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Physico-Chemical and Sensory analysis of Probiotic Dahi Packed in Oxobiodegradable and Areca Nut Sheath Cups

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ABSTRACT

A study was carried out to evaluate the probiotic dahi and to develop eco friendly cups using areca nut sheath and to utilize it to store the probiotic dahi. The different packaging materials namely plastic cups (control), oxo-biodegradable cups and areca nut sheath cups were used to evaluate the keeping qualities of probiotic dahi. Physico-chemical properties, microbial qualities and sensory evaluation were carried out on the product stored in different containers. Statistical analysis showed there was no significant difference between different packaging materials. Sensory analysis of probiotic dahi in different packaging materials was carried out. Statistical analysis showed that the appearance and overall acceptability scores significantly differed in different packaging materials. There was no significant difference in flavor, body/ texture and sourness score of probiotic dahi in different packaging materials.

Keywords : Probiotic Dahi, Sensory analysis, Areca Nut Sheath Cups

India is the world`s largest producer of milk, producing 127.85 million tones per annum, that is 15 per cent of world`s milk production. About 10% of the total milk produced in India is converted into traditional milk products like paneer, dahi, khoa etc. Out of these, dahi products share is around 6.9%. Organized dairies produce 1-2 % of dahi, consumed in India. However, the demand is increasing by 20 per cent per annum for industrially produced dahi (Sivakumar *et al*., 2010).

Lactobacillus acidophilus offers a range of health benefits which include providing immune support against infections and healthy replacement of good bacteria in the intestinal tract following antibiotic therapy, reducing occurrence of diarrhoea in humans (children and adults), aiding in lowering cholesterol and alleviating the symptoms of lactose intolerance (Goldin and Gorbach, 1984).

Over the past five years, packaging suppliers have been introducing various forms of biodegradable plastics. These materials are made from a variety of plants. The market of biodegradable polymers at present is growing based on the demands of the consumers and recycling regulations for environmentally-friendly packaging. Some of the biodegradable polymers are already competitive alternatives to conventional food packaging. Polylactate (PLA) is one of the most important of them (Haugard and Martensen, 2003).

Added to that, in the recent past the ultimate disposability of synthetic plastics has been of greater environmental concern and it has triggered the research and development efforts in the designing of material with an environmental friendly life cycle by integrating material design concepts with ultimate disposability, resource utilization and conservation. Hence, in the present investigation an attempt is made to prepare probiotic dahi and store it in eco friendly cups prepared from areca nut sheath and assess their storage and keeping qualities. This will be of immense help in preventing the ill effects of non degradable packaging materials and thus environmental pollution.

MATERIALS AND METHODS

Milk and Starter Cultures

Fresh cow's milk obtained from the Dairy Plant, Department of Dairy Science, Madras Veterinary College was used for the preparation of probiotic dahi. Freeze dried DVS mesophilic dahi cultures obtained from Indra agencies, Chennai consisted of strains of *Lactococcus lactis* and *Lactococcus cremoris*. Freeze dried DVS cultures of probiotic *Lactobacillus acidophilus* (NCDC-14) was obtained from National Dairy Research Institute, Karnal.

Chemicals/ Reagents and Packaging Materials

All the chemicals used in this study were procured from Hi Media laboratories (P) Ltd, Mumbai. Packaging materials plastic cups (control), oxo-biodegradable cups and areca nut sheath cups were used in this study.

Preparation of Areca Nut Sheath Cups

The areca nut sheath cup was developed by immersing the areca nut sheath in cold water for about 20 minutes and then thoroughly cleaned and dried. The cups were prepared by applying pressure for 30 seconds over the cleaned dust free areca nut sheaths and using an electrically operated aluminum die designed for the purpose. The edges of the cups were smoothened by using a grinding machine. Then cups were exposed to UV rays for 5 minute for sterilization. After sterilization the cups were dipped in molten food grade paraffin wax or food grade lacquer to provide a thin coating so to avoid oozing or seepage of the product stored.

Analysis of Milk

Estimation of Fat- Fat was estimated as per the procedure described in IS:SP:18 (Part XI)-1981 Estimation of Protein- Protein was estimated as per the procedure described in AOAC (1995). Estimation of Lactose- Lactose was estimated as per the procedure described in IS:SP:18 (Part XI)-1981. Estimation of Solids Not Fat-SNF was estimated as per the procedure described in IS:SP:18 (Part XI)-1981.

Propagation and Maintenance of Cultures

The DVS culture was diluted as per the manufacturers instruction in pasteurized skim milk and 1 per cent diluted culture was used for inoculation to prepare dahi.

Preparation of Probiotic Dahi

The probiotic dahi was prepared as per the procedure given by Yadav *et al*., (2007). Cow milk (4.0% fat and 8.5% solid not fat) was procured from the Dairy Plant, Department of Dairy Science, Madras Veterinary College which was filtered and preheated at 60°C and homgenised (2500 psi) than milk was pasteurized at 80-90°C for 15 to 30 min than cooling of milk was done. Cooled milk was inoculated with pure lactic culture (1% Dahi DVS culture + 1% NCDC- 14 culture) than packaging of milk was done in 100 g packets, these packets were incubated at 37–41°C for 16 to 18 hour than cooling and storage at 5°C was done.

