Consumer perception, preferences and purchase intention towards ice cream in brazilian regions

Percepção do consumidor, preferências e intenção de compra de sorvetes nas regiões brasileiras

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ABSTRACT
The study's objective was to evaluate the preferences of ice cream consumption in Brazilian regions and to identify the perception and purchase intention. The research covered 3,339 individuals; most reported having no dietary restrictions, consuming ice cream regardless of the time of year, preferring chocolate and strawberry flavors, considering the ice cream a dessert, unhealthiness was the perception most expressed and, as purchase intention, lactose-free and vegan, light and with fiber products were the most cited. Therefore, ice cream has high market potential for developing new functional products, given its high prevalence of consumption and acceptability.

Keywords: dairy products, eating habits, healthy lifestyle, regional food, social anthropology of food, consumer behavior.

RESUMO
O objetivo do estudo foi avaliar as preferências de consumo de sorvetes em regiões brasileiras e identificar percepção e intenção de compra. A pesquisa abrangeu 3.339 indivíduos; a maioria relatou não ter restrições alimentares, consumindo sorvete independentemente da época do ano, preferindo sabores de chocolate e morango, considerando o sorvete uma sobremesa, sendo ‘não saudável’ a percepção mais expressa e, como intenção de compra, sem lactose e vegano, light e produtos com fibra foram os mais citados. Portanto, o sorvete tem alto potencial de mercado para o desenvolvimento de novos produtos funcionais, dada sua alta prevalência de consumo e aceitabilidade.

Palavras-chave: produtos láteos, hábitos alimentares, estilo de vida saudável, alimentação regional, antropologia social da alimentação, comportamento do consumidor.
INTRODUCTION

In recent years, the food industry has produced numerous products with claims of functional properties due to the growing demand from consumers with dietary restrictions and interest in developing a healthy lifestyle. As a result, its main objective is to promote health and welfare and prevent some pathologies to meet the demand and fill this market niche in constant renewal and expansion (Asioli et al., 2017; Terpou et al., 2019). In this regard, surveys that provide the identification of new consumers, grouped according to the experiences obtained, showing their sensitivities/characteristics and adapted to the context of each country, are of paramount importance for the design of new products based on their expectations (Chen et al., 2021; Puleo et al., 2021; Sridhyya and Savithri, 2021).

Ice cream consumption in Brazil is still less significant than in Asia, North America, and Europe, where the demand for premium products has intensified (Fortune Business Insights, 2022). This is mainly due to the more traditional composition of
Brazilian ice cream, essentially characterized as a dessert or dainty, with low levels of dairy solids and high levels of sugars (Renhe et al., 2015).

Its world consumption is estimated to increase by more than 30% by 2028, reaching a turnover of around US$ 97.85 billion, even with the current decline in the consumer market due to the COVID-19 coronavirus pandemic. The expectation for this product is that using ingredients with nutritional and physiological properties, such as probiotics, prebiotics, and antioxidants, will increasingly win over the market, leveraging its growth (Fortune Business Insights, 2022). According to Caso et al. (2022), there was an increase in the consumption of healthy foods during the lockdown, which was partially continued after the end of isolation, suggesting a change in behavior during the period.

Ice cream’s formulations can vary; however, their manufacture and processing occur similarly and may present few changes (Goff, 2022). In addition, as it is easily digestible, has a sweet taste and a soft texture, it is a food accepted by all age groups, from children to older people, making it a promising vehicle for the industry in the development of new formulations (Brazilian Association of Industries and the Ice Cream Sector, 2021).

To that end, it is necessary to carry out studies to understand the emotions generated by the consumption of a particular food, which seeks to obtain behavioral intention (by tests of purchase probability and consumption frequency). As well as understanding the context of consumption of this item, they are essential tools in the development of new products (King et al., 2013; Piqueras-Fiszman and Jaeger, 2015), especially in the case of ice cream, where there is a greater tendency to choose from the taste or sensation provided by the product (Bullock et al., 2019).

In this context, the present study aimed to evaluate the preferences for ice cream consumption in Brazilian regions and identify the perception and purchase intention of products with dietary restrictions and a functional and healthy approach through an online survey.
2 MATERIAL AND METHODS

To investigate the ice cream consumer's perceptions and preferences, an online questionnaire was developed on the Google® platform to share with the participants; the social networks Facebook® and Whatsapp® were used, and the time of share was 48 hours.

Inclusion/exclusion criteria were not established in the survey, considering that anyone with access to the form could participate. The form was initially built using sample characterization questions such as age, gender, education, region of residence, existence of dietary restrictions, and habit of consumption.

It was also sought, through closed questions, to understand the consumption preferences of the participants through questions about the frequency, the time of year they consume, the preferred flavors, and which fruits they prefer to add to the product.

