applied sciences

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Optimizing Sensory Attributes: Exploring the Placement of the Ideal-Product Question in Check-All-That-Apply Methodology

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Featured Application: Two distinct check-all-that-apply (CATA) approaches were tested on 300 consumers. The original format had 150 participants describe their ideal product after they had evaluated the actual products. Another 150 participants outlined their ideal product in a modified version before judging the real products. Key insights emerged. When consumers were prompted to think about their ideal product first, they provided a description that was more rooted in authenticity and emotion. Conversely, the feedback tended to be more analytical and specific when the ideal product was inquired about last. This finding is crucial for businesses aiming to tailor their products according to consumer desires. By modifying the sequence of the CATA questionnaire, companies can choose to either draw out genuine emotional responses or derive more detailed analytical feedback. Ultimately, this offers a strategic tool for determining the ideal sensory attributes of a product.

Abstract: Consumer research has traditionally played a pivotal role in understanding consumers' preferences for a product. The check-all-that-apply (CATA) methodology is used in consumer research to gather insights on product attributes. The placement of the ideal-product question within the CATA questionnaire, i.e., whether it should be presented before or after actual product evaluation, has been a topic of debate among researchers. This study aims to investigate whether presenting the ideal-product question before or after evaluating food products using the CATA methodology interferes with identifying desired and unwanted attributes by consumers. Milk chocolate and grape juice were evaluated. Two CATA questionnaires were applied (n = 300 consumers): One was in the original format (n = 150 consumers), with the attributes of the "ideal" product asked about at the end of the monadic evaluation of the actual products. The second had modifications (n = 150 consumers), with attributes of the "ideal" product asked about before evaluating the actual products. There was variation in both CATA methods regarding the description of the "ideal" product. CATA-First asked for a more authentic and affective description of the ideal product, and CATA-Last had more specific results, illustrating that consumers tend to be more analytical during the evaluation process. The findings of this study show practical utility for consumer-based methodologies, focusing on the determination of ideal sensory attributes.

Keywords: chocolate milk; consumer research; grape juice; ideal product; sensory profile

Citation: Amorim, K.A.; Dutcosky, S.D.; Becker, F.S.; Asquieri, E.R.; Damiani, C.; Soares, C.; Rodrigues, J.F. Optimizing Sensory Attributes: Exploring the Placement of the Ideal-Product Question in Check-All-That-Apply Methodology. *Appl. Sci.* **2023**, *13*, 11686. https://doi.org/10.3390/app132111686

Academic Editors: Sylwia Żakowska-Biemans, Anna Piotrowska and Eliza Kostyra

Received: 16 September 2023
Revised: 17 October 2023
Accepted: 23 October 2023
Published: 25 October 2023

1. Introduction

For the food industry, sensory evaluation is crucial in product development for the consumer market, as it seeks to comprehend how consumers perceive products [1]. Among the many sensory methods available, descriptive analysis is widely used when the purpose is to obtain a detailed description of the products under analysis [2,3]. One of the most used methods of characterizing consumer sensory products is check-all-that-apply (CATA) [4]. In this method, consumers are presented with a list of terms, attributes, or phrases, and then, asked to mark as many options as necessary to describe the product under review [5–7]. One of the main advantages of the CATA method is the simplicity and speed with which the analyses are performed [8].

The terms presented in the CATA methodology derive from applying other qualitative methodologies, such as focus groups or the free-listing methodology. The latter involves prompting evaluators to list as many perceived attributes as possible related to a specific product [9,10]. Described as "a deceptively simple, yet powerful technique" [11], free-listing stands out from other qualitative methods because it allows for more authentic consumer associations that are less constrained and more realistic [12,13].

However, one of the key challenges for consumer sensory science is describing the product and providing processable knowledge to make specific changes in product formulations [14]. Several studies have highlighted the usefulness of integrating CATA questions with the "ideal" product description to bridge this gap. After evaluating samples using CATA, consumers use the same attributes to describe their "ideal" product. Such an approach sheds light on how sensory differences between actual and ideal products affect acceptance using penalty rewards [15–19] and facilitates the formulation of products that closely match the consumers' ideals [8].

Thus, the CATA method has also been used to identify ideal products, as it is a simple alternative capable of gathering information on the perception of the sensory qualities of consumers concerning products [15,20]. Meyners, Castura, and Carr [21] employed an approach that considers the following scenarios regarding the attribute: whether it was verified in the ideal product but not in the sample; whether it was marked on the sample but not on the ideal product; whether it was marked on both; or whether it was not marked on either the ideal product or the sample. Ares et al. [8] used the CATA method to discern how products deviated from the ideal as perceived by consumers. The questionnaire employed included terms with hedonic intensity connotations, which are used to characterize both the ideal and actual products.

In studies that utilize the CATA method incorporating an "ideal" assessment, the query regarding the ideal product typically follows the evaluation of all actual samples [8,16,17,21–24]. Ares and Jaeger [15] recommended randomizing the order of attributes within a ballot format, grouping them by modality to reduce the influence of attribute sequence on the sensory characterization of the product. However, their study did not address the question of the ideal product. Additionally, no studies were found in the literature that specifically discuss the sequence in which the questions about the ideal product should be posed.

In hedonic studies, there is an academic and scientific consensus that the question of global acceptance should be prioritized. When consumers encounter a product for the first time, they naturally tend to compare it holistically. If this is not the approach, their evaluation can become more analytical, making it challenging to obtain an authentic measure of preferences or rejections [25].

It is acknowledged that in hedonic studies, the sequence in which questions are presented affects consumer responses [25]. In the context of the CATA technique, Ares and Jaeger [15] also showed that the order of terms within CATA influences consumer responses. While Silvestre et al. [26] evaluated the ideal-product question before using CATA, no study has examined the impact of the positioning of the ideal-product question.

This study addresses the question of the sequence in which the "ideal" attributes are inquired about in the CATA methodology and which approach most genuinely captures the desired attributes of consumers. In this regard, this study aims to explore whether

presenting the question about the ideal attributes before or after evaluating food products using the CATA methodology impacts consumers' identification of both desired and undesired attributes.

2. Materials and Methods

This project was submitted to the Research Ethics Committee (CEP) of the Federal University of Goiás—UFG, and approved by Opinion Number CAAE 06671219.2.0000.5083, in compliance with the legal requirements established by Operational Standard No. 001/2013 CONEP/CNS. All evaluations were performed at the Sensory Analysis Laboratory—LASA-UFG of the Food Engineering Sector of the School of Agronomy, Federal University of Goiás.

2.1. Samples

For the sensorial characterization, three trademarks of two food matrices were used, milk chocolate bars (1,2,3) and whole grape juice (1,2,3), which were acquired locally in Goiânia—Goiás. The tested commercial products belonged to leading brands in the Brazilian market. These food matrices were chosen due to their distinct descriptors, with the primary goal of securing experimental validation concerning potential outcome variations. Chocolate was selected because it is among the most consumed products globally, valued for its unique sensory satisfaction derived from its distinct melting experience, aroma, and flavor [27,28]. Grapes rank among the most widespread fruit trees globally. In recent years, whole grape juice has gained notoriety, overcoming challenges like market access issues, heightened competition, technological advancements, and easy information accessibility. Between 2008 and 2018, the market grew by 128% [29], and between 2019 and 2020, there was a growth of 152% in production [30]. The trend is for these segments to reach records [29], which justifies the choice of products. The milk chocolate samples were packaged and, for the sensory tests, presented to the evaluators on plates at room temperature, and the whole grape juice was served at a cooling temperature in 50 mL plastic cups.

