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Protein additives effect on textural properties of comminuted meat products

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SUMMARY: Effects of protein additives on textural properties of comminuted meat products (CMP) were studied. At 80 °C pasteurized sausages and at 121 °C sterilized comminuted canned meats (CCM) were produced by using protein additives such as soy protein isolate, soy protein concentrate, sodium caseinate, milk protein concentrate and dry egg white with an exchange level of 2 % of the meat proteins.

Textural properties (hardness, strain energy of compression, elasticity) were determined by Instron 1140 Universal testing machine using textural profile analysis.

Results of textural measurment has showed that use of protein additives significantly determines textural properties of CMP. However, the effect of protein additives in different types of meat products is different. By using all protein additives the hardness of CMP has decreased with exception of dry egg white in CCM. Strain energy of compression has also decreased by using investigated protein additives. The elasticity of sausages has decreased by using investigated protein additives with exception of soy concentrate. The elasticity of CCM has decreased only by using soy protein concentrate.

According to results all investigated protein additives with exception of soy protein concentrate in sausages and dry egg white in CCM had negative effect on texture.

INTRODUCTION: The use of the plant and animal protein additives in food industry, including meat industry, to improve water retention, fat binding, emulsifying properties and textural properties, increase processing yields and reduce formulation costs. The use and functionality in comminuted meat products of different origin protein additives-soybean flour, soy concentrate and isolate, nonfat dry milk, ultra filtrated milk protein concentrate, sodium caseinate, whey protein, cottonseed and sunflower proteins-has been well documented (CHIMIROV et al., 1981, NEGISKI, 1981, MITTAL and USBORNE, 1985, SCHUT, 1982, WINTER, 1981, TERREL et al., 1981, ASKAR et al., 1982, BRÜCKNER et al., 1982.). In spite of the works of TERREL et al. (1981), WILLS and KABIRULLAH (1981), KEETON et al. (1984), PAULSON et al. (1984), PAULSON et al. (1984), PARKS and CARPENTER (1987), LIN and ZAYAS (1987. a,b), ZAYAS and LIN (1989) relatively limited information has been reported on the qualification of technological behavior of different origin protein additives in meat products. Therefore, the objective of this work was to study the effect of few protein additives on the textural properties of comminuted meat products.

MATERIALS AND METHODS: Protein additives: Five protein additives were used in this work: soy protein isolate, soy protein concentrate, sodium caseinate, milk protein concentrate, dry egg white. The protein content of these proteins was deteremined according to Kjeldahl method. Functional properties were evaluated by the following methods: Water binding ability (WBA) by the method of SOSULSKI (1962), fat binding ability (FBA) by the method of LIN et

al. (1974), emulsifying activity (EA) and emulsion stability (ES) by the method of YASUMATSU et al. (1972).

Meat products: At 80 °C pasteurized sausages and at 121 °C sterilized comminuted canned meats were produced by using protein additives with an exchange level of 2 % of meat proteins. The meat products were processed in a conventional manner under laboratory conditions. Category of meat products is presented in Table 1.

Table 1.

Category of meat products

Meat products		Protein additives
Sausages	Comminuted canned meats	
Control	Control	Meat product without protein additive
S 1	CM 1	Meat product with 2 % soy protein isolate
S 2	CM 2	Meat product with 2 % soy protein concentrate
S 3	CM 3	Meat product with 2 % sodium caseinate
S 4	CM 4	Meat product with 2 % milk protein concentrate
S 5	CM 5	Meat product with 2 % dry egg white

Textural properties: Textural properties of meat products were determined by Instron 1140 Universal testing machine using textural profile analysis. Operating conditions are listed in Table 2.

Table 2.

Operating conditions for Instron Universal testing machine

	Textural profil parameters
Crosshead speed (cm/min)	20
Load range (kg)	5-50
Chart speed (cm/min)	50
Shape of the sample and position on the plate	2,5 cm in diameter and 5 cm in long, horizontal position

Hardness (N) from first "bite" curve, strain energy of compression (Nmm) from area under the loading curve of first "bite" curve and elasticity (N/mm) from slope of linear section of first "bite" curve were determined.

