processed meat products is poorly studied.

On the other hand, sodium reduction is currently recommended as a means of decreasing hypertension and subsequent cardiovascular diseases(WINTER, 1986). This tendency has resulted in extensive research to reduce the sodium levels and to scientifically clarify the effect of components excepting sodium chloride in processed meat products.

From the view of the latter, we previously reported that heat-induced gelation of bologna sausage increased by microcomponents ($CaSO_4$, $MgCl_2$ and $MgSO_4$, at levels of 2-16%) in salt without flavor and color problems (NUMATA, 1992). In this paper, we describe the effect of microcomponents in salt used as a curing agent on the taste development of prosciutto.

MATERIALS AND METHODS

Twenty hams designated in five groups (Table 1) were prepared following a process shown in Fig. 1. The composition of microcomponents in each salt used as a curing agent was referred to that in Japanese sea salt. Physicochemical and organoleptical changes of hams (near the hip joint) were determined at ages 0, 25, 74, 109 and 166 days.

Adenosine 5'-trimhosphate (ATP) -related compouds, free amino acids (FAA) and peptides in an acids-soluble fraction obtained via addition of trichloroacetic acid solution (final conc. 5 %) were analysed. ATP-related compound sand peptides were determined by high performance liquid chromatography (HPLC) using the methods of KITADA et al. (1983) and HEFTI (1982) , respectively. FAA was determined with a Hitachi amino acid analyser (OKITANI et al., 1986). The pH values and moisture, protein and salt contents were analysed in the methods described in AOAC. Calcium-activated neutral protease (calpain) and cathpsin B, H and L were assayed by the methods of ISHIURA et al. (1978) and BARRETT and KIRSCHKE (1981), respectively.

Sensory evaluation was performed by a 10-member sensory panel, using final products and heated soups extracted with an equal weight of water from hams at various stages. Panelists relatively judged the taste intensity of each sample versus that of sample used salt without microcomponents as a curing agent. The evaluated traits were the intensity of saltiness, bitterness, unami, astrinency, aftertaste, thickness, metalictaste and mildness.

Total protein and myosin heavy chain extractability from raw meat was examined with same salt and hams used in the experiment. After the addition 10 vol. of salt solution (final conc. 3.5 %) to minced meat, supernatant obtained by the centrifugation at 20000 rpm for 30 minutes was used. Total protein in supernatant was determined by Kjeldahl semimicro-method. Myosin heavy chain was calculated from the densitometry of polyacrilamide gel electrophoresis in SDS carried out by the method of LAEMMLI (1970).

Statistical analysis was made using Student t-test.

RESULTS AND DISCUSSION

Physicochemical changes of prosciutto No. 1 during curing, aging and drying process are shown in Fig. 2 (pH, moisture, crude protein and salt contents) and in Table 2 (ATP-related compounds) , since there are no differences in these changes among five types of prosciuttoes. The pH values increased to about 6. 0 at the post-curing stage, subsequently to maintain the approximately same values until the final process. Moisture contents considerably decreased in the curing and the later term of drying, and conversely, crude protein and salt contents increased. The degradation of ATP gradually advanced, so that IMP synergistically contributing with glutamic acid to the taste development of meat products (YAMAGUCHI, 1967) was not detected in the final products.

Total amounts of FAA in all prosciuttoes tended to increase with the curing, aging and drying time (Fig. 3). The increases in prosciuttoes No. 3, 4 and 5 were significantly higher ($p<0.05$) than that in prosciutto No. 1 at the drying process. FAA mainly increased were Ala, Glu, Lys and Leu. No difference in the change of FAA composition among five types of prosciutooes was observed.

Fig. 4 shows the peptide pattern of raw meat by HPLC analysis. The molecular weight of each peak was gussed to be 1000 (peak I) , 300 (peak II) and less than 300 (peak III- V). The increase ratio (represented as peak area at each stage versus that at raw meat) of peak I and III mainly increased is shown in Table 3. To compare among prosciuttoes, both peak area at each stage more large depending on the increase of microcomponents in salt used as a curing agent. This tendency was noticeable in the later term of drying. These results suggested that microcomponents in salt had an action to enhance at least the proteolysis of prosciutto during ciring, aging and drying process, and its action depended on the concentration of microcomponents at levels of 4-32%.

