

Carotenoid Bioaccessibility: Effects of Food Matrix and Excipient Foods

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Abstract : Recently, increasing attention has been given to carotenoid bioaccessibility and bioavailability in the field of nutrition research. As a consequence of their lipophilic nature and their specific localization in plant-based tissues, carotenoid bioaccessibility and bioavailability is generally quite low in raw fruits and vegetables, since carotenoids need to be released from the cellular matrix and incorporated in the lipid fraction during digestion before being absorbed. Today's approach related to improving the bioaccessibility is to design food matrix. Recently, the newest approach, excipient food, has been introduced to improve the bioavailability of orally administered bioactive compounds. The main idea is combining food and another food (the excipient food) whose composition and/or structure is specifically designed for improving health benefits. In this study, effects of food processing, food matrix and the addition of excipient foods on the carotenoid bioaccessibility of carrots were determined. Different excipient foods (olive oil, lemon juice and whey curd) and different food matrices (grating, boiling and mashing) were used. Total carotenoid contents of the grated, boiled and mashed carrots were 57.23, 51.11 and 62.10 µg/g respectively. No significant differences among these values indicated that these treatments had no effect on the release of carotenoids from the food matrix. Contrary to, changes in the food matrix, especially mashing caused significant increase in the carotenoid bioaccessibility. Although the carotenoid bioaccessibility was 10.76% in grated carrots, this value was 18.19% in mashed carrots ($p < 0.05$). Addition of olive oil and lemon juice as excipients into the grated carrots caused 1.23 times and 1.67 times increase in the carotenoid content and the carotenoid bioaccessibility respectively. However, addition of the excipient foods in the boiled carrot samples did not influence the release of carotenoid from the food matrix. Whereas, up to 1.9 fold increase in the carotenoid bioaccessibility was determined by the addition of the excipient foods into the boiled carrots. The bioaccessibility increased from 14.20% to 27.12% by the addition of olive oil, lemon juice and whey curd. The highest carotenoid content among mashed carrots was found in the mashed carrots incorporated with olive oil and lemon juice. This combination also caused a significant increase in the carotenoid bioaccessibility from 18.19% to 29.94% ($p < 0.05$). When compared the results related with the effect of the treatments on the carotenoid bioaccessibility, mashed carrots containing olive oil, lemon juice and whey curd had the highest carotenoid bioaccessibility. The increase in the bioaccessibility was approximately 81% when compared to grated and mashed samples containing olive oil, lemon juice and whey curd. In conclusion, these results demonstrated that the food matrix and addition of the excipient foods had a significant effect on the carotenoid content and the carotenoid bioaccessibility.

Keywords : carrot, carotenoids, excipient foods, food matrix

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