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Assamese Pithas: Traditional rice-based preparations

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Assamese pithas are an integral part of the festivals of Assam and are traditional rice-based pancakes prepared from soaked and ground rice. Despite their cultural value and being the staple of every Indian kitchen in Assam, there is still lack of studies on their nutritional value, especially mineral content. The present study investigated the mineral and proximate composition of four pithas which are prepared widely – "Tel Pitha, Ketli Pitha, Narikol Pitha, and Til Pitha". The study aimed to analyze their nutritional in relation to ingredients and methods of preparation. Standard AOAC (2000) methods were used to analyze proximate components, including protein, carbohydrate, fat, fiber, moisture, ash, and calorific value. Wong's approach was used for iron estimation and calcium was determined with complexometric titration approach. Among the samples, Ketli Pitha exhibited the highest moisture content (40.17%), whereas NarikolPitha showed the lowest moisture content (13.29%) along with highest calorific value (379.40 kcal) and carbohydrate content (69.46 g per 100 g serving). Nutrient-wise, Til Pitha was extremely rich, with highest amount of fiber per 100 g serving – 9.8 g protein, 1.33 g ash, 1.35 g fiber, 82.67 mg calcium, and 12.49 mg iron, primarily due to inclusion of sesame seeds. On the other hand, deep-fried Tel pitha had lowest amount of calcium per 100 g serving (45.67 mg), fat (20.06 g), and moderate level of iron (9.07 mg). Among the pithas, there was statistically significant difference in iron and calcium ($p<0.05$). The study discusses nutrition profile of traditional pithas in detail, while providing valuable insights on both mineral and proximate composition. Overall, findings of this study have explored nutritional profile of adding these traditional delicacies to modern diets to improve overall health while retaining cultural heritage

Keywords: Assamese cuisine, Bihu, North-east India, Tilpitha, Traditional food

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Food, clothing and shelter are the fundamental human needs for overall survival. Food is the part of society and cultural identity, which connects people with shared experiences. The environmental, social, and economic aspects of food are interconnected, making food ideal to achieve UN SDGs, beyond nourishment[1]. Based on local environments, traditional and native food systems have been adopted for over 150,000 years, *i.e.,* from hunting to fishing and farming. These practices have shaped local food culture and dietary patterns over the years[2]. Traditional homemade delicacies are widely defined with their heritage and consistency, cultural uniqueness, and certain processing approaches[3].

Traditional delicacies hold cultural presence and significance which have been passed down from generation to generation. However, they eventually declining because of increased reliance on highly and ultra processed foods. There is a risk of losing those traditional foods[4]. Along with cultural identity, traditional food items are important sources of vital nutrients like minerals, antioxidants, vitamins, and dietary fiber to promote overall wellbeing and health[5]. Asia is the densely populated continent, which holds excellent diversity of dishes and culture[6]. Rice acts as an inseparable staple in Asian population, which deeply shapes local economies and culture.

Over half of global population relies on rice and Asian countries still stand top in terms of rice consumption. On average, each individual consumes 80 kg of rice every year[7]. With over 1.2 billion of population, India houses 705 native communities having unique recipes to augment diversity in diet of the country[8]. Across rivers, hills, and forests, there are various communities which depend on diverse languages, food traditions, and cultural practices. Food heritage of the nation dates back to Vedic age, with philosophies of Tamas (carnivorous), Rajas (spicy), and Sattva (vegetarian) Gunas[9].

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Being one of the oldest crops, rice has significant cultural and ritual value in India. It holds prominence in festivals, religious ceremonies, and lifecycle rituals to symbolize nourishment, prosperity, and fertility[10]. Located in the lap of eastern Himalayas, Northeast India is well regarded for its rich biodiversity, significant cultural, linguistic, and botanical diversity[11]. Regional communities primarily rely on changing forest resources and cultivation for sustenance. Traditional food items are widely united in social practices, healthcare systems, and spiritual beliefs, with close relations between the environment and culture. Unique preparation approaches like smoking, drying, and fermentation improve digestibleness and shelf-life. So, these foods become practical and nutrient-dense for daily life[12].

