Published article / Citation:
Guiné RPF, Souta A, Gürbüz B, Almeida E, Lourenço J, Marques L, Pereira R, Gomes R (2020) Textural Properties of Newly Developed Cookies Incorporating Whey Residue. Journal of Culinary Science & Technology, 18(4), 317-332.

Textural Properties of Newly Developed Cookies Incorporating Whey Residue

Short Title: TEXTURE CHARACTERISTICS OF WHEY COOKIES

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Acknowledgments

This study was supported by Instituto Politécnico de Viseu/CI&DETS through project PROJ/CI&DETS/CGD/0007 and FCT - Fundação para a Ciência e Tecnologia, I.P., under the project UID/Multi/04016/2016.

The authors thank the company who provided the whey residue: Casa da Ínsua, Viseu, Portugal.

Abstract

Cookies vary considerably in composition, shapes, flavours or textures, being much appreciated by consumers, and providing easy ways of supplying nutrients and energy, besides bioactive components. The objective of this study was to develop new added-value cookies incorporating whey residue, which is a by-product from the dairy industry, thus finding alternative ways to avail this waste. The cookies were then evaluated for their textural characteristics by means of texture profile analysis. The results obtained revealed that the improved whey cookies were different that the other cookies, better looking and with better global appearance, and also presenting good textural properties, with low hardness and chewiness, allied to high springiness and cohesion, being thus suitable for elderly and children with increased eating difficulties. Furthermore, these properties were maintained along the storage period considered of 15 days, thus guarantying stability of the textural characteristics.

Keywords: compression test, puncture test, residue valorisation, textural properties.

Introduction

Recently, the search for foods and beverages that provide positive health impacts has increased all over the world. Therefore, exhaustive production of functional foods (containing bioactive compounds) has arisen (Góngora Salazar, Vázquez Encalada, Corona Cruz, & Segura Campos, 2018). According to the World Health Organization (WHO) the desirable intake of bread in a healthy and balanced diet should be around 250 g per day (Góngora Salazar et al., 2018). However, in many countries the ingestion of bread is far below these recommendations, and that is why cookies can fill this void (Calle, 2012).

Cookies represent the most important category of snacks in the bakery industry and can serve as effective vehicle for supplying nutrients. The three major ingredients in cookies are flour, fat and sugar, as well as other minor ingredients like leavening agents, salt, emulsifiers and yeast. Also the moisture content should be low, between 1 and 5%, to ensure long shelf life and good textural characteristics (Jan, Panesar, & Singh, 2018). Margarine and sugar are core ingredients in the formulation of cookies. However, some alternatives are possible, combining the added health effects with functionality improvement. Regarding fat, olive oil is a healthier choice, being rich in bioactive molecules, most especially the fatty acids. Also, the distribution of the fat phase and the interactions between fat and the other ingredients affect the texture and stability of the product (Di Mattia et al., 2015; Paolini, Bontempo, & Camin, 2017). As for the sugar, sucrose is the most frequently used sweetener in cookies formulation. However, negative health effects have been attributed to sucrose intake, like for example contributing to excessive calories intake, excessive weight gain as well as increased risk of developing dental caries, type 2 diabetes, and cardiovascular diseases. By replacing

sucrose with honey advantages arise from the pharmacological actions of this natural product, which has proved beneficial against several injuries and illnesses. The beneficial effects of honey have been demonstrated and include antioxidant, anti-inflammatory, antibacterial, antimutagenic, wound healing, antidiabetic, antiviral, antifungal and anti-tumour activities (Caballero, 2013; Eteraf-Oskouei & Najafi, 2013; Ramsay, Shriver, & Taylor, 2017).

According the United Nations, in 2050 the world population is estimated to exceed 9.2 billion, bringing additional challenges regarding food production and management. This is why an efficient utilization of the natural resources becomes more and more important. The utilization of organic residues in particular is advantageous, because many residues and by-products of the food industry can be utilized to produce new foods and/or ingredients with additional nutritional value and improved bioactive properties (de Oliveira, da Silva Lucas, Cadaval, & Mellado, 2017; Keegan, Kretschmer, Elbersen, & Panoutsou, 2013; Kirchherr et al., 2018; Pleissner et al., 2016).

Because cookies are variable in composition, shapes, flavours or textures, they are very appreciated by consumers, and can become a viable option in the field of functional foods. Their energy input is easily adjustable, since the consumer can choose the desirable dosage. In this way, cookies are a potentially important vehicle for the delivery of bioactive compounds that improve their biological functionality (Calle, 2012; Góngora Salazar et al., 2018).

Hence, the main focus of this study was to develop new added-value bakery products (cookies) incorporating whey residue, a by-product from the dairy industry, so as to give new opportunities ta resource with some nutritional relevance and at the same time minimizing environmental impacts. Besides the development of the product and

formulation, also the textural characteristics of the cookies were evaluated due to the importance of these characteristics for the consumer acceptance of this type of food.

Material and methods

Preparation of the cookies

Table 1 shows the formulations used in the preparation of the three types of cookies developed: a basic recipe, a modification to incorporate the whey residue as a replacement for the condensed milk and an improved recipe, with inclusion of several ingredients with additional nutritional and bioactive effects. All the ingredients were purchased on a local market and were proper to include in food preparations. These ingredients were bought and then stored appropriately in the laboratory until usage. The only exception was the whey residue, which was provided by a local company that produces cheeses and that is looking for an alternative use to this residue that otherwise would be discarded as effluent. In the case of the whey residue, it was received in the day before it was used and stored for some hours in the refrigerator.

Table 1. Ingredients used in the formulation of the different types of cookies.

