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Sensory and instrumental texture profile of gluten-free biscuit with different concentrations of carrot co-product flour

Perfil de textura sensorial e instrumental de biscoito isento de glúten com diferentes concentrações de farinha dos subprodutos da cenoura

Perfil sensorial y de textura instrumental de la galleta sin gluten con diferentes concentraciones de harina de subproductos de zanahoria

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Abstract
Instrumental texture profile analysis reproduces the chewing action and texture-related parameters. This, together with the sensory texture profile, allows the obtaining of representative results, characterizing the product under study in a more precise way. Therefore, this work aimed to evaluate the sensory and instrumental texture characteristics of gluten-free buttery biscuits with different proportions of carrot stems and leaf flour (CSLF). From the instrumental texture analysis and the texture profile by the Temporal Dominance of Sensations method, the results showed that the biscuits presented good instrumental quality. The hardness did not differ among the treatments studied, which shows that the increase in the concentration of CSLF did not interfere with this parameter, allowing the addition of higher concentrations of flour in the biscuits. The data from the Temporal Dominance of Sensations method showed positive attributes for the texture of biscuits with a higher concentration of flour, with the main dominant sensations being: crunchiness and low adhesiveness. The cookies showed good sensory quality, constituting a practical, affordable and healthy food alternative to serve the celiac public.
Keywords: Bakery; Texture; Sensory analysis; Co-product; Celiac.

Resumo
A análise de perfil de textura instrumental reproduz a ação da mastigação e os parâmetros relacionados com a textura. Esta, aliada ao perfil de textura sensorial permite a obtenção de resultados representativos, caracterizando de forma mais precisa o produto em estudo. Diante disto, este trabalho teve por objetivo avaliar as características de textura sensórias e instrumentais de biscoito tipo amanteigado isento de glúten com diferentes proporções de farinha de talos e folhas de cenoura. Sendo realizado, análise de textura instrumental, e o perfil de textura temporal por método Dominância Temporal das Sensações. Os resultados demonstraram que os biscoitos apresentaram boa qualidade instrumental, como à dureza, a qual não diferiu entre os tratamentos, o que mostra que o aumento da concentração de FTFC não interferiu nesse parâmetro, possibilitando a adição de maiores concentrações da farinha. Os dados do método Dominância Temporal das Sensações mostraram atributos positivos para a textura dos biscoitos com maior concentração da farinha, sendo as principais sensações dominantes a adesividade baixa e crocância. Os biscoitos apresentaram boa qualidade instrumental e sensorial, podendo ser uma boa alternativa de alimento prático, acessível e saudável para atender o público celíaco.
Palavras-chave: Panificação; Textura; Análise sensorial; Coproduto; Celíaco.

Resumen
El análisis instrumental del perfil de textura reproduce la acción masticatoria y los parámetros relacionados con la textura. Esto, combinado con el perfil de textura sensorial, permite obtener resultados representativos, caracterizando con mayor precisión el producto en estudio. Por lo tanto, este trabajo tuvo como objetivo evaluar las características sensoriales e instrumentales de la textura de galletas de mantequilla sin gluten con diferentes proporciones de harina

de tallo y hoja de zanahoria. Se realizó el análisis de textura instrumental y el perfil de textura temporal mediante el método de dominancia temporal de las sensaciones. Los resultados mostraron que las galletas presentaron buena calidad instrumental, en cuanto a dureza, la cual no difirió entre tratamientos, lo que demuestra que el aumento de la concentración de FTFC no interfirió en este parámetro, permitiendo la adición de mayores concentraciones de harina. Los datos del método de Dominancia Temporal de Sensaciones mostraron atributos positivos para la textura de las galletas con mayor concentración de harina, siendo las principales sensaciones dominantes baja viscosidad y crocancia. Las galletas presentaron buena calidad instrumental y sensorial, pudiendo ser una buena alternativa de alimentación práctica, accesible y saludable para atender al público celíaco.
Palabras clave: Panadería; Textura; Análisis sensorial; Coproducto; Celíaco.

