PRODUCT QUALITY OF LOIN HAMS MANUFACTURED WITH VARIOUS SALT LEVELS

H.C. Lee*, J.S. Hwang and K.B. Chin

Department of Animal Science, Chonnam National University, Gwangju, 500-600 Korea. Email: harmony0318@naver.com

Keywords: loin hams, product quality, salt levels

Introduction

More recently, consumers are selecting healthier foods for the benefit of their health. In the manufacture of healthier meat and meat products, fat and salt levels should be reduced in the formulations. Healthier foods have been consumed to prevent or treat certain disease as well as to provide nutrition (Jimenez-Colmenero *et al.*, 2001). In the west, people prefer low-fat or low-salt meat products as recommended by the World Health Organization (WHO) (Resurreccion, 2003). However, most people consumed sodium more than recommended (AHA, 2000). Following a similar trend, Koreans consumed more sodium than western people (KHIDI, 2001). Since fat and salt contributed to flavour and texture, these ingredients are normally added in the manufacture of meat products. In particular, salt contributes to reduction of cooking loss (Girard *et al.*, 1990) and extension of shelf-life in meat products (Brewer *et al.*, 1995). However, research on the effect of salt on the product quality of whole muscle ham has not been extensively studied. Thus, the objective of this study was to select the optimum salt level without quality defects for the manufacture of loin hams containing various salt levels (0~2.0%).

Materials and Methods

The loin hams were manufactured with various salt levels (0, 0.5, 1, 1.5, and 2%). The brine solution was injected into the loin hams using multiple injectors at about 15% of original weight. The pork loins were then injected with brine solutions and then cooked and smoked in a smoke chamber until the internal temperature reached 71.7°C. After cooking, the loin hams were chilled, packaged and stored in a refrigerator (4°C) until analysed. Proximate analyses were measured according to AOAC (1995) procedure. Colour measurements were performed using a colour meter and expressed as L (brightness), a (redness) and b (yellowness) values. Water holding capacity (WHC, %) and cooking loss (CL, %) were measured to determine the functional properties. WHC was measured according to the modified method of Jauregui *et al.* (1981) and CL was evaluated by a weigh difference of cooking before and after. Warner Bratzler and Allo-Kramer shear values were measured using an Instron Universal Testing Machine. Microbial counts included total bacteria, lactic acid bacteria and *Enterobacteriaceae* were determined. Sensory evaluation performed by a 9-membered sensory panel which evaluated colour, flavour, texture and overall acceptance using an 8-point hedonic test. Statistical analyses were performed using one-way analysis of variance (ANOVA) using the SPSS 12.0 (2003) program, and then the significant differences among treatments were evaluated by Student-Newman-Keuls multiple range test ($p<0.05$). Dunnett's-T test was used to compare each treatment to the control.

Results and Discussion

Table 1 shows the physicochemical, functional and textural properties, and sensory characteristics of loin hams with various salt levels. pH values, moisture (%), fat (%) and protein (%) content of loin hams were 5.99~6.11, 62.9~68.6, 2.15~5.62 and 20.2~26.6, respectively. The salt level of loin hams did not affect physicochemical properties and functional properties, whereas cooking loss (CL, %) was significantly affected by salt level ($p<0.05$). Loin hams containing higher than 1% salt level had lower CL than those containing lower 0.5% salt ($p<0.05$). These results were confirmed with previous results reported by Girard *et al.* (1990). However, loin hams with 1% salt level had similar CL to the control ($p>0.05$). In textural properties, no differences in Warner-Bratzler and Allo-Kramer shear values were observed among treatments including the control ($p>0.05$). The total bacterial counts were lower than 10^2cells/g, and lactic acid bacteria and *Enterobacteriaceae* were not detected in all treatments (data not shown). On the other hand, most sensory characteristics were affected by reduced salt level (Figure 1). The loin hams containing less than 1% salt received lower preference scores in sensory evaluation, for attributes such as texture, juiciness, colour and overall acceptance. These results also indicated that loin hams containing 1.0% or higher salt might be acceptable for consumers because they had better sensory characteristics. Thus, the optimum salt level without quality defect was at least 1%.

