

## Citrus flavanones enhance carotenoid uptake by human intestinal Caco-2 cells

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The health benefit of a diet rich in fruits and vegetables could be attributed to the complex mixture of phytochemicals. It is now widely believed that the actions of the antioxidant microconstituents is a result of additive and/or synergistic effects of these phytochemicals present in whole food. Because citrus juices are considered as a rich source of antioxidants including ascorbic acid (or vitamin C), phenolics compounds, and carotenoids, these different molecules may affect bioavailability or intestinal absorption of each other microconstituent. For these reasons, our study focused on effects of flavonoids and acid ascorbic on intestinal carotenoid uptake. This study was conducted using the differentiated Caco-2 cellline as experimental in vitro model and interactions of different flavanones such as hesperidin (HES-G) and hesperetin (HES) with carotenoid uptake were examined. Effect of ascorbic acid (AA) added to HES-G was also investigated. The data showed an enhancing effect of HES-G and HES on  $\beta$ -carotene (b-C) and  $\beta$ -cryptoxanthin (b-CX) uptake. For instance, at 5h incubation in presence of a mixture b-C:b-CX, HES-G and HES significantly increased total carotenoid uptake by 1.7 and 1.6-fold, respectively. Moreover, AA was able to cancel the enhancing effect of HES-G by decreasing significantly the cellular uptake of carotenoids from 48.2 to 39.8 % ( $P < 0.05$ ). In order to attribute the enhancing effect of HES-G to its already known iron-chelating effect, another experiment was conducted by incubating cells with b-CX in presence of either iron or a metal chelator (deferrioxamine). b-CX uptake decreases in presence of iron and increases in presence of deferrioxamine. In sum, the results indicate that citrus flavanones enhance the carotenoid uptake by intestinal cells and that iron inhibits this process. Thus, the present data suggest that the citrus polyphenols could act through their iron-chelating properties.