Finally, the remaining questions addressed the participants' perception of ice cream. That is, through an association of words about the consumer's relationship with the product, whether ice cream is deemed as a food or dessert, their perception of healthiness, and if there is an intention to purchase a product presenting a functional focus and healthiness.

All answers were compiled using Excel® editor and organized according to their category. The open questions (with written answers) were structured in alphabetical order for better viewing and counting, and subsequently, two surveyors in agreement classified them into groups/categories for a better data representation.

2.1 PARTICIPANT’S CHARACTERIZATION

The age groups of the participants were stratified as follows: 20 years old or less, 21-30, 31-40, 41-50, 51-60, and 61 years old or more. Regarding gender, participants could identify themselves as female, male, or other. As for education, the answer alternatives were complete/incomplete elementary school, high school, graduate, and postgraduate.

Regarding the place of residence of the participants, the alternatives were separated into the North, Northeast, Midwest, Southeast, and South of Brazil. In the
question about the existence of dietary restrictions, participants could choose more than one answer, signaling other types of restriction not included in the options through an open alternative called ‘other’. The food restriction options suggested in the questionnaire are lactose intolerance, milk protein allergy, gluten allergy, veganism/vegetarianism, and none. The habit of consuming ice cream was obtained through categorical answers (yes or no).

2.2 PARTICIPANTS’ CONSUMPTION PREFERENCES

To identify the consumption preference, the participants answered how often they consume ice cream, with the following response options: rarely, 1-3 times/month, 4-6 times/month, 7-9 times/month, 10 times/month or more and, do not consume. Regarding the time of year, the participant usually consumes the product, the answers were acquired through multiple-choice alternatives: summer, autumn, winter, spring, any time - I always consume’, any time - I rarely consume’, and do not consume.

Through open questions, participants were asked which flavors of ice cream they preferred and, in the case of adding fruit to the product, what would be their preferred fruit choices.

2.3 PARTICIPANTS’ PERCEPTION OF ICE CREAM AND PURCHASE INTENTION

Through the word association test, in an open question, the participants were asked about the first words that come to their minds when they ‘think about ice cream’. Data were grouped into categories: flavor, sensation/characteristic, way of consumption, composition, and others. Afterward, they were asked if they deem ice cream 'a food, like any other' or 'a dessert/delicacy' and, in an open question, if they deem ice cream a healthy product, yes/no, and the justification for the answer. The answers were grouped into the categories: yes, no, yes, depending on the consumption manner, no because of its composition, yes because it is a nutritious food, no because it is a caloric food and is harmful to the body, it depends on its composition, manufacture and consumer's health and others.
The purchase intention for the development of a product with a focus on healthiness and functional properties was investigated through a multiple-choice question, where the participants answered if they would buy an ice cream that was lactose-free, diet, light, vegan, supplemented with probiotics, supplemented with fiber, supplemented with whey protein, no matter what, or I wouldn't buy it.

3 RESULTS

The survey had the participation of 3,339 individuals, covering all Brazilian regions. The most significant participation was of female individuals, with an average age of 21-30 years old, complete or incomplete postgraduate education, with most involvement from the southern region. Participants reported that they had no dietary restrictions, and with a prevalence of more than 98%, said they had the habit of consuming ice cream at an average frequency of 1-3 times/month, regardless of the time of year, and preferred the flavors of chocolate, chocolate chip, and strawberry. When adding fruits, the most mentioned flavors were strawberry and pineapple, and more than 90% of the individuals rated ice cream as a dessert.

Based on the word association responses, the category in which the words presented the highest attributions was sensations/characteristics, and, regarding the approach to considering ice cream as a healthy or unhealthy product, most responses rated it as unhealthy, with the justification of its composition. In addition, there were significant responses regarding the purchase intention for products for restrictive diets, with the lactose-free, vegan, and light options being the most prominent, followed by products with a functional focus by adding fiber and probiotics.

3.1 PARTICIPANTS’ CHARACTERIZATION

The distribution of participants by age group, gender, and education level can be seen in Figures 1A, 1B, and 1C, respectively.

Of the total number of participants, the public with the lowest representation was 61 years old or older, with 2.16%, and there was no participation from the country’s northern region in this category. In addition, the age group from 51-60 years old had the
second lowest representation at 6.68%, suggesting that the means used for electronic dissemination of the form were ineffective in reaching this audience. Another important finding was that, regardless of the region, the age group with the most participants was 21-30, with 44.9%, demonstrating that the younger the audience, the more access to electronic media and the greater the availability to participate in online surveys.

Regarding gender identification, 83.8% of individuals belong to the female gender, with the southern region having the highest number of participants (49.5%) and the northern region the lowest (1.93%).

