

Traditional cereal-based cuisines from Himachal Pradesh Palampur region and their nutritional profile

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ABSTRACT

An investigation of traditional food uses among people in Himachal Pradesh's Kangra district's Palampur region indicated an extensive diversity of divergence in regional dishes derived from cereals, pulses, dairy products, and tubers. A few popular cereal-based traditional recipes include Mithdu, Babroo, Gulgule, Sheera, and Meethi roti. The nutrient content of tali roti consumed by people in Himachal Pradesh's Palampur region was documented and analyzed. The raw materials, as well as recipes for traditional foods, were analyzed for their nutritional composition and consumer acceptability. According to the findings, maize flour had the highest moisture content (14.11%), whereas raw sheera had the highest protein content (13.38). Maize flour had the highest crude fat and crude fiber contents (4.14% and 2.26%, respectively). Wheat flour had the highest ash content (3.26%). Basmati rice had the highest total carbohydrate content (89.94%), whereas maize flour had the lowest (79.29%). Wheat flour had the highest phytic acid content (222.47 mg/100 g), whereas maize had the highest total phenol content (14.72 mg TAE/100 mg). Kidney beans had the highest phytic acid content (96.74 mg/100 g), whereas Bengal gram dhal had the lowest (37.99 mg/100 g). Chickpeas had the highest total phenol content (117.16 mg TAE/100 g), whereas kidney beans had the lowest (92.95 mg TAE/100 g). Kidney beans had the highest oxalates (0.91 mg/100 g), whereas chickpeas had the lowest (0.24 mg/100 g).

ARTICLE HIGHLIGHTS

- The key objective of the research was to identify ethnic cereal-based recipes and evaluate them in terms of their nutritional content, since there has not been much work done on assessing the nutritional value of ethnic dishes.
- According to the findings, maize flour had the highest moisture content (14.11%), whereas raw sheera had the highest protein content (13.38). Maize flour had the highest crude fat and crude fiber contents (4.14 and 2.26%, respectively). Wheat flour had the highest ash content (3.26%). Basmati rice had the highest total carbohydrate content (89.94%), whereas maize flour had the lowest (79.29%). Wheat flour had the highest phytic acid content (222.47 mg/100 g), whereas maize had the highest total phenol content (14.72 mg TAE/100 mg).
- Meethe chawal had the highest crude fat content (22.19%), Gulgule had the highest crude protein content (12.33%), followed by Tali roti (12.25%) and Akhri roti (12.24%), whereas Chawal roti had the lowest (6.83%). Mithdu (2.84%) and Gulgule (2.82%) had the highest ash contents. Chawal roti had the highest percentage of total carbohydrates, followed by Rice, Akhri roti, Babroo, Bedvin roti, Tali roti, Gulgule, Mithdu, Meethe chawal, and Sheera, with corresponding values of (82.53%), (76.27%), (71.74%), (64.46%), (61.37%), (55.10%), (53.44%), (49.94%), and (49.45%), respectively.
- These traditional recipes are nutrient dense and an excellent substitute for fast food. Contrary to fast food, the majority of dishes made from cereals were fermented, making them easier to digest.
- In addition, providing these traditional foods in schools, including pre-schools and anganwadis, in the near future will undoubtedly alter young children's attitudes toward fast food, which is more detrimental to one's health and exacerbates the problem of childhood malnutrition.
- In addition, a wide variety of ingredients and additives are used in traditional cereal based foods. This might eventually assist

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in creating more beneficial healthcare routines through dietary changes. Owing to the rising demand for traditional meals as well as the growing conviction that ethnic meals are the most sustainable alternatives to offer nutritious food to the world's population in the future, ethnic food research has consistently expanded globally.

- This study, in our opinion, is a novel attempt that eloquently demonstrates the importance of developing a new scientific perspective to comprehend the field of food. If we bring back old traditional ethnic foods that are a source of probiotics and surely have the capacity to produce positive changes in one's health, the insight would become a holistic approach.
- Further research can be done on the bioavailability of nutrients from these food products.

1. INTRODUCTION

Many distinct dishes defined as indigenous or traditional to the Indian subcontinent are included in Indian cuisines, which take the form of different foods. Traditional foods have been consumed for a very long time, and they are based on a firm understanding of culture, tradition, and our surroundings. The usage of functional foods is expanding worldwide as consumer knowledge of health and nutrition has grown because of their health-promoting qualities [1] and capacity to prevent or alleviate diseases in addition to offering satiety [2]. As a result, there has been a rise in consumer demand for functional meals that have positive health effects, which has created new markets for a variety of processed food products with specific health attributes [3].

