THE BEHAVIOR OF THE CARRAGEENANS IN THE YIELD IMPROVEMENT OF THE "COOK-IN" HAM

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INTRODUCTION

In evaluation of the efficiency or in the manufacture of processed food there are aspects which determine a higher or a smaller yield of a product, such as mass loss, nutrients losses, quality loss, energy loss and others. All this demonstrates that it is necessary to give more importance to the losses which occur in the food processing. Thus, good quality products should be obtained (with higher yield as the consumer is more and more demanding) to meet his/her demands; some inovations in the field of food protection are required.

Presently in Brazil there is a very low yield in the cook ham production and this makes the product very expensive. Due to this fact it is necessary to use devices which may increase its productivity; those devices will favor the ham production, thus reducing its cost.

To manufacture the "cook-in" ham there are certain aspects which will determine a better or worse product quality and yield. To improve the yield of the meat products, substances with linking properties are added mainly to retain water, such as proteins, modified proteins and carbo-hydrates (WHITING, 1988). Carrageenans are polymers with a high molecular weight that can link great amounts of water, promote rheological modifications in the aqueous system (REY & LABUZA, 1981). They are, thefore, hydrocolloids which, despite the fact they have a wide use in the food industry, only recently became part of the daily life of meat industry products. The detailed knowledge of its origins and of its properties has led to the success of its employment in the meat industry (SANOFI, Bio-Industries, 1989, 1992, 1993). The main fractions of the carrageenan are Kappa, Iota and Lambda. The Kappa and Iota fractions form gel; however Lambda does not form it. All the carrageenans fractions consist of galactose residues, sulphates of different degrees, alternatively linked 1-3 and 1-4 (BATER et al., 1992). The term "linked water" may be confused with the capacity to retain water (CRA), which is the water quantity which remains in the gel after a physical stress like the centrifugation. The linked water shows *a physical-chemical alteration in the water structure which affects the colligation properties* of it (the water) and is generaly related to a low water activity (Aw). Thus, the water may remain inside the gel matrix in a concentration smaller than 1% of solids, while the water activity of the gel remais almost undistinguishable from pure water (REY & LABUZA, 1981).

OBJECTIVE

The objective of this work was to evaluate the effect of different carrageenans concentrations in the yield and general quality of the "cook-in" ham.

METHODS

During the processing procedures of the "cook-in" ham the meat was submitted to different treatments: treatment 1: without carrageenans, injection at 20%; treatment 2: with 0.5% of carrageenans, injection at 30%; treatment 3: with 0.5% of carrageenans, injection at 40%; treatment 4: with 0.5% of carrageenans, injection at 50%; treatment 5: with 0.5% of carrageenans, injection at 60% ;

-LOSSES IN THE TUMBLER: It was determined by the weighting of the meat pieces before and after the tumbling. Losses in the tumbling were calculated in percentages from the difference between the weigth before and after the tumbling divided by the weight before the tumbling, and multiplied by 100.

-LOSSES IN THE COOKING: It was verified by the weighting of liquid set free after the cooking. The loss, due to cooking, was calculated in percentages from the inicial weight (HONIKEL, 1988).

-YIELD DETERMINATION: It was determined by the weighting of the ham and of the meat before the tumbling. The percentage of the yield was calculated from the difference between the ham and the meat weight before the tumbling, divided by the weight before the tumbling, and multiplied by 100 plus the quantity of injected brine (for example: 20% (x120); 30%(x130)).

-SENSORIAL ANALYSIS OF THE "COOK-IN" HAM: The Sensorial Analysis was done by a group of six persons previously trained with hams of different kind (six months) in the Department of Technology and Food Science of the Federal University of Santa Maria, using an evaluation card. It was utilized a hedonic scale of 1,0 to 9,0 to evaluate the product as to its color, smell, cohesivity, slicing, taste and texture (CHAVES, 1980).

-STATISTICAL ANALYSIS: The experimental design was randomized blocks, with five treatments and four repetions. It was also utilized a Duncan Means Comparison Test in the sensorial analysis (SAS, 1990).

RESULTS AND DISCUSSION

Effect of carrageenans have been indicated as substances capable of increasing the humidity retention, because their ability to form compounds with water and protein, thus improving the juiciness and softness (BARBUT & MITTAL, 1992).

By the analyses of Table 1, it was observed the main losses occurred when the treatment was with 60% of carrageenans (higher means), followed by the treatments with 50%, 40% of carrageenans and of Control (injection at 20%). Losses which occured in the treatments whose injection of brine was above 40% were due to the fact that meat pieces could not retain all this brine quantity. It is advisible to do shorter cuts in the meat to enable a better absorption and diffusion of the brine or to add the brine excess to the tumbler. In the cooking process the losses which have occurred were minimal and there were no significative differences among the treatments ($P>0.05$). The treatments with 50% of carrageenan has not presented losses in the cooking process. However, the treatments Control and with 30% of carrageenan presented the higher losses in the cooking process. The treatment with 60% of carrageenan has presented a small loss in the cooking process. In relation to the total loss it was verified that treatments with 60% and 50% of carrageenan have presented the higher means, followed by the treatment with 40% of carrageenan, being that the other treatments have not presented significative differences among themselves. In the yield it was observed that the treatments with 60% e 50% of carrageenans have

presented the higher means, even though they have also presented the higher total loss, probably due to the fact that the brine injection was done with different concentrations. The other treatments have obtained yield proportional to brine injection.

