

## Sensory evaluation of ice cream with hydrosoluble soy extract

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### Abstract

Ice cream is a nutritious food because it contains ingredients responsible for supplying energy to the body. Soy has a high nutritional value and functional properties which make it to be an alternative ingredient to replace cow's milk. The purpose of this paper was to formulate an ice cream with hydrosoluble soy extract and submitted to a sensory evaluation. Two formulations of ice cream were prepared: one soy-based and the other with cow's milk (control). Both ice creams were submitted to a sensory evaluation in order to evaluate the appearance, flavor and texture attributes, for this examination it was used the hedonic scale of nine points. For the appearance attribute, the soy-based ice cream had an average score of 7.6, which means between "liked moderately and liked very much", and cow's milk ice cream had an average score of 8.1, "liked very much". For the texture attribute, the soy-based ice cream reached an average of 7.4, meaning "like moderately" and "liked very much" and the cow's milk ice cream obtained an average of 8.2, meaning "liked very much". The flavor attribute had an average score of 6.1, meaning "liked slightly" and 8.2 "liked very much" for the soy-based ice cream and the cow's milk ice cream respectively. When the assessors were asked about their purchase intention, 68% said that certainly they would buy the control sample and 32% definitely or probably would buy the soy-based ice cream. The sensory parameters evaluated showed that the soy-based ice cream had a good acceptance.

## 1. Introduction

Brazil is the second largest soy producer being surpassed only by the United States. In the 2016/2017 harvest it was produced 351 million tonnes in the world, and through this among 113 tonnes were produced in Brazil (Embrapa Soja, 2017). However, only from the end of the 1990s, the Brazilian industry began to adopt new technologies for obtaining soy extract with better sensorial quality, leading the release of a greater variety of soy products on the market (Behrens and Silva, 2004), for example, soy milk, with and without the addition of fruit juice, yogurt, soy soup among others. Despite technological advances, the challenge of improving the residual soy taste has not yet been reached (Chamba *et al.*, 2014).

In the past, the soy nutritional importance of was correlated only with the protein content, and because of this, it is called "vegetal meat", but currently its functional properties have been widely studied and incorporated into the healthy eating habits.

The nutritional value of soy becomes evident, as it

has in its composition considerable quantities of minerals such as potassium, phosphorus, and vitamins. There are also other components that stand out with functional properties, with evidence for the isoflavones, which have antioxidant activity by reducing the risk of several types of cancer (breast, prostate, and colon), cardiovascular diseases, bone loss after menopause and osteoporosis (Esteves and Monteiro, 2001; Goes-Favoni *et al.*, 2004).

According to the National Health Surveillance Agency of Brazil (ANVISA), ice cream and edible ice are food products obtained from an emulsion of fats and proteins, with or without the addition of other ingredients and substances, or even from a mixture of water, sugar and other ingredients or substances that had been subjected to freezing, under conditions that ensure the preservation of the frozen or partially frozen product during storage, period transportation and delivery to consumption (Brasil, 2003).

According to data from the Brazilian Association of Industries and Ice Cream Industry, ABIS (2017), during the summertime in Brazil, it is consumed approximately

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70% of the annual production of ice cream. In 2016, it was produced 1.002 million liters of ice cream, from which it is possible to register a growth of 68.4% in the production comparing to 2003.

The ice cream can be considered a nutritious food because it contains ingredients from the macronutrients, such as carbohydrates, proteins, and lipids, which are responsible for supplying energy that ensures a healthy diet (Marshall and Arbuckle, 1996). Ice cream is also appreciated by the different age groups (Munhoz *et al.*, 2010).

The ice cream of soy become a good alternative for those lactose-intolerant, who are unable to digest the sugar existent in milk. Lactase, the intestinal enzyme, responsible for the hydrolysis of lactose into simpler sugars: glucose and galactose. The most common symptoms of this disease are nausea, flatulence, abdominal pain and diarrhea (Quilici and Missio, 2014). In addition, the consumption of ice cream of soy is a way to stimulate the consumption of soy getting their benefits (Halim *et al.*, 2014).

The purpose of this study was to develop and verify the sensory acceptance of an ice cream-based on hydrosoluble soy extract with strawberry flavor.

