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Development of Nutrient-Dense Ricotta Cheese using Whey Protein Isolate and Natural Herbs

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ABSTRACT

This research is being examined for the purpose of producing ricotta cheese that is nutrient-dense. Obtained by heating and acidifying whey or a whey milk blend to precipitate the protein. Chemical analysis, microbiological analysis, and sensory evaluation were only a few of the approaches used. When choosing food products from the market, health-conscious consumers that prioritise nutrition over other factors may find this product to be a fantastic option. Whey protein isolate at a dosage of 5% and herbs at a concentration of 1% both contributed to the overall acceptability. The study suggests promoting the introduction of ricotta cheese and the usage of whey in other dairy products by the local dairy sector.

Key Words : Nutridense, Chemical analysis, Sensory evaluation, Whey protein isolate, Microbiological analysis

INTRODUCTION

The term "cheese" refers to a set of fermented milk products that are made all over the world in a wide range of flavours, textures, and shapes. Ricotta is a type of whey dairy product that is made by heating whey proteins and then adding lactic or citric acids, calcium and/or magnesium salts, or both to change the ionic strength (Salvatore *et al.*, 2014 and Pizzillo *et al.*, 2005). Due to the recycling of cheese making whey, it can be regarded as a typical Italian dairy product, despite various variations being made in other nations (Nzekoue *et al.*, 2021, Pappa *et al.*, 2016, Rako *et al.*, 2018, Scatassa *et al.*, 2018)

With the gradual accumulation of knowledge about the chemistry and microbiology of milk and cheese, cheese making has lately evolved, allowing for greater control over the production process. Increased knowledge hasn't led to the evolution of many new types, but it has improved the definition and consistency of the quality of the ones that already exist. Fresh ricotta has a high water content, a sweet milk and cream flavour, a granular but non-sandy texture, and is typically white in colour, depending on the animal species from which the raw ingredients were derived. Last but not least, the protein level of the mixture is influenced by the source of the whey, the quantity of milk and cream added, as well as the addition of whey powders and/or milk protein (Camerini *et al.*, 2016 and Rubel *et al.*, 2019; Lalita *et al.*, 2017).

Due to their superior functional and nutritional qualities, whey protein products like whey protein isolate and whey protein concentrate are common ingredients in the food business. Additionally, these items stand for the ideal technique to use whey proteins. The principal whey proteins, which make up about 70% of the whey protein fraction, are -lactoglobulin (-Lg) and -lactalbumin (-La), and the features of whey-based protein products are reflected in their composition and structure. Additionally, the technology used in the production of whey-based protein products has a significant impact on their qualities. Their properties and potential uses are significantly influenced by a variety of treatments, such as heat treatments and membrane fractionation methods.

About 18% to 20% of all milk proteins are found in

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the whey protein fraction. Blood serum albumin (BSA), immunoglobulin, -lactoglobulin (-Lg), and -lactalbumin (-La) are the four main proteins found in this fraction (Ig). These proteins make up 20%, 50%, and 10%, respectively, of the whey protein fraction. In addition to them, this fraction's minor components include lactoferin, blood transferrin, lactolin, and proteose-peptone fraction (PP). According to various studies (de Wit and Klarenbeek, 1984; Morr, 1985; Dordevic, 1987; Mullvihill and Donovan, 1987), diverse amino acid compositions exist.

In the late 1980s, whey proteins attracted interest because of their nutritional value and advantageous functional characteristics. A variety of whey protein products, including whey powder, whey protein concentrate (WPC), whey protein isolate (WPI), whey protein hydrolysate (WPH), and pure lactoglobulin and lactalbumin, have been produced.

