

Fermented Foods of India: A Timeless Tradition Supporting a Sustainable Future

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Abstract

One of the ancient methods for the preservation of food is fermentation, which is deeply rooted in traditional culinary practices worldwide. Due to the health benefits, unique flavors, and sustainable food systems, the interest in fermented foods has increased. From ancient times, humans have depended on fermentation as a key method for preserving the nutritional value of perishable food. This traditional practice has evolved into an industrial technology that allows fermentation processes to be conducted under controlled and standardized conditions, ensuring safety and efficiency. This article examines the significance of traditional fermentation techniques in India. It also highlights the scientific basis of fermentation, its effects on gut health, and its potential to reduce food waste. Traditional fermentation can create healthier and more sustainable food products by connecting ancient wisdom with modern food processing innovations.

Introduction:

Despite its historical significance, fermentation has gradually been overshadowed by other food preservation techniques that have gained prominence over the past century. These modern methods primarily use chemical preservatives such as salt, acids, and synthetic additives, as well as temperature-based approaches like pasteurization and sterilization. These advancements have become the dominant strategies in the food industry, offering extended shelf life and improved stability of food products (Laulund et al., 2022).

Fermented foods are subjected to desirable biological and physical changes due to microbial actions or enzymes providing significant modification of the food. Fermented foods are produced through a biochemical transformation involving controlled microbial activity, leading to acidification, maturation, ripening, and flavor development (Jeevaratnam et al., 2005). This process enhances both the sensory qualities and preservation of the food by facilitating the enzymatic breakdown and modification of its components. During fermentation, beneficial microorganisms interact with the raw ingredients, triggering enzymatic reactions that contribute to the

food's unique taste, texture, and aroma. Additionally, fermentation improves the overall stability of the product, extending its shelf life while enriching its nutritional profile. This natural process not only enhances the digestibility and bioavailability of nutrients but also introduces beneficial compounds such as probiotics, vitamins, and bioactive peptides, making fermented foods both flavorful and health-promoting (Shrivastava and Samuel, 2019). The growing global emphasis on sustainable food production and minimizing food waste has renewed interest in innovative preservation techniques. As such fermentation which is an age-old method of food preservation has regained popularity in both industrial-scale manufacturing and traditional artisanal food production. This resurgence reflects the increasing demand for natural and environmentally friendly food processing methods that enhance shelf life while maintaining quality and nutritional integrity (IDF, 2019).

1.2. Fermented foods and its benefits:

Fermented foods are nutrient-rich foods obtained by microbial metabolic reaction which is popularly known as fermentation reaction. Some of the prevalent fermented foods known are 'Dahi'(curd), yogurt, pickles, vinegar, kimchi, miso, apple cider vinegar, kefir, soy sauce, wine, beer, and a probiotic drink known as Yakult, etc. Bread, wine, and beer making is older than 7,000 and 8,000 years. India is traditionally rich in fermented foods as use of local food crops and natural resources is common. Some common fermented foods found in Indian households are idli, dosa, dhokla, and fermented rice., etc. Due to fermentation, these food items have a longer shelf life and also enhanced nutritional value (Sathe and Mandal, 2016). The different types of fermented food are related to a unique group of microbiota which has potential to increase the level of protein, vitamins, fatty acids, and essential amino acids (Gupta, 2016). Traditional Indian fermented foods are usually fermented by Lactic acid bacteria (LAB), such as *Lactococcus* spp., *L. pentosus*, *L. casei*, *Lactobacillus plantarum*, *Leuconostoc mesenteroides*, *L. kimchi*, *L. fallax*, etc which are considered as the probiotic source from the fermented foods (Sathe and Mandal, 2016). Table 1 represents

some of the popular fermented foods of different region of India. The ingredients used and the microorganisms

related to these foods are also presented below (Gupta, 2016; Haokip et al., 2020).

Table 1: List of fermented foods popular in different region of India

Fermented Food	Ingredients (used for fermentation)	Origin	Related Microorganism
Rabdi (rabadi)	Flour of barley, pearl millet, corn or soybean and buttermilk	Rajasthan	<i>Bacillus</i> and <i>Micrococcus</i> sp.
Kulu	Wheat flour, buttermilk	Himachal Pradesh	<i>Lactobacillus</i> sp.
Idli	Rice, urad dal, table salt, fenugreek seeds.	South India	<i>L. mesenteroides</i> , <i>E. faecalis</i> , <i>P. cerevisiae</i>
Dosa	Rice, urad dal, table salt	South India	<i>L. mesenteroides</i> , <i>E. faecalis</i>
Dhokla	Bengal gram dal, rice and leafy vegetables	Gujrat	<i>L. fermentum</i> , <i>L. mesenteroides</i> , <i>E. faecalis</i>
Kanji	Black carrots, beetroot, mustard seeds, water	North India	<i>L. pentosus</i> , <i>L. paraplantarum</i> , <i>L. plantarum</i>
Shrikhand	Fermented and sweetened milk product	Gujarat, Maharashtra	<i>Lactobacillus bulgaricus</i> , <i>Streptococcus lactic</i> , <i>Streptococcus diactylactis</i> , <i>Lactobacillus citrovorum</i> , and <i>Streptococcus thermopiles</i> .
Sinki	Radish roots	Sikkim	<i>L. casei</i> , <i>L. brevis</i> , <i>L. plantarum</i> , <i>L. fallax</i> , <i>L. fermentum</i>
Kinema	Soybeans	Darjeeling, Sikkim	<i>E. faecium</i>
Ngari	Sun-dried, fermented fish (<i>Puntius sophore</i>)	Manipur	<i>Lactococcus plantarum</i> and <i>Lactobacillus plantarum</i> . <i>Bacillus subtilis</i> , <i>B. pumilus</i> and <i>Micrococcus</i> sp
Axone/Bekang/Peruyyan	Soybeans	Nagaland, Mizoram, Arunachal Pradesh	<i>Bacillus subtilis</i> , <i>Bacillus species</i>
Khorisa	Bamboo shoots	Assam	<i>Lactobacillus plantarum</i> , <i>L. pentosus</i> , <i>L. paracasei</i> , <i>L. brevis</i> , and <i>L. collinoides</i>

Fermented foods have lots of health benefits. Fermentation of food helps in the preservation of food which helps in increasing the shelf life of the food products. By consuming fermented foods good bacteria are added to the human gut and it helps to modulate the digestive system. Fermented foods are rich in vitamins and due to the presence of lactic acid bacteria, the food is easily digestible. Fermented foods develop flavour and taste which increases the appetite. These types of food can eliminate anti-nutrients, such as phytic acid (Sathe and Mandal, 2016).

Conclusion

Fermentation of foods is a cost-effective and natural method of preservation that boosts flavor, improves nutritional value, and strengthens the immune system. In India, traditional fermented foods have evolved uniquely across regions, influenced by climate, culture, and agricultural practices. These foods not only contribute to food security and sustainability but also offer significant health benefits. Despite their potential, many traditional fermented foods remain underexplored. Systematic research and

standardization of processes are necessary to preserve their authenticity and ensure consistent quality. Given the remarkable health and economic advantages of fermentation, it is essential to promote its application in the modern food industry. Integrating traditional fermentation techniques into large-scale production can enhance food security, support sustainable food processing, and preserve India's rich culinary heritage for future generations.

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