

MICROBIOLOGICAL QUALITY AND VALORIZATION OF “WHITE CHEESE” DEVELOPED IN THE EUROPEAN VALLEY

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ABSTRACT

White cheese is a typical product of the European Valley region in Santa Catarina and represents part of the income of many small producers' families. Traditionally obtained through the natural fermentation process of raw cow's milk, white cheese has specific sensory, physicochemical, and microbiological characteristics, with cultural value based on the artisanal process. To obtain information on the quality of the developed product and to organize material for writing a technical report to regulate the production of this cheese, samples from seven producers (S1R, S2R, S3R, S4R, S5R, S6R, and S7P) in the region were studied. Of the samples, six were produced from raw milk and one from pasteurized milk (65 °C / 30 min). In this study, the presence of Thermotolerant Bacteria, *Salmonella sp.*, *Staphylococcus aureus*, and *Escherichia coli* was verified and quantified. The results showed no *Salmonella sp.* in any of the cheese samples. The S6R sample, obtained with raw milk, showed excellent microbiological quality, which can be explained by the implementation of good manufacturing practices and the organization of the manufacturing process. The other samples had *E. coli* more than 1×10^1 CFU/g. Therefore, the property that works with raw milk (S6R) proves to be an excellent model to follow for regulating the process that traditionally uses raw milk.

Keywords: Fresh Cheese. Natural Fermentation. Artisan Production. Food Safety.

1 INTRODUCTION

Artisan cheeses are highly manipulated foods and are therefore susceptible to contamination, particularly bacterial contamination. This risk is heightened using raw milk, especially when good practices are not followed, or the cheeses are not matured for a sufficient period¹.

Artisanal white cheese obtained through natural fermentation is a heritage of traditional culture and cuisine, produced by generations who pass on their knowledge of how to make it from father to son. This cheese is made from raw milk, straight from milking, without undergoing the pasteurization process that removes many naturally present microorganisms².

Natural fermentation is the main stage of this artisanal process. Without the addition of industrial dairy cultures, the milk is left to ferment naturally, allowing native bacteria and fungi to act in the development of the product. This is a slow and process, requiring patience and skill from the cheesemaker³.

The result is a cheese with a unique personality that reflects the terroir of the region where it was produced. Each batch carries the signatures of the climate, the particularities of the producer, and the local microbiota. The flavors and aromas can vary subtly, but always with a richness and complexity that industrial cheeses cannot match⁴.

Thus, studying the microbiological quality of white cheese developed by producers in the European Valley region allows us to identify weaknesses and define improvements that will enable us to regulate the artisanal production of white cheese from raw milk. This not only values local culture but also strengthens the production that represents a significant part of many families' income¹.

2 MATERIAL & METHODS

Seven samples of white cheese were collected from small producers in different municipalities in the European Valley region (Santa Catarina / Brazil): six from raw milk (S1R- S6R) and one from pasteurized milk (S7P). The samples were collected, transported, and stored in sterile packaging and kept refrigerated at 4°C until the time of analysis (Figure 1).

The tests were carried out from May 2023 to May 2024, following approval by the Ethics Committee for Research with Human Beings at the University of Blumenau (CAAE: 67660523.7.0000.5370). Thermotolerant bacteria, *Salmonella sp.*, *Staphylococcus aureus*, and *Escherichia coli* were analyzed according to the methodologies (APHA, 2001)⁵. The results were recorded for each

type of bacteria in colony-forming units per gram (CFU/g) and were analyzed based on NORMATIVE INSTRUCTION - IN N° 161, OF JULY 1, 2022⁶.

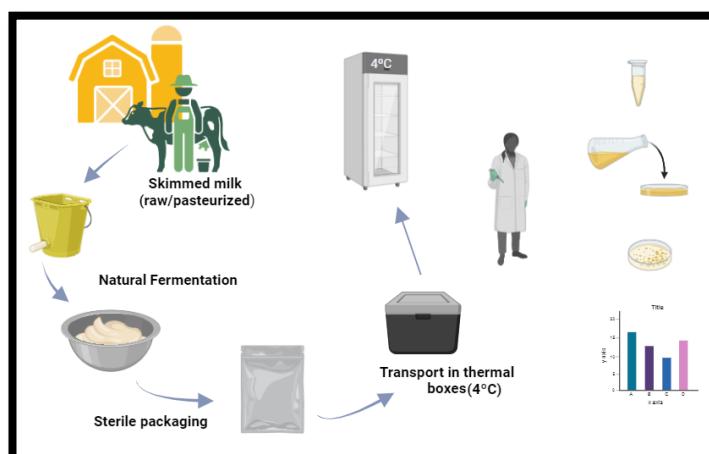


Figure 1. Schematic drawing of the methodology used to obtain and analyze the white cheese samples.

The samples of white cheese underwent physicochemical analysis, assessing moisture content, total protein, fat, ash, and pH (AOAC, 2000)⁷. These analyses were conducted in triplicate, and the results were statistically evaluated using the Tukey test at a significance level of 5% (software *Statistica* 14.1, StatSoft Inc., Tulsa, EUA).