Table 1: Product qualities of loin hams manufactured with various salt levels.

Treatments	Various salt levels				
	0%	0.5%	1.0%	1.5%	2%
pH	6.11	6.04	6.04	5.99	5.99
Moisture (%)	62.9	65.5	67.4	68.6	68.0
Fat (%)	5.62	4.57	3.89	3.72	3.57
Protein (%)	26.6	21.3	20.2	20.9	22.2
Hunter L	73.0	69.2	68.8	70.6	69.6
Hunter a	11.2	12.1	9.11	9.66	9.74
Hunter b	4.99	4.84	2.82	3.75	3.11
Cooking Loss (%)	35.0 [a*]	28.6 [b*]	21.3 [c]	19.4 [c]	18.2 [c]
Expressible Moisture (%)	17.5	15.4	22.9	20.9	21.1
Allo-Kramer (kgf/g)	6.11	5.47	4.63	5.03	4.86
Warner-Bratzler (kgf)	2.89	2.25	2.46	2.45	2.31

[a-c] Means having same superscript within same column are not different ($p>0.05$);
[*] Paired comparisons (CTL 2.0 vs. treatments) significant at the $p<0.05$ level using Dunnett's-T test.

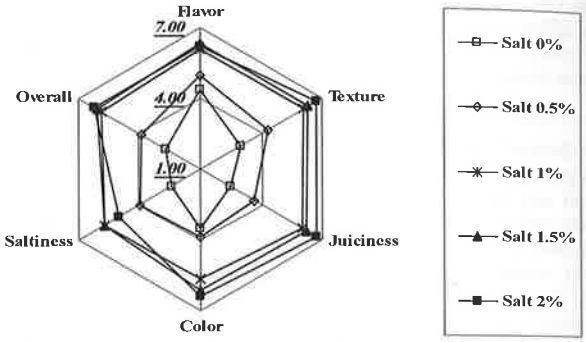

Figure 1: A spider web graphic representation of sensory data from the loin hams containing various salt levels.

Conclusions

Loin hams containing 1% salt had similar product qualities to the control in physicochemical, functional, textural and sensory properties ($p>0.05$). Increasing salt level up to 2% improved sensory characteristics and reduced cooking loss. Thus, the optimum salt level in the manufacture of low-salt loin hams without quality defects was at least 1%.

References

AHA (2000). American Heart Association Guidelines: Revision 2000. Circulation, 102(18): 2284-2299.

AOAC (1995). Association of Official Analytical Chemists. (15th ed). Washington, DC.

Brewer, M.S., Rostogi, B.K., Argoudelis, L., and Sprouls, G.R. (1995). Sodium lactate/sodium chloride effects on aerobic plate counts and color of aerobically packaged pork. Journal of Food Science, 60: 58-62.

Girard, J.P., Culioli, J., Maillard, T., Denoyer, C., and Touraille, C. (1990). Influence of Technological Parameters on the Structure of the Batter and the Texture of frankfurter type Sausages. Meat Science, 27: 13-28.

Jauregui, C.A., Regenstein, J.N., and Baker, R.C. (1981). A simple centrifugal method for measuring expressible moisture, a water-binding property of muscle foods. Journal of Food Science, 46: 1271-1273.

Jimenez-Colmenero, F., Carballo, J., and Cofrades, S. (2001). Healthier meat and meat products: their role as functional foods. Meat Science, 59: 5-13.

KHIDI (2001). Korean national health and nutrition survey 2001. Chapter 3. Research results: pp. 511-512, table 7-47, 8. Korea Health Industry Development Institute.

Resurreccion, A.V.A. (2003). Sensory aspects of consumer choices for meat and meat products. Meat Science, 66: 11-20.