Concerning education, the most significant participation of 48.4% was from individuals with complete/incomplete postgraduate studies, which could be observed in all regions of the country and was also the most significant in all of them, suggesting that people involved with the academic environment have more access to this type of survey, and its dissemination occurs more comprehensively.
Figure 1. Characterization of participants in terms of age group (A), gender (B) and education level (C), by Brazilian region for ice cream consumption (n = 3,339)

Regarding the place of residence, 2.13% of participants reported they live in the northern region, 8.39% northeast, 5.87% midwest, 35.4% southeast, and 48.2% southern.

Regarding food restrictions, 78.8% of the individuals reported not having restrictions, a fact that remained regular among the analyzed regions (Figure 2). On the other hand, the most reported dietary restriction in all regions was lactose intolerance, by 11.5% of the participants, corresponding to approximately 50% of incidence compared to the others. However, 3.44% of the individuals reported having another type of restriction, such as food allergies to oilseeds (nuts, peanuts, walnuts and almonds), seafood (shellfish and crustaceans), soy, eggs, food with caffeine (cocoa and coffee), spices, dyes (mainly yellow, but also red and orange), certain fruits (especially citrus) and foods such as
tomatoes, garlic, hearts of palm, beans and pork. Within this alternative, dietary restrictions involving pathologies such as celiac disease and non-celiac gluten sensitivity, diabetes, irritable bowel syndrome, gastritis, chronic urticaria, and alcoholism have also been reported.

Figure 2. Types of reported food restrictions, related to consumption or not of ice cream, by Brazilian region (n = 3,455)

Source: Authors, 2023.

3.2 PARTICIPANTS’ CONSUMPTION PREFERENCES

The frequency, as well as the time of ice cream consumption by the participants, can be observed in Figure 3A and 3B, respectively, where it is noted that although 98.5% of the participants reported consuming ice cream, the frequency of this consumption is very low since 39.9% reported consuming the product 1-3 times/month and 35.2% rarely consume it.
The time of year of consumption most mentioned in the responses was in the summer, with 47.3% prevalence, and because it is a multiple-choice alternative when grouping the data, it was found that, of these, 17.9% marked the summer option associated with at least one more choice. Another relevant factor was that only the southern region presented higher percentages of responses indicating the summer; in contrast, the other regions, although showing high values at the same time, obtained higher rates in the answers “any time - I always consume”’, which corresponds to 38.39% of the total number of participants.

When the frequency was compared by region, it was found that the highest consumption percentages are in the northern region, at 8.45%, and the northeastern region, at 6.79%, for the frequency of 10 times/month or more. These were very expressive figures, considering the number of people who responded to the form in each of these regions, which is in line with the preference of the population to consume the product at all times due to the constant high temperature in these regions.
Among 8,448 mentions, 173 flavors of ice cream were mentioned, with chocolate being the most representative among them, with 19.0% of observations and 0.26% of individuals who reported not liking and/or not consuming ice cream. The list of flavors by region, whose percentage was more significant than 1% of the total responses, can be seen in Table 1.

Table 1. Preference of ice cream flavors by Brazilian region in relation to the total citations (n = 8,448)

