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Free comment as a valuable approach to characterize and identify the drivers of liking of high-protein flavored milk drink submitted to ohmic heating

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ABSTRACT

Flavored milk drink is a popular dairy product traditionally processed by pasteurization, which is a safe and robust process. Still, it can imply a greater energy expenditure and a more significant sensorial alteration. Ohmic heating (OH) has been proposed as an alternative to dairy processing, including flavored milk drink. However, its impact on sensory characteristics needs to be evidenced. This study used Free Comment, an underexplored methodology in sensory studies, to characterize five samples of high-protein vanilla-flavored milk drink: PAST (conventional pasteurization 72 °C/15 s); OH6 (ohmic heating at 5.22 V/cm); OH8 (ohmic heating at 6.96 V/cm); OH10 (ohmic heating at 8.70 V/cm), and OH12 (ohmic heating at 10.43 V/cm). Free Comment raised similar descriptors to those found in studies that used more consolidated descriptive methods. The employed statistical approach allowed observation that pasteurization and OH treatment have different effects on the sensory profile of products, and the electrical field strength of OH also has a significant impact. PAST was slightly to moderately negatively associated with "acid taste," "fresh milk taste," "smoothness," "sweet taste," "vanilla flavor," "vanilla aroma," "viscous," and "white color." On the other hand, OH processing with more intense electric fields (OH10 and OH12) produced flavored milk drinks strongly associated with the "in natura" milk descriptors ("fresh milk aroma" and "fresh milk taste"). Furthermore, the products were characterized by the descriptors "homogeneous," "sweet aroma," "sweet taste," "vanilla aroma," "white color," "vanilla taste," and "smoothness." In parallel, less intense electric fields (OH6 and OH8) produced samples more associated with a bitter taste, viscosity, and lumps presence. Sweet taste and fresh milk taste were the drivers of liking. In conclusion, OH with more intense electric fields (OH10 and OH12) was promising in flavored milk drink processing. Furthermore, the free comment was a valuable approach to characterize and identify the drivers of liking of high-protein flavored milk drink submitted to OH.

1. Introduction

The food sector is increasingly competitive, which motivates the food industries to become more attentive to innovation possibilities. For example, the competition in the dairy sector manifests in the most diverse categories of products, e.g., cheeses, yogurts, flavored milk drinks, and conventional milk. In this way, dairy industries have focused on different types of innovations, such as the addition of bioactive and functional ingredients (Adinepour et al., 2022), the use of raw materials with a natural and sustainable appeal (Schiano et al., 2021), the development of healthier food products (reduction of salt, sugar, and fats) (Antunes et al., 2021), and elaboration with emerging processing technologies (Ribeiro et al., 2022).

Flavored milk drink is a generally ready-to-drink beverage made

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with milk, sugar, flavorings, and, eventually, food coloring. Flavored milk drink is traditionally marketed as pasteurized products, kept under refrigeration, or as ultra-high temperature processed (UHT) products, which do not require refrigeration. It is among the most popular dairy products and is considered a good alternative to regular milk, mainly for children and adults that dislike milk's typical taste. The global market reached USD 46 billion in 2020 and it is expected to grow at a compound annual growth rate of 8 % up to 2026 (EMR, 2022).

Flavored milk drink has already demonstrated good performance when elaborated with emerging processing technologies, such as pulsed electric field (Bermúdez-Aguirre et al., 2010) and ultrasound (Monteiro et al., 2018). Ohmic heating is a thermal emerging technology consisting of the passage of an electrical current through the food product, resulting in a uniform and rapid heating (Waziiroh et al., 2022). In our previous study, we observed that flavored milk drink submitted to ohmic heating (OH) presented increased functional properties (anti-diabetic, anti-hypertensive, and antioxidant activities) and improved rheological characteristics (Rocha et al., 2022). Furthermore, the electrical field strength was a critical process parameter (Rocha et al., 2022).

The impact of emerging processing technologies on sensory characteristics has been the subject of investigations by researchers in sensory and consumer science (Cardello et al., 2007; Perrea et al., 2015; Priyadarshini et al., 2019). Generally, research is concerned with two main points: evaluating how technology affects the intrinsic sensory characteristics of products (appearance, aroma, flavor, and texture) (Silva et al., 2020) and investigating consumers' perception of the use of emerging technologies (dos Santos Rocha et al., 2022).