Food symbolizes community culture by providing information and reflection on their eating habits, food preferences and consumption patterns, nutritional security and community health, agricultural and livestock systems, as well as socioeconomic, ethnic, and religious taboos [4]. It also helps to strengthen social bonds. Traditional foods were created over years and are continually invented, modified, used, and evolved to combat food dissatisfaction [5]. Traditional production processes, procedures, and technologies have been enacted through the generations. Since there are differences in raw material accessibility and environmental conditions, as well as time-tested traditional knowledge, people in various parts of hill states have created, developed, and continued to consume several different traditional meals and beverages peculiar to their regions for centuries.

Traditional food and beverage preparations are mostly limited to the household level, so processes and technologies for food preparation are passed down from generation to generation with little variation and greater adaptability to ethnic values. Food is a part of an ethnic community's cultural traits. India's vast subcontinent has cuisines as diverse as its cultures. Every corner of this sprawling nation has gradually developed its own cooking method, as well as its own selection of ingredients and flavor combinations, resulting in a fascinating repository of ideas, techniques, and recipes. Eating habits and preparatory recipes vary by location. Due to traditional methods of preparation, the taste, color, texture, and appearance of the same delicacy vary greatly from place to place [6].

Cereals play an important role in human diets because they provide essential nutrients either directly or indirectly through the production of meat, which is dependent on livestock feed [7]. Traditional dietary habits possess many positive effects on health, including reducing the likelihood of certain aging-related disorders, stroke, arteriosclerosis, and so on [8]. For decades, people in the state have prepared and consumed a variety of traditional foods, which have become a

crucial component of the sociocultural life of the hill people. Various technological methods to produce traditional foods from ingredients that are available locally have been developed, with ethnic preferences, agro-climatic conditions, sociocultural ethics, and religion heavily influencing [9]. Some cereal-based traditional foods particular to Himachal Pradesh's tribal and rural regions include bhatooru, chilra, sidu, manna, sepubari, aenkadlu, baari, babroo, patande, madrah, bedvin roti, chukh, sura, chhang, angoori, churpa, and lugdi [10].

It is vital to sustain the old traditions through tourism, current gastronomic styles and cultures, or exquisite food. Even additional environmental benefits will result from the planned development of regional cuisine employing environmentally sustainable methods. This approach ought to be considered a practical tool for fostering regional integration and conserving resources [11]. Humans are experiencing a variety of health issues as a result of numerous factors, including a lack of understanding about ethnic food composition, technology, changing dietary patterns, and societal beliefs about specific foods [12]. Cereals are the main source of vitamins, minerals, and phytochemicals such as flavones, phytic acid, phenolic acids, terpenes, coumarins, and flavonoids, which have potent antibacterial and antioxidant activities. Consuming cereal grains also lowers the incidence of dietary problems and other diseases associated with oxidative damage [13].

The current investigation was conducted to assess the techniques and nutritional values of the traditional cereal-based foods of Palampur Tehsil, Himachal Pradesh, to include these foods in nutritional programs in the near future.

2. METHODOLOGY

The Palampur Tehsil of Himachal Pradesh's Kangra district was selected as the main study area for traditional cereal-based foods. A total of three blocks in Palampur Tehsil, namely, Panchrukhi, Bhawarna, and Baijnath, were selected. For the study, three villages from each block were chosen. A two-stage stratified random sampling design was employed to select the households. A total of 120 households were chosen to gather relevant information, thirty from each of the Panchrukhi, Bhawarna, and Baijnath blocks, along with 30 from Palampur. Indigenous knowledge about these recipes was documented using the Participatory Rural Appraisal technique, which included discussions using primary sources as well as conversations in groups drawn at random from various residential areas.

2.1. Study Area

The research investigation was conducted on three blocks of Palampur Tehsil in Kangra district, Himachal Pradesh, namely, Panchrukhi, Bhawarna, and Baijnath. The study included three villages from each of the blocks. The research was focused on the Palampur Tehsil in particular. It embodies the state's cosmopolitan population.

2.2. Sampling Design

A stratified random sample strategy with two stages was used to choose the households. Similar to cluster sampling, the two-stage sampling strategy divides the population into groups; however, new samples are taken from each cluster sampled. When cluster sizes are large enough, two-stage sampling is used, making it difficult to understand all of the units that make up the cluster. A total of 120 homes from the Palampur Tehsil's Panchrukhi, Baijnath, and Bhawarna blocks, as well as 30 houses from Palampur in Himachal Pradesh's Kangra district, were selected to collect relevant data.

