EFFECT OF TRANSGLUTAMINASE ON THE TEXTURAL PROPERTIES OF MEAT EMULSIONS

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Introduction

Transglutaminases (TGase) are enzymes of great interest to food technologists due to their ability to catalyse the formation (and or strengthening) of gel-type structures through protein cross-linking (Motoki and Seguro, 1998, Kuraishi *et al.*, 2001). The major utility of TGase in meat products is its hability to change the functional properties of the meat products, such as gelling capacity, viscosity, or the water holding capacity and also they contribute to stabilise the network of the proteins (Motoki and Seguro, 1998). The commercial TGase used in this study comes from the microorganism *Streptomyces mobaraense*. There are many works which have studied the effect of this enzyme in the properties of the gel and the emulsions in models of procesing foods (Sakamoto *et al.*, 1994; Dickinson, 1997, Kuraishi *et al.*, 2001) but not at different cooking temperatures and times of fabrication. In addition to the gelification effect this enzyme can stabilize emulsions where there is protein in the interfase as it happens in meat emulsions (Dickinson, 1997).

In this study the time course of the effect of the microbial TGase on the textural properties of a meat emulsion was analysed from the moment of fabrication when the enzyme is added to the moment of cooking at different temperatures.

Materials and Methods

Two types of meat emulsions were fabricated with 44% turkey, 15% olive oil, 36% water, 1% fibre, 1.5% soya and 2% salt. One of the emulsions was added 60ppm of TGase Active (Ajinomoto). The emulsions were refrigerated at 5ºC during 30, 60, 120, 180, 240 minutes and overnight. In order to determine the TGase activity, the viscosity was determined at these time points. A VistoTester 7R (Brookifield Method) (HAAKE) was used to measure the viscosity at 30 rpm. Then, each emulsion was cooked at 45, 60 and 72ºC and then they were cut in cubes of 10x10x10mm (Klettner, 1989) to be analyzed with a texture analyzer (Stable Micro System Model TA-XT2i) using the TPA compression test. Data were analysed statistically with a SPSS 12 program.

Results and Discussion

Figure 1 shows the apparent viscosity values obtained for both types of meat emulsions at different time points after production. In general, a higher apparent viscosity is measured for the sample with added TGase than for the control, and the effect of the enzyme on viscosity is time dependent, increasing with longer incubation periods. Figure 2 compares the apparent viscosity values obtained with the viscosimeter working at 12 rpm. The values obtained for the control emulsion during the first 24 hours oscilate around an average value of about 150 Pa. In contrast, the apparent viscosity of the emulsion with added TGase increases progressively with incubation time. At two hours the apparent viscosity of the sample with added enzyme is significantly higher than the values obtained for the control emulsion ($p<0.001$). By four hours the apparent viscosity of the sample doubles that of the control, and this proportion still increases during further incubation. It has to be pointed out that the apparent viscosity of the sample could not be measured at 24 hours of incubation because the value was above the range detectable under this experimental conditions. Thus, the cross-linking action of the enzyme starts having a detectable effect on the viscosity of the emulsion two hours after production. However, the action of the enzyme is not complete after four hours of incubation, since a longer incubation time leads to higher apparent viscosity values.

There was different texturising activity as a result of the cooking treatment. In this regard, the compression test of the emulsion with TGase at 45ºC and 60ºC showed higher hardness and higher chewiness than the emulsion without TGase ($p\leq0.05$). However, the most important significant differences were shown when the emulsions were cooked at 72ºC. At this temperature the emulsion with TGase showed lower elasticity ($p\leq0.05$) and higher hardness ($p\leq0.01$), cohesiviness and chewiness ($p\leq0.001$) (Table 1).

Conclusion

These results show that at 5ºC and at this enzyme concentration, the meat emulsion requires a long incubation period (longer than four hours) before the full effect of the enzyme is reached (in agreement with the Ajinomoto). In addition, the effect of the enzyme on the textural properties of the meat emulsion is apparent even after cooking, and the sample with added enzyme presents higher breaking strength than the control.

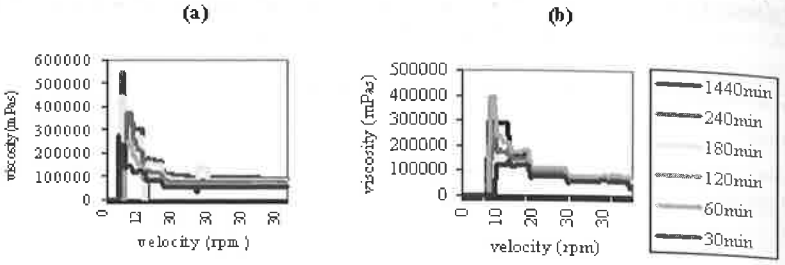

Figure 1: Viscosity evolution of the emulsion with TGase (a) and without TGase (b), over time.

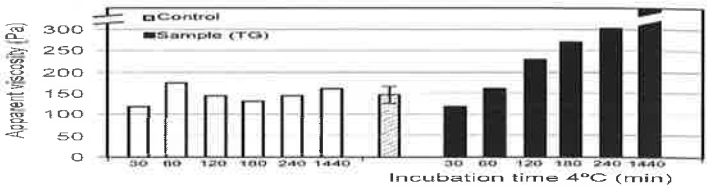

Figure 2: Time course of the apparent viscosity values obtained for the control (without added TGase) and sample (with added TGase) meat batters during the first 24 hours after fabrication.
* Hatched bar corresponds to the average of the apparent viscosity values (standard deviation represented) obtained for the control at the various time points.

Table 1: Means, standard error and significant differences between the control emulsion and the emulsion with Tgase cooked at 45°C, 60°C and at 72°C measured with the TPA compression test.

	Hardness			Chewiness			Elasticity	Cohesiviness
	45°C	60°C	72°C	45°C	60°C	72°C	72°C	72°C
Control	0.36(0.05)	0.48(0.06)	0.36(0.06)	1.51(0.22)	1.49(0.28)	0.88(0.21)	6.19(0.18)	0.46(0.05)
TGase	0.49(0.05)	0.63(0.06)	0.74(0.07)	2.20(0.22)	2.27(0.28)	2.52(0.22)	5.44(0.19)	0.61(0.06)
Significance	*	*	**	*	*	***	*	*

*p≤0.05; **p≤0.01; ***p≤0.001.

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