1. Introduction

The use of alternative flours such as carrot co-products to fortify crackers is a way to increase the nutritional value of a product that is widely consumed by the population, taking advantage of the parts of the vegetable that are usually discarded~and that contain high nutritional value, besides being an option for individuals with dietary restrictions, such as those suffering from celiac disease, due to the difficulty of finding gluten-free products with nutritional and sensory quality (Silva et al., 2020). The limited variety of gluten-free products on the market highlights the difficulty in developing these products. According to Brites et al., (2019) "gluten-free cookies can be considered alternative products in the development of gluten-free foods, since they have a wide range of shapes and flavors, and are widely accepted by consumers".

The sensory characteristics of a product directly affect its acceptance by consumers. Therefore, studying the sensory profile allows the development of a new quality product. Texture, for example, is one of the most important attributes for biscuits, and directly influences the acceptance of the product by consumers (Gang Wu et al., 2021). This is normally perceived by three or four senses: the mechanical, tactile and, contingently, the visual and auditory receptors (Poiani & Montanuci, 2019). Methods such as Temporal Dominance of Sensations allow the observation of the prevalence of sensations related to it, thus obtaining the texture profile of the product. The instrumental texture profile analysis reproduces the chewing action, obtaining a force-time curve and the parameters related to the texture, this, together with the sensory texture profile, allows to obtain representative results that characterize more precisely the attributes given to the food, as foods with complex textures stimulate many sensory perceptions during oral processing (Guimarães et al., 2020).

Due to the high nutritional value of agricultural by-products, several works have been carried out. Oladunjoye et al., (2021) evaluated the effect of incorporating agro-industrial by-products in the preparation of biscuits, using compounds from plum and wheat bagasse. They obtained satisfactory outcomes, resulting in products with higher ash and fiber content, and lower levels of fat and calories, in addition to improving texture, increasing total phenolic content and antioxidant properties.

Silva et al., (2020), evaluating cookies with carrot co-product, obtained satisfactory results regarding sensory acceptance, demonstrating that the addition of higher concentrations of carrot stem and leaf flour did not interfere with the acceptance of the product, thus revealing the possibility of developing buttery cookies using agro-industrial co-products. Therefore, this work aimed to evaluate the sensory and instrumental characteristics of the cookie with carrot stem and leaf flour (CSLF), obtaining the sensory texture profile through the Temporal Domain of Sensations methodology and the instrumental texture profile, making it possible to obtain more complete information about the sensory characteristics of the product. Thus, allowing an alternative of a new product with higher nutritional value, gluten-free and low cost, aiming to serve the celiac public.

2. Materials and Methods

2.1 Materials

The work was developed at the Federal Institute of Education, Science and Technology of the Southeast of Minas

Gerais, Campus Barbacena. Carrot leaves were donated by a rural producer from Carandaí-MG and processed to obtain flour in the Vegetable Processing Sector of the aforementioned campus. The biscuits were prepared in the Bakery Laboratory, based on the buttery biscuit recipe. The ingredients used in their formulation were purchased from local businesses in the municipality of Barbacena and from the aforementioned institution.

2.2 Obtaining the Flour

The leaves and stems were selected, separating only the fresh green leaves, free from burns and/or stains, and that were not yellow or withered. The leaves were washed and sanitized by immersion in chlorinated water with a concentration of 100 mg L -1 of chlorine for 10 minutes. Soon after, the leaves were cut and separated from the stems and then dehydrated in a dryer (artificial drying) for approximately 2 hours and 30 minutes at 60°C. After dehydrated, the grinding proceeded in a blender, followed by sieving and packaging in plastic bags, stored at room temperature.

2.3 Cookie Processing

The biscuits were prepared using the cream mixture method, with manual molding into semi-spheres, followed by baking at 160ºC for approximately 10-15 minutes. The formulations of each treatment consisted of cassava starch, rice flour, sugar, margarine and different concentrations of carrot stem and leaf flour (0%, 10%, 15%, 20%, 25%), corresponding to the treatments (T1, T2, T3, T4 and T5), respectively. With the substitution of carrot stem and leaf meal, the concentrations of cassava starch and rice flour were (50%- T1, 45%- T2, 42.5%- T3, 40%- T4 and 37.5%- T5).

