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"Dashami" As A Viable Option For Preservative-Laden Foods: A Physicochemical And Microbiological Evaluation Study.

Snehalata Pawar[1], Yogesh Shinde[2], Manisha Thakare [3], Ashwin Shete [4]

[1] Assistant Professor, Panchakarma Department Dr. D. Y. Patil College of Ayurved and Research Centre, Pimpri, Pune, Dr. D. Y. Patil Vidyapeeth (Deemed-to-be-University), Pimpri, Pune, Maharashtra, India - 411018

Email ID: sneha.ayurved@gmail.com, Orcid ID : 0000-0003-3933-4019

[2] Assistant Professor, Swasthavritta Department, AIIA, North Goa, India – 403513

Email ID: yogesh.personale@gmail.com, Orcid ID : 0000-0002-1095-599X

[3]. Associate Professor, Swasthavritta Department Dr. D. Y. Patil College of Ayurved and Research Centre, Pimpri, Pune, Maharashtra.

Email id: manisha.ayurved@dpu.edu.in, orchid id: 0000-0001-9045-285X

[4]. Associate Professor, Rasashastra Department Dr. D. Y. Patil College of Ayurved and Research Centre, Pimpri, Pune, Dr. D. Y. Patil Vidyapeeth (Deemed-to-be-University), Pimpri, Pune, Maharashtra, India-411018

Email Id: ashwin3485@gmail.com, Orcid id 0000-0002-3450-3082

Corresponding Author

Dr. Snehalata Pawar

Assistant Professor, Panchakarma Department Dr. D. Y. Patil College of Ayurved and Research Centre, Pimpri, Pune, Dr. D. Y. Patil Vidyapeeth (Deemed-to-be-University), Pimpri, Pune, Maharashtra. India-411018

Email ID : sneha.ayurved@gmail.com, Orcid ID : 0000-0003-3933-4019

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ABSTRACT

Background:

The increasing reliance on out-of-home meals and ultra-processed foods has raised concerns regarding diet quality, food safety, and long-term health outcomes. Such foods are often energy-dense and nutrient-poor and may be associated with chronic metabolic disorders and food safety risks. Traditional foods that are naturally preserved and nutritionally balanced may provide healthier alternatives for travel and ready-to-eat consumption. Dashami, a traditional Indian sweet flatbread prepared from wheat flour, chickpea flour, jaggery, milk, and ghee, has historically been carried during journeys due to its perceived storage stability. However, scientific evidence supporting its microbiological safety and nutritional stability during storage is limited. Therefore, the present study aimed to evaluate the physicochemical characteristics, microbial stability, and nutritional profile of Dashami during ambient storage.

Methods:

Dashami samples were prepared using standardized traditional methods with accurately measured ingredients. Three independent batches (n = 3) were produced under controlled conditions to ensure reproducibility. The prepared samples were stored at ambient temperature and evaluated at six-time intervals (0, 12, 24, 48, 72, and 96 hours). Physicochemical parameters including pH, moisture, and total alcoholic acidity were assessed using FSSAI standard methods. Chemical analysis was performed to determine energy, carbohydrates, proteins, fats, crude fibre, starch, and calcium using standardized laboratory procedures. Microbiological analysis was conducted following Indian Standards (IS) methods to detect pathogens and measure total plate count, coliforms, yeast, and mould. All analyses were carried out at BioSource Biotech Laboratory, Pune.

Results:

The results demonstrated that Dashami maintained stable physicochemical and nutritional characteristics during the storage period. Microbiological evaluation showed the absence of major pathogens including E. coli, Salmonella spp., Staphylococcus aureus, Listeria spp., Vibrio spp., and Clostridium spp. throughout the study duration. Total plate counts increased gradually from 45 cfu/g at 0 hours to 332 cfu/g at 96 hours but remained

well within permissible limits for cereal-based foods. Coliform, yeast, and mould counts remained below detectable levels. The findings indicate that Dashami maintains acceptable microbiological quality and nutritional stability for at least five days under ambient conditions. These results scientifically support the traditional practice of carrying Dashami during travel and highlight its potential as a safe, preservative-free, ready-to-eat alternative to ultra-processed foods

Keywords: Dashami, Indian Sweet Flatbread, Microbiological Evaluation, Shelf life..