Ingredients (units)	**Basic Cookies**	**Whey Cookies**	**Improved Whey Cookies**
Wheat flour for cakes - with baking powder (Brand: Nacional, Type: Fine 55) (g)	1500	1500	1500
Sugar (Brand RAR) (g)	270	90	–
Condensed milk (Brand: Nestlé) (g)	794	–	–
Whey residue (from a local company: Casa da	–	278	279

Ínsua) (mL)			
Margarine (Brand: Vaqueiro) (g)	149	234	–
Eggs – mixed (Brand: Zezerovo) (g)	258	257	399
Baking powder (Brand: Royal) (g)	9	15	9
Sodium bicarbonate (Brand: Farmax) (g)	9	9	9
Cinnamon (Brand: Margão) (g)	–	–	6
Olive oil (Brand: Oliveira da Serra) (mL)	–	–	135
Honey (Brand: Beerural) (g)	–	–	240
Chia seeds (Brand: Iswari) (g)	–	–	30
Poppy seeds (Brand: Iswari) (g)	–	–	30
Cardoon leaves (From local production: ESAV) (g)	–	–	0.4

Basic cookies (BC)

All ingredients listed in Table 1 were mixed by gradually adding the wheat flour, and kneading until forming a homogeneous mass. The dough was stretched with a kitchen roll and the cookies were shaped using appropriate molds. The cookies were distributed into pre-greased and floured trays and then oven baked at a temperature of about 180 °C (180±2 ºC) for 40 minutes, in an industrial electrical oven (Brand Teimarmor). Figure 1 shows the procedure used for the preparation of the cookies with the basic recipe.

Figure 1. Preparation of the basic cookies (BC).

Cookies with whey residue (CWR)

The procedure for the production of these cookies was similar to that described earlier for the basic cookies (Figure 2), however some changes were made with respect to the ingredients used, by replacing the condensed milk with whey residue and increasing the amount of margarine as well as reducing the amount of sugar. The replacement of milk by whey residue was the main goal of this work, which intended to incorporate whey residue into bakery products so as to attribute an added value to this otherwise discarded residue. As to the other changes, increasing the amount of margarine was intended so as to compensate the replacement of the condensed milk by an aqueous product (the whey residue) thus conferring structure to the mixture. The tentative to reduce the amount of sugar was considered having in mind the negative

effects of sucrose for health. The oven temperature was also increased to 240 ºC and as a consequence the cooking time decreased to 15 minutes.

Figure 2. Preparation of the whey cookies (CWR).

Improved whey cookies (IWC)

The procedure used was the same as in the previous formulation (recipe with whey residue). The margarine was replaced with olive oil, and the sugar with honey, besides addition of some other ingredients aimed at improving the nutritional and healthy properties of the final product. The biscuits were brushed with egg white and covered on the surface with chia and poppy seeds, adding some decorative effect besides providing nutritional effects (Figure 3). The oven temperature was also 240 ºC, however the baking time was decreased to 10 minutes.

Figure 3. Preparation of the improved whey cookies (IWC).

For the tests, all cookie samples were left at room temperature for about 30 minutes after oven baking for cooling, and then were placed inside common plastic bags which were closed and left at room temperature for posterior analyses. The textural determinations were made to the cookies 30 minutes after baking and again after 6 hours, 4 days and 15 days.

Consumption considerations

The developed cookies with the improved recipe are soft elastic biscuits that are particularly suitable for elderly and children, who tend to have more difficulty in chewing, although also very suitable for all groups of the population in general. Because

their formulation was designed to include some ingredients with possible bioactive principles, they are also beneficial for people who what to improve their general health status. For example, cinnamon has demonstrated thermogenic, anticarcinogenic and antibacterial effects, allied to prevention and treatment of some chronic diseases such as diabetes, Alzheimer and Parkinson's disease (Meghani et al., 2018; Ribeiro-Santos et al., 2017; Vasconcelos, Croda, & Simionatto, 2018).

Olive oil is one of the basilar ingredients of the so called Mediterranean Diet, which was recognized as UNESCO heritage, and has proved to have many benefits for the human health due to the presence of fatty acids and phenolic compounds. Some of the highlighted effects include: cardioprotection, chemoprevention, decreased risk for neurodegenerative disorders, improve cardiometabolic factors and reduce type 2 diabetes risk, among others (Ntanasi et al., 2018; Visioli et al., 2018; Wani et al., 2018).

Honey is a natural sweetener particularly rich in dietary minerals and phenolic compounds with antioxidant, antibacterial and anti-inflammatory activities and demonstrated to be an ally in cancer treatment acting as as immune booster for patients under chemotherapy (Badolato, Carullo, Cione, Aiello, & Caroleo, 2017; Deng et al., 2018; Yusof, Ahmad, Hamid M.S., & Khong, 2018).

Chia seeds are presently very popular due to their nutritious properties, namely high fibre, protein, polyphenols and lipids, particularly fatty acids like omega-3, contents. Some biological effects attributed to the seeds are, for example, help to maintain energy levels but with a low-glycemic index, help achieve daily iron intake and fuction as ally in primary cardiovascular disease prevention (Laczkowski et al., 2018; Rendón-Villalobos, Ortíz-Sánchez, & Flores-Huicochea, 2018; Tenore et al., 2018; Zettel & Hitzmann, 2018).

