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QUALITY OF MILK FOR THE PRODUCTION OF WHITE BRINED CHEESE

Assistant Prof. Tatjana Kalevska, PhD Associate Prof. Zora Uzunoska, PhD; Assistant Prof. Viktorija Stamatovska, PhD; Teaching assistant Vezirka Jankuloska, M.Sc.

Faculty of Technology and Technical Sciences - Veles

University "St. Kliment Ohridski" - Bitola, Republic of Macedonia

Phone: +389 75 421 673

E-mail: tkalevska@gmail.com

Abstract: *The aim of the research was to examine the quality and technological suitability of cow's milk for the production of white brined cheese. To this end, the physico-chemical composition, hygienic correctness and residues in the milk were examined. According to the results of the research, the chemical composition of the milk does not depart from the values stipulated by Macedonian regulations, i.e. the content of proteins, fats, lactose, mineral matter and dry matter in the milk is 3.31%, 4.28%, 4.67%, 0.70% and 12.98%. The average number of somatic cells and bacteria in the milk is 272.556 / ml and 257.667 / ml respectively. No antibiotics were found, and the amount of aflatoxins in the milk is <0.010 µg / kg. After the maturation of 30 days, average values for the following parameters of cheese were determined: moisture 50.01%, dry matter 49.30%, fat in dry matter 48.68%, proteins 24.77% and milk fat 24%. The microbiological quality of the cheese meets the conditions of the regulations relating to the specific requirements of the microbiological criteria for food. Based on the results, it can be ascertained that the milk is of good quality and technologically suitable for processing to white brined cheese.*

Keywords: cow's milk, quality, white brined cheese.

INTRODUCTION

White brined cheese is an autochthonous kind of cheese, produced from different types of milk, in traditional and industrial conditions. For the production of white brined cheese, a good quality milk is necessary. In addition to the physico-chemical properties, the inhibitory materials and hygienic properties are a thorough indicator of the quality of the milk and the appropriateness of processing and sanitary correctness (Srbinovska, S., 2007). The physico-chemical quality of the milk for cheese production is defined based on the following parameters: proteins, fats, lactose, dry matter without fat and casein, the degree of acidity of the milk (Antunac, N., Samaržija, D., Mioč, B., Pecina, M., Pavić, V., & Barać, Z., 2004).

The variations in the composition of the milk affect its total quality, as well as certain technological operations in the processing of the milk, and manifest themselves on the composition, properties, quality and yield of the dairy products (Srbinovska, S., 2007), (Niketić, G., Oljačić, E., & Gavrić, M., 2006).

Indicators of the hygienic correctness of the milk are the total number of bacteria and the number of somatic cells (Kalit, S., Havranek, L., & Jasmina, 1998), which is correlated with changes in the physico-chemical composition of the milk and is used to evaluate its quality (Katić, V., & Stojanović, L., 2002). As a determining factor in establishing the suitability of the milk for cheese, processing is the ascertainment of the upper limit of the number of somatic cells. An increased number of somatic cells and enzymatic activity adversely affect the milk's processing suitability and its technological properties (Antunac, N., Lukac, J., Havranek, L., & Samaržija, D., 1997). The negative influence of the increased number of somatic cells in the milk is manifested with reduced curd hardness, decreased cheese yield, changes in the sensory properties, decreased shelf life of the cheese and low lucrativity for processing the milk to cheese (Auldish, M.J., Coats S., Sutherland, B.J., Mayes, J.J., McDowell, G.H. & Rogers, G.L., 1996), (Niketić, G., Popović-Vranješ, A., Kasalica, A., & Miočinović, D., 2006), (Kirin, S., 2001).

The milk for cheese must not have the presence of antibiotics and other residues that negatively affect its technological suitability and the human health (Skeie, S., 2007), (Antunac, N., Lukac, J., Havranek, L., & Samarzija, D., 1997). Antibiotics inhibit the development of lactic acid bacteria, (Mijačević, Z., Bulajić, S., & Nedić, D., 2005), and can cause allergic reactions in humans or reduce the sensitivity of harmful bacteria in the human body to some antibiotics used in the treatment of certain diseases (Presilski, S., 2004).