Fig. 5 shows the sensory evaluation on taste of the final products. The unami and aftertaste intensity of prosciutto No. 5 was significantly stronger ($p<0.05$) than that of prociutto No. 1. Same tendency but with no significant difference was found in the case of prociuttoes No. 3 and 4. On the other hand, the salty taste intensity of prosciuttoes No.3, 4 and 5 was significantly poorer ($p<0.05$) than that of prosciutto No. 1. Intensified the unami and aftertaste and mitigates the salty taste had good sensory characteristics. In addition, sensory evaluation studies using soups prepared from prosciutooes at each stage of pressing shwed that microcomponent contents in salt used was positively correlated with the unami and aftertaste intensity and negatively with the salty taste intensity, and these phenomena appeared at the drying process for the former and at the post-curing stage for the latter (date not shown). The discrepancy of unami and aftertaste intensity among five types of prosciuttoes was in good accord with that of FAA and peptide contents. These results may indicate that containing microcomponents in salt leads to the intensification of unami and aftertaste by enhancing the proteolysis and the mitigation of the slaty taste by reducing sodium chloride.

In order to investigate the effect of microcoponents in salt on the enhancement of the proteolysis, the protein extractability from raw meat under the same condition of this experiment and proteolytic enzymes (calpain and cathepsin B, H and L) activities of prosciuttoes were determined. Both total protein and myosin extractability increased with the increase of microcomponents in salt, while there were no differences in all proteolytic enzymes activities among five types of prosciuttoes at various stages (date not shown). Therefore, the enhancement of proteolysis by microcomponents seemed to be caused by the change of meat structure, and susequently, the protein degradation with endogenous enzymes.

CONCLUSION

Microcomponents in salt used as a curing agent contributed not only to reduce the sodium levels and also to improve the cured taste (unami and aftertaste) of prosciutto by the enhancement of proteolysis during curing, aging and drying process.

REFERENCES

BARRETT, A. J. and KIRSCHKE, H. (1981). Methods in enzymology, vol. 80, 535, Academic press. (London).

HEFTI, F. (1982) . Anal. Biochem., 121, 378.

ISHIURA, S. MUROFUSHI, H. SUZUKI, K. and IMAHORI, K. (1978) . J. Biochem.,84,225.

KITADA, Z., SASKI, M. TANIKAWA, K. NAOI, H. FUKUDA, T. and OKAMOTO, I. (1983) . J. Food Hyg. Soc. Japan, 24, 225.

LAEMMLI, U.K. (1970) . Nature, 227, 680.

NAMATA, M. KAWAGUCHI, M. NAKAMURA,T. and ARAKAWA, N. (1992) .J. Japanese Soc. Food Sci. and Technol., 39, 397.

OKITANI, A. NISHIMURA, T. KANEKO, N. CHIJIIWA,A. and KATO, H. (1986). Japanese Soc. Zootechnic. Sci. 57, 593.

WINTER R. (1986). Die Fleischerei. 37, 310.

