



Indigenous Fermentation Practices and Rural Food Culture in Kalahandi District, Odisha

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ABSTRACT

Indigenous fermented foods constitute an important component of the traditional food culture and rural livelihood systems of Kalahandi district, Odisha. The present study was undertaken to document the indigenous fermentation practices prevalent among rural and tribal communities of the district and to examine their nutritional, cultural, and socio-economic significance. Field surveys were conducted in selected villages through personal interviews, informal discussions, and direct observations involving local inhabitants, elderly persons, and traditional food preparers. The investigation documented several commonly consumed fermented foods and beverages, including handia, pakhala, mandia pej, tadi, torani, fermented bamboo shoots, chakuli, fermented rice gruel, curd, and mahua-based beverages. Rice, finger millet, bamboo shoots, palm sap, and mahua flowers were identified as the major raw materials used in fermentation practices. The study revealed that fermentation is primarily carried out through household-level traditional methods using natural microbial activity and locally available utensils such as earthen pots and bamboo containers. These fermented foods were found to possess significant nutritional and medicinal value by improving digestibility, enhancing nutrient availability, providing probiotics, and supporting hydration and gut health. Additionally, they



play an important role in festivals, rituals, agricultural activities, and the preservation of indigenous knowledge systems. However, modernization, urbanization, changing food habits, and declining interest among younger generations were observed to threaten the continuity of these traditional practices. The study highlights the urgent need for proper documentation, scientific validation, hygienic standardization, and awareness programs to conserve and promote the indigenous fermented food heritage of Kalahandi as a valuable component of sustainable food systems and cultural identity.

Introduction

Fermentation is an old way of keeping food fresh and making it taste good. People around the world have been using this method for a long time. It helps food taste better and it is easier to digest. Fermentation also makes food more nutritious. This happens because of the work of living things like bacteria, yeasts and fungi. The foods that are fermented in places are made in a way that suits the local weather, the plants and animals that live there, the way people farm and the customs of the people. These foods are a part of what people have learned over time and they show how closely people are connected to the natural world. Fermentation is a part of this connection. Fermentation and the foods that are made using this method are very important to people. Fermentation helps people understand the relationship between society and the natural environment as seen in the work of Owens in 1996 and Rastogi and others in 2022(Owens, 1996; Rastogi et al., 2022).

The Kalahandi district is really famous for its tribal ways and the fact that people who live there depend a lot on nature. Because of this, people in Kalahandi have different ways of making fermented food that are unique to their area. In the areas and tribes of Kalahandi, people make many traditional fermented foods using things that are readily available to them, like rice, millets, pulses, bamboo shoots and other things they find in the forest. People in Kalahandi really like to eat and drink things like handia, which is a traditional beer made from rice and pakhala, which is a fermented rice dish. They also like to eat fermented bamboo shoots. These foods are not something people eat every day but they are also a big part of the farming work, social events, rituals and festivals that people in Kalahandi take part in. The Kalahandi district and its people have a connection to these foods and they help bring people together and keep the old ways of life alive in the Kalahandi district.



Traditional fermented foods reflect generations of indigenous knowledge and skill. They are usually made with common household methods and ingredients. Fermentation improves food quality, boosts digestibility, increases nutrient absorption, and adds helpful bacteria that support immunity and gut health. Studies have found probiotic microorganisms like *Lactobacillus* spp., *Lactococcus* spp., *Pediococcus* spp., and beneficial yeasts in fermented foods. These microorganisms improve nutrient absorption and support digestive health (Ibrahim et al., 2023; Obafemi et al., 2022). Additionally, fermented foods contain bioactive compounds such as flavonoids, phenolic acids, probiotics, and prebiotics, which have antioxidant, antibacterial, antidiabetic, and immune-boosting effects (Varsha et al., 2022; Ashaolu, 2020).

Fermentation is an ages-old food preparation technique with nutritional and functional significance in traditional fermented foods of Asia and Africa. Microbial activity during fermentation is known to enhance the digestibility, flavor and nutritional value of such products as idli, rice beer, miso, natto, tempeh, ogi and kunu (Tamang & Sarkar, 1996; Obafemi et al., 2022). Fermentation additionally boosts organoleptic properties such as aroma, texture and taste, thus enhancing consumer acceptance and dietary diversity (Deveci et al., 2023). Microbial activity in cereal-legume fermented foods has been linked to leavening, flavor development and improved bioavailability of nutrients, while fermented soybean products are believed to have health-promoting and antioxidant properties (Hesseltine, 1983; Ramos et al., 2023).

