PHYSICAL CHARACTERISTICS AND ACCEPTABILITY OF COOK-IN-BAG CURED HAMS AS AFFECTED BY COLLAGEN FIBER, CARRAGEENAN AND ISOLATED SOY PROTEIN ADDITION

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Background

As consumers and the supply chain (retailers, food service, outlets) look at the price / value ratio of meat products, ingredient technology continues to be refined to help the processors deliver the next generation of consumer oriented foods. Extensors are widely used in meat products to increase water holding and reduce cooking losses, while keeping the physical characteristics and acceptability (Sheard et al., 1999) Isolated soy proteins have been widely used in cooked hams to increase injection levels above 50% green weight, or to create cooked hams without the use of phosphates, keeping the quality characteristics (Versluys et al., 1996), Utilization of hydrocolloids such as carrageenan may improve functionality of non-meat proteins since they can improve texture and sensory attributes of meat products (Lyons et al., 1999). Research has been carried out on the utilization of protein and polysaccharide gels in food systems (Zeigler and Foegeding, 1991) and interactive effects between this ingredients were evaluated (Lyons et al., 1999). Collagen fiber derived from bovine hide has been used as an extensor in various meat products contributing through its gelling properties to water holding during cooking (Giese, 1994).

Objectives

The aim of this work was to evaluate the effect of carrageenan and collagen fiber addition along with isolate soy protein in cook-in-bag cured ham on physical characteristics and acceptability.

Methodology

Twenty fresh deboned hams were purchased from a commercial source and processed at the Meat Technology Center of ITAL All hams were hand injected to 50% over initial weight with freshly prepared brines containing sodium chloride, sodium tripoliphosphate (ASTARIS), sodium nitrite, sodium ascorbate, dextrose, isolated soy protein (HI - BUNGE Alimentos), carrageenan (Gelcarin - FMC) and bovine collagen fiber (Collapro-CAPE) (**Table 1**). The meat cuts were randomly assigned for treatments groups (T1, T2 and T3) as shown on **Table 1**. Once hand injected the hams were hand minced and vacuum tumbled (80% vacuum) for 8 hours under refrigeration. The tumbling cycle was 30 min on, 20 min rest. After tumbling the meat was stuffed into cook-in-bags (CRYOVAC - CN614 - OTR 25cc/m^2/24h) , put in moulds with lids placed on them fully stretched. They were heat treated in a steam heating cabinet using a stepped-temperature procedure until 72ºC core temperature had been reached. After the hams were cooled out, they were stored during 48 hours at 2ºC, before removing from the moulds. The cooking yield was determined gravimetrically after removal from the package. Slices (1kg) 2mm thick were obtained from the central part of each piece and classified visually into three categories (high, medium and low), depending on the slices integrity. Slices were vacuum packaged in trays using nylon polypropylene bags. The samples were stored at 7ºC for two weeks and the amount of exuded liquid determined. Instrumental color was measured using a Minolta Chromameter and the CIE Lab L*, a* and b* co-ordinates were recorded. The shear force was measured with the texturometer TAXTII fitted with Warner Blatzler shear attachment and the peak force was recorded (cross head speed 3mm/s, distance 35mm, force 20g). Acceptability was evaluated by a 30 member consumer panel at the Meat Technology Center sensory laboratory. A 7 point structured scale was used to evaluate overall liking (1- dislike very much; 7 – like very much) and a 5 point scale for likelihood to purchase a similar product. Preference was also determined and differences were tested by Fisher's test. Data were subjected to a one way analysis of variance and Tukey's means comparison test ($p<0.05$) using Statistica package (V.5).

Table 1. Formulation of injected hams and brines used for 50% injection over initial weight.

Composition	T1		T2		T3	
	Final product	Brine	Final product	Brine	Final product	Brine
Ham	66.67	-	66.67	-	66.67	-
Water	27.73	83.65	27.23	82.15	26.73	82.15
Salt	2.2	6.6	2.2	6.6	2.2	6.6
Sodium tripoliphosphate	0.5	1.05	0.5	1.05	0.5	1.05
Sodium nitrite	0.05	0.15	0.05	0.15	0.05	0.15
Sodium erythorbate	0.05	0.15	0.05	0.15	0.05	0.15
Dextrose	0.6	1.8	0.6	1.8	0.6	1.8
Isolated soy protein	1.2	3.6	1.2	3.6	1.2	3.6
Carrageenan	-	-	0.5	1.5	-	-
Collagen fiber*	-	-	-	-	1.0	3.0
Spices	1.0	3.0	1.0	3.0	1.0	3.0

* Collagen fiber was added directly in the tumbler

Results and Discussion

The results of this preliminary study to evaluate the influence of carrageenan and collagen fiber added to cook-in-bag hams along with isolated soy protein are shown on **Table 1**, **Figure 2** and **3**. The screening of the factors that affect acceptability as well as the levels of the ingredients added will allow further optimization studies. The cooking yield, evaluated through weighting the amount of product adhered to the bag, showed that there were no differences between treatments T2 and T3 indicating that both can be added to isolated soy protein in injected hams to increase yield. Sliceability was enhanced through addition of carrageenan or collagen fiber to isolated soy protein in cured hams (**Figure 1**). Objective color showed no significant differences ($p<0.05$) for lightness, redness or yellowness after 15 days storage of the vacuum packaged slices. However, the lightness was slightly lower for treatment T3 48 hours after processing, when the product was removed from the cook-in-bags to slice (**Table 2**). Warner Blatzler shear force measurements sowed significant differences between treatments. Collagen fiber showed the highest increase in WBS followed by carrageenan (**Table 2**), although this treatment revealed less uniformity of the measurements, probably because its distribution in the product is less efficient, since it can not be added through injection. No significant differences in the amount of exuded liquid in the package containing the slices were observed between treatments T1 and T2 after 15 days storage. However, both treatments were significant different from T3, which showed the smallest amount of exuded liquid after

