

## **Elaboration and sensory evaluation of ice cream flavored cream with whey**

## **Elaboração e avaliação sensorial de gelado aromatizado com soro de leite**

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### **ABSTRACT**

Whey is a by-product of the cheese industry, and generates a high cost for its correct disposal, because it is produced in large volume by companies during cheese production.

It is necessary to seek alternatives for the addition of this by-product in food, in order to nutritionally improve poorly nutritious foods. The objective of the work is to add whey in an ice cream formulation. The addition of whey to ice cream becomes an option to link these concepts and nutritionally improve a product that is widely consumed in Brazil, especially by children. Thus, three formulations were developed, the standard formulation without the addition of whey, formulation two with 25% and formulation three with 50% addition of whey, respectively. Sensory analysis was also performed to assess consumer preference. The results were positive, and formulation two with the addition of 50% whey was the one with the best acceptability. Thus, it can be stated that whey can be applied to ice cream formulations, becoming an alternative for the optimization of this by-product.

**Keywords:** Ice cream, Whey, Sensory evaluation

## RESUMO

O soro de leite é um subproduto da indústria do queijo, e gera um custo elevado para a sua correcta eliminação, porque é produzido em grande volume por empresas durante a produção de queijo. É necessário procurar alternativas para a adição deste subproduto nos alimentos, a fim de melhorar nutricionalmente os alimentos pouco nutritivos. O objectivo do trabalho é adicionar soro de leite numa formulação de gelado. A adição de soro de leite ao gelado torna-se uma opção para ligar estes conceitos e melhorar nutricionalmente um produto que é amplamente consumido no Brasil, especialmente por crianças. Assim, foram desenvolvidas três formulações, a formulação padrão sem adição de soro de leite, a formulação dois com 25% e a formulação três com 50% de adição de soro de leite, respectivamente. Foi também realizada uma análise sensorial para avaliar a preferência do consumidor. Os resultados foram positivos, e a formulação dois com a adição de 50% de soro de leite foi a que teve melhor aceitação. Assim, pode-se afirmar que o soro de leite pode ser aplicado em formulações de gelados, tornando-se uma alternativa para a optimização deste subproduto.

**Palavras-chave:** Sorvete, Soro de leite, Avaliação sensorial

## 1 INTRODUCTION

The ice cream arrived in Brazil in 1834 through a North American ship that docked in Rio de Janeiro loaded with 217 tons of ice. City residents purchased this product and used it to make ice cream with Brazilian fruits. Due to storage difficulties, ice cream was produced and consumed on the same day. Initially it was produced only from fruits, and being produced by hand on a small scale. Over time the process evolved and milk was added, and until today milk is a fundamental ingredient in ice cream composition (MENDES, et al. 2002).

Whey is rich in proteins, vitamins, minerals and enzymes. It is a by-product that has several benefits, which makes it an excellent alternative for application in other products, in order to promote nutritional improvement, bringing benefits to health of those who consume it. It is commonly used in sports nutrition for its high protein content,

helping to reduce weight and used in animal feed. Concentrated protein contains a protein level around 34% to 85%, containing components that can protect against toxins, bacteria and viruses (ALMEIDA, et al. 2013)

The production of whey grows proportionally with the increase in the production of cheese, and generates a high cost for the industries to be able to dispose on the environment correctly. It is estimated that in 2017 the production of whey was 10.3 billion liters (CRUZ et al. 2017). Based on this problem, a new option for the use of whey was explored. The purpose of this work is to improve the use of whey in ice cream through sensory analysis, obtaining a sustainable and functional product, with high nutritional value. The product obtained is beneficial to society and the environment, as it avoids the contamination of effluents, and also for industries, being able to add value to a by-product that was previously destined for disposal.

## 2 MATERIAL AND METHODS

Previous researches were carried out for technical basis. Also, the market trends and the demands of consumers and industries were carefully analyzed in order to define the product to be developed.

### 2.1 SAMPLE PREPARATION

The study was performed at the processing plant of milk and dairy products at Faculdade Senai Chapecó - Brazil. Three formulations were defined, Standard (FP) without addition of whey powder, Formulation 1 (F1) with addition of 25% whey and powdered milk, and Formulation 2 (F2) with addition of 50% of whey and powdered milk. Table 1 shows the formulations used, as well as the other ingredients applied in the production of ice cream added with powdered whey.

Table 1- Formulations of ice cream added with whey powder.