Cooking losses tests are the most important in the meat industry to predict the behaviour of the product during the cooking process and in relation to its juiciness, thus the results here obtained confirm the results of BARBUT & MITTAL, 1992, who have verified that the addition of carrageenan and other gums to the products with low fat percentage have decrease significantly the cooking losses. The use of carrageenan in the cooked meat products processing has promoted a diminishing effect in the gel fragility, the cohesivity has been increased (BARBUT & MITTAL, 1989).

TABLE 1 - Means of the variable loss and yield of the treatments with the injection of various brine and carrageenans concentrations in the processing of "cook-in" ham

	LOSS (%)			
TREATMENTS*	TUMBLING	COOKING	TOTAL	YIELD
Control	4.200^{d}	1.198^{a}	5.353^{c}	113.576^{b}
30% Carrageenan	6.042^{d}	1.010^{a}	6.993^{c}	120.897^{ab}
40% Carrageenan	12.219^{c}	0.033^{a}	12.249^{b}	122.850^{ab}
50% Carrageenan	15.926^{b}	0.000^{a}	15.926^{a}	126.111^{a}
60% Carrageenan	20.854^{a}	0.353^{a}	21.127^{a}	126.196^{a}

a , b, c, d - Means of the same column sharing the same subscribed letter are not significantly different (P<0.05).

* Control - Injection at 20% in relation to the meat weight; 30% Carrageenan - injection at 30% in relation to the meat weight; 40% Carrageenan - injection at 40% in relation to the meat weight; 50% Carrageenan - injection at 50% in relation to the meat weight; 60% Carrageenan - injection at 60% in relation to the meat weight.

The treatment means attributed to the sensorial properties can be found in Table 2. Analysing one by one the sensorial properties, it was verified that in relation to color, the tratment with 50% carrageenan has presented the best mean, followed by the treatments with 30% carrageenan, control and 40% of carrageenan (P<0.05). In the texture it was verified that the control treatment has presented the best mean, followed by the treatments with 40%, 30% and 50%, being that these have not presented significative differences among themselves. However, the treatment with 60% of carrageenan has obtained the lowest mean (P<0.05). In relation to color it was observed that the treatment with 50% of carrageenan has presented higher punctuation; in flavor, cohesivity and as far as plotting it has presented a punctuation similar to other treatments being that in the smell and texture it presented reasonable punctuations. However, the control and the treatment with 30% of carrageenan presented a similar behavior as to color, aroma, cohesivity, plotting and flavour, the difference being only the texture, whose higher punctuation has corresponded to the control. The treatment with with 40% of carrageenan presented a reasonable behaviour, but the treatment with 60% of carrageenan presented the lower punctuation among all the treatments. Due to this fact it is reasonable to state that the treatment with 60% of carrageenan does not posses the necessary attributes that make it possible an excellent quality product.

TABLE 2 - Means attributed to the sensorial properties of the hams treated with the injection of different concentrations of brine with carrageenan.

	SENSORIAL PROPERTIES							
*Treatments	Color	Smell	Cohesivity	Plotting	Flavour	Texture	Total	Acceptability
Control	7.6650^{ab}	7.6650^{a}	8.0800^{a}	8.4100^{a}	7.8300^{a}	8.4950^{a}		8.0242^{a}
30% Carrag.	7.8300^{ab}	7.9100^{a}	7.9950^{a}	8.0300^{a}	8.2500^{a}	7.9950^{ab}		8.0517^{a}
40% Carrag.	7.4150^{ab}	8.0800^{a}	7.8300^{a}	8.3300^{a}	8.0800^{a}	8.2450^{ab}		7.9967^{a}
50% Carrag.	8.3300^{a}	7.7500^{a}	7.9950^{a}	8.4150^{a}	7.6600^{a}	7.9100^{ab}		8.0100^{a}
60% Carrag.	7.0800^{b}	7.6600^{a}	7.1600^{a}	8.1600^{a}	7.4100^{a}	7.4100^{b}		7.4800^{b}

9.0 - excellent softness, juiceness, flavour, and desirable color; a more acceptable product;

1,0 - extremely hard, dry, with flavour and undesirable color; a less accepatable product.

a , b, c - Means of the same column sharing the same subscribed letter are not significantly different (P<0.05).

CONCLUSIONS

It may be concluded that:

- The utilization of carrageenan has presented the best yields and the smallest losses in the cooking;
- The use of carrageenan in the brines determine a higher brine retention in the "cook-in" ham;
- The utilization of carrageenan in the injection up to 50% does not modify the sensorial characteristics of the "cook-in" ham.

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