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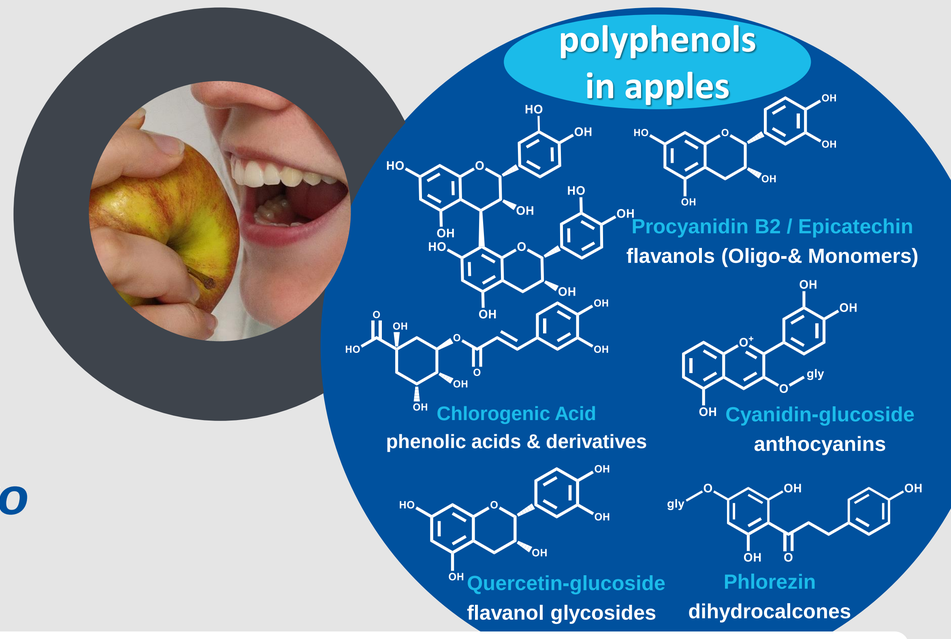

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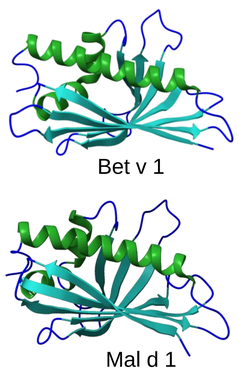
Bioaccessibility of Apple Polyphenols during *in vitro* and *ex vivo* Oral Digestion

Overview

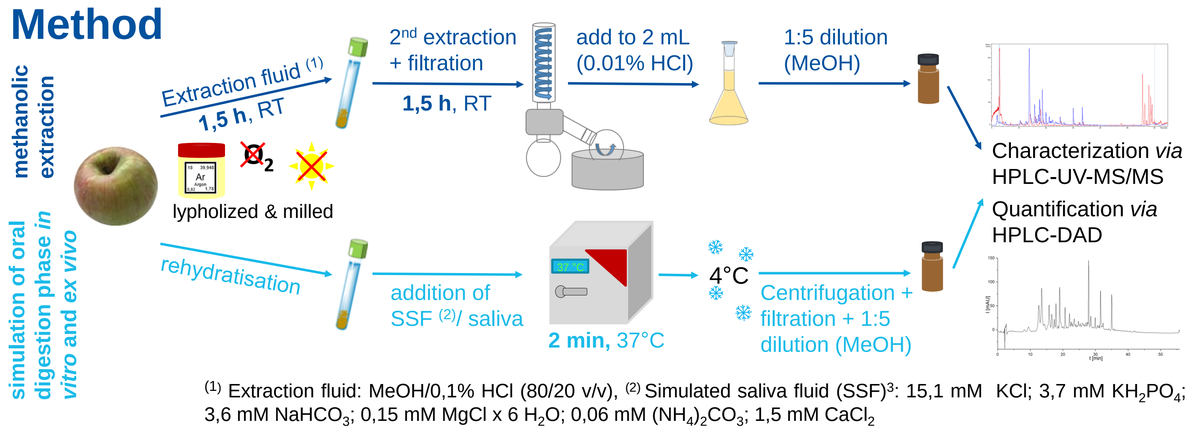
Polyphenol (PP) rich traditional apple varieties are better tolerated by people suffering from an allergy against Mal d 1 than commercial breeds, which tend to have a lower total phenolic content (TPC).[1] Therefore a correlation between TPC and the allergenic potential of an apple variety is hypothesized. Since Mal d 1 is proteolytically labile[2] and symptoms are restricted to the mouth and throat area, only PP bioaccessible during the oral digestion may contribute to the reduction of the allergenic potential.
Therefore, the release of PP from apple flesh and peel using simulated saliva fluid (SSF)[3], centrifuged (cent) and non-centrifuged (non.cent) saliva was investigated. A bioaccessibility of 70±14% and 49±6% from flesh and peel was determined, respectively. Surprisingly no effect of the digestion fluid used was observed. The results of the bioaccessibility studies or TPC were correlated with the Mal d 1 content and the allergenic potential of the apple varieties investigated and no effect of monomeric PP on variety dependent allergenic potential was obvious.

