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Effect of Microwave Treatment on the Shelf-Life Characteristics of Date *Burfi* during Storage

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Abstract
Date Burfi is a nutrient-rich traditional dairy sweet; however, its high moisture and nutrient content make it susceptible to microbial and physicochemical deterioration during storage. The present study investigated the potential of microwave treatment as a post-packaging preservation technique to improve the shelf-life and quality of date Burfi. Date Burfi was prepared using buffalo milk khoa, sugar and date paste, with date paste incorporated at 30% of khoa. Packaged samples were subjected to microwave treatments of 180 W for 100 s (M1), 360 W for 50 s (M2), 540 W for 40 s (M3), 720 W for 30 s (M4) and 900 W for 20 s (M5), while untreated samples served as control. The treated and control samples were stored at ambient (30 ± 1°C) and refrigerated (10 ± 1°C) conditions and evaluated at different storage intervals for sensory, physicochemical and microbiological quality. Sensory evaluation was conducted using a 9-point hedonic scale by a trained panel of seven judges. At ambient storage, sensory scores for colour, appearance, body and texture, flavour and overall acceptability generally declined with increasing storage period. Microwave-treated samples showed better overall acceptability than the control at the end of storage, with M3 recording the highest score of 6.55 on the seventh day. Flavour scores were also higher in microwave-treated samples, particularly M5 on the first day. The study demonstrates that microwave treatment has potential for improving the storage stability and maintaining the sensory quality of date Burfi, with treatment intensity influencing product acceptability during storage.

Keywords: Date Burfi; Microwave Treatment; Shelf Life; Sensory Quality; Storage Stability

Introduction
Traditional Indian dairy products occupy a unique position in the country's food culture, combining nutritional value with sensory appeal and social significance. An estimated 50–55% of milk produced in India is converted into a wide array of traditional sweets and delicacies, many of which are prepared using traditional techniques involving coagulation, desiccation and fermentation (Balasubramanian, 2024) [1]. Among these, *Burfi* stands out as one of the most popular *Khoa*-based confections, widely consumed during festivals, celebrations and as a gift item symbolizing joy and goodwill. *Burfi* is valued not only for its distinctive body, texture and flavour but also for its high content of milk solids, including fat, protein, lactose and minerals, which contribute significantly to its nutritional profile (Yadav *et al*., 2024; Hs and Kg, 2022) [1, 3]. In recent decades, consumers increasingly seek foods that offer both indulgence and functional benefits, prompting researchers and industry to explore novel formulations that integrate traditional dairy bases with nutrient-dense ingredients. Such innovations not only enhance the nutritional quality of conventional sweets but also align with contemporary consumer preferences for natural, functional and culturally familiar foods (Ortiz *et al*., 2017) 41]. Date (*Phoenix dactylifera* L.), often referred to as the "tree of life," has been a staple food in arid regions for thousands of years due to its exceptional nutritional composition and energy density. Dates are rich in carbohydrates (44–88%), contain moderate amounts of protein (2.3–5.6%), minimal fat (0.2–0.5%), and are an excellent source of dietary fibre (6.4–11.5%), essential minerals such as potassium, calcium, magnesium, iron and phosphorus, and B-complex vitamins (Saeed *et al*., 2024; Mahomoodally *et al*., 2023) [5, 6]. Beyond their macronutrient profile, dates exhibit antioxidant, antimutagenic and antimicrobial properties, and their regular consumption has been associated with potential benefits in managing conditions such as anemia, bone disorders, cardiovascular diseases and oxidative stress (Sedighi-Khavidak *et al*., 2022) [7].