2.4 Microbiological Analysis

Microbiological analyses were carried out through service provision by the GTA Alimentos Laboratory, in the city of Juiz de Fora – MG, based on Resolution - RDC 207 n° 12, of January 2, 2001 - Technical Regulation on Microbiological Standards for Food. The presence of Salmonella, coliforms at 45°C, molds and yeasts and Staphylococcus aureus was evaluated in order to verify if the samples met the microbiological standards pre-established by current legislation, being safe for consumption.

2.5 Texture Analysis

To determine the texture, the methodology followed by Assis et al., (2009) with adaptations, was adopted in an AT. XT. (Stable Micro Systems), using the Stable Micro Systems Exponent software. The cookies were randomly selected and placed horizontally on a platform, using a Warner-Bratzler blade to cut the cookie in half, promoting cookie cracking. The test conditions were: pre-test speed 2 mm s-1, post-test 10 mm s-1, test 3 mm s -1, distance 20 mm s-1, time 5.00 s and contact force 50 g. The evaluations were done 24 hours after baking and the results were expressed as the arithmetic mean of 3 replicates. To analyze the instrumental texture profile results, a completely randomized experimental design was used, consisting of 5 treatments (0, 10, 15, 20 and 25% carrot stem and leaf meal) and three replicates. The results were subjected to analysis of variance and the means were evaluated by the Tukey test at a 5% significance level using the SISVAR statistical software (Ferreira, 2019). The instrumental texture parameters obtained were, fracturability, chewability, adhesiveness and hardness.

2.6 Texture Sensory Profile

The sensory analysis was carried out with participants over 18 years old, among professors and students of the IF Sudeste MG, Campus Barbacena, in the Sensory Analysis Laboratory of that institution, after approval by the Ethics and

Research with Human Beings Committee under statement No. 3,489,751. Prior to the sensory analysis, the participants involved were informed about the research and then instructed to read, fill out and sign the Informed Consent Form at all stages of the sensory analysis.

2.6.1 Recruitment

First, 20 participants were invited and recruited through a semi-structured questionnaire with questions related to time availability, health conditions, presence of allergies or other problem(s) that would prevent them from consuming any ingredient used in the production of the studied biscuits and/or ingredients that were part of the composition of the commercial butter biscuits that were used in the selection stage. The recruited participants were then contacted by the researcher, and the selection of tasters was conducted with the 20 recruited participants, through the application of a triangular test, in order to verify the sensory acuity. The test was repeated three times, in the same way, and the approved participants were those who got two right out of the three tests applied (Minim & Silva, 2016).

2.6.2 Survey of Attributes

In the attribute research phase, the selected testers defined the terms that best represented the texture of the cookies studied by the pre-list technique. For this, a test was performed in the Sensory Analysis Laboratory, in individual booths, where the participant received the five treatments (samples) of the studied cookies, in a monadic way, randomly coded. For each sample, the participant defined the terms that best represented its texture, transcribing them on a sheet of paper. These were chosen from a previously defined list (Instituto Adolfo Lutz, 2004), which was available at the booth at the time of the test. The participant could also transcribe words that he or she considered important, but that were not indicated on that list. After defining the word(s) for each sample, the ones that best represented the characteristics of the dominant texture were chosen by mutual agreement among the participants, in a meeting with the presence of the researcher in charge. (Minim & Silva, 2016). A unique list was drawn up for each sample, in order to obtain the terms responsible for characterizing each treatment.

2.6.3 Temporal Dominance of Sensations (TDS)

The treatments were evaluated by the qualitative temporal descriptive methodology - TDS (temporal dominance sensation). Thus, the panel of evaluators received an introduction to TDS and the concept of dominant attribute, and an introduction to the SensoMaker software, used in the analyses. For the evaluation, the samples were presented in a monadic way. The tasters were instructed to place the sample in the mouth, start chewing it and start the evaluation within two seconds, the time required for the individual ambiance of the taster. The evaluation of the texture attributes of each sample lasted 45 seconds, with the taster having to choose between the attributes presented on the computer screen the one they judged to be dominant in any period of the evaluation. This procedure was performed three times in the same way. The analysis of the TDS results was performed according to the methodology described by Pineau et al. (2009), using the SensoMaker software to calculate the TDS curves for each biscuit sample. Thus, two lines were drawn on the TDS graph: the "chance level" and the "significance level". For each curve, three parameters are calculated for each sensation: the rate of dominance (D) which indicates the percentage of evaluators who selected a attribute as dominant at the specific time, the time when the dominance rate is maximum (T) and the time interval in which the dominance rate is at least 90% of the maximum dominance (I).