Evaluation of texture

For the assessment of the textural characteristics the texture profile analysis was performed using a texturometer TA-XT2 Plus from Stable Microsystems. The test involved two compression cycles using a flat probe with 75 mm diameter (P/75), separated by 5 seconds. The parameters used for the test were: 30 kg force load cell, pre-test, test and post-test speeds equal to 1.0 mm/s, distance 4 mm and trigger force 0.1 N. The textural properties: hardness, resilience, springiness, cohesiveness and chewiness were calculated after equations (1) to (5) (see Figure 4) (Correia et al., 2017):

$$\text{Hardness (N)} = F_1 \quad (1)$$

$$\text{Resilience (\%)} = (A_5/A_4) \times 100 \quad (2)$$

$$\text{Springiness (\%)} = (T_2/T_1) \times 100 \quad (3)$$

$$\text{Cohesion (\%)} = (A_2/A_1) \times 100 \quad (4)$$

$$\text{Chewiness (N)} = F_1 \times (T_2/T_1) \times (A_2/A_1) \quad (5)$$

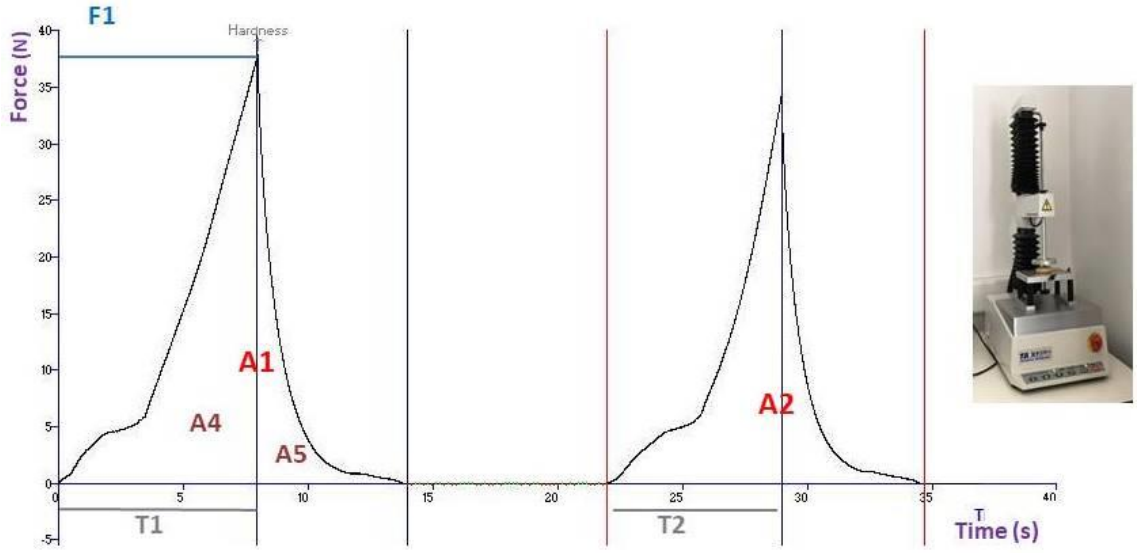

Figure 4. Example of a texture profile analysis obtained for the cookies.

For the textural evaluations 15 cookies of each type were used, and for each sample one measurement was made on the top and another on the underside of the cookie. As

previously stated, the samples were evaluated 30 minutes after baking, and again 6 hours, 4 days and 15 days later, in order to determine the stability of the textural characteristics along time. The results were processed using Exponent software TEE from Stable Micro Systems.

The textural properties determined by the compression test were hardness, resilience, springiness, cohesiveness and chewiness. Hardness represents the force necessary to compress a food between the teeth or between the palate and the tongue. Chewiness measures the energy required to disintegrate a food to a state suitable to swallow. Springiness is associated with the ability to recover shape after compression, being equal to the rate at which the product returns to the initial point after removal of the deforming force. Resilience is the energy used when applying a force to a material without occurring rupture, with or without any residual strain, and corresponds to an instant springiness. Cohesiveness represents the internal forces inside the food that stop the sample from disintegrating (Cruz, Guiné, & Gonçalves, 2015; R. P. F. Guiné, Henriques, & Barroca, 2014; Raquel P. F. Guiné, Almeida, Correia, & Gonçalves, 2015).

Statistical analysis

To validate the results obtained for the mean values calculated, a comparison of means was performed by an analysis of variance (ANOVA), with the Post-Hoc Tukey HSD (Honestly Significant Difference) test for identification of differences between samples. For all statistical analyses was used the software SPSS version 25 (IBM, Inc.) and the level of significance considered was 5% ($p < 0.05$).

Results and discussion

Comparison of the baked cookies

Figure 5 shows the three types of cookies produced. An organoleptic evaluation was performed, using an untrained set of 16 tasters, whose principal conclusions are presented as follows. Although not complying with all requisites of sensory analysis, the highlighted aspects contribute for a better understanding of the sensory characteristics of the different cookies. Regarding the basic cookies, it was observed that this formulation resulted in unglazed biscuits due to the high cooking time, which also led to the dehydration of the biscuits, turning them very dry. In the case of the cookies with whey residue, after molding many cracks and deformations were observed, weakening the appearance of the product, therefore alerting for a need to improve the recipe, particularly producing cookies with better texture. In the case of the improved whey cookies the dough presented a greater homogeneity, allowing an easy molding. The cooking time was shortened to only 10 minutes so that the aromatic compounds would not volatilize and therefore would provide a better flavour. The replacement of margarine with olive oil turned the cookies less crunchy, thus giving them a soft texture, perhaps more similar to biscuits. In this way, the new formulation with the introduction of new ingredients was positive in terms of colour, texture and flavour.

Figure 5. The three varieties of cookies produced for the study.

Textural properties

Figure 6 presents the mean values of the textural properties hardness and chewiness evaluated on the top and bottom faces of the three types of cookies and on different time moments: shortly after baking, after 6 hours, 4 days and 2 weeks. The results were subject to a statistical analysis to verify if significant differences were found in the mean values for each property.