INTRODUCTION

Nutritional sustenance represents a fundamental biological requirement for organism survival, with human dietary patterns demonstrating significant evolution from unprocessed to sophisticated culinary preparations. Contemporary pre-packaged food products, while offering convenience benefits, present potential physiological risks.

The increasing dependence on out-of-home meals, ultra-processed foods and pre-packed ultra-processed foods has raised significant concerns regarding diet quality, food safety, and long-term health outcomes. Foods consumed outside the home are often energy-dense and nutrient-poor, containing high levels of sugars, fats, sodium, and refined carbohydrates while lacking dietary fiber and essential micronutrients[i, ii, iii, iv]. which is associated with poor overall diet quality and an increased risk of chronic metabolic disorders such as obesity, type 2 diabetes, cardiovascular disease, certain cancers, and depression[v, vi], while also promoting mechanisms like chronic low-grade inflammation, gut microbiota dysbiosis, intestinal barrier dysfunction, insulin resistance, and atherosclerosis, thereby making diets dominated by ultra-processed foods a significant public health concern[vii, viii].

In addition, poor hygiene practices, improper cooking, and inadequate food handling during food preparation can increase the risk of foodborne illnesses. Although food processing plays an important role in ensuring food preservation and safety, certain processing methods may generate harmful compounds like carcinogenic compounds including acrylamide, furan, and polycyclic aromatic hydrocarbons, emphasizing the need for careful regulation and improved processing techniques[ix, x, xi].

Another major concern is food adulteration driven by economically motivated practices, where inferior or harmful substances are added to reduce production costs. Such adulteration compromises food quality and safety and may lead to toxicity, allergic reactions, and nutritional deficiencies. These issues collectively highlight the importance of promoting safe, nutritious, and minimally processed food choices, particularly during travel or situations where individuals rely heavily on ready-to-eat foods[xii].

In this context, *Dashami*, a traditional Indian food preparation, presents a promising alternative to ultra-processed travel foods. Traditionally carried as a convenient and ready-to-eat meal during journeys, *Dashami* can be stored for several days without the need for chemical preservatives or extensive processing. Its preparation using natural ingredients aligns with the growing demand for safe, wholesome, and nutritionally balanced foods. However, despite its traditional use and perceived stability, scientific evidence regarding its microbial safety and nutritional stability during storage has been limited.

Therefore, the present study aimed to evaluate the microbial growth and the stability of nutritional parameters of Dashami during storage. The findings of such investigations can provide scientific validation for the traditional practice of carrying *Dashami* during travel and may support its promotion as a safe, nutritious, and culturally relevant alternative to commercially available ultra-processed foods. Encouraging the use of such traditional foods could contribute to improving dietary quality, reducing reliance on adulterated or highly processed foods, and promoting healthier eating practices during travel and daily life.

MATERIAL AND METHODS:

The present study was carried out in three sequential phases: preparation, standardization, and laboratory evaluation of *Dashami*, a traditional Indian sweet flatbread. In the first phase, *Dashami* was prepared following traditional methods with selected ingredients in precise proportions. In the second phase, the preparation process was standardized by optimizing ingredient integration, dough consistency, thickness, and cooking conditions to ensure uniformity and reproducibility of the final product. The standardized samples were then subjected to laboratory investigations in the third phase to assess their physicochemical, microbiological, and sensory parameters for determining shelf-life stability under ambient storage conditions. All analyses were conducted at regular intervals to evaluate changes in quality attributes and to scientifically validate the product's stability and safety.

1.1 Material:

The preparation of *Dashami* required carefully selected ingredients to ensure authenticity and quality. All materials were procured from local sources and used in their fresh, unadulterated form. The ingredients were measured accurately using calibrated kitchen scales to maintain consistency across all trials. The specifications and quantities of the raw ingredients used for the preparation of *Dashami* are presented in Table 1.

Sr. No.	Ingredients	Specification	Quantity
1.	Wheat flour	Whole grain	400 gm
2.	Chickpea flour	Fine milled	130 gm
3.	Milk	Buffalo origin	250 ml
4.	Ghee	Buffalo origin	20 ml
5.	Jaggery	Non-centrifugal cane sugar	250gm
6.	Salt	Refined	q.s.

Table No. 1: Table 1. Specifications and quantities of Ingredients used for the preparation of *Dashami*

Methodology:

Sample Preparation Protocol:

Solution Phase:

The milk and jaggery were combined, and the jaggery was dissolved in the milk under controlled stirring to ensure complete dissolution.

