emergent
Life Sciences Research

Research Article

Foxtail millet dahi: A gluten-free prebiotic

Susmita Chandra, Sonia Kundu, Nidhi Shaw

Received: 10 July 2025
Accepted: 24 May 2026
Online: 1 June 2026

Authors:
S. Chandra ✉, S. Kundu, N. Shaw
Department of Food Science,
Maulana Abul Kalam Azad University of Technology, West Bengal, India

✉ comdrsc2016@gmail.com

Emer Life Sci Res (2026) 12(1): 35-44

E-ISSN: 2395-6658
P-ISSN: 2395-664X

DOI: https://dx.doi.org/10.31783/elsr.2026.1213544

Abstract

In this work, Dahi (Indian Curd) was produced by combining foxtail millet with whole milk. Physico-chemical and sensory properties in foxtail millet-enriched Dahi were found to have close similarities with those of marketed Dahi without enrichment. The sensory qualities in foxtail millet Dahi did not vary much with the marketed Dahi, except for the mouthfeel properties in some of the compositions. The measured pH and acidity values give the levels of fermentation, which were found to be similar to those of commercially available products. Additionally, the enriched Dahi also exhibited comparable water holding capacity, viscosity, firmness, and consistency in specific formulations. The microbial study indicated the presence of viable *Bacillus* sp. up to 7-8 days of aging. Throughout the storage period, no significant differences were observed in total titratable acidity and lactic acid bacteria count in the Dahi samples, and a highly acceptable sensory level was maintained.

Keywords dahi, enrichment, foxtail millet, sensory evaluation

Introduction

Innovations and quality upgradations are very important integral part of upcoming research in the food industry. When fermented milk products are concerned, innovative ideas are being developed for developing newer outcomes. There is always an increasing demand for fortified milk products in the market [1]. Consumers have a preference for dairy products over others with the improved functional properties. It may be considered a driving factor for better consumer acceptance and marketability. Among the dairy products, Dahi is one of the most traditional fermented milk products in India. Use of Dahi is linked to our rich heritage and culture, and it is considered a staple in some parts of India [2]. Dahi has a rich nutrient composition like milk and other milk products, but, at the same time, it is known to have excellent digestive properties specifically for lactose intolerants due to its lactic acid content as compared to milk itself. Dahi is a mixed culture of lactic acid bacteria. The LAB consortium derived from souring pasteurized or boiled milk and can be propagated through generations. The composition of traditional Dahi includes a diverse array of lactic acid bacteria such as *Lactococcus lactis*, *L. cremoris*, *Streptococcus thermophilus*, and *Lactobacillus delbrueckii* subsp. *Bulgaricus* [3]. Dahi is savored as part of a meal, or consumed directly as an appetizer, at any time of the day [4]. It is also used for the preparation of many culinary dishes as it acts as a taste and flavour enhancer, and a cooking aid or cooking base. Approximately 10% of India's total annual milk production is used to obtain Dahi [5], showing a promising growth rate of about 20% per annum [6]. Many researchers are trying to develop different flavored drinks with natural or synthetic functional components. The natural flavoring agents and colorants can add higher value to the nutritional quality of a food product. So, Dahi colored or flavoured with natural and nature-identical substances helps to enhance the food value [7]. Furthermore, the integration of natural food additives and health-promoting ingredients into traditional Dahi formulations can result in a more nutritious product. This modification can increase the contents of omega-3 fatty acids, soluble fibers, vitamins, minerals, and phytosterols, which collectively enhance therapeutic benefits and functional properties [8]. These additives may also play a critical role in providing beneficial effects for managing various health conditions, including hypertension, diabetes, arthritis, coronary artery disease, autoimmune disorders, and certain types of cancer [9].