2.2. Participants

Participants were recruited by disseminating details of the research via social networks, email, and ads attached to murals located in the undergraduate and postgraduate sectors of the Federal University of Goiás, on the Samambaia Campus. Before the sensory tests, the candidates answered a questionnaire to determine characteristics such as age, education, the frequency and habits of consumption of the products to be evaluated, and their preferred brands. All participants signed an informed consent form before performing sensory analyses, as the law requires for human research projects. One hundred consumers, who were above-average users of the product category, participated in free listing.

Ares et al. [30] investigated the number of consumers needed to obtain stable configurations of samples and descriptors from check-all-that-apply (CATA) questions, evaluating 13 datasets with different numbers of consumers. The results showed that the stability of sample and descriptor configurations depends on the degree of difference between samples. Research has suggested that when working with widely different samples, a group of 60–80 consumers is sufficient to obtain stable configurations. Based on this, this study randomly divided three hundred voluntary consumers into two groups of 150. One group participated in the CATA-First (CATA-F), and the other participated in the CATA-Last (CATA-L).

2.3. Free Listing

The survey of terms for the CATA questionnaire was conducted using the free-listing methodology in April 2019, with one hundred consumers with an above-average habit of consuming the test products at least once a week. The two food matrices were individually analyzed in the same session and presented randomly to avoid order bias. Participants were simultaneously presented with three different samples from each food matrix under testing and asked to observe, smell, and taste the samples, listing all the positive and

negative characteristics of the products in question. They received a sheet of paper with written instructions and were asked to complete the task within 15 min.

2.4. Check-All-That-Apply (CATA)

The CATA questionnaire was formulated based on terms acquired and chosen through the free-listing method [31]. Attributes for the CATA questionnaire were selected by quantifying the descriptors each evaluator identified and determining the average number of terms cited. Qualitative analysis grouped terms and associations with analogous meanings into categories. To compose the CATA questionnaire, terms and associations mentioned by more than 10% of the evaluators in the free listing were used. The selection of terms for the CATA questionnaire is not limited solely to the sensory attributes or descriptors of the product. It can also encompass aspects of the product's usage or the concept it aligns with [4].

A total of 300 consumers evaluated the products using two variations of the CATA methodology: 150 consumers used the original format (CATA-L), where they were asked about their "ideal" attributes at the end of the evaluation, while the other 150 used the modified version (CATA-F), where they were questioned about the "ideal" attributes at the beginning. The questionnaire also included a 9-point structured hedonic scale (score of 1 for "extremely disliked" and score of 9 for "extremely liked") [32] to rate global consumer acceptance. In the CATA questionnaires, the terms were presented in a randomized order to the consumers, using a ballot format that grouped attributes by modality [33]. All matrices were analyzed in a single session and presented one by one. The samples were presented using a monadic method, labeled with three random digits, based on a MOLS design (Mutually Orthogonal Latin Square). To mitigate potential biases, the 300 consumers were randomly distributed between the two CATA variations (CATA-L, n = 150, and CATA-F, n = 150), and the sequence in which grape juice and chocolate were presented was also randomized and balanced.

2.5. Data Analysis

The free listing was analyzed using triangulation to address the criteria for term selection and associations for the CATA questionnaire. This involved a combination of various methods, including qualitative analysis of the mentioned terms, evaluation based on the frequency of term mentions, and a review of the relevant academic literature. All statistical analyses were performed using XLSTAT® 2020 software. Frequency distribution was conducted to characterize the population. For the CATA data, evaluations were based on the proportion of consumers choosing each term, perception maps, a Cochran Q test, correspondence analysis, and penalty–rewards analysis [21]. This approach was used to compare the data derived from traditional and modified methodologies. For a given attribute, Cochran's Q test allows for testing of the effect of an explanatory variable (products) on whether the consumers feel the attribute. Correspondence analysis allows for an understanding of the level of association between categories, namely, products and attributes [21]. Penalty analysis was conducted on data from the CATA questions to determine the relative significance of attributes influencing the overall liking scores [16]. An RV coefficient test was conducted to measure the correspondence between the CATA questionnaires, focusing on the first and second dimensions of the correspondence analysis. Analysis of data from the hedonic scale was executed using a frequency histogram.

3. Results

3.1. Population Characterization

Table 1 presents the profile of the target population participating in the two CATA tests. For an experiment with accuracy and good prediction, the following criteria for selecting the target population were defined: a frequency of consumption above the average (more than once a week), an age of 18–32 years, and a high education level of the volunteers. The

differences between the groups refer only to affective data, specifically, the chocolate and grape juice brands they preferred.

Table 1. Characterization of the population that performed the sensory analyses.

		Free Listing *	CATA-L *	CATA-F *
Age (years old (yo))	18–25 yo	85%	85%	85%
	25–32 yo	11%	11%	14%
	32–39 yo	3%	1%	1%
	39–46 yo	1%	2%	0%
Weekly Grape Juice Consumption Frequency	1 × week	24%	9%	8%
	2 × weeks	63%	76%	76%
	3 × weeks	11%	11%	14%
	4 × weeks	2%	5%	3%
Favorite Brands of Grape Juice	Aliança®	0%	9%	16%
	Aurora®	6%	18%	20%
	Del valle®	38%	59%	46%
	La fruit®	29%	43%	31%
	Others	27%	23%	39%
Weekly Milk Chocolate Bar Consumption Frequency	1 × week	0%	0%	0%
	2 × weeks	66%	70%	81%
	3 × weeks	24%	22%	14%
	4 × weeks	10%	7%	5%
Favorite Brands of Milk Chocolate	Cacau show®	8%	18%	23%
	Garoto®	8%	11%	7%
	Lacta®	27%	50%	35%
	Nestlé®	46%	44%	42%
	Others	11%	29%	45%

* Frequency distribution was conducted to characterize the population.

3.2. Free Listing

A list of 89 terms for whole grape juice was generated using the free-listing method, with lists ranging from 3 to 14 descriptors, with an average of 6.8 descriptors per consumer. A total of 84 terms were observed for milk chocolate, with lists of 2 to 13 descriptors, with an average of 6.5 descriptors per consumer. By employing triangulation in data analysis to align various perspectives of descriptors with analogous meanings and by quantifying and selecting only those with a frequency higher than 10% and, sometimes, considering the opposite of the chosen descriptor, verified in the literature, it was possible to obtain a representative lexicon for the sensory attributes of whole grape juice and milk chocolate and the consumers' feelings about chocolate. The descriptors selected for the CATA evaluation forms are presented in Table 2.

Similar to this study, other research evaluating the sensory attributes of grape juice identified sensory variables, including appearance, odor, taste, acidity, sweetness, color, bitterness, and astringency [34–36]. For chocolate, attributes such as sweetness, stickiness, hardness, aroma, and characteristic flavor were noted [37–39]. These results highlighted the significance of the flavor attribute in consumers' perceptions of the two evaluated products, emphasizing its relative importance.

Table 2. Descriptors selected for the CATA evaluation form of whole grape juice and milk chocolate.

