**Indigenous Nutritional Wisdom of Bundelkhand, Uttar Pradesh, India: A Sustainable Strategy for Addressing Malnutrition**

**Abstract**
Climate change poses a complex challenge to food and nutritional security, impacting human health, well-being, and sustainable development. Bundelkhand, a semi-arid region in Uttar Pradesh, faces acute malnutrition, with 40.2% of children under five stunted and 59.1% of women anaemic. This study explores indigenous nutritional practices, rooted in Indian Knowledge Systems (IKS), as a sustainable approach to mitigate malnutrition. Fieldwork in Jhansi, Chitrakoot, and Hamirpur districts documented 45 traditional food preparations, including millets (*Pennisetum glaucum, Echinochloa frumentacea*), pulses (*Cajanus cajan*), and wild greens (*Chenopodium album, Moringa oleifera*). Seventeen foods were analyzed for macronutrients (carbohydrates, proteins, fats) and micronutrients (iron, zinc, vitamin A, calcium) using standard methods. Nutritional analysis revealed high levels of iron, zinc, and vitamin A, essential for combating anaemia and stunting. Surveys (n=650) indicated 84% household reliance on these foods during lean seasons, despite challenges like habitat loss and cultural shifts. Integrating these practices into public health programs could enhance food security, aligning with global sustainability goals. Bundelkhand’s indigenous nutritional practices, rooted in IKS, offer a sustainable solution to malnutrition. Integrating these into public health, conserving biodiversity, and preserving knowledge can enhance food security. This study affirms IKS’s relevance for modern health challenges.

**Keywords:** Indian Knowledge Systems, Malnutrition, Millets, Wild Edibles, Food Security, Ethnobotany

**1. Introduction**

Climate change will continue to significantly impact agriculture, reflecting the close link between climate (temperature and precipitation in particular) and agricultural productivity. These effects are likely to have the greatest impact in the low-income countries of the tropical zones where agricultural productivity would decrease. Climate variability and change influence ecosystems, food security, health, and other domains fundamental to human existence and well-being (Das et al., 2025). Bundelkhand, encompassing seven districts in Uttar Pradesh, is characterised by drought, low agricultural productivity, and persistent malnutrition [1]. Bundelkhand region showed a higher prevalence of underweight and stunting as compared to the rest of Uttar Pradesh and Madhya Pradesh states. One out of three school aged children and one out of five adolescents were undernourished in the Bundelkhand. One out of four adults was suffering from chronic energy deficiency in this region. More than 80% of the population in Bundelkhand was suffering from anemia (Boiroju & K., V, 2018).  The National Family Health Survey-5 (NFHS-5) reports 40.2% stunting among children under five and 59.1% anaemia among women aged 15–49, driven by socioeconomic and environmental stressors [1]. Similar vulnerabilities are observed in nearby tribal communities, highlighting food insecurity and ecological constraints [2]. Modern interventions, such as Integrated Child Development Services (ICDS), face cultural and logistical barriers [3]. In contrast, indigenous nutritional practices, embedded in IKS, utilize drought-tolerant millets, pulses, and wild greens, offering a culturally resonant solution [4,5].

These practices, transmitted orally, include millet-based dishes (bajra roti, kodo porridge) and wild greens (bathua curry, kulfa salad), valued for nutrient density and ecological resilience [6,7]. They are interwoven with cultural traditions, such as postnatal care and festivals, fostering community resilience [8]. However, urbanization and deforestation threaten their continuity [9]. This study aims to: (1) document Bundelkhand’s traditional foods, (2) assess their nutritional contributions, and (3) explore their potential to combat malnutrition, bridging IKS with modern health strategies [10].

**2. Methodology**

2.1 Study Area

Research was conducted in Jhansi, Chitrakoot, and Hamirpur districts, selected for high malnutrition rates and rich IKS [11]. Jhansi features semi-arid plains, Chitrakoot includes forested hills with Kol and Gond tribes, and Hamirpur relies on rain-fed agriculture [12].

2.2 Data Collection

A mixed-methods approach integrated field surveys and nutritional analysis [13].

* Field Surveys: From November 2023 to August 2024, surveys, interviews, and focus group discussions (FGDs) engaged 650 households (~217 per district), targeting women (18–65 years), elders, and healers. Fifteen FGDs (5 per district) explored food preparation and cultural roles, using snowball sampling [14].
* Food Inventory: Forty-five traditional foods were catalogued, detailing ingredients and cultural uses. Wild plants were identified with the Botanical Survey of India, Lucknow [15].
* Nutritional Analysis: Seventeen foods were analysed for macronutrients (carbohydrates, proteins, fats) and micronutrients (iron, zinc, vitamin A, calcium) using standard methods [16]. Data were supplemented with Indian Food Composition Tables [6].
* Household Survey: A questionnaire, adapted from NFHS-5, assessed food consumption, reliance on traditional foods, and malnutrition indicators [1].

2.3 Data Analysis

* Quantitative: Nutritional and survey data were processed using SPSS v27 for descriptive statistics and chi-square tests [17].
* Qualitative: Interview and FGD transcripts were thematically coded using NVivo v12 [18].

**3. Results**

3.1 Traditional Food Systems

Forty-five traditional foods were documented, including staples, curries, porridges, snacks, and desserts (Table 1). These utilize millets (Pennisetum glaucum, Echinochloa frumentacea, Sorghum bicolor), pulses (Cajanus cajan, Vigna radiata), and wild greens (Chenopodium album, Moringa oleifera, Portulaca oleracea). Preparation methods (roasting, boiling, fermenting) preserve nutrients and align with cultural practices like postnatal care, weaning, and festivals (Holi, Diwali, Teej).