Located in Northeast India on the banks of Brahmaputra River, Assam is well-regarded for its rich and vibrant culture, which is redefined by legacy, diversity, geography, and ethnicity. Assam has a rich blend of diverse communities offering vivid blend of languages, arts, traditions, and festivals redefining its identity[13]. The most popular regional festival, Bihu relates closely with seasonal patterns and farming cycles, such as, Bohag Bihu, Magh Bihu, and Kati Bihu[14]. Rice has both ritual and nutritional values in Assam, having the value in daily diet along with festive delicacies.

Traditional dishes such as Sira, Pithas, Pithaguri, and Hurum are made with rice as main ingredient. Pithas hold a unique prominence, which is the symbol of community, celebration, and abundance. During Bihu, their preparation exemplifies rice-based foods are prepared during Bihu festivals to embody heritage, nutrition, and identity of Assam, which fills the gap between cultural expression and sustenance. Scientific studies have constantly identified traditional foods for their significance in food, culture and public health security. It is observed in studies that pithas and other food items having rice as main ingredient such as in Northeast India are rich in minerals, carbohydrates, and essential amino acids, acting as sustainable sources of micronutrients and energy[15,16].

It is also important to investigate traditional dishes to improve food security in the region and protect cultural heritage[5]. These findings are focused on the need to determine nutritional value of pithas for the integration of scientific research with indigenous knowledge and support their addition in modern diets. The culinary tradition in Assam features different rice-based dishes, including Khandoh, Sira, Aakhoi, Pithaguri, and Hurum. Traditional preparations made of rice flour like special pithas have special prominence and are the core of Bihu traditions. Some of the common varieties are Tel Pitha, Til Pitha, Hesha Pitha, and Ghila Pitha, which act as vital festive delicacies[17].

Ketli Pitha, Tel Pitha, Til Pitha, and Narikol Pitha are some of the characteristic kinds for their large-scale preparation around households in Assam. Each has its own recipes and ingredients, providing insightful knowledge about traditional rice-based diseases and diversity in nutrition. Made with jaggery and sesame, Til Pitha has minerals and protein. Narikolpitha is filled with coconut to provide fiber and sweetness naturally. Tel pitha is deep friend which is rich in fat and made in festivals. Ketli Pitha is steamed with traditional methods. Overall, these varieties add diversity in culture and nutrition in festive foods in Assam.

Irrespective of their cultural importance, pithas has not been studied well in nutritional value. Current studies are focused majorly on culinary festivals and practices, while there is a lack of scientific evidence on nutritional value. Many indigenous foods are losing their relevance in this day and age due to Western diets. On the other hand, future generations may not even recognize these traditional foods. Hence, this study highlights and analyzes nutritional value of Assamese pithas to hold cultural heritage and diversity in cuisines. This study provides scientific evidence to know nutritional profile of those native foods to promote their cultural relevance in modern diets.

Methodology

Study area

Assam is the largest state in Northeast India located on the lap of the eastern Himalayas (Fig. 1). It is located on the banks of the Barak and Brahmaputra rivers and holds over 2.4% of the overall geographical region in the country, according to the Government of Assam. The state has diverse topography including plains, hills, and large-scale river systems. Assam is bordered by Bangladesh, West Bengal, and Meghalaya to the west; Arunachal Pradesh to the north and east; and Manipur, Nagaland, Tripura, Bhutan, and Mizoram to the north and south, respectively. This study was based on large-scale consumption of four traditional delicacies – Narikol