Category	Descriptors Grape Juice	% of Mentions [a]	Descriptors Milk Chocolate	% of Mentions [b]
Appearance	Grape's characteristic color	34	Chocolate's characteristic color	21
	Very dark color	13	Very light color	28
	Very transparent	3	Very dark color	15
	Very light color	5	Good appearance	12
Smell	Very weak smell	24	Weak smell	20
	Grape's characteristic smell	17	Chocolate's characteristic smell	72
	Very strong smell	17		
Flavor	Weak taste	15	Very sweet	67
	A little acidic	8	Nauseating	12
	Grape's characteristic flavor	26	Chocolate's characteristic flavor	47
	A little sweet	18	Tasty	51
	Bad taste	11	Weak taste	18
	Tasty	21	Greasy	27
	Acidic	22	A little sweet	25
	Very sweet	16		
	Astringent ("squeeze" sensation in the mouth)	15		
	Bitter	7		
	Wine flavor aftertaste	17		
Consistency	Good consistency	8	Creamy	12
	Concentrated/full-bodied	31	Soft melting in the mouth	30
	Watery	14	Delayed intense melt-in-the-mouth sensation	5
			Soft	30
			Firm	20
			Good texture	31
Sensation			Energizing	3
			Indulgent	10
			Adhesiveness in the mouth	21

[a] n = 80 frequent consumers of grape juice. [b] n = 100 frequent consumers of milk chocolate.

3.3. CATA

3.3.1. Study 1—Grape Juice

Table 3 shows the percentages of consumers who chose descriptors from the CATA-L and CATA-F questionnaires to describe the three commercial whole grape juices and the ideal product. For grape juice, significant differences ($p \leq 0.05$), as determined by the Cochran Q test, were observed in the perceived attributes of commercial products when assessed individually. These differences occurred in 14 out of the 20 attributes for CATA-L and 13 for CATA-F.

Among the attributes that did not present significant differences between the evaluated samples, five of these were shared by the two methods; these were the attributes "bad taste", "grape's characteristic flavor", "grape's characteristic smell", "a little acidic", and "astringent". For CATA-L, the attributes "tasty" and "bitter", and for CATA-F, the attributes "acidic", "very weak smell", and "very strong smell" also showed no significant differences between commercial products; however, they presented significant differences when compared with the ideal product. All descriptors achieved a proportion above 15% of the mentioned terms. Notably, fewer than 15% of consumers indicated nine attributes for the ideal product. These were "very light color", "very weak smell", "bad taste", "very sweet", "weak taste", "acidic", "astringent", "bitter", and "watery". This suggests that consumers do not anticipate these characteristics in actual products.

Table 3. Proportion of consumers who selected descriptors in the CATA-L and CATA-F questionnaires to describe the three commercial whole grape juices and the ideal product.

Descriptors/Products	CATA-L					CATA-F				
	Cochran's *Q* Test	Ideal	1	2	3	Cochran's *Q* Test	Ideal	1	2	3
Grape's characteristic color	*	0.843 ^{a}	0.444 ^{c}	0.693 ^{b}	0.680 ^{b}	*	0.750 ^{a}	0.500 ^{b}	0.697 ^{a}	0.671 ^{a}
Very light color	*	0.013 ^{c}	0.458 ^{a}	0.144 ^{b}	0.013 ^{c}	*	0.007 ^{c}	0.349 ^{a}	0.132 ^{b}	0.013 ^{c}
Very transparent	*	0.00 ^{b}	0.078 ^{a}	0.026 ^{ab}	0.00 ^{b}	*	0.007 ^{b}	0.079 ^{a}	0.033 ^{ab}	0.00 ^{b}
Very dark color	*	0.497 ^{a}	0.144 ^{c}	0.333 ^{b}	0.562 ^{a}	*	0.625 ^{a}	0.250 ^{b}	0.316 ^{b}	0.691 ^{a}
Grape's characteristic smell	*	0.830 ^{a}	0.320 ^{b}	0.431 ^{b}	0.451 ^{b}	*	0.868 ^{a}	0.263 ^{b}	0.342 ^{b}	0.382 ^{b}
Very weak smell	*	0.00 ^{c}	0.510 ^{a}	0.346 ^{b}	0.301 ^{b}	*	0.020 ^{b}	0.487 ^{a}	0.474 ^{a}	0.375 ^{a}
Very strong smell	*	0.706 ^{a}	0.255 ^{c}	0.346 ^{bc}	0.425 ^{b}	*	0.559 ^{a}	0.329 ^{b}	0.355 ^{b}	0.401 ^{b}
Bad taste	*	0.00 ^{b}	0.118 ^{a}	0.163 ^{a}	0.196 ^{a}	*	0.00 ^{b}	0.164 ^{a}	0.105 ^{a}	0.184 ^{a}
Very sweet	**	0.065 ^{b}	0.170 ^{a}	0.092 ^{ab}	0.078 ^{ab}	**	0.086 ^{ab}	0.164 ^{a}	0.099 ^{ab}	0.053 ^{b}
Tasty	*	0.882 ^{a}	0.314 ^{b}	0.359 ^{b}	0.392 ^{b}	*	0.730 ^{a}	0.309 ^{c}	0.467 ^{b}	0.375 ^{bc}
Grape's characteristic flavor	*	0.850 ^{a}	0.301 ^{b}	0.353 ^{b}	0.320 ^{b}	*	0.783 ^{a}	0.283 ^{b}	0.388 ^{b}	0.382 ^{b}
Weak taste	*	0.033 ^{c}	0.307 ^{a}	0.131 ^{b}	0.137 ^{b}	*	0.013 ^{c}	0.336 ^{a}	0.158 ^{b}	0.171 ^{b}
Acidic	*	0.144 ^{b}	0.222 ^{b}	0.359 ^{a}	0.222 ^{b}	*	0.118 ^{b}	0.296 ^{a}	0.428 ^{a}	0.322 ^{a}
A little sweet	*	0.392 ^{a}	0.275 ^{ab}	0.209 ^{b}	0.294 ^{ab}	**	0.434 ^{a}	0.276 ^{b}	0.329 ^{ab}	0.368 ^{ab}
A little acidic	*	0.386 ^{a}	0.196 ^{b}	0.157 ^{b}	0.163 ^{b}	*	0.454 ^{a}	0.257 ^{b}	0.243 ^{b}	0.237 ^{b}
Wine flavor aftertaste	*	0.405 ^{a}	0.261 ^{b}	0.458 ^{a}	0.490 ^{a}	*	0.461 ^{a}	0.263 ^{b}	0.467 ^{a}	0.428 ^{a}
Astringent ("squeeze" sensation in the mouth)	*	0.052 ^{b}	0.222 ^{a}	0.301 ^{a}	0.314 ^{a}	*	0.072 ^{b}	0.243 ^{a}	0.250 ^{a}	0.316 ^{a}
Bitter	*	0.052 ^{b}	0.157 ^{a}	0.183 ^{a}	0.235 ^{a}	**	0.020 ^{b}	0.118 ^{a}	0.125 ^{a}	0.092 ^{ab}
Good consistency	*	0.765 ^{a}	0.516 ^{c}	0.693 ^{ab}	0.608 ^{bc}	*	0.724 ^{a}	0.559 ^{b}	0.638 ^{ab}	0.684 ^{ab}
Watery	**	0.00 ^{c}	0.340 ^{a}	0.170 ^{b}	0.131 ^{b}	*	0.007 ^{c}	0.329 ^{a}	0.224 ^{ab}	0.118 ^{b}
Concentrated/full-bodied	*	0.562 ^{a}	0.196 ^{c}	0.222 ^{c}	0.412 ^{b}	*	0.599 ^{a}	0.171 ^{c}	0.217 ^{c}	0.362 ^{b}

* Indicates significant differences between samples according to Cochran's *Q* test at $p \leq 0.001$ for each method. ** Indicates significant differences between samples according to Cochran's *Q* test at $p \leq 0.01$ for each method. Comparisons between pairs using the McNemar (Bonferroni) procedure; different letters in the same line show significant differences for each method.

