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Enhancing Nutritional Security through Preservation of Traditional Food Systems : A Study on the Local Tribal Community in Jharkhand, India

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ABSTRACT

This study investigates the traditional food environment, consumption patterns, nutritional values, and the factors influencing the intake of indigenous foods (IFs) among the Munda tribal community in Ranchi district, Jharkhand, India. Utilizing a cross-sectional mixed-method approach, the research delves into the diverse types of food environments (wild, cultivated, and built) that the Munda people interact with, alongside the nutritional properties of the IFs they consume. Findings indicate a rich traditional ecological knowledge (TEK) surrounding IFs, although a significant portion remains underutilized due to socio-cultural and environmental challenges. The study highlights the importance of preserving traditional food systems and integrating formal and informal food literacy to enhance the nutritional well-being of the Munda community, amidst the challenges posed by climate change and modern agricultural practices.

Keywords : Indigenous Foods, Munda Community, Traditional Ecological Knowledge, Nutritional Value, Food Security, Climate Change, Agricultural Practices.

I. INTRODUCTION

Everything from production to processing, distribution, preparation, and consumption is a part of the food system (1). The food environment is the point of contact between the various parts of the food system and the people who use them to get food and eat it (2, 3). There are three distinct food habitats that individuals encounter: the natural, the cultivated, and the constructed (i.e., the market) (4). There is a correlation between people's dietary habits and the characteristics of the meals they eat in these settings (5). The second Sustainable Development Goal (SDG) aims to ensure that all people, particularly those who are nutritionally vulnerable, have access to enough food and nourishment, as well as to encourage sustainable agriculture.

(6). But because of the existing global food production and consumption patterns, accomplishing this aim is

fraught with uncertainty. As a whole, our food systems and the diets we eat aren't sustainable or nutritious, which affects our ability to reach SDG 2. The world's food systems are overburdened with the nutritional demands of an expanding population and have put a heavy burden on land, water, soil, and air, even if the food supplies are relatively stable and safe in quantity (7, 8). Sustainable food systems and nutritious eating are trending topics again in this setting (9).

Food systems that are sustainable strive to ensure everyone has access to nutritious food while also reducing their negative effects on the environment and boosting the economic and social well-being of all people, especially those at the bottom of the economic ladder (7). In addition to fostering environmental stability, these sustainable food systems are easily available, inexpensive, safe, and nutritious, with their roots in sustainable cultures and ecosystems (8, 10). Local foods, which are part of traditional food systems and eaten by Local people all across the globe, are also seen as sustainable since they come from natural ecosystems (11). Both farmed and wild foods, sourced from a variety of plant and animal species as well as fungus, have a wealth of traditional ecological knowledge that is integral to these food systems. In addition to being more resilient to climate change, floods, drought, and other extremes, Local food systems also make less use of resources, produce less waste, and use eco-friendly technology (12). Nutritionally dense Local foods that are part of these food systems may help reduce hunger and malnutrition (10, 13). In order to achieve SDG 2, sustainable diets should be sourced from Local food systems, which are based on spirituality and historical legacies that recognise the inseparable connection of people with their responsibly managed resources (7, 8).

Local peoples in India are exemplified by the country's tribal groups, who have preserved their own culinary practices and cultural practices (23). The eastern Indian state of Jharkhand is famous for its diversified agroforestry (24, 25), and 26.2% of the population identifies as Local tribal (26). The Mundas are the third most numerous tribal group in Jharkhand, and they live in the Chota Nagpur area (27). “Their traditional ecological knowledge (TEK) of obtaining and preparing meals from natural sources in traditional ways has been substantially preserved, and they live in areas that are surrounded by natural resources (28).” They cultivate just enough food to get by (29) and they also supplement their diet with wild edibles including fruits, vegetables, and tubers that grow in their area (28, 30). Even though the Munda community has access to a rich agroforestry, the poor nutrition outcomes are a result of variables such as geographical isolation, poverty, lack of formal education, and inadequate access to health care (31). There isn't a tonne of information on the nutritional health of Mundas, but what little there is shows that malnutrition is common, especially among children and women (32, 33). More over half of the Munda children in a cross-sectional survey were determined to be underweight (56%), with 29% classified as extremely underweight (32). Munda women seem to have low-quality diets, since their nutritional intakes are lower than those of Indian women, particularly when it comes to protein, calcium, vitamins A and C, and others (33). The goals of this research were to learn more about the Munda people of Jharkhand and their traditional eating habits, as well as to assess the nutritional content and traditional eating knowledge (TEK) of Local foods and the variables that affect their intake.