Physico-chemical properties of probiotic dahi

Estimation of pH- pH was estimated using a Jenway Digital pH meter. Estimation of Acidity- Acidity was estimated as per the procedure described in IS: SP: 18 (part XI)-1981. Estimation of Syneresis- Syneresis was determined by drainage method as described by Chawla and Balachandran (1994).

Sensory evaluation

Sensory evaluation was carried out by using 9-point Hedonic scale (Larmond, 1977). All the samples were appropriately coded before subjecting to sensory evaluation.

Statistical analysis

The values obtained were analysed statistically as per the procedure given by Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

Chemical composition of milk used for preparation of probiotic dahi :

Table 1 shows the chemical composition of cow's whole milk used for the preparation of probiotic dahi. The fat and SNF (per cent) content of cow milk

used for the preparation of plain and probiotic dahi was within the prescribed limit of PFA standards (2011). Protein and lactose levels were within the average composition of cow milk, reported by De (1980).

Table 1: Chemical composition of milk used for dahi preparation (Mean ± SE)#

Constituents	Level (%)
Fat	4.06 ± 0.230
SNF	8.61 ± 0.051
Protein	3.95 ± 0.248
Lactose	4.71 ± 0.061

Average of six trials

Physico-chemical properties of probiotic dahi in different packaging materials

Table 2 shows comparison of physical properties of probiotic dahi in different packaging materials, namely plastic cups (control), oxo-biodegradable cups and areca nut sheath cups.

Table 2: Physico-chemical properties of probiotic dahi packed in different Packaging materials (Mean ± SE) #

Constituent	Packaging Materials			F- value
	Plastic cups (control)	Oxo-biodegradable cups	Areca nut sheath cups	
pH	4.40 ± 0.182	4.42 ± 0.150	4.47 ± 0.222	0.24^{NS}
Titratable Acidity (Per cent)	0.73 ± 0.023	0.74 ± 0.035	0.73 ± 0.029	2.94^{NS}
Synersis (Per cent)	29.40 ± 0.540	28.87 ± 0.818	27.38 ± 0.741	3.40^{NS}

#Average of six trials; NS- Non significant (P > 0.05)

The results of pH were non significant (at P > 0.05) and are in line with the findings of Salji *et al*., (1985) and Varnam and Sutherland (1994) who found no significant variation in pH of different samples of dahi.

The titratable acidity of probiotic dahi in different packaging materials, namely plastic cups (control), oxo-biodegradable cups and areca nut sheath cups is shown in Table 3. The results of titratable acidity were non significant (at P > 0.05). These results are in accordance with the findings of Davis and Mclachlan (1974). There

was less variation in acidity of different samples of probiotic dahi due to controlled incubation and post production handling and controlled storage at 5°C.

Table 3: Sensory evaluation of probiotic dahi (at 0 day) packed in different Packaging materials (Mean ± SE) #

Sensory parameters	Packaging materials				F- value
	Plastic cups (control)	Oxo-biodegradable Cups	Coconut shell powder cups	Areca nut sheath cups	
Appearance	8.33[a] ± 0.210	8.50[a] ± 0.321	7.23[b] ± 0.281	7.17[b] ± 0.212	2.51[*]
Flavour	8.30 ± 0.212	8.18 ± 0.307	8.10 ± 0.212	8.09 ± 0.365	1.13[NS]
Body and texture	8.25 ± 0.210	8.50 ± 0.223	7.67 ± 0.401	7.80 ± 0.307	1.20[NS]
Sourness	8.33 ± 0.210	8.50 ± 0.223	8.33 ± 0.210	8.50 ± 0.223	0.20[NS]
Overall acceptability	8.36[a] ± 0.197	8.45[a] ± 0.223	7.17[b] ± 0.318	7.12[b] ± 0.405	3.03[*]

Average of six trials; NS- Non significant ($P > 0.05$)

The syneresis of probiotic dahi in different packaging materials, namely plastic cups (control), oxo-biodegradable cups and areca nut sheath cups is shown in Table 3. The results of syneresis did not differ significantly (at $P > 0.05$). These results are in accordance with the findings of Shahid *et al.,* (2002). Probiotic dahi gave minimum syneresis. It was due to presence of more total solids.

Sensory evaluation of probiotic dahi in different packaging materials

Table 3 shows, sensory analysis of the dahi samples using a 9-point Hedonic scale with scores ranging from 1 to 9. Statistical analysis of data obtained for appearance of probiotic dahi in different packaging materials indicates a significant difference ($P < 0.05$). The appearance score was maximum for oxo-biodegradable cups and it was minimum for areca nut sheath cups. The statistical analysis of mean scores of flavour of probiotic dahi in different packaging materials did not differ significantly ($P > 0.05$). The observed results show that different packaging material did not affect flavour of probiotic dahi. The statistical analysis of mean scores of body and texture of probiotic dahi in different packaging materials did not differ significantly ($P > 0.05$). The observed results show that different packaging material did not affect body and texture of probiotic dahi.

The statistical analysis of mean scores of sourness of probiotic dahi in different packaging materials did not differ significantly ($P > 0.05$). The observed result shows that different packaging material did not affect sourness of probiotic dahi. Statistical analysis of data obtained of overall acceptability of probiotic dahi in different packaging materials indicates a significant difference ($P < 0.05$). The overall acceptability score was maximum for oxo-biodegradable cups and it was minimum for areca nut sheath cups, this may be due to the higher score obtained for appearance by oxo-biodegradable cups and minimum by areca nut sheath cups.

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