

## Bioaccessibility of carotenoids from microalgae

Andrêssa S. Fernandes\*<sup>1</sup>, Tatiele C. do Nascimento<sup>1</sup>, Veridiana V. de Rosso<sup>2</sup>, Eduardo Jacob-Lopes<sup>1</sup>, Leila Q. Zepka<sup>1</sup>

<sup>1</sup>Universidade Federal de Santa Maria (UFSM), Santa Maria/RS, Brazil

<sup>2</sup>Universidade Federal de São Paulo (UNIFESP), Santos/SP, Brazil

\*Doctoral student – andressa.asfs@gmail.com.br

The diversified composition of biomolecules microalgae can contribute to nutritious and functional diets. Among the functional compounds, carotenoids are in focus since having properties that result in biological functions beneficial to human health, which are in turn related to their bioaccessibility. In this sense, this study aimed to investigate the composition of carotenoids and their bioaccessibilities from the biomass of *Scenedesmus bijuga* and *Chlorella sorokiniana*. Therefore, the microalgae were cultivated in a bubble column photobioreactor operating in an intermittent regime, fed with 2.0L of BG11 medium. The carotenoid composition was determined by HPLC-PDA-MS/MS, and an *in vitro* digestion protocol was applied to evaluate the bioaccessibility of the carotenoids. A total of twenty-one different carotenoids were identified among species, corresponding to four carotenes and seventeen xanthophylls. *S. bijuga* exhibited a total carotenoid content of 1627.26  $\mu\text{g}\cdot\text{g}^{-1}$ , consisting of seventeen carotenoids and *C. sorokiniana* 1353.71  $\mu\text{g}\cdot\text{g}^{-1}$  with twelve compounds. All-*trans*-lutein (55.91-57.71%) and all-*trans*- $\beta$ -carotene (7.88-11.19%) were the most abundant carotenoids in the two microalgae. After *in vitro* digestion process, the qualitative carotenoid profile of the micellar fraction was similar to that of initial biomasses. Still, the contents were significantly lower: 109.06  $\mu\text{g}\cdot\text{g}^{-1}$  in *S. bijuga* and 104.45  $\mu\text{g}\cdot\text{g}^{-1}$  in *C. sorokiniana*. Twelve compounds were bioaccessible from the biomass of *S. bijuga*, and eight in *C. sorokiniana*. In general, the results of bioaccessibility showed that the compounds in their *cis* conformation were more bioaccessible than *trans*; and total carotenes more than total xanthophylls. Individual bioaccessibility of carotenoids was  $\geq 3.25\%$ . In *S. bijuga*, the bioaccessibility of total carotenoids was 7.30%, and the major bioaccessible carotenoids were 9-*cis*- $\beta$ -carotene (43.78%), 9-*cis*-zeaxanthin (42.30%) followed by 9-*cis*-lutein (26.73%); while in *C. sorokiniana*, the total bioaccessibility was 8.03%, and 9-*cis*- $\beta$ -carotene (26.18%), all-*trans*- $\beta$ -carotene (13.56%), followed by 13-*cis*-lutein (10.71%) were the major compounds. Based on these results, we observed the excellent potential of the *S. bijuga* and *C. sorokiniana* microalgae as alternative natural sources of bioaccessible carotenoids. Finally, this study can assist in the formulation and future development of new natural, functional, and nutraceutical foods and products from microalgae-based ingredients.

**Keywords:** *in vitro* digestion, carotenoids bioaccessibility, carotenes, xanthophylls, green microalgae