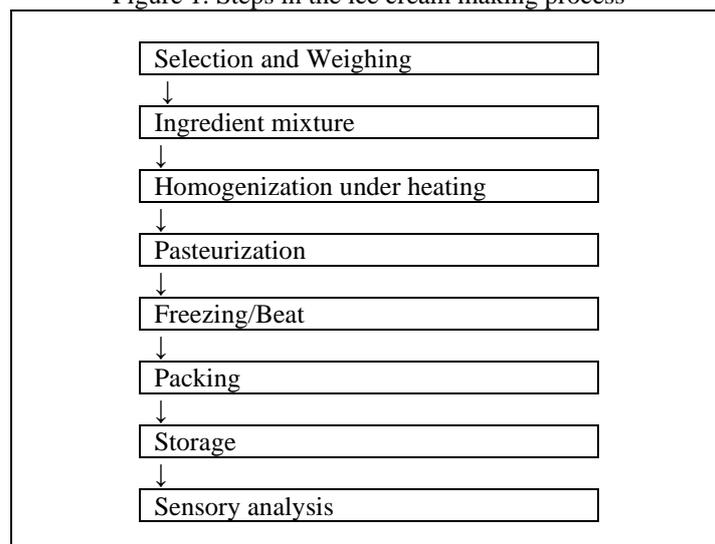
Ingredients	Standard (FP) %	Formulation - with 25% whey - (F1)	Formulation with 50% whey - (F2) %
Milk	64	64	64
Sugar	18	18	18
Powdered glucose	3	3	3
Vegetable fat	3	3	3
Powdered milk	10	8	5

League G3	0.3	0.3	0.3
Stragel emulsifier	0.8	0.8	0.8
Cream flavor	1	1	1
Demineralized whey powder	0	2.5	5

The ingredients were mixed and homogenized, according to each formulation FP, F1 and F2. Next, pasteurization was carried out, which is an essential step in the destruction of pathogenic microorganisms, in addition to uniforming the fat globules, increasing viscosity, facilitating beating and aeration, it also has greater resistance to oxidation, and a brighter and more attractive color (MENDES, et al. 2002).

Afterwards, the syrup was subjected to rapid cooling at 4 °C, followed by the maturation process, which consists of keeping the syrup refrigerated for at least 4 hours. One of the main steps in the final processing is beating followed by freezing, the lower the freezing temperature, the greater the proportion of water that will freeze, with a greater number of small crystals. The air incorporated during beating, commonly called over one, makes the ice cream light, soft and tasty. Figure 1 shows the phases of product development from selection and weighing to sensory analysis, each process is extremely important for a quality product.

Figure 1. Steps in the ice cream making process



## 2.2 STATISTICAL ANALYSIS

Data were obtained through replicates and are presented as mean  $\pm$  standard deviation of the mean. Data were subjected to analysis of variance (ANOVA), and the differences between means were established with a Tukey test. The results are given in the text as probability values, with

$p < 0.05$  adopted as the significance.

## 3 RESULTS AND DISCUSSION

The FP, F1 and F2 ice cream samples were subjected to sensory analysis and a general acceptability was observed. Table 2 presents the statistical results of the samples with a significance of 5%.

Table 2- Statistical analysis of sensory analysis results for samples FP, F1 and F2. The results express the mean  $\pm$  standard deviation. Equal letters in the same column do not differ significantly by the Tukey Test ( $P > 0.05$ ).

Sample	demineralized whey powder (%)	Color	Odor	Flavor	Texture	Global Assessment	Buy intention
FP	0%	7.26 $\pm$ 1.29 <sup>a</sup>	7.48 $\pm$ 1.31 <sup>a</sup>	7.2 $\pm$ 1.22 <sup>a</sup>	7.72 $\pm$ 1.22 <sup>a</sup>	7.74 $\pm$ 1.22 <sup>a</sup>	4.02 $\pm$ 0.90 <sup>a</sup>
F 1	25%	7.68 $\pm$ 1.29 <sup>a</sup>	7.84 $\pm$ 1.05 <sup>b</sup>	8 $\pm$ 0.94 <sup>a</sup>	7.68 $\pm$ 1.30 <sup>ab</sup>	7.86 $\pm$ 1.06 <sup>a</sup>	4.22 $\pm$ 0.91 <sup>a</sup>
F 2	50%	7.86 $\pm$ 1.21 <sup>a</sup>	7.90 $\pm$ 1.01 <sup>b</sup>	8.08 $\pm$ 1.75 <sup>a</sup>	8.2 $\pm$ 0.92 <sup>b</sup>	8.08 $\pm$ 0.94 <sup>a</sup>	4.44 $\pm$ 0.92 <sup>a</sup>

Caption: FP - Standard formulation, F1 - Formulation 1, F2 - Formulation 2.