To accomplish the goals of the study and arrive at acceptable conclusions, a number of mathematical and statistical instruments, including average, mean, percentage, standard deviation, and variance, were used in the examination.

3. DOCUMENTATION OF TRADITIONAL RECIPES

Various traditional food recipes were collected during the study. The data were acquired in accordance with the protocol, which was divided into various heads and subheads. In addition, the formulations used in the preparation of various food recipes are commonly consumed in the study areas.

Traditional foods in Palampur are rich and varied, with a heavy reliance on local ingredients. These foods are suitable for a healthy and balanced diet. Some food recipes are described further below [Figure 1].

3.1. Mithadu

In a container, water and sugar were combined; they were then boiled to a syrup consistency for dough preparation. After sieving the flour, add the malera/yeast, dry fruits, and ghee. Knead thoroughly with the sugar syrup/water. The soft dough should be kneaded. The dough was then covered with a cloth/blanket and left to ferment. In the summer, the fermentation process takes about 3–4 h, whereas in the winter, it takes about 5–6 h. After fermentation, the volume of the dough nearly

doubled. Small balls were formed and placed in a sancha (a wooden Mithdu maker) to be pressed to the desired thickness. Then, they are deep fried in hot oil.

3.2. Babroo

Rice flour was combined with water to form a thick paste-like consistency. Allowed it to ferment for 3–4 h after adding bread masala or yeast. Salt and sugar were added to taste. In a katori, make a thin layer of the paste on a nonstick pan/griddle with a small amount of the above mixture. Cooked until golden brown on both sides.

3.3. Aakhiri Roti/or Ghadiyan Roti

The dough was made with wheat flour, 5 g of yeast, or malera, and ajwain. Allowed 3–4 h for the dough to ferment. A small amount of dough (25–30 g) was used to make small rotis. Cooked it on a griddle until golden brown.

3.4. Mithi Roti

It was made with sieved maize flour; a small amount of the dough (25–30 g) was rolled into round balls. In a mixing bowl, combine the jaggery and dry fruits. This mixture was filled into the balls, which were then rolled into rotis. On a griddle, cook it until golden brown. Ghee can be consumed with roti or used in cooking.

3.5. Tali Roti

Made dough with sieved wheat flour, 5 g yeast or malera (starter culture), and ajwain. Allowed the dough to ferment for 3–4 h. A small portion of the dough, approximately 25–30 g, was used to make small-sized rotis. Deep-fry the roti until golden brown in hot oil.

3.6. Gulgule

Sieve the wheat flour and mix it into a thick paste with water. Then, I added the yeast and let it ferment for about an hour. After fermentation, stir well again and take a small amount in katori before deep frying in hot oil.

3.7. Sheera

The raw Sheera powder was mixed into a thick paste-like consistency. Melted 4–5 tablespoons of ghee in a frying pan (add more ghee if necessary) and added the paste. Cooked until it starts to leave the side of the pan, then seasoned with sugar to taste and served hot.

3.8. Seviyan

With the sieved wheat flour, make a dough. Took small balls in the extruder. Dried the Seviyaan in the sun for 3–4 days. Dry Seviyaan was stored in airtight containers for future use. Then boiled 50 g of seviyan until soft, and drained the excess water. Ghee was melted in a pan, then added to boiled seviyan and milk. Depending on the desired consistency, it was cooked for 5–10 min. Added sugar and dried fruits of your choice. It must be served hot.

3.9. Bedvin Roti

Boiled Kachalu (colocasia) was peeled and mashed, then green chilies and chopped coriander were added to it and seasoned with salt to taste. Made 30–40 g balls of sieved maize flour, then filled them with mashed stuffing, and rolled out the roti with soft hands. On a griddle, cook it until golden brown on both sides. It goes well with curd, chutney, or hot ghee.

