Fruit carotenoids affect the bioaccessibility but not the intestinal cell uptake of β-carotene from Orange Fleashed Sweet Potato

A. ddition of pG F and C lem reduced significantly the bioaccessibility OF N o differences were observed in cellular uptake M icellarization test between carotenoid standards OFSP observed in Figure 1 was probably due to both carotenoid (pG F) and fruit matrix (Kiwi and Clem) or others microconstituents. There was an increase in the bioaccessibility of all-trans BC whereas Kiwi enhanced it (Fig 1a). Despite a more efficient incorporation of 13-cis BC into micelles in all conditions, pG F and Clem increased the bioaccessibility of the cis-form whereas no effect was observed in presence of Clem (Fig 1b). Presence of Lyc standard as a substitute of pG F during in vitro digestion confirmed carotenoid interaction decreasing micellarization of both BC isomers from OFSP. When Lut standard was added instead of Kiwi, only the 13-cis BC was affected (Data not shown). Micellarization test between carotenoid standards (Table 2) confirmed BC-Lyc interaction and showed a better micellarization of BC in presence of Bcx suggesting that Clem Bcx did not interfere in decreasing bioaccessibility of BC from OFSP. Therefore, the modification of the bioaccessibility of BC from boiled OFSP observed in Figure 1 was probably due to both carotenoid (pG F) and fruit matrix (Kiwi and Clem) or others microconstituents. No differences were observed in cellular uptake of all-trans BC from different digested samples (Table 3). Fruits carotenoids did not interact with BC from OFSP for intestinal absorption. The cis-form was less absorbed (9-13 %). Coupled in vitro digestion /Caco-2 cell Micellarization test Equimolar quantity of carotenoids were mixed and incubated in presence of 5 ml of 100 mg/ml bile during 17 h at 37 °C. Table 1. Carotenoid content of fruits.

<table>
<thead>
<tr>
<th>Carotenoids content (µg/g)</th>
<th>OFSP</th>
<th>all-trans BC</th>
<th>75.7 ± 1.0</th>
<th>pG F</th>
<th>Lyc</th>
<th>16.5 ± 0.4</th>
<th>Kiwi</th>
<th>Lut</th>
<th>1.9 ± 0.2</th>
<th>Clem</th>
<th>Bcx</th>
<th>9.7 ± 0.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data are means ± SD (n = 3 independent experiments). OFSP: orange fleshed sweet potato.</td>
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</table>

Table 2. Micellarization test in presence of carotenoids standards.

<table>
<thead>
<tr>
<th>BC micellarized (%)</th>
<th>BC</th>
<th>9.6 ± 0.4 b</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BC + Lyc</td>
<td>6.5 ± 0.3 c</td>
</tr>
<tr>
<td></td>
<td>BC + Lut</td>
<td>9.1 ± 0.9 b</td>
</tr>
<tr>
<td></td>
<td>BC + Bcx</td>
<td>12.7 ± 0.8 a</td>
</tr>
<tr>
<td>Significant differences (P&lt;0.05) are represented by different letter. Data are means ± SD (n = 3 independent experiments). BC: beta-carotene.</td>
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</tbody>
</table>

Table 3. Cellular uptake of all-trans BC from digested boiled OFSP.

<table>
<thead>
<tr>
<th>All-trans BC cellular uptake (%)</th>
<th>OFSP</th>
<th>28.8 ± 3.5</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>OFSP + pG F</td>
<td>27.8 ± 1.8</td>
</tr>
<tr>
<td></td>
<td>OFSP + Kiwi</td>
<td>21.9 ± 1.3</td>
</tr>
<tr>
<td></td>
<td>OFSP + Clem</td>
<td>28.3 ± 1.5</td>
</tr>
<tr>
<td>Data are means ± SEM (n = 3 independent experiments).</td>
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</tbody>
</table>

Results and discussion

Addition of pG F and Clem reduced significantly the bioaccessibility of all-trans BC whereas Kiwi enhanced it (Fig 1a). Despite a more efficient incorporation of 13-cis BC into micelles in all conditions, pG F and Clem decreased the bioaccessibility of the cis-form whereas no effect was observed in presence of Clem (Fig 1b).

Presence of Lyc standard as a substitute of pG F during in vitro digestion confirmed carotenoid interaction decreasing micellarization of both BC isomers from OFSP. When Lut standard was added instead of Kiwi, only the 13-cis BC was affected (Data not shown).

Micellarization test between carotenoid standards (Table 2) confirmed BC-Lyc interaction and showed a better micellarization of BC in presence of Bcx suggesting that Clem Bcx did not interfere in decreasing bioaccessibility of BC from OFSP.

Therefore, the modification of the bioaccessibility of BC from boiled OFSP observed in Figure 1 was probably due to both carotenoid (pG F) and fruit matrix (Kiwi and Clem) or others microconstituents.

No differences were observed in cellular uptake of all-trans BC from different digested samples (Table 3). Fruits carotenoids did not interact with BC from OFSP for intestinal absorption. The cis-form was less absorbed (9-13 %).

Materials and methods

All fruit juices were selected for their special carotenoid profile where major carotenoid was not BC comparatively with OFSP (Table 1). BC representing negligible amount (< 0.4 µg/g).

Fruits carotenoids affect the bioaccessibility but not the intestinal cell uptake of BC from OFSP. The simulated digestion coupled with the Caco-2 cell appeared to have a global approach of the bioavailability. Therefore, our results suggested that the presence of Kiwi had a positive effect on the bioavailability of BC from OFSP whereas pG F seemed to reduce it. However, further investigations are needed to identify other components responsible for interactions in order to improve the use of OFSP to maintain vitamin A status.

Conclusion

Carotenoids from fruit juices modified the bioaccessibility but not cellular uptake of BC from OFSP. The simulated digestion coupled with the Caco-2 cell appeared to have a global approach of the bioavailability. Therefore, our results suggested that the presence of Kiwi had a positive effect on the bioavailability of BC from OFSP whereas pG F seemed to reduce it. However, further investigations are needed to identify other components responsible for interactions in order to improve the use of OFSP to maintain vitamin A status.

References