3. Results and Discussion

3.1 Microbiological Analysis

The results obtained from the microbiological analyses showed that the formulations of the buttery biscuits are within the limits established by the legislation for *Salmonella* (absence in 25g), Coliforms at 45° (<10 CFU/g), *Staphylococci coagulase* positive (<15 UFC/g) and Molds and Yeasts (<10 UFC/g), (Brazil, 2001). According to Ordinance No. 451 (Brasil, 1998) of the National Health Surveillance Secretariat, bread and bakery products must present absence of Salmonella in 25g of the product and, according to Noleto et al., (2017) this result proves the efficacy and hygiene in the preparation of the product, as the microbiological analyses aimed to verify whether the produced goods were adequate and safe for consumption during sensory tests.

3.2 Texture Analysis

Table 1 shows the results of the instrument texture analysis of the prepared biscuits.

Table 1. Texture analysis of buttery biscuits with different concentrations of carrot stem and leaf flour (CSLF).

Parameters analysed	T1	T2	T3	T4	T5
Fractureability	19.27a	3.36d	3.82cd	4.41c	9.17b
Chewability	0.36a	0.14c	1.63ab	1.28b	1.74a
Adhesiveness	-0.06a	-1.70a	-3.30b	-2.87b	-2.86b
Toughness	21.33a	22.76a	25.40a	24.92a	25.16a

* Averages followed by the same letter on the line do not differ from each other by the Tukey test at 5% probability level. Source: Authors (2019).

The results obtained in the analysis of the instrumental texture of the cookies showed a significant difference ($p < 0.05$) between the treatments for the parameters of fracturability, chewability and adhesiveness, observing an increase in fracturability and chewability as the concentration of CSLF in the treatments increased (T2, T3, T4 and T5, with 10%, 15%, 20% and 25% of CSLF, respectively). Souza et al., (2020), evaluating the instrumental texture profile of a shortbread incorporated with açaí kernel flour, observed that the large amount of fiber found in PSA (açaí kernel flour) contributes to the weakening of the network of gluten by the presence of fibers, causing the fracturability to increase.

As for hardness, no significant difference ($p > 0.05$) was observed between the treatments, which shows that the increase in the concentration of CSLF did not interfere with this parameter, allowing the addition of higher concentrations. Brites et al. (2019), evaluating different formulations of gluten-free biscuits with added alternative flours, noticed in their results that biscuits produced with millet flour had higher hardness values, while buckwheat flour contributed to the increase in thickness of biscuits. According to Tarasevičienė et al., (2021) “The hardness of the biscuit is an important physical parameter in evaluating the quality of the biscuit, which in turn affects its sensory attributes.” In a study developed by the same authors, it was observed that biscuits supplemented with 10% raspberry bagasse flour were the hardest (36.09 N), and the softest were those supplemented with 20% strawberry bagasse flour (6. .43 N). The authors justify this fact due to the high concentration of dietary fiber in strawberry bagasse flour, which may have retained moisture in the biscuits, resulting in softer biscuits.

3.3 Sensory Texture Profile

Of the twenty recruited tasters, 13 of them were selected by the triangular test, proceeding to the stage of surveying the attributes. Table 3 shows the most relevant attributes, surveyed for each treatment, by the trained tasters. Since the main objective was to characterize each treatment, in order to obtain the texture profile.