Free comment (FC) is a research technique initially widespread in socio-economics, psychology, sociology, epidemiology, and marketing (Lawrence et al., 2013). However, FC has gradually gained acceptance in food science (Fonseca et al., 2016; Lawrence et al., 2013; Mahieu, Visalli, Thomas, et al., 2020; Mahieu et al., 2022). In the FC technique, the participants are asked to evaluate a product using their vocabulary freely, without using scales or lists with pre-defined terms (Ares & Deliza, 2010). The data from the FC (words, isolated or organized in small sentences) can be analyzed with qualitative research approaches (e.g., content analysis and thematic analysis) or quantitative analysis techniques. In the quantitative methods, the textual data are transformed into codes (Esmerino, Ferraz, et al., 2017) and evaluated with statistical techniques, such as Chi-square global and per cell (Lee et al., 2013; Rodrigues et al., 2021; Vidal et al., 2015), and Cochran's Q test (Mahieu, Visalli, & Schlich, 2020). However, these approaches might be limited for FC data because the independence of the observations may be compromised, as the same consumer (evaluator) evaluates all samples of the set (Mahieu, Visalli, & Schlich, 2020). Therefore, Mahieu et al. (2022) proposed a modified chi-square to analyze data from multiple responses using a multiple-response dimensionality dependence test, a multiple-response correspondence analysis (MR-CA), and a hypergeometric multiple-response test. However, the authors evaluated only cooked ham, and more studies are necessary to validate the methodology and the statistical approach.

This study used FC with the statistical analysis approach Mahieu et al. (2022) proposed to characterize, for the first time, high-protein vanilla flavored milk drink processed by OH or pasteurization. Our aim is to validate the utilization of FC and the suggested statistical approach to describe samples submitted to emerging technologies. Finally, for the first time, the impact of OH on the sensory profile of the products was evaluated using FC, and the drivers of liking and disliking for flavored milk drink were assessed.

2. Material and methods

2.1. High-protein flavored milk drink processing

The flavored milk drink processing was published recently (Rocha et al., 2022). First, refrigerated raw milk (3 % w/w fat, 3 % w/w protein, Ateliê do Queijo, Casemiro de Abreu, Brazil) was added with 10 % industrial whey protein isolate (WPI, 90 % total protein, Sooro Renner Nutrição S/A, Paraná), 3 % sucrose (União, São Paulo) and 0.5 % w/w vanilla flavor. The concentration of WPI was defined to obtain a product with 12 g of protein per 100 mL, classifying it as a high-protein drink (BRASIL, 2012). The samples were then processed by conventional heat treatment or OH.

Five formulations were prepared: conventional pasteurization (72 °C/15 s; PAST), OH at 5.22 V/cm (OH6), OH at 6.96 V/cm (OH8), OH at 8.70 V/cm (OH10), and OH at 10.43 V/cm (OH12). All samples submitted to OH followed the same binomial time/temperature that the PAST sample, and for both processes, the parameters were controlled by a clock and bookmarks to voltage, current, and/or temperature. In all samples, after reaching the temperature and waiting for 15 s, the samples were immediately immersed in a cold-water solution for rapid cooling. The electric field strength values result from calculating the voltage applied to the process with the distance between electrodes.

2.2. Free comment

The FC was performed following Mahieu et al. (2022). One hundred and ten consumers of flavored milk drinks (aged 18–65, 65 male, 45 female, at least once a week) were invited to describe the sensory profiling of the samples in the following order: appearance (visual aspect), aroma, taste, and texture. For each sensory modality, the following instructions were given to the consumers:

✓ Appearance: "Please describe the appearance of this flavored milk drink.".
✓ Aroma: "Please describe the aroma of this flavored milk drink.".
✓ Taste: "Please describe the taste of this flavored milk drink.".
✓ Texture: "Please describe the texture of this flavored milk drink.".

