

## Evaluation of some microbiological and chemical parameters of Campania buffalo ricotta cheese

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### Abstract

Fresh ricotta (whey cheese), owing to its technological characteristics and intrinsic parameters (pH and  $a_w$ ), is an excellent substrate for the growth of spoilage and pathogenic microorganisms. On 19 July 2010, Campania buffalo ricotta cheese was assigned to the register of Protected Designations of Origin (PDO) by the European Commission, with EC Reg. 634/2010. It is mainly produced in the provinces of Caserta and Salerno around the rivers Garigliano and Volturno, the plain of the river Sele and the area of Cilento. This article reports the results of a 9-month monitoring (from May 2014 to January 2015) of ricotta samples aiming at evaluate the microbial status of some cheese factories, since ricotta is considered particularly suitable to judge the hygienic level of the dairy establishments. Four dairies were selected for sampling according to their different structural characteristics and the

adequacy of both their premises and equipment.

### Introduction

Ricotta has very ancient origins and is highly appreciated owing to its nutritional values and low cost. It is obtained from the whey which is steam-heated up to a temperature of about 82°C and then to 92°C (the Latin term *recoctus* means *cooked twice*). Heating causes the albumin and lactalbumin denaturation and aggregation. The addition of both *cizza*, i.e. lactic acid or citric acid, and buffalo milk and/or fresh cream are allowed in order to enhance the process of coagulation of the whey proteins, obtain a more compact structure and increase the yield, respectively. Differences in structure are determined by the pH value at which heat treatment takes place and by the different ratios of  $\beta$ -Lg and  $\alpha$ -La. In buffalo ricotta, the ratio of  $\beta$ -Lg to  $\alpha$ -La is 80:20; at the moment of the thermo coagulation the pH value of the serum is 6.26 (Addeo and Coppola, 1983). Because of the high temperatures reached during production, fresh ricotta is naturally poor in competitive microflora (Pintado *et al.*, 2002). However, spores that survive at high temperatures, as those of *Bacillus cereus*, may be detected (De Santis *et al.*, 1999). The microbiological status of the ricotta may be useful to evaluate the hygiene of the production chain, owing to the open nature of the production, which includes handling of the curd after floating (Greenwood *et al.*, 1991). Moreover, considering the ricotta limited shelf-life, it is essential to ascertain the microbiological characteristics of the buffalo ricotta cheese in order to assess the risk for the consumer.

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### Materials and Methods

For the present study, four dairies were selected on the basis of the authorization for Protected Designations of Origin (PDO); the level of implementation of Good Manufacturing Practices (GMP) and the hygienic adequacy of the working area and the equipment. Two samples each month were collected in the selected dairies from May 2014 to January 2015. All samples (n=72) were transported, in their primary packaging and under refrigeration conditions (4±1°C), to the laboratory, where they were immediately analyzed for the detection of the following microbiological parameters: *Salmonella spp.* (AFNOR BRD 07/6-07/04); *Listeria*

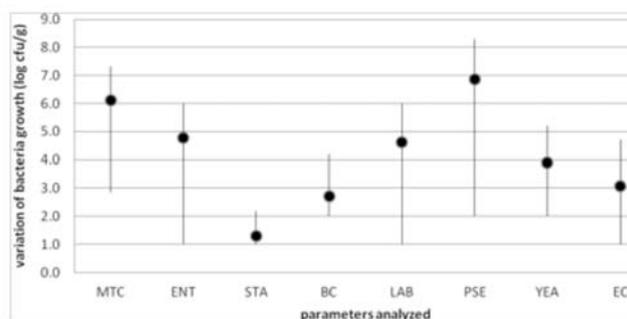


Figure 1. Average, maximum and minimum logarithmic values of the parameters tested. MTC: mesophilic total content; ENT: Enterobacteriaceae; STA: Staphylococci; BC: *Bacillus cereus*; LAB: lactic acid bacteria; PSE: *Pseudomonas spp.*; YEA: yeast; EC: *Escherichia coli*.

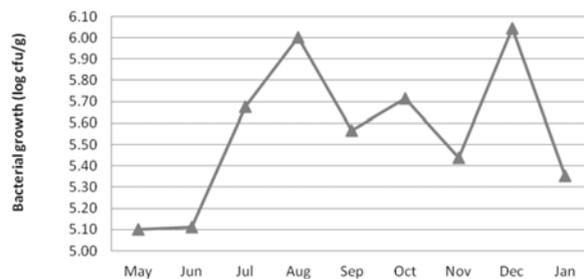


Figure 2. Seasonal trend in the mean mesophilic total content; the data are expressed in logarithmic base.

