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Centesimal Composition of Brazil Nut Freezing: Water and Lipid Content

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Abstract
The Brazil nut tree - (Bertholletia excelsa) - is a tropical species distributed in the Amazon region with great socioeconomic value. Its seeds consists of large amounts of lipids, which makes them more susceptible to degradation, affecting their appearance, color and flavor. This is due to rancidity - a process of alteration in vegetable oils that can cause oxidation in the product due to storage and temperature conditions, since the stability of products with fatty acids is associated with environmental conditions such as light and temperature. Therefore, it is necessary to enable a technique capable of reducing disadvantages of common drying processes and increasing product preservation. The methodology used in the present work was the freezing of fresh samples packed in polyethylene plastic and stored at a temperature of -20 ºC, being later analyzed. Statistical tests were also carried out in order to verify the existence of a significant difference in different storage tests.

Keywords: Brazil nut, freezing, centesimal composition.

1. Introduction

The chestnut tree (*Bertholletia excelsa*) is a tree of socioeconomic and ecological importance in the Amazon region found in different diversities in the northern states of Brazil. Its seeds, known as the Brazil nutor Amazon nut, serve as sustenance for extractive families as they are appreciated in local cuisine for their exotic flavor and are required by the food and the cosmetic industry.[1,2]

Chestnut seeds have appreciable amounts of macro and micronutrients with nutritional value.[3] After being collected in the forest, the raw nut traditionally goes through several stages of storage and drying in processing plants. After production, they are transported to points of sale (retail and wholesale), where customers can include them as ingredients for other products. The vegetable oil of the chestnut consists mainly of oleic, palmitic, and stearic acids.[4] Foods with a high lipid content, such as Brazil nuts, are highly perishable and subject to degradation that can change their smell and taste.[5] The main alteration process in vegetable oils is rancidity, although self-oxidation, polymerization, or thermal oxidation can also occur, which can be accelerated by storage conditions and temperature.[6] The stability of the product and its fatty acids depends on some conditions, such as heat, light, oxygen availability, the presence of free fatty acids, metals, peroxides, and antioxidants. Another factor to consider, in addition to lipid oxidation, is the water content of the food, as it influences the stability of the food.[7]

In the case of Brazil nuts, the seeds naturally have a moisture content of >20%, and the drying process is important to avoid the incidence of aflatoxin-producing fungi.[8] Conventional drying processes for Brazil nuts generally take hours, and rotary dryers, air convection, and hot air can be used; its objective is always to reduce the moisture content of the almonds, reaching up to 9.7% moisture in 48 hours.[9] Even with different conditions that affect the nutrient characteristics of Brazil nuts and with several studies on drying, such as by CHISTE et al. (2012), data on the use of “cold” as a preservation process are scarce. This technique could avoid some disadvantages in the drying/using heat while preserving the product, as it inhibits food spoilage agents, whether chemical, microbial, or

enzymatic.
In freezing, the temperature of the food is reduced below its freezing point (values between -10 and -40 °C), and part of its water changes state by forming ice crystals. This operation prevents microorganisms from using water. The freezing temperature and speed influence the product's final quality, and this process can be slow or fast.[11] By inhibiting microbiological growth, decreasing water activity, and enzymatic activity, freezing results in the shelf life of the product. Many articles have narrowed the relationship between rapid freezing and increased shelf life by keeping their initial quality.[12]
In this context, freezing can be a viable alternative to preserve the nut and guarantee its quality for longer. Hence, this study aimed to freeze the Brazil nut and evaluate the proximate composition.

2. Materials and methods

2.1 Materials: Fresh Brazil nuts (*in natura*) were acquired at a fair in downtown Manaus (Amazonas State, Brazil) was used.
2.2 Methods
2.2.1 Freezing: the peeled and sanitized Brazil nuts were slowly frozen in the amount ofat 300 g for each sample, and they were then submitted to a domestic freezer at -20 °C. Polyethylene plastic packaging was used.
2.2.2 Laboratory analysis: the nuts were analyzed *in natura* and after freezing for seven months. Analyses were made of the nuts before freezing for lipids (Soxhlet method), moisture, and water activity according to the methods described by AOAC (2016).