Milk can also contain aflatoxins, which are the most toxic collection of mycotoxins that are secondary fungal metabolites. The aflatoxin M1 (AFM1) present in milk has a mutagen, carcinogen and teratogen impact, and over an extended period of time even in extremely small quantities poses a health hazard to humans (Sassahara, M., Pontes, Netto, D., & Yanaka, E.K., 2005).

MATERIALS AND METHODS

The samples used for this research were taken from the aggregate milk for production of white brined cow cheese, in industrial conditions in the dairy "Bistra" in Kicevo, following a standard technological process for this type of cheese. The research was carried out in September 2015.

The analysis of the physico-chemical composition and antibiotics in the milk was done in the internal laboratory of the dairy, while the other analyzes were done in the "Institute of Food" at the Faculty of Veterinary Medicine in Skopje: Analysis of the physico-chemical composition (proteins, milk fat, dry matter, lactose and minerals) was performed with Lacto Scope. The active acidity of the milk was determined with the digital pH meter TESTO 720.

Microbiological analysis of milk: total number of bacteria (Bactocount - ISO 21187: 2004) and number of somatic cells (Fossomatic-ISO 13366).

Antibiotics from the group of tetracyclines and β -lactams in the milk were determined by rapid tests with the Twin Sensor incubator.

The analysis of aflatoxins in the milk was performed with (ELISA R-biopharm 1113). The chemical composition of the cheese was determined by standard methods: dry matter in cheese (SOP 345), moisture (ISO 6496: 1999 E), fat content (ISO 6492: 1999 E), proteins (ISO 5983-1 2005), fat in dry matter (SOP 386), NaCl (SOP 337) and energy value of the cheese (SOP 20).

Microbiological analysis of the cheese: *Listeria monocytogenes* (ISO 11290-1), Coagulase positive staphylococci (ISO 6888-1), *Escherichia coli* (ISO 16649-2).

RESULTS AND DISCUSSION

The chemical composition (protein, fat, dry matter, lactose and minerals) of milk has special significance in the production of cheese, since it affects the quality of cheese (Kirin, S., 2001), (Skeie, S., 2007). The average values of the chemical composition of the milk for white brined cheese are shown in Table 1.

Table 1. Physico-chemical analysis of milk

№	Parameter	\bar{x}	S _d	Cv (%)	min	max
1	proteins	3.31	0.03	1.02	3.26	3.36
2	fats	4.28	0.07	1.64	4.14	4.38
3	lactose	4.67	0.03	0.81	4.61	4.72
4	ash	0.70	0.02	2.64	0.68	0.74
5	dry matter	12.98	0.13	1.01	12.68	13.68
6	pH	6.67	0.03	0.56	6.61	6.72

The average content of fat in the milk is 4.28%, proteins 3.31%, dry matter 12.98%, minerals 0.70% and lactose 6.67%. The average value of the active acidity of the milk is 6.67. The average values of all the parameters of the physico-chemical composition are within the value limit

prescribed by the Macedonian regulations on requirements for the quality of raw milk and are in accordance with the results of other authors (Srbinovska, S., 2007), (Dimitrovska, G., Srbinovska, S., Presilski, S., Manevska, V., Kochoski, Lj., & Josheska, E., 2016). According to (Heeschen, w. h. 1987), the quality of milk, in addition to the composition, is also determined by the parameters for hygienic correctness. Table 2 shows the total number of bacteria and the number of somatic cells that are indicative of the hygienic quality of the milk.

From the results shown in Table 2, it can be noted that the total number of bacteria and somatic cells in the milk is in accordance with the requirements of the Macedonian regulations on special requirements for milk safety and hygiene. Similar results were obtained in the research of (Dimitrovska, G., Srbinovska, S., Presilski, S., Manevska, V., Kochoski, Lj., & Josheska, E., 2016), while deviating results were determined by (Srbinovska, S., 2007), (Kalevska, T., 2009). An increased number of somatic cells in milk indicates poor hygienic quality and is a basic indicator of hygiene conditions for milk production (Srbinovska, S., 2007), (Kirin, S., 2001). The technological suitability of milk with an increased number of somatic cells is inadequate for further processing in cheese (Niketić, G., Oljačić, E., & Gavrić, M., 2006).