After the FC task, the consumers rated the flavored milk drink samples' overall liking using an unstructured nine-point hedonic scale. The Ethical Committee of the Federal Institute of Rio de Janeiro (IFRJ) approved the study with protocol number 51314321.0.0000.5268.

2.3. Statistical analysis

The descriptions obtained by the FC task were cleaned, lemmatized, and filtered (Anandarajan et al., 2019). In this way, the open-ended responses were systematically converted into some terms of most significant interest. The descriptors with similar meanings were grouped by triangulation technique, i.e., three researchers independently grouped the terms. Furthermore, the results generated individually by the three researchers were discussed in a subsequent meeting to reach a consensus (Pontual et al., 2017). Finally, the sensory descriptors mentioned by at least 5 % of the participants were considered for quantitative analysis to avoid losing a large amount of information and were cross-tabulated with the consumers and the products, indicating whether each descriptor was cited in the corresponding evaluation or not, in a similar way as check all that apply (CATA) data.

A MR-CA (Mahieu et al., 2021) was performed to depict the sensory space based on each product's descriptor citation proportions. In addition, a confidence ellipse ($\alpha = 5$ %) was built based on bootstrap resampling of the consumers (1000 simulations).

The consumers were clustered using local Clustering around Latent Variables (CLV) (Vigneau & Qannari, 2003) with consolidation. The hierarchical tree was cut at the step of the maximum relative increase in the clustering criterion. This resulted in retaining two clusters of consumers. Individual consumer liking scores were then regressed against MR-CA axes to investigate which directions of the sensory space mainly drive liking and the differences between the two clusters.

For each pair of products and descriptor, a multiple-response hypergeometric test was performed with a two-sided alternative hypoth-

Table 1
Sensory descriptors obtained with Free Comment task (n = 120 consumers).

Appearance	*"Please describe the appearance of this flavored milk"*	White color Yellow color Presence of lumps Homogeneous
Aroma	*"Please describe the aroma of this flavored milk"*	Fresh milk aroma Sweet aroma Vanilla aroma
Taste	*"Please describe the taste of this flavored milk"*	Acid taste Bitter taste Fresh milk taste Sweet taste Vanilla taste
Texture	*"Please describe the texture of this flavored milk"*	Smoothness Viscous

esis (α = 5%) to investigate positive and negative associations between products and descriptors. Finally, for each of the two clusters of consumers, drivers of liking were investigated following the approach proposed by Mahieu et al. (2022), considering the panel and each cluster. Data analyses were performed using R 4.1.0 (R Core Team, 2020).

3. Results and discussion

The FC data for the flavored milk drink samples processed by OH or pasteurization and containing high protein content resulted in the fourteen descriptors that can be seen in Table 1. The data analysis strategy employed was intended to find the primary product descriptors to investigate consumer perception and associations between products and descriptors to check the effect of treatment on samples and then evaluate consumers' drives of liking to verify which of the descriptors are most related to "liking" behavior of consumers.

Despite using a methodology based on the free expression of consumers instead of a closed list of pre-defined descriptors (according to the CATA), almost all the attributes raised in the FC were in agreement with those used in other studies that evaluated flavored milk and flavored milk drinks (Guinard & Mazzucchelli, 1999; Oliveira et al., 2015; Oliveira & Deliza, 2021; Thompson et al., 2004). Only "white color," "acid taste," and "fresh milk aroma" were not found in the literature. These results suggest an excellent ability of consumers to describe samples freely. In addition, much of the consumer vocabulary could be grouped into synonyms and latent descriptors.

In the traditional statistical approach, the descriptors extracted from consumer comments are tabulated in contingency tables. Such tables expose the "attribution" or "non-attribution" of each descriptor term, for each product, by each of the consumers who participated in the test. Thus, data can be analyzed by citation frequency or the absolute value of citation count. The dependence (or independence) between products (samples) and descriptors (terms cited by consumers), exposed in the contingency tables, is traditionally analyzed by Chi-square (Lee et al., 2013; Rodrigues et al., 2021; Vidal et al., 2015), while significant

