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TEXTURAL CHARACTERISTICS OF BRAZILIAN FOODS – BROTH OF BEAN

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RESUMO – Os índios, como os primeiros habitantes do território brasileiro e, portanto, conhecedores de suas matérias-primas alimentares, influenciaram muito os hábitos alimentares dos brasileiros. Uma contribuição são os feijões da espécie *Faseolus vulgaris*, como o feijão preto e o pinto (carioca), tão importantes na dieta atual dos brasileiros. Além das características sensoriais do feijão e do seu caldo, o tempo de cozimento também é um parâmetro importante para o consumidor. Estudos reológicos sobre viscosidade do caldo de feijão são escassos, e inexistem relatos anteriores sobre metodologia de preparo de amostras de caldo de feijão para análise reológica. O presente trabalho teve como objetivo analisar, em reômetro, a viscosidade de dois tipos de caldo de feijão preto e carioca cozidos conforme tradicionalmente recomendado. Todos os caldos diferiram entre si e tiveram comportamento pseudoplástico. A filtragem dos caldos para a separação dos grãos deve ser realizada após o resfriamento à temperatura ambiente.

ABSTRACT – The Indians, as the first inhabitants of the Brazilian territory and, therefore, knowledgeable about their food raw materials, greatly influenced the eating habits of Brazilians. One important contribution are the beans of the species *Faseolus vulgaris*, such as black beans and pinto (carioca), so important in the current diet of Brazilians. In addition to the sensory characteristics of beans and their broth, cooking time is also an important parameter for consumers. Rheological studies on bean broth viscosity are scarce, and there are no previous reports on methodology for preparing bean broth samples for rheological analysis. The present work aimed to analyse, in rheometer, the viscosity of two type of broth from black and *carioca* beans cooked as traditionally recommended. All broths differed from each other in relation to viscosity and had pseudoplastic behaviours. The filtering of the broths to grains separation must be carried out after cooling to room temperature.

PALAVRAS-CHAVE: *Phaseolus vulgaris* L.*;* preparo de amostra; filtragem, análise reológica; viscosidade

KEYWORDS: *Phaseolus vulgaris* L.*;* sample preparation; filtration; rheological analysis; viscosity

1. INTRODUCTION

Common bean (*Phaseolus vulgaris* L.) is an ancient crop originating in Central America and South America. From these regions, a great variety of grains of different colors, shapes, and sizes appeared. Indeed, the visual characteristics are the basis for the classification of the current commercial classes of bean. Brazil is the third- largest producer of beans in the world, behind Myammar and India, respectively, and the first in the genus *Phaseolus*. The high climatic and soil adaptation capacity of this legume allows its cultivation throughout the year in all the states of the country, allowing a constant supply of the product in the market. It is possible to explore the crop in three different seasons in the same year. The four main producing states are, respectively, Parana, Minas Gerais, Sao Paulo, and Goias (Conab, 2017). Pinto (*carioca*) beans are the most produced variety in the country, with 63% of the total, most consumed in the Center- South region; whereas black beans have 18% of production and are most consumed in the states of Rio de Janeiro and Rio Grande do Sul (Brasil, 2017). Nutritional quality is related to the composition of the bean. According to Arvanitoyannis et al. (2007), beans can be a source of proteins, vitamins (thiamine, riboflavin, niacin, vitamin B6, and folic acid), dietary fiber (14–19%), particularly solubles fibres, minerals (Ca, Fe, Cu, Zn, P, K, and Mg), and unsaturated fatty acids.

The culinary quality of beans is as decisive as the commercial quality for future usage of a new cultivar or new trade mark. Brazilian consumers prefer freshly harvested beans, due to their softer texture, lighter coloring, and shorter cooking time (Rios et al., 2002). In storage, a gradual, irreversible, and cumulative deterioration can occur, whose speed and intensity will depend on the time and temperature of storage, the intrinsic characteristics of the grains, and the humidity of the same ones. The loss of quality is manifested by the increase in the degree of hardness of the bean, related to the increase in hardness of the skin, with consequent increases in the time necessary for cooking up to the point where the beans become hard to cook (HTC), the flavour changes, and the integument in some cultivars darken (Sartori, 1996).

According to Coelho et al. (2009), the heat treatment of the bean has nutritional implications, as well as promoting the development of the flavor, texture and color of the broth, important characteristics in the consumer acceptance, to obtain better digestibility, inactive antinutritional factors such as protease inhibitors. However, prolonged cooking time causes the loss of minerals, vitamins and proteins. A shorter cooking time results in energy and time savings, with cultivars having a cooking time of less than 30 minutes being desirable. The cooking of the beans for 20 to 25 minutes in a domestic pressure cooker possibility identifies bean cultivars with better sensory profiles, i.e., product with viscous broth and soft grains (Oliveira, 2009).

Unfortunately, beans broth rheological measurements are scarcely at Brazil. Sensorial analysis are more common. In the main works reviewed, the cooking of the grain was not done as recommended by popular Brazilian cuisine (Oliveira, 2009, João, 2016). And studies on obtaining the bean broth sample were not found. The present work aimed to analyse, in rheometer, the viscosity of two type of broth from black and *carioca* beans cooked as traditionally recommended.