The incorporation of date paste into dairy products thus offers a practical strategy to enhance their nutritional and functional attributes while imparting a distinctive flavour and natural sweetness. Traditional milk-based sweets like *Burfi* are highly perishable because of their high moisture, nutrient-rich composition and susceptibility to microbial and chemical spoilage. During storage, microbial growth, moisture migration, lipid oxidation and non-enzymatic browning reactions collectively reduce shelf life and impair sensory quality (Vijayalakshmi *et al*., 2005) [8]. Conventional preservation strategies such as chemical preservatives, vacuum packaging and refrigeration can extend shelf life but often increase costs, modify product characteristics or encounter consumer resistance due to concerns about synthetic additives. This has stimulated interest in affordable, efficient and consumer-acceptable technologies that improve microbial safety and storage stability without compromising sensory and nutritional attributes (Ranathunga *et al*., 2023) [9]. Microwave technology offers a promising non-conventional thermal processing alternative for dairy sweets. Microwaves (commonly 2,450 MHz) generate heat volumetrically through dipolar rotation and ionic conduction, enabling rapid, energy-efficient processing with better retention of heat-sensitive nutrients and improved product quality compared with conventional surface heating (Meshram *et al*., 2017; Kakar *et al*., 2024) [10, 11]. Studies on concentrated dairy sweets indicate that microwave post-packaging treatment slows microbial proliferation, reduces moisture loss and delays sensory deterioration, extending shelf life by several days under ambient conditions and substantially longer under refrigeration (Sabikhi *et al*., 2018) [12]. Given the nutritional benefits of date-enriched *Burfi* and the proven potential of microwaves in similar products, systematic evaluation of microwave power–time combinations on the physicochemical, sensory and microbiological quality of date *Burfi* during storage is warranted. Such research would advance understanding of microwave–food interactions in dairy–fruit matrices and provide practical guidance for producers seeking cost-effective preservation technologies.

Accordingly, the present study was undertaken with the following objectives: (i) to standardize microwave power–time combinations for date *Burfi*; (ii) to evaluate the influence of microwave treatment on the physicochemical attributes, including moisture, HMF, FFA and titratable acidity; (iii) to assess the sensory quality of microwave-treated date *Burfi* during storage at ambient (30 ± 1 °C) and refrigerated (10 ± 1 °C) conditions; (iv) to determine the effect of microwave processing on microbial load, specifically standard plate count and yeast and mould count; and (v) to establish the shelf life of microwave-treated date *Burfi* in comparison with untreated controls. The findings of this research are expected to provide a scientific basis for the adoption of microwave technology as a viable post-packaging intervention to enhance the quality and shelf stability of date-enriched traditional dairy sweets.

Materials and Methods

Materials: Good quality seedless dates ("Falcon" brand) and pooled buffalo milk were procured from the local market of Pusad city. All chemicals used for analysis were of analytical reagent grade. Key reagents included copper sulphate, potassium sulphate, boric acid, sodium hydroxide, sulfuric acid, iso-amyl alcohol, phenolphthalein indicator, hydrochloric acid, nitric acid, acetic acid, buffer tablets (pH 4 and 7), mixed indicator, phosphotungstic acid, Thio barbituric acid, potassium iodide, mercuric chloride (Himedia Laboratories, Mumbai), ammonia solution, oxalic acid, zinc sulphate, diethyl ether, petroleum ether, ethyl alcohol and trichloroacetic acid (AR Grade, Molychem, Mumbai).

Equipment's

The following equipment were used: digestion and distillation assembly for protein estimation (KELPLUS, Pelican Instruments, Chennai); research polarimeter 220 MM (BD Instrumentations, Ambala); UV-Vi's spectrophotometer (Electronics India, Mumbai); DTC-96 muffle furnace (Innovative Muffle Furnace, Mumbai); and a domestic microwave oven (2450 MHz, variable power settings 180–900 W).

Preparation of date *Burfi*

Date *Burfi* was prepared following the method of Vyawahare *et al*. (2022) [13]. Buffalo milk was concentrated by heat desiccation to prepare *Khoa*. Date paste was prepared by crushing soft seedless dates. *Burfi* was prepared by blending *Khoa*, sugar (@ 30% of *Khoa*) and date paste (@ 30% on *Khoa* basis, as optimized in preliminary trials) with uniform mixing. The mixture was kneaded at 60°C, set, cut into uniform pieces and packed.

Standardization of microwave treatment

Date *Burfi* samples (approximately 100 g each) were packed in low-density polyethylene (LDPE) pouches previously sanitized with 0.5% hydrogen peroxide solution. The packaged samples were subjected to microwave treatment at different power–time combinations to identify acceptable treatments without charring or excessive fat separation. The selected treatments were: M1 (180 W for 100 s), M2 (360 W for 50 s), M3 (540 W for 40 s), M4 (720 W for 30 s) and M5 (900 W for 20 s). Untreated samples served as control (TC).