Milk almost lacks fiber. However, it can be incorporated into Dahi or yoghurt. This enrichment can greatly enhance its nutritive and therapeutic efficacy, as Dahi and yoghurt can also be used to incorporate therapeutic ingredients into the gut [10]. The fibrous oligosaccharides from the millet source can be used as a dietary component to support the growth of LAB inside the gut. In current research, various attempts have been made to incorporate ingredients like probiotics, calcium, fruits, honey, and omega-3 fatty acids to improve the nutritional and functional properties of Dahi and yogurt [11]. Sometimes these added ingredients have been found to modify product superiority with respect to their texture, uniformity, and whey stability. An optimally stabilized composition of these functional Dahi products can be achieved while keeping the nutritional, functional, and sensory properties minimally altered. Achieving it is a major challenge in the dairy industry [12].

Global millet policies during the International Year of Millets 2023 focus on promoting the production of the nutrient-rich crop millet for planting in the arid region, as it can grow with restricted supply of water, and has excellent climate-resilient abilities. These nutrient-rich crops can be a good option to enhance food security and sustainability [13]. Foxtail millet is rich in important nutrients like starch, proteins, amino acids, minerals, B vitamins, fiber, and antioxidant compounds. The fiber content of whole grain is about 15-20%, and the milled grain contains about 8-10% fiber. Amino acids like Glutamic acid, Finger millet contains mainly γ and α tocopherols. Foxtail millet also promotes intestinal bacteria growth, improves serum cholesterol content, and has hypoglycemic and wound healing properties [6]. In light of this, this scientific study aims to prepare a dairy-based product, Dahi, from cow's milk, fortified with soluble fiber to enhance its prebiotic efficacy. This can potentially provide improved health benefits by helping individuals achieve the recommended daily intake of these functional components.

Methodology

Raw materials and ingredients

Pasteurized whole milk was obtained from the local market, Haringhata Nadia, India. Milk was warmed at 40 °C and used as a whole. The milk was standardized through proximate analyses to verify the quality features [14]. Whole milk was purchased from the local marketplace. Food-grade foxtail whole millet as well as milled grains were soaked in water overnight and pressed in a mortar pestle before use and mixing with Milk [15].

Dahi culture

Dahi containing a mixed culture [16] of different *Lactobacillus* species, including *Lactococcus lactis*, *L. cremoris*, *Streptococcus thermophilus*, and *Lactobacillus delbrueckii* subsp. *bulgaricus*, was obtained from the Dairy Microbiology Department at BCKV for inoculum.

Chemicals and standards

Different chemicals and solvents used in this study were procured from Sigma Chemical Co. (St. Louis, MO, USA) or SRL India.

Preparation of foxtail millet-enriched Dahi

A significant portion of millet fiber is either insoluble or has limited solubility in water. However, it can be transformed into a water-dispersible form, enhancing its ability to mix with milk and create a stable emulsion. Foxtail millet has been utilized as a source of prebiotic fiber in conjunction with commercially available milk. The preparation process begins with milled Foxtail millet grains. To start, dry grains are measured and soaked in water at room temperature overnight. Subsequently, the soaked grains are smashed using a mortar and pestle, although this can alternatively be achieved using a laboratory blender (Philips, India) at 700 rpm for 2 minutes. The resulting millet grain paste is then combined with milk at three different concentrations: 10mg/ml, 30mg/ml, and 50mg/ml. This mixture is heated to 80°C for 3-5 minutes before being cooled to 37°C for inoculation with cultured Dahi under sterile conditions. Specifically, about 0.5 g of Dahi is added to each 30 ml of the millet-milk mixture as an inoculum. The mixture is then incubated for approximately 12 hours. Once the curdling process is complete, the batch is placed in a refrigerator at 4°C for storage. A control Dahi sample is prepared in a similar fashion using milk alone, without the addition of the millet paste, to facilitate comparison. Three different consumptions of millet Dahi were prepared by fermenting milk overnight with the millet paste composition of 10 mg /ml (Type A) of millet paste, 30 mg/ml (Type B), and (Type C). With the consumption of about 100 gm of millet-enriched Dahi prepared by us, about 1.5-2 gm of fiber may be consumed from Type A, about 4.5-5 gm of fiber from Type B, and 4.5-5 gm of fiber intake might occur from the third composition, Type C provides 7.5-10 gm of fiber consumption. It is comparable with the recommended daily minimum fiber need of our gut, for the viable cells are about 10-15 gm daily for adults, up to 25-30gm daily [4]. The millet Dahi can provide some portion of the daily recommended intake.