## 2. Material and methods

### 2.1 Preparation of hydrosoluble soy extract

The hydrosoluble soy extract was obtained in accordance with the methodology of Zadinello *et al.* (2010). Once selected, 300g of whole grain of soy (Yoki Foods S.A.) was weighed, placed in a refractory container (500mL) and it was heated in a microwave oven (Maxxi, Brastemp, Whirlpool Corporation/ Michigan/USA capacity of 50 L) for 3 minutes and 20 seconds, in maximum power. Subsequently, these soybeans were placed in a refractory container with 900 mL of water and brought to fire in a double boiler for 30 minutes. After the cooking process was finished the water was thrown away, the material was homogenized in a blender (Model LAR 25, Metallurgical Siemens, Brusque/SC, Brazil with a capacity of 20 L) for 5 minutes, at maximum power with 2100 mL of water and it was filtered in a coffee filters of paper are made from about 100g/m<sup>2</sup>. Then, 140g of sucrose and 1.6 g NaCl were added and mixed a blender for 3 minutes at maximum power. As a result, it was obtained approximately 2100 mL of hydrosoluble soy extract.

### 2.2 Preparation of ice cream

Both ice creams were produced the traditional one and the soy-based ice cream, in which the cow's milk was replaced by the hydrosoluble soy extract according to the formulation described in Table 1. The ice creams

were prepared on a pilot scale, according to the flowchart in Figure 1.

Table 1. The formulations of the cow's milk ice cream and of the soy-based ice cream

Components	Cow's Milk Ice Cream (%)	Ice Cream Soy-Based (%)
Hydrosoluble soy extract	-	81
Milk	81	-
Sucrose	16	16
Strawberry flavour	1.6	1.6
Emulsifier	0.8	0.8
Guar gum based product (thickening agent)	0.25	0.25

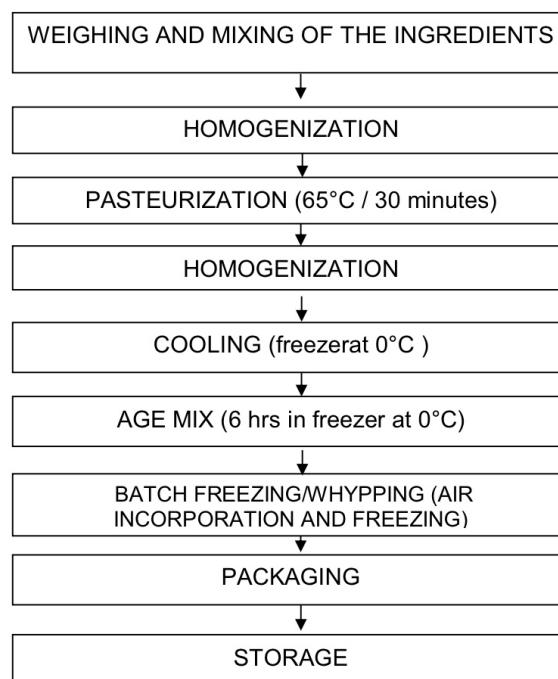


Figure 1. Flowchart of the flavored strawberry cow's milk ice cream and the soy-based ice cream

### 2.3 Overrun

The overrun's calculation was performed according to the equation below (Halim, 2014).

$$\text{Overrun} = \frac{\text{Mix's weight} - \text{Ice cream's weight}}{\text{Ice cream's weight}} \times 100 \quad (1)$$

### 2.4 Sensory evaluation

In order to verify the acceptance and the purchase intention, the test was performed at the Federal Institute of São Paulo (Câmpus Barretos), with the intention to sensorially evaluate both formulations. The test was made by 101 assessors not trained, within a wide range of age and from both sexes.

The assessors must score these three attributes: appearance, flavor, and texture. For this purpose, they used a structured 9 points hedonic scale, using ranges varying from "dislike very extremely" to "liked

extremely" (Villanueva and Da Silva, 2009).

The samples were presented in a monadway (individually) in cups made of polystyrene (50 mL) at a temperature in the range of -10 to 0°C. The assessors were also asked about their habit of soy consumption. The data were analyzed by ANOVA and averages were compared by Tukey Test at 5% level of probability, using Assistat.

This study was submitted to the Brazilian Platform for evaluation of the Ethics Committee-CEP/IFSP, and it was approved, with CAAE (Certificate of Appreciation for Ethics Committee) 38867014.6.0000.5473.

### 3. Results and discussion

Most of the assessor was female and presented the age range of 15 to 60 years. However, 66% were less than 30 years old, which lead us to state that they are not possibly consumers of the soy ice cream yet, once they are still slightly concerned about the consumption of soy products and also they are not worried about the advantage of their functional properties. This fact was confirmed by the low percentage (19%) of assessors who have the habit of consuming soy products, they have stated that they consume this kind of products only once a month (42%), as shown in Figure 2.