The resulting milk-jaggery solution was filtered through a standard sieve to remove any undissolved particles or impurities.

Clarified butter was integrated into the filtered solution phase under continuous stirring to achieve a homogeneous mixture.

Dough Phase:

Dry Ingredient Homogenization:

The dry ingredients were accurately weighed and blended as follows:

Wheat flour (400 g)

Chickpea flour (130 g)

Salt (quantum satis)

The ingredients were mixed thoroughly to achieve uniform distribution.

Dough Development:

The milk-jaggery-ghee solution was gradually incorporated into the homogenized dry ingredients.

Manual kneading was performed until an optimal dough consistency was attained.

The dough was allowed to rest for 20 minutes at ambient temperature to facilitate hydration and gluten development**.**

Production Phase:

The dough was divided into eight equal portions using a calibrated scale to maintain uniformity.

Each portion was rolled manually to form sheets of uniform thickness, ensuring consistent texture and cooking.

The sheets were cooked bilaterally on medium heat until the desired level of doneness was reached, monitoring to avoid burning.

Post-Production:

The cooked product was cooled at ambient temperature in a ventilated container to prevent moisture accumulation.

The cooled product was transferred into hermetically sealed steel containers to ensure preservation and prevent contamination.

1.2.2 Standardization Protocol:

For the study, *Dashami* samples were prepared using the traditional manual process under controlled laboratory conditions to ensure consistency and accuracy. A total of three independent sample batches (n = 3) were prepared to assess reproducibility. From each batch, representative portions were selected through random sampling for physicochemical, microbiological, and sensory analyses. Post-preparation, all samples were cooled to room

temperature and stored under ambient laboratory conditions for subsequent evaluation of shelf-life stability.

Testing of the *Dashami* Samples:

The laboratory testing of *Dashami* samples was done at Six-time intervals (0 to 96 hours) in five days.

Expected spoilage window → The traditional knowledge and pilot trials suggest *Dashami* spoils in 5–7 days at room temperature, so the intervals covered that period densely.

For Example: Day 0 (fresh), 12 hrs, 24 hrs, Day 2, Day 3, Day 5, Day 7.

More frequent checks in the first 24 hrs were intended to observe rapid microbial or sensory changes.

Accordingly, the Microbiological and Physiochemical (Physical, Chemical and Nutritional) analysis was also done at Six-time intervals (0 to 96 hours) for five days.

Quality Analysis: Testing Facility

Comprehensive analytical testing was conducted at BioSource Biotech Lab, Location: Talwade, Pune, Maharashtra, under controlled conditions following standard food testing protocols.

Testing Protocol: Standard food analysis procedures

RESULTS:

Experimental Analysis:

Physical Parameters:

1.1.1 Reference Methods Used for Evaluating Physical Parameters of *Dashami* Samples:

This study assessed the physical properties of *Dashami*, including pH values, moisture content, and total alcoholic acidity. The evaluation was conducted using the reference method IS 12711: 2020, as outlined in the Manual Methods of Analysis of Foods, Cereal & Cereal Products, FSSAI 03.015:2023. The sample was analysed at six different time intervals, yielding six distinct values, which are represented in the corresponding chart (Chart no.1)