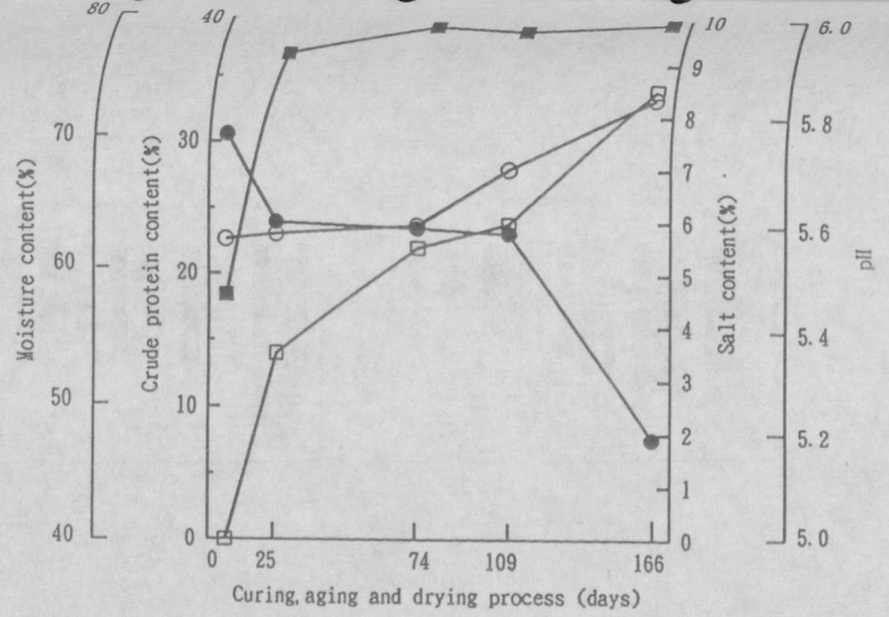

Fig. 2 Changes of PH, Moisture, Cured Protein and Salt Content in Prosciutto No. 1 during Curing, Aging and Drying Process
○: Crude protein content(%)
●: Moisture content(%)
□: Salt content(%)
■: pH

Table 2 Changes of ATP-related Compounds in Prosciutto No. 1 during Curing, Aging and Drying Process

(μmol/g meat)

	Curing, aging and drying process (days)				
	0	25	74	109	166
ATP	0.23±0.05[a)]	0.10±0.02	0.02±0.01	——	——
IMP	2.78±0.12	1.79±0.08	0.46±0.05	0.18±0.04	——
HxR	3.71±0.30	4.24±0.54	5.54±0.65	6.35±0.79	4.42±0.21
Hx	0.62±0.32	0.69±0.10	2.12±0.47	3.49±0.73	5.35±0.65

a) Mean±s.d.

Table 1 Experimental Design

Prosciutto	Curing salt composition used (%, w/w)				
	NaCl	$MgCl_2$	KCl	$CaSO_4$	$MgSO_4$
No. 1	100.00	0.00	0.00	0.00	0.00
No. 2	96.44	1.46	0.42	0.99	0.58
No. 3	92.00	3.34	0.96	2.27	1.33
No. 4	84.00	6.73	1.94	4.56	2.67
No. 5	68.00	13.50	3.88	9.15	5.36

