Swelling properties of *Lactobacillus casei* loaded whey protein-Ca-alginate microparticles

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INTRODUCTION

New approach for microencapsulation was employed in order to improve the viability of the probiotic *Lactobacillus casei* and achieve targeted delivery in the lower intestine after oral administration. Optimal formulation of probiotic loaded whey protein-Ca-alginate microparticles was prepared, using 2.5% (*m/v*) sodium alginate, 3% (*m/v*) whey protein and 3% (*m/v*) $CaCl_2$. Viability of the probiotic after preparation was 10,55±0,21 log_{10}cfu/g, d_{50} 8,65±1,02 μm, zeta potential -28,04±1.4 mV and Ca-content 0.376±0.02 mg/10mg.

OBJECTIVES

To determine the swelling behavior of the optimal formulation of microparticles in mediums with different pH values respective to simulated gastrointestinal conditions.

METHODS

The swelling properties of the microparticles were evaluated by measurement of the particle size in simulated gastrointestinal fluids with different pH values (1.5, 6.8 and 7.4, respectively). An exchange method was used to carry out the swelling test at 37°C, using acetate buffer (pH 1.5) and PBS solutions at pH 6.8 and 7.4.

Percent swelling value was calculated according to Eq. 1, where D_0 and D_t - mean volume diameters of the microparticles in dry state and at time *t*, respectively:

$$swelling\ (\%) = \frac{D_t - D_0}{D_0} \times 100 \qquad (1)$$

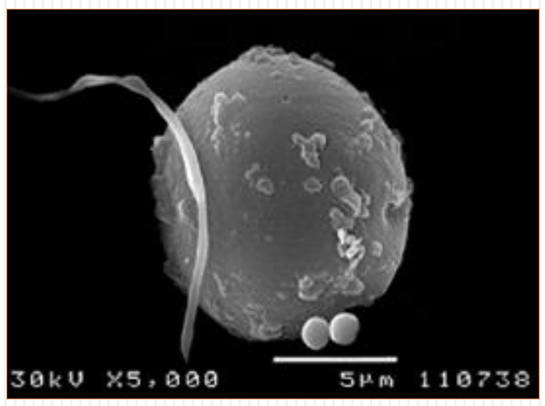

Fig.1: SEM of whey protein-Ca-alginate microparticles, loaded with *L. casei*

RESULTS

No significant tendency for swelling, especially in mediums with pH 1.5 and 6.8 was observed, where increase in d_{50} for 18.05% and 34.09% respectively, was observed.

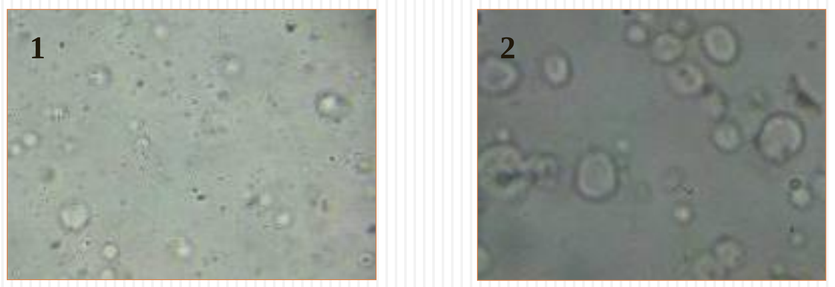

Fig.2: Microscopic view of whey protein-Ca-alginate microcapsules suspended in water at dispersion (1) and at time *t* (2).

Significant change in pH 7.4 was noticed, with increase in d_{50} for 41.76%, probably due to the ion-exchange, increased porosity and diffusion of the medium into the vicinity of the particles. (Fig. 3)

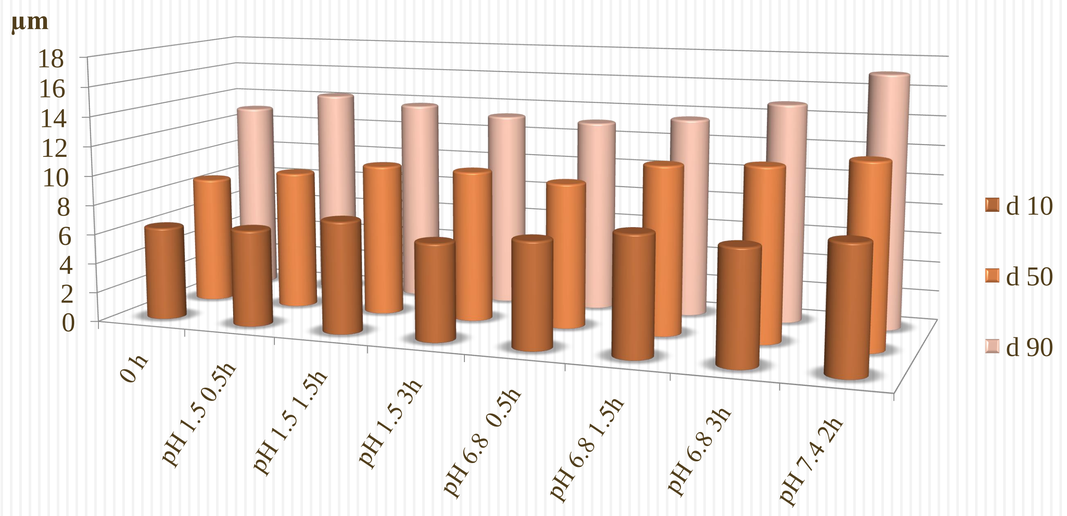

Fig.3: Effect of different pH values on the swelling behavior of whey protein-Ca-alginate microparticles after incubation at pH 1.5, 6.8 and 7.4.

CONCLUSIONS

The low porosity and non-significant increase in particle size, especially in pH 1.5 and 6.8, point that the probiotic will be released in the lower intestine with the degradation of the microparticles as a dominant release mechanism. Further research is taken to confirm the proposed release mechanism and efficacy in *in vivo* rat model.

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Key words: *Lactobacillus casei*, whey protein-Ca-alginate microparticles, swelling properties