



Contents lists available at ScienceDirect

International Dairy Journal

journal homepage: www.elsevier.com/locate/idairyj

Effect of milk thermisation and farming system on cheese sensory profile and fatty acid composition



Daniele Giaccone^a, Andrea Revello-Chion^a, Laura Galassi^b, Piergiorgio Bianchi^b,
Giovanna Battelli^c, Mauro Coppa^{d,*}, Ernesto Tabacco^d, Giorgio Borreani^d

^a Associazione Regionale Allevatori del Piemonte (ARAP), Via Livorno 60, 10144, Torino, Italy

^b ERSAF – Via Pilla, 25/b, 46100, Mantova, Italy

^c Institute of Sciences of Food Production, Italian Natl. Research Council, Via Celoria 2, 20133, Milan, Italy

^d Department of Agricultural, Forest and Food Sciences (DISAFA), University of Turin, Largo P. Braccini, 2, 10095, Grugliasco, Torino, Italy

ARTICLE INFO

Article history:

Received 1 July 2015

Received in revised form

18 February 2016

Accepted 28 February 2016

Available online 10 March 2016

ABSTRACT

The effect of milk thermisation and farming system on the sensory profile and fatty acid (FA) composition of a traditional cheese under real production conditions was evaluated. Raschera Protected Designation of Origin (PDO) cheese, which is produced in North-West Italy, was chosen as a case study. Cheese samples were collected in summer and winter from dairy plants that processed raw milk (IR) or thermised milk (IT) collected from intensive farms, or raw milk (ER) collected from extensive farms. The sensory profile and FA composition of IR and IT cheese were similar. The ER summer cheeses had a lower cream odour, butter odour and aroma. They had a higher rennet, strong toasted, silage, barn, garlic, boiled vegetables, and smoked odours and aromas, a higher hazelnut odour, and tasted more bitter. The ER summer cheese also expressed a more favourable FA composition for human health, which allowed it to be distinguished among the other Raschera cheese.

© 2016 Elsevier Ltd. All rights reserved.

1. Introduction

The sensory properties of cheese are closely related to the environmental conditions of milk production, the type of milk that is utilised, and the particular technology that is applied (Urbach, 1990).

Traditional cheeses are typically produced in small factories or on farms, using milk from animals fed a combination of conserved forages, fresh pasture and concentrates (Bovolenta et al., 2014; Carpino et al., 2004). The specifications of these cheeses do not always include restrictions on animal diet composition, which can vary from diets applied in extensive to intensive dairy systems, with significant changes throughout the year due to seasonal variations in the allowance of the various feedstuffs. These variations in cow feeding are known to affect sensory properties of cheese (Abilleira, Schlichtherle-Cerny, Virto, de Renobales, & Barron, 2010; Buchin, Martin, Dupont, Bornard, & Achilleos, 1999; Martin, Verdier-Metz, Buchin, Hurtaud, & Coulon, 2005) and fatty acid (FA) composition (Coppa et al., 2013; Dewhurst, Shingfield, Lee, & Scollan, 2006; Shingfield, Bonnet, & Scollan, 2013).

Pasture feeding is known to lead to an increase in the strong and herbaceous flavours and odours of cheese, but also to give cheese a yellower colour and reduced firmness, compared with cheese made from milk derived from cows fed conserved forages and concentrates (Bonanno et al., 2013; Coppa et al., 2011b; Esposito et al., 2014). Cheese made from fresh-herbage-derived milk is also richer in n-3 FA, conjugated linoleic acid (CLA) and polyunsaturated FA (PUFA), and poorer in saturated FA (SFA) and n-6 FA (Coppa et al., 2015a; Hurtaud, Dutreuil, Coppa, Agabriel, & Martin, 2014; Revello-Chion et al., 2010), with subsequent implications for human health and cheese sensory properties (Farruggia et al., 2014; Givens, 2010). Feeding cows with high proportions of grass silage or hay instead of maize silage may also induce similar changes in the sensory characteristics of cheese, even though they can be less pronounced (Agabriel et al., 2004; Hurtaud, Peyraud, Michel, Berthelot, & Delaby, 2009; Martin et al., 2005).

Furthermore, some traditional cheeses, even when specifications exist, can be made using both raw and heat-treated milk. The heat treatment necessary for pasteurisation of milk can have significant impact on the sensory properties of cheese (Chambers, Esteve, & Retiveau, 2010; Cornu et al., 2009). It can induce a partial loss of the particular sensory features that can be imparted to

* Corresponding author. Tel.: +39 011 670 8771.

E-mail address: mauro.coppa@unito.it (M. Coppa).

cheese through some feeding systems, such as pasture feeding, especially during summer utilization of upland biodiversified pastures (Coppa et al., 2011b; Farruggia et al., 2014). Consequently, the sensory properties and FA composition of traditional cheeses can be expected to vary extensively. The effect of production conditions on the sensory properties of traditional cheese has rarely been studied in on-farm experiments. Thus, a characterisation of the sensory and FA profiles of traditional cheese could be useful in understanding the role of the production systems and seasons on commercial farms and dairy plants.

The aim of this research was to evaluate the effect of farming system and thermisation of milk on the sensory profile and FA composition of a traditional cheese under real production conditions. Raschera PDO cheese, a traditional cheese that is produced in North-West Italy, was considered as a case study.