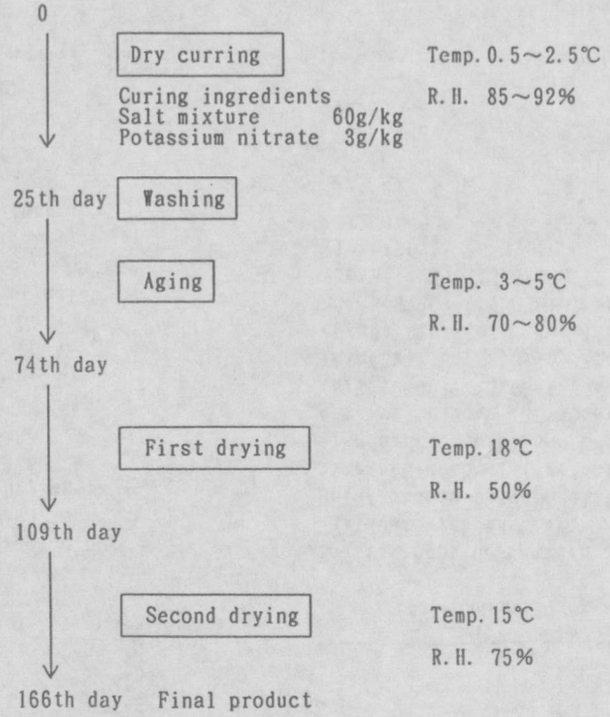

Fig. 1 Processing Procedure of Prosciutto

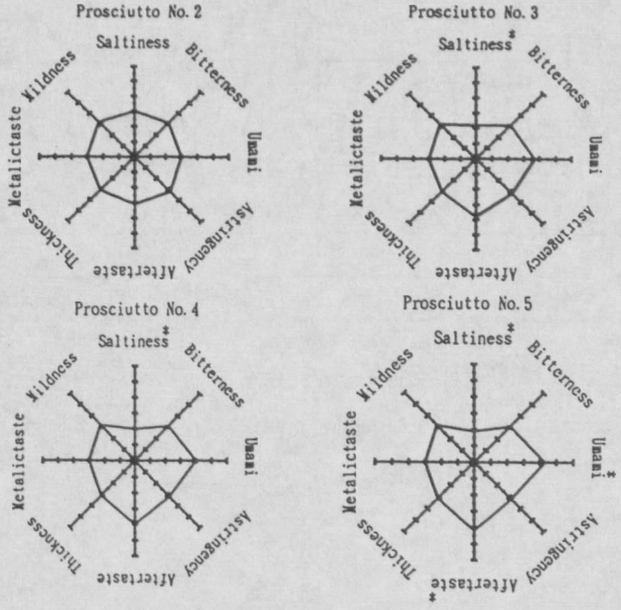

Fig. 5 Sensory Test of Final Products
Each taste of prosciutto No. 2, 3, 4 and 5 was compared with that of prosciutto No. 1. Taste intensity was scaled from extremely poor(-3) to extremely strong(+3) by ten panels.
* Significantly different ($p < 0.05$)

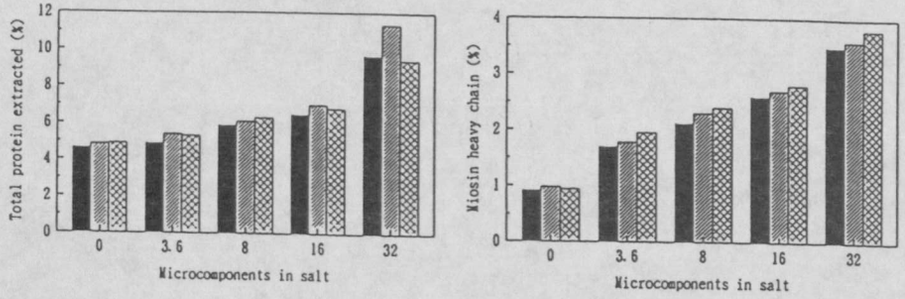

Fig. 6 Effect of Salt Composition and Salt Concentration on the Protein Extractability from Muscle Protein

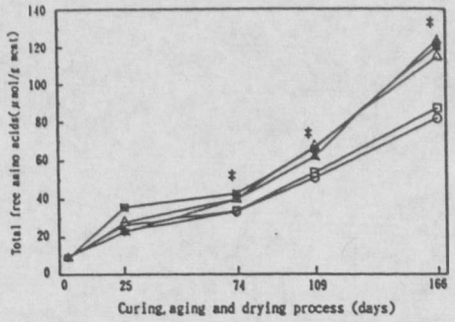

Fig. 3 Changes of Total Free Amino Acid in Prosciutto during Curing, Aging and Drying Process
○: Prosciutto No. 1
□: Prosciutto No. 2
△: Prosciutto No. 3
■: Prosciutto No. 4
▲: Prosciutto No. 5
* The amount of total amino acid in prosciutto No. 3, 4 and 5 were significantly higher ($p < 0.05$) than that in prosciutto No. 1 at 74, 109 and 166 days.

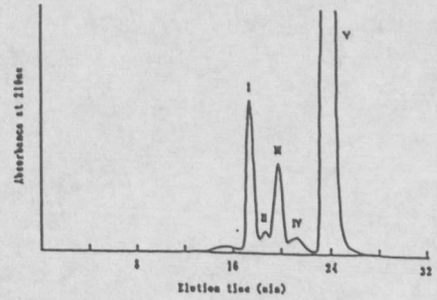

Fig. 4 Initial Peptide Pattern of Raw Meat with HPLC.
Relationship between elution time and molecular weight of standard proteins and peptides are follows : Cytochrome (M.W. 12500); 13.03min, Aprotinin(6211); 14.70min, Insulin (5800); 15.16min, Insulin B-chain(5796); 15.69min, Bacitracin(1420); 16.52min, Glutatione(307); 18.82min.

Table 3 Changes of Peak I and III in Peptides Patterns with HPLC during Curing, Aging and Drying Process

Peak No.	Procsiutto No.	Curing, aging and drying process (days) 25	74	109	166
I	1	1.25	1.37	1.58	2.00
	2	1.25	1.38	1.58	2.12
	3	1.26	1.41	1.64	2.23
	4	1.29	1.44	1.79	2.46
	5	1.30	1.48	1.94	2.55
III	1	1.41	1.61	1.85	2.36
	2	1.44	1.62	1.88	2.39
	3	1.49	1.66	1.95	2.47
	4	1.58	1.67	1.96	2.48
	5	1.61	1.70	2.01	2.60

The values in table represent the increase ratio of peak area at each stage versus that at 0 day.