<table>
<thead>
<tr>
<th>Ice cream flavor</th>
<th>North n</th>
<th>North %</th>
<th>Northeast n</th>
<th>Northeast %</th>
<th>Midwest n</th>
<th>Midwest %</th>
<th>Southeast n</th>
<th>Southeast %</th>
<th>South n</th>
<th>South %</th>
<th>Total n</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chocolate</td>
<td>27</td>
<td>15.1</td>
<td>133</td>
<td>18.1</td>
<td>90</td>
<td>18.8</td>
<td>547</td>
<td>17.5</td>
<td>810</td>
<td>20.6</td>
<td>1607</td>
<td>19.0</td>
</tr>
<tr>
<td>Chocolate chip</td>
<td>11</td>
<td>6.15</td>
<td>59</td>
<td>8.01</td>
<td>43</td>
<td>8.96</td>
<td>292</td>
<td>9.36</td>
<td>429</td>
<td>10.9</td>
<td>834</td>
<td>9.87</td>
</tr>
<tr>
<td>Cream</td>
<td>8</td>
<td>4.47</td>
<td>24</td>
<td>3.26</td>
<td>28</td>
<td>5.83</td>
<td>220</td>
<td>7.05</td>
<td>398</td>
<td>10.1</td>
<td>678</td>
<td>8.03</td>
</tr>
<tr>
<td>Pistachio</td>
<td>1</td>
<td>0.56</td>
<td>11</td>
<td>1.49</td>
<td>17</td>
<td>3.54</td>
<td>149</td>
<td>4.77</td>
<td>132</td>
<td>3.36</td>
<td>310</td>
<td>3.67</td>
</tr>
<tr>
<td>Pineapple</td>
<td>3</td>
<td>1.68</td>
<td>23</td>
<td>3.12</td>
<td>10</td>
<td>2.08</td>
<td>86</td>
<td>2.76</td>
<td>133</td>
<td>3.38</td>
<td>255</td>
<td>3.02</td>
</tr>
<tr>
<td>Passion fruit</td>
<td>2</td>
<td>1.12</td>
<td>18</td>
<td>2.44</td>
<td>17</td>
<td>3.54</td>
<td>89</td>
<td>2.85</td>
<td>120</td>
<td>3.05</td>
<td>246</td>
<td>2.91</td>
</tr>
<tr>
<td>Neapolitan</td>
<td>3</td>
<td>1.68</td>
<td>31</td>
<td>4.21</td>
<td>19</td>
<td>3.96</td>
<td>91</td>
<td>2.92</td>
<td>98</td>
<td>2.49</td>
<td>242</td>
<td>2.86</td>
</tr>
<tr>
<td>Vanilla</td>
<td>4</td>
<td>2.23</td>
<td>27</td>
<td>3.66</td>
<td>15</td>
<td>3.13</td>
<td>65</td>
<td>2.08</td>
<td>108</td>
<td>2.75</td>
<td>219</td>
<td>2.59</td>
</tr>
<tr>
<td>Fudge</td>
<td>2</td>
<td>1.12</td>
<td>21</td>
<td>2.85</td>
<td>8</td>
<td>1.67</td>
<td>71</td>
<td>2.27</td>
<td>116</td>
<td>2.95</td>
<td>218</td>
<td>2.58</td>
</tr>
<tr>
<td>Coconut</td>
<td>1</td>
<td>0.56</td>
<td>32</td>
<td>4.34</td>
<td>9</td>
<td>1.88</td>
<td>101</td>
<td>3.24</td>
<td>74</td>
<td>1.87</td>
<td>217</td>
<td>2.57</td>
</tr>
<tr>
<td>Lemon</td>
<td>1</td>
<td>0.56</td>
<td>8</td>
<td>1.09</td>
<td>10</td>
<td>2.08</td>
<td>105</td>
<td>3.36</td>
<td>64</td>
<td>1.63</td>
<td>188</td>
<td>2.23</td>
</tr>
<tr>
<td>Rum and raisin</td>
<td>4</td>
<td>2.23</td>
<td>17</td>
<td>2.31</td>
<td>17</td>
<td>3.54</td>
<td>58</td>
<td>1.86</td>
<td>79</td>
<td>2.01</td>
<td>175</td>
<td>2.07</td>
</tr>
<tr>
<td>Powdered milk</td>
<td>2</td>
<td>1.12</td>
<td>14</td>
<td>1.90</td>
<td>12</td>
<td>2.50</td>
<td>90</td>
<td>2.88</td>
<td>21</td>
<td>0.53</td>
<td>139</td>
<td>1.65</td>
</tr>
<tr>
<td>Mint</td>
<td>2</td>
<td>1.12</td>
<td>12</td>
<td>1.63</td>
<td>5</td>
<td>1.04</td>
<td>20</td>
<td>0.64</td>
<td>67</td>
<td>1.70</td>
<td>106</td>
<td>1.25</td>
</tr>
<tr>
<td>Condensed milk</td>
<td>3</td>
<td>1.68</td>
<td>4</td>
<td>0.54</td>
<td>4</td>
<td>0.83</td>
<td>27</td>
<td>0.87</td>
<td>63</td>
<td>1.60</td>
<td>101</td>
<td>1.20</td>
</tr>
<tr>
<td>Truffled milk</td>
<td>1</td>
<td>0.56</td>
<td>3</td>
<td>0.41</td>
<td>10</td>
<td>2.08</td>
<td>69</td>
<td>2.21</td>
<td>18</td>
<td>0.46</td>
<td>101</td>
<td>1.20</td>
</tr>
<tr>
<td>Powdered milk</td>
<td>2</td>
<td>1.12</td>
<td>1</td>
<td>0.14</td>
<td>2</td>
<td>0.42</td>
<td>25</td>
<td>0.80</td>
<td>71</td>
<td>1.81</td>
<td>101</td>
<td>1.20</td>
</tr>
<tr>
<td>Chocolate with</td>
<td>0</td>
<td>0.00</td>
<td>13</td>
<td>1.76</td>
<td>6</td>
<td>1.25</td>
<td>46</td>
<td>1.47</td>
<td>32</td>
<td>0.81</td>
<td>97</td>
<td>1.15</td>
</tr>
<tr>
<td>Mint</td>
<td>1</td>
<td>0.56</td>
<td>8</td>
<td>1.09</td>
<td>4</td>
<td>0.83</td>
<td>17</td>
<td>0.54</td>
<td>56</td>
<td>1.42</td>
<td>86</td>
<td>1.02</td>
</tr>
<tr>
<td>Chocolate Ball</td>
<td>2</td>
<td>1.12</td>
<td>6</td>
<td>0.81</td>
<td>5</td>
<td>1.04</td>
<td>25</td>
<td>0.80</td>
<td>48</td>
<td>1.22</td>
<td>86</td>
<td>1.02</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>92</strong></td>
<td><strong>51.4</strong></td>
<td><strong>553</strong></td>
<td><strong>72.7</strong></td>
<td><strong>370</strong></td>
<td><strong>77.1</strong></td>
<td><strong>2,438</strong></td>
<td><strong>78.1</strong></td>
<td><strong>3,347</strong></td>
<td><strong>85.1</strong></td>
<td><strong>6,783</strong></td>
<td><strong>80.3</strong></td>
</tr>
</tbody>
</table>

Source: Authors, 2023.

