

Evaluation of Physico-chemical and Textural Properties, and Sensory Evaluation of No-fat Sausages Manufactured with Various Salt Levels

Hong C. Lee*, Koo B. Chin

Meat Science Laboratory, Department of Animal Science, Chonnam National University, Gwanju, Korea

Introduction

In general, no-fat sausages did not contain any fat in the final products. However, it may not be feasible, therefore, the final products that contained less than 0.5% fat were classified as no-fat products in USA regulations. To meet this requirement, the raw meats should be high quality lean meats and trimmed out external fats completely (<0.05%). On the other hand, no-fat sausages may have rubbery texture due to the high protein content(%). Several processing technologies were made to prevent the rubbery texture; reducing the salt level and comminution time, and addition of fat replacers. Therefore, the objectives of this study were to develop no-fat sausages by using the high quality lean meats with reduced salt levels, determine functional and textural properties, and sensory evaluation, and select the optimum salt level similar quality characteristics to those with regular-fat counterpart.

Materials and Methods

The manufacture and measurements of no-fat comminuted sausages

No-fat sausages with reduced salt levels were manufactured followed by Choi and Chin⁽¹⁾. The sausages were vacuum-packaged and stored at 4°C until analyzed. pH values were measured by a pH meter (Mettler Toledo MP120 pH meter, Schwerzenbach, Switzerland). Proximate analysis determined by AOAC(1995)⁽²⁾ and water holding capacity (WHC, %) was measured according to the modified method of Jauregui et al.⁽³⁾. Color measurements were performed using a Color meter (CR-10, Minolta Corporation, Japan) and expressed by L, a and b values. Cooking losses (CL, %) were evaluated by a weigh difference of cooking before and after. Textural analyses were measured by Instron Universal Testing Machine (Model 3344, Canton, MA, USA) according to described by Bourne⁽⁴⁾. Microbial tests were determined to total plate count (TPC) for total bacteria and violet red bile agar (VRB) for coliform bacteria. Sensory evaluation was performed by 7-trained panels in Meat Science Lab in Chonnam National University and evaluated the color, taste, texture and overall acceptability rating as #1 being a most like, and # 8 least like. Statistical analyses were performed by one-way analysis of variance(ANOVA) using the SPSS

(version 10.0, 2000) program with three replicates.

Results and Discussion

pH values of no-fat sausages (NFS) were 5.8~5.9, which tended to be lower, as compared to the previous study⁽¹⁾. This result was partially due to the low pH value of raw meats. The fat content(%) of NFS was less than 0.5%, except for 1.5% salt, and therefore they may be classified as NFS. Thus, approximately 20% fat was removed in these products. The reduced salt level did not affect ($P>0.05$) pH values and proximate composition (Table 1). NFSs tended to be darker and less yellowness ($P<0.05$) than regular-fat sausages (RFS). Although RFS had less expressible moisture (EM, %) than NFSs, reduced salt level did not affect the water holding capacity(WHC, %). This would be due to the strong binding of emulsion and lower moisture(%) in RFS. Cooking losses (CL, %) were not different among the control and treatments. No differences in textural properties were observed among the treatments ($P>0.05$), even

Table 1. Quality characteristics of no-fat sausages with reduced salt level as compared to those with regular-fat counterpart

	No-fat sausages(salt, %)				
	RFC	0.75	1.0	1.25	1.5
pH	5.82±0.03	5.79±0.08	5.81±0.04	5.82±0.08	5.80±0.09
Moisture	58.6±3.06 ^b	75.8±1.92 ^a	75.7±0.02 ^a	76.6±1.47 ^a	76.2±1.83 ^a
Fat	21.7±2.83 ^a	0.43±0.01 ^b	0.32±0.01 ^b	0.23±0.01 ^b	0.66±0.01 ^b
Protein	13.8±0.98	14.8±0.89	14.4±0.96	14.3±0.99	14.1±0.27
L	59.2±2.06 ^a	54.9±1.96 ^b	56.2±1.75	^{ab} 52.9±1.78 ^b	56.0±2.76 ^{ab}
a	17.8±1.29	17.8±1.61	15.9±1.35	17.7±4.56	15.2±2.80
b	19.8±1.83 ^a	17.1±0.92 ^{ab}	16.4±0.57 ^b	16.8±2.59 ^{ab}	15.5±1.70 ^b
EM	18.3±6.71 ^b	31.1±2.61 ^a	31.1±3.76 ^a	28.3±2.63 ^a	27.4±3.54 ^a
CL	8.39±1.12	9.23±0.67	8.77±0.99	8.40±0.34	8.14±1.01
Hardness	5635±1330	3407±951	4104±801	3922±1676	4133±1744
Springiness	0.30±0.03	0.25±0.05	0.25±0.05	0.26±0.04	0.30±0.02
Cohesiveness	0.22±0.04	0.19±0.02	0.19±0.03	0.20±0.02	0.24±0.02
Gumminess	240±129	676±278	773±193	809±490	929±433
Chewiness	392±89	195±102	187±95	240±177	296±158
Flavor	3.87±0.85	4.24±0.72	3.97±0.44	4.05±0.63	3.73±0.74
Texture	4.18±1.83	5.24±0.52	4.55±0.96	4.86±0.31	3.50±0.33
Juiciness	3.97±0.90	5.43±0.38	4.42±0.54	4.56±0.41	3.84±0.58
Color	4.02±0.71	4.84±0.61	4.24±0.32	4.55±0.77	3.82±0.55
Saltiness	4.11±1.07	5.20±0.54	4.56±0.70	4.77±0.39	3.80±0.43
Overall	4.28±1.39	5.70±0.51	4.79±0.67	5.06±0.18	3.69±0.28

RFC : Regular-fat control(fat > 20%), NFS : No-fat sausage(fat < 0.5%)

though there were numerical differences. However, NFSs containing 1.0% salt were similar hardness values to those with 1.5% salt. These results indicated that the salt level did not affect the textural properties of NFS. The addition of fat replacer (konjac-carrageenan-soy protein) in NFSs may contribute to cover the textural defects due to the reduced salt level. Sensory evaluation shows that panelists preferred to higher salt treatments than lower-salt products. NFSs containing 1.5% salt were similar or better sensory results to those with RFS and NFS containing 1.25% salt had similar overall acceptability to that of RFS. NFS containing 1.0% had also similar sensory flavor, color and saltiness values to those with RFS. These results indicated that NFS containing 1.0% salt would be acceptable for consumers because they had similar instrumental texture value and sensory results to those with RFS.

Summary

pH, proximate analysis and functional properties were not significantly affected by reduced salt levels in NFS which contained 75~76% moisture, 14~15% protein < 0.5% fat in the final products. However, NFSs had differences in color and EM (%) values as compared to RFS. The results of textural test showed that they were not different with reduced salt levels (0.75~1.5%) among the RFS and no-fat treatments ($P>0.05$). NFS containing 1.0% salt had similar sensory color, flavor and saltiness values to those RFS. These results indicated that NFSs was successfully manufactured with 1.0% salt level and these may contribute to the "healthier meat products" for consumers due to no-fat and low-salt meat products.

References

1. Choi, S. H. and Chin, K. B. *Korean J. Food Sci. Technol.*, 34(4), 577-582 (2002).
2. AOAC. Official Methods of Analysis, Washington DC (1995).
3. Jauregui et al. *J. Food. Sci.* 46:1271-1273 (1981).
4. Bourne, M. C. *Food Technol.* 32(7), 62066, 72 (1978).