The results in Figure 6 show that the CWR presented in general highest hardness and chewiness as compared with the other two types, BC and IWC. For the BC it was

observed that the hardness was maintained in the day of confection, at least until 6 hours, but the cookies became much harder after 4 days and remained then unchanged until the end of the evaluation period of 15 days. Also the CWR showed an increase in hardness right after 6 hours, although the greatest increase was also after 4 days. This means that the textural characteristics of the BC and CWR were more difficult to maintain during the storage. The IWC, which are the targeted cookies for marketing, presented very uniform hardness and chewiness considering both sides of the cookie (top and bottom), with quite low values, making these products more similar to soft biscuits. Also, it was verified that time did not have any effect on texture, at least for the period analysed of 2 weeks. This is a good indicator, because the product does not lose its firmness on one hand and also does not become harder on the other hand. Regarding the uniformity between both faces of the cookie, in all cases there was a trend to have similar hardness and chewiness regardless on the side of the cookies.

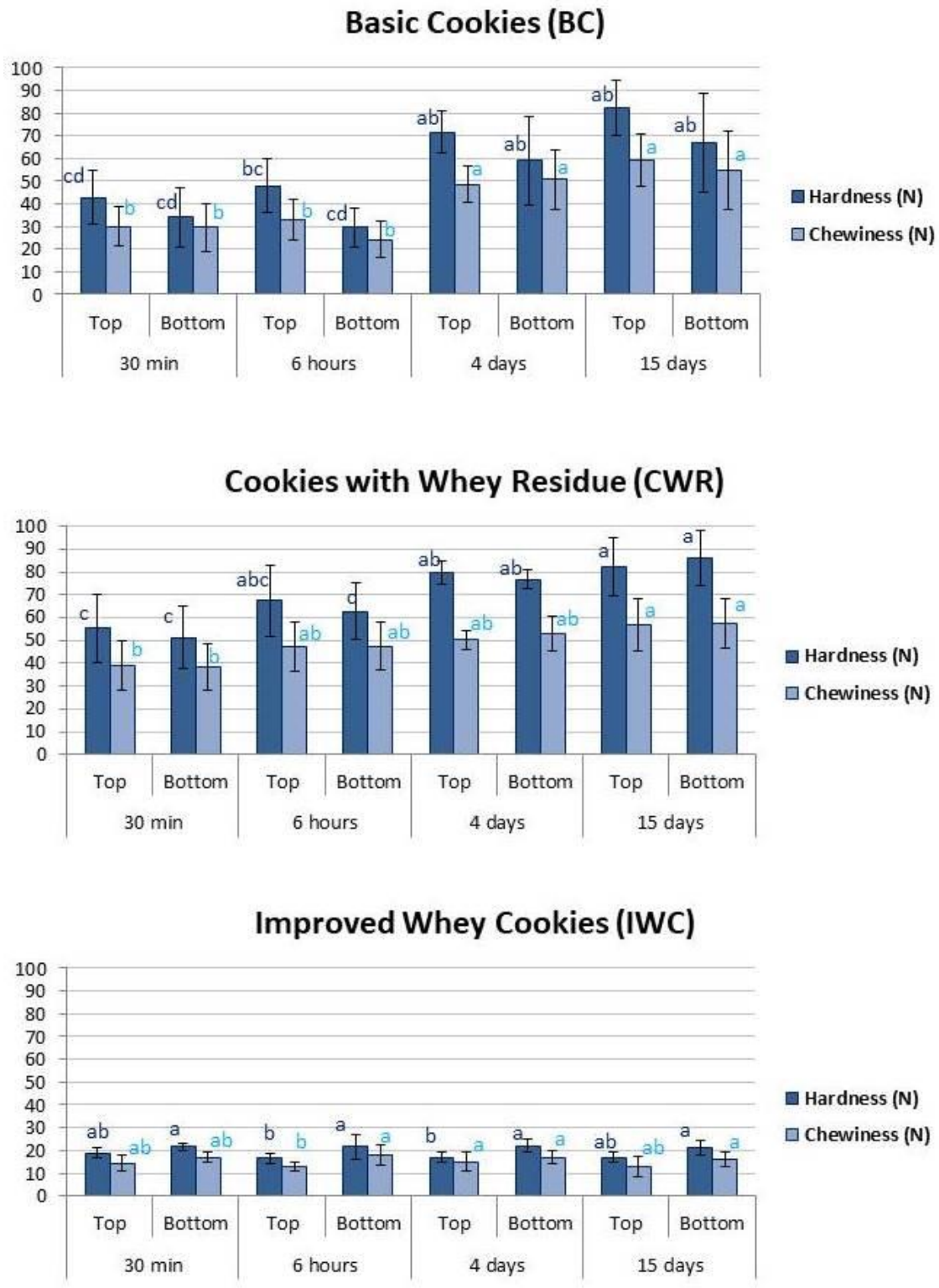

Figure 6. Hardness and chewiness separated according to the sides of the cookies (For the same property, bars with the same letter are not significantly different: ANOVA with Tukey post-hoc test, $p > 0.005$).

In Figure 7 are shown the mean values of the textural properties resilience, cohesion and springiness, on both sides of the cookies along the evaluation period considered, from 30 minutes up to 15 days. The results show that the resilience is very uniform between the sides and similar for all cookies, around 40%, being constant along time, with just a slight reduction for the IWC cookies between the 30 min and 6 hours observations, being constant thereafter. Regarding cohesion, the values were also relatively similar for all the samples, varying between 77.82 and 91.04%, and with no visible variations along time. Finally, springiness was similar for samples BC and CWR and a little higher for the IWC, meaning that these were more elastic, which together with the lower hardness made these cookies more tender. Again, in most cases no significant differences were found for these three textural properties between the two sides of the cookies, leading to uniform products.

