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PHYSICO-CHEMICAL CHARACTERISTICS OF SHEEP MILK CHEESES PRODUCED WITH TRADITIONAL AND INDUSTRIAL PROCEDURE

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Abstract

White brined cheeses are the most widely produced and consumed cheeses in Macedonia and it have significant part in the nutrition of consumers. Currently, white brined cheeses in Macedonia are produced by both traditional and industrial methods. One of the characteristics of white-brined cheeses is their high salt content, and this probably accords with the fact that they are traditionally manufactured in countries with hot climates.

This study was conducted to determine some physico-chemical characteristics (NaCl, pH, proteins, milk fat, dry matter of cheese, titrable acidity) of white brined cheese, made from sheep's milk which has been produced on traditional and industrial way of production. For that purpose, five industrial and five traditional sheep cheeses have been taken for analysis. From the obtained results there is a statistical significance between traditional and industrial cheese way of production at level of $p < 0,001$ in salt content and $p < 0,05$ in fat content in cheese samples.

Key words: cheese, NaCl, brine.

Introduction

Cheese is the generic name for a group of fermented milk-based food products, delivered in an extensive variety of flavors and forms all through the world (Fox et al. 2000). Traditional cheeses belong to cultural heritage and are the result of accumulated empirical knowledge passed from generation to generation (Alichanidis et al. 2008). Every traditional cheese is connected to the territory of its origin and to the prevailing pedoclimatic conditions (Santa and Srbinovska, 2014). In industrial way of production the first step in cheese making is to standardize the milk casein-to-fat ratio. The exact ratio will depend on the desired fat content of the final cheese. Standardization is accomplished by a number of methods including centrifugal separation of the milk fat creating skim portion and cream portion, then recombining the portions, or by adding cream or nonfat solids, as appropriate, to incoming milk. This step controls the final fat content of the cheese (Johnson, et al. 2009). On the other hand, the use of commercial starter cultures in

an industrial way of cheese production is necessary for obtaining a final product with a standard identifiable future (El Soda at al., 2003).

Macedonian white brined cheese might be characterized as a soft (50 - 60 %) moisture, high fat cheese (25-30%), with protein content (12–21%) and high salty (3–5%) with a pH range of 4.20 – 5.05 (Mojsova, et al. 2013).

Material and methods

The research was conducted at the Faculty of biotechnical sciences- Bitola and for this purpose were collected five samples made by traditional method from local producers in Pelagonia region and five samples produced with industrial procedure from the local markets in Bitola (Figure 1). Traditional samples were taken together with brine solution while industrial produced cheese was in vacuum foil. Samples were brought to the laboratory and analyzed within 48h.