During data analysis, when evaluating flavor vs region, it was observed that specific local flavors appeared in some regions, such as cupuaçu (13.4%), açaí berry (9.53%), tapioca (7.26%), bacuri and corn (2.23%), tucumã, carimbó, murici and buriti...
(1.12%) in the northern region, and guava and cajá (2.04%) and tapioca (1.49%) in the northeast, and corn (1.54%) in the southeastern region.

Regarding adding fruit to the product, 7,360 mentions were observed, where 93 flavors were mentioned, 15 were not fruity, and 6 were oilseed. Overall, 92 people reported not liking fruit, 17 did not choose a specific type of fruit (stating “fruits in general”), and 15 reported not consuming ice cream. The ratio of fruits by region, whose percentage was more significant than 1% of the total responses, can be seen in Table 2.

When the data were grouped considering the region, the presence of some regional fruits was observed, such as bacuri, soursop, and murici in the north; cajá, soursop, guava, and mangaba in the northeast; plums in the midwest; guava and avocado in the southeast; and peach, avocado, papaya, and melon in the south. Other fruits were mentioned less than 0.5% of the total by region, and among these were acerola, butiá, jackfruit, lychee, pequi, tamarind, tangerine, tucumã, umbu, uvaia and uxi.
3.3 PARTICIPANTS’ PERCEPTION OF ICE CREAM AND PURCHASE INTENTION

Regarding the word association made by the participants when ‘thinking about ice cream’, the northern region had 2.02% of the mentions, northeast 7.20%, midwest 5.08%, southeastern 34.9%, and south 50.2%. According to the respective categories and the main attributes mentioned in the answers, the results can be seen in Table 3.

Table 3. Main attributes mentioned in the word association test referring to ‘thoughts about ice cream’ by Brazilian region (n = 7,202)

<table>
<thead>
<tr>
<th>Category</th>
<th>Region</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>North</td>
<td>Northeast</td>
<td>Midwest</td>
<td>Southeast</td>
<td>South</td>
<td></td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Flavor</td>
<td>2</td>
<td>1.37</td>
<td>26</td>
<td>4.65</td>
<td>12</td>
<td>3.28</td>
</tr>
<tr>
<td>Pineapple, açaí berry,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>chocolate, fruit, cream,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>chocolate chip, strawberry,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>grape</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensation/characteristic</td>
<td>109</td>
<td>74.7</td>
<td>463</td>
<td>82.8</td>
<td>304</td>
<td>83.1</td>
</tr>
<tr>
<td>Creamy, joy, pleasant,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>welfare, comfort, warmth,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>happiness, frosty</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumption manner</td>
<td>9</td>
<td>6.16</td>
<td>46</td>
<td>8.23</td>
<td>32</td>
<td>8.74</td>
</tr>
<tr>
<td>Ice cream cone, ball, with</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>syrup, buffet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Composition</td>
<td>4</td>
<td>2.74</td>
<td>17</td>
<td>3.04</td>
<td>9</td>
<td>2.46</td>
</tr>
<tr>
<td>Sugar, fat, milk</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>22</td>
<td>15.1</td>
<td>7</td>
<td>1.25</td>
<td>9</td>
<td>2.46</td>
</tr>
<tr>
<td>Handmade, expensive,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>celebration, coexistence,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>homemade, throat, flu</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Authors, 2023.

Participants were also encouraged to classify ice cream, being asked whether they considered it food or dessert, and 90.8% of the participants ranked the product as dessert.

When analyzing the word association test, we highlighted the “sensation/characteristic” category that retained the highest percentage of responses between regions, followed by “consumption manner”. These results demonstrate that ice cream is mainly linked to positive perceptions and sensations and that its presentation/consumption manner is essential to consider before and during ingestion.

Regarding the question that “ice cream may or may not be considered a healthy product”, participants from the northern region presented 2.10% of the mentions,
northeast 10.2%, midwest 5.88%, southeast 37.4%, and southern 40.6%. According to their respective categories and justifications, the results can be seen in Table 4.