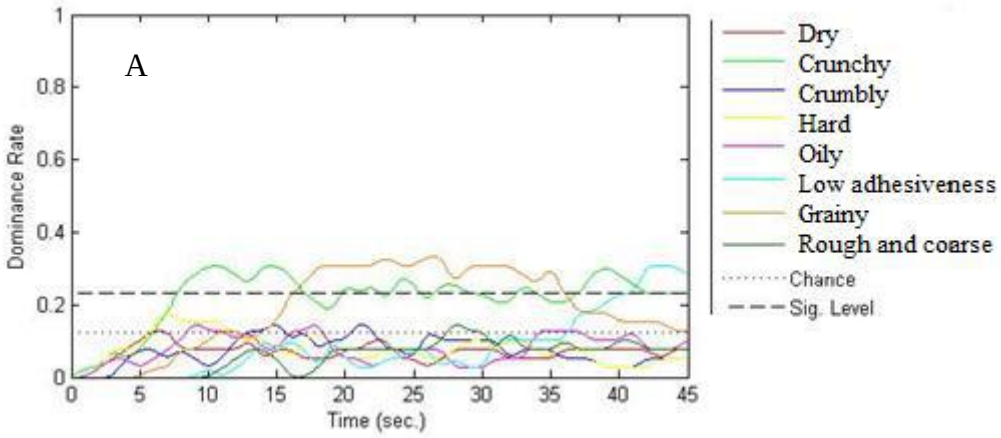
Table 2. Attributes surveyed for each treatment (T1, T2, T3, T4 and T5) by the trained tasters.

Treatments	Attributes
1	Dry, crunchy, crumbly, hard, oily, low adhesiveness, grainy, rough and coarse.
2	Dry, crunchy, crumbly, hard, sandy, grainy, oily, and rough and coarse
3	Crumbly, firm, dry, crunchy, grainy, rough and coarse, oily and low adhesiveness
4	Crunchy, firm, dry, sandy, crumbly, grainy, oily, and low adhesiveness.
5	Crunchy, dry, firm, sandy, low adhesiveness, rough and coarse, fibrous and oily.

Source: Authors (2019).

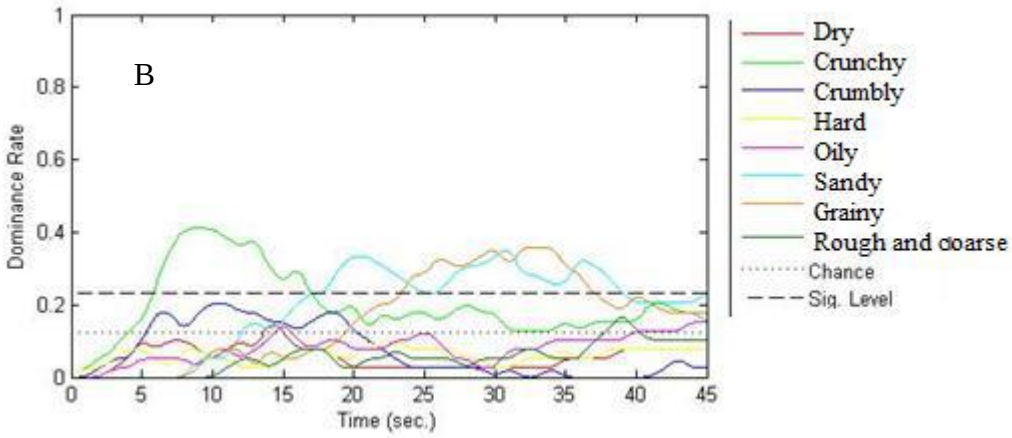
As can be seen in the table above, the tasters surveyed eight attributes for each treatment, which were chosen by the team in consensus during a meeting with all participants. Graphs A, B, C, D and E show the dominant temporal sensations (DTS) profile of the five treatments. Each curve represents the dominance of a specific attribute over time. In the graphical representation of the TDS analysis, two lines indicate the 'level of chance' and the 'level of significance'. The "level of chance" is the dominance rate that an attribute can obtain by chance, and the "significance level" is the minimum value that the dominance rate must equal to be considered significant (Pineau et al, 2009).

Figure 1. Dominant sensations raised for treatment 1.