For both CATA methods, it is notable that the most important attributes of the ideal product are "grape's characteristic smell", "tasty", and "grape's characteristic flavor", with over 70% of mentions by consumers. Still, less than 50% of consumers noticed these attributes in commercial products, suggesting that the products analyzed did not meet consumer expectations. In addition, the attributes "characteristic color" and "good consistency" were also mentioned by more than 70% of consumers for the ideal product and observed in juices 2 and 3 by more than 60% of consumers. For CATA-L, the attribute "very strong smell" was notably prevalent in the ideal product, receiving mentions from more than 70% of participants. However, fewer than 45% of consumers found this trait characteristic in actual products. Even though the methods were applied in a differentiated order to the ideal, when comparing CATA-L to CATA-F, it is evident that the attributes were perceived at nearly identical frequencies. In both CATA-L and CATA-F, the most prominent attributes, especially those related to appearance, were clearly described (for instance, juice 1 was notably lighter; juice 3 was significantly darker; and juice 2 had the most distinctive color, with no significant difference from juice 3 in both CATA methods). As for the more complex attributes, they presented equivalent and equally well-described results, except for the differences already mentioned in the "smell" category.

3.3.2. Study 2—Milk Chocolate Bars

Table 4 presents the proportions of consumers who selected the CATA-L and CATA-F questionnaire descriptors to describe commercial milk chocolate bars and the ideal product. Concerning milk chocolate commercial products, in CATA-L and CATA-F, no differences were found regarding the attributes "very dark color", "energizing", and "a little sweet" between the samples. In CATA-L, six other attributes (very sweet, soft, soft melting in the mouth, delayed intense melt-in-the-mouth sensation, creamy, and indulgent) did not produce significant differences when comparing commercial products assessing them independently. However, they were differentiated in CATA-F. These differences between the samples may be related to the different methodologies employed. Still, for grape juice,

smaller variation in the results between CATA-L and CATA-F was found, which may be related to the variability of the experiment.

Table 4. Proportion of consumers who selected descriptors in the CATA-L and CATA-F questionnaire to describe the three commercial milk chocolates and the ideal product.

Descriptors/Products	CATA-L					CATA-F				
	Cochran's *Q* Test	Ideal	1	2	3	Cochran's *Q* Test	Ideal	1	2	3
Very dark color	*	0.351 ^{a}	0.033 ^{b}	0.007 ^{b}	0.099 ^{b}	*	0.430 ^{a}	0.040 ^{b}	0.007 ^{b}	0.099 ^{b}
Good appearance	*	0.742 ^{ab}	0.636 ^{b}	0.364 ^{c}	0.848 ^{a}	*	0.636 ^{a}	0.742 ^{a}	0.377 ^{b}	0.742 ^{a}
Chocolate's characteristic color	*	0.762 ^{a}	0.616 ^{b}	0.384 ^{c}	0.682 ^{ab}	*	0.709 ^{a}	0.556 ^{b}	0.212 ^{c}	0.675 ^{ab}
Very light color	*	0.033 ^{c}	0.219 ^{b}	0.636 ^{a}	0.079 ^{c}	*	0.033 ^{c}	0.205 ^{b}	0.709 ^{a}	0.073 ^{c}
Weak smell	*	0.033 ^{c}	0.417 ^{b}	0.603 ^{a}	0.318 ^{b}	*	0.046 ^{c}	0.305 ^{b}	0.695 ^{a}	0.444 ^{b}
Chocolate's characteristic smell	*	0.974 ^{a}	0.596 ^{b}	0.404 ^{c}	0.728 ^{b}	*	0.980 ^{a}	0.702 ^{b}	0.311 ^{c}	0.576 ^{b}
Chocolate's characteristic flavor	*	0.762 ^{a}	0.351 ^{c}	0.384 ^{c}	0.563 ^{b}	*	0.715 ^{a}	0.444 ^{b}	0.252 ^{c}	0.457 ^{b}
Weak taste	*	0.007 ^{c}	0.212 ^{ab}	0.285 ^{a}	0.113 ^{b}	*	0.020 ^{c}	0.179 ^{b}	0.318 ^{a}	0.172 ^{b}
Nauseating	*	0.00 ^{c}	0.272 ^{a}	0.232 ^{ab}	0.146 ^{b}	*	0.007 ^{c}	0.199 ^{ab}	0.298 ^{a}	0.159 ^{b}
A little sweet	*	0.391 ^{a}	0.185 ^{b}	0.106 ^{b}	0.146 ^{b}	*	0.563 ^{a}	0.205 ^{b}	0.166 ^{b}	0.219 ^{b}
Tasty	*	0.934 ^{a}	0.358 ^{c}	0.411 ^{c}	0.642 ^{b}	*	0.801 ^{a}	0.530 ^{b}	0.331 ^{c}	0.530 ^{b}
Very sweet	*	0.086 ^{b}	0.232 ^{a}	0.258 ^{a}	0.232 ^{a}	*	0.106 ^{c}	0.291 ^{ab}	0.338 ^{a}	0.205 ^{bc}
Greasy	*	0.007 ^{c}	0.265 ^{a}	0.185 ^{ab}	0.126 ^{b}	*	0.033 ^{c}	0.166 ^{b}	0.305 ^{a}	0.159 ^{b}
Soft	*	0.536 ^{a}	0.272 ^{b}	0.285 ^{b}	0.318 ^{b}	*	0.450 ^{ab}	0.265 ^{c}	0.483 ^{a}	0.344 ^{bc}
Good texture	*	0.662 ^{a}	0.417 ^{bc}	0.338 ^{c}	0.536 ^{ab}	*	0.694 ^{a}	0.430 ^{bc}	0.305 ^{c}	0.490 ^{b}
Soft melts in the mouth	*	0.728 ^{a}	0.285 ^{b}	0.338 ^{b}	0.377 ^{b}	*	0.695 ^{a}	0.219 ^{c}	0.351 ^{bc}	0.437 ^{b}
Firm	**	0.311 ^{b}	0.477 ^{a}	0.331 ^{ab}	0.331 ^{ab}	**	0.338 ^{ab}	0.450 ^{a}	0.212 ^{b}	0.344 ^{a}
Delayed intense melt-in-the-mouth sensation	*	0.099 ^{b}	0.318 ^{a}	0.278 ^{a}	0.265 ^{a}	*	0.185 ^{b}	0.477 ^{a}	0.305 ^{b}	0.219 ^{b}
Creamy	*	0.662 ^{a}	0.344 ^{b}	0.338 ^{b}	0.430 ^{b}	*	0.530 ^{a}	0.331 ^{b}	0.503 ^{a}	0.430 ^{ab}
Adhesiveness in the mouth	*	0.139 ^{c}	0.497 ^{ab}	0.530 ^{a}	0.371 ^{b}	*	0.192 ^{c}	0.517 ^{a}	0.623 ^{a}	0.351 ^{b}
Energizing	*	0.550 ^{a}	0.232 ^{b}	0.185 ^{b}	0.272 ^{b}	*	0.444 ^{a}	0.205 ^{b}	0.152 ^{b}	0.205 ^{b}
Indulgent	*	0.874 ^{a}	0.351 ^{b}	0.344 ^{b}	0.477 ^{b}	*	0.841 ^{a}	0.397 ^{bc}	0.311 ^{c}	0.470 ^{b}

* Indicates significant differences between samples for each method according to Cochran's *Q* test at $p \leq 0.001$. ** Indicates significant differences between samples according to Cochran's *Q* test at $p \leq 0.01$ for each method. Comparisons between pairs using the McNemar (Bonferroni) procedure; different letters in the same line show significant differences for each method.

