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Evaluation of Physicochemical and Textural Properties of Low-Fat/Salt Sausages Manufactured with Two Levels of Milk Proteins

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Introduction

Recently, the consumer attitudes toward the foods have changed to well-being tendency that they prefer to consume those with functional ingredients with reduced fat or salt. However, fat serves as not only as a source of essential fatty acids and important components of cell membranes, but also as a flavor and textural agents Furthermore, salt attribute to reduction of cooking loss[2], improvement of the textual characteristics and extension of shelf-life[3] of meat products. As a result, textural agents should add to these meat products for the compensation of the textural problems. Thus, the objectives of this study were to evaluate different two levels of milk proteins for the manufacture of low-fat/salt sausages and determine the characteristics of low-fat/salt sausages formulated with two levels of milk protein similar to those of regular-fat counterparts.

Materials and Methods

The Processing and Analytical Measurements of low-fat/salt Sausages with Milk Proteins

Low-fat sausages (<3%) with reduced salt level (<1.0%) were manufactured followed by Choi and Chin[4]. The sausages were vacuum-packaged and stored at 4℃ until analyzed. pH values were measured by a pH meter (Mettler Toledo MP120 pH meter, Schwerzenbach, Switzerland). Proximate analysis was determined by AOAC (1995)[5] and water holding capacity(WHC, %) was measured according to the modified method of Jauregui et al.[6]. Color measurements were performed using 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]. Statistical analyses were performed by two-way analysis of variance(ANOVA) using the SPSS package (10.01) with three replicates. When significant interactions were not observed between kind and level of milk protein, mean separation was accomplished with pooled mean. Dunnett's-T-test compared to each treatments with controls.

Results and Discussion

Physicochemical and Textural Properties of Low-fat/Salt Sausages

Since no interactions (P>0.05) were observed between any main effect combinations (type and level), data with no interactions were pooled for subsequent analysis and are shown in Table 1. pH values, and moisture and fat contents of low-fat/salt sausages were 6.10-6.11, 74-75%, < 3%, respectively. Two levels of milk protein did not affect these parameters. In addition, increased level up to 2% of each milk protein did not affect the pH and proximate composition, as well. Because Hunter L, a, b values of low-fat/salt sausages were not different from each other, these values were not also affected by two levels of milk proteins. For the functional properties

Table 1. Low-fat/salt sausages with different kind and level of milk proteins

	Milk Protein		Addition level(%)	
	WP	SC	1%	2%
pH	6.10 ± 0.04	6.11±0.05	6.10±0.05	6.11±0.04
Moisture	74.4±1.17	74.3±1.10	74.6±1.15	74.1±1.05
Fat	2.17±0.70	2.01±0.71	2.06±0.74	2.13±0.68
L	65.1±2.07	63.9±1.89	64.2±1.99	64.8±2.11
a	16.4±4.11	17.6±4.75	17.3±4.14	16.7±4.78
b	6.13±2.10	4.77±1.97	5.20±1.84	5.70±2.42
EM	28.5±3.34	26.4±3.87	27.1±4.29	27.8±3.18
CL	8.11±2.15	8.48±2.51	8.52±2.28	8.07±2.45
Hardness	4217±492	3990±559	4387±404	3820±459
Springiness	0.24±0.03	0.24±0.02	0.25±0.01	0.22±0.02
Gumminess	725±130	639±132	758±129	606±86
Chewiness	170±43	150±38	190±28[a]	130±19[b]
Cohesiveness	0.18±0.01	0.17±0.01	0.18±0.01	0.16±0.01

LFSs: Low-fat/salt sausages (Fat<3%, 1.0% salt), WP: whey protein (WP), SC: sodium caseinate(SC).

of low-fat/salt sausages, cooking loss (%) and expressible moisture (%) were not different as affected by the type and level of milk proteins. Textural profile analysis values of low-fat/salt sausages were not different with these ingredients except for chewiness which reduced with increased level of milk proteins. These results indicated that the type and level of milk proteins did not affect the most physicochemical and textural properties.