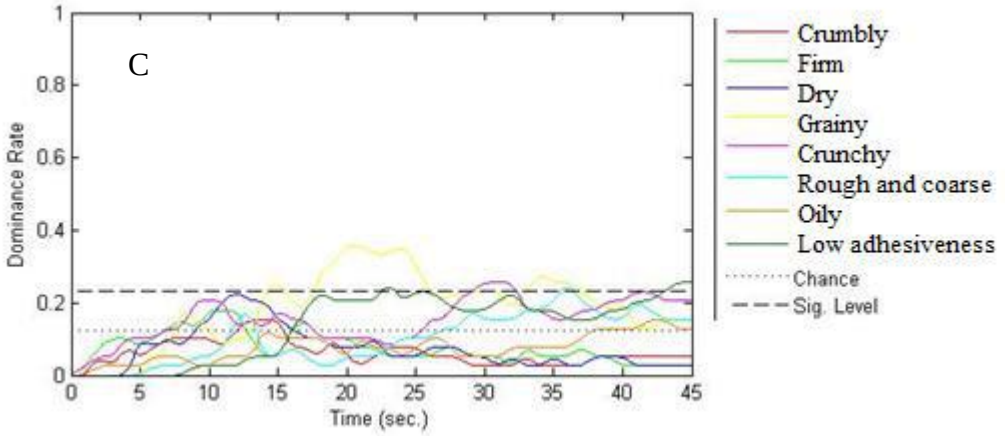
Source: Authors (2019).

Figure 2. Dominant sensations raised for treatment 2.



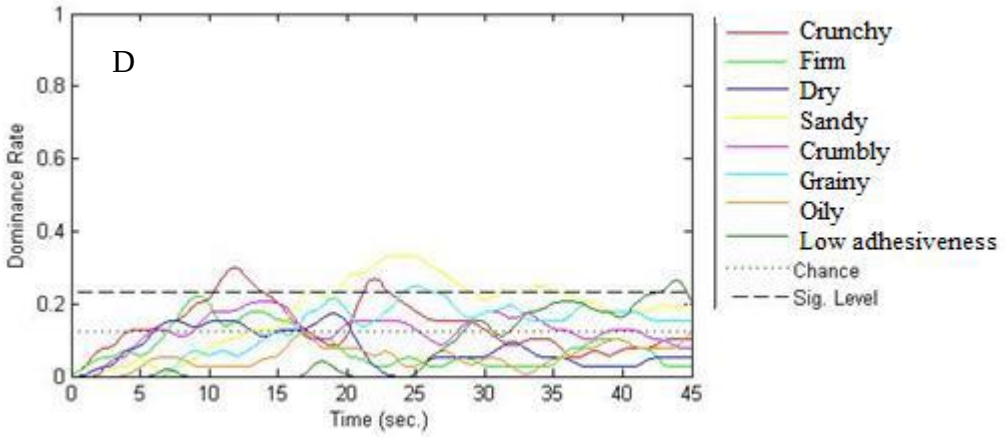
Source: Authors (2019).

Figure 3. Dominant sensations raised for treatment 3.



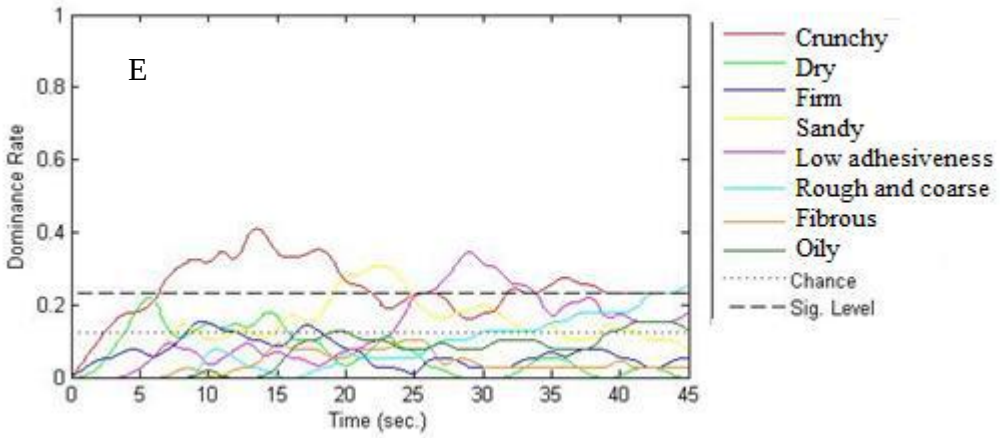
Source: Authors (2019).

Figure 4. Dominant sensations raised for treatment 4.



Source: Authors (2019).

Figure 5. Dominant sensations raised for treatment 5.



Source: Authors (2019).

