Sustaining Odisha's legacy: Traditional rice cakes as cultural treasures

Taranisen Panda, Nilamani Dikshit, Nirlipta Mishra, Shaik Rahimuddin, Bikram K. Pradhan, and Raj B. Mohanty

Correspondence

Taranisen Panda[1*], Nilamani Dikshit[2], Nirlipta Mishra[3], Shaik Rahimuddin[3], Bikram K. Pradhan[1], and Raj B. Mohanty[4]

[1]Department of Botany, Chandbali College, Chandbali, Bhadrak 756133, Odisha, India.
[2]ICAR- Indian Grassland and Fodder Research Institute, Gwalior Road, Jhansi-284003, Uttar Pradesh, India.
[3]Department of Zoology, Chandbali College, Chandbali, Bhadrak 756133, Odisha, India.
[4]Ex-Reader in Botany, Plot No. 1311/7628, Satya Bihar, Rasulgarh, Bhubaneswar,751010, Odisha, India.

*Corresponding Author: taranisenpanda@yahoo.co.in

Ethnobotany Research and Applications 28:1 (2024) - http://dx.doi.org/10.32859/era.28.1.1-18
Manuscript received: 17/07/23 - Revised manuscript received: 24/12/2023 - Published: 01/01/2024

Notes on Ethnobotany

Abstract

Background: Food in India reflects the complex interplay of caste, class, and spirituality, creating a cultural tapestry that mirrors societal intricacies. This paper focuses on the indigenous knowledge held by women in Odisha's coastal regions, shedding light on the cultural richness surrounding rice cakes and emphasizing the need to preserve these culinary traditions in the face of modernization.

Methods: To catalog rice cake varieties, we conducted a survey in the coastal districts of Odisha, India, covering three seasons. Data from one hundred and thirty-three female informants were gathered through semi-structured interviews, key informant discussions, and direct observations.

Results: The study documented ten types of rice cakes, ranging from Arisa to Tala Pitha. These rice cakes highlighted a culinary fusion, blending rice with diverse plant and animal-based ingredients, including chenna, coconut (*Cocos nucifera*), groundnut (*Arachis hypogea*), ada (*Zingiber officinale*), among others. Notably, these rice cakes held profound socio-cultural significance—Manda for Kumar Purnima, Poda for Ratha Jatra, and Arisa for marriage ceremonies. All the documented Pithas' were exclusively crafted at the household level, showcasing the expertise and culinary skills of the women in the coastal districts of Odisha.

Conclusion: These traditional culinary delights, steeped in tradition, symbolize auspicious occasions, preserving the region's culinary heritage. Passed down through generations, the art of crafting these rice cakes strengthens intergenerational bonds and safeguards cultural traditions. Initiatives like "Food Festivals" play a crucial role in revitalizing indigenous cuisine, fostering awareness, and inspiring the youth to actively contribute to the preservation of their cultural identity.

Keywords: Coastal Odisha, Indigenous knowledge, Ethnic food, Natural resources, Rice cake

Background

The interest in traditional ethnic foods has always existed, as these foods are not only the basis of nutrition but also express the diverse cultures, histories, and lifestyles of different societies. Despite rapid globalization, food habits remain diverse in different countries, influenced by ethos, cultural beliefs, and community norms. Moreover, food choices, including ethical food choices, are always made in a social context (Sathyanarayanan & Chandra 2013). Studying traditional foods can provide significant insight into dietary patterns and how they have been shaped through time. With the current public interest in nutrition and healthy eating, there has been an increased demand for traditional foods. This interest in traditional foods can also promote the preservation and continuation of cultural practices and customs related to food.

Rice is one of the most important food crops in the world, with Asian rice being the second most consumed crop by humans. It is a vital commodity that supports nearly a billion households across 115 countries in Asia, Africa, and America, providing a source of livelihood for millions of people (Sharif et al. 2013). Rice is a versatile ingredient that plays a significant role in various cuisines, including breakfast cereals, staple carbohydrates, snacks, alcoholic beverages, and desserts (Ghosh et al. 2014; Ray et al. 2016; Nath et al. 2019; Bhatt et al. 2022; Parthasarathi et al. 2022). As a staple food, rice is crucial in the fight against world hunger and poverty. Its significance extends beyond food security and nutrition, as it has also influenced millions of people's cultures, diets, and economies (Gnanamanickam 2009; Spengler 2021). The rice grain that is widely consumed is the endosperm of a grass species called *Oryza sativa* L., which belongs to the Poaceae family. Of the 27 species of the *Oryza* genus, only two are cultivated, with *Oryza sativa* L. (Asian rice) being the most widespread and *Oryza glaberrina* Steud. (African rice) being exclusive to Africa (Fukagawa & Ziska 2019; Shuaib 2020). India has a diverse range of agroecosystems where rice is cultivated, from below-sea-level farming in Kuttanad to high-altitude farming in the Himalayas (Swaminathan & Kesavan 2012). This has resulted in a rich genetic diversity of rice varieties with valuable properties such as flood, drought, salinity or pest resistance, and enriched with vital nutrients (Deb 2019). However, during the Green Revolution, emphasis was given to high-yielding varieties resulting in the loss of many indigenous rice landraces (Kesavan & Swaminathan 2018). Half a century ago, India was home to more than 100,000 folk rice varieties (Richharia & Govindasamy 1990). Currently, only around 6,000 rice landraces exist in India (Deb 2019), and many of them contain high levels of vit-B complex, metal micronutrients, antioxidants, phenols, and flavonoids not found in modern high-yielding varieties (Ray et al. 2021). Traditional rice varieties can play a vital role in alleviating malnutrition and achieving nutritional security (Rasheed et al. 2021). Additionally, with the increasing threat of climate change, traditional rice varieties have become a valuable gene pool for traits that can help modern rice varieties adapt to changing climatic conditions (Rekha et al. 2011). India's abundance of rice varieties has always found a special mention in the records of ancient times where rice is documented as a medicinal plant capable of curing various disorders and vital for the sustenance of life (Ahuja et al. 2008; Rathna Priya et al. 2019). In addition to staple food, rice has extensive protective and curative properties against human ailments like epilepsy, chronic headache, rheumatism, paralysis, skin diseases, diabetes, arthritis, indigestion, blood pressure, colon cancer, internal rejuvenation of tissues, overcoming postnatal weaknesses and also boost milk secretion in lactating mothers (Chen et al. 2016; Rathna Priya et al. 2019; Ashokkumar et al. 2020).