Due to their functional qualities, medicinal and aromatic herbs are utilised as spice and food additives for scent, colouring, preservative, and antioxidant functions. Due to growing scepticism about the dependability of synthetic antioxidants and the food industry's keen interest in getting natural antioxidants from various plant materials, their inherent antioxidant qualities made them safer to employ than synthetic antioxidants. Thyme (*Thymus vulgaris*), coriander (*Coriandrum sativum*), peppermint (*Mentha piperita*), coconut (*Cocos nucifera*), cumin (*Cuminum cyminum*), cinnamon (*Cinnamomum zylancium*), rosemary (*Rosmarinus officinalis*), black pepper (*Piper nigrum*), and garlic (*Allium sativum*) can enhance the sensory qualities of aroma, taste, colour, and general quality in dairy products (Carocho *et al*., 2016, Hosny *et al.,* 2011, Hosseini *et al.*, 2015, Javidi *et al.*, 2016, Josipovic *et al.*, 2015, Menon *et al.*, 2007, Oran *et al.*, 2017, Ozkan *et al*., 2017, Regu *et al.*, 2016, Tarakci *et al.*, 2004).

Basil supplementation was used as a natural and suitable ingredient in the production of Serra da Estrela cheese due to the importance of basil bioactive compounds, which were found to be important in preventing peroxidation in proteins and unsaturated fatty acids as well as preventing moisture loss in cheese (Carocho *et al.*, 2016).

METHODOLOGY

Preparation of Sample :

Milk, fresh cream, whey protein isolate, and inulin were purchased at a local market for this project. Three distinct types of ricotta were produced and fortified with varying amounts of whey protein isolate and organic herbs. Milk is heated to 95 degrees Celsius to create ricotta cheese, which is then coagulated by adding 2% citric acid. Curd is left in the whey for around 10 minutes while the whey is being drained. Following that, inulin (5%), is added. Ricotta cheese is now being sliced into cubes and supplemented with whey protein isolate (5%) and natural herbs (1%). The cheese is currently being sealed in an airtight container and kept in the refrigerator.

Sensory Evaluation:

Ten panellists were used to assess the sensory quality of the ricotta cheese. The products' appearance, texture, colour, flavour, and general acceptability were all evaluated by the panellists using nine scales. Before testing, codes were given to the samples. The samples carried the T_1, T_2, and T_3 codes. After that, the data were validated while they were requested to complete the sensory sheet.

Determination of Moisture :

Principle:

Accurately weighed cooked product is heated in oven maintained at 105°C for 2 hours and loss in mass on drying is calculated as Moisture.

Apparatus:

Hot Air Oven, Moisture dish, Analytical Balance, Desiccator.

Procedure:

– Weigh accurately about 5 gm of sample in a previously dried and tared dish.

– Place the dish with its lid underneath in the oven maintained at 105°C for 2 hours.

– The time should be recorded from the moment the oven attains 105° C after the dishes have been placed.

– Remove the dish after 2h ours.

– Cool in the desiccator and weigh.

Calculation:

$$\text{Moisture}\,(\%) = \frac{W_1 - W_2}{W} \times 100$$

where,

W_1 = Weight in gm of the dish with the material

before drying

W_2 = Weight in gm of the dish with the material after drying

W= Weight in gm. of sample weight

Determination of Total Ash:

Principle:

This test is to indicate amount of inorganic substance present in food.

Apparatus:

Crucible, Muffle Furnace, Desiccator, Whatman Filter Paper

Procedure:

– Accurately weigh 2 gm sample in crucible

– Then heat the crucible carefully over small flame to char the material.

– Then ignite in muffle furnace at 550 + 25 °C for 6 hours

– The ash should be carbon free, remove the crucible and put it in a desiccator, allow it to come to room temperature and weight it.

– If the ash shows the presence of carbon leach the ash with hot water, filter through the Whatman ash less filter paper

– Wash the filter paper thoroughly, transfer the filter paper and contents to the ashing crucible, dry and ignite in muffle furnace at 550 ± 25 °C, until the ash is white.

– Cool the crucible and weigh.

Calculation:

$$\text{Total Ash (\% by Weight)} = \frac{W_2 - W_1}{W} \times 100$$

where,

W = Weight in gm of sample

W_1 = Weight in gm of empty crucible

W_2 = Weight in gm of crucible + sample after ashing

Determination of Fat:

Principle:

Lipid is soluble in an organic solvent and insoluble in water. Because of this the organic solvent like hexane, petroleum ether etc. has the ability to solubilize fat. Thus, fat is extracted from the food in combination with solvent.

Apparatus:

Soxhlet Extraction, Soxhlet Flask, Desiccator

Procedure:

– Weigh about 10 gm of Sample weigh in thimble.

