

Effect of pH on the chemical stability of carotenoids in juice

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Carotenoids are abundantly present in fruits and vegetables and are considered beneficial for human health. Although carotenoids are inherently unstable and degradation occurs during food preparation and storage, bioavailability of β -carotene from processed foods, such as carrot juice, can be up to 70 % higher as from raw carrots⁽¹⁾. Thus, well-chosen food processing techniques can increase health benefits of fruit and vegetables. During juice and smoothie preparation, organic acids are released from sheered plant cells⁽²⁾. Carotenoids are sensitive to environmental factors such as light, temperature, oxygen as well to acidic conditions⁽³⁾. This study investigated the effect of pH on carotenoid stability in juice.

Freshly prepared carrot juice (pH 6.07) was adjusted to pH 8, 7, 6, 5, 4 and 3 using citric acid or NaOH and stored at 4 °C for 4 days. Juice samples were freeze-dried and total carotenoids extracted and quantified as previously described⁽⁴⁾. Neutral and slightly basic conditions (pH 8 and 7) reduced total carotenoid content by 26 % ($p < 0.05$) and acidic conditions (pH 6, 5, 4 and 3) increased the measured total carotenoid content in carrot juice by 18 %, 22 %, 27 % and 22 % respectively ($p < 0.05$) (Figure 1).

When fresh fruit and vegetable juices (carrot, lemon, orange and apple) were blended to attain a pH of 3.15, 3.98 and 4.95, no carotenoid degradation was observed after 8 day storage at 4 °C. A pH of 3.15 however resulted in a 16 % reduction of total carotenoids ($p < 0.05$) (Figure 2).

These findings indicate that carotenoids in fresh juices were sensitive to pH. However, observed carotenoid degradation in fruit and vegetable juice was small (16–25 %). The apparent increase of total carotenoid content (~20 %) in acidified carrot juice may be due to enhanced solubility of crystallized carotenoids present in the vacuoles of plant material⁽⁵⁾. While our findings confirm the notion that carotenoids are pH sensitive all observed variation were less than 25 %.

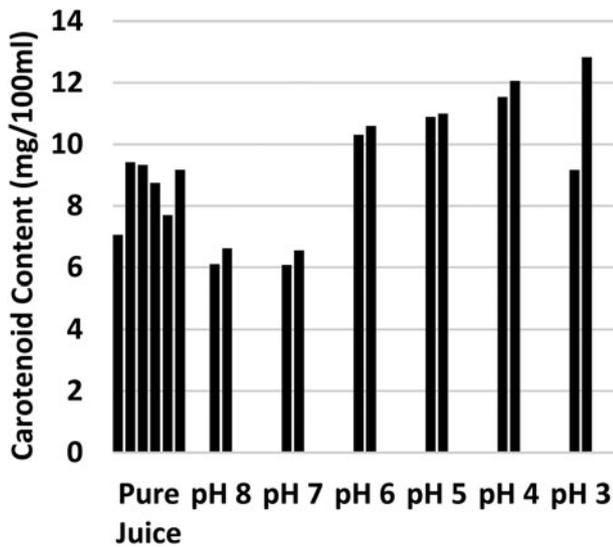


Fig. 1. Carotenoid content in refrigerated and pH adjusted fresh carrot juice.

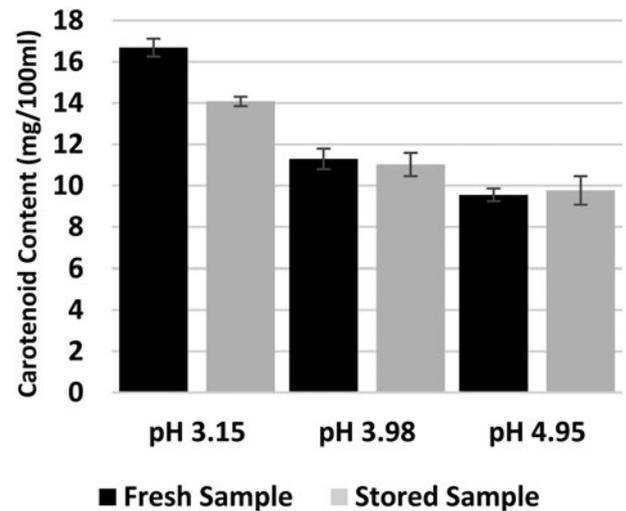


Fig. 2. Carotenoid content in fresh and refrigerated fruit & carrot juice.

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