Introduction

- 70% of all patients suffering from birch pollenosis develop a cross allergy against apple[4]
  → Reason: structural homology of Mal d 1 to Bet v 1 allergen in birch
- Symptoms are usually mild and localized to mouth and throat area
- Variety dependent allergenic potential is reported [1;5]
- Effect of PPs on allergenic potential is proposed,[1] however only bioaccessible PP in the oral phase might interact with allergen
  → **Objective:** Determination of the bioaccessibility of PP in 20 varieties and correlation with the Mal d 1 content and tolerability



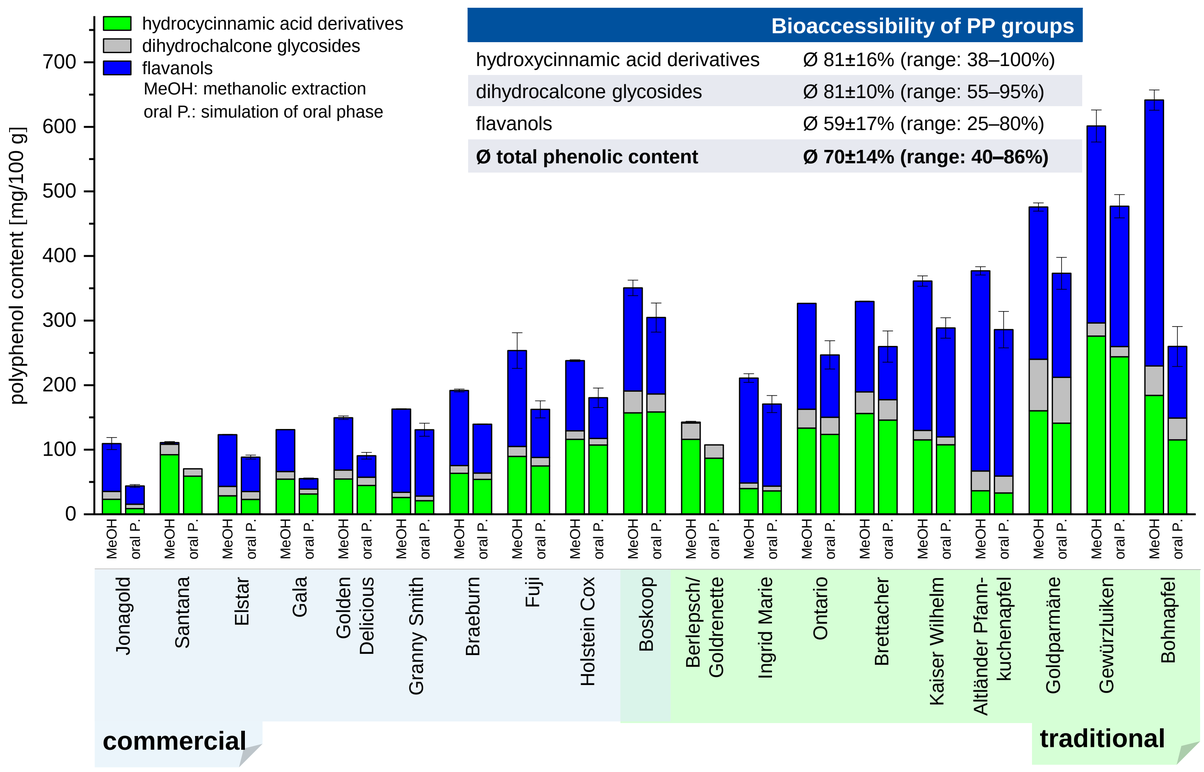
Method



(1) Extraction fluid: MeOH/0,1% HCl (80/20 v/v), (2) Simulated saliva fluid (SSF)[3]: 15,1 mM KCl; 3,7 mM KH_2PO_4; 3,6 mM $NaHCO_3$; 0,15 mM MgCl x 6 H_2O; 0,06 mM $(NH_4)_2CO_3$; 1,5 mM $CaCl_2$