Physico-chemical analysis

The pH and acidity of Dahi made from control and enriched milk were studied among the physico-chemical properties to observe how fermentation progressed after 1, 3, and 7 days of adding a 2% mixed culture to the Dahi.

pH, acidity and total ash

The pH levels of both control and enriched Dahi were measured using a digital pH meter from Scientific Instruments. To determine the titratable acidity, a sample of 1 g of Dahi was mixed with 20 ml of distilled water and titrated with a standardized 0.1(N) sodium hydroxide (NaOH) solution, utilizing phenolphthalein as an indicator. The results were expressed as a percentage of lactic acid, following the standard protocol [17]. Additionally, the total ash content of the Dahi samples was assessed by incinerating 1 g of the sample in a Muffle Furnace (LabIndia) at a temperature of 550°C for 8 to 10 hours.

Viscosity

Viscosity was measured at a temperature of 30°C using a falling sphere viscometer, allowing a sphere of known mass of the test sample to pass vertically through a liquid of known density, and the time was measured to travel the known distance, and the results are expressed as centipoise (cP) [18].

Water-holding capacity (WHC)

WHC was determined by the whey separation technique. About 20 g of Dahi of both types (control and enriched) was taken in a 50 ml graduated centrifuge tube (Tarsons), and centrifuged at 3500 rpm for 15 min at 30 °C using a bench-top centrifuge (Remi). After centrifugation, the separated clear whey was collected and the weight was measured after centrifugation [19] and expressed as percentage water-holding capacity [20].

Textural analysis/Load test
The two most important textural attributes of Dahi, namely firmness and integrity, were quantitatively assessed using a Texture Analyzer (Universal Testing Machine) equipped with appropriate accessories probe attached to it. (Instron). For the texture analysis, Dahi samples were prepared from 30 ml of fresh milk, placed in 100 ml burnt mud cups. For fermentation, it was inoculated at a controlled temperature of 37±1°C [21]. For the texture evaluation, the samples were subjected to a longitudinal force using a specialized penetration probe. The probe of 1 mm diameter was carefully inserted along the vertical axis, allowed to insert to a depth of 10 mm with a crosshead speed of 2 mm/s of the load cell under the test conditions [22].

Sensory evaluation
The sensory evaluation was conducted by a 25-member panel, which included 19 men and 6 women from the Institute, comprised of scientists, students, and technical staff aged between 20 to 50 years. They assessed both controlled and enriched Dahi samples using a double-blind method, following published methodology [23] with some modifications. Dahi samples were prepared in earthen burnt pots and allowed to incubate at 37°C overnight before testing [24]. Panelists were instructed to taste the samples and rate various sensory parameters using a 9-point hedonic scale. The sensory parameters included color and appearance, body and texture, consistency, flavor, and overall acceptability or mouthfeel, as established in the structured hedonic scale [23].

Microbiological analysis
Lactic acid bacteria were enumerated, and yeast and mold counts were assessed after 1, 4, and 8 days of fermentation using triplicate samples. The bacteria grew on De Man, Rogosa, and Sharpe (MRS) agar media, and the viable *Bacillus* counts were recorded. Each sample (1.0 ml) was mixed with 9.0 ml of sterile saline (0.9% sodium chloride), and serial dilutions were performed as needed. Similarly, the direct hemocytometer counting method was also used under a compound microscope (Olympus) with 40x and 10x magnification to determine the counts of viable *bacillus.* The colonies grown on MRS agar were enumerated using a digital colony counter (Labtronics Microprocessor Colony Counter), and the results were expressed as log numbers of colony-forming units per gram (log-cfu/g).