II. MATERIALS AND METHODS

Study Locale and Population

Ranchi district, Jharkhand, India, was the site of the research. Forty percent of the 2,535 sq. km (34) that make up the Ranchi district is forested and has irregular terrain (28). The Munda tribal group makes

up 61% of the district's total population of 531,885 (34). The investigation was purposefully limited to two geographically separate blocks of Ranchi, namely Murhu and Torpa (Figure 1). There is a disproportionately large Munda population in these two blocks, which are characterised by steep terrain with forest cover and plain fields. Eleven villages were chosen for the research from the Murhu and Torpa blocks using probability proportional to size sampling. The specifics of this selection process are detailed elsewhere (35). From this group of villages, nine of them underwent qualitative inquiries until theoretical saturation was reached, meaning no new information pertinent to the study issue could be derived (36).

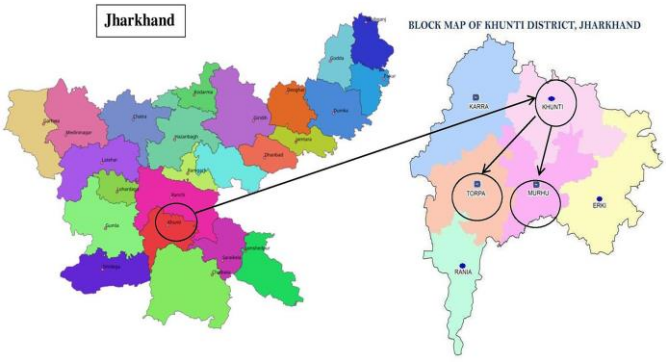
"Study Design

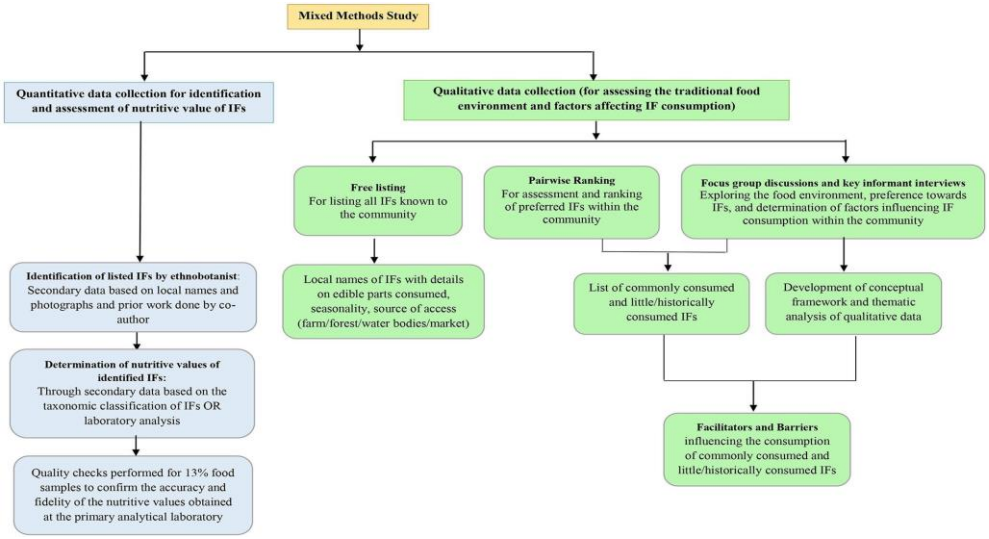
The traditional food environment of the Munda tribal community was investigated in a cross-sectional mixed-method study that utilised quantitative estimates and qualitative inquiries. The study aimed to identify the different types of food environments (wild, cultivated, and built) that the Munda people interact with, the Local foods (IFs) that they consume, their nutritional properties, and the factors that influence their consumption. As part of a larger research, this one examined the impact of IFs on food security and dietary variety among Jharkhandi tribal tribes, specifically looking at women and children (35). Multiple visits were made to capture the range of foods eaten over various seasons during the data collecting period of June 2021to January 2022."

