Antioxidant studies of Soy and Oat beverages during shelf life

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Introduction

Since many years, consumers are interested in using plant-based beverages. In addition to vegetarian and vegan diet, soybean or oat based beverages are milk-alternatives suitable for various people suffering from lactose intolerance or milk protein allergy.

Aim of the study

The stability of two products, soy and oat-based beverages, was studied in order to evaluate the capability to maintain antioxidant properties during twelve months of shelf life. The analysis was carried out on different samples provided by Centrale del Latte di Vicenza, with commercial formulation, in a time scale going from zero month, corresponding to production, and every two months of shelf life up to the fourteenth month.

Materials and methods

Hydroalcoholic extracts were prepared for addressing the antioxidant activity of the two beverage samples. Total phenolic content was estimated in addition to the ABTS (2,2'-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid) and DPPH (2,2-diphenyl-1-picrylhydrazyl) tests in order to measure the radical scavenging activities. Furthermore, lipid peroxidation was studied through determination of malondialdehyde (MDA, a final product of lipid peroxidation), while oxidation of protein was evaluated by determining protein fragmentation and carbonyl groups formation during shelf life.

Results

Both beverages are able to retain their antioxidant capability during all shelf life, even though in different manner. ABTS radical scavenging test revealed that values were stable for both matrices during shelf life, but they were three times lower in the oat beverage with respect to soy. DPPH assay indicated similar results. Only in oat beverages, percentage values of DPPH scavenging showed a slight decrease after twelve months. In addition, the total phenolic content in the two food matrices was studied. GAE (Gallic Acid Equivalent) (mg/100 mL product) measured in soy (25-30 mg/100 mL product) was double with respect to GAE in oat (about 15 mg/100 mL product), indicating a minor content of polyphenols in the latter. Lipid peroxidation of the two beverages was estimated by determination of MDA. The analysis did not reveal any increase of peroxidation in both samples. In oat-based beverages, MDA estimation showed reduction of peroxidation at the end of shelf life. Lipoperoxidation data showed differences between the two matrices. Both the beverages presented very low levels of MDA (a.u. of fluorescence/mL of product). In particular, soy-based beverages exhibited values ten times higher with respect to oat, due to the different composition in polyunsaturated fatty acids. Regarding the protein fraction changes during shelf life, oat proteins were slightly less fragmented with respect to soy proteins, however in both cases values did not show substantial alterations. The analysis of potential protein oxidation during shelf life displayed that oat proteins were three times more oxidizable with respect to soy proteins, but, after expiration date, carbonyl groups were not increased.

Conclusions

Through these studies, soy and oat-based beverages showed differences in lipid and protein behaviour due to the different composition of the two plant-based beverages. Antioxidant capacity of the two samples did not changed significantly during every analysis performed. Based on all experimental studies, during shelf life (twelve months), both products do not undergo alterations because significant changes regarding lipid and protein oxidation were not observed.

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