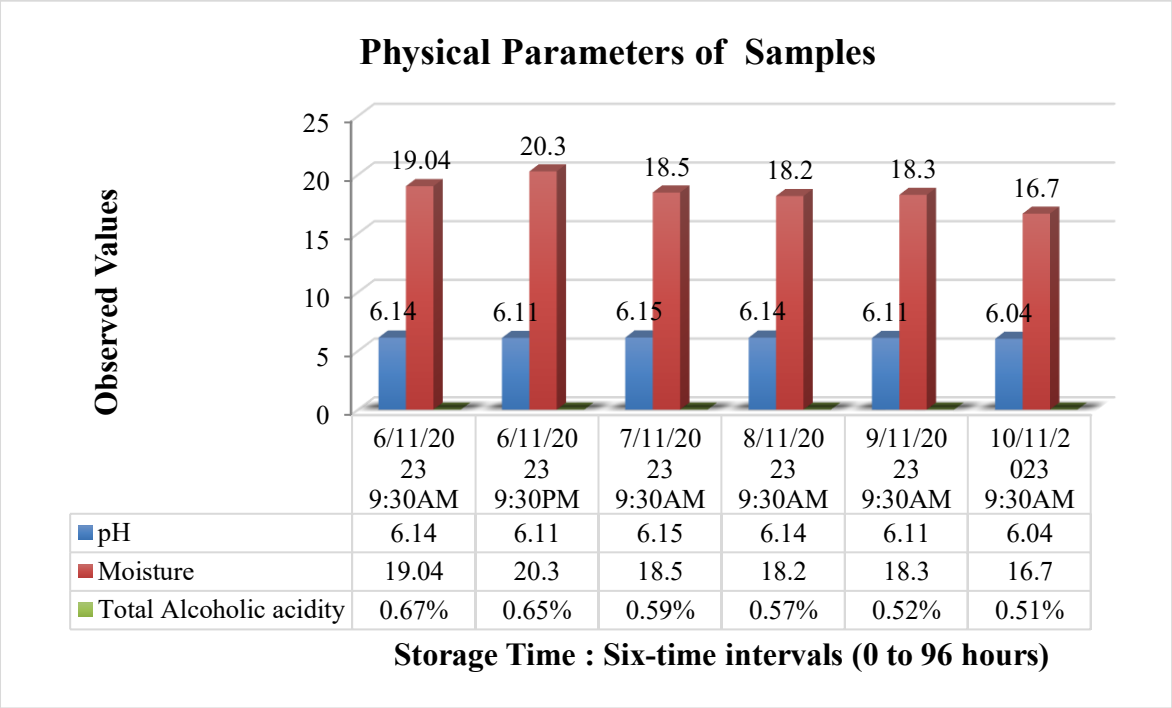

Chart 1: Observed Values of physical Parameters over six-time intervals (0 to 96 hours) of *Dashami* Samples under ambient conditions:

Chemical Parameters:

The chemical composition of *Dashami* was determined through laboratory analysis, measuring the concentrations of energy, carbohydrates, protein, fat, crude fibre, starch, and calcium. The assessment was conducted following standardized reference methods (Table no.2)

Sr. no.	Chemical Parameter	Reference Method
1.	Energy	BSB/SOP/CH/024 Issue No.: 01. Issue Date: 01.07.2023
2.	Carbohydrate	BSB/SOP/CH/023 Issue No.: 01. Issue Date: 01.07.2023

3.	Protein	IS 7219: 1973 Dumas Method
4.	Fat	BSB/SOP/CH/021 Issue No.: 01. Issue Date: 01.07.2023
5.	Crude Fiber	Manual methods of Analysis of Foods, cereal & Cereal Products, FSSAI 03.018:2023
6.	Starch	BSB/SOP/CH/071 Issue No.: 01. Issue Date: 01.07.2023
7.	Calcium	BSB/SOP/CH/072 Issue No.: 01. Issue Date: 01.07.2023

Table 2. Standardized reference methods used for the evaluation of chemical parameters in *Dashami* samples

The sample was tested at six different time intervals for different chemical parameters (Chart no.2).

