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Development of the Second Ingredient of the New Product "Yogrik"

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ABSTRACT

Research in this area aims to develop a milk-protein product similar to ricotta cheese. This product will be the second component of the newly developed two-component Yogrik product, a mixture of yogurt and ricotta. Combination of the biological value of yogurt and ricotta will create a balanced amino acid food.

Cheeses obtained by acid and thermo-acid coagulation are usually fresh soft cheese varieties made by the coagulation of milk, cream, whey, or their mixtures, by direct chemical acidification, bacterial cultures coagulation, or by a combination of chemical acidification and high-temperature processing.

In appearance and production technology, ricotta is between cheese and cottage cheese. But in terms of the softness of the clot and versatility, it is an outstanding product. Ricotta is rich in proteins including albumin and contains about 11 % protein. Whey cheese proteins are in the most easily assimilated state. Combining the biological value of yogurt and ricotta will create a balanced food with amino acid content.

Introduction

Ricotta cheese was traditionally made in Italy from the whey of sheep`s milk cheese. The whey was heated to denature and coagulate the whey proteins; the coagulated protein was scooped from the whey. The traditional process has been modified in some countries due to the increasing popularity of Ricotta, which is now often made from milk or milk/whey mixtures. Dried whey protein powders are also used in Ricotta manufacture. In the traditional (batch) process, whey (or milk/whey mixtures) is acidified to pH 5.6-6.0 with a starter culture or acid (e.g., acetic or citric) and heated to 80 ^{0}C by steam injection or by indirect heating of the vats. The flocculated protein rises to the surface where it is collected and separated from the whey. It is placed in forms for further drainage. Calcium chloride is sometimes added to improve flocculation. Curds may be homogenized to produce a smoother consistency (Weinzweig, 2018).

UF is now often used to concentrate the whey (or milk/whey mixtures) before or after acidification and the retentate is concentrated to ~ 30 % TS. The UF retentate is then heated and packaged in a hot environment. Acidification can

also be achieved by adding acidic whey powder to milk. The whey derived from Ricotta cheese can be acidified to pH 5.4 with citric acid and boiled at 80 ^{0}C to recover additional whey proteins and is used to make Ricottone cheese (sometimes whole milk is added to the whey). In a continuous Ricotta process, blends of full-fat milk and whey are heated to 90 ^{0}C and directly acidified with acid to pH 5.3 to 5.5, which results in protein precipitation. The curd is then separated from the whey on a conveyor belt and hot packaged. Ricotta is often used in baking and confectionery applications. Requesón is a spreadable Hispanic cheese similar to ricotta (John, 2022; Cotter, 2017).

Soft cheeses like ricotta, in contrast to hard cheeses, are of increasing importance, as their production from 1 ton of raw materials increases by 10…20 % and labor costs decrease. The show of soft, especially fresh, and short-ripening cheeses can be widely implemented in existing farms and urban dairies without significant capital investment, which increases the volume of cheeses obtained and their production efficiency (Tetra Pak Processing Systems AB, 2003).

The purpose of the research was to find out the method of ricotta production with the properties we need. It was also to improve the technological parameters of ricotta production, and ensure a high food yield.

Materials and methods

These research activities were carried out with the support of the Innovative Agriculture Training and Learning Camp (AGRI CAMP) Program which is financed by The United States Agency for International Development (USAID) and implemented by the International Center for Agribusiness Research and Education Foundation (ICARE).

The contents are the responsibility of the author/s and do not necessarily reflect the views of USAID or the United States Government. Experimental ricotta were produced from reconstituted milk. Fat content: 3.2 %, dry fat-free substances: 8.2 %, density: 1027 kg/m^3, titratable acidity: not higher than 21 oT. The reconstituted milk was kept at 6-8 ^{0}C for 9-12 hours for hydration. Ricotta cheese was produced in three ways to find out which method is more convenient for us in terms of the quality of the finished product (Kristensen, 1999; Lucero, 2020).