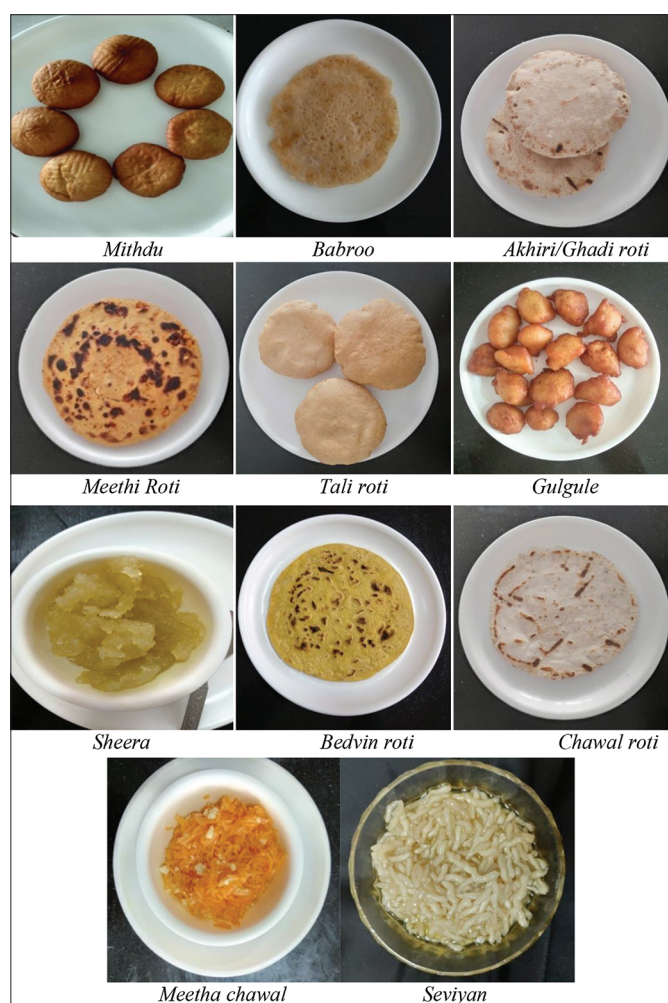


Figure 1: Traditional cereal based recipes.

3.10. Chawal Roti (Rice Roti)

Made dough with the sieved rice flour. Took 25 g of dough and formed it into small balls. Made the roti with a gentle hand. It could be cooked on a griddle or deep-fried.

3.11. Meethe Chawal (Sweet Rice)

The rice was cooked in a pressure cooker. Set aside the cooked rice to cool. 100 mL of water, sugar, and 3–5 drops of food coloring were combined to make syrup. Cook the rice for 5 min after adding the sugar syrup. Before serving, add khoya and dry fruits to it.

4. ASSESSMENT OF RAW MATERIALS AS WELL AS PREPARED FOOD RECIPES

The raw materials employed, as well as various food recipes, were examined for the following parameters.

4.1. Chemical and Nutritional Characteristics

4.1.1. Moisture levels [14]

The method of oven drying was used to estimate the moisture content of the sample. A five-gram sample was put in an already weighed, dried moisture box, and baked for 1 h at 105°C in a hot air oven with a partially uncovered lid. To achieve a uniform weight, the moisture boxes were removed from the oven and placed in desiccators for 30 min. After cooling, samples were weighed with moisture boxes. The moisture content of the sample was determined by the weight loss.

$$\text{Moisture (\%)} = \frac{\text{Loss in weight (g)}}{\text{Weight of sample (g)}} \times 100$$

4.1.2. Crude protein [14]

The protein content was estimated using the micro-Kjeldahl method, and the nitrogen content was converted into crude protein using a factor of 6.25.

4.1.2.1. Reagents used

Digestion mixture: Copper sulfate: Potassium Sulfate (1:10)

Boric acid solution: 4.0%

Sodium Hydroxide: 40.0%

Standard H₂SO₄: 0.1 N

Mixed Indicator: 0.1 g Methyl Red and 0.5 g Bromocresol Green in 100 mL of 95.0% ethanol.

4.1.2.2. Procedure

In a Kjeldahl digestion flask with concentrated sulfuric acid (25 mL) and digestion mixture (5 g), a weighted sample (2 g) was broken down. The liquid was then chilled and poured into a 250 mL volumetric flask. Distilled water was combined to create the volume. A condenser was used to collect the ammonium borate into a flask with 10 mL of a 4.0% boric acid solution after a measured aliquot (5 mL) was added to a distillation flask along with 40.0% sodium hydroxide. On the distillate, titration with 0.1 N sulfuric acids was carried out. A blank sample was also taken and ran along with the sample.

$$\text{Nitrogen (\%)} = \frac{\text{Titre value} \times 0.00014 \times \text{volume made}}{\text{Aliquot taken (mL) weight of the sample (g)}} \times 100$$

$$\text{Crude protein (\%)} = \text{Nitrogen (\%)} \times 6.25.$$

4.1.3. Crude fat reagent [14]

Petroleum ether (B.P. 40–60°C).