Table 4. Main categories and justifications mentioned by the participants when answering the question regarding the fact that “ice cream is healthy or not” by Brazilian region (n = 3,333)

<table>
<thead>
<tr>
<th>Category</th>
<th>Region</th>
<th>North</th>
<th>Northeast</th>
<th>Midwest</th>
<th>Southeast</th>
<th>South</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Yes</td>
<td>7</td>
<td>10.0</td>
<td>7</td>
<td>2.06</td>
<td>26</td>
<td>13.3</td>
</tr>
<tr>
<td>No</td>
<td>4</td>
<td>5.71</td>
<td>4</td>
<td>1.17</td>
<td>8</td>
<td>4.08</td>
</tr>
<tr>
<td>Yes. Depending on the consumption manner</td>
<td>9</td>
<td>12.9</td>
<td>9</td>
<td>2.65</td>
<td>12</td>
<td>6.12</td>
</tr>
<tr>
<td>No. Due to its composition</td>
<td>27</td>
<td>38.6</td>
<td>152</td>
<td>44.8</td>
<td>83</td>
<td>42.3</td>
</tr>
<tr>
<td>Yes. Because it is a nutritious food</td>
<td>6</td>
<td>8.57</td>
<td>6</td>
<td>1.7</td>
<td>7</td>
<td>3.57</td>
</tr>
<tr>
<td>No. Because it's a caloric food and it's bad for the body</td>
<td>6</td>
<td>8.57</td>
<td>28</td>
<td>8.25</td>
<td>20</td>
<td>10.2</td>
</tr>
<tr>
<td>It depends on its composition, manufacturing and consumer health</td>
<td>7</td>
<td>10.0</td>
<td>66</td>
<td>19.5</td>
<td>35</td>
<td>17.9</td>
</tr>
<tr>
<td>Yes. It brings good sensations</td>
<td>4</td>
<td>5.71</td>
<td>4</td>
<td>1.17</td>
<td>4</td>
<td>2.04</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>1</td>
<td>0.51</td>
</tr>
</tbody>
</table>

Source: Authors, 2023.

Based on the answers obtained, we can observe that in all regions, most participants consider ice cream an unhealthy product; their primary justification is its composition. The region where the highest percentage of participants classified the ice cream within the category "no, due to its composition" was the northeast, with 44.8%. It
is also worth mentioning that the category "depends on its composition, manufacturing and consumer health", received the second highest percentage of responses between regions, with the choice for this category being higher in the northeast.

When observing the answers sorted into categories of "yes, depending on the consumption manner" and "yes, because it is a nutritious food", we can see that in the northern region, the highest percentages were obtained for both categories, followed by the southern. In addition, it should be noted that these same regions had the lowest rate in the "no, due to their composition" category. In parallel, we have the data that these regions were the ones that presented the highest number of answers about the preference of the flavor related to fruits, evidencing a high consumption of fruit ice cream and, consequently, justifying the high percentages of characterization it as a healthy food.

The participants were also asked about their intention to purchase ice cream made for restrictive diets (lactose-free, diet, light and vegan) and/or with a functional approach (probiotic, with fiber and whey protein). The answers obtained can be seen in Figure 4, where the 'lactose-free' option has the highest percentage of intention, with 35.2% of the participants in all regions evaluated. This data was in line with what was observed in dietary restrictions, where lactose intolerance was the most prominent.

**Figure 4.** Purchase intent for ice cream made for restrictive diets and/or with functional appeal, by Brazilian region (n = 8,100)

![Purchase intent for ice cream made for restrictive diets and/or with functional appeal, by Brazilian region (n = 8,100)](data:image/png;base64,iVBORw0KGgoAAAANSUhEUgAAAoAAAAHCAIAAABK95WAAAAGXRFWHRTb2Z0d2FyZQBBZG9iZSBJbWFnZVJlYWR5ccllPAAAA3NElEQVQ4y2OwQ3DIAwFgC5MzAFFFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgFmGmGgs...
On the other hand, the option for ‘vegan’ ice cream also had a high percentage, 33.06%, even though there was no significant participation of individuals identified in this category. This result may be associated with lactose-intolerant participants but may also be linked to the claim of healthiness of vegan products.

Regarding the options referring to the functional approach, 30.5% and 28.0% of the participants said they would buy a product with added fibers and probiotics, respectively.

4 DISCUSSION

The use of online forms to carry out an academic survey was a speedy and effective tool, given that access is free, it could be carried out on several digital platforms, and it allows for wide dissemination, with its use mainly boosted by the COVID-19 pandemic (Akidunde et al., 2021).

Similar to the results observed in the present study, in a study conducted by Silva et al. (2014), 58.8% of the participants identified themselves as male, were aged 16-24 years (50.9%) and had completed higher education (51.3%). In addition, for Sipple et al. (2022), 77.7% of the participants were female, and 55.5% were aged 18-34.