3 RESULTS & DISCUSSION

All the microorganisms studied are undesirable (Table 1), although legislation in some cases tolerates a maximum limit: thermotolerant bacteria and *E. coli* ($< 1.00E+1$), *S. aureus* ($< 1.00E+2$) and *Salmonella sp.* (absence in 25 g of sample)⁶.

The evaluation of the microbiological quality of the cheeses showed no contamination by *Salmonella sp.*, one of the pathogens most frequently investigated by inspection bodies⁸. This highlights the effectiveness of current measures to prevent this contamination⁹. In addition, only one of the samples showed growth of *Staphylococcus* (S5R).

Despite the absence of other microorganisms, the pasteurized milk sample (S7P) showed growth of *Escherichia coli*, which can be explained by improper handling after heat treatment¹⁰. Samples S3R, S4R, and S5R showed thermotolerant bacteria ($>1.00E+1$) and samples S2R, S3R, S4R, S5R, and S7P showed *E. coli* ($>1.00E+1$). The presence of these bacteria may be due to improper handling, mastitis, and other factors that affect the safety of white cheeses¹¹.

Table 1. Microbiological results (Thermotolerant bacteria, *Salmonella*, *Staphylococcus aureus*, and *Escherichia coli*) of 7 white cheese samples studied (S1R, S2R, S3R, S4R, S5R, S6R, and S7P), produced in the European Valley region.

(CFU/g)	Samples						
	S1R	S2R	S3R	S4R	S5R	S6R	S7P
Thermotolerant bacteria	0	0	5.40E+02	2.10E+02	2.40E+03	0	0
<i>Salmonella sp.</i>	0	0	0	0	0	0	0
<i>Staphylococcus aureus</i>	0	0	0	0	2.00+E+1	0	0
<i>Escherichia coli</i>	0	1.00E+02	8.80E+02	4.00E+02	1.00E+02	0	8.00E+01

Cheese samples from raw milk (S1R- S6R) and from pasteurized milk (S7P).

The physicochemical parameters are shown in Table 2. The results confirmed that all the white cheese samples belonged to the category of cheeses classified as very high moisture ($>55\%$).

Only samples S1R, S3R, and S7P had a fat content of less than 10% and were classified as skimmed cheeses³. The cheese samples with a lipid content of more than 10% (10-25%), classified as low-fat cheese, can be explained by the lack of maintenance of the skimming machine. It is in the interest of small producers to remove as much fat from the milk as possible to produce cream and increase their income. White cheese not only had a low lipid content compared to other cheeses but also a high protein value¹².

Table 2. Physicochemical results of the 7 white cheese samples studied (S1R, S2R, S3R, S4R, S5R, S6R, and S7P) produced in the European Valley region.

Parameter	Samples						
	S1R	S2R	S3R	S4R	S5R	S6R	S7P
Moisture (%)	75.14±2.10 ^a	69,08±2.60 ^a	73.05±3.05	76.35±2.60 ^a	75.67±2.10 ^a	72.22±3.10 ^a	69.09±3.15 ^a
Protein (%)	19.65±1.90 ^a	21.04±1.89 ^a	21.74±1.70 ^a	16.61±1.58 ^a	16.09±2.05 ^a	20.62±0.96 ^a	23.63±1.45 ^a
Fat (%)	1.37±0.05 ^c	21.02±1.20 ^a	4.42±1.50 ^c	10.57±0.50 ^{bc}	14.39±1.05 ^b	14.4±2.08 ^b	9.71±1.25 ^b
Ash (%)	1.02±0.05 ^a	2.01±0.10 ^a	1.10±0.05 ^a	0.90±0.02 ^a	1.02±0.01 ^a	1.40±0.05 ^a	1.85±0.05 ^a
pH	3.86±0.95 ^a	3.94±0.50 ^a	4.40±1.01 ^a	3.75±1.05 ^a	4.10±1.10 ^a	4.02±0.89 ^a	3.94±0.80 ^a

Cheese samples from raw milk (S1R- S6R) and from pasteurized milk (S7P).

Mean (± standard deviation) of physicochemical results. Different letters on the same line differ significantly by the Tukey test ($p < 0.05$).

4 CONCLUSION

This research has presented results that highlight the importance of guiding and monitoring the production process of artisan cheeses to promote improvements in quality. In general, the cheeses meet the physicochemical standards established by legislation, and the microbiological parameters indicate food safety potential. Since white cheese is traditionally produced with raw milk, the sample from S1R showed the best characteristics and manufacturing procedures, making it a suitable model for other small producers. Although some areas need to be improved, the ongoing efforts to provide guidance on good practices and motivate producers to produce safer cheeses are promising. Therefore, this study confirms that, regardless of whether white cheese is made with raw or pasteurized milk, it is essential to use high-quality milk and adhere to good manufacturing practices throughout the process to ensure that the cheese is of high quality, safe for consumption, and has greater added value for small producers.

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