Cottage cheese is a soft, fresh cheese curd product with a mild flavour that is uncured and obtained from skim milk. The term originated from cheeses made by early Americans settlers in their small dwellings, in the 1830’s right on the stove. The cottage cheese shows an adequate profile to incorporate probiotic cells and prebiotic substances. In addition, it is a healthy alternative by virtue of its low-fat content. It is rich in proteins, relatively low in fat and high in calcium, phosphorous, sodium, selenium and vitamin B12.

A prebiotic is non-digestible food ingredient that pass undigested through the upper part of the gastrointestinal tract and stimulate the growth or activity of advantageous bacteria that colonize the large bowel by acting as substrate for them.

Pectin is a structural heteropolysaccharide contained in the primary cell walls of terrestrial plants. It is considered as a soluble dietary fibre and exerts physiological effects on the gastrointestinal tract, such as reducing glucose absorption, hypocholesterolaemic effect of and delaying gastric emptying. In addition, the oligosaccharides obtained from pectin have been proposed as an excellent new generation prebiotic (Hotchkiss et al., 2003).

The world health organization (WHO, 2002) defines probiotics as live micro-organisms that “when administered in adequate amounts, confer a health benefit on the host.”

Lactobacillus acidophilus is one of the most common type of probiotic and can be found in fermented foods, yoghurt, cheese and supplements. It is used as probiotic because of its crucial properties like high tolerance to acid and bile, capability to adhere to intestinal surfaces, withstand low pH of gastric juices, inhibiting potentially pathogenic species, resisting antibiotics, producing exopolysaccharides and removing cholesterol. It is effective in preventing antibiotic-associated diarrhoea (Sabina, 2014).

Synbiotic refers to food ingredients or dietary supplements combining prebiotics and probiotics in a form of synergism, that beneficially affect the host by improving the survival and implantation of live microbial dietary supplements in the gastrointestinal tract, by selectively stimulating the growth and / or by activating the metabolism of one or a limited number of health promoting bacteria, thus improving host welfare.

MATERIALS AND METHODS

Skim milk: Fresh whole milk was received from Livestock Farm Complex, Veterinary College and Research Institute, Namakkal. The skim milk was obtained from whole milk by centrifugation method after separation of cream.

Pectin: Neotea pectin powder was purchased from Neoteric DCBA Ideas, TN and was preserved in moisture proof pack for incorporation in cottage cheese.

Starter culture: Cheese starter culture and Lactobacillus acidophilus (LA-5) was procured in freeze dried form, from National Collection of Dairy cultures, NDRI, Karnal for the preparation of cottage cheese.
Preparation of synbiotic cottage cheese: Cottage cheese was manufactured using the short set method as described by Blanchette et al. (1996), with mild modification of procedure.

1. Fresh whole milk
2. 1st heat treatment at 40°C
3. Cream separation
4. Addition of pectin
5. Pasteurisation of skim milk at 80°C for 10 minutes
6. Filtration
7. Cooling to 32°C
8. Addition of 0.02% of calcium chloride
9. Addition of 5% starter culture
10. Incubation @ 37°C for 40 min
11. Addition of Rennet (0.1–0.2g)
12. Incubation @ 37°C for 3-4 hrs
13. Cutting (1 cm)
14. Cooking (Slow cooking @ 53°C for 90 min)
15. Whey Drainage
16. Washing of curd (2 times 2°C and 5°C)
17. Salting (0.6%)
18. Storage at 4°C
19. Packaging (polystyrene cups)

Sensory evaluation: The synbiotic cottage cheese was evaluated by the panelists on the basis of 9-point hedonic scale where 9 indicate extremely like and 1 extremely dislike (Amerine et al., 1965).

Physico-chemical parameters: The pH of cottage cheese estimated using a digital pH meter. The coagulation time was estimated by glass rod test.

Cheese yield: The cheese yield was calculated as the cheese mass per equivalent mass of the initial milk (Ogunlade et al., 2017).

% of cheese yield = grams of cheese produced /grams of milk used x 100

Microbial analysis: The synbiotic cottage cheese and control samples were analyzed for different microbial parameters such as probiotic viable count, coliform count and yeast and mould count by adopting standard procedure according to ICAR Dairy bacteriological manual (1972).

Statistical analysis: The data were analyzed by one way ANOVA in SPSS (version 20.0).

RESULTS AND DISCUSSION

Sensory evaluation: Table 1 gives the score for sensory parameters, which includes colour and appearance, body and texture, flavour as well as the overall acceptability of synbiotic cottage cheese with various pectin level. The highest sensory evaluation presented for colour and appearance, body and texture, flavor and taste and overall acceptability is for synbiotic cottage cheese prepared by using 0.3 per cent pectin level.

