I. Abstract

Probiotic bacteria have been added to dairy products and as adjunct cultures to impart health benefits to consumers. However, to gain maximum therapeutic benefit, the bacteria must remain viable over the entire shelf-life period of the product. Studies have shown that the viability of these bacteria decreases significantly over this period and in some products their presence is negligible towards the end of the shelf life.

Various studies have used different strains of probiotics to get better viability but even the probiotic with special characteristics such as oxygen tolerant and acid resistance, still face significant survival problems in dairy products. Several studies have indicated that carbohydrates, peptides and amino acids added to dairy products at various concentrations showed positive effect on the growth and survival of many strains of probiotic bacteria in dairy products. *Bifidobacterium lactis* Bb12 has been found to have a wide use in dairy products because of their oxygen tolerance and acid resistance, which made it one of the chosen strain in this study.

The growth rate was indirectly measured by the rate of change of the pH in fermented skim milk while the survival was measured as the total count, cfu/ml, over the storage period of 28 days at 4°C±1. The results showed that the addition of prebiotics such as fructooligosaccharides (FOS) at 5% or Inulin at 3% to skimmed milk enhanced the growth and survival of *B lactis* Bb12 in comparison to the control. The growth rate was better in both cases and the survival in the sample with 5% FOS was significantly better (P<0.05).

The effect of the hydrolyzed skim milk on the growth and survival of *B lactis* Bb12 showed that skim milk with Degree of Hydrolysis DH<5% with trypsin at 1:20000, enhanced the growth and survival significantly (P<0.05) compared to the control. The synergistic effect of the combination of prebiotics, fructooligosaccharides (FOS) at 5% and Inulin at 3%, and DH<5% hydrolysed milk (called Mix Design Skim Milk or MDSM) on the growth and survival of *B lactis* Bb12 showed to be the best combination with significant (P<0.05) growth rate and survival for Bifidobacteria and Lactobacillus with a decrease in fermentation time by 12 hours and a significant (P<0.05) survival compared to the control.

The sensory qualities of the product made with MDSM and *B lactis* Bb12 showed to be of good quality and comparability to the commercially available products.
II. Declaration and Statements

DECLARATION

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

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This thesis is the result of my own investigations, except where otherwise stated. Where correction services have been used, the extent and nature of the correction is clearly marked in a footnote(s).

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ABBREVIATIONS

AB  yoghurts containing L. acidophilus and Bifidobacterium spp.

ABC  yoghurts with L. acidophilus, Bifidobacterium spp., and L. casei

ANZFA  Australian and New Zealand Food Standards.

ATCC  the American Type Culture Collection.

B. infantis  Bifidobacterium infantis

B. lactis Bb12  Bifidobacterium animalis subspecies Lactis Bb12 (From Chr. Hansen)

CCUG  Culture Collection of University of Göteborg. Sweden.

CFU  Colony Format Unite

CPPs  Caseinophosphopeptide-rich fraction

DP  Degree of polymerization

DSMZ  German Collection of Microorganisms and Cell Cultures.

F6PPK  Fructose-6-Phosphate Phosphoketolase

FAO/WHO  Food and Agriculture Organization /World Health Organization

FOS  Fructooligosaccharides

FOSHU  Food for Specified Health Use.

FSM  Fructooligosaccharides in Skim Milk.

g  gram(s)

GIT  Gastrointestinal Tract

GOS  Galcto-oligosaccharides

GRAS  General Recognized As Safe

h  hour (s)

H2O2  hydrogen peroxide

ISM  Inulin in Skim Milk.
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO</td>
<td>International Organization of Standardization</td>
</tr>
<tr>
<td>L</td>
<td>liter (s)</td>
</tr>
<tr>
<td>L. acidophilus</td>
<td>Lactobacillus acidophilus</td>
</tr>
<tr>
<td>L. bulgaricus</td>
<td><em>Lactobacillus delbrueckii subspecies bulgaricus</em></td>
</tr>
<tr>
<td>LAB</td>
<td>Lactic Acid Bacteria</td>
</tr>
<tr>
<td>LDL-C</td>
<td>Low-density lipoprotein cholesterol</td>
</tr>
<tr>
<td>LMG</td>
<td>Laboratory of Microbiology Gent Bacteria Collection.</td>
</tr>
<tr>
<td>MDSM product</td>
<td>Mix Design Skim Milk (hydrolysed Skim milk for 10 minute by using trypsin supplied with 5%FOS and 3% inulin)</td>
</tr>
<tr>
<td>MRS</td>
<td>deMan Rogosa Sharpe medium</td>
</tr>
<tr>
<td>NNLP</td>
<td>Neomycin sulphate, nalidixic acid, lithium chloride and Paromomycin</td>
</tr>
<tr>
<td>NYA</td>
<td>National Yogurt Association of the United States.</td>
</tr>
<tr>
<td>S. thermophilus</td>
<td>Streptococcus salivarius subspecies thermophilus</td>
</tr>
<tr>
<td>Spp</td>
<td>subspecies</td>
</tr>
<tr>
<td>μ</td>
<td>micro</td>
</tr>
</tbody>
</table>

**XVII**