MINI REVIEW

Mascarpone cheese – a butter substitute

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Abstract Mascarpone is a high fat, high moisture, fresh and heat – acid coagulated Italian cheese. Milk cream is heated and coagulated with diluted organic acid. Whey is drained out from this coagulum using cloth without applying any pressure. Mascarpone cheese is soft, smooth and spreadable and can be used as butter substitute. It is used to prepare different culinary dishes in Italian kitchen and sweet dishes. It has 44 - 50 % moisture and 45- 55% fat and has a shelf life of 3 – 4 days at room temperature. This cheese is very susceptible to yeast and mould growth because of its low pH. Tapioca and whey protein can be used as fat replacers in Mascarpone cheese.

Keywords: Mascarpone, high fat, fresh cheese, low shelf life

Introduction

Fresh acid-curd cheeses are defined as those varieties produced by the coagulation of milk, cream or whey via acidification or a combination of acid and heat and is ready for consumption immediate after manufacture (Guinee et al., 1993). Mascarpone is a high fat, fresh, heat and acid coagulated soft variety of cheese. It is milky-white in color and easily spreadable, obtained from thermal-acidic coagulation of milk cream. The texture of Mascarpone ranges from smooth creamy to buttery, depending on how it is processed during cheese making. This concise portrayal of Mascarpone really is thickened cream which is on its way to becoming butter. Composition of Mascarpone cheese varies; moisture – 44 to 50%, fat - 45 to 55%, protein - 7 to 8% and ash - 0.5 to 0.7% (Maggi 1987). Mascarpone cheese is typically seasonal product, being obtained only in winter in Italy (Alfredo et al. 2013).

It is a main ingredient of modern Tiramisu (Italian dessert). It is sometimes used as butter substitute and enriches Risotto (Italian rice dish). Its mild flavor and soft texture allow it to be used in savory and sweet dishes, making the possibilities of nearly endless items in the kitchen. It is added to enhance flavour without overwhelming the original taste. The cheese tastes best with anchovies, mustard and spices or mixed with cocoa or coffee.

History and origin

Mascarpone originated in the area between Lodi and Abbiategrasso, southwest of Milan in Italy, probably in the late 16th or early 17th century. Italy is very popular country for fresh cheese where more than 40 % fresh cheese is sold (Potenza 2002). The name is said to come from Mascarpa, a milk product made from whey or from Mascarpia, the word in the local dialect for ricotta. The correct name of the cheese should be Mascarpone, originally stemming from cascina mascherpa, a farmhouse that once was located halfway between Milan and Pavia, belonging to the Mascherpa family where it was reputedly first made.

Methods of manufacture

Mascarpone is a traditional soft Italian cheese, made from hot (85-90°C) cream or high fat milk which is acidified with acid (edible) solution to ~5.0 pH; the curd is drained in cloth bags and packed after complete draining of whey. Traditionally, Mascarpone cheese is manufactured by collecting cream and heating it to 85-90°C in a double jacketed steam kettle to prevent scorching the cream solids. Then, edible acid solution is added to the hot cream. This mixture coagulates in short time and is then transferred to a filtering cloth to drain out whey. This process is similar to paneer preparation in India.

Alternative process for traditional Mascarpone cheese is to use naturally ripened cream with bacterial culture. Cream is normally heated to 29-30°C, the culture is added and allowed to ripen for 10-12 hours to form a thick but soft curd. Although ripening sometimes takes more time, it results in much smoother and creamier consistency in the product than that of produced by traditional process. Mascarpone cheese manufacture takes long time but it is an alternative to use higher fat cream (45-55%) which is mixed with 4:1 to 2.5:1 proportion of milk retentate (whole milk concentrated to 4-5 times by ultrafiltration). This
method is quicker, economical in terms of labour and improved shelf life. It is reported that the ratio of cream to UF concentrated milk in the mixture proportionally increases the protein content of Mascarpone cheese ranging from 4.5 to 6%. This technology is employed in Italy for Mascarpone cheese (Resmini et al. 1984).

Pagani et al. (1995) have prepared a Mascarpone cheese using a milk ultrafiltration technology. Cream (19% fat) can be concentrated to 45% fat by UF and thereafter the heat and acid coagulation (95°C at pH 5.8 / 6.0) can be carried out for Mascarpone cheese preparation (www.cfrossicatelli.com). Continuous production of Mascarpone cheese with using ultrafiltration technology decreases time of preparation and heating by plate exchangers rather than by steam injection which improves product quality (Sordi 1984). Alfredo and Drioli (2013) outlined a process (Fig. 1) for the production of Mascarpone cheese traditionally and by the use of ultrafiltration technology.

