

Tolerance of free and encapsulated probiotics towards heat treatment and high sodium concentration.

ABSTRACT

Lactobacillus acidophilus LA-5 and *Bifidobacterium pseudocatenulatum* G4 were encapsulated in 4% w/v of alginate in combination with 2% of starch via the extrusion technique. The probiotics capsules produced were further coated with 1% chitosan to enhance the survival of probiotics. Heat tolerance of free and encapsulated *L. acidophilus* LA-5 and *B. pseudocatenulatum* G4 was evaluated by subjecting the cells to mild heat treatment (55°C, 60°C and 65°C) over a 30 min period. On the other hand, the effect of sodium chloride concentration (1% w/v, 2% w/v and 3% w/v) and incubation period (1, 2 and 3 h) on the viability of both free and encapsulated *L. acidophilus* LA-5 and *B. pseudocatenulatum* G4 were also assessed. Results indicated that the encapsulated probiotics survived significantly ($P < 0.05$) better than the free cells during heat exposure at 55°C and 60°C. Free cells experienced about 5 log reductions after heat exposure at 60°C for 30 min, whereas encapsulated *L. acidophilus* LA-5 was reduced by 1.99 log cycles, while *B. pseudocatenulatum* G4 was only reduced by 0.85 log cycles. However, there was drastic decrease in cell viability of free and encapsulated probiotics after 30 min of heat treatment at 65°C. Only encapsulated *B. pseudocatenulatum* G4 exhibited significant ($P < 0.05$) protective effect at this condition, while the encapsulated *L. acidophilus* LA-5 declined at a same rate as its free cells. Viable cell counts of free *L. acidophilus* LA-5 and *B. pseudocatenulatum* G4 decreased with increasing incubation period in all the sodium chloride concentrations. Results show that during exposure to 3% sodium chloride for 3 h, the encapsulated *B. pseudocatenulatum* G4 survived with the highest viable cell counts (9.73 log cfu/ml), followed by the encapsulated *L. acidophilus* LA-5 (9.34 log cfu/ml). Free cells of *B. pseudocatenulatum* G4 appeared to be the most sensitive towards increasing sodium concentration (7.13 log cfu/ml).

Keyword: Encapsulation; Extrusion alginate; Starch; Chitosan; *Lactobacillus acidophilus* LA-5; *Bifidobacterium pseudocatenulatum* G4; Survival; Heat treatment; Sodium chloride.