As observed in Table 2, about the color parameter, there was no statistically significant variation in relation to the three samples, FP, F1, F2, obtained in this study. As for the odor parameter, samples F1 and F2 had higher scores compared to sample FP, considering a significance level of 95%. In the flavor parameter, there was no statistically significant difference in relation to the standard FP sample and the added whey samples. The texture of sample F2 received a higher rating compared to sample FP. Regarding the average global evaluation and purchase intention, the results showed that there was no statistically significant difference from samples F1 and F2 compared to the standard sample FP, so the addition of whey powder in the production of ice cream did not caused negative changes in the product. Figures 1,2 and 3 show the sensory acceptance of the three formulations.

Figure 1. Sensory acceptance graphs of the FP sample.

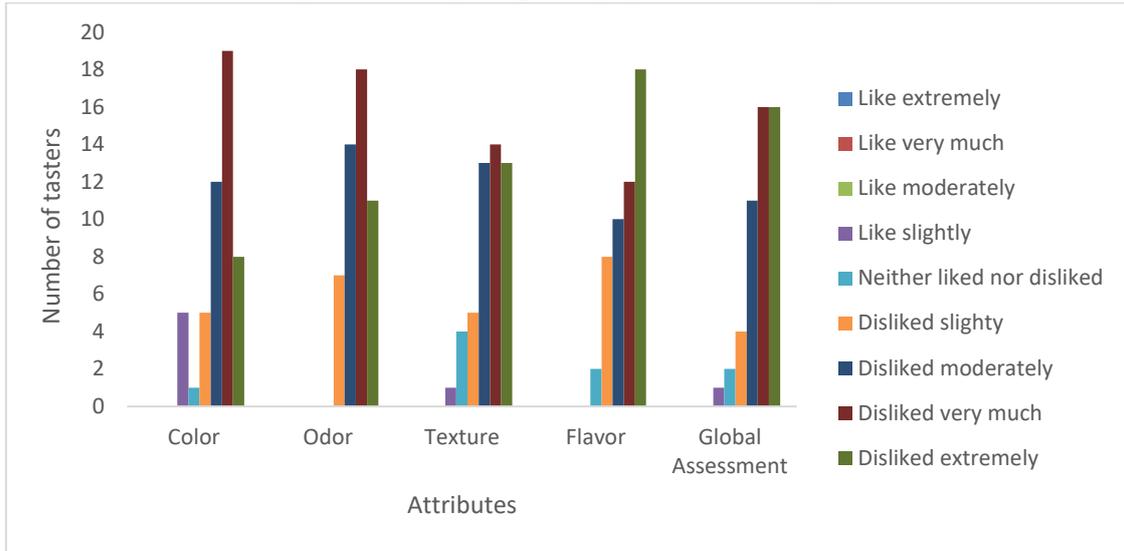


Figure 2. Sensory acceptance graphs of sample F1.