Study Procedures

Qualitative and quantitative approaches were also used to gather data for the research. To improve data integrity and provide rich contextual information, researchers used a mixed-methods technique that allowed them to triangulate qualitative and quantitative data (37). Figure 2 provides a comprehensive flow diagram of the study's methodology.

"Key informant interviews and focus groups (FGDs) were used to conduct qualitative research. Using FGD and interview guides that had been piloted in three villages (not the study villages itself), a grand total of nine interviews and six focus groups were carried out in the nine study villages. By following the FGD guidelines, we were able to free-list all IFs that were known to the community," learn about their traditional agricultural practices, how they gathered food from places like woods and bodies of water, how they traded goods, what they typically ate, and how they interpreted IFs culturally. In order to determine how local food systems might be affected by climate change, researchers used questions from a tool that was created by Bioversity International and the Institute of Development Studies (38). Following the creation of a comprehensive, free list of all IFs known to the community, participants were asked additional questions to determine which IFs were popular and favoured, as opposed to those that were historically consumed or seldom used. To get further specifics on which IFs within a certain food group category people liked during a given season, we utilised a pairwise ranking algorithm (39). We also looked at how people felt about the elements that affected IF consumption, such as the reasons why certain IFs were used more often or less often (such as taste, accessibility, or production). Six key-informant interviews were also carried out to corroborate and compare the results, in response to specific questions and information gaps identified during FGD.





An ethnobotanist on the team with substantial experience in taxonomic categorization of Munda tribal cuisines (28, 30, 40-47) confirmed the listed IFs using common names and pictures. To determine the nutritional content of these IFs, we combed through secondary sources and the Indian food composition database (23, 40, 42-45). "A food testing laboratory certified with the National Accreditation Board for Testing and Calibration Laboratories (NABL) was tasked with analysing IFs sourced from field locations that did not have any secondary data on nutritional contents. Nutrient analysis was carried out in accordance with established reference protocols in conjunction with the NABL certified laboratory, and food sample collection was carried out following the standard methodology designed as part of the broader research (35). Vitamin A (in beta-carotene form), vitamin C, vitamin B1, vitamin B2, iron, calcium, zinc, folate, phosphorus, and dietary fibre were among the factors examined. There were 100 g of edible weight reported for the analyte readings. Supplementary Table 1 outlines the methodologies utilised for particular nutrients and provides the limit of quantification."

The primary research group was in charge of and oversaw all aspects of data collecting. Local field workers who were well-versed in the Mundari dialect and who were able to provide a hand with qualitative inquiries and food sample collection for nutritional analysis and identification were also an integral part of the study team. Two local field workers were instructed on the research goals and their duty as translators during the qualitative inquiries during a two-day training session prior to the focus group discussions (FGDs) and interviews. In addition, three employees received instruction on how to properly gather, package, and transport food samples from the field to the labs of the ethnobotanist and the food analysis lab.

Study Participants

Community health and nutrition workers (Anganwadi workers and Accredited Social Health Activists, ASHAs) and community leaders were among the many age groups represented in the FGDs, which were attended by men and women of all ages in the hamlet. Table 1 lists the demographic information of the study's participants, broken down by village, including their ages and genders. In order to ensure that all village residents were informed about the planned FGDs, the community health workers and village leaders were called in advance. The research participants were asked to think about additional people in their community who could have traditional knowledge about Local foods, how to get their hands on them, and what they eat as a means of sampling.