Comparison of regular-fat sausages with low-fat/salt counterparts (Dunnett's-T test)

Dunnett's-T-test was performed for each parameter evaluate to determine whether differences between the regular-fat control and individual treatments were significant ($P<0.05$). Although the pH values of regular-fat sausages were similar to those of low-fat/salt sausages, moisture and fat contents of low-fat/salt sausages were significantly different from those of regular-fat counterparts (Table 2). The addition of 1% sodium caseinate into low-fat/salt sausages decreased brightness, resulting in lower L* values, as compared to the regular-fat sausage. In addition, increased expressible moisture(EM,%) values were found in low-fat/salt treatments, even though milk proteins were added. Hongsprabhas & Barbut(1999)[8] reported that preheated whey protein isolates(WPI) enhanced the water holding capacities(WHC, %), reduced the cooking loss(CL, %), and improved the rheological properties in the food products lower than 1.5% salt level. Therefore, protein isolate with preheating might be better effect than the concentrate, due to high protein content and gelling properties. In TPA values, the addition of milk protein higher than 1% gave lower textural hardness and gumminess, with regardless of type of milk proteins. These results were in agreed with previous report[8] and indicated that the addition of milk proteins lower than 1% into the low-fat/salt sausages had textural characteristics similar to those of regular-fat counterpart.

Table 2. Dunnett's T-test of low-fat/salt sausages with different kind and level of milk proteins

			Low-fat/salt sausages				
		RFC	LFC	WP 1%	WP 2%	SC 1%	SC 2%
pH	Mean	6.05	6.03	6.07	6.12	6.13	6.09
	SD	0.04	0.02	0.04	0.00	0.03	0.07
Moist	Mean	58.1	74.3*	74.5*	74.2*	74.7*	74.0*
	SD	0.67	0.87	1.44	1.14	1.10	1.19
Fat	Mean	20.3	2.37*	2.05*	2.30*	2.07*	1.96*
	SD	0.92	0.83	0.69	0.84	0.94	0.60
Color	Mean	69.8	64.7	64.8	65.3	63.6*	64.3
(L, Lightness)	SD	3.39	2.23	2.65	1.86	1.30	2.62
EM	Mean	13.4	20.1	28.6*	28.4*	25.6*	27.1*
	SD	2.03	2.83	4.07	3.36	4.80	3.58
Hardness	Mean	6653	4437	4573	3861*	4201	3780*
	SD	1699	137	467	23	366	791
Springiness	Mean	0.27	0.27	0.25	0.22	0.25	0.22
	SD	0.02	0.04	0.01	0.03	0.00	0.03
Gumminess	Mean	1274	954	823	627*	693	586*
	SD	349	199	108	21	145	141
Chewiness	Mean	348	256	203	138	178	122
	SD	132	85	30	23	30	16
Cohesiveness	Mean	0.20	0.22	0.19	0.17	0.18	0.16
	SD	0.01	0.03	0.01	0.01	0.02	0.01

Treatments: RFC: Regular-fat sausage (Fat 20%, 1.5% salt);
LFSs: see the Table 1*: Significant ($p<0.05$) are expressed by the asterisk

Summary

Low-fat (< 3%)/salt(< 1%) sausages were manufactured with two levels (1, 2%) of milk proteins(whey protein and sodium caseinate) to compensate for the textural problems due to reduced fat and salt(%). The addition of two levels of milk proteins into these meat products did not affect the most physicochemical and textural properties. As compared to regular-fat counterpart, higher expressible moisture of low-fat/salt sausages were observed. In addition, low-fat/salt sausages containing more than 2% of milk proteins reduced the textural hardness and gumminess, resulting in significantly lower these values, as compared to regular-fat counterparts. These

results indicated that the low-fat/salt sausages were successfully manufactured with the addition of these milk proteins at the lower than 1% to improve the textural difference, however further research will be performed to improve the water holding capacity in these products.

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