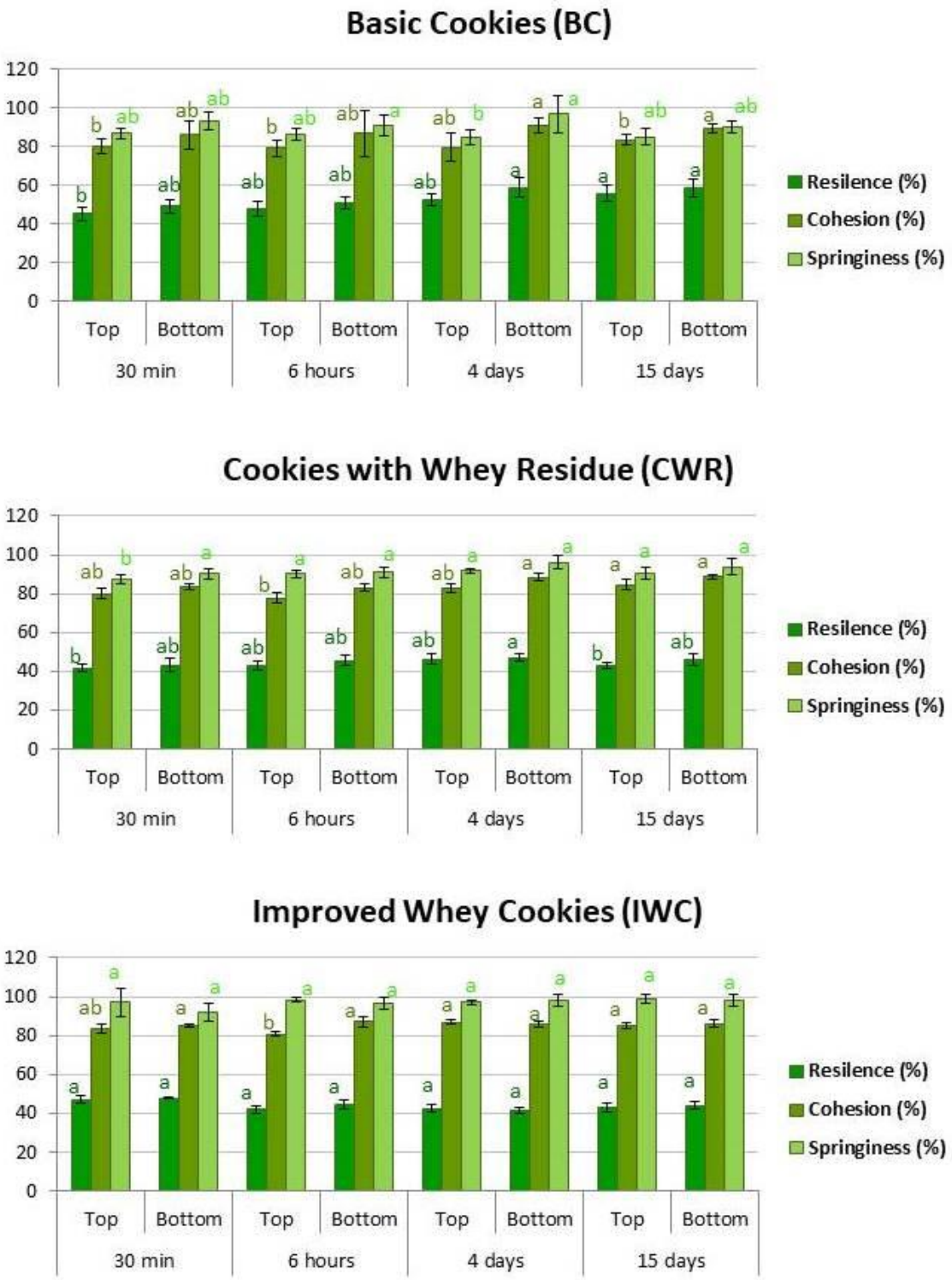

Figure 7. Resilience, cohesion and springiness separated according to the sides of the cookies (For the same property, bars with the same letter are not significantly different: ANOVA with Tukey post-hoc test, $p > 0.005$).

293 Figure 8 shows the results considering the whole samples, i.e., as mean values of the
294 determinations made on the top and bottom faces of the cookies. As previously seen, the
295 properties hardness and chewiness showed some significant differences between both
296 sides, and that results in higher dispersion of the data for each sample, as the higher
297 values of the standard deviation for some of the samples indicate. The chart in Figure 8
298 (top) confirms that in all moments of evaluation the IWC presented lowest hardness and
299 chewiness, while the CWR presented the highest values for those textural attributes.
300 Again, the trends observed for both variables were parallel, due to the connection that
301 exists between them, as expressed by Equation (5). The bottom graph in Figure 8 shows
302 that while springiness is a little higher for the IWC as compared to the other two in all
303 moments of evaluation, cohesion tends to be similar and also approximately constant
304 along time. Regarding resilience, more variability was observed, with the values for the
305 BC after 4 and 15 days being the highest, as opposed to the IWC whose values were the
306 lowest in all determinations except for the 30 min.
307
308

