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Apple juice found to contain novel phenolics with surprising tanning properties



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Castillo-Fraire CM *et al.*

Preparative fractionation of 5'-O-caffeoylquinic acid oxidation products using centrifugal partition chromatography and their investigation by mass spectrometry.

Journal of Chromatography A. 2019 - <https://doi.org/10.1016/j.chroma.2019.01.071>

Castillo-Fraire CM *et al.*

Interactions between polyphenol oxidation products and salivary proteins: Specific affinity of CQA dehydromers with cystatins and P-B peptide.

Food Chemistry. 2020 - <https://doi.org/10.1016/j.foodchem.2020.128496>

Partnerships

This study materialized through thesis work by C.M Castillo-Fraire and through a collaborative venture with the REQUIMTE/LAQV Laboratory at University of Porto in Portugal.

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Context

Cider apples contain high amounts of phenolic compounds, which are nutritionally significant substances. Using cider apples could prove a pertinent way forward for developing innovative high-nutritional-value apple juices, but not if it compromises organoleptic quality, such as excessive astringency due to the tanning properties of certain polyphenols complexing with specific salivary proteins like proline-rich proteins (PRPs).

When apples are processed into juice, the enzymatic oxidation of polyphenols generates new polyphenolics ('oxidation products') with original structures, but little is known about their nutritional and organoleptic properties. To address this gap, we set out to characterize the structures and study the tanning properties of products resulting from the oxidative dimerization of chlorogenic acid, the main phenolic acid in apple juice.

Results

Precipitation of various salivary proteins by a mixture containing several chlorogenic acid oxidation products was measured, and we found that these oxidized phenolics significantly interacted with statherin/P-B peptide and cystatins whereas precipitation

was significantly weaker for the PRPs. This original behaviour was subsequently confirmed by fluorescence quenching experiments performed with pure proteins and purpose-purified oxidized phenolics. To the best of our knowledge, the strong and specific affinity of phenolic compounds for these two families of salivary proteins (P-B peptide and cystatins) had never previously been observed, and their relatively low ability to precipitate PRPs was also unexpected. These results strongly suggest that the tanning effect of some polyphenols—in this case oxidation products—may more specifically concern other salivary proteins than PRPs.

Future outlook

Work ongoing and in the pipeline aims to explore the tanning properties of oxidation products from other polyphenolic families of polyphenolic compounds (catechins, procyanidins), and to press ahead with sensory analysis to investigate the material effects of these specific interactions on perceived in-mouth astringency.