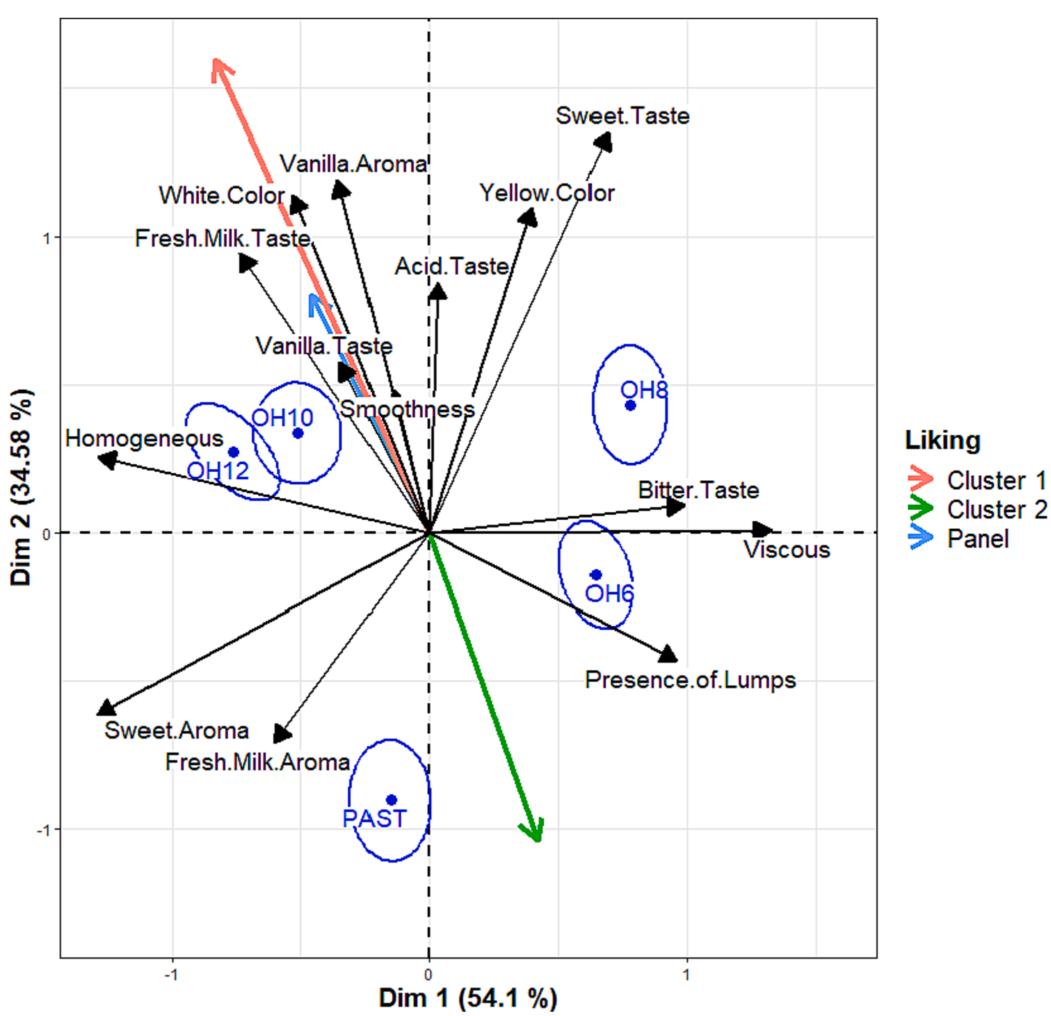

Fig. 1. Biplot from multiple-response Correspondence Analysis and the mean panel (Liking) and by segment (Cluster 1 and Cluster 2) liking scores (projected as supplementary variable).

