

## TRADITIONAL PRODUCTION OF BEATEN CHEESE

Goce TALEVSKI<sup>1\*</sup>

<sup>1</sup>IMB "Mlekara"-Bitola, Macedonia  
(Corresponding author: [g.talevski@t-home.mk](mailto:g.talevski@t-home.mk))

### Abstract

Cheese production in Macedonia is mainly based on 4 products including: White brined cheese, Kashkaval, Urda (whey cheese) and Beaten cheese.

The Beaten cheese is an indigenous dairy product which dates from the Ottoman Empire, formerly produced by sheep milk, but today mostly from cow's milk, and have a real chance to get a protected denomination of origin.

This paper presents the results of examination of the traditional production of Beaten cheese from cow's milk in Mariovo region.

After 45 days of ripening the Beaten cheese had average results for following parameters: pH (5.35), titrable acidity (66 °SH), moisture (38.78%), dry matter (61.22%), milk fat (25.73%), milk fat in dry matter (42.16%), protein (27.44%), ash (9.18%) and salt (5.15%).

Lack of hygienic procedures during the manufacture of Beaten cheese was the reason for detection of *E. coli*, *Enterobacteriaceae* and coagulase positive staphylococci in the final product.

**Key words:** *Beaten cheese, traditional production, Mariovo region.*

### Introduction

Beaten cheese is a typical indigenous dairy product in Macedonia with the central area of production in Mariovo region. Depending on the production site there are more varieties of beaten cheese: Kumanovsko zolto sirenje, Tetovsko, Malesevsko etc., which are based on the same technology with minimal differences among them.

According to some literature data it was invented by Vlach pastoralists - nomads and was known as Vlach cheese (Matkovski, 1996).

Specific manner of production when the curd is beating, contributed to appoint as "beaten cheese", while the high content of salt 5-10% allowed to be consumed in small amounts by the poor population was reason to get the name "sirotinsko sirenje" (cheese for poor) (Kapac-Parkačeva, 1988).

Negative trend in sheep breeding in Macedonia have contributed to reduce the number of sheep, from the golden age in the mid-19<sup>th</sup> century when there were about 7-9 million sheep, the number reducing to around 767.000 according to official statistics (Državen zavod za statistika, 2012).

Thus the main raw material base for production of beaten cheese is cow's milk, while smaller quantities are produced from sheep, goat and mixed milk.

Beaten cheese is hard, fat cheese with spongy appearance, which ripened in brine, with a great diversity in production and unequal non-standard quality.

By adopting the quality laws of agricultural products (Služben vesnik na RM, 2010) as well as secondary legislation, in the Republic of Macedonia are established three protected

designations: protected designation of origin, protected geographical indication and traditional speciality guaranteed.

The creation of a national standard for beaten cheese makes an opportunity for this indigenous milk product to receive some of the protected designations, and consequently higher market value.

The aim of this paper is to present the indigenous technology, chemical composition and microbiological quality of beaten cheese produced in the traditional way.

### Materials and methods

Field research in this paper was conducted in households in Mariovo region which produces beaten cheese on the indigenous way. Analysis of raw cow's milk was performed in independent laboratory "Pelagonija-Mlekokontrol" - Bitola on the following methods:

- Milk fat, protein, lactose and dry matter with an infrared analyzer Lactoscope (Delta Instruments - Holland)
- Active acidity (pH) (with pH-meter Mettler Toledo)
- Titrable acidity ( $^{\circ}$ SH) (by the method of Soxhlet – Henkel)
- Total number of somatic cells (with instrument Somascope)
- Total number of bacteria (with instrument Bactoscan FC).

Ten samples of beaten cheese were analyzed at the Faculty of Agriculture and Food in Skopje by the following methods described by Carić et al. (2000):

- pH of cheese (with a pH-meter, mark Mettler Toledo)
- Titrable acidity (by the method of Soxhlet-Henkel, modified by Moress)
- Dry matter (drying to constant weight, standard AOAC: 1995)
- Contents of milk fat (by the method of Soxhlet - Henkel)
- Content of total protein (by the method of Kjeldahl, standard AOAC: 1995)
- Content of ash and salt (by methods according Inihov, 1971);

Microbiological analyzes of cheese after 45 days ripening were made at the Faculty of Veterinary Medicine - Skopje, under the Regulation for specific requirements for food safety in terms of microbiological criteria (Služben vesnik na RM, 2008). Statistical data processing was performed using the program package STATISTICA-Stat Soft, Inc. Version 6. (2001).

