



EUROCAROTEN



International Conference on Carotenoid research
and applications in agro-food and health

BOOK *of* ABSTRACTS

COST ACTION CA15136

Lemesos (Cyprus), 26th-28th November 2019

OP-33

Citrus juice concentrate obtained by coupling enzymatic liquefaction with microfiltration: carotenoid bioaccessibility

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Citrus juices represent a significant dietary source of carotenoids. These micronutrients contribute to their health effects in combination with vitamins and polyphenols. Often coupled with enzymatic treatment to improve filterability, crossflow microfiltration (CMF) is an innovative process that allows carotenoid content to increase without heating¹. However, this process modifies juice characteristics that could probably alter the bioaccessibility of carotenoids. In this study, the effect of enzymatic liquefaction coupled to CMF on carotenoid bioaccessibility was investigated. A formulation consisting of a mixture of 60/40 *Citrus clementina* and *C. paradisi* juices was chosen to obtain a balanced β -carotene/ β -cryptoxanthin/lycopene profile. Carotenoids in the juice and the concentrate obtained were analyzed by HPLC. The individual bioaccessibility was assessed using an *in vitro* digestion model². Granulometry, viscosity, and pectin content were chosen as structural indicators to better understand the process impact on bioaccessibility. The concentrate was obtained coupling an enzyme liquefaction using Ultrazym AFP Novo (300 mg L⁻¹, 45 min, 30°C) and a CMF step with a 0.2 μ m tubular ceramic membrane at 30°C. Bioaccessibility of the 3 carotenoids in the juice was improved by the enzymatic liquefaction. This positive effect can be explained by particle size, viscosity, and pectin content reduction due to enzymatic degradation of cell walls. The CMF step also decreased the average diameter of insoluble particles but simultaneously increased viscosity and pectin content of the concentrate (9-fold). Because of these combined effects, carotenoid bioaccessibility was not significantly enhanced by CMF (in range of 25% for β -cryptoxanthin, 11% for β -carotene and 0.7% for lycopene). However, CMF was particularly relevant because carotenoid content in the concentrate increased by a factor of 9 for the 3 carotenoids. These results showed the interest to combine enzymatic liquefaction with CMF not only to increase the product filterability but also to improve its nutritional quality, combining carotenoid content with bioaccessibility. So, granulometry, viscosity and pectin content measured could be reliable indicators to predict carotenoid bioaccessibility.

References:

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2. Gence L, Servent A, Poucheret P, Hiol A, Dhuique-Mayer C. (2018). *Food & Function*, 9, 3523-3531.