Storage study

Microwave-treated and control samples were stored at two temperatures: ambient (30 ± 1°C) and refrigerated (10 ± 1°C). Samples were analyzed on days 1, 3 and 7 (30 ± 1°C) and days 1, 7, 14 and 21 (10 ± 1°C) for sensory and microbiological parameters.

Physicochemical analysis

Moisture, total solids, protein, fat, ash, lactose, titratable acidity and pH were determined as per IS: SP (Part XI) and AOAC methods. Hydroxymethylfurfural (HMF) content was estimated by the method of Keeney and Bassette, and free fatty acid (FFA) content was determined as % oleic acid.

Sensory evaluation

A panel of seven trained judges from the College of Dairy Technology evaluated samples for colour, appearance, body and texture, flavour and overall acceptability using a 9-point hedonic scale. Samples were served at room temperature (~30°C) in coded, closed HDPE containers.

Microbiological analysis

Standard plate count (SPC) and yeast and mould (Y & M) count were determined using appropriate media and

incubation conditions. Results were expressed as colony forming units (CFU) per gram.

Statistical analysis

Data from three replications were subjected to one-way analysis of variance (ANOVA) followed by least significant difference (LSD) test at 5% level of significance using standard statistical methods (Snedecor and Cochran, 1989) [14].

Results and Discussion

Effect of microwave treatment on sensory quality

Sensory scores for microwave treated date *Burfi* samples along with non-microwave treated control samples were given by trained panel of 7 judges from the institute. Score was given on 9-point hedonic scale. Study was carried out on both storage temperatures viz., 30±1°C and 10±1°C separately for each parameter.

Sensory quality of microwave treated *Burfi* during storage at 30±1°C

Color

It was observed from Table 1 that scores for color on day 1 was found to be significant. The highest score was recorded for M3 (7.88) and lowest for M2 (7.38) against control (7.72). Score for color on day 3rd was found to be non-significant. The highest score was recorded for M3 = M5 (7.50) and lowest for M1 (7.22) against control (7.33) on third day of storage. The scores recorded for color on 7th day of storage was also found to be non-significant. The color score observed for samples was high for M3 (6.69) and low for M1 (6.38) against control (6.50). It is observed that color score decreases gradually in all the treatments during storage period.

Appearance

It was observed from Table 1 that scores for appearance on day 1 was found to be non-significant. The highest score was recorded for M3 (7.72) and lowest for M2 (7.44) against control (7.88). Score for appearance on day 3rd was found to be non-significant. The highest score was recorded for M3 = M5 (7.50) and lowest for M1 (6.94) against control (7.22) on third day of storage at 30±1°C. The scores assigned for appearance on 7th day of storage was also found to be non-significant. The score for appearance observed for samples was high for M3 (6.50) and low for M1 (5.83) against control (5.72). It was observed from tabulated data that scores for appearance decreases gradually from first to last day of storage in all the treatments at 30±1°C .This might be due to the loss in freshness of samples stored at 30±1°C. Sensory scores of microwave-treated date *Burfi* during storage at 30 ± 1°C are presented in Table 1.

