THE INFLUENCE OF SOME HYDROSOLUBLE VITAMINS AND BIOMINERALS ADDITION ON THE BIOCHEMICALS MODIFICATIONS DURING THE RUCĂR PRESSED CHEESE MATURATION PROCESS

Viorel Ghiguță*, Bianca Marica*,

* University "Stefan cel Mare" of Suceava , Food Engineering Faculty, 13 Universitatii St., Suceva, cod 720246, Romania,e-mail: gviorel@usv.ro

Abstract: *This work studies the effect of some hydrosoluble vitamins addition (thiamine, pyridoxine and folic acid) and biominerals (magnesium, zinc) on the curing of Rucăr pressed cheese, having in view the modifications that occur in the fat and sugar compounds levels. After the analysis of the selected parameters, the fat acidity index registered certain increases in comparison to the addition free samples, the acidity had a variable evolution in all studied samples, a higher value being registered at the end of the curing period (six days), and the fat content registered a higher values after 3 days curing period and variable values after 6 day-curing period.*
Since some types and dosages of vitamins and biomineral compounds used in this study have led to important increases of acidity and fat as compared to blank samples, we may say that these vitamins and biominerals compounds may be used in cheese manufacturing in order to get some more flavored ranges or render valuable thin milk.

Key words: *acidity, fat content, curing period, vitamins, biominerals, Rucăr pressed cheese*

Introduction

Traditionally, cheese was made as a way of preserving the nutrients of milk. In a simple definition, cheese is the fresh or ripened product obtained after coagulation and whey separation of milk, cream or partly skimmed milk, buttermilk or a mixture of these products. It is essentially the product of selective concentration of milk. Thousands of varieties of cheeses have evolved that are characteristic of various regions of the world.

In this work some vitamins and biominerals were introduced in order to study the effect of these additions on the biochemical processes taking place during the Rucăr pressed cheese curing process, having in view the evolution of fat and sugar compounds.

Materials and methods

The materials for this work included: cow milk as raw material, rennet (chemozine – coagulating enzyme) and additions, in certain proportions of vitamin B_1 (thiamine), B_6 (pyridoxine), B_9 (folic acid) and biominerals, magnesium and zinc.

The Rucăr pressed cheese used in this work was prepared using the classic procedure which consisted of two distinct phases: phases 1 obtaining the green cheese (filtration of cow milk, centrifugal cleansing, standardization and finally addition of the coagulation enzyme) and the manufacture of the pressed cheese (green cheese was heated and kneaded, then the pressed cheese was salted and cured).

In table 1 the characteristics of the raw material used in the pressed cheese production process are presented.

Table 1: Features of the raw material used to obtain Rucăr pressed cheese

Measurement	Values
Fat, %	3.4
Free amino acids %	0,91
pH	6,6
Raw Protein%	3,25
Casein%	2,56
Casein/Raw protein (proportion)	0,787
Relative density	1.030
Acidity, °T	16
Moisture %	87,5

For the Rucar pressed cheese manufacture, used in the experimental part, the milk was heated to the clogging temperature (32˚C), then brought to a 6.1 pH trough Purac addition (a product containing lactic acid) and then chemozine was added (20 grams rennet per 200 liters of milk). It was let to rest for 30-40 minutes, meanwhile the pH reached 3,2. The coagulum was processed and the fresh cheese obtained was melted at 80-82˚C temperatures, then the young cheese obtained was subjected to a drying process that took place in shaping moulds.

After drying, the vitamins and biominerals were added. The quantities of the additions are shown in table 2.

Table 2 Vitamin and mineral compound addition quantities established for analyzed variants

Samples / Vitamin and biominerals content	Rucar pressed cheese			
	Sample I	Sample II	Sample III	Sample IV
Folic acid, mg	20	40	-	20
Vit. B_1, mg	-	-	10	10
Vit. B_6, mg	-	-	250	250
Magnesium, mg	47,9	100	47,9	47,9
Zinc, mg	10	20	10	10

The way the additions were made is similar for all four samples. Vitamins were not added to the raw material, as they might have been eliminated in the whey during the curdling process, but only after the young pressed cheese has been obtained (before the curing process).