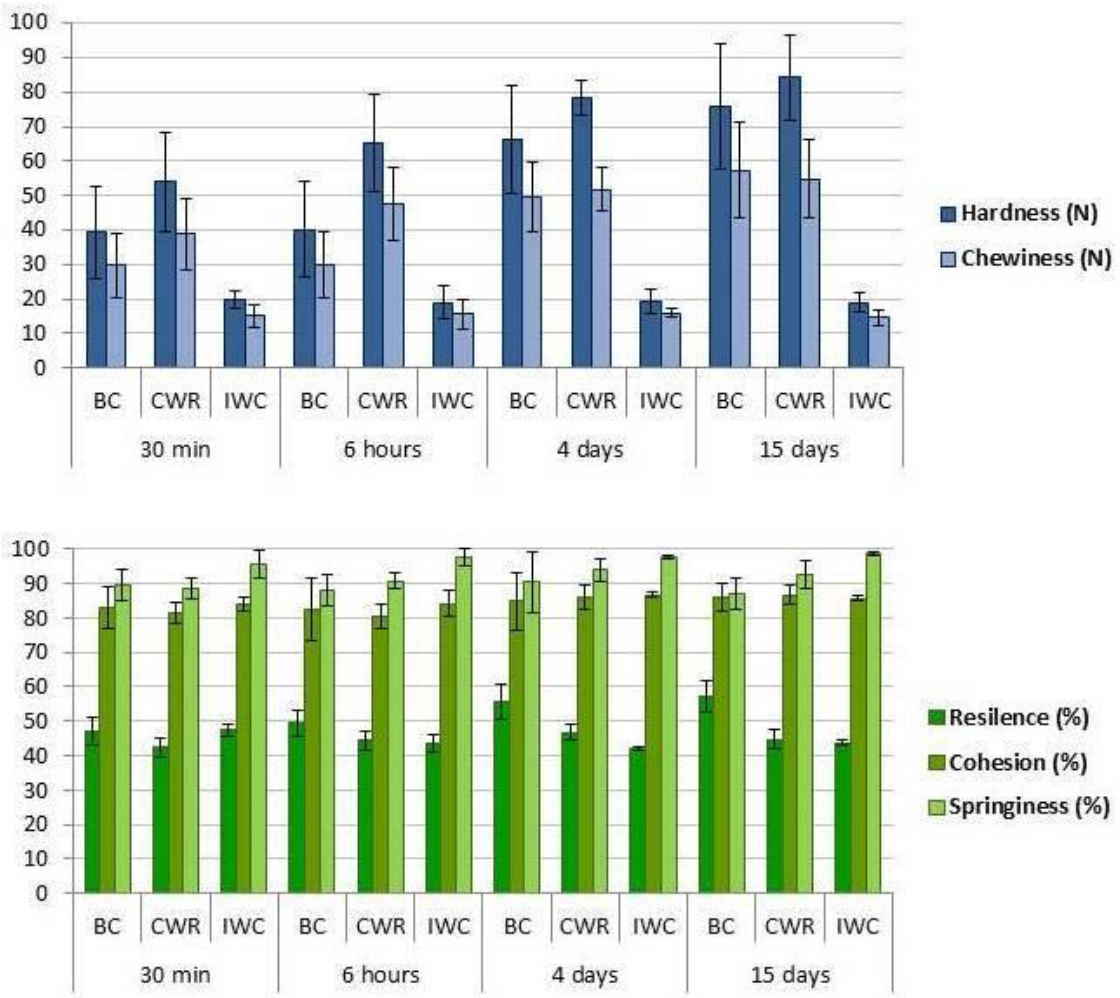

Figure 8. Textural properties, considering each sample as a whole. Legend: BC = basic cookies, CWR = cookies with whey residue, IWC = improved whey cookies.

Figure 9 represents the evolution along time of the textural properties for the IWC, which are the target cookies intended for commercialization. The results indicate good stability of all textural properties along time, for the 2 weeks period considered. Naturally that further studies should include longer storage periods and conservation under packaging, which was not considered in the present case, in which the cookies were left in conventional plastic bags without proper sealing and appropriate packaging materials, if industrial production is targeted. Nevertheless, for home prepared cookies the expected shelf-life is shorter and the storage conditions include cookie cans or

plastic box containers, which much resemble those simulated in the present work.