Physico-chemical analysis: The prepared synbiotic cottage cheese with 0.3 per cent pectin was subjected to various physico-chemical analysis (pH, coagulation time and yield) and the results are presented in Table 2 and Table 3. The coagulation time and yield of the synbiotic cottage cheese using commercial cheese strain and Lactobacillus acidophilus (LA-5) has significance difference (P<0.05). The pH for both the treatment varies significantly both in between the treatment as well as between the storage period (P<0.05).
DEVELOPMENT OF SYMBIOTIC COTTAGE CHEESE USING LACTOBACILLUS

Table 1: Sensory evaluation score for symbiotic cottage cheese

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Colour and appearance</th>
<th>Flavour</th>
<th>Body and texture</th>
<th>Overall acceptability</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>7.33 ± 0.21</td>
<td>7.17 ± 0.17</td>
<td>7.33 ± 0.21</td>
<td>7.33 ± 0.21</td>
</tr>
<tr>
<td>T2</td>
<td>7.17 ± 0.17</td>
<td>7.17 ± 0.17</td>
<td>7.50 ± 0.22</td>
<td>7.17 ± 0.17</td>
</tr>
<tr>
<td>T3</td>
<td>7.84 ± 0.17</td>
<td>7.33 ± 0.21</td>
<td>7.83 ± 0.17</td>
<td>7.82 ± 0.17</td>
</tr>
<tr>
<td>T4</td>
<td>6.33 ± 0.21</td>
<td>6.83 ± 0.17</td>
<td>6.17 ± 0.17</td>
<td>6.33 ± 0.21</td>
</tr>
<tr>
<td>T5</td>
<td>6.17 ± 0.17</td>
<td>6.67 ± 0.21</td>
<td>5.67 ± 0.21</td>
<td>6.17 ± 0.17</td>
</tr>
</tbody>
</table>

Table 2: Coagulation time and Yield of symbiotic cottage cheese

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Commercial strain</th>
<th>Lactobacillus acidophilus (LA-5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coagulation time (min)</td>
<td>188.67 ± 1.17</td>
<td>201.67 ± 1.41</td>
</tr>
<tr>
<td>Yield (per cent)</td>
<td>15.292 ± 0.164</td>
<td>14.292 ± 0.077</td>
</tr>
</tbody>
</table>

Table 3: pH of symbiotic cottage cheese during storage period

<table>
<thead>
<tr>
<th>Treatment</th>
<th>0 day</th>
<th>3 day</th>
<th>7 day</th>
<th>14 day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial strain</td>
<td>4.92 ± 0.03</td>
<td>4.75 ± 0.02</td>
<td>4.57 ± 0.05</td>
<td>4.42 ± 0.03</td>
</tr>
<tr>
<td>Lactobacillus acidophilus (LA-5)</td>
<td>4.83 ± 0.02</td>
<td>4.67 ± 0.02</td>
<td>4.50 ± 0.03</td>
<td>4.37 ± 0.02</td>
</tr>
</tbody>
</table>

Table 4: Microbial analysis of symbiotic cottage cheese (log$_{10}$ cfu/g)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Probiotic viability</th>
<th>Coliforms</th>
<th>Yeast and mould</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial strain</td>
<td>9.08 ± 1.00</td>
<td>1.18 ± 0.43</td>
<td>NIL</td>
</tr>
<tr>
<td>Lactobacillus acidophilus (LA-5)</td>
<td>9.05 ± 1.25</td>
<td>1.43 ± 0.56</td>
<td>NIL</td>
</tr>
</tbody>
</table>

The sensory values for the desired level of pectin almost resembles to the values obtained by Sadia et al. (2016) for cottage cheese made from cow milk. The result of yield of the two symbiotic cottage cheese are remarkably similar to that of Satterness et al. (1978) for culture method of making cottage cheese. The pH values are almost similar to those of Blanchette et al. (1996). The coliform count falls under the acceptable range of not more than 10 cfu/ml or 10 cfu/g of sample (FDA, 2015). Our results are as per the results obtained by Aylward et al. (1980). Also Trmcic et al. (2016) has observed that 16% of fresh cheese used in the study were positive for coliforms at a level >10 cfu/g. The probiotic count markedly resembles the results of Rafael et al. (2013), Araujo et al. (2010) and Gomes et al. (2011) and the viable counts are more than that of recommended probiotic viability in dairy foods. The present study is concluded that symbiotic cottage cheese incorporated with 0.3% pectin scored good overall acceptability and microbial quality with recommended levels of probiotic viability and it can cater the needs of present day health consciousness of consumer.

REFERENCES

5. Fijan, Sabina (2014). Microorganisms with claimed probiotic


9. ICAR Microbiological testing of ice cream was determined as per the procedure given in, Manual in Dairy Bacteriology, 1972.