Notwithstanding their advantages, challenges with food safety and the uniformity of traditional fermenting processes have also been recorded. Unsanitary circumstances, pathogenic microbe contamination, and a lack of traditional processing techniques can all influence the safety of fermented foods (Anyogu et al., 2021; Skowron et al., 2022). However, foodborne illnesses can be substantially minimized and food safety increased by employing beneficial microbial cultures and suitable fermentation procedures.

However, indigenous fermentation knowledge is progressively declining, particularly among younger generations, because of rapid modernization, urbanization, migration, and evolving dietary choices. Native food preparation skills is mostly passed down orally, which leaves it susceptible to deterioration and eventual disappearance. The practice and appreciation of traditional fermented foods have been additionally decreased by the increased preference for processed and westernized foods. The meticulous documentation of indigenous fermentation techniques in Kalahandi is still lacking, regardless of their cultural and nutritional value.



Therefore, the present study aims to document the indigenous fermentation practices of Kalahandi district, examine their role in shaping rural food culture, and highlight their cultural, nutritional, and socio-economic significance. The study also seeks to contribute to the preservation and recognition of traditional food knowledge as an important component of the intangible cultural heritage of Odisha and India as a whole.

Materials and Methods

Study Area

The present investigation was carried out in the Kalahandi district of Odisha, India. The district is predominantly inhabited by rural and tribal communities and is well known for its rich traditional knowledge, cultural diversity, and dependence on agriculture and forest-based resources. The climatic conditions, availability of local raw materials, and traditional lifestyle of the inhabitants favor the preparation and consumption of various indigenous fermented foods and beverages.

Survey and Data Collection

The study was primarily based on field surveys conducted in selected villages of Kalahandi district. Information related to indigenous fermented foods and beverages was collected through direct interaction with local inhabitants, elderly persons, traditional food preparers, and tribal households possessing knowledge of traditional fermentation practices.

Data were collected using personal interviews, informal discussions, and field observations following standard ethnobotanical survey methods (Jain, 1986; Martin, 1995). Information regarding local names of fermented foods, raw materials used, methods of preparation, fermentation duration, utensils employed, storage conditions, and consumption patterns was systematically documented.

Documentation of Indigenous Fermented Foods

Different indigenous fermented foods and beverages commonly consumed in the study area were identified and documented during the survey. Particular emphasis was given to traditional preparation techniques, cultural significance, and household-level practices associated with fermentation. Photographs and field notes were also recorded during the study for proper documentation.



Collection of Secondary Information

Secondary information related to fermentation technology, nutritional importance, microbial aspects, and traditional food culture was gathered from books, scientific journals, research articles, reports, and other relevant published literature.

Data Analysis

The collected data were compiled, classified, and analyzed using descriptive methods. Indigenous fermented foods were categorized based on raw materials, mode of preparation, and cultural utilization. The socio-cultural and nutritional significance of the documented fermented foods was interpreted qualitatively.

Results

Table- Indigenous Fermented Foods of Kalahandi

Sl. No.	Fermented Food Type	Preparation Method	Plant Product Used	Raw Materials	Significance / Benefits
1	Handia (Rice Beer)	Cooked rice is mixed with traditional starter culture (ranu) and fermented in earthen pots for 2–5 days.	Rice (<i>Oryza sativa</i> L.)	Cooked rice, herbal starter culture	Improves digestion, provides energy, culturally important during festivals and ceremonies.
2	Pakhala	Cooked rice is soaked in water and allowed to ferment naturally overnight.	Rice (<i>Oryza sativa</i> L.)	Cooked rice, water, curd (optional)	Cooling effect, prevents dehydration, improves digestion during summer.
3	Mandia Pej	Finger millet gruel is prepared and left overnight for natural fermentation.	Finger millet (<i>Eleusine coracana</i> L.)	Millet flour, water	Rich in calcium and iron, it improves gut health and provides sustained energy.
4	Tadi	Palm sap collected from trees	Date palm / Palmyra palm	Palm sap	Refreshing traditional beverage, provides