An online study on dairy consumption in Brazil during the COVID-19 pandemic showed that the place of residence of the participants was arranged as follows: 3.5% domiciled in the north, 9.8% northeast, 11.1% midwest, 60.4% southeast, and 11.1% south, showing similarity in the lower willingness to participate in online surveys in the northern, northeastern and midwestern regions (Embrapa, 2021).

Concerning food allergies, adverse reactions to the ingestion and/or exposure to certain foods, the information regarding their prevalence is scarce, often contradictory, and varies according to age and population profile (culture, eating habits, region geographic), an immunological mechanism involved, diagnostic procedure and type of food. There are few studies in Brazil, most of which are limited to specific population groups (Moore et al., 2017).

Considering that information on the prevalence of food allergies in the world population is insufficient, and that less than 10% of cases persist in the adult population
(Sicherer and Sampson, 2018), the data observed in the present study are highly relevant, given that 18.7% of the participants reported having some food restriction, related to adverse reactions.

In this context, the data were further assessed, considering whether the participants had more than one restriction, and the assessment showed significant values, as 2.99% of the individuals reported having more than one dietary restriction.

In the study by Schneider-Kamp (2020), it was shown that the social stigma (self-imposed and public) of participants with food intolerance triggered feelings of devaluation since, in addition to the inability to enjoy well-being when consuming certain foods, this health condition also makes them often excluded from social life. Therefore, putting foods on the market that include different cultural and health aspects is extremely important for people with food intolerances and restrictions.

It is worth mentioning that 5.93% of the participants reported being vegetarian/vegan and used this space to reinforce their preference, stating that their food options should not be considered restrictions. For Santaoja and Jallinoja (2021), there is a growing change of ideology among vegans, where ethical and environmentally conscious eating can also be done easily and pleasantly, bringing in the concept of indulgent veganism. Through it, the approach to food could be carried out from the perspective of health, aesthetics, ethics, social class, and gender, thus expressing their ideological identity and food positivity.

And, regarding the habit of consuming ice cream, 98.5% of the participants reported consuming the product, regardless of the region assessed. Data from Fortune Business Insights (2022) indicate that the COVID-19 pandemic triggered a worldwide reduction in the consumption of ice cream. However, the consumption demands of this product must be assessed according to the habits of each country.

These data are in line with what was reported in the study developed by Embrapa (2021) on the consumption of dairy products, where, although 76% of the participants said the habit of buying ice cream during the pandemic, there was a 14% drop, which was the most notable reduction among the dairy foods evaluated.
However, according to data on regional ice cream consumption in 2020, reported by the Brazilian Association of Industries and the Ice Cream Sector (2021), 52% of the population in the southeast of the country consumes the product, followed by 19% in the northeast, 15% south, 9% 16782idwest and 5% northern, data that can also be observed in the present study.

According to market research carried out by Fortune Business Insight (2022), the world preference is vanilla flavor, followed by chocolate and fruit ice cream, information that differs from what was observed here, where the flavor most mentioned by Brazilians was chocolate, followed by chocolate chip.

Brazilian food habits are rooted in indigenous culture, mainly associated with Portuguese and African immigrants. However, due to later immigration, other cultures have also directly influenced the customs (Brazil, 2015). In addition, due to the vast territorial and climatic diversity, the population of each region developed their habits according to the availability of food and natural resources, directly influencing the supply and demand of certain products/raw materials. So, it is possible to find peculiar flavors, especially of fruits, associated with particular regions (Chaves and Anhesini, 2014).

The regionally characteristic flavors, however, are not restricted only to their places of origin and could be mentioned in other regions since the industry has increasingly explored market trends based on consumer interests and also due to advances in innovations and technologies (Costa and Jongen, 2006).

Words and/or phrases generated in a word association test significantly enable understanding the method that guides consumers’ choices when purchasing a product through their perception (Vidal et al., 2017). On the industrial level, this process is of paramount importance for developing new products, as it allows for an assertive direction of the industry (Krumreich et al., 2019). It is worth mentioning that food choices are closely linked to cultural differences in an individual’s food memory, and awareness of their motivations and expectations helps in the design of strategies to meet their needs and demands (Nelson et al., 2018). Similarly, Wang et al. (2018) observed that an individual’s emotional characteristics, such as nostalgia, can influence preferences for
healthy and/or indulgent foods and may be associated with social connections, suggesting that the greater the social interaction, the better the individual’s food choices.

Silva et al. (2014) observed that the highest levels of health awareness were among women (63.5%), with results that align with those obtained in the present study. Here, 92.9% of respondents classified ice cream as dessert, and 63.4% ranked it as unhealthy, regardless of the justification addressed, with the most significant explanation belonging to the category of “no, due to its composition”, with 72.3% of the answers.

