EFFECT OF RESISTANT STARCH CONCENTRATIONS ON THE PHYSICOCHEMICAL CHARACTERISTICS OF COOKED HAM

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Abstract – The aim of this work was to study the effect of incorporation of resistant starch in the formulation of cooked ham. For this purpose, formulations with two concentrations of resistant starch were elaborated following the regular procedures of a meat company and compared with a control, where no resistant starch was added. According to the results, the incorporation of resistant starch modified slightly the color, chemical and textural parameters, but also increased the dietary fiber content to values of 4.42 %. In this sense, products with the highest concentration of resistant starch presented similar textural scores to control ones, which makes them an interesting way to improve the nutritional profile of this products.

Key Words – resistant starch, cooked ham, physicochemical properties.

I. INTRODUCTION

Meat and meat products have always been considered a good protein source. However, increasing concerns about the potential health risks associated to the consumption of meat, like degenerative and chronic diseases (hypertension, obesity, ischemic heart disease and cancer), has forced to the meat industry to develop products with better nutritional properties, which increase health benefits and potentially reduce the risk of diseases [1]. In this sense, considering that meat is low in fiber, increasing the fiber concentration in meat products could be an adequate strategy to improve the nutritional profile of products such as ham, where fat content is also relatively low. The aim of the work was to evaluate the effect of resistant starch (RS) concentrations on the physicochemical and textural properties.

II. MATERIALS AND METHODS

Cooked hams with 0% (control), and two concentrations (A and B) of RS HI-Maize resistant starch (Ingredion, Germany) were elaborated according to the regular formulation of company, where the addition of cornstarch was reduced to 1%. Brine injection at 50% of the pork meat (hind leg) was manually done and then, tumbled for 10 h (cycles of 10 min at 6 rpm each hour). After that, the three formulations were vacuum packed in a heat shrinkable film and steam cooked in a Rational® (Germany) oven at ΔT of 25 °C until reach a core temperature of 50 °C and then oven temperature was set at 77 °C until hams reached a core temperature of 75 50 °C. After cooking, hams were chilled to 4 °C for 72 h. After that, physicochemical analyses were done.

CIELab colour parameters were analyzed with a portable Hunter Lab (Reston/USA) previously calibrated with illuminant D65 and observer angle of 10°. Chemical parameters (water content, protein, fat and ash) were determined according to AOACE procedures [2]. Total dietary fibre (TDF) was determined by Sigma analysis kit (Sigma-Aldrich, USA) based on AOAC method 991.43. Also, pH, water activity (a_w) and water holding capacity were measured according to standard procedures.

Texture profile analysis (TPA) was used to evaluate texture using the TA-xt Plus texturometer (Stable Micro Systems, Godalming, England) equipped with a cilindrical probe P/25. Samples, tempered at 25 °C, were cut into 15 mm x 25 mm x 25 mm pices and compressed 50 % at 5 mm/s. Parameters determined were hardness, springiness, adhesiveness, cohesiveness, gumminess and chewiness.

III. RESULTS AND DISCUSSION

Physicochemical results are presented in table 1. Concentrations of RS added were lower than 10 %. When the RS is added water content was reduced because of the increasing of matter, but the capacity to retain water was also lower. The inclusion of RS also affected to the color, making the hams lighter. Samples with the highest concentration of RS doubled the fiber content, which is a good data to be considered as a better nutritional profile.

Table 1 Physicochemical characteristics of the samples

	Color			a_w	WHC	pH	H_20	Fat	Ash	Protein	Fibre
	L*	a*	b*				%	%	%	%	%
Control	62.87^{a}	13.18^{b}	9.25	0.988^{a}	11.53^{a}	6.62^{a}	78.24^{c}	2.40^{a}	4.59^{a}	13.79^{a}	1.98^{a}
A	64.88^{a}	12.05^{ab}	10.46	0.988^{a}	21.16^{b}	6.63^{a}	75.94^{b}	3.02^{b}	4.70^{ab}	13.36^{b}	2.80^{b}
B	67.27^{b}	11.91^{a}	10.38	0.988^{a}	20.90^{b}	6.64^{a}	74.64^{a}	3.03^{b}	4.72^{b}	13.77^{ab}	4.42^{c}

^{a,b}: values in the same column with different letter are significant different ($P < 0.05$)

The presence of fiber content in control samples could be attributable to the retrogradation of cornstarch included in the formulation, formed during cooling of the gelatinized starch [3]. According to the textural results (Table 2), A samples (less RS concentration) were less hard and presented also the lowest values in cohesiveness, gumminess and chewiness, while B samples with highest concentration of RS presented similar characteristics to control.

Table 2 TPA results of the samples

	Hardness (g)	Springiness (%)	Adhesiveness (g.s)	Cohesiveness	Gumminess	Chewiness
Control	8.438^{b}	89.69^{a}	-0.451^{a}	0.622^{b}	5.200^{b}	4.66^{b}
A	$6,567^{a}$	90.59^{ab}	-0.494^{a}	0.552^{a}	4.213^{a}	2.27^{a}
B	$8,406^{b}$	91.93^{b}	0.196^{b}	0.613^{b}	5.159^{b}	4.74^{b}

^{a,b}: values in the same column with different letter are significant different ($P < 0.05$)

IV. CONCLUSION

The inclusion of resistant starch modified slightly color, chemical and textural parameters, however it could be a good strategy to increase the fiber content of the product, although an evaluation of sensory changes should be necessary.

ACKNOWLEDGEMENTS

Authors thank to Empacadora Murgati SA de CV and CONACyT-Incentives for Research, Technological Development and Innovation Program, the financial support and facilities for this research.

REFERENCES

1. Cox, S. & Abu-Ghannam, N. (2013). Enhancement of the phytochemical and fibre content of beef patties with Himanthalia elongate Seaweed. International Journal of Food Science and Technology 28: 2239-2249.
2. AOAC (1997). Official methods of analysis (16the ed.). Washington, DC: Association of Official Analytical Chemists.
3. Raygond, P., Ezekie, R. & Raigond, B. (2015). Resistant starch in food: a review. Journal of the Science of Food and Agriculture 95: 1968-1978.