Thesis Title: Process Technology for the Preparation of Multi-Millet-Based Probiotic Biscuit.

ABSTRACT

The rising popularity of functional food in the diet for improved health benefits has led to the development of new probiotic foods. In the present study, a multi-millet biscuit was developed by substituting the wheat flour (WF) with multi-millet flour (MMF) (an amalgamation of an equal proportion of barnyard, pearl, kodo, and finger millet) at a ratio of 0, 20, 40, 60, 80, and 100%. Biscuits made from MMF had significantly more fat, ash, and fiber, phenolic content (50.30 ± 1.64 mg of GAE/100 g), and antioxidant activity (13.85 ± 0.33 mg of TE/100 g) than the control (100% WF). Biscuits made with 40% MMF were more acceptable by consumers. Probiotic cells (*L. acidophilus*) were encapsulated by spray drying to produce probiotic powder using 20% maltodextrin and varied concentrations of gum arabic (0 – 10%, w/v), and inlet air temperature (130, 140, and 150 °C). The optimized encapsulated conditions were obtained for an inlet air temperature and gum arabic concentration of 150 °C and 8.51%, respectively. Probiotic biscuits were prepared by adding free cells (FC) and encapsulated cells (EC) separately in the dough and baking them at 160, 180, 200, and 220 °C. The inactivation kinetics of cells were predicted by linear and non-linear models. Log-linear model was the best model for describing the inactivation of FC and EC. FC showed a higher susceptibility to temperature than EC. Cryogel was developed using a foam template method to prepare hydroxypropyl methylcellulose (HPMC)-based oleogels. Biscuit filling cream was prepared by replacing the butter with oleogel at different ratios (100:0, 85:15, 70:30, 55:45, 40:60, 25:75). The oil binding capacity of cream was decreased from 89.71 to 80.58% with increasing the oleogel ratio. The TOTOX value of all the samples ranged from 4.06 ± 1.00 to 25.42 ± 0.9. Cream prepared at a 70:30 butter-to-oleogel ratio showed higher overall consumer acceptability. Probiotics (FC and EC) were incorporated into the biscuit filling cream separately and their viability was studied during *in-vitro* gastrointestinal conditions and storage at 22 and 4 °C for 28 days. EC showed a viability of 6.15 log CFU/g after *in-vitro* intestinal digestion while FC viability was 2.03 log CFU/g.

Keywords: *Biscuit, Millets, Probiotics, Spray drying, Cell viability, Oleogels, Biscuit filling cream, Sensory analysis.*