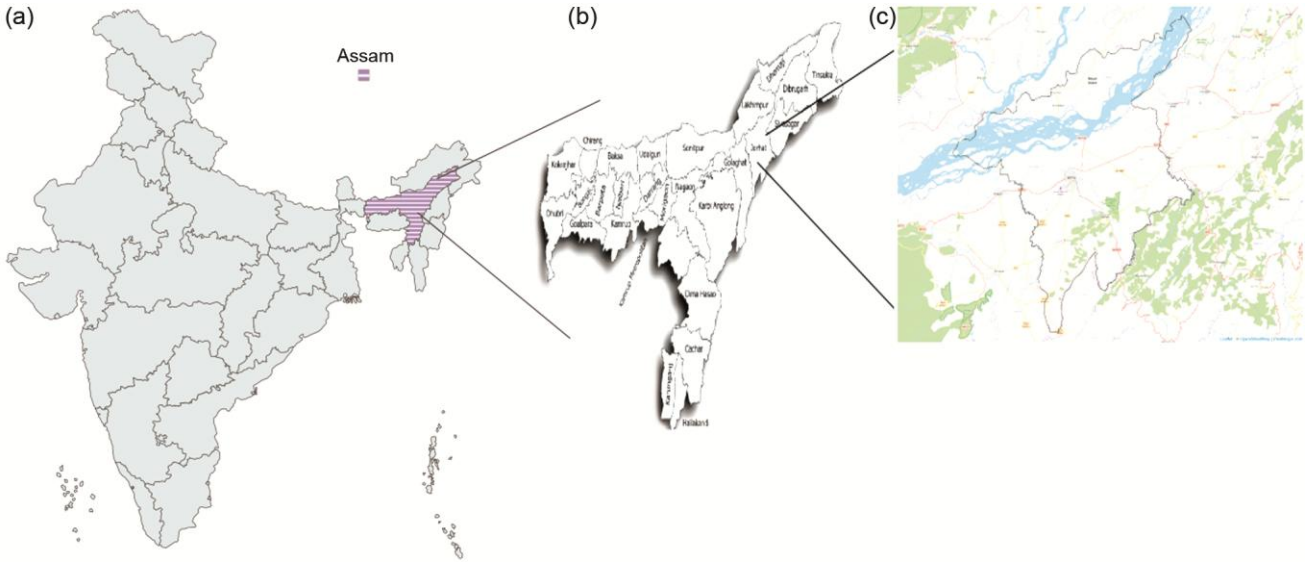

Fig. 1 — Study Site: (a) India map highlighting Assam; (b) Assam map highlighting Jorhat; (c) Map of Jorhat (Source: https://www.mapsofindia.com/,https://paintmaps.com/map-charts/238c/Assam-map-chart,https://www.google.com/maps)

Table 1 — Types of Pithas made in Assam

Name of Pitha	Raw Ingredient	Description	Photos
Til Pitha	1. Bora Rice (Sticky Rice) 2. Black Sesame Seed 3. Jaggery	A jaggery and sesame seeds filled rice role. It is roasted dry without oil on a hot griddle, which is the symbol of simplicity and purity in festive dishes in Assam.	
Tel Pitha	1. Bora Rice 2. Mustard oil 3. Jaggery	Made of jaggery and rice flour, Tel pitha is deep-fried. It is known for high amount of fat and crispiness. It holds festive engagement in seasons.	
Tekeli Pitha/ketli Pitha	1. Rice 2. Coconut 3. Jaggery/sugar 4. Ghee	A steamed pitha prepared by pouring a semi-liquid rice batter onto a muslin cloth stretched over a steaming kettle (ketli). It is soft, easy to digest, and oil-free, which is usually consumed as light snack.	
Narikolpitha	1. Bora rice 2. Coconut 3. Jaggery	Stuffed with jaggery and grated coconut in dough of rice flour, Narikolpitha is usually roasted or pan-cooked. It is well-regarded for its fiber and sweetness.	

Pitha, Ketli Pitha, Tel Pitha, and Til Pitha – made of rice flour along with their cultural significance during Bihu and other festivals in Assam. Each of these dishes has its own nutritional profile, ingredients and recipes. Table 1 illustrates the different kinds of Pithas with their preparation methods and their ingredients.