2.3 Statistical analysis.
The student's t test was used to evaluate the results in laboratory tests of samples analyzed in triplicate in order to observe whether the mean value found follows a normal distribution. An analysis of variance (ANOVA) was used to verify any significant differences between the means obtained in the different storage times of the products.

3. Results and discussion

The data obtained from the analysis of *in natura* nuts and the first six months of storage are listed in Table 1.

Table 1: Brazil nuts in natura and frozen.

Component	in natura	Months[1]		
		1	6	7
Moisture content (%)	18.45 ± 0.37	19.66 ± 1.72	23.58 ± 0.00	23.70 ± 2.07
Aw	0.98 ± 0.31	0.97 ± 0.00	0.97 ± 0.00	0.98 ± 0.00
Lipids (%)	24.3 ± 1.25	27.99 ± 3.5	36.29 ± 2.89	27.66 ± 1.94

The moisture data obtained differ from the retail nut data presented in Table 1 because the latter was previously dried and those used in our study were not. In turn, the moisture content is closer to values described by BOTELHO et al. (2019) for nuts that did not undergo any drying process. The water activity values show that there were no significant changes during storage. Brazil nut water activity remained in a close range during the three analyses. In the nuts of this work, which are whole, the values remained close to 0.98 during slow freezing.
As for the lipid content, KLUCZKOVSKI et al. (2017) reported that dehydrated Brazil nuts from the plant have 64.76% and retail nuts have 57.94%. The lipid content of Brazil nuts was in the same range except for Sample 2. The values of protein or nitrogen fraction of Brazil nuts, which were only analyzed in *in natura* nuts and in the last month, were not affected by slow freezing, with only a 2% change from one analysis to another. Additionally, the ash content does not seem to have been affected by the freezing preservation process, as from the first month to the last, there was only an increase of less than 1%.

4. Conclusions

In the long term, slow freezing did not seem to drastically affect the lipid fraction of the nut since it is the component with the highest percentage in the composition. Considering that it is a lower-cost method and more accessible to the consumer who has access to *in natura* nuts and even a new option for the slow freezing industry, it seemed to be a viable alternative for the analyzed variables.

References

1. AZEVEDO, V. R.; WADT, L. H. de O.; PEDROZO, C. A.; DA FONSECA, F. L.; DE RESENDE, M. D. V. Coeficiente de repetibilidade para produção de frutos e seleção de matrizes de Bertholletia excelsa (Bonpl.) em castanhais nativos do estado do Acre. Ciênc. Florest., Santa Maria, v. 30, n. 1, p. 135-144.
2. SILVA, L. de J. de S.; MENEGHETTI, G. A.; PINHEIRO, J. O. C.; DOS SANTOS, E. M.; PARINTINS, D. M. O extrativismo como elemento de desenvolvimento e sustentabilidade na Amazônia: um estudo a partir das comunidades coletoras de castanha-do-Brasil em Tefé, AM. Revista Destaques Acadêmicos, [S.l.], v. 11, n. 2, ago. 2019. ISSN 2176-3070. Disponível em: <http://www.univates.br/revistas/index.php/destaques/article/view/2271/1527>. Acesso em: 18 jan. 2020. doi:http://dx.doi.org/10.22410/issn.2176-3070.v11i2a2019.2271.
3. KLUCZKOVSKI, A.; LIMA, N.; OLIVEIRA, M. K. Brazil nut powdered milk properties. Journal of Food Processing and Preservation, v. 41, n. 5, p. e13147, 2017.
4. SCHONS, J. I., FIORI, K. P., RIBEIRO, E. B., ANDRIGHETTI, C. R., NOGUEIRA, R., DE SOUSA VALLADÃO, D. M. (2017). Extração assistida por ultrassom e caracterização do óleo da castanha-do-brasil (Bertholletia excelsa H.B.K.). Interciencia, 42(9), 586–590
5. CASAGRANDE, J.; BRANCO, C. dos S.; NICOLETTO, B. B. Análise da rancidez oxidativa em castanhas do Brasil em diferentes condições de armazenamento. RBONE-Revista Brasileira De Obesidade, Nutrição E Emagrecimento, v. 13, n. 81, p. 812-820, 2019.

