Viability of *L. casei* during microencapsulation in chitosan-Ca-alginate microparticles and in simulated *in vivo* conditions

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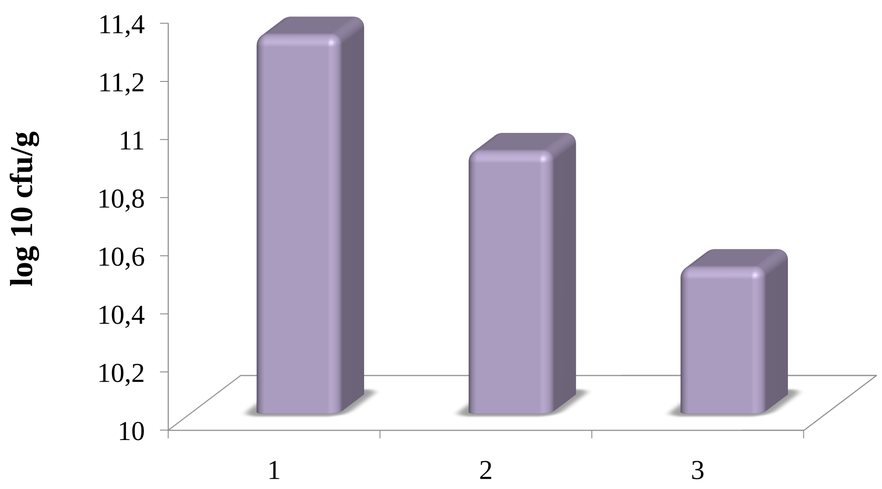
INTRODUCTION AND AIM

Viability loss of probiotics in pharmaceutical and food products and during the passage in the upper gastrointestinal tract has always been an obstacle for effective delivery of bacterial cells able to colonize the intestine. Microencapsulation has shown to be efficient method in preserving probiotic's viability.

The aim of this study was to evaluate the survival rate of *L. casei* during microencapsulation and in simulated *in vivo* conditions after incorporation in chitosan-Ca-alginate microparticles enriched with fructooligosaccharide as prebiotic.

METHODOLOGY

Microparticles were prepared by spray-drying combined with polyelectrolyte complexation of alginate, fructo-oligosaccharide and chitosan, and cross-linking with $CaCl_2$. The viability of probiotic cells, alone and encapsulated, after freeze-drying, in simulated gastric juice (pH 1,2), bile salts solution (0,6%, pH 6,8) and colonic pH 7.4, in different time intervals, was investigated.



1. Initial cell population of *L. casei*;
2. Viability of encapsulated *L. casei* after spray-drying;
3. Viability of encapsulated *L. casei* after freeze-drying

Fig. 1 Survival of *L. casei* during microencapsulation and subsequent lyophillization (log_{10} cfu/g)

RESULTS AND DISCUSSION

The initial cell population before encapsulation was 2 x 10^{11} cfu/g. High cell entrapping, within the therapeutic value, in the particles was achieved (3,2 x 10^{10} cfu/g). Narrow size distribution of the particles was observed ($d_{50\%}$ of 18,42 μm; PDI 0,155), with production yield of approximately 40%.