Traditional pithas

These pithas are highly nutritious and are an integral part of Assamese culture as they have different preparation methods (such as frying, roasting, and steaming), cultural imagery and ingredients (coconut, jaggery, and sesame). Bordered by North Lakhimpur in the north, Sivasagar in the east, Nagaland in the southeast and south, and Golaghat district in the west, Jorhat district is located in the east of Assam.

The study area of Jorhat town is located in the fertile upper valley of the Brahmaputra River, which is well-regarded for its rich heritage and cultivation. Jorhat has been well-renowned as the core of Assamese

Table 2 — Table showing the nutritional composition of traditional Assamese pithas as is basis

Type of Pitha	Moisture content %	Protein (g/100 g)	Fat (g/100 g)	Crude Fiber (g/100 g)	Total Ash (g/100 g)	Carbohydrate content (g/100 g)	Energy content (Kcal)	Calcium (mg/100 g)	Iron (mg/100 g)
TP	23.37± 0.42 [c]	9.81± 0.27[a]	14.02± 0.52[b]	1.35± 0.20[a]	1.33± 0.02[a]	50.11± 0.20 [b]	365.88 ± 3.39 [b]	82.67± 2.08a	12.49± 0.02 a
TeP	29.83± 0.39 [b]	6.44± 0.13[b]	20.06± 0.64[a]	0.53± 0.06[c]	0.48± 0.02[d]	42.66± 0.39 [d]	376.90± 4.64 [a]	45.67± 2.08d	9.07± 0.02 b
KP	40.17± 0.58 [a]	7.00± 0.02[b]	6.78± 0.02 [d]	0.89± 0.02[b]	0.58± 0.08 [c]	44.58± 0.51[c]	267.35± 2.00 [c]	58.00± 2.0c	8.02± 0.01 c
NP	13.29± 0.53 [d]	7.31± 0.35[c]	8.03± 0.26[c]	1.08± 0.05[b]	0.82± 0.02[b]	69.46± 0.44 [a]	379.40± 2.75 [a]	70.00± 1.52b	8.05± 0.01 c
SEd	0.4	0.19	0.35	0.09	0.03	0.33	2.73	1.81	0.01
CD (0.05)	0.91	0.44	0.81	0.20	0.08	0.76	6.29	4.17	0.03

All values are (Mean±SD) with 3 independent observation.
*TP = Til Pitha, *TeP = Tel Pitha, *KP= Ketli Pitha, *NP= Narikol Pitha
*SEd= Standard Error of Difference, *CD = Critical Difference at 5% level

literature, culture, and traditional practices. There are different varieties of rice that grow abundantly locally and they are constantly observed in Bihu festivals. Therefore, this location is ideal for studying traditional pithas. The preparation of pithas is an important part of gatherings and festive occasions in semi-urban and rural households in Jorhat. Hence, the district was selected as the study area to cover the sources of ingredients and preparation methods.

Proximate composition analysis

The proximate composition of the samples was analyzed using the standard methods outlined by AOAC (2000)[18]. Moisture content was determined by drying the samples in a hot-air oven at 105°C until a constant weight was reached. Protein content was measured using the Kjeldhal method, while ash content was obtained by incinerating the samples in a muffle furnace at 550°C for six hours. Fat content was analyzed using the Soxhlet extraction method, and crude fiber was estimated according to AOAC (2000)[18] procedures. Carbohydrate content was calculated by difference following the method described by Gopalan *et al*., (2000)[19], using the formula:

Carbohydrate (%) = 100 – (Moisture + Crude Protein + Crude Fat + Crude Fiber + Ash)

Mineral profile

The iron content of the samples was measured using Wong's method[20]. In this technique, ferric ions in the sample react with potassium thiocynate (KSCN) to form a red-color ferric thiocyanate complex. The intensity of this color was then quantified using a UV-VIS spectrophotometer. Calcium content was determined using the complexometric titration method.