Shelf life evaluation
The enriched and control Dahi samples were stored in triplicate at a refrigerated temperature of 4°C. Evaluations were conducted on days 1, 4, and 8 to assess sensory, physico-chemical, textural, and microbiological characteristics.

Statistical analysis
For the statistical analysis, mean values and standard deviations for each parameter were calculated based on the triplicate data sets. Statistical significance was determined at a threshold of $P < 0.05$ with 95% significance by SPSS Software version 25.0.

Results and Discussion

Degree of fermentation
The pH and acidity of Dahi prepared from both control and millet-enriched milk were measured at intervals of 0, 4, 8, and 12 hours of post-inoculation with a mixed culture of lactic acid bacteria (LAB) as given in Table 1. Acidity rises consistently with the logarithmic growth of bacteria. The pH level decreases steadily and reaches around 4.5 after 12 hrs. of incubation. However, the differences

Table 1. pH and Percentage Acidity detected in control and millet-enriched (Type A, B, C) and control Dahi up to 12 hrs. of incubation after inoculation during the production of Dahi.

Duration of Incubation (hrs.)	pH				% Acidity (In terms of lactic acid percentage)			
	Millet enriched				Millet enriched			
	Control	10mg/ml milk **(Type A)**	30mg/ml milk **(Type B)**	50mg/ml milk **(Type C)**	Control	10mg/ml milk **(Type A)**	30mg/ml milk **(Type B)**	50mg/ml milk **(Type C)**
0	6.68± 0.054	6.51± 0.033	6.7± 0.034	6.6± 0.036	0.184± 0.015	0.098± 0.001	0.125± 0.04	0.165± 0.06
4	5.24± 0.137	5.17± 0.30	5.0± 0.016	4.98± 0.034	0.49± 0.073	0.30± 0.046	0.36± 0.032	0.41± 0.029
8	4.83± 0.163	4.86± 0.184	4.62± 0.092	4.67± 0.042	0.74± 0.026	0.78± 0.063	0.81± 0.05	0.89± 0.082
12	4.54± 0.0157	4.50± 0.021	4.53± 0.026	4.33± 0.03	0.83± 0.046	0.80± 0.081	0.85± 0.04	0.92± 0.027

Results are expressed as Mean ± SD with significance level ($P < 0.05$)

observed during changes in pH and acidity were not statistically significant ($P > 0.05$). This finding suggests that the rate of acid production and the degree of fermentation of the millet-enriched Dahi, remained closely similar to that of the normal marketed Dahi. Although it is possible to have variations in the types of organic acids produced by the bacterial consortium, the overall fermentation dynamics were similar to those of the control sample.

Analysis shows pH and acidity of Dahi prepared from fortified milk are comparable to those of the control sample (Table 1). These observations align with the findings reported in publications [25]. They reported that fortified Dahi exhibited markedly lower viscosity values when compared to the control. This reduction in viscosity can be attributed to the gel like structural nature of Dahi, with a matrix formed by casein micelles that trap water. The incorporation of millet into the milk might not have enhanced the thickness or gel matrix integrity in Dahi, to maintain a similar rheological property to that of the control.

Sensory and physico-chemical analysis

The sensory and physico-chemical properties of the Dahi samples are presented in Table 2. The findings indicate that the sensory score for the color and appearance of millet-enriched Dahi was comparable to that of the control. Minor differences were observed in Type C, which contained the highest millet content. This increased millet content resulted in a grainier texture, reflected in the sensory scores for body and texture, when compared to the control. Although Types A and B did not show significant differences from the control, Type A millet-enriched Dahi exhibited a slightly weaker texture and less firmness than the control Dahi. Firmness increased for Type B but decreased for Type C. These differences may be attributed to variations in bond formation during the development of the Dahi gel with differing millet compositions. Type B showcased overall optimal textural properties. Regarding flavor, Type C, got a slightly lower sensory score, likely due to its higher millet content. The essential oils present in the millet seeds may be the contributing factor for bringing differences in taste. Overall acceptability scores for the control and fortified Dahi were comparable for Types A and B, while Type C received lower acceptability scores exceeding 7.0 across all sensory attributes.

