

RESEARCH CONCERNING THE DYNAMICS OF THE MODIFICATIONS OF SOME PHYSICAL-CHEMICAL PARAMETERS DURING MATURATION OF THE SEMI-HARD CHEESES

Jimborean Mirela, C. Laslo, D. Țibulcă

University of Agricultural Sciences and Veterinary Medicine, Faculty of Agriculture, 3-5 Mănăștur
Street, 3400 Cluj-Napoca, Romania, mirelajimborean2004@yahoo.com

Key words: physical-chemical indicators, protein, water content, maturation, acidity, pH.

Abstract. The research presented had as purpose the study of the variation of some physical-chemical parameters during the maturation of two types of semi-solid cheese. (Holland and Moeciu). For the investigations there have been harvested and analysed four samples for each type.

INTRODUCTION

Cheese maturation is a complex biochemical process realised following the action of the enzymes of different microorganisms. It is the global result of some various phenomena like: the proteolysis, the dissemination of the amino acids, the decarboxylation, the lipolysis, the degradation of fat acids, the saccharolysis, the effervescence of the lactic acid, acid-bases reactions and the collision, the synergetic action of some substances implied in flavour and savour. The goal of the maturation is the bettering of the taste, savour, texture and aspect of the cheese, as well as the destruction of some pathogenic embryos.

The global analysis of cheese implies the determination of the humidity and of the dry substance, of the ashes, salt, fat and protein in accordance with the standard methods (IDF/1995), AOAC (*Cunniff*, 1995) and Romanian Standards (STR, STAS-ISO or STAS). In some cases, the determination of the pH, acidity, contaminants etc. is also imposed. These parameters are being differently analysed, during cheese maturation.

MATERIALS AND METHODS

Two types of semi-hard cheese have been analysed: Holland and Moeciu. There have been harvested four samples noted as follows:

P₁ – the sample harvested in 48 hours from the make;

P₂ – the sample harvested in 10 days from the make;

P₃ – the sample harvested in 17 days from the make;

P₄ – the sample harvested in 25 days from the make, which represents the final point of the maturation.

The sample harvest was made according to STAS 6343/81.

There have been used for the analyses the following methods:

- humidity determination of the cheese – by drying it in the drying stove at $103 \pm 2^{\circ}\text{C}$ until constant mass (STAS 6344/88);
- protein determination – through the Kjeldahl method, according to STAS 6355/89;
- acidity determination – titrated with solution NaOH 0,1 N according to STAS 6353/85;
- pH determination – through the potentiometer method, according to STAS 8201/82.

RESULTS AND DISCUSSIONS

The results obtained in what the content of dry substance and humidity is concerned, are presented in the 1st table, 1st and 2nd image.

Table 1

The dynamics of the evolution of the content of dry substance and humidity for the analysed cheese

Crt. No	Type	Sample	Dry substance, %	Humidity, %	Observations
1.	Holland	P ₁	54.6	45.4	The values obtained both for the content of dry substance and humidity, are framed in the provisions of the Company Standard.
		P ₂	55.2	44.8	
		P ₃	55.4	44.6	
		P ₄	56.6	43.4	
Company standard for the finite product			min 54	max 46	
2.	Moeciu	P ₁	54.6	45.4	
		P ₂	55.8	44.2	
		P ₃	57	43	
		P ₄	57.3	42.7	
Company standard for the finite product			min 56	max 44	