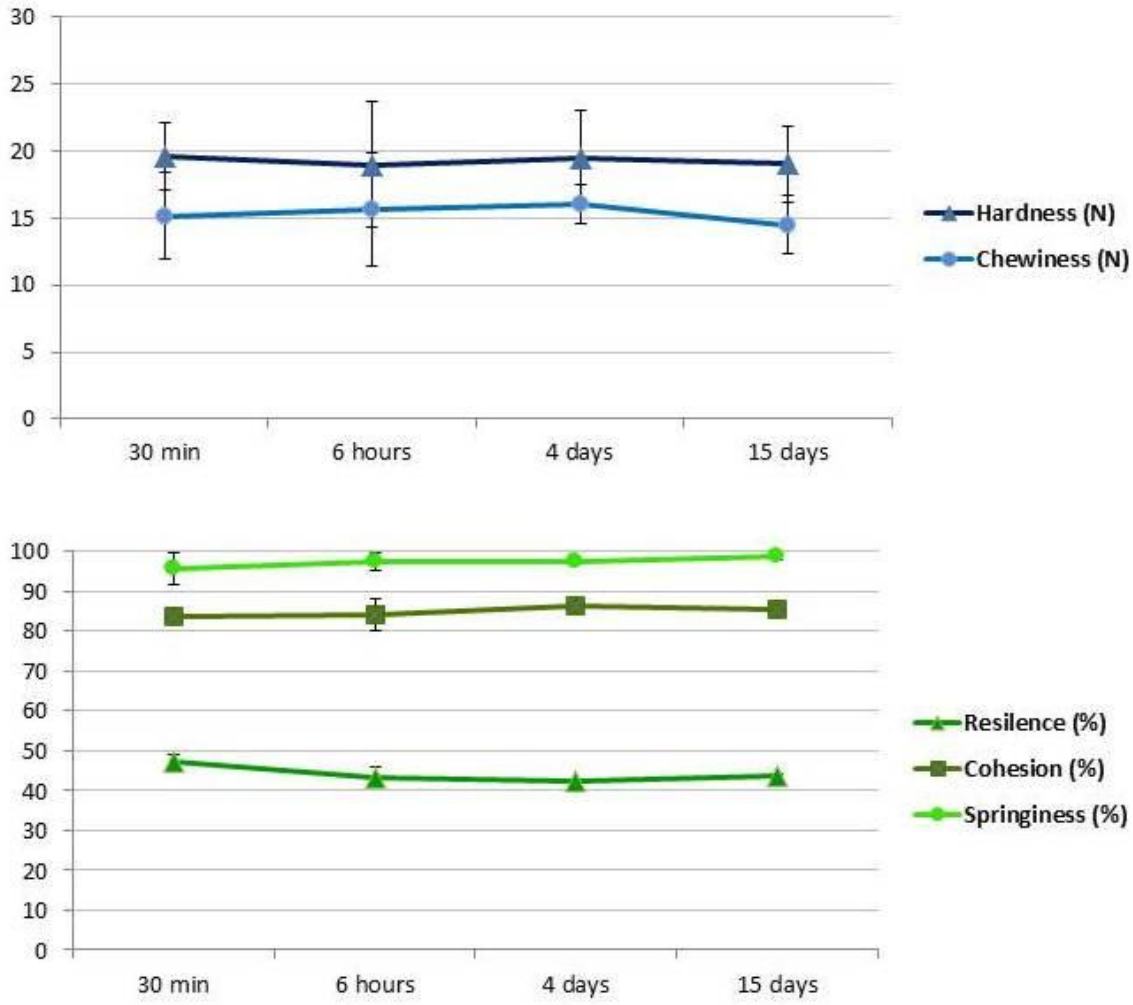

Figure 9. Variation along time of the textural properties of the improved whey cookies.

Culinary recommendations

The IWC are mild sweet snacks that can be eaten in between meals. Besides, they can be consumed at breakfast together with milk, yogurt or natural fruit juices. In the afternoon or just before bedtime they can be combined with a cup of hot tea and provide comfort (Figure 10).

Apart from eating the IWC in the form of cookies, they can also be incorporated into some deserts, providing alternative flavours to fruit creams, pies or dairy based deserts.

Figure 10. Serving suggestions of the improved whey cookies.

Conclusions

The results obtained in this work showed that the developed cookies with an improved recipe containing whey residue and ingredients with potential health benefits had a satisfactory appearance and desirable global properties, as indicated by the results of the organoleptic evaluation conducted by the set of tasters. Regarding texture and its variation along an observation period of 15 days, it was verified that the IWC showed good textural properties, with low hardness and chewiness, allied to high springiness and cohesion, and that these properties were maintained along the storage period considered.

Acknowledgments

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References

Badolato, M., Carullo, G., Cione, E., Aiello, F., & Caroleo, M. C. (2017). From the hive: Honey, a novel weapon against cancer. *European Journal of Medicinal Chemistry*, *142*, 290–299. https://doi.org/10.1016/j.ejmech.2017.07.064

Caballero, B. (2013). Sucrose: Dietary Sucrose and Disease. In Benjamin Caballero (Ed.), *Encyclopedia of Human Nutrition (Third Edition)* (pp. 231–233). https://doi.org/10.1016/B978-0-12-375083-9.00257-9

Calle, J. (2012). Tendencias actuales en galletas funcionales: Reducción de calorías. *Reciteia*, *12*, 26.

Correia, P., Guiné, R., Correia, A. C., Gonçalves, F., Brito, M., & Ribeiro, J. (2017). Physical, chemical and sensory properties of kiwi as influenced by drying conditions. *Agricultural Engineering International*, *19*(3), 203–212.

Cruz, A. C., Guiné, R. P. F., & Gonçalves, J. C. (2015). Drying Kinetics and Product Quality for Convective Drying of Apples (cvs. Golden Delicious and Granny Smith). *International Journal of Fruit Science*, *15*(1), 54–78. https://doi.org/10.1080/15538362.2014.931166

de Oliveira, L. M., da Silva Lucas, A. J., Cadaval, C. L., & Mellado, M. S. (2017). Bread enriched with flour from cinereous cockroach (Nauphoeta cinerea). *Innovative Food Science & Emerging Technologies*, *44*, 30–35. https://doi.org/10.1016/j.ifset.2017.08.015

Deng, J., Liu, R., Lu, Q., Hao, P., Xu, A., Zhang, J., & Tan, J. (2018). Biochemical properties, antibacterial and cellular antioxidant activities of buckwheat honey in comparison to manuka honey. *Food Chemistry*, *252*, 243–249. https://doi.org/10.1016/j.foodchem.2018.01.115

Di Mattia, C., Balestra, F., Sacchetti, G., Neri, L., Mastrocola, D., & Pittia, P. (2015). Physical and structural properties of extra-virgin olive oil based mayonnaise. *LWT - Food Science and Technology*, *62*(1, Part 2), 764–770. https://doi.org/10.1016/j.lwt.2014.09.065

Eteraf-Oskouei, T., & Najafi, M. (2013). Traditional and Modern Uses of Natural Honey in Human Diseases: A Review. *Iranian Journal of Basic Medical Sciences*, *16*(6), 731–742.