		undergoes natural fermentation in containers.	(<i>Phoenix dactylifera</i> L., <i>Borassus flabellifer</i> L.)		hydration and quick energy.
5	Fermented Bamboo Shoot	Bamboo shoots are sliced and stored for natural fermentation.	Bamboo (<i>Bambusa spp.</i>)	Tender bamboo shoots, salt, spices	Improves flavor and shelf life, rich in fiber and antioxidants.
6	Torani	Fermented starchy rice water obtained after soaking cooked rice.	Rice (<i>Oryza sativa</i> L.)	Rice water, salt	Prevents dehydration, economical probiotic drink, aids digestion.
7	Chakuli	Rice and black gram batter is fermented overnight before cooking.	Rice (<i>Oryza sativa</i>), Black gram (<i>Vigna mungo</i> L.)	Rice, black gram, water	Enhances protein digestibility and nutrient availability.
8	Dahi (Curd)	Lukewarm milk is inoculated with starter curd and fermented.	Milk product	Milk, starter curd	Rich in probiotics, calcium, and proteins; improves gut health.
9	Mahua Fermented Beverage	Dried mahua flowers are soaked and naturally fermented.	Mahua (<i>Madhuca longifolia</i> L.)	Mahua flowers, water	Traditional tribal beverage provides energy and cultural value.
10	Fermented Rice Gruel	Rice gruel is naturally fermented before consumption.	Rice (<i>Oryza sativa</i> L.)	Rice starch water	Easily digestible, cooling food is consumed during hot seasons.

The data presented in the table were collected during field visits to selected rural and tribal villages in Kalahandi and other parts of the district. Information regarding indigenous fermented foods and beverages was obtained through direct interaction with local inhabitants, elderly persons, traditional food preparers, and tribal households possessing traditional knowledge of food fermentation practices. During

the survey, observations were made on the types of fermented foods commonly consumed, the methods of preparation, the plant products used, the raw materials involved, and their nutritional and cultural significance. The collected information revealed that rice, finger millet, bamboo shoots, mahua flowers, and palm sap are the major plant resources used in traditional fermentation practices in the region.

The study indicated that fermentation practices are primarily household-based and depend largely on natural microbial fermentation under ambient environmental conditions. Traditional utensils such as earthen pots, bamboo containers, and locally available storage vessels were frequently used during the preparation process. Most respondents reported that fermented foods are consumed not only for their nutritional benefits but also for their medicinal value, cooling effect during summer, digestive properties, and cultural importance during festivals, rituals, and agricultural activities.

The field investigation further demonstrated that indigenous fermented foods constitute an important component of the traditional food system of Western Odisha and contribute significantly to food preservation, dietary diversity, and rural food security. However, modernization and changing food habits among younger generations were observed to threaten the continuity of these traditional fermentation practices.

Fig- Data collection during field visits.





Discussion

The present investigation revealed that indigenous fermented foods constitute an important component of the traditional food system of Kalahandi. Rural and tribal communities of Kalahandi district were found to possess rich traditional knowledge regarding the preparation, preservation, and consumption of fermented foods and beverages. Rice-based fermented products such as handia, pakhala, torani, and fermented rice gruel were commonly consumed across households, while millet-based foods such as mandia pej and naturally fermented beverages like tadi and mahua liquor also formed integral parts of local dietary practices.

The preparation methods documented during field visits demonstrated strong similarities with indigenous fermentation systems reported from other parts of India and Asia. Traditional fermentation practices observed in the present study primarily depended on spontaneous microbial activity and household-level preparation techniques using earthen pots, bamboo containers, and locally available utensils. Similar observations were reported by Hesseltine (1983), who described oriental fermented foods as products developed through natural microbial fermentation under traditional environmental conditions. Tamang (2009) also emphasized that indigenous fermented foods of Himalayan regions are strongly associated with ethnic traditions, local biodiversity, and household-based fermentation knowledge.

Handia, the most widely consumed traditional beverage documented during the study, showed similarities with rice beer fermentation practices reported from Northeast India and Southeast Asian tribal communities. The use of traditional starter cultures for fermentation supports the growth of beneficial microorganisms responsible for alcohol production, flavor development, and preservation. Swain et al. (2014) reported that cereal-based fermented foods and beverages across Asia are nutritionally important due to the activity of lactic acid bacteria and yeasts, which improve digestibility and nutrient availability.