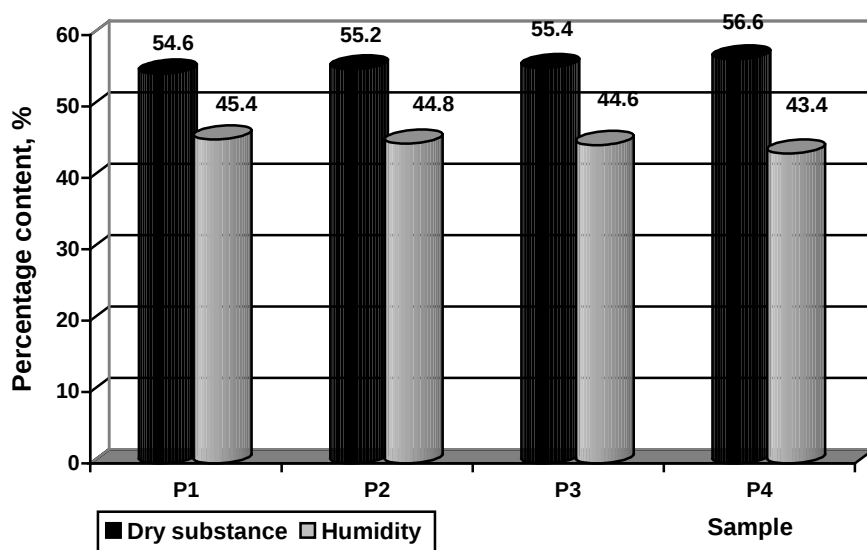


Fig. 1. The evolution of the content of dry substance and humidity for the Holland type

The content of dry substance has increased during the maturation in the following way:

- for the Holland type the content of dry substance has increased from 54.6% immediately after the getting to 56.6% at the end of the maturation, and the content of water has lowered from 45.4% immediately after the getting to 43.4% at the end of the maturation;
- for the Moeciu type the content of dry substance has increased from 54.6% immediately after the getting to 57.3% at the end of the maturation and the content of water has lowered from 45.4% immediately after the getting to 42.7% at the end of the maturation.

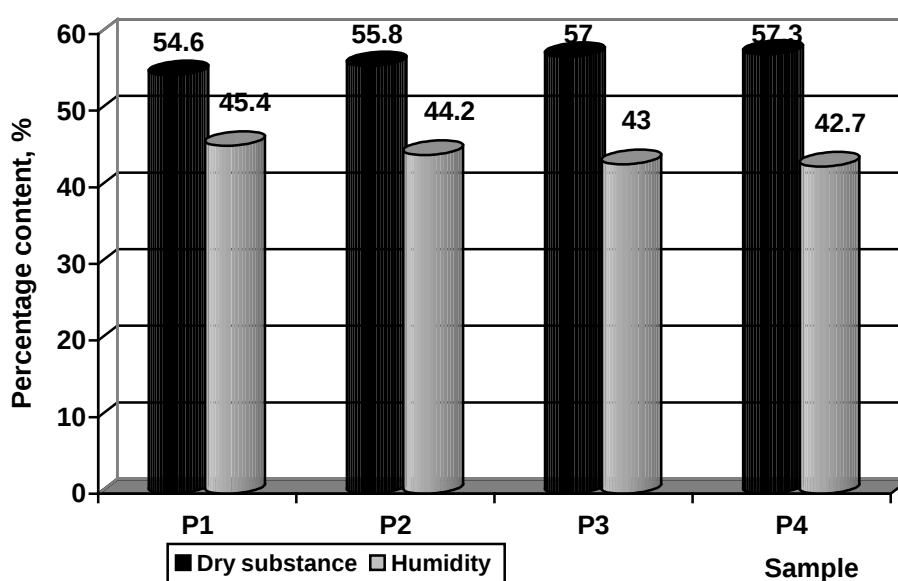


Fig. 2. The evolution of the content of dry substance and humidity for the Moeciu type

The results obtained in what the protein content is concerned, determined on the analysed samples, are presented in the 2nd table and 3rd image.

Table 2

The dynamics of the evolution of protein content and total nitrogen on the analysed cheese

Crt. No	Type	Sample	Protein, %	Total nitrogen, %
1.	<i>Holland</i>	P ₁	29.4	4.61
		P ₂	27.68	4.34
		P ₃	25.48	3.99
		P ₄	25.15	3.94
2.	<i>Moeciu</i>	P ₁	25.12	3.94
		P ₂	24.71	3.87
		P ₃	24.01	3.76
		P ₄	23.98	3.76

The protein content of the cheese has registered a continuous diminution during the experimental variant, as follows:

- for the Holland type the protein content has lowered from 29.4% immediately after the getting to 25.15% at the end of the maturation;
- for the Moeciu type the protein content has lowered from 25.12% immediately after the getting to 23.98% at the end of the maturation.