6. SANCHES, M. Z.; MASSAD, J. A.; GIRALDI, E. H.; SIMEÃO, D. da S.; UENO, C. T.; SAKANAKA, L. S. Avaliação da viscosidade de óleo de café torrado (Coffea arabica) durante armazenamento em diferentes temperaturas. X Simpósio de Pesquisa dos Cafés do Brasil, 2019.
7. CHISTÉ, R. C.; LOPES, A. S.; PENA, R. da S. ISOTERMA DE ADSORÇÃO DE UMIDADE DA CASTANHA-DO-BRASIL (Bertholletia excelsa). Revista Brasileira de Tecnologia, v. 6, n. 01, p. 671-679, 2012.
8. DA SILVA, A. C.; SARTURI, DALL'OGLIO, E. L.; SOARES, M. A.; DE SOUSA, P. T.; DE VASCONCELOS, L. G.; KUHNEN, C. A. Microwave drying and desinfestation of Brazil nut seeds. Food Control, v. 70, p. 119-126, 2016.
9. BOTELHO, F. M.; BOSCHIROLI NETO, N. J.; BOTELHO, S. de C. C.; DE OLIVEIRA, G. H. H.; HAUTH, M. R. Sorption isotherms of Brazil nuts. Rev. bras. eng. agríc. ambient., Campina Grande, v. 23, n. 10, p. 776-781, Oct. 2019. Available from <http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1415-43662019001000776&lng=en&nrm=iso>. access on 21 Aug. 2020. Epub Sep 09, 2019. https://doi.org/10.1590/1807-1929/agriambi.v23n10p776-781.
10. KLUCZKOVSKI, A. M.; MARTINS, M.; MUNDIM, S. M.; SIMÕES, R. H.; NASCIMENTO, K. S.; MARINHO, H. A.; KLUCZKOVSKI JUNIOR, A. Properties of Brazil nuts: A review. African Journal of Biotechnology, v. 14, n. 8, p. 642-648, 2015.
11. DE MELO, D. B.; DA SILVA, A. P. F.; DE MOURA, D. F.; MEDEIROS, S. M. de F. M. dos S.; CAVALCANTI, I. D. L.; DA SILVA, J. H. L.; LEITE, A. R. de F.; DOS SANTOS, J. M. S.; MELO, M. de A.; COSTA, J. de O.; DA SILVA, G. M.; DE OLIVEIRA, G. B.; ROCHA, T. A.; DA COSTA, M. P.; PADILHA, A. C. B. da S.; FERREIRA S. A. de O; DA FONTE, R. A. B. Principais Técnicas de Conservação dos Alimentos/Main Food Preservation Techniques. Brazilian Journal of Development, v. 6, n. 1, p. 806-821, 2020.
12. ALHAMDAN, A.; HASSAN, B.; ALKAHTANI, H.; ABDELKARIM, D; YOUNIS, M. Freezing of fresh Barhi dates for quality preservation during frozen storage. Saudi Journal of Biological Sciences, v. 25, n. 8, p. 1552-1561, 2018.
13. FREITAS, S. C. S.; GONÇALVES, E. B.; ANTONIASSI, R. FELBERG, I.; OLIVEIRA, S. P. D. Meta-analysis of selenium content in Brazil nuts. BRAZ J FOOD TECHNOL, V. 11, P. 54-62, 2008.
14. GALEMBECK, F.; CSORDAS, Y. Cosméticos: A Química da beleza. 2009. Net, Rio de Janeiro 2011.
15. JAMES, S. J.; JAMES, C. Food Safety Management: Chapter 20. Chilling and freezing. Elsevier Inc. Chapters, 2013.
16. DE VILHENA, A. E. G.; SEHWARTZ, R. L. da C.; BEZERRA, P. T. da S.; BRASIL, D. do S. B. Caracterização físico-química do óleo de castanha do Pará extraído por prensagem hidráulica/Physical and chemical characterization of Pará chestnut oil extracted by hydraulic pressing. Brazilian Applied Science Review, v. 4, n. 3, p. 859-865, 2020.