	OH10	OH12	OH6	OH8	PAST
Acid.Taste	60.91	71.82	54.55	75.45	42.73
Bitter.Taste	50.00	40.91	73.64	85.45	57.27
Fresh.Milk.Aroma	59.09	72.73	62.73	34.55	75.45
Fresh.Milk.Taste	65.45	71.82	45.45	39.09	28.18
Homogeneous	62.73	66.36	19.09	30.00	47.27
Presence.of.Lumps	57.27	46.36	98.18	81.82	75.45
Smoothness	79.09	60.91	58.18	64.55	52.73
Sweet.Aroma	59.09	86.36	42.73	23.64	73.64
Sweet.Taste	46.36	38.18	49.09	66.36	13.64
Vanilla.Aroma	90.00	89.09	61.82	79.09	43.64
Vanilla.Taste	68.18	53.64	56.36	37.27	32.73
Viscous	22.73	33.64	77.27	64.55	37.27
White.Color	78.18	91.82	56.36	67.27	39.09
Yellow.Color	35.45	41.82	35.45	58.18	18.18

Fig. 2. Sensory descriptors with positive (green cells) and negative (red cells) and neutral (white cells) associations with products according with multiple-response hypergeometric test (α = 5 %). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

differences between proportions are routinely analyzed via Cochran's Q test (Stephen & Adruce, 2018). Therefore, it is customary to use correspondence analysis (CA) to generate a factor map that decomposes this dependence between the evaluated products and the descriptors. As a rule, the decomposition is carried out in axes of maximum dependence organized in descending order, adopting all axes (Bemfeito et al., 2021; Portela et al., 2022; Pramudya & Seo, 2018). In this way, products are compared according to the ratio between the citations of each descriptor and the total number of citations of all descriptors combined. So, samples containing products with very different average citation rates will distort the graphical representation (Mahieu et al., 2021).

However, despite the traditional use of chi-square, some critical limitations related to using this technique in data from the FC were pointed. That's because the p-value (in Pearson's chi-squared test) is only valid when the observations are independent, when no cell in the contingency table has a low count (>5) and when the table is not very sparse (Mahieu, Visalli, & Schlich, 2020). In studies with FC, the same consumer (evaluator) evaluates all the samples of the set, which compromises the independence of the observations.

Mahieu, Visalli, & Schlich (2020) proposed a dimensionality test using chi-square and Monte-Carlo simulation (simulations = 1000, α = 5 %) to calculate valid p-values. Furthermore, the authors proposed a modified chi-square square framework dedicated to analyzing multiple-response data in which experimental units are the evaluations (Mahieu et al., 2021). To overcome the noise caused by including all axes in the CA factorial map plot, the authors proposed a step-by-step method to test the dependence of each CA axis. This way, only the significant axes can be considered in the analysis. The number of significant CA axes is determined using the Monte-Carlo dependence tests (simulations = 1000, α = 5 %). MR-CA overcomes the limitations by scaling products according to the number of reviews rather than the number of citations received (Mahieu et al., 2021). Thus, the fact that some products receive more citations than others from the same sample set does not affect MR-CA as classical CA.

The Bi-plot of the MR-CA (Fig. 1) shows the positioning of the samples concerning the descriptors. As an indirect consequence, the Bi-plot presents a general aspect of the samples' sensory profile and the vectors' position related to the "liking" of consumers. Therefore, the position of samples and descriptors in the dimensions and among themselves (product × descriptor) is initially considered. The MR-CA Biplot allowed us to visualize the associations between samples and descriptors satisfactorily. However, the density of essential vectors in the second quadrant led to a deeper investigation of the association between samples and descriptors. Thus, the hypergeometric multiple response test was used to increase the clarity of the association between samples and descriptors (Fig. 2).

In the inspection of the "liking" vectors presented in Fig. 1, an antagonistic behavior of the two vectors that represent the two clusters of consumers is observed, as well as the predominance of consumers in cluster 1 and its consequent impact on the general vector "like" (panel). In this way, we can infer that the consumers were divided into two groups based on the acceptance of the products, with more consumers in cluster 1 (n = 77).