2. Materials and methods

2.1. Raschera PDO cheese: a case study

Raschera PDO cheese is a traditional uncooked and pressed cow milk cheese that is produced in the Cuneo Province, in North-West Italy. Currently, almost all Raschera cheese is produced from full-fat bovine milk. The geographical shape of the Cuneo Province is highly heterogeneous and changes significantly over a rather narrow territory. Consequently, the farming systems vary considerably, ranging from intensive maize silage-based farming systems in the Po plain area, to extensive farms on which herds graze on upland pastures in the Alps during summer. The limited number of dairy plants producing Raschera in the Province allowed cheese to be collected from almost all of the producers, and to establish the real variations in production conditions of almost the entire production of Raschera PDO cheese.

2.2. Schedule for cheese sensory evaluation

A representative sample of cheese was collected with the aim of identifying the sensory attributes that are able to describe the sensory profile of Raschera PDO cheese. Five representative factories were selected considering their different farming systems and cheesemaking technology characteristics to obtain the widest possible range of variability of the sensory properties.

A Quantitative Descriptive Analysis (QDA[®]) (Stone, Sidel, Oliver, Woolsey, & Singleton, 1974) was performed on two cheeses ripened for 60 days, produced in the winter and summer seasons, by each cheese factory. Ten expert panellists selected to form the panel underwent a training period for QDA[®], and they were then involved in the development of a list of attributes describing the texture, odour, taste and flavour of cheese. The tests were performed in three sessions (one for winter cheese and two for summer cheese), following the procedure described for the sensory analysis (Nielsen & Zannoni, 1998). Each panellist was asked to identify a list of sensory descriptors of the cheese in individual sensory booths (Hunter & McEwan, 1998; ISO, 1988). These attributes were characterised and agreed upon in a round-table meeting, in which the sampling tastes of the products used as reference odour, flavour and taste were dealt with, to create the final list of attributes that described the sensory profiles of the cheese.

A total of 36 attributes were identified: 14 for odour, 14 for flavour, 4 for taste and 4 for texture (Table 1). Subsequently, a validation test was performed in 14 sessions. During each session, panellists were asked to evaluate the sensory attributes on an intensity scale ranging from 1, at which the attribute was defined as

not perceptible, to 9, at which the attribute had the maximum expression.

Statistical analyses of the validation test were performed using Sens stools (v 3.3.2, OP&P, Utrecht, The Netherlands), applying a Procrustes Generalised Analysis (PGA; Arnold & Williams, 1986) associated with a GLM of the analysis of variance, to establish agreement among the assessors in the sensory evaluation of each descriptor, and to avoid deviations related to individual panellists. The PGA returns the average score of a sample, corrected for the differences between the individual assessors' judgements (Dijksterhuis, 1996). The minimum and maximum value of each score perceived by the assessors were used to establish the reference range of variation of each attribute, except for those attributes that showed significant differences among samples by analysis of variance. The range of variation for those attributes was established by adding the least square distance achieved by the GLM to the maximum score and subtracting it from the minimum score. The established reference range of variation has been used to conduct the further characterization of the sensory profile of Raschera PDO cheese.

2.3. Characterisation of cheese production systems

To explore the widest possible variation in the production conditions and cheesemaking technologies, ten dairy plants, producing more than 80% of the total Raschera PDO cheese production, were involved in the experiment. One 60-day ripened cheese produced in winter (W, December) and one in early summer (S, June), were collected from each dairy plant, to give a total of 20 cheeses. The production conditions applied on the dairy farms (around 260 farms in total), from which the milk used for the cheesemaking of each collected cheese was derived, were characterised through a questionnaire, in which the main data about the performance of lactating cows and herd characteristics (number of cows and milk yield) and diets of the lactating cows were collected. A questionnaire was also completed in the dairy plants to characterise the main cheesemaking technologies. Overall, the farms from which the dairy plants collected the milk covered a wide variation of production conditions (i.e., cow diet composition and milk production level). However, the characteristics of the farms that supplied milk were quite homogeneous within each dairy plant. Six dairy plants collected milk mainly from intensive dairy farms; three of them produced cheese from raw milk (IR), and three from thermised milk (IT), which was heated at 63–65 °C for 15 s. Four dairy plants collected milk from extensive farms and produced cheese only from raw milk (ER). Thus, these three types of production systems were identified as being representative of the whole Raschera PDO cheese production.

2.4. Cheese sensory analysis

A sensory evaluation was performed, by ten trained panellists, on the 20 sampled cheeses using the sensory attributes defined during the construction of the schedule for cheese sensory evaluation. The samples were presented as described for the construction of the schedule; 3–4 cheese samples were coded with a random 3-digit number and randomly presented to the panellists at 16 °C as 1.5 × 1.5 × 8.0 cm parallelepipeds (Nielsen & Zannoni, 1998). Each session involved three replicates. The sensory evaluation was carried out in individual sensory booths (ISO, 1988), following the same procedure described for the schedule validation test; the panellists scored each descriptor on a scale from 1 (non-perceptible attribute) to 9 (maximal expression of the attribute). In all, six sessions were necessary to analyse all the cheese samples, three for the winter cheeses and three for the summer cheeses. One

Download English Version:

<https://daneshyari.com/en/article/2433946>

Download Persian Version:

<https://daneshyari.com/article/2433946>

[Daneshyari.com](https://daneshyari.com)