Statistical analysis

The experiment data were analyzed following a completely randomized design (CRD). Each measurement was performed in triplicate, and the mean values were calculated. One-way analysis of variance (ANOVA) was conducted using IBM SPSS statistics software (v20). The standard error of the mean (S.Ed±) was determined, and treatment means were compared using the critical difference (CD) test at a 5% level of significance ($p<0.05$).

Results and Discussion

Nutritional composition of pithas

Moisture content

Table 2 presents the moisture content of some traditional Assamese pithas. The values vary significantly depending on the preparation methods and ingredients. Ketli Pitha holds highest amount of moisture among all samples (40.17±0.58%). It is made of soaked rice before grinding, which absorbs water and retains moisture content. Grated coconut is naturally moist, which is also expected to increase moisture content. In Ketli Pitha, the steaming process retains moisture as moist heat enables granules of starch to absorb water and swell.

Previous studies have observed similar trends where rice soaked at 10 to 40°C for 120 min increases the swelling of starch and absorption of water[21]. Made from steamed rice, Bhapa Pitha holds high amount of moisture[22]. Similarly, Bhakka has increased moisture levels. It is made from steamed rice in Nepal. It holds the relationship between high moisture retention and steaming in traditional dishes made of rice[23]. Narikol Pitha holds lowest amount of moisture (13.29±0.53%), probably because of direct heating at high temperature

which rapid evaporation. Before filling, the grated coconut is roasted to further reduce water retention by changing its physicochemical and structural properties. Heat moisture treatment restricts absorption of water, water binding, and improves the crystalline properties[24].

Protein content

Tel pithas have around 6.44±0.13 g of protein per 100 g and Tilpithas have around 9.81±0.27 g of protein per 100 g. In Til Pitha, a higher protein content is related to having black sesame seeds, which are well-regarded for their rich protein content. In addition, both jaggery and bora rice have moderate levels of protein. These findings are aligned with those of previous studies, which have found that increasing levels of sesame in foods significantly improves their protein content[16,25]. On the other hand, Tel Pitha held the lowest amount of protein, probably because the lack of fillings rich in protein, such as coconut or sesame. Bora rice is the base ingredient which has low amount of protein. It is also deep fried to induce interactions between lipid and protein and Maillard reactions to reduce the availability of protein. Deep-fried foods based on cereals are more likely to have reduced amount of protein[15].

Fat content

There was also a significant variation in fat content across samples in per 100 g serving, that is from 6.78±0.02 g to 20.06±0.64 g, in Ketli pitha and Tel pitha, respectively. Tel pitha is usually high in fat because it is deep fried and it absorbs high amount of oil. Water evaporates rapidly during the process of frying, creating gaps that are filled with oil thereby increasing the fat content. There is a rise in oil absorption from 42% to around 50% in 40 seconds of frying at high temperature from 165 to 185 degrees Celsius, which reduces moisture steeply[26].

There is a direct relationship between oil absorption and the frying process, especially in rice-jaggery cuisine which is deep fried, that is Ariselu[27]. Ketli Pitha displayed the lowest amount of fat, which can be attributed to both the preparation approach and ingredients. It does not contain any added fat and is steamed. Grated coconut is naturally low in fat. There is also lack of oil-based processing. Steamed rice cakes have shown comparable results without the integration of coconut residue[28].

Crude fiber content

Til Pitha has crude fiber ranging from 0.53±0.06 g and 1.35±0.20 g per 100 g of serving. This is because of having black sesame seeds, naturally have high dietary fiber naturally. Adding sesame has also been reported to increase fiber content in fortified and traditional food items[29-31]. Tel pitha had lowest amount of fiber, probably because of lack of fiber. The composition of rice flour and jaggery contributes little to fiber, and the frying process adds none. These observations correspond with the findings of Digra *et al*.[15] who reported low fiber values in fried rice-based traditional foods.