Rice has a long history of cultivation in South and Southeast Asia, dating back to 10,000 years ago (Gnanamanickam 2009). It is believed to have originated in India, as references to rice can be found in the Vedic scriptures, which are some of the most well-known texts in Indian literature (Sarkar et al. 2015). While barley was initially the primary food of the Aryans, they later included rice in their diet (Dutt 1906). The domestication of rice in India has been attributed to the Indus Valley Civilization between 3000-1500 BC (Possehl 2002). However, evidence of rice cultivation in India has been pushed back to 5000 BC, with the discovery of rice grains and early pottery found in the Lahuradewa site in Uttar Pradesh, situated in the middle Ganges plains dating to c. 6400 BC (Pokharia et al. 2017). A molecular-based evolutionary study, on the other hand, suggests that rice was domesticated in the Yangtze Valley of China around 8200-13500 years ago (Jeanmaire et al. 2011).

India has a rich history and diverse culture, with each region having its unique food traditions and customs. Odisha, located on the eastern coast of the Indian peninsula, is home to ancient temples and land where rice cultivation flourishes due to favorable agro-climatic conditions. The importance of rice in the sociocultural life of Odishan people is evident in the traditional foods processed and prepared from rice by women, which are intimately connected to their social rites, rituals, festivals, and medications (Hedge et al. 2013). Rural women in Odisha have honed their skills in making countless varieties of rice-based products, with rice powder being a staple ingredient in the production of many types of traditional and ethnic foods, including numerous kinds of cakes. Rice cakes are popular in many different cultures (Ji et al. 2007), where rice is a dietary staple, particularly in Asia. In India, rice cakes are well-known, especially in Odisha, where rice is a significant economic staple food and forms the foundation of many meals and dishes. Rice cakes have become increasingly popular as festival treats and local specialties. While various rice-legume-based cakes, such as Idli, Dosa, and Dhokla, have been

reported from different parts of India (Rani et al. 2019; Basaiawmoit et al. 2021), there has been a lack of documentation on the ethnic rice-based cakes of Odisha, especially those from coastal districts. Therefore, this study seeks to investigate the ethnobotanical significance of various rice cake varieties, their processing techniques, shelf life, and the sociocultural importance within the coastal districts of Odisha, India.

Materials and Methods

Study area

Odisha formerly called Orissa is situated on the eastern coast of India between the parallels of 17°49'N and 22°34'N latitudes and meridians of 81°27'E and 87°29'E longitudes (Figure 1). Bordered on the north by Jharkhand, on the west by Chhattisgarh, on the south by Andhra Pradesh, on the north-east by West Bengal and on the south-east by the Bay of Bengal with a coastline of 482km, the state covers an area of 155,707km^2. It contributes 4.87% of the country's land area. The state has a total population of 4.2 crores (2011census) those who live in 51349 villages and 138 urban centers. Moreover; there are 62 types of scheduled tribe (22.85%) and 93 types of scheduled caste (17.13%) communities, those who mostly live in hilly and rural areas of the state earning their livelihood from their age-old traditional practices. Being situated in close proximity to the Bay of Bengal, the coastal districts are experiencing periodic earth tremors, thunderstorms during monsoon, and dust storms in April and May.

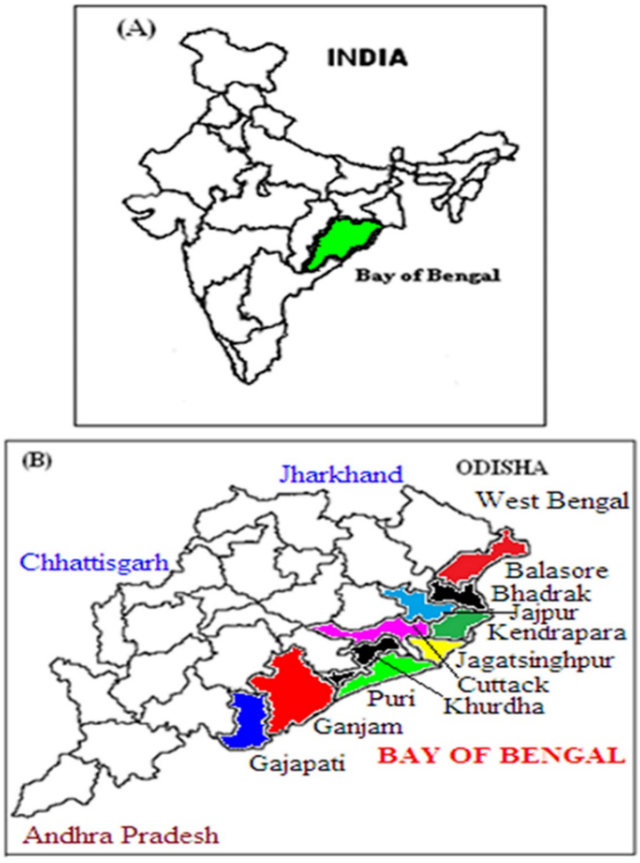

Figure 1. (A) Location of Odisha state in the eastern region of India (B) Study area showing different coastal districts

Data Analysis

An extensive field survey was conducted from April 2020 to March 2022. Ten coastal districts of the state mainly Balasore, Bhadrak, Jajpur, Kendrapara Jagatsinghpur, Cuttack, Puri, Khurdha, Ganjam, and Gajapati (Figure 1) were selected for the present study. Before the field study- aims, methods, and anticipated benefits of the study were adequately explained to the informants in the local language, i.e. (Odia), due consent and cooperation were taken for the documentation of the ethnic food used by them. Generally, rice cakes were prepared by women in most traditional families, and the family is an institution with some norms and values attached to it. The women of rural Odisha were mostly shy in nature and generally feared and felt ashamed to talk with unknown persons. To overcome this problem, we discussed it with the heads of the village, asked about their opinions and made decisions together on where to go and what to do. Information was gathered

from informants of various ages in different villages by using participant observation, open-ended conversations and semi-structured questionnaires (Martin 1995). One hundred and thirty-three female informants were interviewed. The key informants in the study were elderly traditional rice cake makers, and the selection process was based on their experience and current practices in preparing various rice cakes. The interviews were carried out individually as well as in groups with members of the local population in the local language for each of the villages visited. Information on methods of processing various traditional rice cakes, ingredients used, and their relation with the rituals were collected and recorded from the informants. Personal interviews and group discussions with local inhabitants revealed some valuable and specific information about the rice cakes, which were further compared and authenticated by crosschecking (Cunningham 2001). Interviews with people were also conducted on a systematic basis to know more details about rice cakes, and their sociocultural acceptability.