Table 2. Microbiological analysis of milk

№	Parameter	\bar{x}	S _d	Cv (%)	min	max
1	*TC SC	272.556	49.56	18.18	213.000	367.000
2	*TCB	257.667	60.32	30.07	174.000	350.000

From a health and technological aspect, the presence of residues and contaminants in the milk is not desirable. The control of the presence of antibiotics in the milk is mandatory, and it should be prompt and timely. The results of the analysis of the residues (antibiotics) and the contaminants (aflatoxins) in the milk are presented in Table 3.

Table 3. Residues and contaminants in the milk

№	Sample: cow's milk	Results
1	aflatoxin	<0,010 mg/kg
2	antibiotics	not found

The presence of antibiotics was not established in the milk samples. The content of aflatoxins in the examined milk samples for the production of white brined cheese is <0.010 mg / kg and is within the limits of the permitted quantities according to the food safety regulations in relation to the maximum levels of certain contaminants. The results of the analysis of the chemical composition of the cheese are presented in Table 4.

Table 4. Chemical composition of white brined cow cheese

№	Parameter	\bar{x}	S _d	Cv (%)	min	max
1	moisture	50.01	0.75	1.51	49.10	51.50
2	dry matter	49.30	0.48	0.99	48.66	50.06
3	fat in dry matter	48.68	1.19	2.45	46.60	50.43
4	fat	24.0	1.07	4.47	22.70	25.80
5	proteins	24.77	0.71	2.86	23.65	25.98
6	NaCl	3.23	0.04	1.13	3.21	3.32
7	energy value	315 kcal/100gr or 1322 kj/100gr				

The analysis of the chemical composition of the white brined cow cheese was done on the 30th day of ripening. The average moisture content in the cheese is 50.01%. The value of this parameter is in accordance with the results of (Bojanić Rašović, M., Mirecki, S., Nikolić, N., Vučinić, S., Ivanović, I., & Rašović, R., 2010). The dry matter in the cheese is 49.30%. Lower dry matter values from ours were found by (Popović-Vranješ, A., Pejanović, R., Ostojić, M., Bauman, F., Cvetanović, D., Glavaš-Tribić, D., & Tomaš, M., 2011), (Mateva, N., 2012). The fat content in the dry matter is 48.68%. Similar results with ours for this parameter have been established by (Dozet, N., & Mačej O., 2006) for the Svrlijsko white brined cow cheese. The average protein content is 24.77% and the average fat content is 24%. Our results are consistent with the results of (Comakov, H., Simov, Z., & Pysheva, I., 2000), which indicate that fat contents in cow cheese range between 21-25%. The energy value of the cheese is 315 kcal / 100 gr or 1322 kJ / 100 gr. The results obtained from the microbiological analysis of white brined cow cheese are shown in Table 5.

Table 5. Microbiological analysis of cheese

№	Analyte	Results
1	Listeria monocytogenes	not found in 25 g
2	Coagulase positive staphylococci	0 cfu/g
3	Escherichia coli	0 cfu/g

From the results of the microbiological analysis it can be noted that in the cow cheese samples, on the 30th day of ripening no *Listeria monocytogenes* (Sassahara, M., Pontes, Netto, D., & Yanaka, E.K., 2005), coagulase positive staphylococci or *Escherichia coli* have been found and these results comply with the regulations on special demands for microbiological criteria for food.

CONCLUSION

Based on the performed tests and the results obtained for the physico-chemical composition, the hygienic quality and the presence of residues and contaminants in the milk, it can be concluded that the milk for the production of white brined cheese is of good quality and is technologically suitable for the production of white brined cheese, which is confirmed with the quality of the cheese determined on the 30th day of ripening. According to the content of fat in dry matter, which is an important parameter for classification of cheeses, it can be concluded that white brined cow cheese belongs to the group of fatty cheeses.

