SENSORY AND TEXTURAL CHARACTERISTICS OF LOW-FAT AND SODIUM REDUCED SAUSAGES USING KAPPA-CARRAGEENAN AND OTHER IONS.

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Background

Low fat meat products are a new line in meat science and technology research. The use of hydrocolloids to reduce fat content without loss any sensory or textural property is important in order to maintain consumer acceptance. Carrageenan had been used widely in meat products (DeFreitas et al., 1997a, b; Foegeding and Reamsey, 1986, 1987). The use of carrageenan is mainly in order to decrease fat content. In the same way, sodium consumption in excess an important problem to people with hypertension troubles. The affinity of carrageenan to another kind of ions, like potassium and calcium, can be used to reduce sodium content in emulsifying meat products with no detriment of sensory attributes.

Objectives

Formulate a sausage decreasing fat content and sodium reduction, using κ-carrageenan and another salts (potassium and calcium). Determine the sausages yielding, changes in instrumental texture and the sensory acceptance of the sausages.

Methods

In a Frankfurt type sausage formulation (Guerrero y Arteaga, 1990) the fat was reduced from 15 to 5%. κ-carrageenan (Gelcarin ME-913, kindly provided by FMC-Biopolymer) was added in 0.5% (w/w) concentration to the formulation. Sodium chloride was reduced in 5% and potassium and calcium chloride were added according to the formulations listed in Table 1. Cooking loss and expressible humidity were calculated according to the methodology reported by Shand (2000). Textural profile analysis were performed in a texture analyzer TAXT2 (Texture Technologies Corporation, Scarsdale, NY/ Stable Microsystems, Godalming, Surrey, UK). Sausages (cut in 20 mm height cylinders) were tested with a 10 mm ∅ probe (penetrating 50%) at a constant rate of 5 mm/s, a return speed of 1 mm/s and a wait period of 5 s. Results are the average curve of at least 3 reproducible repetitions. Finally, a descriptive comparative analysis were performed with a semi-trained panel (10 judges, 6 ♀ and 4 ♂), comparing the four treatments with the reference sample (T-0). Each sensory attribute was evaluated with a non structured scale, using "less" (0 points), "same that reference" (% points) and "more" (10 points). Red light was employed to avoid color differences. Four training session were made to unify criteria and samples attributes description. Texture attributes analysis of sausages were made in three session.

Results and discussions

The yielding in the sausages were incremented when different ions were added to the formulations (Table 2). Carrageenan gel strength increase according to ion type: K^+>Ca^+>>Na^+ (Therklensen, 1993). The diminution of sodium with potassium and calcium incorporation helped to create a strong carrageenan gel structure, retaining more water. Slight significant differences were found in the most of the instrumental textural parameters (Table 3), creating a more compact structure with ions variation. In the sensory analysis (Table 4), the T-3 sample was the most similar to the reference sample. In T-4 a relative high calcium chloride concentration gave a fishy flavor to the samples. T-1 and T-2 do not had the same responses than the treatments containing calcium. Because the no protein-carrageenan interaction reported (DeFreitas et al., 1997a, b), the effect of the potassium and calcium ions had to be on the carrageenan gelation, retaining more water and forming a different kind of structure improving the textural characteristics.

Conclusions

Carrageenan increased the yielding in the different formulations immobilizing water. The reduction of sodium ions with the potassium and calcium ions provoked differences in carrageenan gelation. No differences were found in instrumental texture, but a significant differences were found in the sensory attributes, salty and fat flavor as compared with the reference. Studies in protein-carrageenan-ions interaction need to be done.

References

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Table 1. Low fat sausages formulation

Ingredient (%, w/w)	T-0	T-1	T-2	T-3	T-4
Pork	18	18	18	18	18
Beef	38	38	38	38	38
Fat	15	10	10	10	10
Ice	25	25	25	25	25
Sodium nitrite	0.25	0.25	0.25	0.25	0.25
Brine phosphates	0.50	0.50	0.50	0.50	0.50
Sodium chloride	2.5	2.0	1.5	1.5	1.5
Potassium Chloride	0	2.0	1.5	1.5	1.5
Calcium Chloride	0	0	0	0.5	0.1
κ-carrageenan	0	0.5	0.5	0.5	0.5

Table 2. Yielding of the different sausage formulations*

Variable	T-0	T-1	T-2	T-3	T-4
Cooking loss	0.9600^{b}	0.9433^{c}	0.9933^{a}	0.9900^{a}	0.9933^{a}
Expressible humidity	0.9333^{c}	0.9400^{bc}	0.9466^{ab}	0.9533^{a}	0.9400^{bc}

* means with same letter in same row are no significantly different (P<0.05)

Table 3. Textural profile analysis for the sausages formulations

Variable	T-0	T-1	T-2	T-3	T-4
Hardness	26.47^{b}	26.90^{ab}	30.93^{ab}	33.48^{a}	28.88^{ab}
Cohesiveness	0.19^{c}	0.21^{bc}	0.22^{b}	0.27^{a}	0.26^{a}
Adhesiveness	10.94^{a}	11.33^{a}	8.83^{b}	10.31^{ab}	10.26^{ab}
Elasticity	1.74^{a}	1.59^{ab}	1.48^{b}	1.73^{b}	1.60^{ab}
Resilience	1.37^{a}	1.19^{ab}	0.94^{b}	1.30^{ab}	1.18^{ab}

* means with same letter in same row are no significantly different (P<0.05)

Table 4. Comparative descriptive analysis for the sausage formulations

Variable	T-0	T-1	T-2	T-3	T-4
Hardness	5.00^{c}	5.80^{a}	5.80^{a}	5.40^{b}	5.17^{c}
Cohesiveness	5.00^{c}	5.87^{a}	5.93^{a}	5.43^{b}	5.23^{bc}
Elasticity	5.00^{a}	4.93^{b}	5.00^{ab}	4.77^{c}	5.13^{a}
Juiciness	5.00^{ab}	4.60^{b}	4.73^{b}	4.33^{c}	5.00^{a}
Fat	5.00^{ab}	4.70^{c}	4.87^{b}	4.37^{d}	5.07^{a}
Salt	5.00^{bc}	5.33^{a}	4.77^{c}	4.87^{bc}	5.07^{b}

* means with same letter in same row are no significantly different (P<0.05)