### Results and discussion

The quality of raw cow's milk was used for the production of beaten cheese is shown in Table 1 and can be found that is relatively good. The individual milk producers often in the case of unconditioned milk, which appears with increased acidity, being processed in beaten cheese as a final compromised solution.

Table 1. Chemical-physical characteristics and hygienic quality of milk for beaten cheese (n=10).

Parameter	$\bar{x}$	SD	CV (%)
Milk fat (%)	3.65	0.19	5.22
Proteins (%)	3.27	0.10	2.98
Lactose (%)	4.47	0.05	1.01
Dry matter (%)	12.75	0.24	1.89
pH	6.62	0.09	1.39
Titrable acidity ( $^{\circ}$ SH)	6.76	0.21	3.06
TCSC/ml	339800	36533.55	10.75
TCB/ml	257600	91917.35	35.68

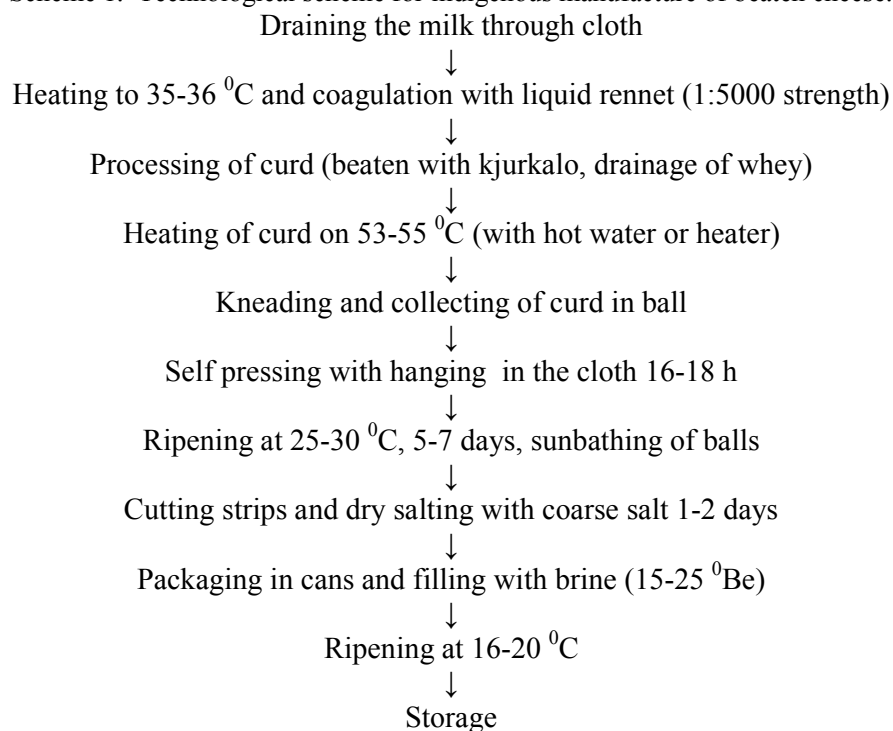
Weak sanitation procedures in the processing of milk in the traditional way are noted by Kakurinov (2002), who found that raw milk contains from  $2.7 \times 10^6$  to  $1.0 \times 10^8$ / ml total

number of bacteria. In 66.6% of examined varieties of beaten cheese, the author found  $1 \times 10^6$ /g cheese coliform bacteria and yeasts that cause early blowing and other sensory defects in cheese.

Poor microbiological situation is the result of the use of wooden vessels, vats, kjurkalo (wooden stick for processing curd) which are difficult to wash and then use the wool strainers, and in the past by using homemade rennet of lamb stomachs. Indigenous way of making beaten cheese is shown in Scheme 1, while the chemical composition of cheese is shown in Table 2. In the past in the processing of the curd, a part of the fat was separated and used in the diet of the population so that the cheese belonged in fat cheese. The scalding of the curd has also seen a lot of changes because in the past a hollow black stones were heated in the fire and put directly in the curd. This cheese got dirty gray color, parts of the stones fell into the cheese and the curd was improperly heated. Later the scalding is changed by adding hot water or heating fire.

This thermal treatment of curd enhances microbial status and leads to a significant reduction in the total number of bacteria according with the results of Šutić (1964), who indicates that after the scalding of baskija at  $75^\circ\text{C}$  13% of the total number of bacteria remains, while at  $85^\circ\text{C}$  0.05% of the initial number of bacteria before scalding of the baskija remains.