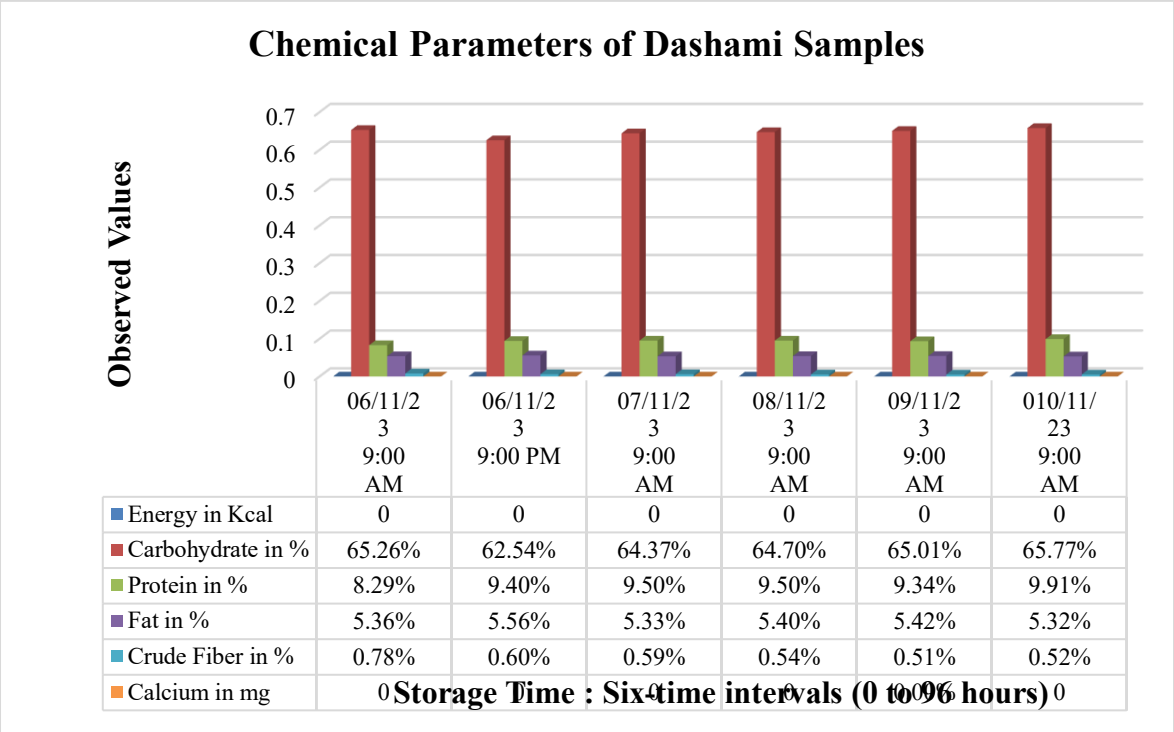

Chart No. 2: Observed Values of Chemical Parameters over six-time intervals (0 to 96 hours) of *Dashami* Samples under ambient conditions

The apparent increase in protein percentage from Day 1 (8.29%) to Day 5 (9.92%) is attributable to the natural reduction in moisture content during storage, leading to a concentration of solids, including proteins. This does not reflect a true increase in protein content of *Dashami* but rather a relative rise due to dehydration.

Nutritional Composition Analysis of *Dashami* Samples:

The nutritional profile of *Dashami* was estimated using the reference values from the book Nutritive Value of Indian Foods. The composition per 100g of the primary ingredients (wheat flour, chickpea flour, buffalo milk, buffalo ghee, and cane jaggery) was calculated (Table no.3).

This evaluation included macronutrients such as energy, carbohydrates, proteins, and fats, along with micronutrients like calcium, phosphorus, iron, and vitamins. Additionally, amino acid profiling was conducted to determine comprehensive overview of the nutritional quality of *Dashami*.

Sr. No.	Component of *Dashami*	Quantity per 100gm					Total
		Wheat flour	Chickpea flour	Milk (Buffalo's)	Ghee (Buffalo's)	Jaggery (Cane)	
	Energy (Kcal)	346	372	117	900	383	2118 Kcal
2.	Carbohydrate (gm)	71.2	59.8	5.0	-	95.0	231 gm
3.	Protein (gm)	11.8	20.8	4.3	-	0.4	36.9 gm
4.	Fat (gm)	1.5	2.7	6.5	100	-	110.7 gm
5.	Crude Fiber (gm)	1.2	1.2	-	-	-	2.4 gm
6.	Calcium (mg)	41	56	210	-	80	307 mg
7.	Phosphorus (mg)	306	331	130	-	40	767 mg
8.	Iron (mg)	5.3	5.3	0.2	-	2.64	10.8 mg
9.	Carotene (mg)	29	129	48	270	-	476 mg
10.	Thiamine (mg)	0.49	0.48	0.04	-	-	1.01 mg
11.	Riboflavin (mg)	0.17	0.18	0.10	-	-	0.45 mg
12.	Niacin (mg)	4.3	2.4	0.1	-	-	6.8 mg
13.	Folic acid Free (µg)	142	32.0	3.3	-	-	177.3 µg
14.	Folic acid Total (µg)	36	147.5	5.6	-	-	189.1 µg
15.	Vitamin C (mg)	-	1	10	-	-	251 mg
16.	Mg (mg)	132	119		-	-	76.3 mg
17.	Sod (mg)	20	37.3	19.0	-	-	16.3 mg
18.	Pot (mg)	315	808	214	-	-	1337 mg
19.	Cu (mg)	0.51	1.18	-	-	-	1.69 mg
20.	Mn (mg)	2.29	1.21	-	-	-	3.5 mg
21.	Mo (mg)	0.039	0.154	-	-	-	0.193 mg
22.	Zn (mg)	2.2	6.1	-	-	-	8.3 mg
23.	Cr (mg)	0.006	0.008	-	-	-	0.014 mg
24.	S (mg)	122	179	-	-	-	301 mg
25.	Cl (mg)	29	58	-	-	-	87 mg
26.	Arginine (mg/gm N)	290	570	200	-	-	1060 mg
27.	Histidine (mg/gm N)	130	160	130	-	-	420 mg/gm N
28.	Lysine (mg/gm N)	170	440	490	-	-	1100 mg/gm N
29.	Tryptophan (mg/gm N)	70	50	090	-	-	210 mg/gm N
30.	Phenylalanine (mg/gm)	280	360	270	-	-	910 mg/gm N
31	Tyrosine (mg/gm N)	180	180	-	-	-	360 mg/gm N
32	Methionine (mg/gm N)	90	80	170	-	-	340 mg/gm N
33	Cystine (mg/gm N)	140	80	090	-	-	310 mg/gm N
34	Threonine (mg/gm N)	180	220	300	-	-	700 mg/gm N
35	Leucine (mg/gm N)	410	580	640	-	-	1630 mg