The descriptors "viscous," "bitter taste," and "presence of lumps" were the most positively associated with the first dimension. Among the samples, OH8 and OH6 were the most associated with Dim1 and the descriptors mentioned above. The intensity of these associations between samples and descriptors can be confirmed with the multiple-response hypergeometric test (Fig. 2). The low association of the "liking" vectors with the first dimension signals that OH6 and OH8 were the least accepted samples. The negative impact of low electric field strengths of OH on the acceptance of the products may be related to the longer times to achieve the processing temperature. In OH, the electric field strength is closely related to the time the sample is subjected to heating; stronger electric fields allow the sample to faster reach the desired temperature in processing (Cappato et al., 2017; Silva et al., 2020). Theoretically, there is a hypothesis that exposing the food to shorter heating periods reduces the intensity of undesirable heat-promoted changes in the matrix (Coolbear et al., 2022). In fact, OH12 and PAST flavored milk drinks took shorter times (4.16 and 4.58 min, respectively) to achieve the processing temperature than OH6, OH8, and OH10 (20, 12, and 6 min, respectively) (Rocha et al., 2022).

The thermal and non-thermal effects may have resulted in a higher denaturation of whey proteins and formation of denser protein aggregates in OH6 and OH8 samples, resulting in products with higher viscosity and presence of lumps (Sereechantarerk et al., 2021). Furthermore, the increased action of OH and prolonged heating on milk proteins, may have favored the formation of peptides with a bitter taste, which is a concern for the dairy industry due to its negative impact on sensory quality (Fox et al., 2015). Silva et al. (2020) reported that low and medium-intensity electric fields might be associated with increased bitterness in the samples. Flavored milk drinks are characterized by the low consistency and high homogeneity (Rocha et al., 2022), which may explain the lower acceptance of OH6 and OH8 samples.

Still, in the first dimension, "homogeneous" and "sweet aroma" were more negatively associated, while "fresh milk aroma" showed a subtle negative association. Among the samples, mainly OH12 and, more subtly, OH10 showed a negative association with Dimension 1. Only the OH12 sample was related to all descriptors with a stronger negative association in Dimension 1 (Fig. 2). The association of the "like" vectors of Cluster 1 and all consumers (panel) was also negative concerning Dimension 1. This way, OH10, and, mainly, OH12 were the most accepted samples considering dimension 1. In this way, the faster processing at higher electric fields (OH10 and OH12) may have resulted in smaller aggregates with lower fractions of accessible sulfhydryl groups, which stabilize rapidly, resulting in homogeneous products (Rodrigues et al., 2020).