Table 1: Sensory score of Microwave treated *Burfi* during storage at 30±1ºC

Parameter	Treatment	Day 1	Day 3	Day 7
Color	Control	7.72±0.46^{abc}	7.33 ±0.48	6.50±0.98
	M1	7.44±0.61^{bc}	7.22±0.54	6.38±1.03
	M2	7.38±0.69^{c}	7.33±0.84	6.44±1.09
	M3	7.88±0.53^{a}	7.50±0.78	6.69±1.12
	M4	7.80±0.51^{ab}	7.44±0.98	6.61±1.19
	M5	7.86±0.53^{a}	7.50±0.92	6.58±1.03
Level of significance		*	**NS**	**NS**
Appearance	Control	7.88±0.75	7.22±0.73	5.72±1.48
	M1	7.61±0.77	6.94±0.72	5.83±1.38
	M2	7.44±0.78	7.05±0.87	5.94±1.47
	M3	7.72±0.75	7.50±0.78	6.50±1.20
	M4	7.69±0.75	7.44±0.85	6.44±1.24
	M5	7.61±0.67	7.50±0.61	6.41±1.23
Level of significance		**NS**	**NS**	**NS**
Body and Texture	Control	7.88±0.58	7.22±0.73	5.83±1.50
	M1	7.50±0.70	7.00±0.76	6.05±1.34
	M2	7.58±0.77	7.11±0.83	6.11±1.13
	M3	7.77±0.52	7.38±1.09	6.13±1.39
	M4	7.75±0.73	7.27±0.89	5.94±1.55
	M5	7.72±0.75	7.16±1.29	5.83±1.88
Level of significance		**NS**	**NS**	**NS**
Flavor	Control	7.77±0.42^{bc}	7.11±0.67^{b}	5.72±1.44
	M1	7.61±0.69^{c}	7.05±0.63^{b}	5.77±1.16
	M2	7.55±0.70^{c}	7.22±0.94^{ab}	5.83±1.24
	M3	8.13±0.72^{ab}	7.63±0.76^{a}	6.44±1.14
	M4	8.16±0.70^{ab}	7.69±0.89^{a}	6.05±0.99
	M5	8.33±0.68^{a}	7.69±0.66^{a}	6.27±1.17
Level of significance		*	*	**NS**
Overall Acceptability	Control	7.83±0.51^{a}	6.27±0.57	4.94±1.51^{d}
	M1	7.38±0.60^{b}	6.94±0.63	5.41±1.24^{c}
	M2	7.41±0.64^{b}	7.30±0.75	6.02±1.21^{bc}
	M3	7.77±0.71^{ab}	7.47±0.84	6.55±1.04^{a}
	M4	7.97±0.65^{a}	7.44±0.85	6.30±120^{b}
	M5	8.05±0.63^{a}	7.38±0.69	6.50±1.16^{a}
Level of significance		*	**NS**	*

Data is represented as mean ± SD; means with different superscripts in column differ significantly at 5%* level of significance; n=3

Body and texture

It can be observed from Table 1 that scores for body and texture on day 1 was found to be non-significant. The highest score was recorded for M3 (7.77) and lowest for M1 (7.50) against control (7.88). Scores for body and texture on day 3rd was also found to be non-significant. The highest score was recorded for M3 (7.38) and lowest for M1 (7.00) against control (7.22) on third day of storage at 30±1℃.

The scores recorded for body and texture on 7th day of storage at 30±1℃ was also found to be non-significant. The score for body and texture observed for samples stored at 30±1℃ was high for M3 (6.13) and low for M5 (5.83) which resembles control (5.83). It was observed from tabulated data that scores for body and texture decreases gradually during storage at 30±1℃. The decreased scores for body and texture during storage might be due to increase in hardness of samples due to moisture loss caused by microwave treatment.

Flavor

It was observed from Table 1 that scores for flavor was significant (p<0.05) on 1st day. The highest score was recorded for M5 (8.33) and lowest for M2 (7.55) against control (7.77). Score assigned for flavor was found to be significant on 3rd day while non-significant on 7th day. The highest score was recorded for M4 = M5 (7.69) and lowest for M1 (7.05) against control (7.11) on third day of storage at 30±1℃. The score given on 7th day for flavor of samples stored at 30±1℃ was high for M3 (6.44) and low for M1 (5.77) against control (5.72). It can be observed from data that scores for flavor decreases gradually in all the treatments during storage period at 30±1℃.

Overall acceptability

It can be observed from Table 1 that the overall acceptability score varied significantly (p<0.05) on 1st and 7th day while that on 3rd day was found to be non-significant. The scores assigned for overall acceptability on day 1 was in the order of M1<M2<M3<M4<M5. The highest score was recorded for M5 (8.05) while lowest for M1 (7.38) as compared to control (7.83). The score given on 3rd day was in the order of M1<M2<M5<M4<M3. The highest score was recorded for M3 (7.47), whereas lowest for M1 (6.94) against control (6.27). The score for overall acceptability on 7th day was decreased in the order of M1 (5.41) <M2 (6.02) <M4 (6.30) <M5 (6.50) <M3 (6.55). The highest score for overall acceptability was assigned for M3 (6.55), whereas lowest for M2 (5.94) against control (4.94). It can be observed from data that overall acceptability score decreases gradually in all the treatments during storage period at 30±1℃. Similar results were observed for *Burfi* by Solanki *et al*. (2002) and Naresh *et al*. (2009) [15, 16] for *Peda*. They also observed the decrease in sensory scores with increase in level of microwave treatment and storage period of *Burfi* and *Peda*, respectively.