During the first method (thermal acid method: precipitation of protein from pre-fermented milk coagulation), milk is heated to the coagulation temperature of 43-45 ^{0}C, and thermophilic bacterial culture STI-15 (*Streptococcus thermophilus*) is added and thoroughly mixed for 5 minutes. The dosage is 50 units per 500 liters of milk. Coagulation is carried out thermostatically until the formation of a dense clot without syneresis pH = 4.5-4.6. The finished coagulum is heated on steam at 85 to 87 ^{0}C until protein flakes appear. This temperature is kept for 15 to 20 minutes, and the clot is carefully collected from the surface and transferred to the serum separation mold. After 2 hours, the obtained protein mass is transferred to a refrigerator at +5 ^{0}C. Studies were performed 12 hours after placing the mass in the refrigerator (McSweeney, 2010).

During the second method (thermo-acid method of protein precipitation), milk is heated to 85...87 ^{0}C, and an aqueous solution of citric acid is added in the ratio of 30 g of citric acid per 100 liters of milk and mixed for 2 minutes. Protein flakes appear almost immediately, which we do not stir, but leave alone to grow. We keep it at this temperature for 15 to 20 minutes. The clot is carefully collected from the surface and transferred to the serum separation mold. At high temperatures, whey proteins are denatured, which, when acidified with food organic acids, causes casein coagulation. Unlike lactic acid cheeses, which coagulate at pH 4.6, with thermo acid processing, coagulation occurs at a higher pH greater than 5.3. After 2 hours, the obtained protein mass is transferred to a refrigerator at +5 ^{0}C. Studies were performed 12 hours after placing it in refrigerator (Bouchait, 2019).

In the third method (thermo-salt method of precipitation of proteins), milk is heated to 85 to 87 ^{0}C, and an aqueous solution of calcium chloride is added in the ratio of 120 g per 100 liters of milk, and mixed for 2 minutes. Protein flakes appear almost immediately, which we do not mix, but leave alone to grow. They are kept at this temperature for 15 to 20 minutes. A clot is carefully collected from the surface and transferred to a serum separation mold. After 2 hours, this protein mass is transferred to a refrigerator at +5 ^{0}C. Studies were performed 12 hours after placing them in the refrigerator (Robinson, et al., 2012). Organoleptic evaluation and physicochemical studies of experimental ricotta were performed using standard methods (Aghababyan, et al., 1988).

Results and discussions

The proposed research aims to develop and study the technology of a new lactic acid techologies. Our idea is to create a super product from yogurt and ricotta. Thanks to special technology, the updated product will not contain lactose. It will be useful for lactose intolerant patients, children, and athletes.

The second ingredient in the upcoming Yogric product being developed is ricotta, made from whole milk.

We have developed 3 ricotta samples using different protein precipitation techniques. The results of the organoleptic evaluation of the experimental ricotta (from 1 to 5 points), and the results of determining the product yield, are presented in Figures 1, 2.

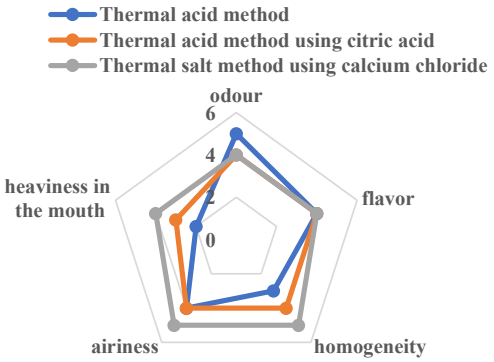

Figure 1. Organoleptic evaluation of the tested ricotta (*composed by the authors*).