In relation to treatment 1 (graph A), only three of the attributes raised were perceived by the tasters as a dominant sensation; these were: crunchiness, granularity and low adhesiveness, with granularity being perceived by longer dominance time (16 to 35 seconds). The crunchiness attribute also appeared as dominant in treatment 2 (graph B), between the first seconds (5-10), followed by the sandy and granularity attributes. For treatment 3 (graph C) the tasters felt again the granularity and crunchiness as the dominant sensations, being perceived at the end of the analysis the low adhesiveness of the sample.

For treatment 4 (graph D), the crispness and low adhesiveness attributes also appear as dominant sensations, but the grittiness remained for a longer time (20-35 s). While in treatment 5 (graph E), crunchiness was perceived as a dominant sensation, which remained dominant for two periods (5-20s and 35-40s), sandiness and adhesiveness appear again, being the last one noticed for the longest time (25-35s) for this treatment. At the end of the analysis time, roughness and coarseness were perceived by the tasters, which is justified by the higher concentration of CSLF.

Crunchiness was one of the attributes that appeared as dominant in all treatments, but with the increase of the CSLF it was possible to notice a greater permanence of this attribute, a factor that can be considered positive because, according to Oliveira et al (2017), crunchiness is a important sensory attribute for biscuits, which can be correlated with hardness, which is an attribute considered favorable and characteristic of some types of biscuits. In this study, as observed in Table 2, there was no significant difference for this parameter between treatments, that is, the increase in CSLF did not change the hardness in relation to the control biscuit (treatment 1). This result is positive, and it can be inferred that higher concentrations of CSLF do not imply an increase in the hardness of the product, allowing the addition of greater amounts.

Macedo et al. (2020) used the temporal dominance of sensations (TDS) methodology in biscuits formulated with creole grains and pine nuts *(Araucaria angustifolia)* starch, and crispness was perceived in a maximum time of 20.5 seconds. According to the authors, these data suggest that the attributes generated for biscuits were positive, as it is expected that there is prolonged crispness in this type of product.

Granularity predominated from treatments 1 to 3, while treatments 4 and 5 had a predominance of sandiness, this fact may be linked to the increase in the amount of CSLF, as well as the granulometry of the flour, since such attributes are related to the geometric characteristics of texture. However, the sensations raised by the evaluators were positive and characterized the biscuits with desirable attributes by consumers, in addition to being able to correlate the instrumental analyses, which were in agreement with the results of the analysis of the sensorial texture profile.

4. Conclusion

TDS analysis is an important tool for the development of products, such as gluten-free biscuits with the addition of carrot co-product flour. It allowed the observation of the prevalence of dominant attributes during the tasting of the product, making it possible to describe the sensory texture profile of the elaborated biscuits and to correlate with the instrumental analysis, demonstrating that the evaluators raised positive attributes for the texture of biscuits with a higher concentration of CSLF, the main ones being low adhesiveness and crunchiness. The addition of higher concentrations of CSLF did not interfere in the hardness of the biscuits, which allows for further studies with a higher concentration of it.

As a perspective, the authors propose, the realization of physical-chemical analysis to obtain the chemical profile of the cookies, for comparison with the sensory profile, being also valid tests for increasing the concentration of flour from carrot stalks and leaves, since it did not affect the sensory characteristics. In this way, it will be possible to obtain the complete profile of the cookies, being able to observe, besides the sensory characteristics, their nutritional characteristics, adding even more value to the product.

References

Assis, L. M., Zavareze, E. R., Radünz., A. L., Dias., A. R. G., Gutkoski, L; C., & Elias, M. C. (2009) Nutritional, technological and sensory properties of biscuits with replacement of wheat flour by oat flour or parboiled rice flour. *Food and Nutrition*, 20(1), 15-24.

Brazil. (1997). Ministry of Health. Health Surveillance Secretariat, *Ordinance No. 451 of September 19, 1997. Technical regulation, general principles for the establishment of microbiological criteria and standards for foods.* Official Gazette of the Federative Republic of Brazil.

Brazil. (2019). Resolution RDC No. 12 of January 2, 2001. *Approves the "Technical Regulation on Microbiological Standards for Food".* Issuing agency: ANVISA- National Health Surveillance Agency. Available at: www.anvisa.gov.br. Accessed on: March 24, 2019.