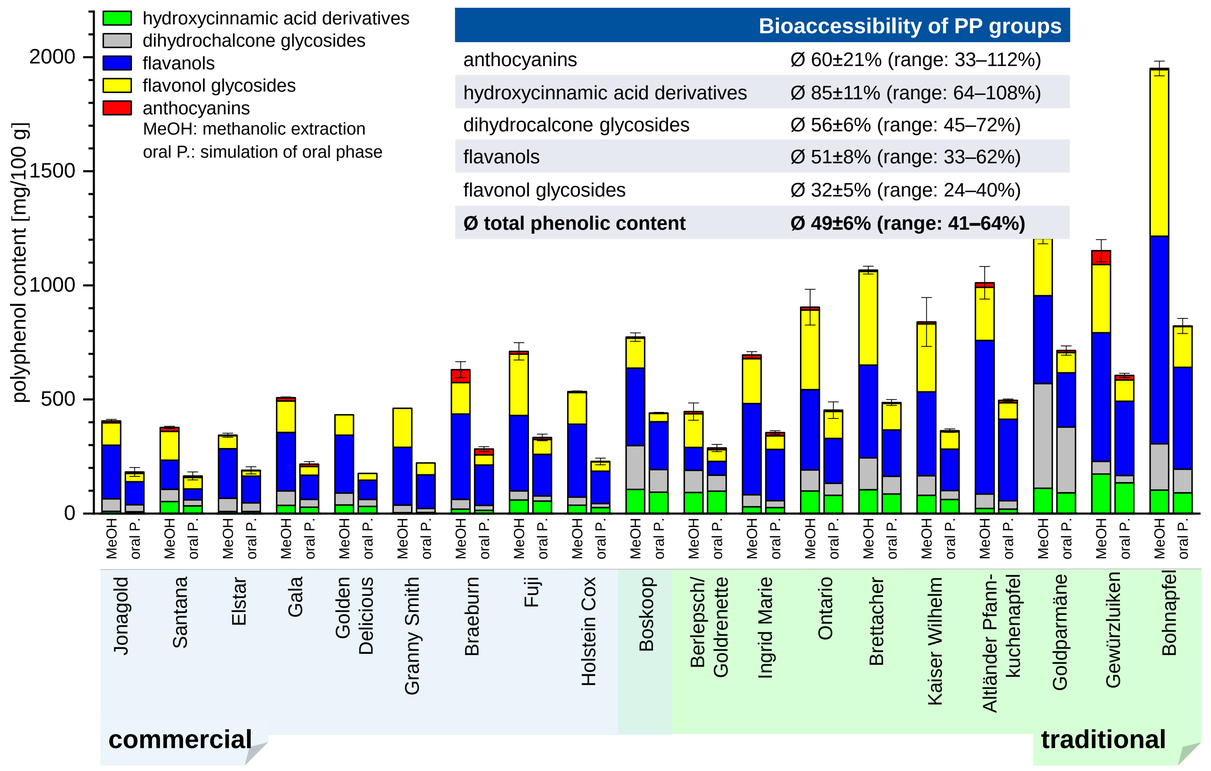
Results

flesh



Bioaccessibility of PP groups	
hydroxycinnamic acid derivatives	Ø 81±16% (range: 38–100%)
dihydrocalcone glycosides	Ø 81±10% (range: 55–95%)
flavanols	Ø 59±17% (range: 25–80%)
Ø total phenolic content	**Ø 70±14% (range: 40–86%)**

peel

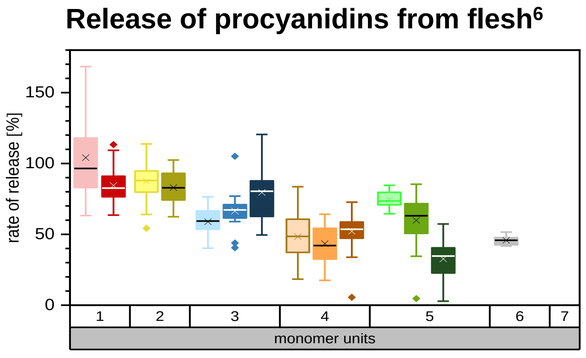


Bioaccessibility of PP groups	
anthocyanins	Ø 60±21% (range: 33–112%)
hydroxycinnamic acid derivatives	Ø 85±11% (range: 64–108%)
dihydrocalcone glycosides	Ø 56±6% (range: 45–72%)
flavanols	Ø 51±8% (range: 33–62%)
flavonol glycosides	Ø 32±5% (range: 24–40%)
Ø total phenolic content	**Ø 49±6% (range: 41–64%)**

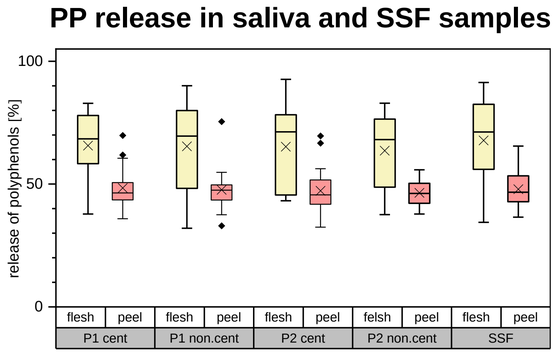
conclusion

- TPC is 2–4 times higher in the peel than in the flesh
- Significant differences in TPC content and profile between varieties
- Higher TPC content in traditional varieties compared to commercial breeds, exceptions are Berlepsch, Ingrid Marie and Boskoop
- Average bioaccessibility from the peel is lower than from the flesh
- Bioaccessibility differs between the different PP groups present in apples
- Low bioaccessibility of flavanols from Bohnapfel, Gala and Jonagold from the flesh cannot be explained so far

