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

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Aim

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

Abstract

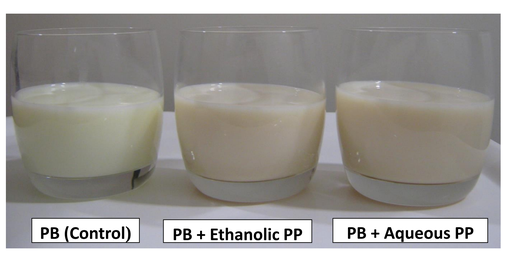
This study aimed to investigate the effects of apple skin polyphenol (PP) extracts on the attachment and survival of probiotic bacteria (PB) in a model fruit extract-enhanced milk drink. Results show that the PB viability was higher in PP-enhanced milk than in milk only (control). Survival of PB in milk drinks can be prolonged by microencapsulating PB together with apple skin PPs in alginate polymer. Apple skin PP extracts also enhanced the adhesion of PB. Apple skin may be a cost-effective source of PPs for enhancing PB functionality in dairy foods.

Introduction

Probiotic therapy shows promise in the prevention or treatment of gastrointestinal (GI) disorders. However, the survival of PB in foods and their attachment to the GI tract are prerequisites for imparting desired health benefits. The health benefits of apple-derived PPs are well known. This enables apple PPs as acceptable antioxidants to consumers for reducing the oxidative stress in foods, to provide PB with an environment favourable to their survival and attachment. This study evaluated the efficacy of apple skin PPs on the attachment and survival of PB in model milk drinks.

Methods

Apple skin PP extracts were prepared using either absolute ethanol (Ethanolic PP) or citric acid infused water (Aqueous PP), and then added directly, or after being microencapsulated with PB (*Lactobacillus acidophilus*) in alginate beads (Sun-Waterhouse et al., 2011), to a 12% reconstituted skim milk in the absence or presence of PB. The obtained milk samples were stored at 4 °C for 50 days, and subsamples on Days 0 to 50 were subjected to a viability assay. The influence of polyphenolic extracts on the ability of PB to adhere was estimated by Crystal violet assay (Oh et al., 2007) in aerobic and anaerobic conditions at 37 °C.



Results and Discussion

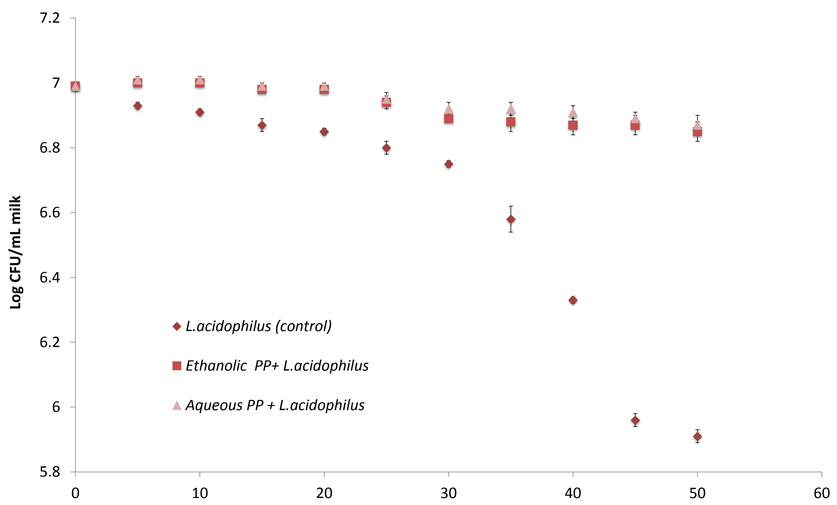


Fig 1. Influence of apple polyphenol extracts on the viability of *Lactobacillus acidophilus* in model milk drinks.

- A steady loss of viability (from 6.99 to 5.91 Log CFU/mL) of *L. acidophilus* was detected in control milk over 50 days .
- The viability of *L. acidophilus* was significantly higher in PP-enhanced milk drinks
- The viability of *L. acidophilus* in milk enhanced with aqueous PP extract was marginally higher than that with ethanolic PP extract, especially around Day 30.