							/gm N
36	Isoleucine (mg/gm N)	220	320	330	-	-	870 mg/gm N
37	Valine (mg/gm N)	280	310	380	-	-	970 mg/gm N

Table 3. Estimated nutritional composition of *Dashami* samples per 100 g of ingredients and cumulative contribution to the final formulation of *Dashami*

Microbiological Analysis of *Dashami* Samples:

Microbiological testing of *Dashami* was performed to assess the presence of microbial contaminants over a five-day period. The colonies were initially counted after 12 hours and then again following a 24-hour incubation at 37°C.The detection and enumeration of microbes followed the methodologies outlined in the respective Indian Standards (IS) (table no.4)

Sr. No.	Microbial Parameter	Reference Method	Observation / Unit	Difference over five days Test 1 (T0) to Test 6 (T5)
1	Aspergillus spp.	IS 5403: 1999	Absent/25g	No variation observed over 5 days
2	Bacillus spp.	IS 5887 (Part-6): 2012	Absent/25g	No variation observed over 5 days
3	E. coli	IS 5887 (Part-1): 1976	Absent/25g	No variation observed over 5 days
4	S. aureus	IS 5887 (Part-2): 1976	Absent/25g	No variation observed over 5 days
5	Total Plate Count	IS 5402: 2012	cfu/g	Variation observed over 5 days
	Test 1 (T0)	0 Hour	45 cfu/g	-
	Test 2 (T1)	12 Hours	60 cfu/g	15^{+}
	Test 3 (T2)	24 Hours	65 cfu/g	5^{+}
	Test 4 (T3)	48 Hours	95 cfu/g	30^{+}
	Test 5 (T4)	72 Hours	200 cfu/g	105^{+}
	Test 6 (T5)	96 Hours	332 cfu/g	132^{+}
6	Coliform Count	IS 5401 (Part-1): 2012	<10 cfu/g	No variation observed over 5 days
7	Yeast & Mould Count	IS 5403: 1999	<10 cfu/g	No variation observed over five days
8	Salmonella spp.	IS 5887 (Part-3): 1999	Absent/25g	No variation observed over 5 days
9	Listeria spp.	IS 14988 (Part-1): 2020	Absent/25g	No variation observed over 5 days
10	Clostridium spp.	IS 5887 (Part-4): 1999	Absent/25g	No variation observed over 5 days
11	Vibrio spp.	IS 5887 (Part-5): 1976	Absent/25g	No variation observed over 5 days
12	Pseudomonas spp.	IS 13428: 2005	Absent/25g	No variation observed over 5 days
13	Shigella spp.	IS 5887 (Part-7): 1999	Absent/25g	No variation observed over 5 days

Table 4. Microbiological quality assessment of *Dashami* samples over six-time intervals (0 to 96 hours) under ambient storage conditions

Microbial parameters of *Dashami* were evaluated over a period of five days using standard Indian Standards (IS) reference methods. Pathogenic microorganisms, including E. coli, Salmonella spp., S. aureus, Listeria spp., Shigella spp., Vibrio spp., and Clostridium spp., remained absent throughout the study period. Total plate counts showed a gradual increase, while coliforms, yeasts, and moulds remained below detectable limits, indicating that *Dashami* maintained acceptable microbiological quality under ambient storage conditions.