**Table 1: Selected Traditional Foods of Bundelkhand**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Food Item** | **Local Name** | **Ingredients** | **Preparation Method** | **Cultural Use** | **Seasonal Availability** |
| Kodo Porridge | Kodon ka Daliya | E. frumentacea, ghee | Boiled, seasoned | Postnatal diet | Monsoon–Winter |
| Bathua Curry | Bathua ka Saag | C. album, mustard oil | Steamed, spiced | Anaemia remedy | Winter |
| Bajra Flatbread | Bajra ki Roti | P. glaucum, water | Roasted | Staple food | Year-round |
| Purslane Salad | Kulfa ka Saag | P. oleracea, yogurt | Raw, mixed | Cooling food | Summer |
| Moringa Soup | Sanjna ka Soup | M. oleifera, pulses | Boiled | Child weaning | Year-round |
| Jowar Dessert | Jowar ki Kheer | S. bicolor, jaggery | Slow-cooked | Holifestival | Winter |
| Sanwa Pancake | Sanwa ki Tikka | E. crus-galli, spices | Fried batter | Snack (Teej)  | Monsoon |
| Arhar Dal | Arhar ki Dal | C. cajan, herbs | Boiled, tempered | Daily meal | Year-round |
| Kodo Sweet | Kodon ka Laddoo | E. frumentacea, nuts | Jaggery-bound | Diwali festival | Winter |
| Amaranth Porridge | Chauli ka Daliya | Amaranthus viridis , milk | Boiled | Infant nutrition | Monsoon |

Other foods include moong fritters, bajra khichdi, and sainjna pakoras, linked to rituals like chhathi (postnatal) and Karva Chauth [20].

3.2 Nutritional Profiles

Analysis revealed high micronutrient content (Table 2). Bathua curry provides 920 µg/100g vitamin A, exceeding children’s RDA, while kodo porridge offers 8.2 mg/100g iron [21,6].

**Table 2: Nutritional Composition of Key Foods (per 100g)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Food Item** | **Energy (kcal)** | **Protein (g)** | **Iron (mg)** | **Zinc (mg)** | **Vitamin A (µg)** | **Calcium (mg)** |
| Kodo Porridge | 355 | 10.5 | 8.2 | 2.6 | 55 | 38 |
| Bathua Curry | 125 | 4.8 | 6.4 | 1.9 | 920 | 215 |
| Bajra Flatbread | 365 | 11.2 | 5.2 | 3.2 | 25 | 45 |
| Purslane Salad | 90 | 3.5 | 3.8 | 1.4 | 700 | 120 |
| Moringa Soup | 145 | 6.2 | 4.0 | 1.6 | 410 | 190 |

3.3 Community Reliance and Cultural Role

Surveys (n=650) showed 84% of households consume traditional foods four times weekly, with 92% reliance during lean seasons (March–June) [22]. Women hold 70% of recipes, tied to health practices (e.g., moringa for weaning) [23]. Beliefs like bathua as a “blood cleanser” reinforce use [24]. Festival foods (jowar kheer, kodo laddoo) symbolize prosperity [25].

3.4 Challenges

* Habitat Loss: Deforestation reduces wild greens availability (72% of respondents) [26].
* Cultural Shifts: Youth prefer processed foods (45%, aged 18–30) [27].
* Knowledge Loss: Only 14% of households teach recipes to younger generations [28].
* Economic Barriers: 60% of farmers shift to cash crops due to low millet demand [29].

3.5 Malnutrition Patterns

Surveys aligned with NFHS-5, reporting 40.2% stunting and 59.1% anaemia [1]. High traditional food consumption (>5 times/week) correlated with lower anaemia (18% vs. 47%, χ²=16.78, p<0.01) and stunting (32% vs. 52%, p<0.05) [30].

**4. Discussion**

4.1 Nutritional Value

Traditional foods are nutrient-dense, with millets providing iron and zinc, and wild greens offering vitamin A and calcium [6,7]. These address anaemia and stunting, aligning with global indigenous food research [31]. Their drought tolerance suits Bundelkhand’s climate [32].

4.2 Cultural and Ecological Role

Foods like kodo porridge (postnatal) and jowar kheer (Holi) enhance cultural acceptability [33]. IKS integrates nutrition with ecology, using seasonal resources [34]. Deforestation threatens wild greens, requiring conservation [26].

4.3 Public Health Potential

Integrating traditional foods into ICDS could improve outcomes, as seen in millet programs elsewhere [35]. Community kitchens and seed banks could bolster food security [36,37].

4.4 Challenges and Solutions

Processed food preferences mirror global trends [27]. Knowledge loss demands documentation [28]. Solutions include:

* Conservation: Community forestry for wild greens [38].
* Education: IKS in curricula [39].
* Policy: Subsidies for millets [40].

4.5 Limitations

Nutritional data relied partly on secondary sources [6]. Longitudinal studies are needed [41].

**5. Conclusion**

Bundelkhand’s indigenous nutritional practices, rooted in IKS, offer a sustainable solution to malnutrition. Integrating these into public health, conserving biodiversity, and preserving knowledge can enhance food security. This study affirms IKS’s relevance for modern health challenges.

**Recommendations:**

The following recommendations should be adopted:

* Include traditional foods in ICDS [42].
* Establish seed banks [37].
* Promote recipes via campaigns [43].
* Subsidize millet farming [40].

Consent :

Informed consent was obtained, with findings shared with communities, per ICSSR guidelines

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Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc. have been used during the writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

1. **Checked grammatical errors in Grammarly only )**

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