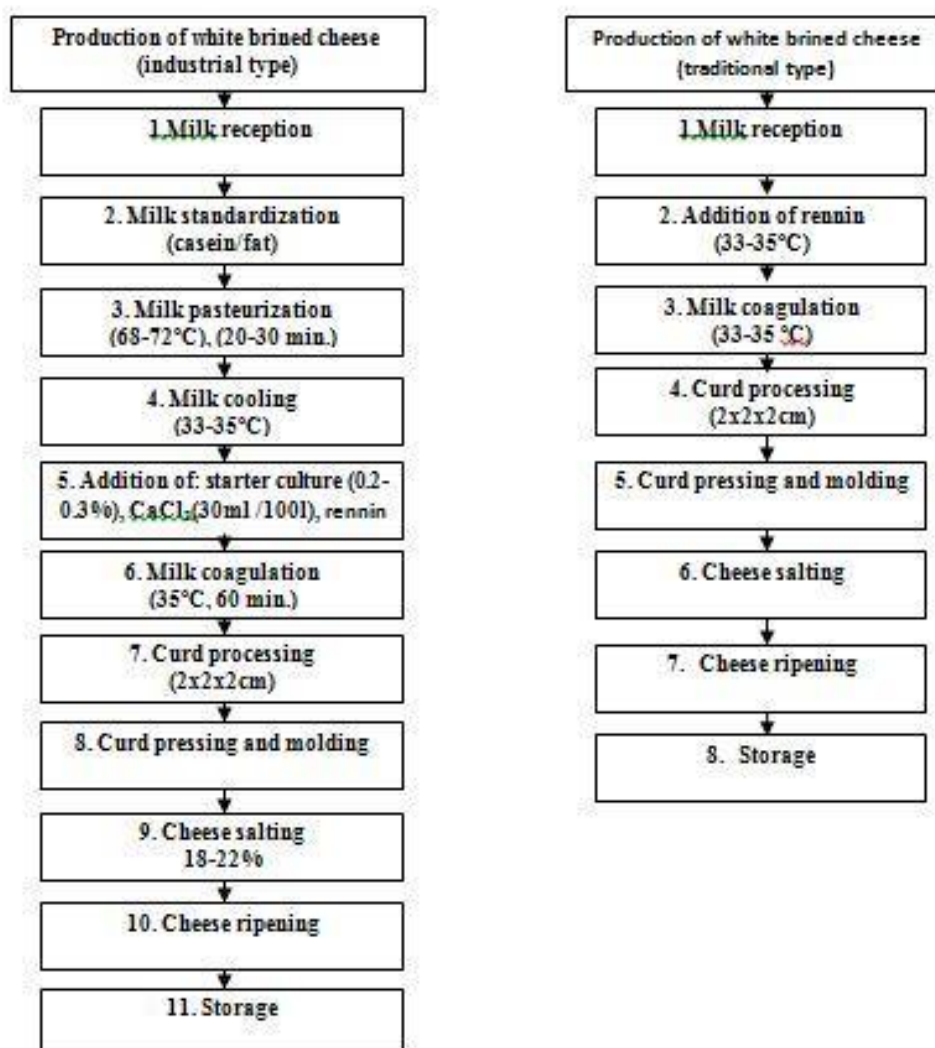


Figure 1: Technological scheme of industrial and traditional cheese (Popovski N., et al., 2015)

The determination of fat and protein content, pH and OSH, dry matter (%), NaCl (%) were done on cheese samples. The determination of the content of milk fat and protein in cheese is determined by the Gerber method (Caric et al. 2002) and Kjeldahl method (ISO 8968-1:2014), respectively. The pH of milk and cheese samples was measured using a digital pH meter (model MP120FK Mettler Toledo, Greifensee, Switzerland). Titratable activity (TA) was determined by titration using Soxhlet-Henkel method. Dry matter and water content was determined by MJ33 Mettler Toledo. The NaCl contents in brine and cheese were determined by the Mohr method. All analyses were performed in duplicates. Microsoft Office Excel was used for statistical analysis of the obtained data.

Results and discussion

In our research ten cheese samples have been analyzed, five were industrial and five traditional produced. The chemical composition of traditional and industrial cheese samples are presented in table 1. The amount of dry matter in sheep milk cheeses samples varied from 48,68%, up to 53,15% in traditional cheeses and from 43,29% up to 64,48% in industrial cheeses. The average pH content at traditional and industrial way of production was 4,54 and 4,61, respectively. The maximum protein content was recorded in traditional cheese with 18,74%, while in the industrial cheese was 18,17%. As well, the amount of fat in samples varies from 26,5% up to 35% in traditional cheese and from 23% up to 31 % in industrial cheese ($p < 0,001$). The average salt content in industrial produced cheese was 4,01% while in traditional cheese samples the average salt content was 5,70% ($p < 0,05$). Fat and salt are important elements in the flavor, texture, food safety, and overall acceptability of cheese (Johnson, et al. 2009). In the traditional way of production, we observed brine salt content of 11,41%. The higher salt content in traditional cheese was as a result of dry salting and also storage of cheese in brine for an appropriate period of time. Also increase in salt content could be attributed to the higher water content because salt penetrates the cheese matrix in water (Hayaloglu, 2003). Our results correspond to the results of Mojsova, et al. (2013). According to Johnson, M. E., et al., (2009) the salt is used for at least 6 purposes in the manufacture and aging of good-quality cheese. The purposes are: (1) to encourage syneresis and control final moisture of the cheese, (2) to control the metabolism and survival of the starter bacteria, (3) to influence the types of secondary organisms that may grow and create flavors during the ripening period, (4) to control enzyme activity in the final cheese, (5) to control texture of the final cheese as the sodium replaces calcium in the cheese microstructure, and (6) to be a component of the expected taste of the cheese. Salt, in addition to pH, Aw, and lactic acid content, is one of the hurdles inherent in maintaining the food safety of the traditional cheeses.

Table 1. Physico-chemical composition of traditional and industrial cheeses

Traditional cheese samples	NaCl in cheese (%)	Dry matter (%)	pH	Titrateable acidity (°SH)	Proteins (%)	Fat (%)
Traditional cheese						
1	5,34	51,41	4,21	108	15,98	30,25
2	5,37	49,48	4,58	72,8	13,18	35
3	6,64	50,49	4,39	103,2	18,74	26,5
4	5,94	53,15	4,49	44	18,01	33,75
5	5,22	48,68	5,04	81,6	15,0	29,5
\bar{x}	5,70 ^a	50,64	4,54	81,92	16,18	31 ^c
min	5,22	48,68	4,21	44	13,18	26,5
max	6,64	53,15	5,04	108	18,74	35
Industrial cheese samples	Industrial cheese					
1	4,36	43,29	4,66	69,6	14,20	27,5
2	3,44	52,24	4,80	103,2	18,17	31
3	3,55	49,45	4,57	107,2	13,68	26
4	4,23	64,48	4,49	106,4	15,35	27
5	4,01	61,83	4,55	74,4	14,18	23
\bar{x}	4,01 ^b	54,26	4,61	92,16	15,12	26,9 ^d
min	3,44	43,29	4,49	69,6	13,68	23
max	4,36	64,48	4,80	107,2	18,17	31

*The differences in values with different superscripts in same column are statistically significant at level of $p < 0,001$ (a:b), $p < 0,05$ (c:d)

Conclusions

From the obtained physico-chemical analysis we can conclude that there is a statistical significance between traditional and industrial cheese produced at level of $p < 0,001$ in salt content and $p < 0,05$ in fat content in cheese samples. Statistical significance was not observed between other parameters.

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