4.1.3.1. Procedure

Weighed samples (5.0 g) were extracted in triplets with petroleum ether using a Soxhlet extraction apparatus over a period of 18 h. The ether extract was filtered through a sintered funnel in a pre-weighed beaker and washed 2–3 times with a small quantity of petroleum ether. The petroleum ether must be thoroughly evaporated before weighing the beakers.

$$\text{Fat (\%)} = \frac{\text{Amount of ether extract (g)}}{\text{Weight of the sample (g)}} \times 100$$

4.1.4. Crude fibre reagents [14]

Sulfuric Acid: 1.25%.

Sodium Hydroxide: 1.25%.

4.1.4.1. Procedure

Weighed defatted samples (5.0 g) were digested in triplicate with 200 mL of 1.25% sulfuric acid by gentle boiling for 30 min. The contents were filtered, and the residue was washed with hot distilled water to remove any remaining acid. After transferring the acid-free residue to the same flask, 200 mL of 1.25% sodium hydroxide were added. The contents were digested for an additional 30 min before being passed through filters and washed free of alkali with hot distilled water. The residue was dried overnight in an oven at 105°C, weighed, and then placed in a muffle furnace at 600 ± 5°C for a period of 4 h. The reduction in weight after ignition represented the crude fiber in the sample.

$$\text{Crude fibre (\%)} = \frac{\text{Weight of sample (before ignition)} - \text{weight of sample (after ignition)}}{\text{Weight of the sample (g)}} \times 100$$

4.1.5. Total ash content [14]

Weighed samples (5.0 g) were placed in silica crucibles and incinerated on a hot plate before being placed in a muffle-furnace at 600°C for 4 h to obtain light-gray ash, and the percentage of ash content was determined as follows:

$$\text{Ash (\%)} = \frac{\text{Weight of ash (g)}}{\text{Weight of the sample (g)}} \times 100$$

4.1.6. Total carbohydrates [15]

The percent available carbohydrate content was calculated by subtracting from 100 the sum of the percentage values of moisture, crude protein, crude fat, crude ash, and crude fiber. The values in the samples were expressed as total carbohydrates (%).

$$\text{Total carbohydrates (\%)} = 100 - (\text{moisture\%} + \text{protein\%} + \text{fat\%} + \text{fiber\%} + \text{ash\%})$$

4.1.7. Tannins [16]

4.1.7.1. Reagents

20% Na₂CO₃.

1N Folin ciocalteu reagent (FCR).

4.1.7.2. Extraction

A beaker containing 10 mL of 70% acetone and 0.2 g of finely ground material was used. The extraction process took place for 2 h at 370°C in a shaking water bath. To avoid evaporation, the beaker was densely packed. After the extraction process, the mixture was centrifuged at 3000 rpm for 20 min, and the resulting filtrate was utilized to identify phenols.

4.1.7.3. Estimation

Took a 0.1 mL aliquot of the filtrate and made a final volume of 1.0 mL with distilled water. Now, add 2.5 mL of 20% Na₂CO₃, followed by 0.5 mL of FCR (1N). The solution was incubated at room temperature for 40 min. A spectrophotometer was used to measure the absorbance of blue at 725 nm, and total phenols were calculated in g/100 g using a standard curve as the basis.

4.1.8. Phytic acid [17]

4.1.8.1. Reagents

Phytate reference solution: 100 mL of 0.2 N HCl were combined with 30.54 mg of sodium phytate to produce a solution that had 200 mL of phytic acid per milliliter.

Ferric ammonium sulfate: 0.2 g of ferric ammonium sulfate was dissolved in 100 mL of 2N HCl and diluted to 1000 mL with distilled water.

Bipyridine solution: 10 g of 2',2' bipyridine and 10 mL of thioglycolic acid were dissolved in distilled water to make a 1 L solution. This solution is stable at room temperature for several months.

4.1.8.2. Extraction

A finely ground sample (1 g) was extracted in a shaker with 25 mL of 0.2 N HCl after 3 h of continuous shaking. After vigorous shaking, it was filtered using Whatman No. 1 filter paper, and 0.2 N HCl was used to increase the volume to 25 mL.