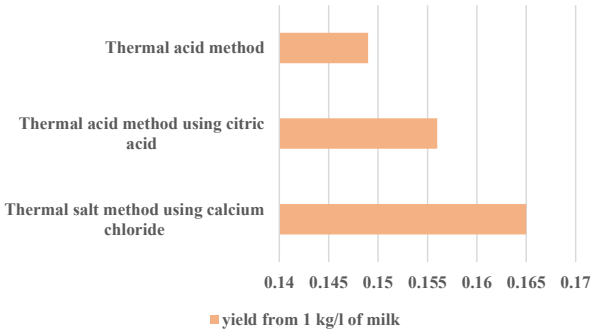

Figure 2. Yield of tested ricotta depending on the method of protein separation (*composed by the authors*).

We need ricotta with a pleasant taste and aroma, light, homogeneous, delicate, and without solid protein grains. It is also important to get a high intake of food. As can be seen from the results obtained in Figures 1, 2, the most suitable product under our development is ricotta produced by the thermo-salt method of protein precipitation.

The ricotta produced with thermo-acidic ricotta is delicately expressed in aroma and taste, but not so homogeneous and with low solubility in the mouth. The ricotta produced by the thermal-aza method is more homogeneous, delicate, highly soluble in the mouth, and has an aromatic and delicious taste. The sample obtained by the addition of citric acid with the thermo-acidic method has a pleasant taste, medium solubility in the mouth, and is inhomogeneous but delicate and aromatic.

Every producer, in addition to producing safe and tasty food, thinks about how to generate more food with minimal costs and thus get more income. According to Figure 2, the thermo-acidic method provides the lowest output of 0.148 kg from 1 kg of milk. In the case of the given weather, a bacterial mass is used and it is necessary to provide the necessary conditions for the development of microbes so that the acidity of the food will increase and the proteins will coagulate, which will further extend the duration of production. If the bacterial concentration is replaced by citric acid (120 g for 100 liters of milk), the duration of production will be reduced and the output of the product will be 0.156 kg from 1 kg of milk. Lime made using the thermal-salt method shortens production time. The amount of calcium chloride added to milk was 120 g per 100 kg of milk. Thanks to this production method, we got the highest yield: 0.165 kg from 1 kg of milk.

Table 1. Calculation of energy value of finished food*

Components	Energy separated from 1g of the component, kJ	Content of the component in 100 g of food, %	Energy value, Kj/100 g of food
Protein	16.747	11.02	184.6
Fat	37.681	3.2	120.6
Carbohydrates	15.909	3.7	58.9
Total	-	-	364.1

*Composed by the authors.

The most suitable product we are developing is ricotta, which is produced by the thermo-salt method of protein precipitation. It is this method that allows excellent product output. The resulting product has a pleasant taste and aroma, is light, and homogeneous. We also calculated the nutritional value of the produced food, which is presented in Table 1.

The technological scheme for the production of the developed ricotta is as follows: milk recovery at a temperature of 35 to 40 ^{0}C > exposure of the recovered

milk for 9 to12 hours at a temperature of 6 to 8 ^{0}C > milk heating to 83 to 85 ^{0}C > addition of calcium chloride 120 g per 100 liters of milk > milk heating to 85 to 87 ^{0}C > milk stirring for 2 minutes > release of protein mass in 10 minutes > transfer of the released milk curds into a mold > whey drainage in 2 hours > cooling to +5 ^{0}C in 4 to 5 hours > storage and sale.

Conclusion

The results of the research allowed for the development of a technology to obtain ricotta from milk with a fat content of 3.2 %, which should become the second component of an upcoming product called Yogrik. Studies have shown that ricotta obtained by thermo-salt protein coagulation is easy to dissolve in the mouth, homogeneous, and has a shorter production time, so it is suitable for the product we are developing. It was found out that the significant technological parameters affecting the yield of the product are: the amount of calcium chloride – 120 g per 100 liters of milk, the temperature of calcium chloride addition – 83 to 85 ^{0}C, the temperature of milk coagulation is 85 to 87 ^{0}C. At this temperature, milk is mixed for 2 minutes. This method provided a high yield of 0.165 kg from 1 kg milk. We calculated Ricotta's energy value, wich makes 364.1 kJ.

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