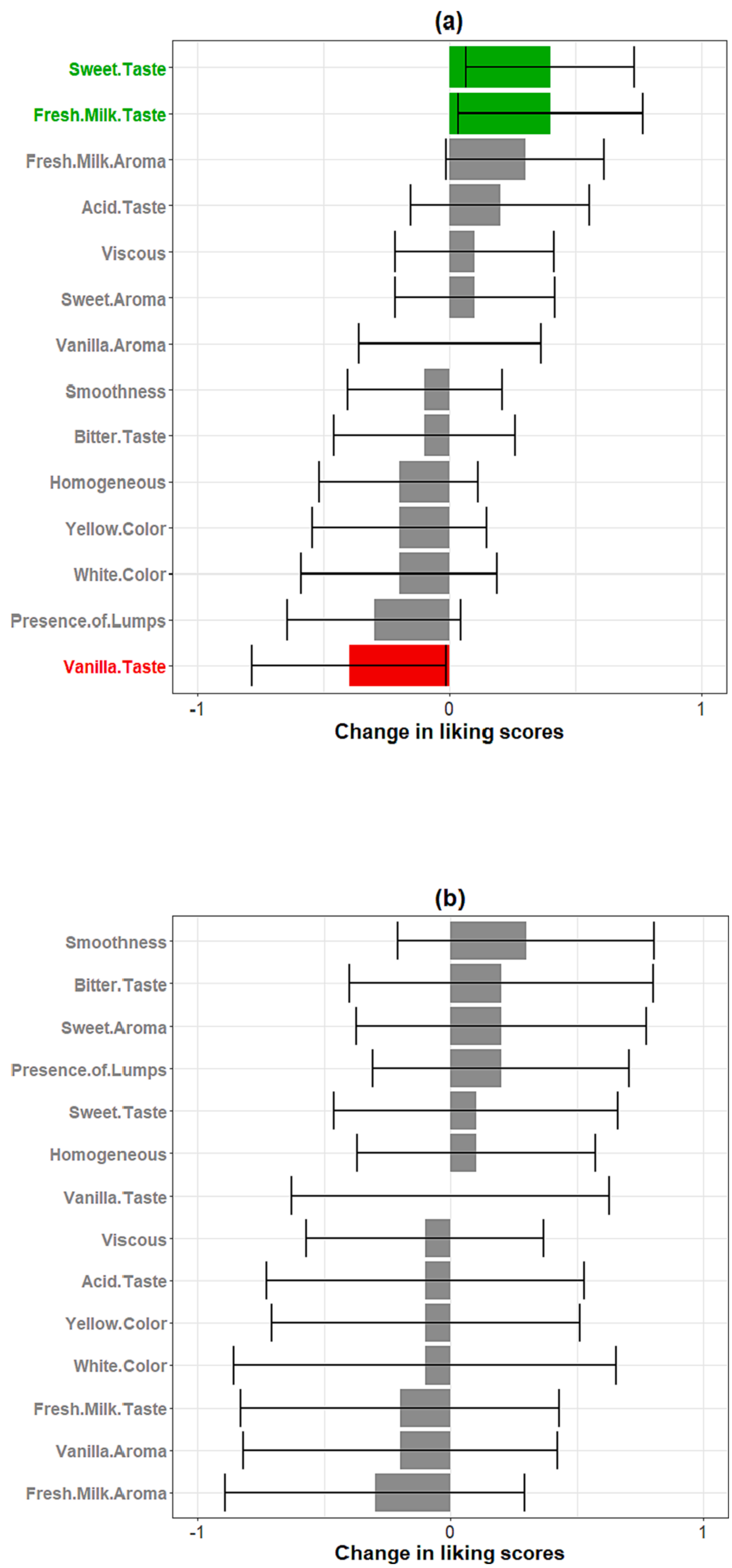

Fig. 3. Regression loadings of each descriptor with their respective confidence intervals (α = 5 %) for the two segments of consumers: (a) cluster 1 (N = 77) and (b) cluster 2 (N = 33).

The second dimension was positively associated with the descriptors "sweet taste," "vanilla aroma," "white color," "yellow color," "fresh milk taste," and "acid taste," and more subtly with "vanilla taste," and "smoothness." Among the samples, only OH10 and OH12 were associated with Dim2, and the attributes positively related to it. The vectors representing the "liking" of consumers in cluster 1 and, more subtly, of total consumers (panel) are also positively associated with the second dimension. This way, OH10, and OH12 were the most accepted samples considering dimension 2. The faster processing at higher electric fields (OH10 and OH12) may have resulted in lower formation of Maillard reaction products compared to the products subjected to lower electric field strength (OH6 and OH8) and PAST, with maintenance of the typical white or slightly yellow color of vanilla flavored milk drinks (Rocha et al., 2022). Furthermore, OH may have maintained or increased the number of volatile compounds, positively influencing the aroma and flavor characteristics of the products (dos Santos Rocha et al., 2022).

"Fresh milk aroma" and, more subtly, "sweet aroma" and "presence of lumps" were the attributes most negatively associated with the second dimension. Only "PAST" was more significantly associated with the second dimension among the samples, evidencing its different sensory profile compared to the samples treated by OH. PAST was also slightly to moderately negatively associated with "acid taste," "fresh milk taste," "smoothness," "sweet taste," "vanilla flavor," "vanilla aroma," "viscous," and "white color." The "liking" vector of the second cluster of consumers was negatively associated with the second dimension.

The hypothesis that heat promotes sensory changes in dairy products was proved in this study (Fox et al., 2015), suggesting the derived hypothesis: products with less aggressive heat treatments preserve more of the natural characteristics of the milk matrix. Thus, the hypothesis suggests that such an effect could be reflected in the descriptors related to fresh milk. "Fresh milk taste" was more strongly associated with products treated with more intense fields OH10 and OH12, while OH6 was neutral and OH8 and PAST were negatively associated. Regarding the "Fresh milk aroma," it can be observed that only OH12 and PAST were strongly associated.