Texture is a crucial parameter for consumer acceptability of Dahi [17]. Although the firmness and consistency of the fortified Dahi were found slightly lower than those of the control sample, these differences were not statistically significant. Subjective analysis of sensory detection revealed insignificant differences in body and texture attributes between the control and Type B; however, it was considered significant when compared between Types A and C, as indicated by the panelists. It is also suggested that the inclusion of binding agents might improve the textural integrity and firmness of millet-enriched Dahi [26].

Table 2. Results of Sensory, physico-Chemical properties (pH, Acidity, ash content), and Textural analysis of Millet-enriched and microbial count after dahi production at the onset of 12 hrs. incubation time

Properties after 12 hrs. of incubation	Control	Millet enriched dahi 10mg/ml milk Type A	Millet enriched dahi 30mg/ml milk Type B	Millet enriched dahi 50mg/ml milk Type C
Sensory properties				
Color and appearance	8.99±0.01	8.95±0.04	8.94±0.22	8.92±0.46
Body and texture	8.13±0.02	7.88±0.23	7.68±0.21	7.0±0.34
Flavor	8.97±0.01	8.68±0.14	8.84±0.19	8.89±0.33
Overall acceptability	8.21±0.02	7.67±0.14	7.8±0.16	7.2±0.34
Physico-chemical properties				
Viscosity, cP	4385.3±229.6	3647.6±152.2	3445±128.6	3245±122.4
Water holding capacity, %	68.80±4.80	72.58±2.30	73.85±3.27	81.44±4.48
Firmness/hardness (N)	1.54±0.13	1.312±0.07	1.30±0.08	1.89±0.16
Ash content%	0.84±0.036	1.03±0.17	1.05±0.14	1.08±0.098
LAB (Log cfu/ml) Live cell count by enumeration of bacillus. (Mean total viable count of Lactic acid bacteria)	5.15±0.15	6.54±0.25	7.21±0.17	7.45±0.31

Water holding capacity

The water-holding capacity (WHC%) showed a significant difference between the control and the millet-rich Type C product. This difference is again likely due to the higher millet content in the Type C Dahi, leading to increased water absorption by the millet grains and resulting in a coarser or relatively more grainy texture than Types A and B. This phenomenon is attributed to greater water retention by swollen polydextrose, in addition to the formation of a complex network within the curd gel. Polydextrose also serves as a cryoprotectant, helping to maintain the viability of lactic acid bacteria (LAB) during eight days of storage [12]. In terms of viscosity and WHC%, significant differences were noted for millet-enriched Dahi Type C in comparison to the control sample. Primarily, the Dahi type A to C, the viscosity gradually decreases, although the difference between them is not significant, but the difference with the control was found to be significant (Table 2). On the other hand, storage for 8 days gives an unmatched value, but viscosity tends to follow a decreasing nature gradually with the storage condition. After a few days of storage in the refrigerated condition the Dahi was found to be dried out although it would have been more slimy and more viscous due to faster cell growth and death in the room temperature (Table 3). Instead, it is getting less viscous, which might be due to loss of moisture in the refrigeration.

Ash content

Ash content of the millet enriched Dahi did not change significantly after 8 days of storage at 4-5°C. Fortified Dahi provides almost from 0.5 up to 0.9 percent of Dahi mineral contents as soluble ash in a 100 ml serving size of Dahi.