The addition of vitamins and mineral compounds was made by injecting the bio-compounds solutions into the samples. The injection is done in several steps, the injection volume being of 5 ml, each pressed cheese sample weighing 100g. This was made in order to spread the addition solution as uniformly as possible in the pressed cheese mass.

The samples were taken at different time periods, namely after three days and after six days, keeping in mind that the Rucăr pressed cheese curing takes six days. Acidity, pH, fat content and fat acidity index were determined analyzed.

For air curing, a temperature of 16-18˚C and an environmental humidity of 80% were ensured in a climate controlled space. The pressed cheese was left six days to cure, and then it was introduced in thermo-contractile wrapping and kept in a refrigerated room at 4˚C.

Also a blank sample was produced, for the studied samples, by submerging a pressed cheese piece into a solution without the addition compounds.
The acidity was determined using the AOAC standard (Cunniff 1995), the pH in conformity with the STAS 8201/82 standard (Costin a.o. 2003), and the fat using the acid-butyrometrical method (Costin a.o. 2003) and the fat acidity index by titration.

Results and discussion
After testing the pressed cheese during the curing period, the results were put together to form table 3 which contains the results of the measurements taken after three and six days curing period.
As to titratable acidity, one can see that after three day curing period, the PI sample has the lowest value while the PIII sample registers the highest one. After six days curing period the PIII sample reaches the lowest value while the highest value is registered at the blank sample PM.
In figure 1 the acidity values are given for three days and six days curing time.

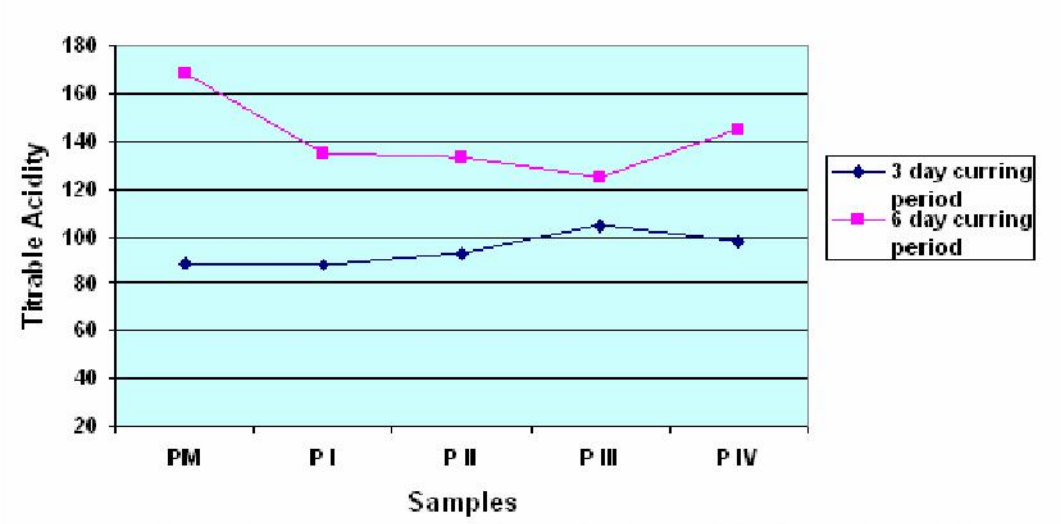

Figure 1. Acidity values for Rucar pressed cheese after three and six days curing period

The values of the pH are fluctuant with the lowest value going to the PIII sample and the highest value being registered for the PI sample at three days curing period. After six days curing period the PIV sample reaches the lowest value while the highest value is registered at the blank sample PM.
Analyzing the fat content, one can see that after three days curing period, the PII sample has recorded the lowest fat percentage while the P IV sample presents the highest value.