Scheme 1. Technological scheme for indigenous manufacture of beaten cheese.



Lethal effect of high heat treatment on coliform bacteria highlighted Spano et al. (2003) where after the heat treatment of curd at temperature of  $80^\circ\text{C}$  for 5 minutes in the manufacture of Mozzarella cheese the presence of *E.coli* was not identified.

Kneading the curd, self pressing with hanging in the cloth and ripening, aims to remove excess whey and properly directed the lactic acid fermentation.

The most important bacteria in the initial stage of beaten cheese ripening was lactic acid cocci with main representative species (*Cit*  $\bar{}$ ) *Lactococcus lactis ssp. lactis* and in the further course of fermentation predominate rod-shaped lactic acid bacteria with the highest representation of *Lactobacterium plantarum* (Levkov and Kakurinov, 2007).

During ripening some manufacturers wash the cheese with warm whey and sunbathe it, so it gets a nice yellow color and in certain areas is called yellow cheese. Salting is also quite specific procedure for this type of cheese because brine with high strength 15-25 °Be is used which causes intense migration of moisture giving cheese with a hard consistency. Salting was formerly done by making holes in cheese itself and putting coarse salt in them.

The average salt content of 5.15% in our tests compared with previous research of beaten cheese (Kapac-Parkačeva, 1988; Micev, 1966) shows lower values compared to their scores from 6.75-7.93% salt.

Table 2. Physico-chemical composition of beaten cheese during ripening (n=10).

Investigated parameters (%)	Period of ripening (day)		
	2 (day)	20 (days)	45 (days)
Moisture	47.02	39.60	38.78
Dry matter	52.98	60.40	61.22
Milk fat	23.43	26.39	25.73
MFDM	44.25	43.68	42.16
Proteins	27.06	27.20	27.44
Ash	2.91	8.49	9.18
Salt	0	5.08	5.15
Titration acidity (°SH)	46	64	66
pH	5.61	5.42	5.37

Moisture after 45 days ripening reached 38.78%, which affects the ripening of this cheese and is slower compared to cheeses with higher moisture (semihard, soft cheese).

The slow ripening can be noted from achieved pH value of 5.37 and titration acidity of 66 °SH. Total protein content had similar values as the beaten cheese produced in industrial way described by Radevska et al. (2003).

The ash content in cheese is directly correlated with its amount in the milk and affect on rheological characteristics of the final product. From the results shown in Table 2 it could instead can be concluded that the dynamics of ash shows continuous increase from 2.91% at the beginning to 9.18% at the end of the ripening of cheese.

Production of beaten cheese from raw cow's milk results with the appearance of enterococci that according Giraffa (2003), are tolerant on temperatures of 10-45 °C, pH of 4.0-9.0 and salt concentration of 6.5%.

The presence of *E.coli* is a sign of fecal contamination of milk and poor hygiene in primary production, while the low number of coagulase positive staphylococci is result of scalding of curd with hot water carrying their reduction (Gomez-Lucia et al., 2008).

The yield of beaten cheese from cow's milk produced in the traditional way ranges from 10 to 11 liters of milk per 1 kg of cheese.

Table 3. Microbiological quality of beaten cheese (n=10).

Bacterial species	$\bar{x}$	Min	max
<i>Enterobacteriaceae</i>	1420	260	3000
<i>E. coli</i>	477	0	1300
<i>Coagulase positive staphylococcus</i>	40	5	110
<i>Listeria monocitogenes</i>	0	0	0
<i>Salmonella spp.</i>	0	0	0

Beaten cheese as an indigenous dairy product in Macedonia has a real chance to get a protected denomination of origin. According to Babcock and Clemens (2004), products with protected geographical designations achieve higher market prices, support rural development, contribute to the protection of biodiversity, have been promoting certain regions, opening of

new jobs etc. Protecting of the beaten cheese will prevent possible fakes in the market and keep the unique and original flavor. For this purpose, besides the already adopted legislation, the state together with municipalities and scientific institutions should undertake a media campaign, financial support and appropriate training for producers, support for the development of scientific studies, elaborate and specifications and other activities that would preserve the traditional way of producing this indigenous product.

### Conclusion

The beaten cheese in the past is used mostly by poor population, but today is a valued product in Macedonian kitchen. Production from raw milk contributes to the presence of a wide range of bacterial species that give a unique and distinctive taste, but poor hygiene in rural households can contribute to the presence of pathogenic species.

This indigenous product have a real chance to get a protected denomination of origin which would have mutual benefit for producers and consumers of this type of cheese.

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