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Modelization of dry-cured ham texture to define optimal processing conditions (#130)

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Introduction

Decrease of textural and appearance problems incidence in dry-cured ham production is of interest for industry. To do so, it is necessary to study more in depth aspects related to raw material quality, saltiness level, processing temperatures and its combined effects on the texture of the final product. The aim of this work was to study the effect of pH_{24}, fat and salt contents and weight loss on texture development in dry-cured hams processed at different temperatures. Optimal processing conditions to obtain optimal textures will be defined.

Methods

196 hams from 98 animals with different fat content (High and medium level) and pH_{SM24h} (Low and Medium level) were obtained. Salting process was performed according to the traditional system with some modifications to obtain different salting levels (High, Standard and Reduced). After a 2-month resting period at 4ºC, hams were processed at different temperatures (10ºC, 15ºC or 20ºC) until reaching different weight losses (33%, 36% or 40%).

At the end of process, the aitch bone, the butt and the femur bone of the hams were excised and the cushion part, containing *Biceps femoris* (BF) muscle, was trimmed. Texture was instrumentally determined on BF muscle using a Stress relaxation test (SR). Initial force F_0 (kg) and force decay at 2 s (Y_2) and 90 s (Y_{90}) were calculated. Physicochemical characterization (pH, moisture content, salt content, non-protein nitrogen content (NPN), total nitrogen (TN) and proteolysis index (PI)) was performed.

Effect of different factors on texture, physicochemical characteristics and appearance of the samples was tested by using an ANOVA procedure. Fat content, pH_{SM24h}, salting, processing temperature and the weight loss and their double interaction were included as fixed effects. Animal was included as random effect nested to fat content, pH_{SM24h}, salting process and weight loss. Non-significant effects and interactions were dropped from the model. Differences were evaluated by using a Tukey test ($p<0.05$). Contour plots for Y_{90} were represented for Processing temperature and Weight loss parameters for each salting treatment.

Results

In the studied range, fat content and pH_{SM24h} did not have a significant effect on texture. Only salt content, processing temperature, weight loss showed significant effects. A significant decrease of F_0 and an increase of Y_2 and Y_{90} were found when decreasing salt content ($p<0.05$). Although processing temperature did not influence F_0, a decrease of Y_2 and Y_{90} when increasing processing temperatures was observed. Therefore, temperature has an important effect on the final texture. Besides, a significant interaction between weight loss and processing temperature must be remarked, showing a higher decrease of Y_2 and Y_{90} with the increase of weight loss at lower processing temperature (Table 1). This fact indicates that both parameters in combination may help to define optimal dry-cured ham elaboration procedures.

Previous studies considered dry-cured ham samples with Y_{90} values of 0.74 and 0.70 as defective or soft. Taking this into account, in this study, dry-cured ham samples with Y_{90}>0,690 were considered as defective. Optimal texture has been defined to have Y_{90} values between 0.551 and 0.611.

Contour plots in Figure 1 represent, for each salting treatment, variation of Y_{90} according to weight loss and temperature since they are the effects that significantly influence texture development in this study. It also draws optimal processing conditions intervals to achieve optimal texture. In hams with a standard salt content and a low weight loss (33%), the best processing temperature to avoid texture defects was 20ºC. Processing temperature was less important when weight losses of 36-40% were reached. In contrast, for salt reduced hams, a minimum weight loss of 38% and high processing temperatures (20ºC) are needed to achieve optimal textures. In this case, optimal texture in the final product was only reached when hams achieved a weight loss of 40% at a processing temperature of 20ºC.

Conclusion

Salt content, processing temperature and weight loss has a significant effect in the texture of dry-cured ham. Besides, there is a significant interaction between weight loss and processing temperature, obtaining less hams with soft textures when processing at 20ºC and reaching 40% of weight loss. Contour plots may help to define optimal dry-cured ham elaboration procedures.

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Notes

	Temperature									RMSE
	10ºC			15ºC			20ºC			
Weight loss	33%	36%	40%	33%	36%	40%	33%	36%	40%	
Y_2	0.419^{a}	0.333^{e}	0.324^{ef}	0.403^{b}	0.351^{d}	0.313^{ef}	0.369^{c}	0.351^{d}	0.310^{f}	0.024
Y_{90}	0.735^{a}	0.633^{d}	0.611^{e}	0.715^{b}	0.646^{d}	0.595^{ef}	0.668^{c}	0.636^{d}	0.586^{f}	0.025
F_0	1.274^{d}	2.537^{b}	3.247^{a}	1.305^{d}	2.103^{c}	3.473^{a}	1.586^{d}	2.155^{c}	3.294^{a}	0.515

a-f means within columns without a common letter are significantly different ($p<0.05$). RMSE: root mean square error of the linear model.

Table 1: LSMeans of hardness (F_0, Kg), force decay at 2s (Y_2) and 90s (Y_{90}) in *Biceps femoris* muscle according to the interaction Processing temperatures x Weight loss.

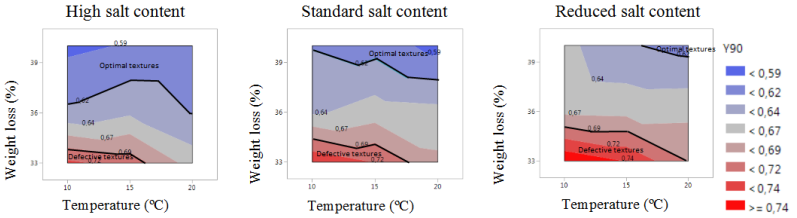

Figure 1. Instrumental texture (Y_{90}) contour plot showing the effect of Processing temperature and Weight loss for each salting process.

Notes