All attributes resulted in a significant proportion of mentions exceeding 15%, except for "very dark color", which did not typify the tested samples. Yet, 35% of CATA-L and 43% of CATA-F consumers marked it as the ideal product, indicating it is a desired trait in commercial products.

Concerning the two CATA questionnaires, the most important attributes for the ideal product, mentioned by over 70% of consumers, are "chocolate's characteristic color, smell and flavor", "tasty", and "indulgent". The attribute "good appearance" was also selected by 74% and 64% of the consumers for the ideal product and was observed in chocolates one and three, as were the attributes "characteristic smell and taste". The attribute "soft melting in the mouth" was also marked by most consumers and was not observed in commercial chocolates. Regarding the chocolate samples, the attributes were characterized at practically the same frequencies, with chocolates one and three perceived as having the most characteristic color and smell. In contrast, chocolate two was described as having a lighter color and weaker smell.

3.3.3. Ideal Product

The ideal product concept refers to the standard of perfection, i.e., the consumer's description of the product's characteristics as perfect [18]. Figures 1 and 2 present the correspondence analysis for grape juice using the CATA-L and CATA-F methods, respectively. For CATA-L, the correspondence analysis obtained 96% data explanation, and CATA-F achieved 94%, characterizing the richness of information generated by the CATA questionnaire. Both methodologies presented similar correlation configurations.

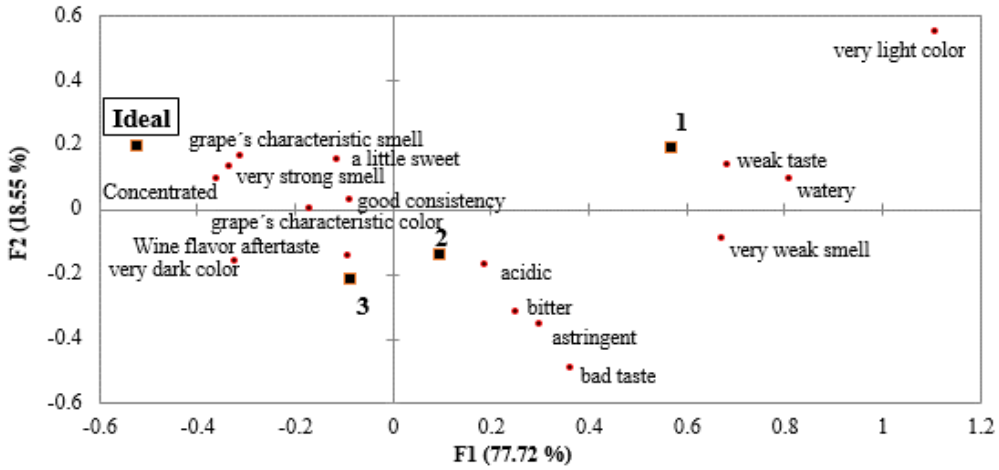

Figure 1. Representation of whole grape juice samples, the ideal product, and the attributes in the CATA-L count correspondence analysis' first (F1) and second (F2) dimensions.

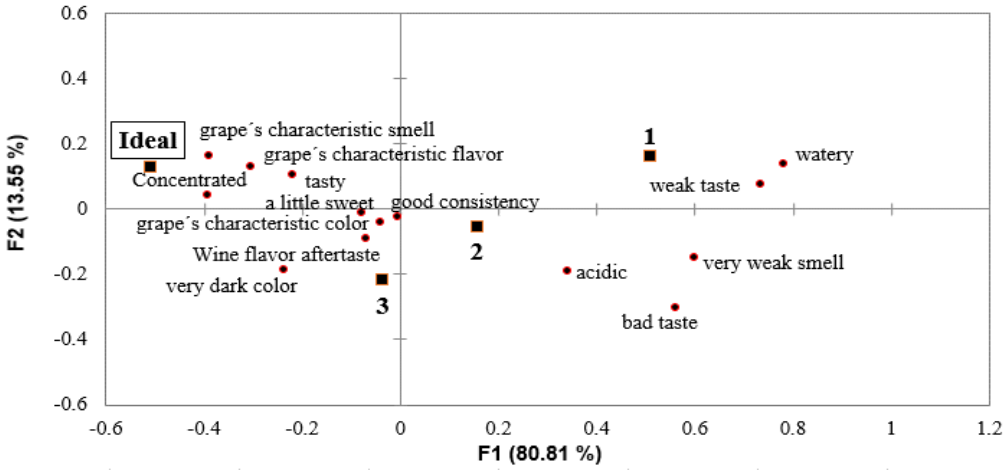

Figure 2. Representation of whole grape juice samples, the ideal product, and the attributes in the CATA-F count correspondence analysis' first (F1) and second (F2) dimensions.

Grape juices were well characterized and differentiated by consumers. In both methods, juice one is perceived to have the attributes "weak taste" and "watery". Juice two, in turn, is characterized by the "acidic" attribute in both methods, in addition to the "good consistency" attribute for CATA-F. Juice three is characterized primarily by the attributes "very dark color" and "wine flavor aftertaste" by both methods. According to the correspondence analysis, the ideal juice for both methods is characterized by the attributes "characteristic smell" and "concentrated", as well as "very strong smell" for CATA-L and "characteristic taste" and "tasty" for CATA-F. In neither method were commercial juices close to the ideal juices for consumers.

According to Bender et al. [35], whole juice should have the sensory characteristics of the fruit that generated it and offer a predominantly sweet taste, but not be excessive concerning its acidity. Moreover, one of the most desired qualities is a balance between sweet and sour tastes, and it should not possess a cooked, musty, or any other strange and unpleasant taste. Studies found that consumers appreciate grape products whose sensory attributes are perceived at a high intensity and balance each other [40]. According to Bendaali et al. [41], color is the most important characteristic when choosing beverages and is used by consumers as an indicator of juice quality. There is a strong relationship between color and flavor, as consumers can base their expectation of flavor on the color of products [42].

For milk chocolate bars, the correspondence analysis explained 97% and 95% of the data variations in CATA-L (Figure 3) and CATA-F (Figure 4), respectively. Chocolates were well characterized and differentiated by consumers. The ideal chocolate was described as "tasty", "chocolate's characteristic flavor", and "indulgent" in both methods, as well as "creamy" and "a little sweet" for CATA-L and "good texture" and "soft melting in the mouth" for CATA-F. Chocolate two is characterized by "weak taste" and three by "characteristic smell", "characteristic color", and "good appearance" in both CATA methods, and chocolate one by the "firm" attribute in both methods. The differences found in the correspondence analysis between the two methods (CATA-L and CATA-F) regarding grape juice and chocolate are related to the attributes that most characterize the ideal products. For CATA-F, they are more general ("tasty", "characteristic flavor"), and for CATA-L, they are more specific ("characteristic smell", "concentrated", "creamy", "a little sweet").