Total ash content

The ash content, indicative of total mineral matter, ranged from 0.95±0.04 g/100 g to 1.33±0.02 g/100 g. Til Pitha again showed the highest ash content, resulting from the combined mineral contribution of sesame seeds, jaggery, and Bora rice. Studies conducted by Irshad *et al*.[30] and Ghosh & Sengupta[32] observe significant increases in ash content with rising sesame concentration and substitution of refined sugar with jiggery

Carbohydrate content

Carbohydrate content was found to be highest in NarikolPitha (69.46±0.44 g/100 g). The elevated carbohydrate level reflects the dominance of jaggery, grated coconut, and Bora rice in its composition. It has been reported[33] that jaggery is a concentrated sugar source (72-78 g/100 g sucrose) that substantially increases carbohydrate values. Similar results were found for Tepung Gomak, a traditional Malaysian glutinous rice-based sweet with high carbohydrate levels[34]. Coconut also adds carbohydrates, as noted[35] with 6.9% carbohydrate content in coconut copra.

Energy value

The energy values ranged from 267.35±2 kcal in Ketli Pitha to 379.40±2.75 kcal in NarikolPitha. The higher energy content in NarikolPitha stems from its greater amounts of carbohydrate, fat, and protein. Previous works[33,35] emphasized that jaggery and coconut are energy-dense ingredients due to their sugar and fat content. Glutinous rice-based sweets also exhibit higher caloric values[35], consistent with the present observations.

Mineral profile

Calcium

Among all pithas, Til Pitha had the highest calcium content (82.67±2.08 mg/100 g), mainly due to black sesame seeds, a known rich source of calcium.

According to previous findings, adding sesame to any traditional dish significantly improves calcium[16,30].

Iron

Due to jaggery and sesame, Til Pitha had highest amount of iron per 100 g serving, *i.e.*, 12.49±0.02 mg, which are both rich in dietary iron. As per the comparative findings, adding jaggery and sesame results in significantly high iron levels in traditional desserts[16,33].

Conclusion

In this study, it is observed that traditional pithas are culturally rich foods based on rice with high nutritional value. NarikolPitha had highest calories and carbohydrates, while Til Pitha had highest amount of mineral and dietary fiber because of having high amount of jaggery and sesame seeds. There is also clear difference in fat, protein, and moisture levels among various pithas, showing different preparation methods and ingredients. In comparison to other rice-based foods cooked in India and worldwide, Assamese pithas have different culinary and nutrition profile.

Made of fermented steamed rice and lentils, a south Indian dish, Idli has high amount of protein (that comes from black gram) and low fat because it is steamed, not fried. On the other side, Tel Pithas have high amount of fat as they are deep fried, which is aligned widely with sweets like Anarsa in Maharashtra or Ariselu in A.P., both made with jaggery and rice flour, but varies in oil retention and texture. In the same way, a dumpling made of rice flour, jaggery and coconut, Modak is similar to Narikolpitha. However, Assamese pitha has higher moisture and carb content because of using local approaches and softer varieties of Bora rice.

Products made of steamed rice like TepungGomak in Malaysia and BhapaPitha in Bangladesh have comparable patterns of micronutrients. Still, Assamese pithas are well-regarded for diverse ingredients, especially coconut and sesame, which improves their fiber and minerals. Hence, Assamese pithas are nutritionally dense, regionally diverse, and symbolic by culture. As people constantly avoid traditional dishes and constantly eat western foods, it is very important to highlight nutritional value of these recipes. This study delivers scientific grounding to know dietary importance of Pithas and recommends pithas to be integrated into modern food practices and preserved to hold cultural value.

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Author Contributions

AP: Research work, writing, and conceptualizing; MD: Validation, framing, review, and finalizing; MS: Review and suggestions; SG: Review and suggestions; BN: Review and suggestions; PN: Guidance and validation.

Ethics Approval

The study involving human participants was reviewed and approved by the Institutional Ethics Committee (IEC) of Department of Food Science and Nutrition, CCSc, AAU, Jorhat, India (Approval No: AAU/CCSc/FSN/IEC(H)/23-HMJ-17/25-26/07).

Informed Consent

Written informed consent was obtained from all individual participants included in the study.

Conflict of Interest

There is no conflict of interest among the authors.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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