Table 1 Participant characteristics from the villages of Murhu and Torpa blocks in the Ranchi district of Jharkhand

Block	Study Village	Group Size	Gender and age group of respondents
Block 1: Muru	Charid	10	10 Adults (Women)
	Gangina	6	1 Elderly (Women), 5 adults (4 men and 1 Women)
	Burju	7	1 Elderly man, 4 adult men
	Kurki	11	1 elderly women, 10 adult women
Block 2: Torpa	Urikel	13	13 Adults (7 men and 6 women)
	Tati	17	15 Adults (8 men and 3 women), 2 elderly women
	Nichitpur	24	5 elderly (2 men and 3 women), 19 adults (10 men and 9 women)
	Jibilong	14	1 elderly men, 13 adults (6 men and 7 women)

Data Analysis"

The focus group discussions (FGDs) and interviews were filmed, transcribed, and translated from Mundari to Hindi and English. All of the IFs that are known to the community were compiled from the transcripts. Additionally, the meals were sorted into two groups: those with a high frequency of consumption and those with a lower frequency or lower historical consumption rate, according to the participants' inputs. For the purpose of determining which IFs to include in the preferred food list category, the data from the pairwise ranking was used. To do this, we scored and compared IFs within each dietary category. A list of IFs that are considered "good" and "rich" nutrient sources was prepared by documenting their nutritional content. "Good" and "rich" nutrition sources, respectively, were defined as foods with nutrient levels between 10% and 19% and 20% and 50% of the recommended dietary allowances (RDA) for adults in India per serving. We did this for IFs that are often used as well as those that are seldom used or have never been eaten. The content of the transcripts was coded using Atlas.ti version 8, and then theme analysis was employed for additional analysis (52). The data were coded using a deductive technique. Main themes and sub-themes linked to variables impacting IF intake were generated by merging comparable codes. The results of the qualitative research informed the development of a conceptual framework, the seven overarching themes of which shed light on the many elements that had an impact on the community's IF consumption.

III. RESULTS

Traditional Food Environment of Munda Tribal Community

With most homes eating two to three major meals a day, the population reported a regular diet that was mostly rice based. Green leafy vegetables (GLVs), roots, tubers, grains, and sometimes pulses and meat, poultry, eggs, or fish make up the bulk of most people's diets. Consumption includes both native and non-native kinds of rice, pulses, fruits, GLVs, roots, tubers, vegetables, and meat (further specific details on particular foods are provided in subsequent sections). People in this village don't often drink milk or anything made with milk. The neighbourhood

relies on small-scale subsistence farming and gets its food from a variety of sources, including those that are naturally occurring (such as farms, backyard gardens, and livestock), those that are man-made (such as informal markets and government food security programmes), and those that are in the immediate vicinity (such as forests, pastures, roadsides, wastelands, and local bodies of water). Domestic consumption accounts for the vast majority of agroforestry and livestock output, with the remaining excess being sold at local markets. Down below, we've gone into more depth about the food habitats and the particular IFs that may be accessible inside them.

Cultivated Food Environment

Among the Munda people, established agriculture is most common on one of three types of farmland: the low-lying Loyong, the middle-lying Badi, and the dry, rocky plain Godha. The first two types of farmland have the greatest water needs for crops, while the latter two types have lower ones. Farmland typically ranges in size from 1.5 to 3 Bigha, the customary unit of land measurement that is equal to 0.25 hectares. Native and hybrid rice, millets, and pulse types are widely grown (more information on this in the sections that follow). Nonetheless, hybrid cultivars account for a much greater share of reported land utilisation compared to Local types. Their backyard kitchen gardens, called Bakdi in the local dialect, are an extension of their farmlands; people cultivate a variety of vegetables, roots, and tubers there. Livestock including pigs, goats, and chickens are also raised by the community for the purpose of producing meat and eggs.