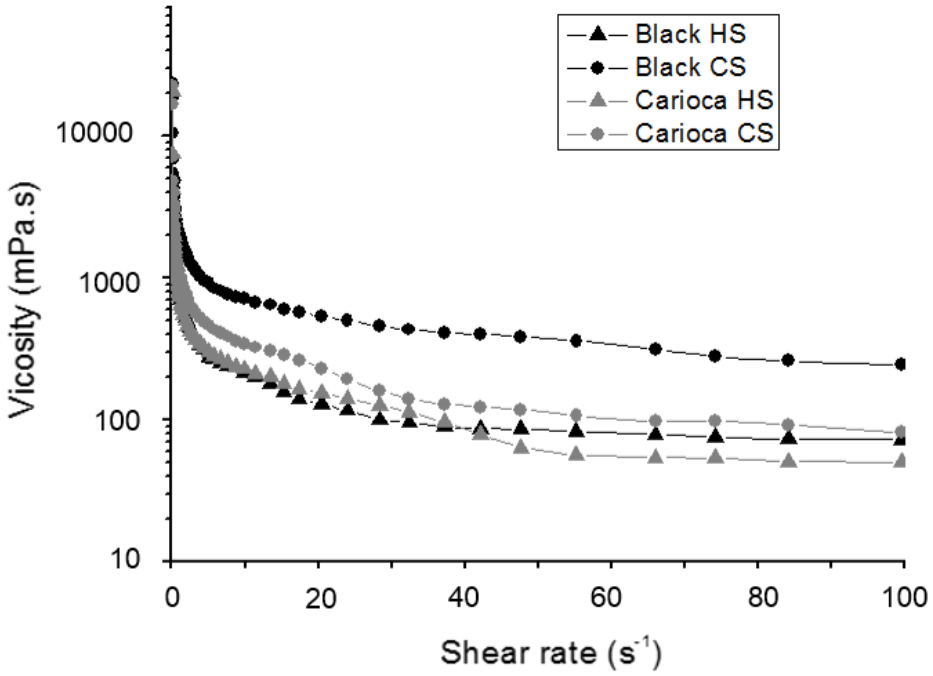
2. METHODOLOGY

From beans acquired at local market, *carioca* and black beans samples were cooked, in duplicate, as preconized by João (2016). At the sequence, the samples were added of salt (1.2 % w/w), onion and fresh garlic sliced (7 and 1 % w/w, respectively), in relation to beans weight, and a new cooking of 10 min with the pan uncovered was performed. The grains were separated from the broths using a 0.70 mm aperture metal sieve and broth recovery was made by two mode to each beans variety – sifting at hot (HS), immediately after the cooking finished, and at cold (CS), after reaching 25º C. The viscosity was determined in rheomether using the geometry of concentrical cylinders; the conditions of analysis were temperature of 25ºC, deformation rate from 0.1 to 100 s^{-1}, during 100 s.

3. RESULTS AND DISCUSSION

All broths had pseudoplastic behaviours. The viscosity of broths obtained by filtration after cooling (CS) was higher than other broths. In opposition to sensorial results obtained by Oliveira (2009), the black beans broths had the highest viscosities. Figure 1 shows the behaviour regarding the viscosity of black and *carioca* beans.

Figure 1 - Viscosities at 25 ºC of broths of black and *carioca* beans sifted hot (HS) and cold (CS) to grain separation.



The values at the rate approximately of 55.5 s^{-1} were 360 (CS) and 78.6 (HF) mPa.s for black beans broths against 112 (CS) and 56.2 (HS) mPa.s for *carioca* beans broths. But one must remember that these results may have been influenced by different storage time after harvest.

4. CONCLUSION

For more approximation to real results, the cooking of sample to posterior analysis need be performed in accordance to the traditional culinary recommendations, and the broths filtration must be performed after cooling until room temperature. The filtering of the broths must be carried out after cooling to room temperature. Differences between the viscosity of different varieties must be made in beans stored in the same condition.

5. BIBLIOGRAPHIC REFERENCES

Arvanitoyannis, I. S.; Mavromatis, A.; Rodiatis, A.; Goulas, C. (2007) Physicochemical and sensory analysis of dry bean landraces in conjunction with multivariate analysis: an explorative approach. *International Journal of Food Science and Technology*, 42 (7), 819-826.

Brasil. Ministério da Agricultura. Pecuária e Abastecimento. Secretaria de Política Agrícola (2017). *Projeções do Agronegócio Brasil 2016/17 a 2026/27 - Projeções de Longo Prazo.* Diário Oficial da República Federativa do Brasil.

Coelho, C.M.M.; Bordin, L. C.; Souza, C. A.; Miquelluti, D. J.; Guidolin, A. F. (2009). Tempo de cocção de grãos de feijão em função do tipo d'água. *Ciência e Agrotecnologia*, 33 (2), 560-566.

Conab. Companhia Nacional de Abastecimento. (2017). *Evolução dos custos de produção de feijão no Brasil e sua rentabilidade safra 2010/11 a 2015/16.* Brasília: CONAB. 5, 23.

João, E. C. B. (2016). *Qualidade tecnológica de grãos de feijão carioca armazenados.* **(**Dissertação de mestrado). Universidade Federal de Lavras, Lavras.

Oliveira, V. R. *Análise físico-química, microbiológica e sensorial de cultivares de feijão.*(Tese de doutorado). Universidade Federal de Santa Maria, Santa Maria.

Rios, A. O.; Abreu, C. M. P.; Corrêa, A. D. (2002). Efeitos da época de colheita e o tempo de armazenamento no escurecimento do tegumento de feijão (*Phaseolus vulgaris L.*). *Ciência e Agrotecnologia*, 26(3), 550-558.

SARTORI, M.R. Armazenamento (1996). In: ARAÚJO, S.R. et al. *Cultura do feijoeiro comum no Brasil.* Piracicaba: POTAFÓS. 786p. p.543-562.