Góngora Salazar, V. A., Vázquez Encalada, S., Corona Cruz, A., & Segura Campos, M. R. (2018). Stevia rebaudiana: A sweetener and potential bioactive ingredient in the development of functional cookies. *Journal of Functional Foods*, *44*, 183–190. https://doi.org/10.1016/j.jff.2018.03.007

Guiné, R. P. F., Henriques, F., & Barroca, M. J. (2014). Influence of drying treatments on the physical and chemical properties of cucumber. *Journal of Food Measurement and Characterization*, *8*(3), 195–206. https://doi.org/10.1007/s11694-014-9180-9

Guiné, Raquel P. F., Almeida, I. C., Correia, A. C., & Gonçalves, F. J. (2015). Evaluation of the physical, chemical and sensory properties of raisins produced from grapes of the cultivar Crimson. *Journal of Food Measurement and Characterization*, *9*(3), 337–346. https://doi.org/10.1007/s11694-015-9241-8

Jan, K. N., Panesar, P. S., & Singh, S. (2018). Optimization of antioxidant activity, textural and sensory characteristics of gluten-free cookies made from whole indian quinoa flour. *LWT*, *93*, 573–582. https://doi.org/10.1016/j.lwt.2018.04.013

Keegan, D., Kretschmer, B., Elbersen, B., & Panoutsou, C. (2013). Cascading use: a systematic approach to biomass beyond the energy sector. *Biofuels, Bioproducts and Biorefining*, *7*(2), 193–206. https://doi.org/10.1002/bbb.1351

Kirchherr, J., Piscicelli, L., Bour, R., Kostense-Smit, E., Muller, J., Huibrechtse-Truijens, A., & Hekkert, M. (2018). Barriers to the Circular Economy: Evidence From the European Union (EU). *Ecological Economics*, *150*, 264–272. https://doi.org/10.1016/j.ecolecon.2018.04.028

Laczkowski, M. S., Gonçalves, T. R., Gomes, S. T. M., Março, P. H., Valderrama, P., & Matsushita, M. (2018). Application of chemometric methods in the evaluation of antioxidants activity from degreased chia seeds extracts. *LWT*, *95*, 303–307. https://doi.org/10.1016/j.lwt.2018.04.080

Meghani, N., Patel, P., Kansara, K., Ranjan, S., Dasgupta, N., Ramalingam, C., & Kumar, A. (2018). Formulation of vitamin D encapsulated cinnamon oil nanoemulsion: Its potential anti-cancerous activity in human alveolar carcinoma cells. *Colloids and Surfaces B: Biointerfaces*, *166*, 349–357. https://doi.org/10.1016/j.colsurfb.2018.03.041

Ntanasi, E., Yannakoulia, M., Kosmidis, M.-H., Anastasiou, C. A., Dardiotis, E., Hadjigeorgiou, G., … Scarmeas, N. (2018). Adherence to Mediterranean Diet and Frailty. *Journal of the American Medical Directors Association*, *19*(4), 315-322.e2. https://doi.org/10.1016/j.jamda.2017.11.005

Paolini, M., Bontempo, L., & Camin, F. (2017). Compound-specific δ13C and δ2H analysis of olive oil fatty acids. *Talanta*, *174*, 38–43. https://doi.org/10.1016/j.talanta.2017.05.080

Pleissner, D., Qi, Q., Gao, C., Rivero, C. P., Webb, C., Lin, C. S. K., & Venus, J. (2016). Valorization of organic residues for the production of added value chemicals: A contribution to the bio-based

economy. *Biochemical Engineering Journal*, *116*, 3–16. https://doi.org/10.1016/j.bej.2015.12.016

Ramsay, S. A., Shriver, L. H., & Taylor, C. A. (2017). Variety of fruit and vegetables is related to preschoolers' overall diet quality. *Preventive Medicine Reports*, *5*, 112–117. https://doi.org/10.1016/j.pmedr.2016.12.003

Rendón-Villalobos, J. R., Ortíz-Sánchez, A., & Flores-Huicochea, E. (2018). Chapter 9 - Nutritionally Enhanced Foods Incorporating Chía Seed. In A. M. Holban & A. M. Grumezescu (Eds.), *Therapeutic Foods* (pp. 257–281). https://doi.org/10.1016/B978-0-12-811517-6.00009-X

Ribeiro-Santos, R., Andrade, M., Madella, D., Martinazzo, A. P., de Aquino Garcia Moura, L., de Melo, N. R., & Sanches-Silva, A. (2017). Revisiting an ancient spice with medicinal purposes: Cinnamon. *Trends in Food Science & Technology*, *62*, 154–169. https://doi.org/10.1016/j.tifs.2017.02.011

Tenore, G. C., Caruso, D., Buonomo, G., D'Avino, M., Ciampaglia, R., & Novellino, E. (2018). Plasma lipid lowering effect by a novel chia seed based nutraceutical formulation. *Journal of Functional Foods*, *42*, 38–46. https://doi.org/10.1016/j.jff.2018.01.007

Vasconcelos, N. G., Croda, J., & Simionatto, S. (2018). Antibacterial mechanisms of cinnamon and its constituents: A review. *Microbial Pathogenesis*, *120*, 198–203. https://doi.org/10.1016/j.micpath.2018.04.036

Visioli, F., Franco, M., Toledo, E., Luchsinger, J., Willett, W. C., Hu, F. B., & Martinez-Gonzalez, M. A. (2018). Olive oil and prevention of chronic diseases: Summary of an International conference. *Nutrition, Metabolism and Cardiovascular Diseases*, *28*(7), 649–656. https://doi.org/10.1016/j.numecd.2018.04.004

Wani, T. A., Masoodi, F. A., Gani, A., Baba, W. N., Rahmanian, N., Akhter, R., … Ahmad, M. (2018). Olive oil and its principal bioactive compound: Hydroxytyrosol – A review of the recent literature. *Trends in Food Science & Technology*, *77*, 77–90. https://doi.org/10.1016/j.tifs.2018.05.001

Yusof, A., Ahmad, N. S., Hamid M.S., A., & Khong, T. K. (2018). Effects of honey on exercise performance and health components: A systematic review. *Science & Sports*. https://doi.org/10.1016/j.scispo.2018.02.007

438 Zettel, V., & Hitzmann, B. (2018). Applications of chia (Salvia hispanica L.) in food products. *Trends in*
439 *Food Science & Technology*. https://doi.org/10.1016/j.tifs.2018.07.011
440
441
442