Results

The coastal districts of Odisha were known for their unique and diverse varieties of rice cakes (Pitha), which were typically prepared for special occasions such as Durga Puja, Laxmi Puja, Raja festival, and marriage ceremonies. These rice cakes were made using rice flour and black gram, which give them a crispy texture and delicious taste. The different ingredients, plant species, methodology and shelf life of the various types of rice cakes found in coastal districts of Odisha are represented in Table 1 and Figure 2. Nineteen species from 11 families and 18 genera were identified for making various rice cakes (Table 2). Seeds were the most commonly used plant part. Ten types of the most popular rice cakes in this region are discussed hereunder.

Table 1. Ingredients, plant species and methodology used for the preparation of rice cakes (Pitha) along with the shelf life in coastal districts of Odisha

Name of cakes	**Ingredients**	**Plant Species used**	**Methodology**	**Shelf life**
Manda Pitha	Salt, sugar/jaggery, chenna (cheese, made from cow milk by adding lemon juice),	*Anacardium occidentale* L., *Arachis hypogaea* L., *Cocos nucifera* L., *Elettaria cardamomum* (L.) Maton), *Oryza sativa* L., *Piper nigrum* L. and *Zingiber officinale* Rosc.	Rice powder is mixed with boiling water to form a dough, which is then shaped into balls, stuffed with a filling prepared separately, and cooked through steam in a heated earthen oven.	2-3 days
Poda Pitha	Salt, sugar/jaggery	*Anacardium occidentale* L., *Cocos nucifera* L., *Cinnamomum tamala* Buch.-Ham.T.Nees & C.H.Eberm),*Cinnamomum zeylanicum* Bl., *Elettaria cardamomum* (L.) Maton), *Musa × paradisiaca* L., *Oryza sativa* L., *Piper nigrum* L., *Trachyspermum ammi* (L.) Sprague ex Turrill), *Vigna mungo* (L.) Hepper, and *Zingiber officinale* Rosc.	Preparation involves soaking sun-dried rice and black gram overnight, creating a thick batter, adding diverse ingredients, and wrapping it in banana leaves. Slow-cooked on a traditional chuli with hot charcoal for 3-5 hours, the Pitha obtains a unique texture, featuring a slightly burnt exterior and a soft, white interior.	Up to 7 days
Enduri Pitha	Salt, sugar/jaggery, chenna	*Anacardium occidentale* L., *Cocos nucifera* L., *Curcuma longa* L., *Elettaria cardamomum* (L.) Maton, *Oryza sativa* L. *Vigna mungo* (L.) Hepper and *Zingiber officinale* Rosc.	Preparation involves pounding sun-dried rice, creating a black gram paste, fermenting the batter, and stuffing it with diverse ingredients. This delicacy, sandwiched between turmeric leaves, is then steamed in an earthen oven, acquiring a distinctive flavor from the aromatic turmeric leaves.	2 days
Munha Pitha	Salt, sugar/jaggery	*Anacardium occidentale* L., *Cocos nucifera* L., *Arachis hypogaea* L., *Syzygium aromaticum* (L.) Merr. &	The preparation involves mixing rice powder and black gram paste, creating a stuffing with specified ingredients. Steam-cooked in a	2 days

		L.M.Perry), *Prunus avium* (L.) L., *Oryza sativa* L. and *Vigna mungo* (L.) Hepper.	handi filled with water, the Pitha achieved a spongy texture. Checking for doneness involved inserting a sharp object through the center, with no adherence indicating thorough cooking.	
Gaintha Pitha	Salt	*Oryza sativa* L.	Distinctive for its simplicity, this Pitha consisted solely of rice flour, cooked in boiled water to form a stiff dough, rolled into shapes, and boiled until fully cooked.	2-3 days
Chitou Pitha	Salt	*Cocos nucifera* L. and *Oryza sativa* L.	Chitau is made by mixing rice flour with sugar or jaggery, salt, and grated coconut, forming a batter that is spread on a tawa. Covered with a wet cloth and cooked on low heat,	1 day
Chakuli Pitha	Salt	*Allium cepa* L., *Cocos nucifera* L*., Daucus carota* L., *Coriandrum sativum* L.., *Oryza sativa* L., *Piper nigrum* L., *Vigna mungo* (L.) Hepper and *Zingiber officinale* L.,	This traditional rice cake is crafted using rice and black gram. The batter undergoes a natural fermentation process, yielding a delightful round-shaped flat cake when fried. Enriched with ginger, onion, carrot, coriander leaf, and black pepper, this cake is flavorful.	1 day
Arisa Pitha/ Ghee Pitha	Sugar/jaggery and oil/ghee.	*Oryza sativa* L. and *Musa × paradisiaca* L.	Soaked rice ground into flour, mixed with jaggery, shaped into balls, flattened into semi-circular forms, and fried until golden-brown in ghee or oil.	30 days
Tala Pitha	Salt, sugar, oil/ghee	*Borassus flabellifer* L. and *Cocos nucifera* L.	Extracted palm fruit juice is combined with rice flour, sugar, and other ingredients. The process involves forming small balls, frying them into medium-sized round shapes called tala bara, or crafting a stiff dough wrapped in banana leaves and roasted for a delectable palm-infused treat.	3-4 days
Idli	Salt	*Oryza sativa* L. and *Vigna mungo* (L.) Hepper	Preparation involves the melding of rice and black gram in a 2:1 ratio, soaked, ground, fermented overnight, and steamed into savory spongy cake.	1 day

Figure 2. a. Sun-dried rice (*Oryza sativa* L.), b. *Vigna mungo* (L.) Hepper, c. Jaggery, d. Grated coconut (*Cocos nucifera* L.), e. Chenna (cheese, made from cow milk by adding lemon juice), f. Ada (*Zingiber officinale* Rosc.), g. Cashew nuts (*Anacardium occidentale* L.), h. Badam (*Arachis hypogaea* L.), i. Black pepper (*Piper nigrum* L.), j. Gujurati (*Elettaria cardamomum* (L.) Maton), k. Madhurkathi (*Cinnamomum zeylanicum* Bl. Bijdr.), l. Tejpatra (*Cinnamomum tamala* Buch. -Ham.T.Nees & C.H.Eberm)

Table 2. List of plant species used for the preparation of rice cakes along with family name, local name, and parts used