Brites, L. T. G. F, Ortolan, F., Silva, D. W d., Bueno, F. R, Rocha, T.d. S., Chang, Y. K, & Steel, C. J. (2019). Gluten-free biscuits elaborated with buckwheat flour, millet flour and chia seeds. *Food Science and Technology*, 39(2), 458-466.

Ferreira, D. F (2019). Sisvar: A Computer Analysis System To Fixed Effects Split Plot Type Designs. *Brazilian Journal of Biometrics*, 37(4), 529-535.

Gang Wu., Xiaodan Hui., Ruibin Wang, HNN, Dilrukshi., Yanyu Zhang., Margaret, A., Brennan,. Charles, S, & Brennan. (2021). Sodium caseinate-blackcurrant concentrate powder obtained by spray-drying or freeze-drying for delivering structural and health benefits of biscuits. *Journal of Food Engineering*, (299), 110466.

Guimaraes. J. T., Balthazar, C. F., Silva, R., Rocha, R. S., Graça, J. S, Esmerino, E. A., Silva, M. C., Sant'Ana, A. S., Duarte, M. C. K. H., Freitas., M. Q, & Cruz., A. G. (2020). Impact of probiotics and prebiotics on food texture. *Current Opinion in Food Science*, (33), 38-44.

Hutchings, S., Foster, K. D., Hedderley, D., & Morgenstern, M. (2014). Differences between Age Groups in the use of the Temporal Dominance of Sensations Technique across the Range of Food Textures. *Journal of Texture Studies*, 45(3).

Adolfo Lutz Institute. (2004). Physical-Chemical Methods for Food Analysis. *Sensory Analysis* (Chap 4, p. 287). São Paulo.

Macedo, L. D., Ávila, B. P., Saraiva, J. F. R., Lacerda, M. S., Domingues, B. P., Machado Pereira, A., & Gularte, M. A. (2020). Chemical and sensory characterization of biscuits consisting of creole grains and pine nut (Araucaria angustifolia) starch. *Research, Society and Development*, 9 (12), e3491210677.

Minim, V. P. R., & Silva, R. C. S. N. (2016). *Descriptive Sensory Analysis*. Viçosa, MG: Ed. UFV.

Noleto, K. S. (2017). Development and characterization of fish protein enriched biscuit. *Brazilian Journal of Fishing Engineering*, 10, (2) 69-77.

Oladunjoye, A. O., Eziama, S. C., & Aderibigbe, O. R. (2021). Proximate composition, physical, sensory and microbial properties of wheat-hog plum bagasse composite biscuits. *LWT*, (141), 111038.

Oliveira, D. L., Kolakowsk, A. P., Simões, D. R. S., Los, P. R., & Demiate, I. M (2017). Gluten-free biscuits made with bean bran, rice flour and cassava starch. *Brazilian Journal of Agroindustrial Technology*. 2(11), 2502-2522.

Pineau, N., Bouille. N., Lepage. AG., Lenfant, M., Schlich, F., Martin, P., Rytz, N., & Andreas (2012). Temporal Dominance of Sensations: What is a good attribute list. *Food Quality and Preference*. (26), 159-16.

Poiani, M. R, & Montanuci, F. D (2019). Physical and technological characterizations and texture profile of grape flour and linseed biscuits. *Brazilian Journal of Food Technology* (22), 2018074.

Silva, F. N., Oliveira, T. O., & Assumpção, G. M. P. (2020) Evaluation of sensory acceptance of biscuit typegluten-free butter with flour of stems and carrot leaves. *Brazilian Journal of Development*. 12(6), 96109-96114.

Simas, N. S. (2008). *Residue from the processing of organic royal palm (archontophoenix alexandrae): physical-chemical characterization, application in gluten-free fibrous biscuits and sensory evaluation by celiac consumer*. (Master's dissertation), Federal University of Santa Catarina, Florianópolis.

Souza, J. O., & Camilloto, G. P (2020). Buttery biscuits incorporated with açaí corn flour. *Brazilian Journal of Development.* 10(6), 81331-181340.

TaraseviČIenĖ, Ž., ČEchoviČIenĖ, I., JukniŪTĖ, K., ŠLepetienĖ, A., & PaulauskienĖ, A. (2021). Qualitative properties of biscuits enriched with berries pomace. *Food Science and Technology*, 41(2), 474-481.