References

1. Balasubramanian G. Growth and development of dairy industry in India. Eur Econ Lett. 2024;14(1). doi:10.52783/eel.v14i1.1048.
2. Yadav D, Arora P, Kumar NC. Development and quality evaluation of burfi (Indian sweet dish) prepared with incorporation of coconut milk and watermelon seeds. Asian J Microbiol Biotechnol Environ Sci. 2024;26(1):157-162. doi:10.53550/ajmbes.2024.v26i01.026.
3. Hs S, Kg V. Development of burfi with incorporation of kodo millet. Int J Agric Food Sci. 2022;4(1):93-97. doi:10.33545/2664844x.2022.v4.i1b.119.
4. Ortiz Y, García-Amézquita E, Acosta CH, Sepúlveda DR. Functional dairy products. In: [Book details not provided]. New York: Springer; 2017. p.67-103. doi:10.1007/978-1-4939-6496-3_5.
5. Saeed M, Haider M, Khaliq B, Ahmad M, Muzamil M, Murtaza G, *et al*. Exploring the nutritional, functional, and sustainable utilization of date palm (Phoenix dactylifera L.) in food applications: a comprehensive review. Insights J Health Rehabil. 2024;2(2):234-242. doi:10.71000/ijhr129.
6. Mahomoodally MF, Khadaroo SK, Hosenally M, Zengin G, Rebezov M, Ali Shariati M, *et al*. Nutritional, medicinal and functional properties of different parts of the date palm and its fruit (Phoenix dactylifera L.): a systematic review. Crit Rev Food Sci Nutr. 2024;64(22):7748-7803. doi:10.1080/10408398.2023.2191285.
7. Sedighi-Khavidak S, Shekarbeygi N, Delfani M, Haidar Nejad F. Nutritional and medicinal values of dates (Phoenix dactylifera L.) from the perspective of modern medicine and Iranian traditional medicine. Complement Med J. 2022;12(1):44-55. doi:10.32598/cmja.12.1.1101.2.
8. Vijayalakshmi NS, Indiramma AR, Viswanath P, Dattatreya A, Kumar KR. Extension of the shelf-life of burfi by packaging. J Food Qual. 2005;28(2):121-136. doi:10.1111/j.1745-4557.2005.00001.x.
9. Ranathunga NS, Wijayasekara KN, Abeyrathne EDNS. Application of bio-preservation to enhance food safety: a review. Korean J Food Preserv. 2023;30(2):179-189. doi:10.11002/kjfp.2023.30.2.179.
10. Meshram BD, Vyahaware AN, Wasnik PG, Agrawal AK, Sandey KK. Microwave processing of milk: a review. In: [Book details not provided]. Apple Academic; 2017. p.219-251. doi:10.1201/9781315207407-8.
11. Kakar UM, Sarwari A, Rahime M, Hassand MH, Niazi P. Revolutionizing food processing: a comprehensive review of microwave applications. Eur J Theor Appl Sci. 2024;2(2):38-47. doi:10.59324/ejtas.2024.2(2).04.
12. Sabikhi L, Khetra Y, Raju PN. Processing and packaging of dairy-based products. In: [Book details not provided]. Apple Academic; 2018. p.311-375. doi:10.1201/9781315232966-12.
13. Vyawahare AN, Meshram BD, Gawande HM, Kanoje RR. The development of burfi with date paste. Indian J Tradit Knowl. 2022;21(4):851-855.
14. Snedecor GW, Cochran WG. Statistical methods. 8th ed. Ames (IA): Iowa State University Press; 1989.
15. Solanki P, Dabur RS, Masoodi FA. Storage study of microwave treated burfi. Indian Food Packer. 2002;56(6):153-157.
16. Naresh L, Venkateshaiah BV, Arun Kumar H, Venkatesh M. Effect of microwave heat processing on physico-chemical, sensory and shelf life of peda. Indian J Dairy Sci. 2009;62(4):262-266.