Plant species with family	**Local/English name**	**Parts used**
Allium cepa L. (Amaryllidaceae)	Piaja/ Onion	Bulb
Anacardium occidentale L. (Anacardiaceae)	Saitamba/Cashew nuts	Seed
Arachis hypogaea L. (Fabaceae)	Badam/Ground nut	Seed
Borassus flabellifer L. (Arecaceae)	Tala/ Palmyra palm	Fruit
Cinnamomum tamala (Buch. -Ham.) T. Nees & C.H.Eberm. (Lauraceae)	Tejpatra/ Indian bay leaf	Leaf
C. zeylanicum Bl. (Lauraceae)	Madhurkathi/ Ceylon cinnamon	Stem bark
Cocos nucifera L. (Arecaceae)	Nadia/Coconut	Fruit
Coriandrum sativum L. (Apiaceae)	Dhania/ Coriander	Leaf
Curcuma longa L. (Zingiberaceae)	Haldi/Turmeric	Leaf
Daucus carota L. (Apiaceae)	Gajar/ Carrot	Root
Elettaria cardamomum (L.) Maton) (Zingiberaceae)	Gujurati/ Green cardamom	Seed
Musa × paradisiaca L. (Musaceae)	Kadali/Banana	Leaf
Oryza sativa L. (Poaceae)	Dhana/Rice	Seed

Piper nigrum L. (Piperaceae)	Golmaricha/Black pepper	Seed
Prunus avium (L.) L. (Rosaceae)	Cherry/ Sweet cherry	Fruit
Syzygium aromaticum (L.) Merr. & L.M. Perry (Myrtaceae)	Labang/Clove	Flower
Trachyspermum ammi (L.) Sprague ex Turrill (Apiaceae)	Juani/ Ajwain	Seed
Vigna mungo (L.) Hepper (Fabaceae)	Biri/Black gram	Seed
Zingiber officinale Rosc. (Zingiberaceae)	Ada/ Ginger	Rhizome

Manda Pitha (Sweet stuffed steamed cake)

Manda Pitha was a traditional rice cake prepared during post-monsoon rituals such as Kumar Purnima and Manabasa Gurubara. To make this dish, rice grains were washed, soaked, dewatered, and sun-dried. The dried rice was pounded and sieved to obtain a fine powder. A thick dough was prepared by boiling water and adding the rice powder with continuous stirring, which was left at room temperature. Various ingredients, as listed in Table 1, were prepared in a frying pan to create the stuffing. The dough was rolled into balls with the help of palms, then flattened and stuffed with the filling. The flattened balls were closed with a round shape by hand. A handi, filled with water, was heated in an earthen oven called a chuli with firewood, and the balls were poured into the boiling water. The balls were cooked with the help of continuously generated steam (Figure 3). Manda Pitha has a shelf life of around 2-3 days.

Figure 3. a. Pounded sun-dried rice b. Preparation of dough by adding fine powder of rice to the boiling water with continuous stirring c. Preparation of stuff in a frying pan with various ingredients d. Preparation of flattened balls with the help of palms e. Stuff poured into a flattened ball f. Flattened balls closed g. Round-shape by hand h. Round-shaped balls poured into a handi with water heated in the earthen oven with firewood i. Manda Pitha (steam-cooked balls)

Podo Pitha (Baking cake)

Podo Pitha was a traditional rice cake prepared during the Bijaya Dasami, Raja festivals and Ratha Jatra. To make this dish, sun-dried rice and black gram were soaked overnight and ground separately. A thick dough was prepared by boiling water and adding rice powder, with continuous stirring. Various ingredients (Table 1) were added to the batter, which was then mixed and wrapped in banana leaves. The wrapped batter was cooked with hot charcoal in a traditional stove or fireplace

called a chuli on low to medium heat for 3-5 hours. This slow-cooking method gives the Pitha a slightly burnt exterior with a soft, white interior (Figure 4). Podo Pitha had a shelf life of around 3-4 days.

Figure 4. a. Preparation of dough by adding fine powder of rice and ingredients to the boiling water with continuous stirring b. Transfer of batter to the banana leaves c Pouring of batter d. wrapping banana leaves all around and roasting in low/medium heat in a chuli e. Burnt exterior part f. Poda Pitha

Enduri, or Haladi Patra (Cakes made with turmeric leaves)

Enduri or Haladi Patra Pitha was a traditional steamed rice cake. It was made by pounding sun-dried rice into a fine powder and making a paste from soaked black gram. The batter was fermented and then stuffed with various ingredients (Table 1) before being sandwiched between two turmeric leaves. The Pitha was then steamed using a handi filled with water in an earthen oven. The unique aroma of the turmeric leaves gives Enduri its distinct flavor (Figure 5). It was typically prepared during the Prathamastami Puja celebration in November and had a shelf life of 2-3 days.

Muaan pitha (Steam rice cakes)

The process of making "Muaan Pitha" involved mixing rice powder and black gram paste in a ratio of 3:1, and preparing a stuffing using the ingredients listed in Table 1. A handi (a large-mouthed pitcher) was filled with water and a piece of cloth was tied over its mouth, creating a shallow cavity. Once the water began to boil, a thick batter made with the stuffing was poured over the cloth, and the Pitha was cooked with the help of continuously generated steam. To check the completion of cooking, a sharp object was inserted through the center of the batter mass to check the completion of cooking. If there was no adherence of batter to the object, this indicated that the Pitha were fully cooked, even at the center. The resulting rice cake was spongy and was served by cutting it into pieces. The shelf life of Muaan Pitha was only 1-2 days, and it was traditionally prepared during the Raja festival (Figure 6).

Gaintha Pitha (Steam cake without the addition of any stuff)

Gaintha Pitha (Figure 7) was traditionally prepared on Thursdays during the Oriya month of 'Margasira,' which was celebrated as Manabasa Gurubara, a day of worship for the Goddess Laxmi. Unlike other types of Pitha, Gaintha Pitha was made solely from rice flour without any added fillings. To prepare the Pitha, rice flour was poured into boiled water and cooked until it formed a stiff dough. After cooling, small lumps of the dough were rolled into elongated or rounded shapes and then boiled in water for 30 minutes until fully cooked.