*monocytogenes* (*L. monocytogenes*) (AFNOR BRD 07/10-04/05); *Escherichia coli* O157 : H7 (UNI EN ISO 16654: 2003); Total Aerobic Mesophilic Counts (MTC) (AFNOR BIO 12/15-09/05); *Enterobacteriaceae* (ETB) (AFNOR BIO 12/21-12/06); *E. coli* (AFNOR BIO 12/13-02/05); *Staphylococci* (AFNOR BIO 12/28-04/10); *B. cereus* (ISO 7932:2005); Lactic Acid Bacteria (LAB) (ISO15214:1998); *Pseudomonas spp.* (ISO/TS 11059IDF/RM 225 01-08-2009); yeast and molds (ISO 21527-1: 2008). Both pH (Five Easy Plus Metter-ToledoAG) and  $a_w$  (AQUA LAB- Dewpoint water activity meter) were also monitored on each occasion.

## Results

The results obtained are reported in Figure 1 and in Table 1. The following average values were recorded in the analyzed samples: *E. coli* 3.07 log cfu/g; *Staphylococci* 1.30 log cfu/g; Total Mesophilic Counts 6.12 log cfu/g; *Enterobacteriaceae* 4.79 log cfu/g; *Pseudomonas spp.* 6.86 log cfu/g; *B. cereus* 2.72 log cfu/g; yeasts and molds 3.90 log cfu/g and lactic acid bacteria 4.61 log cfu/g. (Figure 1). The presence of *Salmonella spp.* and *L. monocytogenes* was never detected. At the organoleptic analysis no change in color, smell or texture was observed. The pH and  $a_w$  values were stable, ranging from 6.2 to 6.7 and from 0.987 to 1.00, respectively.

## Discussion and Conclusions

The monitoring carried out represents a starting point for the evaluation of a traditional Italian product, which has at the moment a mainly local distribution. The data obtained from the examined samples demonstrate a high level of Total Mesophilic Counts during the whole period, with peaks occurring in August (6.00 log cfu/g) and December (5.60 log cfu/g) (Figure 2).

The higher microbial concentrations

found in the months of increased commercial activity stress the need of a better control of the supply chain in all production seasons. Three of the dairies selected were located in old premises that seemed unsuitable to prevent the cross-contamination in the different stages of production and the post-contamination of the finished product in the later stages. The best microbiological results were obtained in the samples of the fourth dairy where a better control of the *hygiene process* and a satisfactory adequacy of the premises were observed. It is well known that food may be contaminated through direct contact with different surfaces of the processing equipment and environment (Greenwood *et al.*, 1991; Kousta *et al.*, 2010). Contamination is frequently caused by microorganisms belonging to the genus *Pseudomonas spp.*, which can persist within niches in the processing environment, if protected by a structured biofilm ecosystem (Simões *et al.*, 2009). In this study, average values of *Pseudomonas spp.* found in the dairies where the whey was directly poured into the steam boilers (7.07 log cfu/g) were higher than those of the dairies with double-bottomed boilers (6.43 log cfu/g). Considering the high temperatures of steam inflation in whey there is not a real risk of contamination by the biofilm that may form in the pipes of boilers. Nevertheless, the fact that a high concentration of *Pseudomonas spp.* adversely affects the taste and texture of the product (Leriche *et al.*, 2004) should not be underestimated to guarantee the quality of the ricotta. The climatic and geographical conditions of the production areas greatly contribute to the typical taste and flavour of the Campania buffalo ricotta cheese. The properties of the milk are transferred to ricotta by using only sweet whey from the breakage of fresh buffalo milk clot (EC Reg. 510/2006; European Commission, 2006). Standardization of the procedures, adequacy of the premises, corrective actions, staff reliability and training are important conditions to improve and preserve the quality and safety of the product.

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**Table 1. Average values of pH and water activity May 2014-Jan 2015.**

	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
pH	6.47	6.38	6.42	6.53	6.65	6.57	6.26	6.32	6.53
$A_w$	1.000	1.000	0.998	0.998	0.998	0.990	0.992	0.991	0.987