Types of acid used

Mascarpone cheese is heat-acid coagulated cheese where organic acid solution is used for its coagulation. The taste and yield of Mascarpone cheese depend on the acid used for coagulation. It is mainly prepared by using citric, acetic or lactic acids. Among three acids, lactic acid is the costliest. Therefore, use of this acid for commercial manufacture of Mascarpone cheese is not economical. Vinegar (4% acetic acid solution), which is easily accessible and commonly available, can be used for cheese manufacture. Citric acid is a weak organic acid which is present in a variety of fruits and vegetables, most notably citrus fruits like lemons and lime having the highest concentration. It is added to obtain acidic or sour taste to foods and soft drinks. Most commercially used citric acid is obtained from a bacteria or sugar process which is sold as a white crystalline powder. Lactic acid is also used in a wide range of foods such as bakery, meat, dairy products, etc. Lactic acid is mainly used as flavouring agent or pH regulator.

Buratto (2010) has observed that use of vinegar yield about 1% higher yield and fat recovery than that of cheese made with citric acid. However, the use of citric acid was recommended due to better textural characteristics in the Mascarpone cheese. Mascarpone cheese made by citric acid was whiter in color and was easily spreadable than the cheese manufactured with other acids. It also provides clean taste whereas other acids produce cooked creamy and tangy flavor.

Rheological properties

Mascarpone is soft, fresh and high fat cheese. Rheological properties of the product mostly depend on its composition, temperature and manufacturing conditions. Due to this high fat and high moisture content, Mascarpone cheese has spreadable body and texture. It is also used on the bread as spread where it requires higher spread ability and smoothness. Negative correlation was found between shear stress values and panel response, while slope values showed to be directly correlated with sensory score. On the basis of this observation, it is possible to describe spreading properties of Mascarpone cheese (Cattaneo et al. 2005).

Cheese curd heated with constant stirring and dynamic cooling followed by storing at 5°C for 7-9 days, resulted in a curd which showed the time dependent hysteresis of the flow properties and dynamic viscoelastic behavior. A double cream cheese curd mixed at 500 r.p.m. at 70°C and dynamic cooling at 20°C or 13°C resulted in decrease of firmness and increase in viscosity. But this result became totally opposite when the curd was homogenized at 20MPa +5 MPa at 85°C followed by cooling at 13°C. The product became also more firm (Sanchez et al. 1994a). Double cream cheese homogenized at (0, 5,10,20,30 and 50MPa) showed the extrusion shear force increasing due to the increase of homogenization pressure up to 20 MPa and thereafter it could not be extruded because it became brittle. Further, if the homogenization pressure increases, storage modulus increases and loss modulus of the cheese decreases simultaneously indicating that double cream cheese became more solid. Therefore, it is better to keep maximum homogenization up to the 20 MPa for good result (Sanchez et al. 1995). In double cream cheese, increasing the curd cooling rate produces soft body with weaker structural organization which means decrease in the loss and storage modulus (Sanchez et al. 1994b).

Microbial, chemical and physical quality

Mascarpone cheese has high moisture and fat. High moisture products have low shelf life. It has 3-4 day shelf life at room temperature. Microbial spoilage is less as compared to other cheeses because Mascarpone cheese is heat-acid coagulated cheese. Lodi et al. (1994) have suggested that the presence of high content of lactic acid bacteria in cheese indicates good quality and fresh cheese. It has been reported that Mascarpone and Ricotta cheese may not show the presence of lactic acid bacteria as its production may not involve the use of LAB but it can also be produced by heat – acid coagulation milk/ high fat milk. However, it is susceptible to bacterial spoilage specially by spores. Carminati et al. (2001) have investigated the ability of a biological control system to inhibit the growth of Clostridium sporogenes spores during storage of Mascarpone cheese under temperature-abuse condition. Nisin has found practical application in Mascarpone cheese as natural food preservative in many categories of food such as natural cheese, process cheese and other dairy products like clotted cream (Daniela et al. 2010).