Mandia pej prepared from finger millet was observed to serve as an affordable and nutritious food among economically weaker rural communities. Finger millet-based fermented products are known to contain high levels of calcium, iron, dietary fiber, and essential amino acids. Ray and Joshi (2014) reported that fermentation improves the nutritional quality of cereals and millets by reducing anti-nutritional factors and enhancing mineral bioavailability. Similar nutritional benefits may explain the widespread use of fermented millet products among tribal populations of Kalahandi.

Pakhala and torani were widely consumed during summer seasons due to their cooling effect and ability to prevent dehydration during agricultural labor. Local respondents reported that these fermented rice



products improve digestion and reduce body heat. Similar observations have been reported by Marco et al. (2016), who stated that fermented foods contribute beneficial microorganisms, organic acids, and bioactive compounds that support gut microbiota and digestive health. Fermentation also improves food palatability, shelf life, and microbial stability.

The present study further demonstrated that fermented bamboo shoots and palm sap beverages such as tadi hold both nutritional and cultural importance among tribal communities. Fermented bamboo shoots were valued for their flavor, storage potential, and medicinal uses. Montet and Ray (Montet & Ray, 2015) reported that fermented bamboo products are rich in antioxidants, probiotics, and antimicrobial compounds that contribute to food preservation and human health. Likewise, naturally fermented palm beverages are traditionally consumed in many tropical regions as refreshing and energy-providing drinks.

Women were found to play a significant role in the preparation and preservation of indigenous fermented foods. Traditional fermentation knowledge was primarily transmitted orally from older generations to younger family members. However, respondents indicated that modernization, urbanization, migration, and changing dietary preferences are gradually reducing the practice of traditional fermentation among younger generations. Similar concerns regarding the erosion of indigenous food knowledge and ethnic food traditions were highlighted by Tamang (2009) and Ray and Joshi (2014).

Although indigenous fermented foods possess considerable nutritional and socio-cultural value, the study also identified concerns regarding hygienic preparation and food safety. Traditional fermentation systems generally lack standardization and scientific quality control. Previous studies have reported that poor sanitation and improper storage conditions may increase the risk of microbial contamination in fermented foods if hygienic practices are not maintained (Skowron et al., 2022). Therefore, scientific validation, microbial characterization, and hygienic standardization of indigenous fermented foods are necessary to improve safety while preserving traditional authenticity.

Overall, the present study demonstrates that indigenous fermented foods of Kalahandi represent valuable traditional knowledge systems that contribute significantly to household nutrition, food preservation, cultural identity, and rural sustainability. Proper documentation, scientific research, and awareness programs are therefore essential for conserving these traditional food practices and promoting their recognition as important components of indigenous food heritage.



Conclusion

The present study highlights the rich diversity of indigenous fermented foods and beverages traditionally practiced by rural and tribal communities of Kalahandi. The investigation revealed that products such as handia, pakhala, mandia pej, tadi, torani, fermented bamboo shoots, chakuli, and mahua-based beverages constitute important components of the local food system and cultural heritage. The study demonstrated that these fermented foods are prepared mainly through household-level traditional methods using locally available plant resources and natural microbial fermentation. Indigenous fermentation practices were found to possess significant nutritional, medicinal, economic, and socio-cultural importance. Fermented foods improve digestibility, enhance nutrient availability, support gut health, and provide sustainable low-cost dietary resources for rural populations. In addition, these foods and beverages are closely associated with festivals, rituals, agricultural activities, and social interactions, thereby strengthening community identity and traditional knowledge systems. Comparative analysis with previous studies indicated that the fermentation practices observed in Kalahandi share similarities with indigenous food traditions reported from other tribal and rural regions of India and Asia. The findings also emphasize the important role of women in preserving and transmitting traditional fermentation knowledge across generations.

However, the study identified several challenges threatening the continuity of indigenous fermentation practices, including modernization, urbanization, changing dietary preferences, migration, and reduced interest among younger generations. Lack of scientific documentation and hygienic standardization may further contribute to the gradual erosion of these traditional food systems. Therefore, proper documentation, scientific validation, microbial characterization, and awareness programs are urgently needed for the conservation and promotion of indigenous fermented foods of Kalahandi. Preservation of these traditional practices will not only safeguard valuable cultural heritage but also contribute to nutritional security, sustainable food systems, and rural livelihood development.

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