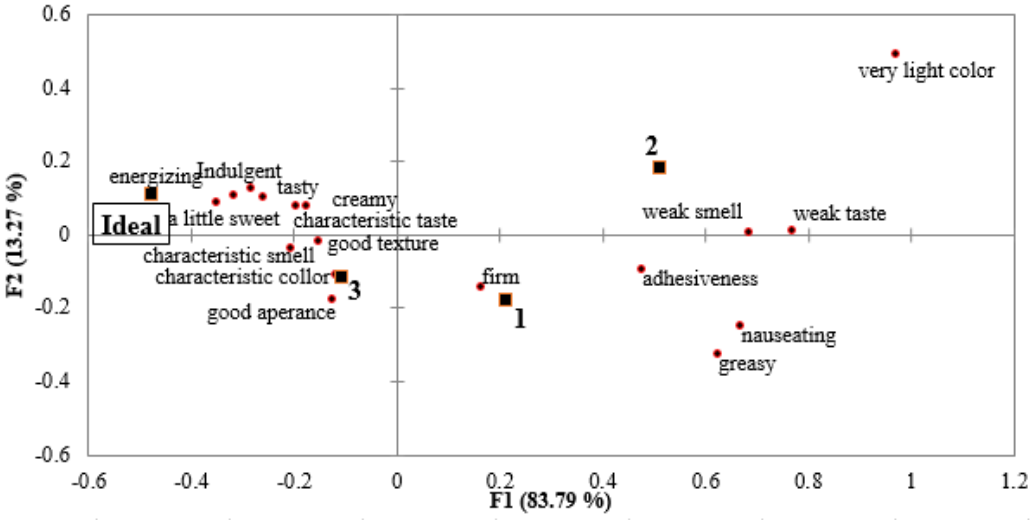

Figure 3. Representation of milk chocolate samples, ideal product, and attributes in the first (F1) and second (F2) dimensions of the CATA-L count correspondence analysis.

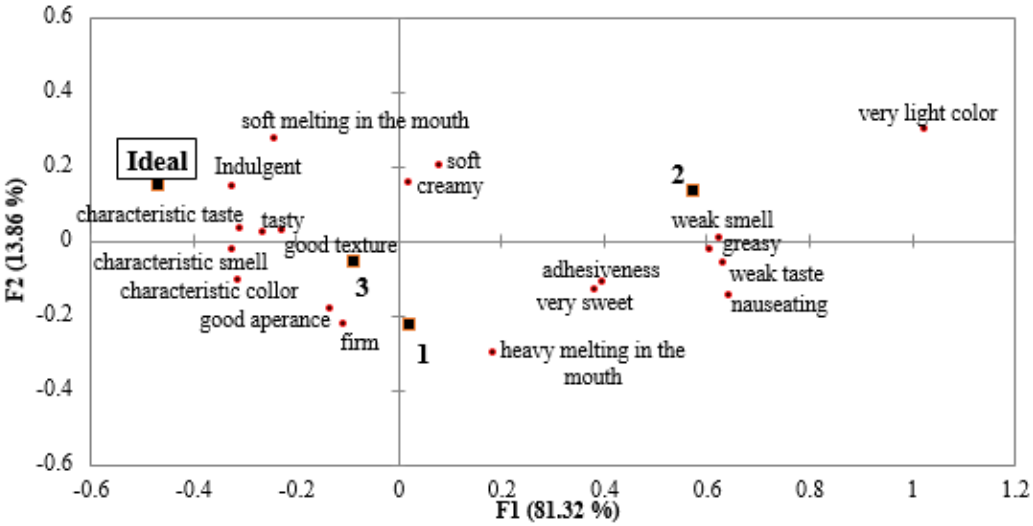

Figure 4. Representation of milk chocolate samples, ideal product, and attributes in the first (F1) and second (F2) dimensions of the CATA-F count correspondence analysis.

According to Worch et al. [43], in the "ideal" case, consumers describe fictitious products they would like more than those under analysis, if any. However, the data provided by the ideal method must be consistent, meaning that its sensory profile must be in accordance with the sensory and hedonic classifications provided by the tested products, and its estimated appreciation potential must be high.

The RV coefficient test was performed between the sample configurations in the first and second dimensions of the correspondence analysis [4] to depict the similarity between the two CATA methods. For grape juice, the RV coefficients varied between 0.367 and 0.413, indicating that the methods were not similar, which may indicate that the way consumers described the samples differed between the methodologies. For milk chocolate bars, the RV coefficients varied between 0.842 and 0.861, indicating a high similarity between the methods. These results suggest that the accuracy and reproducibility of sensory information obtained by consumers with CATA-F are comparable to those of CATA-L for milk chocolate but not for grape juice. Therefore, it indicates that the difference in the order in which the CATA ideal is asked about may or may not change the answers. Such a result can confirm the hypothesis that the consumer responds more spontaneously and genuinely to CATA-F when compared to CATA-L.

In addition, a penalty–rewards analysis was performed to identify the attributes most related to general acceptability by consumers, measuring how much the acceptability was penalized or increased due to deviations in the hedonic scores in the sensory profiles between actual and ideal products [15,16]. The influence of the attributes on average hedonic ratings was assessed. Attributes that positively affect acceptance when identified in ideal and actual products are deemed "essential" in the real product. Conversely, attributes found in the samples but not in the ideal product are viewed as "undesirable" by consumers.

Figure 5 shows the attributes that had significant positive and negative effects on the mean acceptance of different samples of whole grape juice for both CATA methods. For both CATA questionnaires, the attributes "tasty", "grape's characteristic flavor", "very strong smell", "wine flavor aftertaste", "grape's characteristic color", "grape's characteristic smell", and "good consistency", had a positive effect on average acceptance when perceived in commercial juices and are therefore necessary for grape juice. There are some differences in the impact of the hedonic average between the two methods. For CATA-L grape juice, the relevant attributes not identified in the CATA-F were "a little sweet" and "concentrated", which are attributes that were perceived after further product analysis and more analytical.

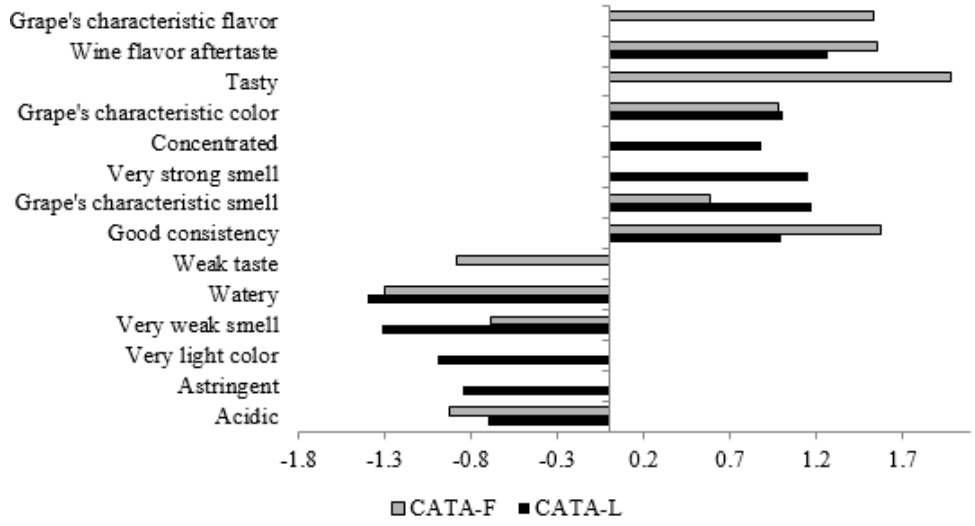

Figure 5. Significant positive and negative impact on the overall hedonic average for grape juice, CATA-L, and CATA-F.