Wild Food Environment

Forests, bodies of water, and natural vegetation, such as fields and pastures, are all part of the village's wild food ecosystem that the community uses. The majority of the communities in the research said they would go to the forest for firewood and forest edibles. In addition to gathering firewood for domestic use, Local peoples gather a wide variety of fruits, vegetables, roots, tubers, and mushrooms (more on this in the sections that follow) for both personal use and sale at local markets. Additionally, it was said that the males of the hamlet would get together once a year to go hunting for food. During the monsoons in particular, people go to the local ponds, lakes, and rivers in search of native crustaceans, snails, and fish. Furthermore, weeds cultivated in fields, pastures, and wastelands are also gathered for ingestion.

"Built Food Environment

The weekly local informal marketplaces, or "Hatiya," are within a five- to ten-kilometer radius of the villages, and the community often visits them. Most people shop for cooking oil, spices, packaged groceries, and freshly made sweets and savoury at these neighbourhood markets. In addition to this, the community may find both Local and non-Local kinds of pulses, fruits, vegetables, roots, tubers, meat, and fish at the local markets (more on this in the next sections). Pulses (Munmuna, "Baturi dal": Vicia hirsuta), horse gramme ("Kulthi": Macrotyloma uniflorum) and vegetables (Cowpea, white, "Simbi": Lablab purpureus) and roots and tubers (Pechki, "Toti": Colocasia esculenta, "Jat sanga": Dioscorea alata) are some of the Local food varieties available in local markets. In addition to the weekly markets, the families in all the study villages also get subsidised food commodities (such as sugar, salt, rice, etc.) via the government's food security system, the Public Distribution System (PDS) (54). The Integrated Child Development Service (ICDS) provides supplemental nutrition to children under the age of six through Anganwadi centres, which are centres for maternal and child health and nutrition (55), and the Mid-Day Meal (MDM) programme, which is run by schools, provides cooked meals to students (56).

Local Foods of Munda Tribal

Community We invited the community to provide a list of all known IFs. After that, we looked for IFs that people often use as well as ones that are seldom used or have never been used before.

Types of IFs Based on Free Listing

A diverse list of 194 IFs was produced by the FGDs, which revealed a rich TEK within the community. The IFs included a variety of foods, including cereals (17.5%), pulses (3.6%), green leafy vegetables (GLVs) (29.2%), other vegetables (5.7%), roots and tubers (4.7%), fruits (7.8%), mushrooms (12%), meat (19%), and honey (19%). In Supplementary Table 2, all the IFs that were mentioned by the research participants are included, together with information on the plant parts that were ingested, where they are mostly sourced, and the season in which they are accessible.

Classification of IFs Based on Preference"

Of the 194 IFs that were reported, 87 (or 45%) were found to be eaten often, whereas 107 (or 55%) were either seldom used or consumed in the past. Seasonal preferences for individual IFs from the favourite food list category were further revealed using a pairwise ranking system that took into account criteria including flavour, availability, and the ease of production or gathering by the community. You may see several instances of Local rice and GLV rating and ranking in Figure 3. To clarify, a matrix was created on a flip chart by asking FGD participants to rank four or five Local rice types in order of preference. In this task, participants had to compare the row's top rice variety with each of the column's varieties in turn. For each succeeding variety of rice shown in the columns, this process was repeated. The number of times each rice variety was chosen was used to determine its score, which was then used to rank the varieties. In decreasing order, the ratings revealed comparative preferences for various types of rice, with the highest scoring variety ("Laldhan": Oryza sativa) ranking first. As a result, we were able to narrow down the most popular IFs across all cuisine categories. In Supplementary Table 2, you may find a comprehensive list of the most popular and less popular IFs, as well as a record of their consumption history.