4.1.8.3. Estimation

0.5 mL of the aforementioned extract should be pipetted into a test tube with a glass stopper. A solution of ferric ammonium sulfate in 1 mL was added to the test tube. The tube was heated before being centrifuged for 30 min at 3,000 rpm. Now, 1.5 mL of the bipyridine solution and 1 mL of supernatant were added to a different test tube. The absorbance at 519 nm was calculated and compared with that of distilled water. For the standard curve, various concentrations of a standard sodium phytate solution were obtained and distilled to 1.4 mL with water. This solution included 40–200 g of phytic acid. 120 g of phytic acid was represented by a value of 0.5 OD.

$$\text{Phytic acid (mg/100g)} = \frac{\text{Reading of Graph} \times \text{ml of volume made}}{\text{Weight of sample (mg)} \times \text{ml of aliquot taken}} \times 100$$

4.1.9. Oxalates [18]

4.1.9.1. Reagents

Sulfuric acid (H₂SO₄): 15 N

Potassium permanganate (KMnO₄): 0.01 N.

75 mL of 15 N H₂SO₄ was added to 1 g of sample. The solution was stirred periodically with a magnetic stirrer for 1 h before being filtered through Whatman No. 1 filter paper. After that, 25 mL of the filtrate was obtained and titrated against a 0.1 N KMnO₄ solution for 30 s, until a faint pink color emerged.

$$\text{Oxalic acid (mg / 100g)} = \frac{\text{KMnO}_4 \text{ used (mL)} \times 0.45}{\text{Aliquot taken} \times \text{weight of sample}}$$

5. RESULTS AND DISCUSSION

The nutritional value of raw ingredients and cooked recipes is as follows:

5.1. Moisture Content

The relative moisture content of various crops differed considerably [Figure 2]. The highest moisture content was found in maize flour (14.11%). Begum *et al.* [19] observed a moisture content of 12.15% in maize flour, which is consistent with the current findings. It was followed by wheat flour (11.93%), basmati rice (9.57%), rice (9.21%), and sheera (7.70%), which had lower moisture content. David *et al.* [20] determined the moisture content of soft wheat flour to be 3.33%, whereas Begum *et al.* [19] determined the moisture content of wheat flour to be 13.09%. According to Devi *et al.* [21], the moisture content of rice ranged from 7.1% to 11.6%. Rice variety PUSA-3 had the lowest moisture content of 11.85%, as reported by Salim *et al.* [22]. The information in the table relates to the nutritional properties of raw ingredients used in cereal-based recipes.

5.2. Crude Protein

According to Table 1, sheera had the highest crude protein content (13.38%), followed by wheat flour (13.31%), maize flour (12.14%), rice (8.17%), and basmati rice (8.00%). Surve and Dushing [23] reported that the protein content of fermented wheat ranged from 10.13 to 10.81%, which is consistent with the current results for the fermented wheat product sheera. Begum *et al.* [19] reported the protein content of wheat and maize flour as 9.08% and 12.56%, respectively, which is consistent with the current findings. According to David *et al.* [20], the protein content of wheat flour is 10.23%. Salim *et al.* [22] reported protein content for three rice cultivars ranging from 6.35% to 8.13%, which is consistent with the current study.

5.3. Crude Fat

The crude fat content of various cereals varied significantly, with maize flour having the highest (4.14%). It was followed by sheera (1.71%), wheat flour (1.65%), and rice (0.73%), which had the lowest fat content. Sule *et al.* [24] found that fat content ranged from 2.17 to 4.43% in maize and maize products, whereas Ullah *et al.* [25] discovered that fat content ranged from 3.21 to 7.71% in maize varieties, which is consistent with the current findings. David *et al.* [20] discovered 1.33% crude fat in soft wheat flour. Salim *et al.* [22] reported that fat

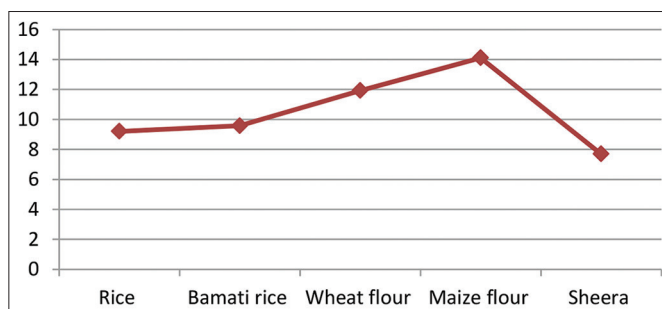


Figure 2: Moisture content of raw ingredients used in the preparation of cereal based recipes.

content ranged from 0.43 to 0.51% for different rice cultivars, which is consistent with the current study.

