

Chapter 5

Conclusion

This study was aimed to investigate the possibility of bean milk as a food vehicle to deliver a probiotic bacterium, *Lactobacillus acidophilus*. Four studied bean milk types, including black bean, mung bean, red bean and soy bean milk, had chemical compositions of 91.00 ± 0.06 to $95.08 \pm 0.01\%$ (w/w) moisture content, 2.45 ± 0.02 to $4.64 \pm 0.35\%$ (w/w) protein, 0.005 ± 0.000 to $1.051 \pm 0.049\%$ (w/w) fat, 1.63 ± 0.15 to $2.87 \pm 0.35\%$ (w/w) carbohydrates, 0.33 ± 0.01 to $0.45 \pm 0.01\%$ (w/w) ash and 0.04 ± 0.01 to $0.12 \pm 0.03\%$ (w/w) fiber.

In the first section of this study, the survival of *L. acidophilus* in different types of bean milk was assessed during a storage period at 4°C for 15 days. The results showed that the population of *L. acidophilus* was significantly increased in all the bean milk types during refrigerated storage and the highest increasing population of *L. acidophilus* was shown in the mung bean milk that had an increase for up to 1.05 log CFU/ml *L. acidophilus*. Other microorganisms that might survive a pasteurization process at 69 ± 3 °C for 30 minutes (Marshall and Arbuckle, 1996) could not be significantly detected on PCA medium. The increasing *L. acidophilus* population in the bean milk caused significant increases in the bean milk acidities and viscosity during the storage period. At the same time, no significant changes for the total soluble solid of the bean milk was recorded, except for the total soluble solid of the red bean milk.

In the second part of the study, different pH levels of 6.0, 6.5 and 7.0 and 3 casein concentrations, which were 0, 125 and 250 mg/l, were examined for their effects on the survival rate of *L. acidophilus* in mung bean milk kept at 4°C for 15 days. The collected data displayed that all the mung bean milk treatments could support and produced significantly higher *L. acidophilus* populations at the end of the storage period compared to those at the beginning. However, only the mung bean milk with a pH value of 6.5 and 250 mg/l casein and the milk with pH 7.0 and 125 mg/l casein had higher increasing rates of *L. acidophilus* population compared to that of the control mung bean milk (a pH value of 6.0 and no casein addition).

The increasing population of *L. acidophilus* in the mung bean milk found in the second part of the study significantly affected the physical and chemical properties of the bean milk. It was generally shown that the total soluble solids of the milk were significantly reduced, while the bean milk acidities and viscosities were significantly increased during 15 days storage at 4°C. No significant changes was found for the total protein content of the mung bean milk, except for the mung bean milk with a pH value of 6.5 and 250 mg/l casein.

The effects of initial inoculation levels of *L. acidophilus* and an immobilized technique on the survival of *L. acidophilus* in the mung bean milk were evaluated in the third part of the study. The analyses results positively showed that higher initial inoculation levels of *L. acidophilus* produced higher increasing rates of the *L. acidophilus* population during chilled storage at 4°C. At the same time, the free cells of *L. acidophilus* significantly had a higher increasing rate of the probiotic population

compared to that of the immobilized *L. acidophilus* cells. The increasing *L. acidophilus* population in the mung bean milk significantly affected the acidities and viscosities of the bean milk, which were increased throughout the storage period. Although no significant changes was observed for the total soluble solid of the mung bean milk, a reduction in the total soluble solid values could be noticed. For the color values, it was only the L* value that was significantly increased during the mung bean milk storage period, except for the bean milk with 11 log CFU/ml *L. acidophilus* encapsulated cells.

In the last part of the study, the survival of *L. acidophilus* in simulated gastrointestinal conditions during the shelf-life of the *L. acidophilus* in mung bean milk stored at refrigerated temperature for 15 days was investigated. Collected data suggested that the *L. acidophilus* strain used in this study was not resistant to a simulated high-acid gastric condition, while a simulated bile-salt condition did not significantly affected the survival of the probiotic bacterium.