Even though rice is the most common grain, other cereals such as maize, finger millet, pearl millet, sorghum, little millet, and jowar were brought up during the focus group discussions. There were about 29 different kinds of Local rice listed, but only 14 of them were said to be regularly eaten. Neither now nor in the past have millets been widely eaten. Fewer than half of the 57 GLVs reported are really eaten on a regular basis. While a total of 23 mushroom types were included, only 12 of those kinds are actually eaten on a regular basis. The same holds true for fruits; just seven out of fifteen are regularly eaten, and only around half of the roots and tubers are consumed. The typical diets only include one-third of the 37 animal products that have been documented.

Figure 4 provides a comprehensive record of all known IFs, including those that are favoured and those that are infrequently utilised or historically used. It also details the current state of their taxonomic categorization and an evaluation of their nutritional properties.

Taxonomic Classification

There were 156 IFs (80%) found using taxonomic categorization; of these, 80 (51% of the total) were foods that are often eaten, and 76 (49% of the total) were foods that are seldom or never eaten. In Supplementary Table 2, you may find information on the taxonomic classification.

FGD1

Rank	Indigenous varieties of rice	Scores
1	*Karnidhan*	3
2	*Arababa/Laldhan*	2
2	*Anthanawbeydhan*	2
2	*Jhilldhan*	2
3	*Songalpuridhan*	1

Rank	Indigenous varieties of GLVs	Scores
1	Beng saag *(Chokke ara)*	4
2	Drumstick leaves *(Munga ara)*	3
3	Koinaar leaves *(Sing ara)*	2
4	Amaranth leaves *(Leped ara)*	1
5	Katai saag *(Sarla ara)*	0

FGD2

Rank	Indigenous varieties of rice	Scores
1	*Arababa/Laldhan*	4
2	*Hesalxar*	2
2	*Pundi baba*	2
3	*Songalpuridhan*	1
3	*Anthanawbeydhan*	1

Rank	Indigenous varieties of GLVs	Scores
1	Koinaar leaves *(Sing ara)*	4
2	Water spinach *(Kalmi ara)*	3
3	Ponnaganni *(Garundi ara)*	2
4	Amaranth leaves *(Leped ara)*	1
5	Kauwa leaves *(Kauwa ara)*	0

FGD3

Rank	Indigenous varieties of rice	Scores
1	*Arababa/Laldhan*	4
2	*Lalhat*	3
3	*Munadhan*	2
4	*Godadhan*	1
5	*Karnidhan*	0

Rank	Indigenous varieties of GLVs	Scores
1	Beng saag *(Chokke ara)*	4
2	Phutkal leaves *(Phutkal ara)*	3
3	Koinaar leaves *(Sing ara)*	2
4	Ponnaganni *(Garundi ara)*	1
5	Kauwa leaves *(Kauwa ara)*	0

FIGURE 3. Pairwise ranking and scores to Local foods under different food groups. Note: GLVs, Green Leafy Vegetables.

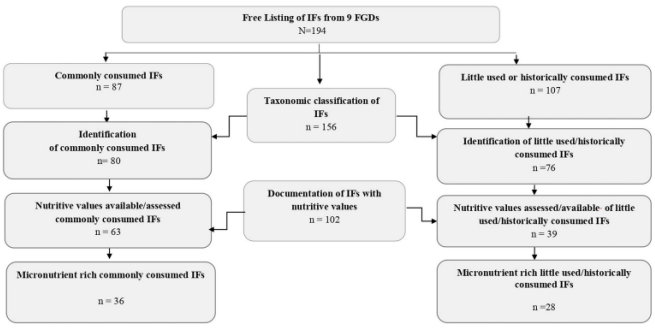


FIGURE 4. The systematic approach adopted to classify IFs available in the community.

Nutritive Values of Ifs"

The nutritional values of 102 IFs were recorded, with 63 of them being widely ingested and 39 being seldom utilised or historically used, according to the taxonomic categorization of IFs. Supplementary Table 3 shows that nutritive values for 60 of these IFs were derived from secondary sources, while the remaining 42 were evaluated in the lab as part of the research.