Chitau Pitha (Steamed pancakes)

Chitau was traditionally prepared by mixing rice flour (without black gram) with sugar or jaggery, salt, and grated coconut (*Cocos nucifera* L.) to form a batter. The batter was spread onto a tawa, a type of flattened frying pan made of iron or aluminum and covered with a lid. The junction was closed with a wet cloth and water was sprinkled intermittently (Figure 8). The batter was fried on low heat until cooked to perfection. Despite having a shelf-life of only one day, Chitau was delicious when taken fresh and hot. It was prepared during Chitau Amabasya or Chitalagi Amabasya in the month of Shravan (July-August) in the Odisha calendar.

Figure 5 a. Pounded sun-dried rice, b. Preparation of stuff using different ingredients, c. Batter prepared from rice flour and black gram, d. Flattened batter in the turmeric leaf (*Curcuma longa* L.), e. Addition of stuff, f and g. Folding of turmeric leaf lengthwise in such a way that the stuffing gets sandwiched between two layers of batter, h. Pouring folded turmeric leaf (batter with stuff) into a wide-mouthed pot filled with water placed in an earthen oven (locally called chuli) with help of wood, i. Enduri Pitha

Chakuli Pitha (Round fermented pancake)

Chakuli Pitha was a traditional fried pancake made from rice and black gram that had been washed, soaked overnight, and dewatered. The dried rice was pounded in iron or wooden mortar and sieved to obtain a fine powder. The seed coat of the black gram was removed by applying gentle pressure and the black gram was ground into a smooth paste using a stone grinder. The paste was mixed with rice powder, lukewarm water, and salt, and beaten repeatedly by hand. The batter was left to ferment naturally under cover for 4-5 hours during the summer, and for 12-15 hours during the winter. The fermented batter was fried over a hot pan into a round-shaped flat cake. Some people also added spices, such as ginger (*Zingiber officinale* L.), onion (*Allium cepa* L.), carrot (*Daucus carota* L.), coriander leaf (*Coriandrum sativum* L.), and black pepper (*Piper nigrum*) powder at the time of frying. Chakuli Pitha had a shelf-life of one day and was typically made for all occasions. Chakuli Pitha is a popular staple food in the coastal districts and is consumed in day-to-day life by its people (Figure 9).

Arisa Pitha (Fried sweet pancake)

The rice was soaked in water overnight. The dewatered rice was allowed to dry under shade and ground into fine flour with the help of an iron mortar and pestle. Jaggery was boiled in hot water and then rice flour was slowly added to it till it was converted to a stiff dough. Small balls of dough were prepared and flattened into semi-circular shapes using ghee or oil to prevent sticking. The semi-circular dough pieces were fried in ghee or oil until they turned a golden-brown color. The resulting Arisa Pitha had a shelf-life of approximately one month and was widely enjoyed at special occasions, such as marriage and thread ceremonies (Figure 10).

Figure 6. a. Ingredients, b. Batter (pounded rice and black gram along with ingredients), c. A wide-mouthed handi filled with water placed in an earthen oven (locally called chuli) with help of wood, d. A net tied tightly around its mouth, e. A muslin cloth placed above the net and ingredient mixed batter poured into the cloth, f. Wrapping of cloth all around, g. Checking the completion of cooking by inserting a sharp object through the center of the batter mass, h. Muan Pitha showing the upper surface i. Muan Pitha after cutting into pieces

Figure 7. Preparation of Gaintha Pitha (method of preparation is same as Manda Pitha except addition of stuffings)

Tala Pitha (Sugar Palm cake)

Ripe palm fruit was used to create sweet delicacies like 'Pitha', porridge (bara), and chakuli. To make Pitha, the juice of the palm fruit was extracted and mixed with rice flour, along with other ingredients listed in Table 1. The top portion of the palm fruit was peeled off, and the kernels were separated and squeezed with water to extract the juice, which was collected in a bowl. The freshly extracted juice was boiled for 10-15 minutes and then cooled before use to reduce bitterness. In a separate bowl, rice flour and sugar were mixed well, palm juice was added and small balls were prepared using hands. In a deep-frying pan, the oil was heated, and the balls were slowly dropped into the oil. The balls swelled up in the oil and were fried until they turned deep brown, resulting in a medium-sized round shape called tala bara. The palm juice, rice flour, and other ingredients were mixed, and a stiff dough was formed. The dough was wrapped in banana leaves and roasted in an earthen oven (locally called Chakuli) using wood or charcoal. Finally, the Pitha was cut into pieces and served (Figure 11).

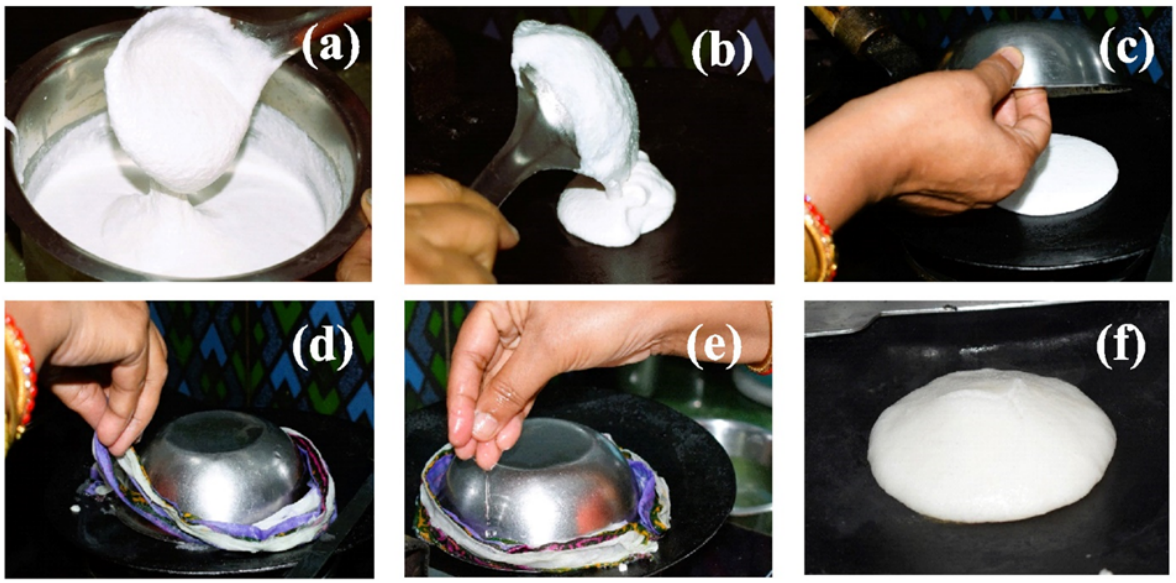

Figure 8. a. Batter prepared by mixing pounded sun-dried rice with sugar, salt and grated coconut (*Cocus nucifera* L.), b. Pouring of batter over tawa (a flattened frying pan made up of iron), c. covering of batter with another pitcher, d. Closing of junction with a wet cloth, e. Sprinkling of water intermittently, f. Chitou Pitha