5.4. Crude Fiber

Crude fiber levels varied significantly across all five crops, with maize flour (2.26%) having the highest level, followed by wheat flour (1.78%), sheera (0.81%), rice (0.31%), and basmati rice (0.29%). Begum *et al.* [19] obtained 0.68 and 1.25% fiber content in maize and wheat flour, respectively. According to David *et al.* [20], soft wheat flour contains 0.51% crude fiber. Devi *et al.* [21] found that two rice varieties, MTU 3626 and MTU 1010, had the highest crude fiber content of 0.99%.

5.5. Total Ash Content

The total ash content of various crops varied significantly. Wheat flour (3.26%) had the highest percentage, followed by maize flour (2.17%), rice (1.10%), basmati rice (1.03%), and sheera (0.86%). David *et al.* [20] discovered a 1.00% ash content in soft wheat flour. Begum *et al.* [19] identified an ash content of 1.60% in maize flour, which is consistent with the current study. Devi *et al.* [21] discovered total ash content in rice genotypes ranging from 0.43 to 2.34%, which is consistent with the current study.

5.6. Total Carbohydrates

The total carbohydrate content of cereal-based raw ingredients is shown in Table 1. The highest value (89.94%) was found in basmati rice, followed by rice (89.69%), sheera (83.24%), wheat flour (80.00%), and maize flour (79.29%). Devi *et al.* [21] found total carbohydrate content in different rice genotypes ranging from 78.2 to 85.2%, which is similar to the current study. Ullah *et al.* [25] reported carbohydrate content in ten different maize varieties ranging from 69.66 to 74.54%, which is consistent with the current findings.

5.7. Phytic Acid

The results for the phytic acid content of various cereal-based ingredients are shown in Table 2. Rice, basmati rice, wheat flour, maize flour, and sheera had phytic acid values of 35.89, 25.96, 222.47, 75.31, and 43.09 mg/100 g, respectively. Rasul *et al.* [26] discovered 379.9 mg/100 g phytic acid content in wheat. According to Uchechukwu *et al.* [27], the phytic acid content of maize was 90.23 mg/100 g. Olukemi *et al.* [28] found the phytic acid content to be 82.81 mg/100 g in maize flour and 121.76 mg/100 g in wheat flour,

which is in accordance with the current investigation.

5.8. Total Phenols

The results of the total phenols content of various cereal-based ingredients are shown in Table 2. Rice, basmati rice, wheat flour, maize flour, and sheera had total phenols of 9.22, 6.20, 5.30, 14.72, and 1.49 mg TAE/100 g respectively. Tannin content in wheat flour was reported to be 8.65 mg/100 g by Gunashree *et al.* [29]. Uchechukwu *et al.* [27] found 13.15 mg/100 g of tannins in maize, which is comparable to the present study.

5.9. Oxalates

The oxalate content of cereal-based ingredients was shown in Table 2. Maize flour contained the most oxalates (3.63 mg/100 g), followed by wheat flour (1.75 mg/100 g), rice (0.65 mg/100 g), basmati rice (0.44 mg/100 g), and sheera (0.20 mg/100 g). Oyarekua *et al.* [30] observed 1.60 mg/100 g oxalate content in wheat, which is on par with the findings of this research. Olukemi *et al.* [28] found 1.76 mg/100 g of oxalate content in rice and 3.71 mg/100 g in maize, which is comparable to the current study.

5.10. Nutritional Analysis of Traditional Cereal-Based Food Recipes

The nutritional value of cereal-based traditional foods is shown in Table 3. Sheera (25.30%) had the highest moisture content, followed by Bedvin roti (16.91%), Meethe chawal (16.30%), Babroo (14.82%), Rice (12.93%), Gulgule (12.44%), Mithdu (12.42%), Chawal roti (9.18%), and Akhri roti (4.84%). Sheera possessed the highest percentage of crude fiber content (2.45%), which was followed by Bedvin roti (2.14%), Mithdu and Gulgule 2.07%, Akhri roti 2.04%, Tali roti 1.93%, Babroo 0.25%), Meethe rice (0.20%), and rice (0.18%).

Meethe chawal had the highest crude fat content (22.19%), followed by Mithdu (17.07%), Sheera (15.90%), Tali roti (15.60%), Babroo (5.67%), Bedvin roti (4.57%), Akhri roti (1.95%), Rice roti (0.54%), and Rice (0.49%). Gulgule had the highest crude protein content (12.33%), followed by Tali roti (12.25%) and Akhri roti (12.24%), whereas Chawal roti had the lowest (6.83%). Ash content was highest in Mithdu (2.84%) and Gulgule (2.82%), followed by Akhri roti (2.67%), Bedvin roti (1.52%), Meethe chawal (0.68%), Chawal roti (0.67%), Rice (0.57%), and Sheera (0.42%). Chawal roti had the highest percentage of total carbohydrates, followed by Rice, Akhri roti, Babroo, Bedvin roti, Tali roti, Gulgule, Mithdu, Meethe chawal, and

Table 1: Nutritional characteristics of traditional cereal-based raw ingredients used in recipe preparation.