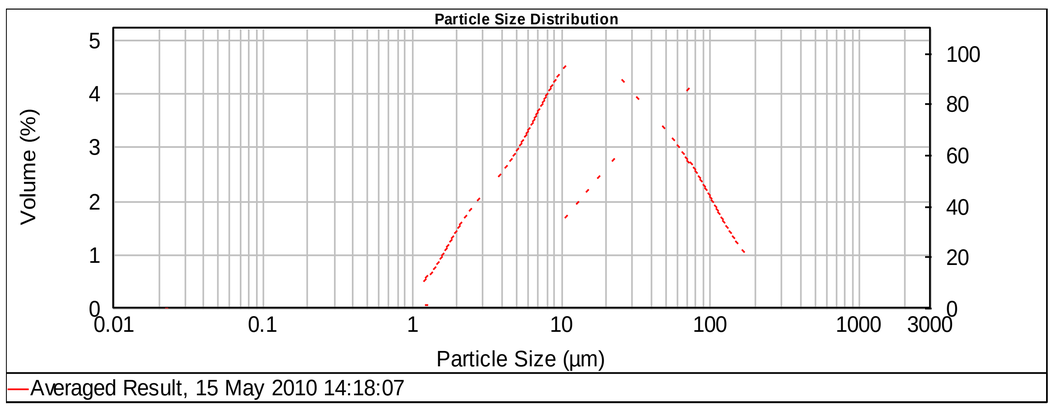


Fig. 2 Particle size distribution

When comparing the viability of *L. casei* after spray-drying alone or with alginate and fructooligosaccharide, increased survival in the microparticles for 4 log was observed. After incubation in simulated gastric (3h) and intestinal juices (6h), the number of viable cells decreased for 3,8 log and 3,6 log for microencapsulated cells, and for 7,2 log and 6,3 log for the free cells, respectively. No significant difference in viability between the free and encapsulated cells in simulated colonic pH was observed.

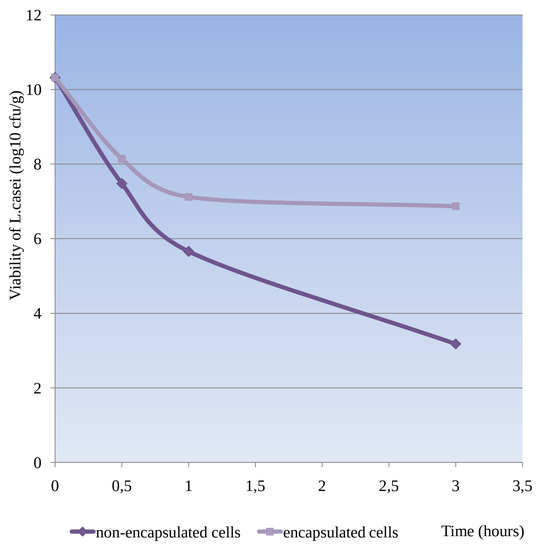


Fig. 3 Viability of *L. casei* in simulated gastric conditions (pH 1,5)

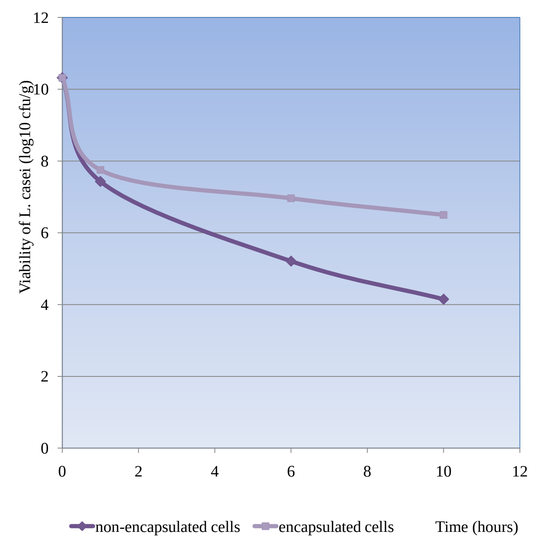


Fig. 4 Viability of *L. casei* in simulated intestinal juice (pH 6,8)

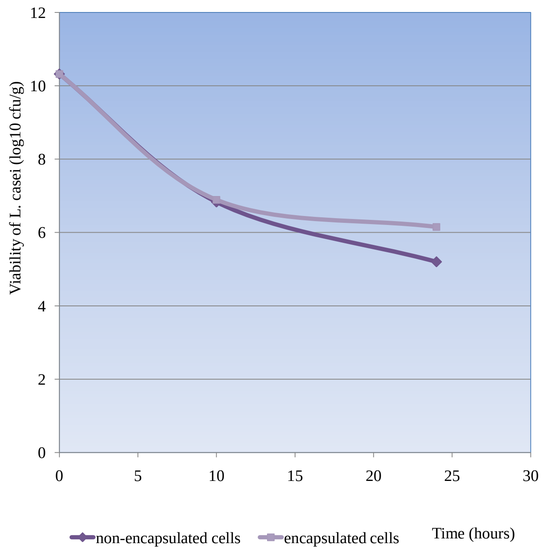


Fig. 5 Viability of *L. casei* in simulated conditions in colon (pH 7,4)

CONCLUSION

The presented microencapsulation method and formulation of microencapsulated *L. casei* shows potential for effective preservation and targeted release of viable cells in the colon. Further studies are needed for optimal formulation to be prepared and in vivo effects of the probiotic to be confirmed.