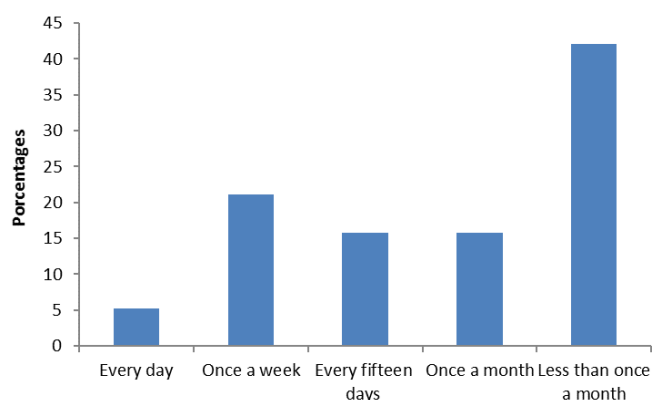


Figure 2. Frequency of soy products consumption.

It was noted that the soy products that are the most consumed by the by participants are the "hydrosoluble soy extract" (37%) and soy milk with fruit juice (37%), as indicated in the literature that shows the increase in consumption of soy-based drinks (Silva *et al.*, 2007).

The present research showed data which are similar to the work of Junior *et al.* (2010), where 31% of the men and 37% of the women participating stated that they consume soy milk, with a frequency of 5 times a month maximum, in a total of 35% of the interviewed (men and women).

In sensory evaluation, the soy-based ice cream had a good acceptance in sensory (Table 2), although significant difference ( $p < 0.05$ ) in relation to the cow's

milk ice cream (traditional).

With regard to appearance, the ice cream soy-based obtained average rating equal to 7.6 remaining between the terms "liked moderately" and "I liked it a lot", while the ice cream with cow's milk reached average grade 8.1 indicating that consumers "really liked" the appearance. This significant difference maybe the result of the pink-yellowish tone presented in ice cream soy-based (Figure 3).

Table 2. Average notes for the sensory attributes assessed by acceptance test with 101 assessors to the ice cream's formulations.

	Appearance	Taste	Texture
Cow's Milk ice cream	8.12±0.88 <sup>a</sup>	8.23±0.86 <sup>a</sup>	8.23±0.89 <sup>a</sup>
Soy-based ice cream	7.58±1.38 <sup>b</sup>	6.08±2.12 <sup>b</sup>	7.42±1.34 <sup>b</sup>

Mean ± standard deviation. For the same column, means with different alphabet superscript indicates significant difference by Tukey test ( $p < 0.05$ ).



Figure 3. Soy-based ice cream (a) and cow's milk ice cream (b)

For the attribute "taste", as it was expected, the ice cream formulated with soy had the lowest average (6.1) which corresponds to the acceptance "I enjoyed slightly", on the other hand, the traditional ice cream reached average (8.2) which is equivalent to the term "liked it very much". Despite this, it can be stated that the result obtained from the soy-based ice cream is considered satisfactory since 80% of the participants assumed that they are not used to consuming soy products. Cardoso *et al.* (2011) also reported low acceptance for the attribute taste, which is perfectly justifiable, since soy products have slightly unpleasant flavor to the Brazilian taste because they don't have the habit of eating it.

For the attribute texture, the soy-based ice cream, obtained an average 7.4, getting between the terms "I enjoyed moderately" and "liked it very much" whereas the traditional ice cream presented rate 8.2, showing average rating higher than the soy-based ice cream. This significant difference between the soy-based ice cream and the traditional one might have occurred because on the formulation of cow's milk ice cream there are components (fat and protein) that would have influenced

the texture of the final product. This fact is emphasized by the overrun of the soy-based ice cream sample obtained the value of 11.65% against 15.3% of the traditional.

For the test of purchase intention, there was also a significant difference ( $p < 0.05$ ) between the samples. With regards to assessors, 68% mentioned that "certainly would buy the cow's milk ice cream", whereas 32% answered that "definitely or probably would buy the soy-based ice cream". It is important to state that even if this result seems to be low, it can be a good result once it is related to a product made by soy.

The results obtained suggested that these consumers only would buy the soy-based ice cream if they have a restriction to milk components.

#### 4. Conclusion

The soy-based ice cream had a good acceptance based on the sensory parameters evaluated, demonstrating the great potential of acceptance in the market for people intolerant to lactose or who want to consume food health claim purpose. However, to ensure that the soy-based ice cream reaches higher rates for consumers, in general, it will be necessary to find methods for the soy processing that make it more attractive to the palate.

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