– Extract it with Petroleum ether in Soxhlet extraction apparatus for about 16 hours.

– Evaporate the extract contained in the Soxhlet flask at 100 °C.

– Then cool it in a desiccator and weigh it.

Calculation:

$$\text{Fat (\% by mass)} = 100 \times \frac{W_2 - W_1}{W}$$

where,

W_1 = Weight of the flask after drying

W_2 = Weight of empty flask

W = Weight of sample in gm.

Determination of Protein:

The protein content in foodstuffs was estimated by multiplying the determined nitrogen content by a nitrogen-to-protein conversion factor, set at 6.25 (Jones, 1941). Hence the per cent protein is calculated as follows:

Protein (%) = 6.25 × % Nitrogen

The protein content of milk products was estimated by multiplying the determined nitrogen content by a nitrogen-to-protein conversion factor, set at 6.38 (Dupont *et al.,* 2013).

Determination of Calcium:

Aim:

Estimation of Calcium by the method of Clark and Collip (1925).

Principle:

Calcium can be determined by AOAC in 1930. The calcium present in ash solution as precipitates are treated with H_2SO_4, and oxalic acid released is titrated against standard potassium permanganate.

Reagents:

Bromocresol Green Indicator (1 gm %), Saturated sodium, Oxalic Acid Solution (4 gm %) 2% ammonia Solution, 1 N H_2SO_4, 0.01N Potassium permanganate

Procedure:

Sample:

– 3 ml and 15 ml ash solution were taken in 2 test tubes

– To each add 2 drops of bromocresol green

indicator and pH of solution was adjusted to 6.5 (until blue color) with addition of saturated sodium acetate.

– The calcium was precipitated as calcium oxalate by adding 4 % oxalic acid until solution changed to yellowish green shadow.

– The ppts were heated in a sand bath at 70°C for 45 min. and allowed to stand for 24 hours. Next day, decent the Supernatant. The ppts were washed with 3 ml of 2% ammonia solution to remove excess oxalic acid. Repeat washing for 2-3 times with 2% ammonia solution.

– Centrifuge it and decant the supernatant and invert the test tube. So that all ammonia is drained Then to the ppts, add 3 ml of 1 N H_2SO_4, and heated for 5 min at 50-70°C in water bath and titrated against 0.01 N $KMnO_4$

Blank:

Take 3 ml of 1 N H_2SO_4 heat for 5 min at 50-70°C. And titrate against 0.01 N KMnO4.

Calculation:

Calcium (mg%) = (0.02) (Titer value (sample-blank)) / Ca. Content of $KMnO_4$, (mg)/ Aliquot taken × Volume made up/ sample taken

RESULTS AND DISCUSSION

According to the previously mentioned facts, ricotta cheese has a 31% moisture content due to the presence of milk and fresh cream; as a result, natural preservative is added to prevent microbial spoilage (Table 1 and 2).

Table 1 : Sensory Evaluation Results

Sample	Flavour	Texture	Taste	Overall Acceptability
T_1	6	7	6	6.3
T_2	7	8	8	7.6
T_3	7	6	7	6.6

Table 2: Test Results

Test	Result
Carbohydrate	4.85gm
Fat	27gm
Protein	23gm
Moisture	31%
Ash	3.50%
pH	5.3%
Acidity	1.38
Yeast and Mould	Absent
E. coli	Absent
Calcium	678 mg

Conclusion:

In a recent study, the ricotta cheese underwent sensory, microbiologic, and chemical analyses. As a consequence of the sensory investigation, Sample T_2 was found to be more favourable. It is a good source of calcium and other important minerals and has 4.85 grams of carbohydrates, 27 grams of fat, and 23 grams of protein. The inclusion of whey protein isolate and natural herbs was discovered to make the product extremely nutrient-dense. Herbs are an efficient preservative because of their antibacterial and antioxidant components. Herbs added to dairy products have been shown to improve people's health and medical conditions. Whey proteins have a high biological value and are a rich supply of important amino acids, which enhances the nutritional value of cheese. As a result, ricotta cheese, that is nutrient-dense, contributes to the product's overall nutritional value.

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