Table 3: The acidity and fat content evolution for the Rucăr pressed cheese samples

Sample No. And added compounds*	Measured parameter	Curing time	
		3 days injection	6 days injection
PM (blank sample)	pH	5,14	5,23
	Titrable acidity °T	89°T	168°T
	Fat content % S.U.	37,19	45,5
	Fat acidity index mg KOH/g	5,2	6,5
PI (Folic acid, Mg, Zn)	pH	5,21	4,91
	Titrable acidity °T	88°T	135°T
	Fat content % S.U.	37,35	45
	Fat acidity index mg KOH/g	6,3	7,6
PII (Mg, Zn and double folic acid quantity)	pH	5,18	5,13
	Titrable acidity °T	93°T	133°T
	Fat content % S.U.	37,02	44,80
	Fat acidity index mg KOH/g	5,8	7,8
PIII (vit. B_1, B_6, Mg, Zn)	pH	5,13	5,00
	Titrable acidity °T	105°T	125°T
	Fat content % S.U.	39,11	44,80
	Fat acidity index mg KOH/g	8,7	9,9
PIV (Folic acid, vit. B_1, B_6, Mg, Zn)	pH	5,15	4,86
	Titrable acidity °T	98°T	145°T
	Fat content % S.U.	39,20	44,50
	Fat acidity index mg KOH/g	10,4	14,04

- The addition dosages were calculated based on the daily necessary dosage so that will not affect the human organism after consumption.

From the figure 2 chart we can see that the P IV sample presents the highest fat contend reported to dry solids after three days curing time but after it was ripened for another three days, as it reached the end of the curing period the sample registered the lowest value for fat percentage in comparison to the others. This could be interpreted by a slower fat cleaving activity in the first three days, followed by a more intense activity of the lipase in the last three days, which can mean one of two things: either the lipase activity was inhibited by the addition in the first three days, either it was accelerated in the last three days of the curing process.

The fat acidity index registered a significant increase for the PIV sample relative to the blank PM sample both after three and after six days ripening period, the other samples recording intermediate values. A higher value of this index means a higher concentration of fatty acids, which were most likely produced via enzymatic hydrolysis of the triglycerides that form the fat.

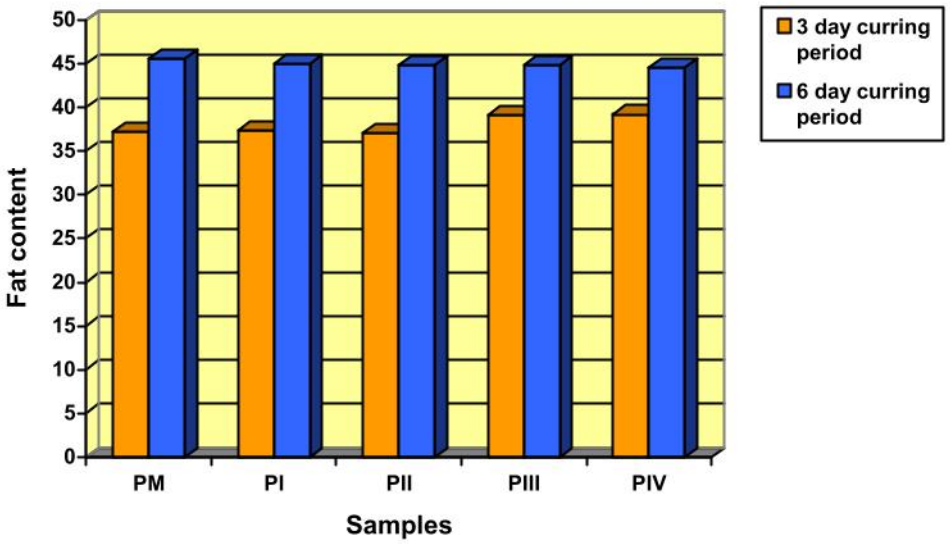

Figure 2. The fat content for three and six days curing period variation (evolution)

Conclusions

Following the analysis of the samples of pressed cheese with vitamins and biominerals added, a more intense fat cleaving process was observed relative to the addition free samples (blank). This was made obvious by the higher fat acidity index values recorded for the added samples in comparison to the blank samples.

Regarding the lactose fermentation by microorganisms, the highest value of the acidity (expressed in the pH values) was registered at the PIV sample, witch leads to the interpretation that the addition made influenced positively the acid production via bacterial fermentation from sugar compounds.

It seems that the additions used in the experimental part of this research could be used in the industry to fructify thin milk or to obtain a fortified product with vitamins and biominerals compounds.

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