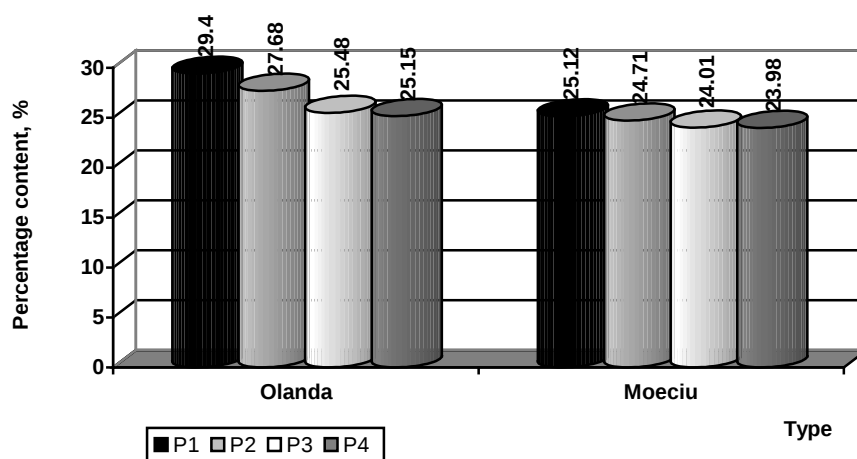


Fig. 3. The evolution of the protein content for the analysed types of cheese

The results obtained after the determination of the acidity and pH for the Holland, Moeciu and Parmesan cheese are presented in the 3rd table and 4th and 5th image.

Table 3

The dynamics of the acidity and pH evolution for the analysed cheese

Crt. No	Type	Sample	Acidity, °T	pH
1.	<i>Holland</i>	P ₁	101	5.01
		P ₂	170	5.36
		P ₃	180	5.4
		P ₄	180	5.32
2.	<i>Moeciu</i>	P ₁	105	4.94
		P ₂	125	5.22
		P ₃	180	5.34
		P ₄	184	5.28

- The acidity has increased during the maturation for all the analysed types, as follows:
- for the Holland type the acidity increases from 101°T to 180°T at the end of the maturation;
 - for the Moeciu type the acidity increases from 105°T to 184°T at the end of the maturation.