In evaluating the attributes that generate a negative impact on the hedonic average, particularly those absent ("do not have") from the products, it could be verified that the greatest negative impact on grape juice's hedonic average is the "watery" attribute, with values of −1.4 and −1.3 points for CATA-L and CATA-F (Figure 5), respectively. The attributes "very weak smell", "astringent", and "acidic" also had negative impacts on both methods, albeit with slightly different intensities. The significant difference between the methods

refers to the "very light color" attribute in CATA-L, which is a more analytical attribute, while in CATA-F, it was "weak taste" that was more related to the "watery" attribute.

Figure 6 indicates the significant positive and negative effects on the mean acceptance of different milk chocolate samples for CATA-L and CATA-F, respectively.

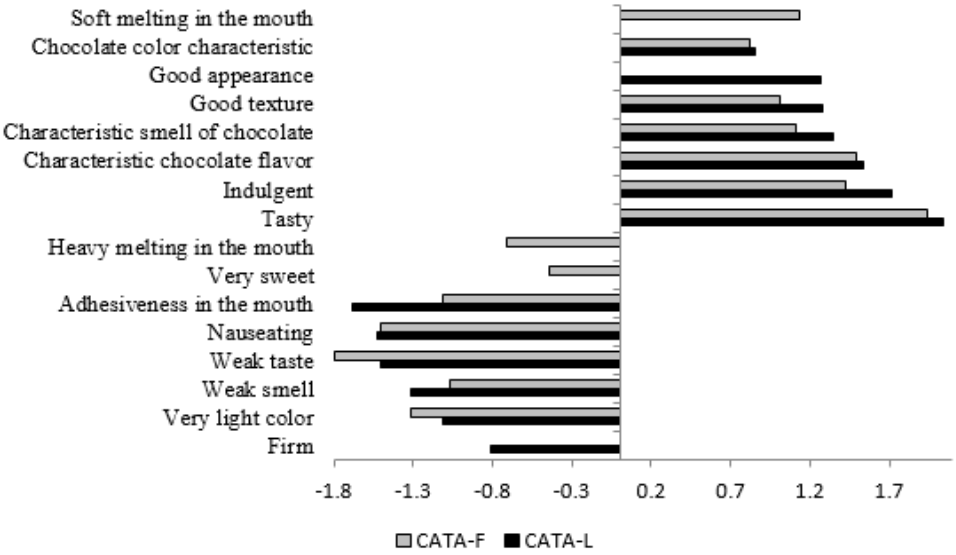

Figure 6. Significant positive and negative impact on the overall hedonic average for milk chocolate bars, CATA-L, and CATA-F.

The attribute with the highest impact on the hedonic average was "tasty", with increases of 2.0 and 1.9 points in CATA-L and CATA-F, respectively. The lowest impact was "characteristic color", with an increase of 0.8 points in both methods. The other significant attributes showed varying results regarding their positive influence on the hedonic average between the two methods, with CATA-L scoring higher. The primary distinction between the outcomes of the two methods is the recognition of four additional attributes (creamy, soft, energizing, good appearance) in CATA-L that significantly contribute to the positive hedonic impact. Additionally, one more attribute (firm) was noted in CATA-L as having a negative influence, which was not identified in CATA-F. Although chocolate flavor is often considered the most important and studied attribute in product identification, studies point out that texture and appearance are key attributes in consumer choice and acceptance and are essential to product quality [44,45], corroborating the findings of this study. For chocolate, it should be noted that the RV coefficients were similar between the methods. However, differences emerged in the penalty–rewards analysis. After evaluating each attribute through a penalty–rewards analysis, it was possible to verify which attributes are essential and which ones the product should not contain to be considered ideal, as summarized in Table 5. It is noteworthy that for grape juice and milk chocolate, when asking the question of the ideal product at the end (CATA-L), there is a greater positive and negative impact on the hedonic average, that is, greater discrimination by consumers when compared with CATA-F, implying that the evaluator tends to be more analytical and specific during the evaluation process, as previously observed by Earthy, Macfie, and Hedderley [25] in hedonic studies.

Table 5. Summary table of essential and undesirable attributes of grape juice and milk chocolate for both CATA methods.

Attributes	Grape Juice		Milk Chocolate	
	CATA-L	CATA-F	CATA-L	CATA-F
Essentials	Characteristic color * Characteristic smell * Good consistency * Very strong smell Concentrated	Characteristic color * Characteristic smell * Good consistency * Tasty Characteristic flavor	Characteristic color * Characteristic smell * Characteristic flavor * Tasty * Good texture * Indulgent * Good appearance	Characteristic color * Characteristic smell * Characteristic flavor * Tasty * Good texture * Indulgent * Soft melting in the mouth
Undesirable	Very weak smell * Watery * Acidic * Very light color Astringent	Very weak smell * Watery * Acidic *	Very light color * Weak smell * Weak taste * Nauseating * Adhesiveness in the mouth * Firm	Very light color * Weak smell * Weak taste * Nauseating * Adhesiveness in the mouth * Very sweet Heavy melting in the mouth

* Common attributes for both methods.

After examining the data, we observed that the sequence in which the ideal-product question is presented leads to variations in the characterizations of both real and ideal products. This aligns with the findings of Matos and Trez [46], who demonstrated that two surveys with identical questions could yield notably different results merely by altering the order of the questions. According to Carlomagno [47], the order of the questions when applying the questionnaires must be considered, as this order can influence the responses of the evaluators. Responses given to earlier questions can influence responses to later questions [48]. In terms of neuropsychology and social psychology, in turn, how the initial stimulus is applied can affect an individual's responses to subsequent stimuli without knowing the subject of such influence [49]. Thus, CATA-F could be a new way of evaluating how consumers describe an ideal product without previous stimuli.

3.4. Consumer Acceptance

Global consumer acceptance was assessed using a nine-point hedonic scale. The results of the CATA-L and CATA-F (Figure 7) grape juice scores are presented below. For grape juice, a significant observation was that acceptance rates surpassed 70% among respondents in both methods. Furthermore, all three juice brands under evaluation consistently obtained ratings over six.