the period. There were no significant differences ($p<0.05$) between treatments T1, T2 and T3 for overall acceptability, whose scores where respectively 6.3, 5.9 and 6.7, showing approval by the consumers for all treatments. No significant differences ($p<0.05$) were detected for preference between treatments T1/T2 and T1/T3. However, Fisher's test detected preference difference ($p<0.05$) between T2/T3. **Figure 2** shows the purchase intent histogram which shows that 64% consumers would certainly buy or probably buy T3, 44% T2 and 52% T1. The treatment T2 showed 12% rejection. Likelihood to purchase can be ranked as follows: T3>T2>T1.

Table 2. Means and standard deviation for cooking yield, slices objective color before and after storage at 4-7°C, Warner Blatzler shear force and amount of exuded liquid in packaged slices stored at 4-7°C.

Treatments	Cooking yield (%)	Objective color after 48h processing			Slices Objective color after storage 15days			Warner Blatzler shear force (kgf/cm^2)	Exuded liquid in vacuum packaged slices (%)
		L*	a*	b*	L*	a*	b*		
T1	98.0 (0.1)^{a}	64 (2)^{a}	7 (2)^{a}	6 (1)^{a}	62 (4)^{a}	8 (2)^{a}	6 (1)^{a}	2.0 (0.7)a	15.7 (0.9)^{a}
T2	99.0 (0.1)^{b}	65 (2)^{a}	6 (2)^{a}	6 (1)^{a}	65 (4)^{a}	7 (2)^{a}	7 (1)^{b}	2.5 (0.6)a	14.1 (0.4)^{a}
T3	98.5 (0.6)^{a,b}	60 (1)^{b}	8 (1)^{a,b}	6 (1)^{a}	65 (2)^{a}	6 (1)^{a}	6 (1)^{a}	3 (1)^{b}	11.0 (0.8)^{b}

$^{a-c}$Means in the same column with the same letter do not differ significantly by Tukey's test ($p<0.05$).

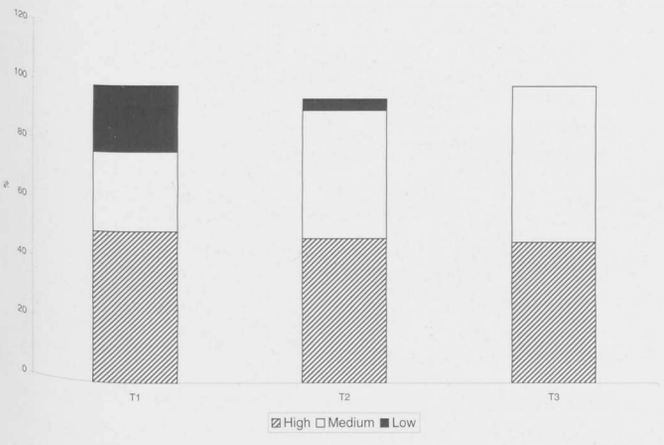

Figure 1. Visual classification of slices obtained from treatments T1, T2 and T3 expressed in percentage of weight.

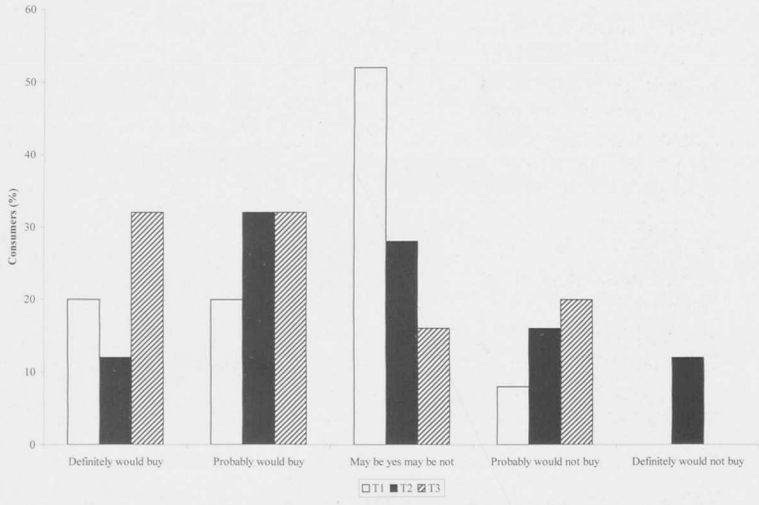

Figure 2. Consumers purchase intent.

Conclusions

This work indicates that there are several alternatives to formulate acceptable for the consumers cook-in-bag cured hams injected to 50% over initial weight. Both carrageenan and collagen fiber enhanced the product quality, especially sliceability. An association of all three extensors must be further investigated to optimize the physical characteristics. Cooking tests after processing must be carried out to allow choosing the best extensors system for the ham added as na ingredient in ready-to-eat convenience foods.

Pertinent literature

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