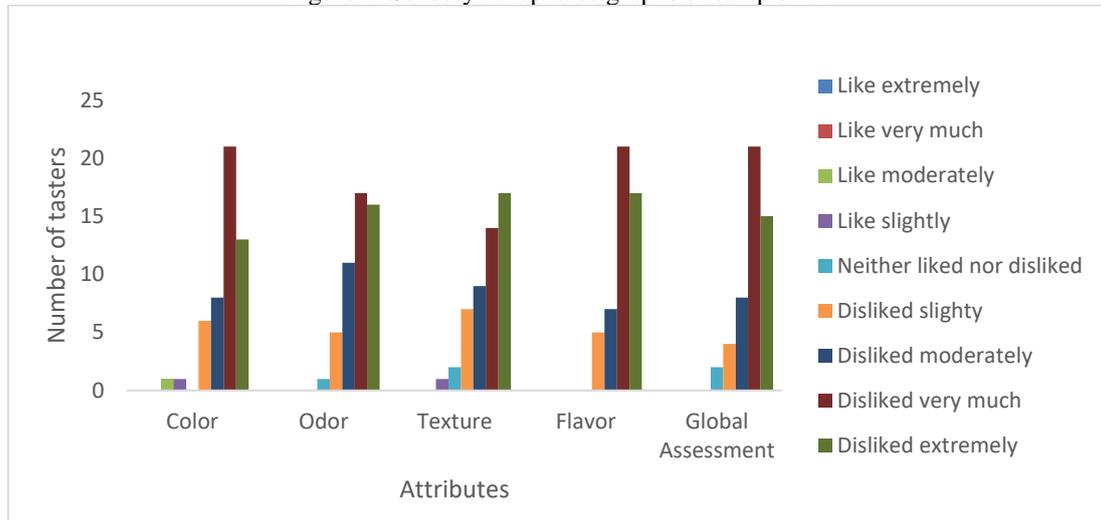
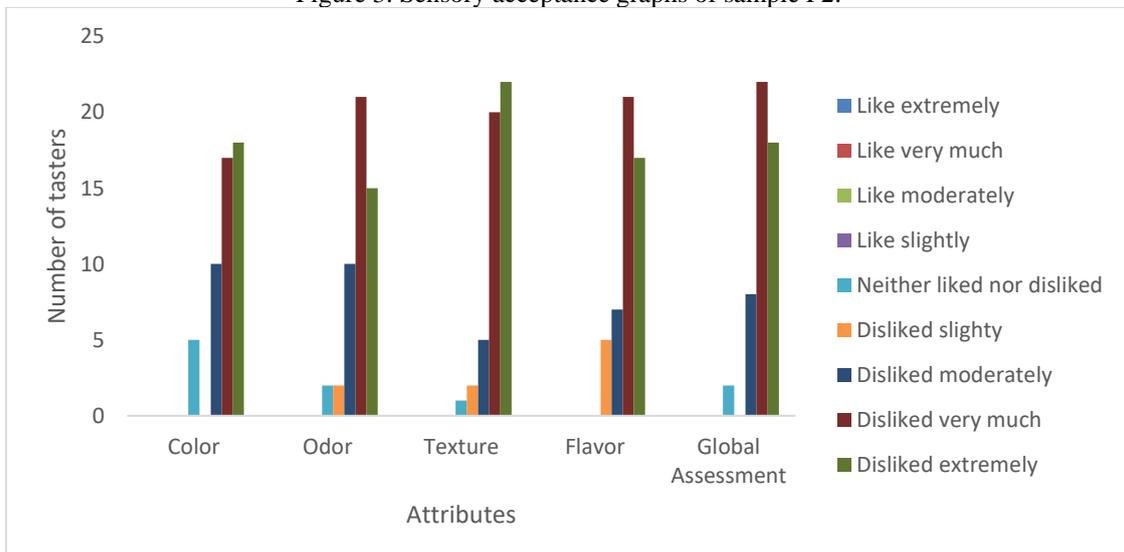


Figure 3. Sensory acceptance graphs of sample F2.



According to Figures 1, 2 and 3, the formulation with the highest acceptance was the F2 sample with 50% addition of whey, it can suggest greater additions of demineralized whey due to this acceptance. The result obtained is similar to Rodrigues (2012), where in his experiment he also obtained the same result that the most accepted sample was the formulation with the addition of 50% whey to ice cream, characterizing that the product was well accepted to the taste of consumers of this type of product. The author Vetorello et al (2017), also obtained positive results with the addition of 50% of reconstituted whey in ice cream. The two authors cited above have achieved extraordinary increases in protein in their products.

The increase of protein in ice cream made with 50% whey (more accepted in sensory analysis), turns the product into a differential in the market, which is further enhanced by the addition of a cheese by-product that is most often discarded by the cheese industries. This use of by-product - whey, aims not only to nutritionally enrich the ice cream, but also to favor companies that discard it without any value to be returned, and still need to do its treatment, thus spending an “unnecessary” value. Protein becomes valuable in food because it is the nutrient responsible for building cells, tissues, organs, etc, in addition to providing energy to the body (GLOBALFOOD, 2006).

It is identified through the results of sensory analysis and also through comparisons with other authors mentioned above, that formulation B (with the addition of 50% of whey) obtained the greatest public acceptance, proving that the addition of whey powder it is a viable option for the reuse of this industrial waste. Organoleptic characteristics can and should be explored in order to improve the sensory aspect of the product, and further improve its acceptability by consumers.

#### **4 CONCLUSION**

The ice cream developed was well accepted by the tasters and also it is a new alternative to the use of whey in the cheese industry. The product developed meets the consumer's need to consume more nutritious and sensory pleasurable foods. As suggestions for future work, it is indicated the characterization of the product as its physical, chemical and microbiological characteristics, in order to present more results of the product and then evaluate its production viability by the industry.

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