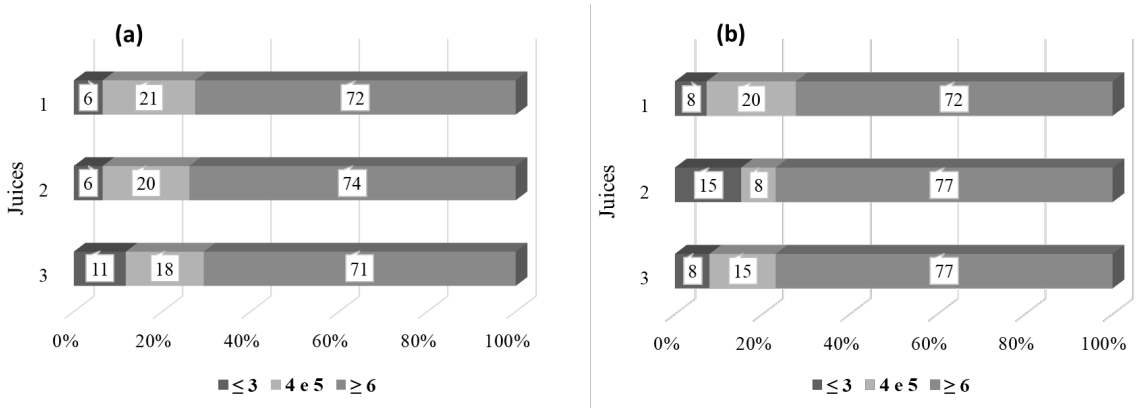

Figure 7. Histogram of acceptance scores for the evaluated grape juice samples: (**a**) CATA-L, (**b**) CATA-F (%).

For chocolate, we can observe (CATA-L and CATA-F, Figure 8) different results for both methods regarding chocolates one and two.

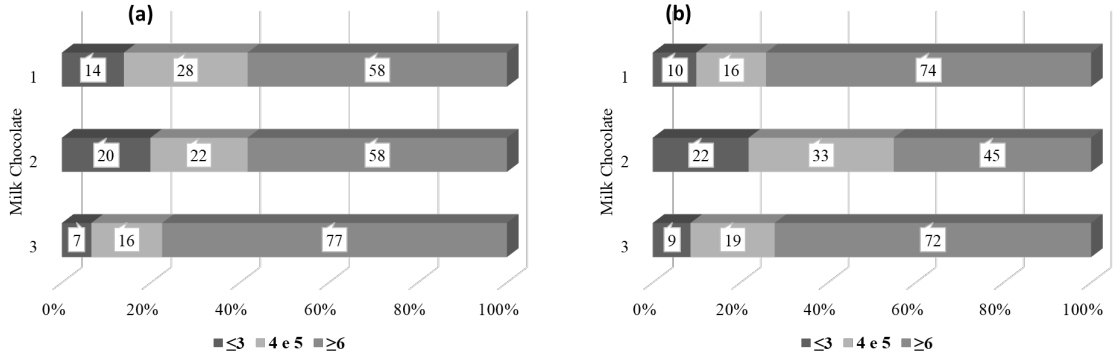

Figure 8. Histogram of acceptance scores for the evaluated milk chocolate samples: (**a**) CATA-L, (**b**) CATA-F (%).

Figures 7 and 8 offer a comprehensive insight into the hedonic classification of grape juice and milk chocolate, respectively.

For grape juice (Figure 7), both the CATA-L (a) and CATA-F (b) methodologies exhibit a high level of alignment in their results. Juice 1 received ratings above six from 72% of respondents in both methods. Juice 2 secured a slightly higher percentage of 74% in method (a) and 77% in method (b) for ratings above six. Juice 3 demonstrated similar acceptance levels, with 71% in method (a) and 77% in method (b).

Turning to milk chocolate (Figure 8), while there are some variances, a general trend of consistency between the two methods persists. Chocolate 1 received ratings exceeding six from 58% of participants in method (a) and a higher rating of 74% in method (b). Chocolate 2 maintained consistent ratings, with 58% in method (a) and a slightly divergent 45% in method (b) for ratings above six. Chocolate 3 exhibited the most significant percentage difference, with 77% in method (a) and 72% in method (b).

These results emphasize a key observation: the predominant preference for products remains consistent irrespective of the employed methodology. This observation extends across both food matrices, grape juice and milk chocolate. Whether a product was favorably received or less preferred in the CATA-L method, similar outcomes were reflected in the CATA-F method. This consistency affirms that the sequencing in which the "ideal" product attributes were identified did not influence product acceptance, suggesting that both CATA-L and CATA-F are robust techniques for capturing consumer preferences.

4. Conclusions

The free-listing method has emerged as an effective tool for capturing a representative lexicon related to the sensory attributes of food products. The current study accurately employed this method to discern four sensory attribute categories for whole grape juice and five for milk chocolate bars. The derived lexicon offers insight into consumers' sensory perceptions and emotional responses to these products.

When interpreting the results of the check-all-that-apply (CATA) questionnaires, the positioning of the 'ideal' question proved crucial. If the aim is to gain a comprehensive, holistic grasp of how consumers recognize product attributes, the CATA-First (CATA-F) methodology stands out. The portrayal of the ideal product using this approach was more exhaustive and seemed to capture the authentic targets of consumers. Conversely, if more precise characterization of actual test samples is sought, the CATA-Last (CATA-L) method would be the method of choice. It provided more detailed results, captured a broader range of attributes, and demonstrated a pronounced influence on the hedonic average. Thus, CATA-F offers a novel possibility to estimate consumer descriptions of the typical product without any preceding stimuli.

While evident, the influence of question placement may vary based on factors intrinsic to the product samples in question. This highlights the importance of the hypothesis that initiating with attributes of the ideal product before evaluating actual products could imply more spontaneous and genuine responses. This hypothesis calls for further exploration across diverse food matrices, each with unique complexities. Such investigations would provide a more profound understanding of CATA questionnaires, unraveling the strengths and potential pitfalls of the 'ideal' product description.

Expanding this line of inquiry to include a broader spectrum of food products and their packaging materials is vital, each presenting its unique complexities. Moreover, future studies must be more demographically inclusive to ensure a holistic understanding, capturing the cultural, social, and personal nuances that blend consumer preferences.

In sum, while the recent research offers a fresh perspective on the 'ideal' product description within the CATA framework, much work remains to be conducted. A balanced consideration of its findings, limitations, and future directions ensures that consumer research remains ever-evolving and insightful.

Author Contributions: Conceptualization, K.A.A., S.D.D., F.S.B. and C.D.; methodology, K.A.A., S.D.D., F.S.B., E.R.A., C.D. and J.F.R.; validation, K.A.A., S.D.D., F.S.B., E.R.A., C.D., C.S. and J.F.R.; formal analysis, K.A.A. and S.D.D.; investigation, K.A.A.; resources, K.A.A., S.D.D., E.R.A. and C.D.; writing—original draft preparation, K.A.A., S.D.D., F.S.B., C.D., C.S. and J.F.R.; writing—review and editing, all authors; visualization, K.A.A., C.D., C.S. and J.F.R.; supervision, S.D.D., E.R.A. and C.D.; funding acquisition, K.A.A. and C.D. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by CAPES, grant number 88882.385763/2019-01.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, submitted to the Research Ethics Committee (CEP) of the Federal University of Goiás—UFG, and approved by Opinion Number CAAE 06671219.2.0000.5083, in compliance with the legal requirements established by Operational Standard No. 001/2013 CONEP/CNS.

Informed Consent Statement: Informed consent was obtained from all subjects involved in this study.

Data Availability Statement: Not applicable.

Acknowledgments: This work was supported by CAPES (88882.385763/2019-01) and projects REQUIMTE/LAQV—UIDB/50006/2020 and UIDP/50006/2020, and financed by the FCT/Ministério da Ciência, Tecnologia e Ensino Superior (MCTES) through national funds. The authors also thank the CNPq and FAPEMIG.

Conflicts of Interest: The authors declare no conflict of interest.

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