Improving Bacterial Viability in The *In Vitro* Gastrointestinal System by Encapsulation of *Lactobacillus paracasei* Probiotic Bacteria on Chestnut (*Castanea sativa* Mill.) Fruit

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Abstract

Probiotic bacteria offer numerous health benefits, such as improving gastrointestinal health, boosting the immune system, reducing inflammation, and regulating cholesterol[1]. However, their effectiveness can only be protected if their viability is preserved. Encapsulation techniques can enhance the effectiveness of probiotic bacteria by preserving their viability and promoting their survival in the gastrointestinal tract before and after consumption[2]. Plants, specifically those high in protein, carbohydrates, and fiber, are often used as coating materials for encapsulation.

Chestnut (*Castanea sativa* Mill.) is a fruit rich in carbohydrates, protein, dietary fiber, vitamins, minerals, lipids, and other nutrients. They are recognized for their therapeutic effects, which include antioxidant properties that help combat oxidative stress, anti-inflammatory properties that can reduce swelling and pain, anticarcinogenic properties that may help prevent cancer, and antimicrobial properties that can inhibit the growth of harmful microorganisms[3].

In this study, the probiotic bacteria *Lactobacillus paracasei* was encapsulated by freeze-drying (lyophilization) method[4]. The encapsulation process involved using three different parts of the chestnut fruit - the interior, inner shell, and outer shell - as coating materials. The encapsulation efficiency of the *L. paracasei* capsules was determined for each coating material. Additionally, conducted structure and size analyses of the capsules using FTIR and SEM. Also, the viability of the capsules and free bacteria was compared during *in vitro* gastrointestinal digestion and during 28 days of storage. It is thought that new products can be developed by using the obtained *L. paracasei*-chestnut fruit capsules as natural additives in food products.

Keywords: Probiotic bacteria, *Lactobacillus paracasei*, Encapsulation, Freeze-drying, Chestnut, *Castanea sativa* Mill.

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