Table 2 shows that many IFs are excellent micronutrient sources. Finger millet (Kodde), an Local grain variety that isn't often eaten IF, has 364 mg of calcium per 100 g. Native pulses are abundant in a number of minerals and have a respectable amount of protein (ranging from 21.3 to 28.2 g/100 g). Take horse gramme (Kulthi), a popular pulse that is rich in both calcium (269 mg/100 g) and folate (163 µg/100 g) as an example. Pulses that aren't often eaten but are rich in micronutrients are worth eating. For instance, the rice bean, also known as "Sutri" (Vigna umbellata), has a lot of calcium (302 mg/100 g), a lot of folate (249 µg/100 g), and a lot of iron (17.1 mg/100 g) in Munmuna (Baturi dal).

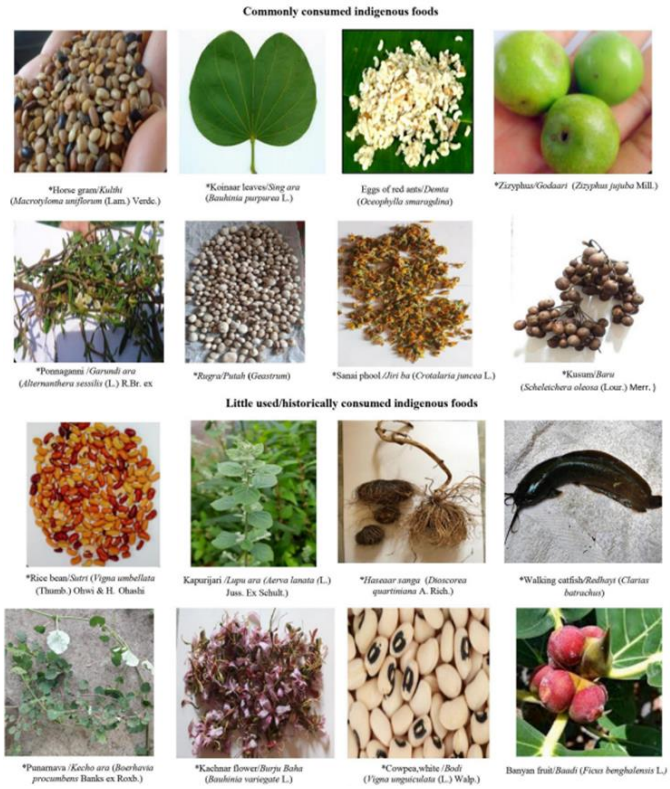


FIGURE 5. Local foods with high micronutrient content.

The vitamin A concentration of the GLVs was found to be high, ranging from 1015 to 21760 µg/100 g, with the underutilised GLV Kapurijari ("Lupu ara": Aerva lanata) having the highest level. The vitamin C content of the popular Ponnaganni leaves ("Garundi ara": Alternanthera sessilis) was discovered to be very high, at 103 mg/100g. Punarnava ("Kecho ara": Boerhavia procumbens) had the greatest calcium content among GLVs (877.9 mg/100 g), while Kantha leaves ("Kantha ara": Dentella repens) had the highest iron level (81.1 mg/100 g). Neither of these GLVs was widely eaten by the local population. Important for bone health, certain GLVs contain a calcium to phosphorus ratio of around 2:1. The flowers of Kachnar, also known as Bauhinia variegate, which is not often eaten, and Sanai, also known as Crotalaria juncea, which is eaten often, are abundant in calcium with 404.9 mg/100 g and vitamin A with 1113 µg/100 g, respectively. Of the roots and tubers studied, the underappreciated tapioca variety "Adel sanga" (Manihot esculents) had a high vitamin C content