DISCUSSION:

The present study provides a scientific characterization of Dashami, a traditional Indian flatbread, evaluating its stability and safety under ambient storage conditions. The findings validate the historical practice of using Dashami as a preferred travel food, demonstrating remarkable microbial resilience and nutritional persistence over

a 96-hour period. The findings validate the historical practice of using Dashami as a preferred travel food, demonstrating remarkable microbial resilience and nutritional persistence over a 96-hour period.

This finding is noteworthy, as most Indian breads are known to deteriorate rapidly and become susceptible to microbial spoilage within 24–48 hours. The relative stability of *Dashami* can be explained by a combination of factors inherent to its preparation and composition.

Dashami preparation included wheat flour, chickpea flour, jaggery, ghee, and buffalo milk as the main ingredients (see Table 1). Wheat flour, obtained by grinding wheat grains, is a widely used cereal product and a good source of carbohydrates, proteins (mainly gluten), dietary fiber, vitamins, and minerals, making it an important ingredient in several food products[xiii]. Chickpea flour (gram flour), a pulse-based ingredient, is rich in protein, amino acids, dietary fiber, and minerals such as iron, magnesium, and folate[xiv]. Chickpea seeds also contain bioactive compounds such as β-sitosterol, linoleic acid, phytosterols, tocopherols, and tocotrienols, which contribute to various health benefits including reduction of cholesterol levels and risk of cardiovascular diseases[xv]. The combination of cereals and pulses improves protein quality because cereals are relatively low in lysine, whereas pulses are rich in lysine but limited in sulfur-containing amino acids; thus, their combination provides complementary amino acids and results in a more balanced protein profile[xvi,xvii,xviii]. Jaggery is considered a natural sweetener due to its nutritional and therapeutic properties, as it contains essential minerals such as iron, calcium, magnesium, and potassium along with vitamins, amino acids, and polyphenols that provide nutraceutical and antioxidant benefits. Ghee enhances the nutritional quality of food preparations by supplying fat-soluble vitamins and antioxidants such as tocopherols[xix]. The incorporation of buffalo milk further improves the nutritional value due to its higher protein content, which enhances protein quality and nutritional density. Its higher fat content contributes to better softness and texture, while the presence of minerals and vitamins such as A, B-complex, and D improves the overall nutritional profile[xx], thereby increasing the energy value and overall nutritional quality of the product.

Thermal processing during roasting significantly reduces the initial microbial load, thereby delaying the onset of spoilage. Furthermore, gradual loss of moisture during storage results in reduced water activity, creating conditions unfavourable for microbial proliferation.

Microbiological Safety and Shelf-Life

The microbiological analysis revealed that Dashami remains well within safe consumption limits throughout the five-day study period. The Total Plate Count (TPC) increased from an initial 45 cfu/g to 332 cfu/g at 96 hours. When compared to the Food Safety and Standards Authority of India (FSSAI) standards for baked and cereal-based products—which typically permit a maximum TPC of up to 5×10^4 cfu/g for cereal-based foods[xxi]. the observed values for Dashami are exceptionally low. Furthermore, the absence of pathogens such as E. coli, Salmonella spp., and S. aureus, along with coliform and yeast/mould counts remaining below detectable limits (<10 cfu/g), underscores the product's inherent safety.

This microbial stability can be attributed to the synergistic effect of its core ingredients. Jaggery (non-centrifugal cane sugar), contains high concentrations of sucrose and minerals which exert osmotic pressure, thereby reducing water activity and inhibiting microbial proliferation[xxii]. Ghee (clarified butter)[xxiii] contributes to shelf-life by acting as a moisture barrier and providing oxidative stability[xxiv], while its fat content may also encapsulate nutrients, shielding them from environmental degradation. The cooking process, involving eating on both sides of the flatbread, further serves as a thermal kill-step, ensuring a low initial microbial load.

Similar microbial stability has been reported in traditional Indian processed foods such as Kerala Mixture, *Achappam*[xxv] which exhibit extended shelf life due to low water activity and the presence of natural preservatives, However, these products are typically deep-fried, which may limit their nutritional desirability when consumed frequently.