Storage stability of Dahi, physicochemical sensory quality of Dahi

Dahi samples were evaluated for their sensory and physico-chemical properties over an 8-day storage period, targeting the key indicators such as pH and acidity. The results are summarized in Table 3. A thorough analysis of both control and millet-enriched Dahi samples for their sensory

Table 3. Results of Sensory, physico-Chemical properties (pH, Acidity, ash content) and Textural analysis of Millet-enriched and microbial counting of LAB observed after 8 days of storage

Properties after storage for 8 days	Sample Type	Millet Enriched dahi		
Properties	Control	10mg/ml milk **(Type A)**	30mg/ml milk **(Type B)**	50mg/ml milk **(Type C)**
Sensory properties				
Color and appearance	7.99±0.05	7.96±0.04	7.95±0.02	7.96±0.02
Body and texture	7.83±0.02	7.38±0.23	7.21±0.02	6.98±0.098
Flavor	7.97±0.01	7.58±0.14	7.43±0.47	6.86±0.22
Overall acceptability	8.01±0.09	7.67±0.14	7.53±0.28	7.24±0.02
Physico-chemical properties				
Viscosity, cP	4344±120.36	3441±110.20	4639±105.04	3431±116.35
Water holding capacity, %	65.73±2.03	68.74±2.08	70.76±3.03	75.78±3.01
Firmness/hardness (N)	1.35±0.11	1.15±0.090	1.02±0.072	1.93±0.17
Ash content %	0.52±0.02	0.89±0.05	0.98±0.052	1.08±0.13
LAB (Log cfu/ml) Live cell count by enumeration of bacillus. (Mean total viable count of Lactic acid bacteria)	3.95±0.13	5.34±0.12	6.51±0.25	5.95±0.32

attributes revealed that, overall, there was no significant difference in the average scores for color, appearance, or overall acceptability of the Dahi samples throughout the storage period. Types A and B of the enriched Dahi performed similarly. However, it was evident that enriched Dahi Type C showed a considerable decline in sensory scores related to body and texture as samples were harboring an unpleasant taste profile by day eight and unacceptable coarseness from the very beginning. Consequently, Type C also showed a marked decrease in overall acceptability, particularly at the beginning and after 8 days of storage. This suggests that the addition of millet at a higher content introduced an undesirable graininess to Type C, compared to Types A and B, which remained almost unaffected by the fortification.

In examining the physico-chemical properties, in the storage duration of 8 days, it was found that both the control and the fortified Dahi samples (Types A, B, and C) demonstrated a decrease in pH and an increase in titratable acidity, aligning with the reports stated by other researchers [26]. Interestingly, the pH remained unaltered until 8 days for all samples, but started to change significantly after that, also persisting with the process called post-acidification [27].

Moreover, the percentage of water holding capacity (WHC) for control and fortified Dahi showed an increase—from 65% to 68% for the control and from 65% to 75% for the fortified samples—after 8 days of storage. Differences in %WHC were noted across different storage intervals for both the control and fortified Dahi. These results are consistent with those seen in earlier studies, such as those by Foda et al., [26]. In terms of ash content, Type C fortified Dahi exhibited an increased value, although it is not quite notable [28]. Lastly, the firmness and consistency values for both control and fortified Dahi exhibited significant increases throughout the 8-day storage period. It's important to highlight that the overall firmness of yogurt, in general, remains largely unaffected by the length of the storage period [29].

Viability of LAB

In the study, lactic acid bacteria (LAB) in fortified Dahi were found to be significantly higher than those in the control sample. The differences observed by viable cell counts of bacillus species and colony formation in MRS media. Furthermore, the 8-day storage period did not significantly impact

LAB counts in either the control or fortified Dahi. Live cell counts decrease on storage mainly due to cell death. (Table 2 and Table 3)

Additionally, no yeast or mold colonies were detected on the agar plates, nor in the microscopic visualization with a hemocytometer, from either sample, suggesting that good manufacturing practices and hygienic storage conditions were effectively implemented throughout the study.