REFERENCES

- Srbinska S. (2007). Hygiene and quality of milk in the Republic of Macedonia in accordance with the legislation. *Savremena poljoprivreda*, 56, (5): 61 – 68.
- Antunac, N., Samaržija, D., Mioč, B., Pecina, M., Pavić, V., & Barać, Z. (2004). Physiological threshold of somatic cell count in diagnosis of subclinical mastitis of Paška sheep. The Future of the Sheep and Goat Dairy Sectors. *International Symposium*, 28-30 October, Zaragoza, Spain.
- Niketić, G., Oljačić, & E., Gavrić, M. (2006). Hemijske i bakteriološke analize mleka od kojeg se proizvodi somborski sir. *Prehrambena industrija*, 17, 52–55.
- Kalit, S., Havranek L., & Jasmina. (1998). Current status of somatic cell count (SCC) in the milk from individual farms in Croatia. *Milchwissenschaft*, 53, 183-184.
- Katić, V., & Stojanović, L. (2002). Broj mikroorganizama i broj somatskih ćelija u funkciji ocenekvaliteta mleka. *Jugoslovenski mlekarški simpozijum*, "Savremeni trendovi u mlekarstvu". Vrnjačka Banja. Zbornik radova, 11-18.
- Antunac N., Lukac J., Havranek, L., & Samaržija D. (1997). Somatske stanice i njihov utjecaj na kakvoću i preradu mlijeka. *Mlijekarstvo*, 47(3)183-193. Zagreb

Auldist, M.J., Coats S., Sutherland B.J., Mayes J.J., Mc Dowell G.H. & Rogers G.L. (1996). "Effects of somatic cell count and stage of lactation on raw milk composition and the yield and quality of cheddar cheese", *J. of Dairy, Res.* 63: 269.

Niketić, G., Popović-Vranješ, A., Kasalica, A., & Miočinović, D. (2006). Uticaj Hemijskog Sastava i mikrobiološke ispravnostikozijeg mleka na kvalitet sira. *Prehrambena Industrija*, 17, 72–74.

Kirin, S. (2001). Higijenska kakvoća sirovog mlijeka u svjetlu zakonskih propisa. *Mljekarstvo*, 51 (1) 49–60.

Skeie S. (2007). Characteristics in milk influencing the cheese yield and cheese quality. *J. Anim. Feed. Sci.*, 16 (1), 130-142.

Sassahara, M., Pontes Netto, D., & Yanaka, E.K. (2005). Aflatoxin occurrence in foodstuff supplied to dairy cattle and aflatoxin M1 in raw milk in the North of Paraná state. *Food Chemical Toxicology*, 43, 981-984.

Dimitrovska, G., Srbinovska, S., Presilski, S., Manevska, V., Kochoski, Lj., & Josheska, E. (2016). Traditional production and chemical composition of "Bieno cheese" in the republic of Macedonia. *Journal of Faculty of Food Engineering*. Ștefan cel Mare University of Suceava, Romania. Volume XV, Issue 1- 2016, pag. 55 – 60.

Heeschen, w. h. (1987). Sanitary and health aspects of milk. In: gravert, h.o. "worls animal science, c. dairy cattle production" *elsevier science publishers*.

Kalevska, T. (2009). Vlijanje na higijenskata ispravnost na mlekoto vrz randmanot na sirenjeto. Magisterski trud. Fakultet za biotehnicki nauki. Bitola.

Mijačević, Z., Bulajić, S., & Nedić, D. (2005). Toksikološki i tehnološki aspekt rezidua antibiotika u mleku. *Biotechnology in animal husbandry*, 21, s.i., 65–76.

Presilski, S. (2004). Proizvodstvo na sirenje i puter. *Ucebnik*. Bitola.

Bojanić Rašović, M., Mirecki, S., Nikolić, N., Vučinić, S., Ivanović I., & Rašović, R. (2010). Mikrobiološki i hemijski kvalitet autohtonih sireva u Crnoj Gori. *Prehrambena industrija- Mleko i mlečni proizvodi*, Br.1-2, 127-133.

Popović-Vranješ, A., Pejanović, R., Ostojić, M., Bauman, F., Cvetanović, D., Glavaš-Tribić D., & Tomaš, M. (2011). Proizvodnja Sjeniškog sira u industrijskim uslovima. *Prehrambena industrija -Mleko i mlečni proizvodi*. Br.1, 47-51.

Mateva, N. (2012). Ucestvo na serum proteinite pri proizvodstvo na belo salamureno sirenje so ultrafiltracija. *Doktorska disertacija*, Fakultet za zemjodelski nauki i hrana, Skopje.

Dozet, N., & Maćej, O. (2006). Autohtoni beli sirevi u salamuri. *Poljoprivredni fakultet*. Beograd.

Comakov, H., Simov, Z., & Pysheva, I. (2000). Technologija na mlekoto i mlecnite produkti. Sofija, 20.