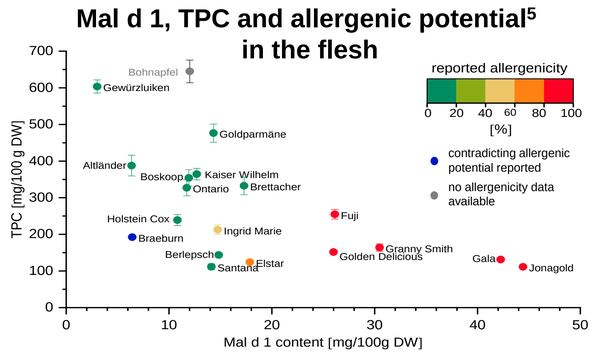
Release of procyanidins from flesh[6]



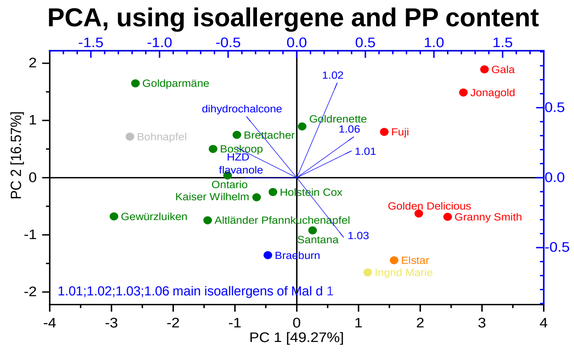
PP release in saliva and SSF samples



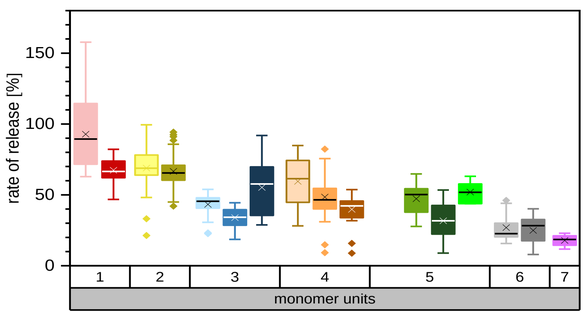
Mal d 1, TPC and allergenic potential[5] in the flesh



PCA, using isoallergene and PP content



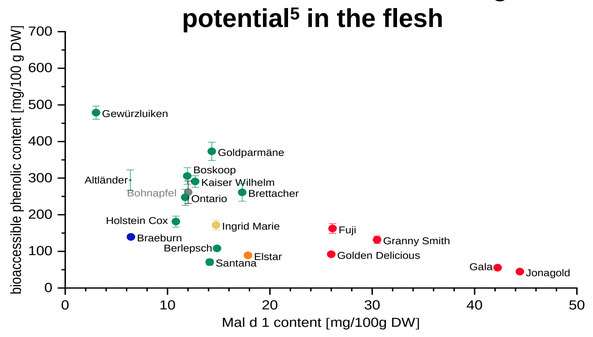
Release of procyanidins from peel[6]



conclusion

- Bioaccessibility of procyanidins decreases with increasing number of monomer units
- No differences in results among tested saliva fluids
  → **Exchange of saliva by SSF without loss of information in the future possible**

Mal d 1, bioaccessible PP and allergenic potential[5] in the flesh



conclusion

- No correlation between allergic potential, Mal d 1 content and monomeric phenolic content
- According PCA Mal d 1 content and profile are the main factors affecting allergenic potential
- Effect of browning products is of interest in future research

References

[1] Kschonsek et al. Nutrition. 2019;58:30-35; [2] Jensen-Jarolim et al. FASEB J. 1999;13(12):1586-1592; [3] Minekus et al. Food Funkt. 2014;5(6):1113; [4] Gao et al. BMC Plant Biol 2008;8:116; [5] BUND Lemgo Sortensliste Apfelallergie 2020 https://www.bund-lemgo.de/apfelallergie.html. (13. Mai 2021); [6] Kaeswurm et al. J Agric Food Chem. 2022 13;70(14):4407-4417.

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Research funded by the German Research Foundation (DFG, grant number 3811/1-1) and by the Ministry of Science, Reseach and the Arts Baden-Württemberg, the Dr. Leni Schöninger Foundation and fund of the chemical industry, Germany (FCI).