Evaluation of nitrate, nitrite and saponins contents, total antioxidant potential, antioxidant capacity and activity in different products of beetroot: cereal bar, juice and chips.

Diego S Baião1, Fabrício de Oliveira Silva2, Daniel Perrone2, Eduardo Mere Del Aguila3, Vânia M Flosi Paschoalín1

1 Advanced Analysis in Biochemistry and Molecular Biology Laboratory, Chemistry Institute, Federal University of Rio de Janeiro, 21941-909, Rio de Janeiro, Brazil.
2 Nutritional Biochemistry and Food Laboratory, Chemistry Institute, Federal University of Rio de Janeiro, 21941-909, Rio de Janeiro, Brazil.

ABSTRACT

The beetroot of Beta vulgaris L. species is considered NO3 dietary and antioxidants source. However, the amount of these nutrients varies in relation to the administration form. This study aimed to develop a beetroot cereal bar (BB) and compare the NO3, N2O3 and saponins contents; potential, capacity and antioxidant activity to beetroot juice (BJ) and chips (BC). All ingredients used in the BJ, BC and BB formulations were obtained from the market from Rio de Janeiro, Brazil. The NO3, N2O3 contents and the total antioxidant potential (TAP) were analyzed by high-performance liquid chromatography. Saponins quantification was performed using spectrophotometry. The assessment of antioxidant capacity and activity was performed by the ferric reducing ability of plasma (FRAP), trolox equivalent antioxidant capacity (TEAC), oxygen radical antioxidant capacity (ORAC), 2,2-diphenyl-1-picrylhydrazyl radical scavenging assay (DPPH) and lipid peroxidation methods, respectively. BB showed the highest NO3 (16.6±0.1 mmol/100 g) and saponins (86.4±3.18 mg/100g) contents when compared to BJ and BC. Significantly higher values in the antioxidant capacity analysis were observed in BB when compared with BJ and BC. BB also showed an ability to inhibit lipid peroxidation (86.0%) significantly higher than BJ (54.3%), BC (65.0%), butylated hydroxyanisole (BHA, 76.3%), α-tocopherol (34.3%) and similar to butylated hydroxytoluene (BHT, 86.4%) standards. All beetroot administration forms showed a high TAP. In conclusion, a new nutritional approach, BB, showed to have the highest contents of nutrients, potential, activity and total antioxidant capacity, these characteristics are important to improve the vascular health, endothelial function and exercise performance.

MATERIAL AND METHODS

The beetroot used in this study was Chenopodiaceae family and Beta vulgaris L. species. All ingredients used in the formulations of juices, bars and chips were obtained from the trade of Rio de Janeiro, RJ, Brazil. All beetroots were sanitized beforehand in a clean container, containing 1 tablespoon of bleach soup (200 ppm active chlorine) in 1 liter of water for 20 min. The BB was formulated containing a dry phase of 61% and a lignin phase of 39% (Arévalo-Pinedo et al., 2013[1]). Beetroot chips was formulated cutting vertically into slices 6-8 cm wide and 2-4 mm thickness and beetroot slices were deposited side by side on a baking sheet lined with parchment paper and the surfaces of the slices was painted with olive oil. The baking was carried oven at 180°C for 20 min and then 150°C for 10 min. The chips were crushed by a portable grinder to obtain a homogeneous powder. BJ was formulated cutting into 4 cubes and liquefied it in centrifuge food. Saponins were performed as previously described by Shiao et al., 2009[2], using a calibration curve prepared with a commercial mixture of saponins obtained from soybeans and performed using spectrophotometer. The analysis of NO3, N2O3 and TAP were performed as described by Baião et al. 2016[3] and Wantuski et al., 2012[4] by HPLC. The antioxidant capacity and activity were performed FRAP, TEAC, ORAC, DPPH and lipid peroxidation methods and their results are expressed in mg or mmol/60g (dry weight and wet basis).

REFERENCES

1. Arévalo-Pinedo A, Arévalo ZDS, Beserra NS, Zuniga ADG, Coelho AFS, Pinedo RA. Desenvolvimento de barra de cereais à base de farinha de amêndoas de baçaú (Orbignya spesiosa). Revista Brasileira de Produtos Agroindustriais. 2013: 15(4); 405-411.