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Influence of the Polyphenol Extracts from Apple Skin on the Viability of Probiotic Bacteria in Model Milk Drink

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Aim

To investigate the effects of apple skin polyphenols on the survival of probiotic bacteria in a model fruit extract-enhanced milk drink.

Introduction

Functional foods containing polyphenol (PP) antioxidants and probiotic bacteria (PB) are gaining increased market leverage. Probiotic bacteria however, exhibit low viability in dairy foods during storage, due to the low pH and oxidative stress generated during processing. The low viability subsequently affects the ability of probiotic bacteria to impart their desired health benefits. PPs are well known antioxidants that can reduce the oxidative stress in food systems. Thus, it is of interest to examine the influence of added PPs on the survival of probiotic bacteria in dairy drinks.

Methods

PP extracts from apple skin were prepared using either absolute ethanol (EtOH) or citric acid infused water (Acidic H_2O), and subjected to analyses of total extractable PP content (by Folin-Ciocalteu assay, Singleton et al. 1999) and PP composition (by High Performance Liquid Chromatography, Stevenson et al. 2006). The PP extracts were then added to 12% reconstituted skim milk in the absence or presence of *Lactobacillus acidophilus* as probiotic bacteria. The obtained milk samples were stored at 4°C for 30 days, and the subsamples on Days 0, 5, 10, 15, 20, 25 and 30 were subjected to the viability assay.

Results and Discussion

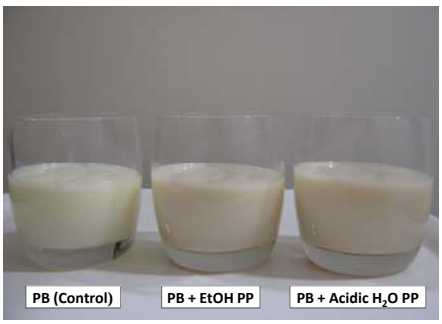

Fig 1. Probiotic (PB) milk drinks with and without added apple skin polyphenols (ethanolic PP extract, EtOH PPs, or acidic water extract, Acidic H_2O PPs)

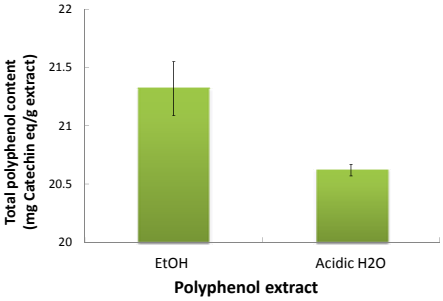

Fig 2. Total polyphenol content of apple skin extract

- Total PP content of Acidic H_2O extract was slightly lower than that of EtOH extract.

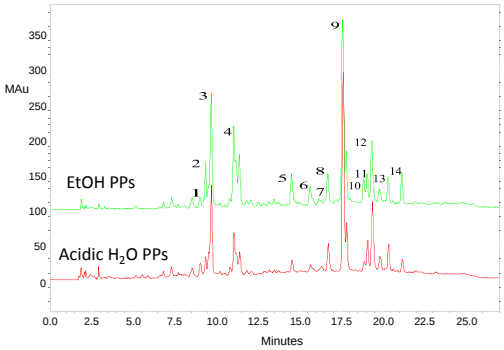

Fig 3. High performance liquid chromatography chromatograms (280 nm) for Ethanolic and acidic H_2O extracts. Peaks 1. catechin 2. caffeic acid 3. chlorogenic acid 4. epicatechin 5. *p*-coumaric acid 6. procyanidin trimer 7. *m*-coumaric acid 8. ferulic acid 9. rutin 10. *o*-coumaric acid or salicylic acid 11. quercetin derivative-1, 12. quercetin derivative-2 13. quercetin derivative-3 14. phloridzin

- The main species of typical apple PPs appeared in the HPLC profile of both EtOH and Acidic H_2O extracts.
- The proportion of the PPs in the two extracts differed as a result of the differences in the composition, pH and polarity of the two extracts.

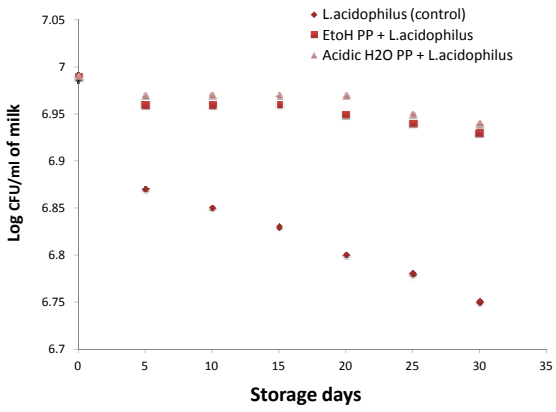

Fig 4. Influence of apple polyphenol extract on the viability of *Lactobacilllus acidophilus* in model milk drinks.

- A steady loss (from 6.99 to 6.75 CFU/mL) of viability of *L. acidophilus* was detected in control milk over 30 days.
- The viability of *L. acidophilus* was significantly higher in milk drinks that were enhanced with an apple skin PP extracts (either EtOH or Acidic H_2O extract)
- The viability of *L. acidophilus* in milk enhanced with Acidic H_2O extract was marginally higher than that with EtOH PP extract especially around Day 20.

Conclusion

- Apple skin PPs can maintain the viability of probiotic bacteria in milk drink systems.
- Apple skin is a potential source of polyphenols that can be used as a bioactive food ingredient for dairy products containing probiotic bacteria.

References

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Stevenson DE, Wibisono R, Jensen DJ, Stanley RA & Cooney JM. 2006. Direct acylation of flavonoid glycosides with phenolic acids catalysed by Candida antarctica lipase B (Novozym 435®). Enzyme and Microbial Technology 39(6):1236-1241.

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