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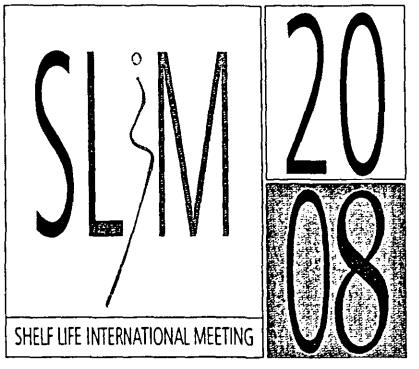

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TEXTURE AND SENSORY CHANGES OF A FRESH EWE'S CHEESE PACKED UNDER DIFFERENT MODIFIED ATMOSPHERES

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ABSTRACT

Shelf-life extension of fresh ewe's milk cheese packaged with three different MAP conditions was studied. Fresh cheeses were stored in barrier trays, hermetically sealed with a barrier to gas and water film. The gas mixtures used were: 20%CO_2/80%N_2, 30%CO_2/70%N_2 and 50%CO_2/50%N_2. Trays were stored at 4 °C and inspected at 0, 7, 14 and 21 days. Physical-chemical and microbiological analyses (pH, colour, dry matter, a_w, mesophilic micro-organisms, psychrotrops, total coliforms, Escherichia coli, Salmonella, Staphilococcus aureus and Listeria monocytogenes), gas composition inside the packaging (CO_2, O_2 and N_2), texture analysis (puncture test and Texture Profile Analysis-TPA) and sensory evaluation (acceptability test by scoring for colour, flavour, taste and texture) were carried out. Samples packaged with 30%CO_2/70%N_2 and 50%CO_2/50%N_2 had a shelf life of 21 days. Pathogens were not found during all the storage. Cheese stored with 30%CO_2/70%N_2 reached the best acceptability score to the sensory evaluation.

Key words: ewe's cheese; MAP; sensory analysis; shelf-life; texture.

INTRODUCTION

The increased consumer demand for fresh foods has resulted in the need to extend their shelf-life. The shelf-life extension, however, can not be attained with the use of thermal stabilisation and other techniques, such as product reformulation or use of additives, that are often unsuccessful or not liked by consumers.

The main cause of product quality loss is caused by micro-organisms, which are preferably controlled by the use of modified atmosphere packaging (MAP), which allows to stop or slow down microbial growth and not alter the overall quality of the product (Elena Gonzales-Fandos *et al.*, 2000; Frau *et al.*, 1999; Olarte and Gonzales-Fandos, 2001). Fresh cheeses have a very short life because of their pH, near to neutrality, the high a_w and the low salt content. Usually, the shelf-life of fresh cheese is only 7 days (Di Marzo *et al.*, 2006). There are few studies on the effect of MAP on the evolution of sensory and texture characteristics during storage of fresh cheeses (Fava *et al.*, 1993; Piergiovanni *et al.*, 1993; Maniar *et al.*, 1994). In fact, MAP can modify sensory and texture characteristics of the products during storage. In this research we examined a fresh ewe's cheese packaged under MAP with different gas mixtures to evaluate texture and sensory changes during storage.

MATERIALS AND METHODS

Fresh cheese was obtained by pasteurized ewe's milk, coagulated with calf liquid rennet and inoculated with probiotics. After 24 h of ripening it was packaged inside barrier to gas trays, containing 4 forms and wrapped with a barrier to gas and water film. Three batches were prepared with the following gas mixtures: 20%CO_2/80%N_2 (A), 30%CO_2/70%N_2 (B) and 50%CO_2/50%N_2(C), and stored at 4°C. The following analyses were carried out at 0, 7, 14 and 21 days: pH using a pHmeter Orion, mod. 710/A; colour with a Minolta colorimeter CR-300; dry matter (%) in a vacuum oven at a temperature of 70°C and water activity (a_w) using an electronic hygrometer (Rotronic, pbi International). Mesophilic micro-organisms, coliforms, *Escherichia coli*, *Salmonella*, *Listeria monocytogenes*, *Staphylococcus aureus*, yeasts and moulds, were determined using the following media: PCA, VRBA, Chromogenic EC X-Gluc agar, Vidas SLM, Vidas DUO, Baird-Parker agar + RPF and PDA, respectively. Texture analyses were performed with a texturimeter TA.XT2i (Stable Micro Systems), equipped with a 6 mm cylindric probe (puncture test) and a 75 mm compression plate (TPA), respectively. The gas composition inside the trays was checked by a Dansensor gas analyser. Sensory evaluation was performed using an acceptability test, following the IDF standard 99B (1995), using a panel of eight judges from our laboratory. Judges used an hedonic scale from 1 to 7 (1= terrible; 7=excellent) to evaluate the following descriptors: colour, deformation, odour intensity, taste, aroma and consistency.

All data were submitted to two-way analysis of variance (ANOVA) using the soft-

Table 1. Values[1] of the physical-chemical parameters of the three cheese samples

Cheese	pH	dry matter (%)	a_w	L	a*	b*	Z
A	5.64a*	40.67b	98.41$^{n.s.}$	90.54a	-2.07b	10.01a	65.51$^{n.s.}$
B	5.55b	43.68a	98.33	90.33a	-2.05b	10.37b	64.71
C	5.67a	43.41a	98.53	89.79b	-2.24a	10.55c	63.47

[1] Data are the mean of the values obtained during the storage period.
* Data followed by different letters, for each column, significantly differ by LSD Fisher, $p \leq 0,05$. $^{n.s.}$ not significant

Table 2. Values[1] of the TPA parameters of the three cheese samples

Cheese	Hardness (g)	Cohesivene ss	Springiness (mm)	Chewiness (g · mm)
A	758.39c*	0,57 n.s.	6.64b	2824.65c
B	874.36b	0,57	6.92a	3423.74b
C	*1065.31a*	*0,56*	*6.83ab*	*3998.98a*

[1] Data are the mean of the values obtained during the storage period.
* Data followed by different letters, for each column, significantly differ by LSD Fisher, $p \leq 0,05$. n.s. not significant

ware Statistica 6.0 for Windows, where the factors were the three batches and the days of storage. Means, when required, were separated according to LSD Fisher test, significance level $P \leq 0.05$.

RESULTS AND CONCLUSIONS

Physical-chemical changes: the sample B showed the lowest pH value during storage, while the sample A had the highest dry matter. No difference was found for the a_w in the three samples. The yellowness index Z did not differ significantly among the three samples (Table 1). *Microbiological analyses:* pathogens were not found in any samples throughout the whole experiment. The other micro-organisms increased during storage but they remained below the limits reported in the Reg. EEC n. 2073 (2005) for fresh cheeses. *Gas composition:* it was observed a decrease of N_2 % and an increase of CO_2 % for every sample and during storage. *Texture analysis:* hardness and chewiness values were higher in the sample C, during storage, while the cohesiveness remained constant in all the samples analysed (Table 2). Puncture test data showed a decrease for all the three samples during storage, but the B sample rupture force resulted significantly the highest (data not shown). *Sensory analysis:* a decrease in acceptability was observed during storage for all the samples. The sample A was above the acceptability score at 14^{th} day of sampling, corresponding to 4 in the hedonic scale used in our test. Samples B and C reached the same results at 21^{th} day of sampling.

MAP packaging resulted successful in doubling the shelf life of this fresh cheese.

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