Conclusion

The study showed that millet-enriched Dahi can be developed without significant difference from the contemporary marketed Dahi with an acceptable quality and can be a very rich source of both prebiotics and probiotics [16]. The physicochemical, textural, microbiological, and sensory characteristics of the millet-enriched product, i.e., Dahi, were comparable to those of the control product. The millet-enriched Dahi was also stored without any significant change in texture at 4-5°C for 8 days, and also without hampering the growth of Lactic acid bacteria (LAB) [25]. The LAB growth was confirmed by the viable cell count of the storage samples at 8 days. Further, the prebiotic components in millet rich Dahi can be an effective source of a nutrient-rich environment for the LAB growth inside the gut. This would not only help in improving the nutritional value but would also incorporate functional benefits to the product.

Conflict of interest

The authors declare no conflict of interest.

Acknowledgements

The authors are thankful to Maulana Abul Kalam Azad University of Technology, WB, for extending the financial support to conduct this research work.

References

[1] V. Fogliano and P. Vitaglione **(2005)**. Functional foods: planning and development. Mol. Nutr. Food Res., **49:** 256-262.

[2] D. F. Drinan, S. Robin and T. M. Cogan **(1976)**. Citric acid metabolism in hetero- and homofermentative lactic acid bacteria. Appl. Environ. Microbiol., **31:** 481-486.

[3] A. Liutkevicius, R. Narkevicius, V. Speicienė, G. Zaborskiene, D. Sekmokiene, A. Abaravicius and Z. Kucinskiene **(2007)**. Study of milk and whey beverages with flaxseed oil. Food Chem. Technol., **41:** 29-35.

[4] ICMR **(2010)**. Nutrient requirements and recommended dietary allowances for Indians. A report of the expert group of the Indian Council of Medical Research. http://icmr.nic.in/final/RDA-2010.pdf. Accessed 20 Jan 2014.

[5] P. Behare, R. Singh and R. P. Singh **(2009)**. Exopolysaccharide-producing mesophilic lactic cultures for preparation of fat-free Dahi-an Indian fermented milk. J Dairy Res., **76:** 90-97.

[6] P. B. Devi, R. Vijayabharathi, S. Sathyabama, N. G. Malleshi and V. B. Priyadarisini **(2014)**. Health benefits of finger millet (*Eleusine coracana* L.) polyphenols and dietary fiber: a review. J. Food Sci. Technol., **51:** 1021-1040.

[7] J. Wang, H. Sun, S. Guo Y. Sun L.-Y. Kwok, H. Zhang and C. Peng **(2021)**. Comparison of the effects of single probiotic strains Lactobacillus casei Zhang and *Bifidobacterium animalis* ssp. *Lactis* Probio-M8 and their combination on volatile and nonvolatile metabolomic profiles of yogurt. J. Dairy Sci., **104:** 7509-7521.