Therefore, to attract the attention of consumers, a new line of functional foods known as “better-for-you” (BFY) has been explored by modifying the composition of ice cream through the alteration or incorporation of numerous components such as probiotics, prebiotics, fruits, antioxidant compounds and natural sweeteners (Goff, 2022; Sipple et al., 2022). Their use can be carried out in a combined or isolated manner as long as it abides by the specifications of the legislation and does not provide any unwanted sensorial change or alteration of physicochemical properties during the storage period (Souza et al., 2010).

In a study by Sipple et al. (2022), consumers’ preferences regarding the consumption of BFY frozen desserts, the responses regarding “price”, “all natural”, “naturally sweetened”, and “few ingredients” stood out, and their purchase influence ranged from 70% to 90%. These results were related to those obtained in the present study, considering that the attributes mentioned above align with the category “no, due to its composition”, highlighting the trend for increased consumption of healthier products. These data corroborate a study by Tadhani et al. (2010), which reported an association between perception and awareness of ice cream consumption, where 85% of respondents reported willingness to purchase functional ice cream and 66% were willing to pay a higher price for the product.

Riquelme et al. (2022) classified desserts through categories considering healthiness and like/dislike, with the most mentioned category being “unhealthy and I like it”. The results presented by the authors match the main results of the present study on the perception of consumers in general regarding ice cream, which is seen as a dessert...
and as an unhealthy product, instead of a food that could be a source of proteins, calcium, and other nutrients, according to its formulation.

Considering that most of the answers describe ice cream as an unhealthy product, the development of projects to promote its image as food is essential, making it part of the daily life of the population due to its potential to connect people, feelings, and relationships, at all times of the year (Brazilian Association of Industries and the Ice Cream Sector, 2021).

The food industry seeks to meet the demand for healthier foods, and ice cream is an excellent candidate for functional food (Souza et al., 2010) [29]. Within the food industry, the development of new products has, as one of its main guidelines, targeted the current needs of consumers. Because of this, it has taken a more intimate approach, generating a feeling that consumers are the ones who determine/lead the market (Busse and Siebert, 2018), based on their perceptions and values. In this context, data surveys are carried out to identify new trends, where environmental, demographic, economic, sociocultural, and even technological factors are evaluated, directly impacting consumer needs (Janssen and Dankbaar, 2008).

Ronteltap et al. (2012) suggest that health perception correlates with several factors, most of which are subjective to each consumer and interpreted differently by them. So, it is necessary to understand the meaning of healthy eating for consumers. Consumers still tend to disregard health standards in favor of products of their preference, especially when it comes to ice cream, as Bullock et al. (2019) reported that vegan ice cream accompanied claims among the participants that it is highly healthy.

Studies indicate that consumers attribute food as a way to improve their health and welfare, giving special attention to functional foods due to the potential reduction in the risk of developing diseases related to their consumption (Baboota et al., 2013). According to Küster-Boudaa and Vidal-Capilla (2017), a healthy lifestyle will not always affect attitudes toward the consumption of functional foods, suggesting that complementary information on the benefits linked to its consumption should be inserted in marketing and advertising campaigns and packaging, increasing the level of knowledge of the population. In addition, according to Kraus (2014), this type of consumer seeks health
promotion and satisfaction when consuming sensorially agreeable products that bring them pleasure during consumption.

Regarding the consumption of probiotic food, according to Ávila et al. (2020), consumers associated the low consumption of this type of product with high costs and not understanding the information on the labels. However, ‘nutritional’ and ‘aspects related to health’ were words associated with the product evaluated, suggesting a slight knowledge of the benefits of these foods.

Based on the results of the present study, it is observed that investment in marketing by industries in the dairy sector, especially ice cream, needs more attention. For consumers who usually do not associate nutritional benefits with these food products, a demand for quality improvement was evidenced, linked to the product’s composition.

It is also worth mentioning that a suitable diet requires the search to incorporate healthy food and the recognition of the importance of eating and the sensory experiences related to the product (Brazil, 2015).

5 CONCLUSION

It was possible to identify ice cream consumption preferences and also the perception and purchase intention of the Brazilian consumer. Most participants fall into the age group of 21-30 years old; the average consumption is 1-3 times/month, and the north region has the highest frequency of consumption. Chocolate flavor was preferred in all regions, and strawberry stood out as a fruit flavor.

In addition to the participant's preference and frequency of consumption, it was possible to verify that even consuming ice cream frequently, the population mainly considers ice cream unhealthy as a food. On the other hand, there was significant interest concerning the intention to consume ice cream for restrictive diets, with the option of lactose-free being the most significant response, followed by vegan, and, for a functional product, the addition of fibers and probiotics was what presented the most answers.

Therefore, it was found that the population is generally concerned about the health benefits that the products they consume can provide, which is a potential focus to leverage ice cream consumption and the industry's development.
CONFLICT OF INTEREST

The authors confirm that they have no conflicts of interest with respect to the work described in this manuscript.

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