Figure 9. a. Naturally fermented batter, b. Pouring of batter over a tawa placed in an earthen oven (locally called chuli) with help of wood and dry leaves, c. Spreading fermented batter over a pan, d and e. Showing upper and lower surfaces, f. Chakuli Pitha

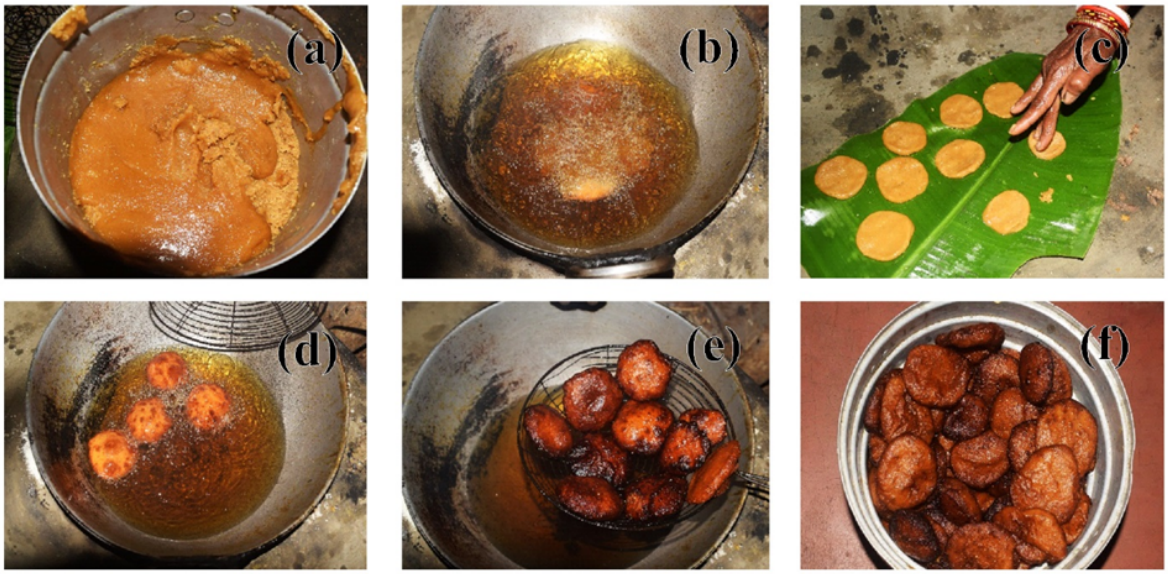

Figure 10. a. Thick dough prepared from rice flour and jaggery b. Kadei (a pan made up of iron or aluminum) placed in an earthen oven (locally called chuli) with help of wood, c. Small-sized ball of dough made into semi-flat round shapes with the use of ghee/oil in banana leaf, d. The semi-flat round-shaped dough fried in ghee, e. Color changes to a golden brown, f. Arisa pitha.

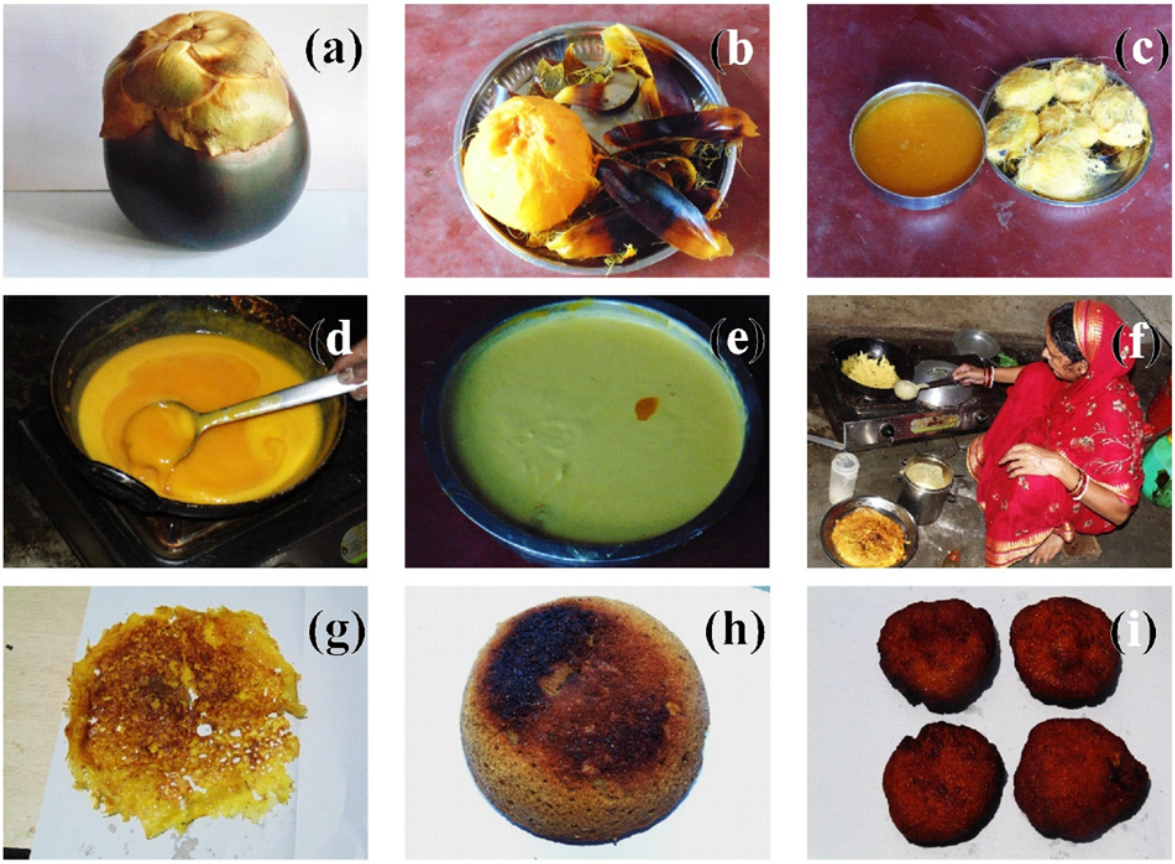

Figure 11. a. Ripe palm fruit, b. Top portion of palm fruit peeled off and opened the ripen fibrous layer, c. Kernels separated and squeezed, juice collected in a bowl, d. Boiling of juice, e. Rice flour added, stirred and mixed well, f-i. Preparation of various items (Chakuli, Pitha, and Porridge)

Idli (Savoury spongy rice cake)

Idli, a well-known traditional rice and pulse-based cake in coastal districts, was typically made from about two parts of rice (*Oryza sativa* L.) and one part of decorticated black gram (*Vigna mungo* (L.) Hepper). The process involved soaking, washing,

and polishing the rice and black gram in drinking water overnight. Subsequently, the rice and black gram were wet-ground into thick batters, with the rice being coarsely ground and the black gram finely ground. The two batters were then mixed and left to ferment naturally overnight at room temperature. The resulting batter was steamed to produce the Idli (Figure 12).