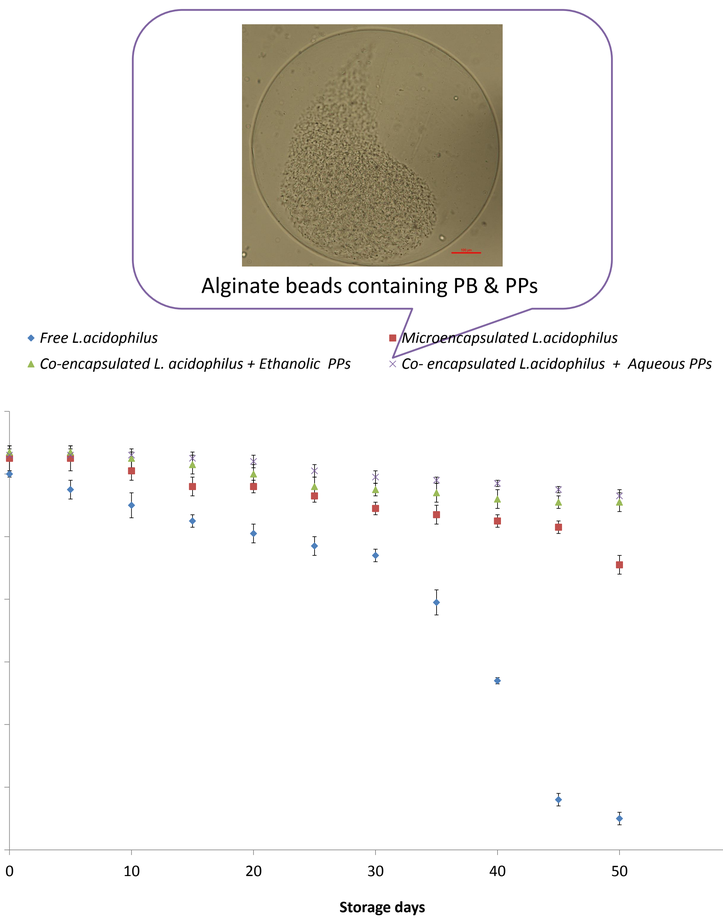


Fig 2. Influence of apple polyphenol extracts on the viability of co-encapsulated *Lactobacillus acidophilus* in milk drinks

- The viability of free (unencapsulated) PB declined gradually over 50 days.
- The viability of microencapsulated PB alone decreased (from 8.05 to 7.82 Log CFU/mL) over 50 days.
- The viability of PB microencapsulated together with either aqueous or ethanolic PP extract, was prolonged significantly in milk drinks.

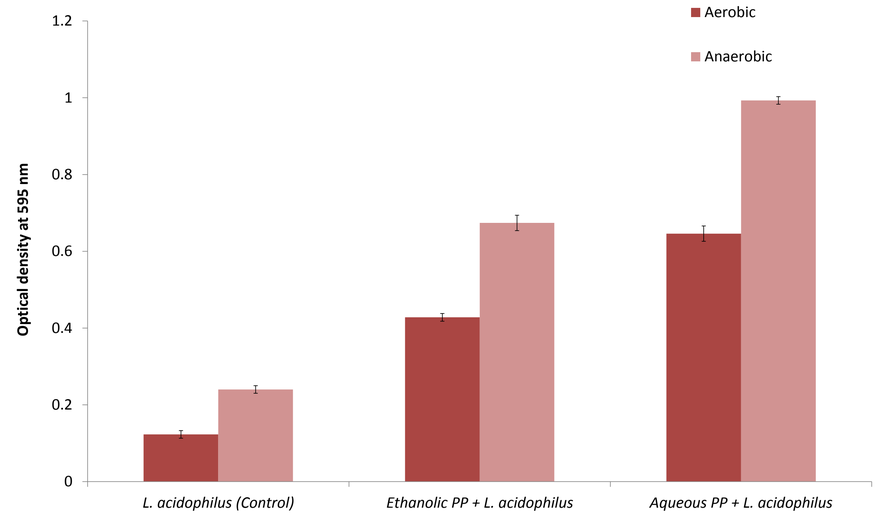


Fig 4. Influence of apple polyphenol extracts on the adhesion of *Lactobacillus acidophilus* in model milk drinks.

- Anaerobic conditions favoured significant adhesion of *L. acidophilus* compared with aerobic conditions.
- The presence of an apple skin PP extract significantly enhanced the attachment of *L. acidophilus* under both aerobic and anaerobic conditions.
- The efficiency of aqueous PP extract was significantly higher in enhancing the adhesion of *L. acidophilus* compared with that of ethanolic PP extract.

Conclusions

- Apple skin PPs can preserve the viability of probiotic bacteria in milk drink systems.
- Survival of PB in milk drinks can be prolonged by microencapsulating the bacteria with apple skin PPs.
- Apple skin PPs positively influence the adhesion properties of PB.
- 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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