RESULTS AND DISCUSSION: Protein content and functional properties of protein additives are shown in Table 3.

Table 3.

Protein content and functional properties of protein additives

Protein additives	Protein content %	WBA %	FBA %	EA %	ES %
		($\bar{x} \pm s$, n=3)			
Soy protein isolate	85,93 ± 0,05	559,19 ± 2,87	164,98 ± 6,26	95,47 ± 3,54	100 ± 0
Soy protein concentrate	66,70 ± 0,10	276,28 ± 2,18	152,57 ± 5,54	60,90 ± 2,14	60,57 ± 2,17
Sodium caseinate	88,60 ± 0,10	-	156,54 ± 0,98	88,62 ± 2,29	100 ± 0
Milk protein concentrate	73,53 ± 0,50	-	168,11 ± 1,97	69,53 ± 1,59	69,88 ± 2,31
Dry egg white	78,26 ± 0,20	-	178,53 ± 7,00	74,51 ± 3,02	100 ± 0

Instrumental determinations of the textural properties of meat products are presented in Table 4.

Table 4.

Textural characteristics of meat products

Meat products	Hardness N	Strain energy of compression Nmm	Elasticity N/mm
		($\bar{x} \pm s$, n=3)	
Sausages:			
Control	154,19 ± 11,98	1892,05 ± 52,53	6,94 ± 0,70
S 1	121,52 ± 3,39	1656,86 ± 97,30	3,68 ± 0
S 2	142,43 ± 7,92	1593,09 ± 163,18	6,54 ± 0,70
S 3	98,65 ± 2,26	1567,99 ± 88,52	5,10 ± 0,35
S 4	94,73 ± 4,93	1223,56 ± 51,87	3,47 ± 0,36
S 5	115,29 ± 1,13	1507,89 ± 36,17	3,68 ± 0
Comminuted canned meats:			
Control	94,73 ± 5,66	804,38 ± 80,76	7,35 ± 0
CM 1	87,55 ± 2,99	740,10 ± 46,75	7,35 ± 0
CM 2	66,64 ± 0	583,30 ± 20,39	5,72 ± 0,71
CM 3	78,40 ± 3,92	611,52 ± 39,02	7,35 ± 0
CM 4	79,71 ± 2,99	545,66 ± 25,91	8,50 ± 1,22
CM 5	101,92 ± 3,92	789,23 ± 45,02	6,94 ± 0,70

Results showed that incorporation of protein additives had some tenderizing effect on the finished product. Instron hardness values were significantly lower ($P<0,05$) for experimental samples with 2 % additives with exception of soy protein concentrate in sausages and with exception of dry egg white in comminuted canned meats than for the all-meat control.

Strain energy of compression data demonstrated significantly lower ($P<0,1$) strain energy value for sausages containing all investigated protein additives and comminuted canned meats containing soy protein concentrate and milk proteins than the all-meat control.

The elasticity value were significantly lower for sausages with 2 % protein additives with exception of soy protein concentrate and for comminuted canned meats with soy protein concentrate than the all-meat control.

Instron hardness, strain energy of compression and elasticity value indicated that the use of protein additives significantly determines textural properties of comminuted meat products. However, the effect of protein additives in different types of meat products is different.

The results showed that the use of all investigated protein additives with exception of soy protein concentrate in sausages and dry egg white in comminuted canned meats causes significant differences ($P<0,05$) in textural properties of the finished products compared to the all-meat control. COMER (1979) and other workers (SMITH et al., 1973, COMER and DEMPSTER, 1981, PARKS and CARPENTER, 1987) have likewise reported negative textural effects of nonmeat ingredients.

CONCLUSION: The content of protein additives-- soy protein isolate, soy protein concentrate, sodium caseinate, milk protein concentrate, dry egg white-- causes differences in hardness, strain energy of compression and in elasticity of the comminuted meat products. The effect of protein additives in different types of meat products is different. According to our results all investigated protein additives with exception of soy protein concentrate in sausages and dry egg white in comminuted canned meats had negative effect on texture.

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