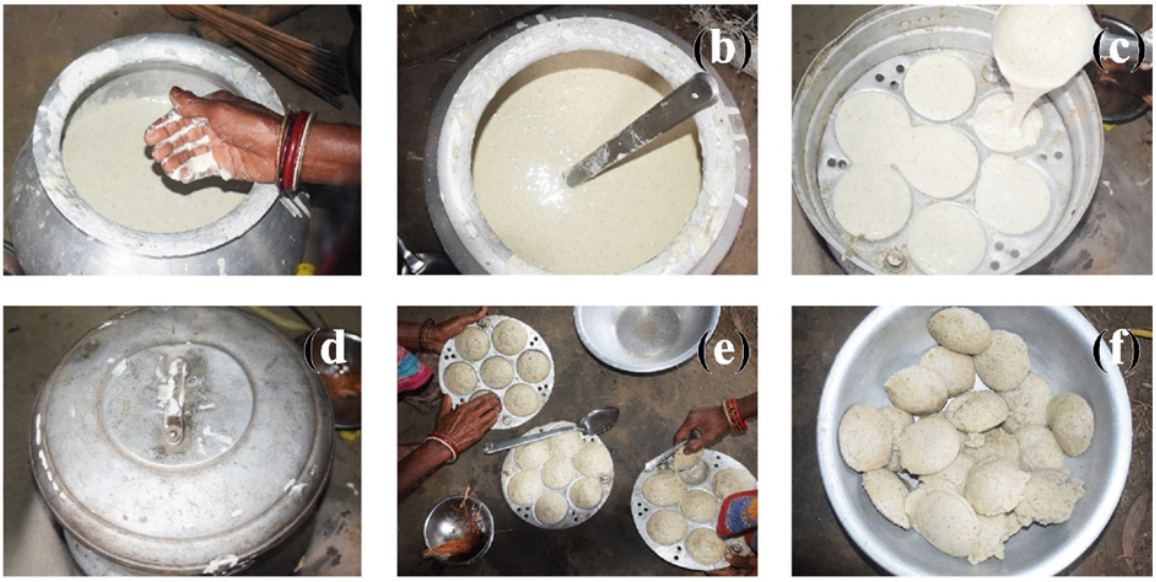

Figure 12. a. Batter prepared from pounded sun-dried rice and black gram, b. Naturally fermented batter, c-f. Steps in preparation of spongy rice cake Idli

Discussion

Throughout human civilization, local food products have played a vital role in shaping dietary cultures around the world. These indigenous foodstuffs, which are traditionally prepared and consumed in specific regions, are an integral part of local heritage. According to Jordana (2000), to be considered traditional, a food product must be linked to a specific territory and part of a set of traditions that ensure its continuity over time. Traditional foodstuffs are typically inexpensive, sustainable, and made using manual techniques without the use of artificial additives ((Li & Ganzle 2020). They have been passed down through generations and are an essential part of many communities' diets and cultures. In India, food is a marker of identity, reflecting factors such as caste, class, family, kinship, lineage, religiosity, ethnicity, and increasingly, secular group identification. Thus, India's socio-cultural patterns can be traced through its food culture and culinary choices. The impact of food on the human body has been discussed in many important texts, such as Patanjali's Yoga Sutras, Charaka's Charaka-Saṃhita, and the Upanishads. These texts emphasize the importance of food choices and their impact on physical and mental well-being. Ayurveda, an ancient system of medicine in India, recognizes that food impacts various dimensions of a person, including physical build, temperament, status, emotion, state of mind, and spiritual level. The Vedas emphasize the connection between spirituality and food choices while also valuing taste and health. Rice cake is a food item found in many cultures, particularly in rice-eating Asian countries (Ji *et al*. 2007). The Vedas also mention various cakes offered to God, such as Purodasa (sacrificial cake) and Apupa (cake). Rice cakes are a popular snack in Asia and are made by condensing or molding rice into a food item.

Diversity of rice-based cakes

Ethnic foods are strongly influenced by the cultural setup of a particular region and the knowledge is generally transferred from generations, which subsequently becomes a tradition over time. Globally, there is a growing interest in researching ethnic foods, fueled by the rising demand for traditional cuisines and the belief that these foods provide sustainable and healthy alternatives for future global food needs (Chen *et al.* 2018). In the context of Indian ethnic foods, diversity is pronounced, and shaped by strong influences from culture, religion, and traditional knowledge systems such as Ayurveda (Tamang 2016; Mishra 2019; Wagh & Bhalerao 2020). Substantial differences in food availability exist between rich and poor households in coastal districts of Odisha. However, both the rich and poor prepare rice cakes (locally called Pitha) during festivals and ceremonial rituals. Women are typically the ones responsible for food preparation and they have inherited the traditional knowledge of preparing these rice cakes from their elders. In the current investigation, ten types of rice-based cakes (Arisa Pitha, Chakuli Pitha, Chitau Pitha, Enduri Pitha, Gaintha Pitha, Manda Pitha, Muaan Pitha, Podo Pitha, Tala Pitha,

and Idli) are documented. The diverse types of rice cakes in the coastal district of Odisha are also reported in various regions of India with different local names (Roy *et al.* 2007; Latha *et al*. 2019; Rani *et al*. 2019; Antony *et al*. 2020; Baruah *et al*. 2020; Palika *et al.* 2020; Tamang 2020; Basaiawmoit *et al*. 2021; Shukla 2021; Basaiawmoita *et al*. 2023). Rice cakes, are not only popular in the coastal districts of Odisha but are also widely consumed in many Asian regions, including Korea, China, Japan, and Myanmar, as a daily food item and during festivals and celebrations (Kim *et al.* 2012).