The aroma and taste of vanilla also seem to have been affected by the treatment with higher intensity OH, being more associated with samples treated with stronger electric fields. The sweet aroma, according to fresh milk, was more associated with the OH12 and PAST samples. The analysis of aroma descriptors suggests that these seem more sensitive to the electric field intensity when compared to the analogous flavor descriptors. Acid taste, unlike bitter, does not necessarily represent a defect in dairy products. Thus, the simple association of the sample with such a descriptor does not allow apparent inferences.

In this way, most consumers liked the samples submitted to OH at stronger electrical fields (OH10 and OH12, n = 77, cluster 1), due to the improved characteristics. Still, many consumers also prefer the PAST product (n = 33, cluster 2), commonly found in supermarkets. This preference may be related to the familiarity with the products' characteristics. The samples' positioning demonstrated consumers' ability to discriminate between protein-rich flavored milk drink treated by pasteurization and OH.

Although the hypergeometric test is practical for the analyst to investigate its hypotheses regarding the product, it may not be sufficient to rank the most critical points for product improvement. Likewise, it is insufficient to reveal whether a descriptor is mentioned as a "quality" or a sensory "defect." In this way, the analysis was performed for the product-liking drivers to clarify which attributes are of greater importance to consumers and avoid an excessive interpretation of the data by the analyst. So often, what interests trained analysts and tasters are irrelevant to the final consumer (Chen & Opara, 2013; Mendes da Silva et al., 2021).

Fig. 3 highlights the distinct behavior of consumer clusters about liking drivers. For cluster 1 (Fig. 3a), the descriptors "sweet taste" and "fresh milk taste" were identified as positive drivers related to consumer liking. However, when analyzing the "sweet taste," only the OH8 sample showed a positive association, and only the PAST sample showed a negative association (Fig. 2). Regarding the "fresh milk taste," samples OH10 and OH12 showed a positive association, while OH8 and OH6 showed a negative association. The only driving of dislike was the "vanilla taste," positively associated with the OH10 sample and negatively associated with the PAST and OH8 samples. For cluster 2, no drives were identified. In this way, it may be concluded that the impact of OH on sweet taste and the maintenance of fresh milk taste contributed to the increase in its acceptance by consumers.

Among the studied samples, OH12 presented a better balance in the attributes of interest to the analysts, for example, a low association with the bitter taste and the presence of lumps and a strong association with the flavor and aroma of fresh milk. Also, a good balance in terms of consumer "liking" drivers, except for "sweet taste," which was below expectations. Therefore, OH12 proved to be the most promising sample among those studied, surpassing the pasteurized standard sample and the others treated with OH. However, the OH12 sample would need a brief correction of its sweet taste to better adhere to consumers' preferred drivers.

4. Conclusion

This was the first study to use the free comment to describe the sensory profile of flavored milk drink submitted to ohmic heating and identify the drivers or liking and disliking. Consumers raised the descriptors commonly observed in studies with other sensory methodologies using FC methodology. The employed statistical approach allowed observing that pasteurization and OH treatment have different effects on the sensory profile of products, and the electrical field strength also has a significant impact. Ohmic heating processing with more intense electric fields produces flavored milk drink that is more associated with fresh milk attributes and less with a bitter taste. At the same time, less intense electric fields tend to produce products that are more bitter, more viscous, and with a more significant presence of lumps. Further studies with a higher number of consumers and different food products are still necessary to prove the suitability of FC and the new statistical approach.

CRediT authorship contribution statement

Ramon S. Rocha: Conceptualization, Investigation, Data curation, Formal analysis. **Benjamin Mahieu:** Data curation, Writing – original draft. **Elson R. Tavares Filho:** Conceptualization, Investigation, Data curation, Formal analysis. **Patrícia B. Zacarchenco:** Conceptualization, Investigation, Data curation, Formal analysis. **Mônica Q. Freitas:** Conceptualization, Investigation, Data curation, Formal analysis. **Eliane T. Mársico:** Conceptualization, Investigation, Data curation, Formal analysis. **Tatiana C. Pimentel:** Writing – original draft, Writing – review & editing. **Erick A. Esmerino:** Writing – original draft, Writing – review & editing. **Adriano G. Cruz:** Conceptualization, Visualization, Funding acquisition, Project administration, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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