[8] F. Remeuf, S. Mohammed, I. Sodini and J.P. Tissier **(2003)**. Preliminary observations on the effects of milk fortification and heating on microstructure and physical properties of stirred yogurt. Int. Dairy J., **13:** 773-782.
[9] S. Behera, F. A. El Sheikha, R. Hammami and A. Kumar **(2020)**. Traditionally fermented pickles: how the microbial diversity associated with their nutritional and health benefits? J. Funct. Foods. **70:** 103971. doi: 10.1016/j.jff.2020.103971.
[10] M. Beer, E. Arrigoni, D. Uhlmann, D. Wechsler and R. Amado **(1991)**. Stability of polydextrose solutions to heat treatment and storage under acid conditions. Lebensmittel-Wissenschaft Technol., **24:** 245-251.
[11] K. K. Tiihonen, H. Roytio, H. Putaala and A. C. Ouwehand **(2011)**. Polydextrose functional fibre—improving digestive health, satiety and beyond. Nutrafoods. **10:** 23-28.
[12] C. Beal, J. Skokanova, E. Latrille, N. Martin and G. Corrieu **(1999)**. Combined effects of culture conditions and storage time on acidification and viscosity of stirred yoghurt. J Dairy Sci., **82:** 673-681.
[13] F. Muskan, M. Redhu, S. Redhu and M. Rahimi **(2025)**. Millets in the Global Market: a critical review of challenges and opportunities Food Prod. Process. Nutr., **7:** 1-14. doi: 10.1186/s43014-025-00316-1.
[14] Q. Zhang, B. Yang, M. M. Brashears, Z. Yu, M. Zhao, N. Liu and Y. Li **(2014)**. Influence of casein hydrolysates on exopolysaccharide synthesis by *Streptococcus thermophilus* and *Lactobacillus delbrueckii* ssp. *bulgaricus*. J. Sci. Food Agric., **94:** 1366–1372.
[15] I. Amadou **(2019)**. Millet based fermented beverages processing. *In*: A. M. Grumezescu, A. M. Holban (Eds). Fermented beverages. Woodhead Publishing. pp.433-472. doi: 10.1016/B978-0-12-815271-3.00011-7.
[16] T. M. Cogan, T. P. Beresford, J. Steele, J. Broadbent, N. P. Shah and Z. Ustunol **(2007)**. Advances in starter cultures and cultured foods. J. Dairy Sci., **90:** 4005-4021.
[17] J. B. Noffsinger, M. Emery, D. J. Hoch and J. Dokladalova **(1990)**. Liquid chromatographic determination of polydextrose in food matrixes. J. Assoc. Off. Anal. Chem., **73:** 51-53.
[18] P. Walstra, T. J. Geurts, A. Noomen, A. Jellema and M. A. J. S. Van Boekel **(1999)**. Dairy technology: principles of milk properties and processes. New York: Marcel Dekker Inc; doi: 10.1201/9780824746414.
[19] J. B. Prajapati and V. Sreeja **(2014)**. Dahi, related products—industry point of view. https://www.fnbnews.com/FB-Specials/Dahi-related-products--Industry-point-of-view-update.
[20] AOAC **(2005)**. Official methods of analysis. The association of official analytical chemists. 8. Maryland: North Fredrick Avenue Gaithersburg. pp481.
[21] R. Pushkala and N. Srividya **(2011)**. Influence of aloe gel enrichment on the physicochemical, textural and sensory characteristics of dahi. J. Food Sci. Eng., **1:** 141-153.
[22] J. A. Lucey and H. Singh **(1998)**. Formation and physical properties of acid milk gels: a review. Food Rev. Int., **30:** 529-542.
[23] B. M. Watts, G. L. Ylimaki, L. E. Jeffery and L. G. Elias **(1989)**. Basic sensory methods for food evaluation. Ontario: International Development Research Centre.
[24] H. S. Makelainen, H. A. Makivuokko, S. J. Salminen, N. E. Rautonen and A. C. Ouwehand **(2007)**. The effects of polydextrose and xylitol on microbial community and activity in a 4-stage colon simulator. J Food Sci., **72:** M153-M159.
[25] J. D. Estrada, C. Boeneke, P. Bechtel and S. Sathivel **(2011)**. Developing a strawberry yoghurt fortified with marine fish oil. J. Dairy Sci., **94:** 5760-5769.
[26] M. I. Foda, M. Abd El-Aziz and A. A. Awad **(2007)**. Chemical, rheological and sensory evaluation of yoghurt supplemented with turmeric. Int. J. Dairy Sci., 2: 252-259.
[27] M. N. Hossain, M. Fakruddin and M. N. Islam **(2012)**. Development of fruit dahi (yoghurt) fortified with strawberry, orange and grape juice. Am. J. Food Technol., **7:** 562-570.

[28] A. Goyal, V. Sharma, M. K. Sihag, A. Singh, S. Arora, L. Sabikhi **(2016)**. Fortification of dahi (Indian Yoghurt) with omega-3 fatty acids using microencapsulated flaxseed oil microcapsules. J Food Sci Technol., **53:** 2422-2433.

[29] M. S. Hanif, T. Zahoor, Z. Iqbal, Ihsan-ul-Haq and A. M. Arif **(2012)**. Effect of storage on rheological and sensory characteristics of cow and buffalo milk yogurt. Pak. J. Food Sci., **22:** 61-70.