Use of ingredients and plant/animal products

Ethnobotanical resources play a crucial role in the creation of traditional foods, influenced by factors such as local demand, cultural practices, economic considerations, ethnicity, and dietary preferences (Dutta & Dutta, 2005). The diverse types of rice cakes are made from cereal (rice) and rice-legume batters, which can be shaped and filled with sweet or savory ingredients. The simplest form of rice cake contains only rice and salt. Various ingredients contribute to the rich tapestry of rice cake recipes, including rice, salt, sugar, jaggery, mustard, turmeric, ginger, and more, as documented (Kadirvel 2021; Basaiawmoita *et al*. 2023). However, the ratio of different ingredients and the method of preparation may vary from place to place (Ray *et al.* 2016). The unique method of preparation of rice cakes typically involves the use of simple utensils and locally available plant and animal products. Notable plant products are *Allium cepa, Arachis hypogaea, Borassus flabellifer, Cocos nucifera, Coriandrum sativum, Anacardium occidentale, Cinnamomum tamala*, among others. Additionally, the inclusion of animal products such as cheese and ghee enhances the flavor and texture of rice cakes. The present findings draw support from the studies of Ray *et al*. (2016) and Siju & Babu (2020). This highlights the diverse and resourceful utilization of both plant and animal resources in the preparation of rice cakes across various culinary traditions.

The link between ethnobotanical resources and local communities in making rice cakes is intricate, and influenced by cultural, economic, and environmental dynamics. The unique plants shape the culinary identity of regions with rice cake traditions, holding historical and cultural importance across generations. Rice cakes are intertwined with local rituals and celebrations, and infused with symbolic meaning. Adaptation to the surrounding flora ensures a sustainable, resource-efficient food culture. Ethnobotanical choices also align with nutritional needs, enhancing the value of rice cakes. The interplay between natural resources and local communities reflects a balance between tradition, sustainability, and cultural heritage.

Socio-cultural significance of rice cake

Rice holds a central role in the cultural identity of many Asian countries including India (Fuller 2011). In Indian tradition, rice symbolizes auspiciousness, prosperity, and fertility, embodying life-sustaining qualities, and is considered a sacred grain (Ahuja & Ahuja 2006; Rathna Priya *et al*. 2019). In the state of Odisha, rice cakes hold profound significance, becoming intrinsic elements in various traditions, festivals, and religious ceremonies. These rice cakes are intricately linked to a spectrum of ceremonies, encompassing Kumar Purnima, Manabasa Gurubara, Bijaya Dasami, Raja festivals, Ratha Jatra, Prathamastami Puja, Chitau Amabasya, as well as pivotal life events like marriages and thread ceremonies. Symbolizing auspiciousness and devotion, these cakes are often offered to deities for blessings. In addition to their religious role, rice cakes play a vital part in fostering community unity, reflecting the diverse culinary heritage passed down through generations. During grand celebrations such as Nuakhai, the act of offering rice cakes to guests in Odisha becomes a symbolic gesture of hospitality, embodying generosity and creating a warm and welcoming atmosphere. The connection to agriculture is also highlighted through the preparation and consumption of rice cakes, celebrating the harvest, and the predominant agrarian way of life in Odisha (Achaya 1994; Paul 2017). During the Rath Yatra festival at the Jagannath Puri temple, devotees express deep devotion by offering "Poda Pitha" - made with rice, jaggery, and coconut, traditionally baked in earthen ovens. This centuries-old ritual symbolizes gratitude and submission, representing a vital cultural tradition in the religious practices of Lord Jagannath (Dubey 2010).

Nutrient composition

Rice cakes are also known for their nutritional value, with 100g of rice cake containing moisture (23%), total proteins (3.7%), total fats (0.9%), total carbohydrates (65%), fibers (7%), crude ash (3.4%), calcium (7.1mg), magnesium (17.7mg), Iron (0.5mg), and an energy value of 283.1 Kcal (Ratiarimananjatovo *et al*. 2020). Studies have demonstrated that mixing rice with pulses and ghee leads to a significant reduction in glycemic index (GI) values and increases resistant starch (RS), making such food combinations suitable for diabetics (Kumar *et al*. 2020).

Commercialization

Traditional rice cakes are mainly produced in individual households and are not commercially available at food stalls. With the increasing availability of foreign media through satellite channels, the younger generation is being exposed to a wider range of entertainment, consumer products, and lifestyle ideals compared to their parents. This exposure to Western

thought and religious philosophy may impact the thinking, attitudes, and cultures that have been preserved by the people. This could pose a threat to the rich knowledge that has been passed down through generations and may give way to a culture of commercialization. The recent pandemic, COVID-19, has brought to light the vulnerability of households in developed and developing countries to sudden and disastrous events. It has emphasized the need to improve household preparedness for such events in the future (Leddy *et al*. 2020). Overcoming challenges in commercializing traditional foods requires addressing issues such as inadequate training for food handlers and entrepreneurs in processing, marketing, and logistics, as well as a lack of knowledge about proper packaging and transportation. Effectively promoting and marketing diverse rice cakes can meet evolving consumer tastes and fulfill the demand for a variety of culinary offerings.

Conclusion

Food is an important aspect of culture and traditions, and exploring the different cuisines can provide insight into a society's way of life. In the coastal districts of Odisha, traditional rice cakes remain a popular food, reflecting the local culture and taste. However, globalization has started to impact rural areas as well, with pre-cooked packaged noodles, pasta, and foreign snacks becoming more widely available. This trend threatens to erode the unique food identity of the region. To preserve and celebrate the local cuisine and traditions, it is important to encourage efforts to sustain them. One way to do this is by organizing "Food Festivals" that promote indigenous food and raise awareness about the importance of cultural preservation. Such festivals can help to revive traditional foods and educate the younger generation about their heritage.

Declarations

List of abbreviations: The article does not contain abbreviations.
Ethics approval and consent to participate: Not applicable
Consent for publication: Not applicable
Competing interests: Authors declare no conflict of interest.
Funding: Not applicable
Authors' contributions: TP designed the research, carried out the survey, and wrote the manuscript. SR and BKP helped the first author (TP) with data collection and interpreted the photographs. ND, NM, and RBM considerably contributed to the literature survey and revised the manuscript. All authors read, provided feedback, and approved the final manuscript.

Acknowledgements

We thank all the informants and the elderly women community, especially Sachilata Panda, Gitanjali Roul and Saudamini Mishra for their valuable knowledge.

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