Parameters	Rice	Basmati rice	Wheat flour	Maize flour	Sheera	CD ($P\leq0.05$)
Crude protein (%)	8.17	8.00	13.31	12.41	13.38	0.49
Crude fat (%)	0.73	0.75	1.65	4.14	1.71	0.59
Crude fibre (%)	0.31	0.29	1.78	2.26	0.81	0.46
Total ash (%)	1.10	1.03	3.26	2.17	0.86	0.37
Total carbohydrates (%)	89.69	89.94	80.00	79.29	83.24	0.66

Table 2: Anti-nutritional factors present in raw ingredients used for Traditional cereal-based recipes.

Parameters	Rice	Basmati rice	Wheat flour	Maize flour	Sheera	CD ($P\leq0.05$)
Phytic acid (mg/100 g)	35.89	25.96	222.47	75.31	43.09	29.75
Total phenols (mgTAE/100 g)	9.22	6.20	5.30	14.72	1.49	4.07
Oxalates (mg/100 g)	0.65	0.44	1.75	3.63	0.20	0.58

Table 3: Anti-nutritional factors present in raw ingredients used for Traditional cereal-based recipes.

Parameters	Rice	Meethe chawal	Akhri roti	Chawal roti	Tali roti	Bedvin roti	Babroo	Mithdu	Gulgule	Sheera	CD ($P \leq 0.05$)
Moisture (%)	12.93	16.30	4.84	9.18	6.35	16.91	14.82	12.42	12.44	25.50	0.18
Crude protein (%)	6.76	10.69	12.24	6.83	12.25	10.4	6.86	12.17	12.33	6.27	0.21
Crude fat (%)	0.49	22.19	1.95	0.54	15.60	4.57	5.67	17.07	15.23	15.90	0.28
Crude fibre (%)	0.18	0.20	2.04	0.25	1.93	2.14	0.25	2.07	2.07	2.45	0.10
Total ash (%)	0.57	0.68	2.67	0.67	2.49	1.52	0.67	2.84	2.82	0.42	0.12
Total carbohydrates (g)	79.07	49.94	76.27	82.53	61.37	64.46	71.74	53.44	55.10	49.45	0.57

Sheera, with corresponding values of (82.53%), (76.27%), (71.74%), (64.46%), (61.37%), (55.10%), (53.44%), (49.94%), and (49.45%), respectively. Farzana and Mohajan [31] examined the nutritional characteristics of wheat products such as alsu ke laddu, coconut laddu, green gram laddu, groundnut gacchak, groundnut ke laddu, and sundh ke laddu. On a fresh weight basis, the maximum values for fat, crude fibre, energy, calcium, and iron were 29.85%, 1.23%, 480 kcal, 142 mg, and 23.95 mg, respectively. The ash content was comparable to the present study.

According to Agrahar-Murugkar and Subbulakshmi [32], the protein content of rice-based snacks ranged from 3.9 to 9.1%. Pumaloi, Jashulia, Pulum, Pusla, and Pukhleim, fried products, had fat contents ranging from 0.1 to 14.5%. Fiber content ranged from 0.1 to 1.4% in Jashulia, and minerals ranged from 0.4 to 1.4% in Pumaloi and Pusla, which is in accordance with the present research. Sharma *et al.* [33] observed that in ethnic foods made from cereals with or without pulses, protein content increased from 5.1 to 6.2 and thiamine content increased from 0.49 to 1.3 mg/100 g.

6. CONCLUSION

The current investigation was undertaken with the goals of documenting traditional cereal-based food recipes, their processes or preparations, and the nutritional evaluation of the selected food recipes. The current study concluded that traditional cereal-based recipes had higher nutritional value, along with sufficient quantities of minerals, vitamins, protein, and dietary fiber. Cereal-based fermented foods did possess health benefits, and these have been consumed by locals for decades. There is a need to document such food recipes, as they are missing the critical attention that they ought to receive. If we keep neglecting this major problem, our indigenous traditional knowledge of such food recipes will disappear earlier due to current food choices and shifting lifestyle patterns.

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This study does not involve experiments on animals or human subjects.

12. DATA AVAILABILITY STATEMENT

All the data is available with the authors and shall be provided upon request.

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