Effect of encapsulation with gelatin and alginate, and coating with βeta-glucan, chitosan and gellan gum on the viability of lactobacillus acidophilus during freeze-drying and exposure to simulated gastrointestinal conditions

ABSTRACT

One major challenge in the delivery of probiotic products is the reduced viability of the probiotic caused by the high or low temperature during processing and storage, and the extreme acidic pH conditions in the gut before reaching the target site colon. This study aimed to investigate the effect of encapsulation and coating with hydrocolloids on the viability of L. acidophilus (La05) during freeze-drying and in simulated gastrointestinal conditions. La05 was encapsulated in two different hydrocolloid matrices namely (1) alginate and (2) gelatin. The beads obtained were subsequently subjected to three different coating materials namely (1) β-glucan, (2) chitosan, and (3) gellan gum. All encapsulated La05, with and without coating, were exposed to freeze-drying and subsequently 4-hr sequential simulated gastrointestinal environment. Free cells of La05 were used as the control sample. Free cells of La05 recorded 3.58 log CFU g-1 reduction in cell viability during freeze-drying. Cell viability during freeze-drying of the encapsulated La05 was improved ($p<0.05$) with a reduction of 1.86-1.92 log CFU g-1. The cell viability during freeze-drying was further enhanced by coating with a lower reduction of 1.22-1.52 log CFU g-1. The protection on the La05 by the encapsulation was again demonstrated during the simulated gastrointestinal exposure with a lower reduction in cell viability (4.22-4.23 log CFU g-1) for the encapsulated La05. Further protection on the La05 by coating was evident as a much lower reduction in cell viability (2.64-3.43 log CFU g-1) was observed during the simulated gastrointestinal exposure. Encapsulation and subsequent coating provided protection to La05 during both the freeze-drying and the simulated gastrointestinal exposure. Encapsulation and coating with hydrocolloids can address the issue of reduced viability of probiotic in probiotic products.