Colour of Mascarpone cheese depends upon its raw material used. Cow milk Mascarpone cheese is slightly milky-yellow in colour whereas buffalo milk Mascarpone cheese has white colour. Content of β-carotene and fatty acid composition of the cream has maximum influence on physical and sensory properties of
Mascarpone cheese. It was concluded by Battelli et al. (1995) that ideal cream for Mascarpone cheese should have Yellow index of less than 20, fatty acid compositional index of RFM should be 2.9 to 3.1 with DM greater than 58% and degree of fat globule damage indexed as RPL should be 30 to 35 to obtain the desired characteristics in Mascarpone cheese. These requirements could be satisfied by blending different types of creams available. Giangiacomo et al. (1991) analysed the measurement of cream colour index and classified the cream on the basis of the colour for good Mascarpone cheese preparation. However, during storage of Mascarpone cheese, discoloration happens which ranged from creamy yellow to orange brown colour due to the Pseudomonas aeruginosa, P. fluorescens, P. aureofaciens, Shewanella putrefaciens, Serratia marcescens, Enterobacter agglomerans and Micrococcus luteus (Cantoni et al. 1997).

Presence of D-Amino acid in cultured food and cheese functions as ripening markers. D-Amino acid may also be present in Non-cultured food due to the microbial contamination of raw material. Mascarpone cheese also contains D-Amino acid (Chiavaro et al. 1998). Presence of Clostridium botulinum type A spore in dessert Tiramisu was reported through its key ingredients of Mascarpone cheese (Aureli et al. 2000). A fetal case of C. botulism in Italy due to the consumption of Mascarpone cheese from an industrial dairy was reported and possible sources of contamination were discussed by Spolaor (1996). Presence of toxin in Mascarpone cheese produced by C. botulinum due to the different temperature conditions was also reported (Franciosa et al. 1999). Joseph et al. (1998) have discussed the detection of botulinal toxin producing organisms from Mascarpone cheese using an Amplified Elisa System.

Reduction of fat content in cheese

Mascarpone cheese contains high fat. The consumption of fat is linked to increase in low density lipoprotein (LDL) cholesterol levels, which in turn is linked to increased risk of atherosclerosis and cardiovascular diseases (CVD). Therefore, reductions of fat level in Mascarpone cheese by using suitable fat replacer may result in reducing the risk of atherosclerosis and CVD of the consumers. Quiblier et al. (1990) have reported the use of tapioca as a partial fat substitute in fresh cheese. Corradini (1998) reviewed the use of high protein as fat replacer in the production of high fat Mayonnaise and Mascarpone cheese by incorporation of pasteurized skim milk whey. Similarly, Sensidoni (1994) investigated the possibility to mix the traditional Mascarpone

![Fig. 1: Mascarpone Cheese making technology - comparison between traditional & membrane process. (Alfredo and Drioli 2013).](image-url)
cheese with pasteurized whey to achieve low fat Mascarpone cheese.

Use

Mascarpone cheese is used to prepare Italian dessert like Tiramisu. It is frequently used to thicken and enrich the Italian rice dish Risotto instead of butter or Parmesan cheese. Its mild flavor and soft texture allow it to be used in savory and sweet dishes, making the possibilities of nearly endless items in the kitchen. Mascarpone cheese can be used for direct consumption, as a topping for desserts, with roti, chapatti and bread as spread. It can also be added to pasta for creamy finish, dishes to increase the richness and in fresh cut fruits.

Recipes for frozen desserts such as mousses, ice creams and cocktail sauces were made with fresh cheese such as Quarg and Mascarpone (Mehrens 1990). Fresh Mascarpone cheese (85% fat in DM) can be used in frozen dessert as a base formulation (Mehrens 1991). White chocolate Mascarpone cheese filling and dark chocolate shells look fancy (Anthony 2015). White chocolate Mascarpone filling in Italian dessert made with biscuits dipped in coffee & layered with a whipped mixture of Mascarpone cheese, egg yolk, liquor and coca has also been reported by Alfredo et al. (2013).

References

Alfredo C, Drioli E (2013) Integrated membrane operations: In the food production. Deutsche Nationalbibliothek. Italy


Carminati D, Perrone A, Neviani E (2001) Inhibition of clostridium sporogenes growth in Mascarpone cheese by co-inoculation with streptococcus thermophiles under condition of temperature abuse. Food microbiology 18:571-579


Daniela D, Milena S (2010) Application of alternative food- preservation technology to enhance food safety & stability. Department of food science, faculty of agriculture science. University of Foggia, Italy


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