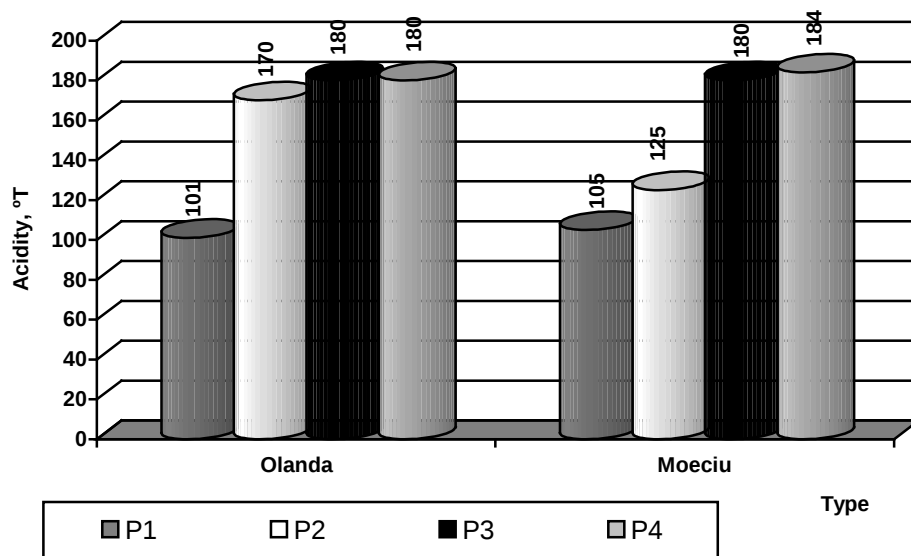


Fig. 4. The evolution of the acidity for the analysed types of cheese

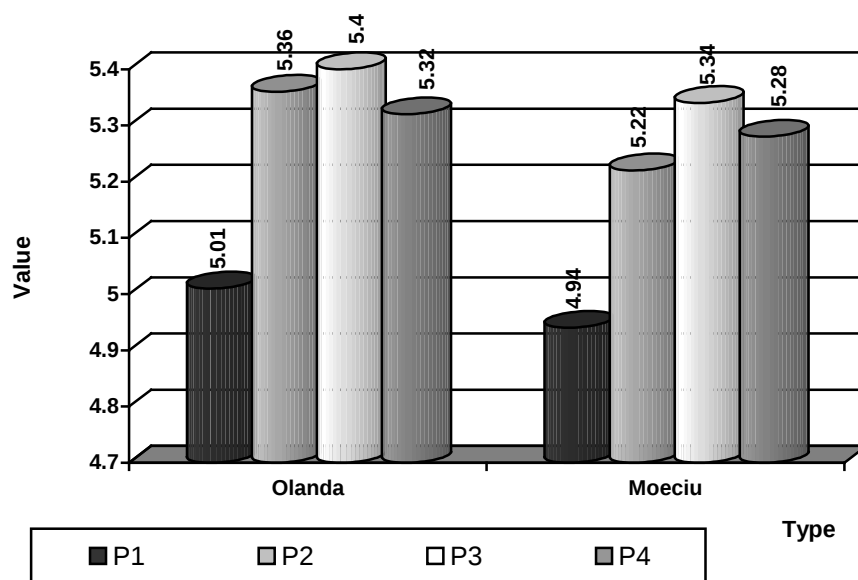


Fig. 5. The pH evolution for the analysed types of cheese

The pH value increases in the first phase of the maturation and at its end lowers for all the analysed types:

- for the Holland type, the pH value increases from 5.01 to 5.4 after 17 days of maturation, then lowers at 5.32 at the end of the maturation;
- for the Moeciu type, the pH value increases from 4.94 to 5.34 after 17 days of maturation, then lowers at 5.28 at the end of the maturation.

CONCLUSIONS

- ✓ The maturation of the cheese took place in some climatic warehouses, where the temperature and air relative humidity have been monitorized. The medium temperature values were placed between 8.44 and 9.2°C; and the air relative humidity between 65.57 and 66.67%.
- ✓ The content of dry substance increased during the maturation for all the analysed samples. The provisions concerning the minimum content of dry substance of the Company Standard have been accomplished. The percentage content of dry substance was of 5.07% for the Holland type and 11.07% for the Moeciu type.
- ✓ The humidity content of the product has lowered during the maturation for all the analysed types. The cheese have been distributed in the commercial network after the humidity parameter had reached the values under the Company Standard limit. The percentage diminution of humidity compensated the percentage increasing of dry substance.
- ✓ The protein content lowers during the maturation through their hydrolysis under the influence of proteolytic enzymes, after which more simple compounds are formed, like: peptones, amino acids, ammonia, which have a role in the formation of the flavour, taste and specific odour. For the Holland type, the protein content lowers with 4.25%, and for the Moeciu type the protein content lowers with 3.47% during the maturation.
- ✓ At the beginning of the maturation it takes place an acidification of the cheese paste through the transformation of the lactose in lactic acid. Thus, for the Holland type the acidity increases with 69°T after 10 days of maturation, and in the following 15 days only increases with 10°T, and for the Moeciu type the acidity increases with 79°T after 10 days of maturation, and in the following 15 days the acidity only increases with 6°T.
- ✓ The pH value increases in the first phase of the maturation for all the types, after which it lowers, as a result of the accumulation of the lactic acid in the cheese. Thus, for the Holland type the pH increases with 0.26 unities after 17 days of maturation, then gradually lowers until the end of the maturation with 0.08 unities. For the Moeciu type the pH increases with 0.4 unities after 17 days of maturation, then gradually lowers until the end of the maturation with 0.25 unities.

BIBLIOGRAPHY

1. Banu C. & CO., 2000, *Biotechnologies in food industry*, Technical Publishing house, Bucarest;
2. Barlow, I., Lloyd, G.T., Romshaw, E.H., Miller, A.J., Mc. Cabe, G.P., 1989, *Corelations and changes in flavour and chemical parameters of Cheddar cheese during maturations*, Aust J. Dairy Technol., 44, 7;
3. Costin, G., 1985, *Principles and modern methods in cheese industyr*, University of Galați, Galați;
4. Costin, G. & CO., 2003, *The science and engineering of cheese make*, Academic Publishing House, Galați;
5. Fox, P.F., O'Connor, T.P., McSweeney, P.L., Guinee, T.P., O'Brien, N.M., 1996, *Cheese: physical, biochemical, and nutritional aspect*, Adv. Food Nutrit. Res., 3, 163-328;
6. Segal Rodica, 1998, *Biochemistry of food products*, vol I – II, Alma Publishing House, Galați;

7. Țibulcă, D. and Mirela Jimborean, 2003, The make of dairy and cheese products, Academicpres Publishing House, Cluj-Napoca.
8. ***The collection of state standards for the milk industry, Bucurest, 1999.