2. Physicochemical and Nutritional Stability

The physical parameters showed a consistent profile, with a notable observation regarding the "apparent" increase in protein content from 8.29% on Day 1 to 9.92% on Day 5. As noted in the results, this increase is primarily attributed to moisture loss during ambient storage. As water evaporates, the concentration of total solids, including proteins and minerals, increases relative to the total mass. This phenomenon is frequently observed in semi-dried traditional foods and does not indicate actual protein synthesis but rather a concentration effect that enhances the nutrient density per gram of the consumed product[xxvi].

The nutritional estimation (Table 3) highlights Dashami as a calorie-dense and micronutrient-rich formulation. The combination of wheat flour (carbohydrates and gluten) and chickpea flour (lysine-rich protein and fiber) creates a complementary amino acid profile, improving the overall Protein Efficiency Ratio (PER) compared to single-grain flatbreads. The inclusion of jaggery and buffalo milk provides essential minerals like calcium (307

mg/100g) and phosphorus (767 mg/100g), which are vital for metabolic health during strenuous activities like travel.

3. Dashami as a Safe Alternative to Ultra-Processed Foods

Meals consumed outside the home are often dominated by pre-packed ultra-processed foods which are characterized by high glycemic indices, trans fats, and artificial preservatives[xxvii]. Fast-food outlets further contribute to unhealthy eating patterns by offering inexpensive, energy-dense foods that may promote weight gain and obesity[xxviii].

In contrast, Dashami represents a "clean-label" traditional alternative. The results demonstrate that Dashami achieves a shelf-life of at least five days without the need for synthetic additives like calcium propionate or sorbic acid. The natural preservation provided by jaggery and ghee aligns with contemporary consumer demands for minimally processed, wholesome foods. By maintaining nutritional integrity and microbial safety at room temperature, Dashami addresses the health concerns associated with the long-term consumption of UPFs, such as gut dysbiosis and metabolic disorders.

The findings suggest that *Dashami* can be positioned as a preservative-free, ready-to-eat food with practical utility for travel and short-term storage, aligning with the growing consumer demand for natural, additive-free products. Nevertheless, the study has certain limitations, including a small sample size, single ambient storage condition, and absence of water activity measurements and sensory evaluations. Future research should focus on larger-scale trials, controlled storage conditions, water activity determination, packaging innovations, and consumer acceptability studies to strengthen the evidence base and support broader applications of *Dashami* as a functional ready-to-eat food.

V. CONCLUSION:

This study provides the first systematic scientific evaluation of *Dashami*, a traditional Indian sweet flatbread, with respect to its shelf-life and stability under ambient conditions. Physicochemical and microbiological analyses demonstrated that *Dashami* maintained nutritional integrity and microbial safety for at least five days of storage, with no significant deterioration in physical, chemical, or sensory parameters. Microbial counts consistently remained within permissible limits, underscoring the inherent resilience of this formulation against spoilage.

These findings establish *Dashami* as a promising preservative-free, ready-to-eat formulation suitable for short-term distribution and consumption, particularly in contexts where cold chain facilities are unavailable, such as travel or remote settings. Importantly, the product aligns with the increasing global demand for natural, minimally processed, and additive-free foods.

Dashami, a traditional Indian sweet flatbread demonstrates significant potential as a culturally rooted, health-conscious, and preservative-free ready-to-eat food, bridging traditional culinary practices with modern consumer needs for safe, stable, and natural convenience foods.

FUTURE SCOPE OF THE STUDY

The shelf life of *Dashami* can be assessed for extended time of 7 to 10 days.

To substantiate commercial shelf-life claims and regulatory compliance, we recommend:

Replicate studies with larger batches and controlled temperature/humidity matrices;

Direct measurement of water activity and water-phase salt;

Accelerated and real-time shelf-life testing (including sensory panels);

Validated challenge tests for common spoilage/pathogenic organisms; and

Evaluation of packaging options to further extend stability.

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DATA AVAILABILITY STATEMENT

The data generated and analysed during this study are available from the corresponding author.

CONFLICT OF INTEREST

All the authors contributed in this study declared and given consent for publishing this manuscript.

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AUTHOR CONTRIBUTIONS

Conceptualization, Methodology, Data Collection, Analysis, Project Administration: S.P.

Writing Original Draft, Review and Editing: Y.S.,
Visualization: M.T.,
Supervision: A. S.

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