DEVELOPMENT AND QUALITY ASSURANCE OF A PROBIOTIC CEREAL BAR

V.C. Muthukumarana* and P.N. Yapa

Department of Biological Sciences, Faculty of Applied Sciences, Rajarata University of Sri Lanka, Mihintale, Sri Lanka.
**vindyamuthukumarana@gmail.com*

Probiotic-incorporated cereal bars offer a convenient and nutritious option for delivering beneficial microorganisms to consumers of all ages. This study presents a cereal bar composed mainly of rice, corn, and oats, with free and microencapsulated probiotics incorporated within a chocolate coating, as an attractive method for probiotics delivery. A mixed culture of *Streptococcus thermophilus* and *Lactobacillus delbrueckii* subsp. *bulgaricus* was utilized as probiotics. Two methods, extrusion and emulsion were employed for probiotic microencapsulation. The encapsulation efficiency of the extrusion method was 73.64±0.69%, while the emulsion method achieved 84.11±0.86%. Microbial load after freeze-drying did not significantly differ between the two methods. Microencapsulation notably enhanced the survival of probiotic cells under simulated gastrointestinal pH conditions, compared to free probiotics. Four cereal bar types; without probiotics (CB1), with free probiotics (CB2), with probiotics encapsulated through extrusion (CB3), and emulsion (CB4) were evaluated for nutritional composition, and also for probiotic viability and shelf stability in three storages; room temperature (S1), refrigerator (S2), and freezer (S3) for 21 days. Without a significant difference among cereal bar types, they contained commendable nutrient levels including moderate fat (8-10%) and high crude fiber (9-10%) content. Statistical analysis revealed that the cereal bar type, storage condition, and storage duration individually and interactively affected viable probiotic cell count and yeast and mold counts. S1 exhibited a significantly high reduction of viable probiotic cell count compared to S2 and S3. The reduction of viable free probiotics number was significantly higher than microencapsulated probiotics in all three storages. CB3 and CB4 retained more viable probiotic cells in S2 and S3, but CB2 has reduced lower than 10^6 CFU g^{-1}. Yeast and mold growth peaked in S1 at 21 days but was not reported in S2 and S3. *Escherichia coli* was not reported in cereal bars in any storage condition during the time. This research highlights that microencapsulation increases the survival of viable probiotic cells in gastrointestinal pH and also extends the probiotic viability for 21 days in refrigerator or freezer storage compared to room temperature. Further investigations into controlling yeast and mold growth can extend the shelf life of the cereal bars.

Keywords: *Probiotic-incorporated foods, Cereal bar, Chocolate coating, Microencapsulation, Gastrointestinal tract simulation*