(17.6 mg/100 g) and the dioscorea quartiniana variety "Haseaar sanga" had a high iron content (55.9 mg/100 g). Fruits like Banyan ("Baadi": Ficus benghalensis) and Marking nut ("Soso": Semecarpus anacardium) that aren't often eaten contain a lot of calcium (295-364 mg/100 g). Protein content was also shown to be quite high in marking nut (26.4 g/100 g). An abundance of vitamin A (6238 µg/100 g), calcium (134.8 mg/100 g), and iron (44.2 mg/100 g) were discovered in the fruit of Kusum ("Baru": Schleichera oleosa), which is normally eaten throughout the summer. Zizyphus jujuba, often known as Zizphus, has the highest vitamin C content (60.9 mg/100 g) and is commonly eaten in the winter. A common mushroom called "Rugra/Putuh" (Gestrum) has a high calcium content (193.4 mg/100 g), while an iron content of 10.8 mg/100 g was discovered in Gitilud (classified NA). The calcium content of most widely eaten meats ranged from 104 to 870 mg/100 g. Among the few meats eaten, walking catfish (Clarias batrachus), also known as "Redhayi," is rich in calcium (210 mg/100 g). In Figure 5, you can see some examples of Local foods that are rich in micronutrients.

Qualitative Enquires to Assess Factors Affecting IFs Consumption

More over half of the IFs reported during the free listing exercise were determined to be either historically eaten or seldom used, despite the high quantity of IFs (n = 194). An analysis of the qualitative data led to the development of a conceptual framework, which in turn uncovered a number of elements that had an impact on the community's IF consumption, either directly or indirectly (Figure 6). Factors that encouraged the use of IFs were called facilitators, while those that prevented their use were called obstacles.

Contributors to the Munda Tribal Community's Traditional Diet

Four main themes emerged from the focus groups regarding the factors that influence the consumption of IFs. Firstly, there is the fact that IFs have a pleasant taste, make people feel full, and have good nutritional value. Secondly, IFs can withstand changes in the weather, which increases their availability and productivity. Thirdly, traditional ways of preserving and preserving IFs encourage their inclusion in daily diets. Lastly, the cultural significance of IFs makes them suitable for use on special occasions.

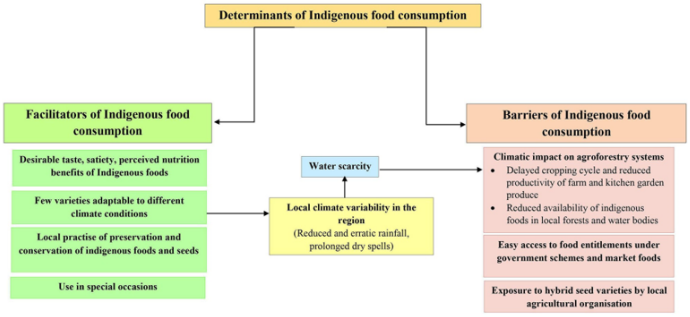


FIGURE 5. Factors influencing Local food consumption in Munda tribal community of Jharkhand, India

Appreciated Nutritional Value and Appealing Organoleptic Features of Ifs

People also thought the IFs were healthy, which contributed to their appealing organoleptic qualities, particularly when contrasted with hybrid crop kinds. Local rice varieties like Laldhan and Karnidhan, as well as GLVs (Amaranth leaves/Leped ara), are highly regarded for their nutritional value. "We get lot of strength when we consume Local foods and they help us to improve the blood production in our body" (Respondent number 1, male, study village 1, Torpa block, 21st June, 2021). This is according to the respondents.

The Capability of IFs to Withstand Climate Change

It is believed that IFs may adapt to changing temperature conditions, terrain, and soil, in addition to possessing excellent flavour and nutritional properties. Everyone in the town grew and ate various IFs that produce the same amount of food no matter the weather. Some of these types of Local rice—Laldhan, Reicibaba, Mansoridhan, Gitil baba, Dhusridhan, and Karangadhan—are resistant to drought and need less water than others. Black gramme ("Rambada/Urad": Vigna mungo) and horse gramme (Kulthi), two Local pulse types, are said to be economical to grow since

they need little in the way of additional inputs (chemical fertilisers) or labour. Consequently, these pulse crops are staples in the diets of almost all residents and are farmed by nearly every home. Some native pulses and rice varieties are said to have insect-resistant seeds as well. Even though the weather was terrible, members of the community nevertheless managed to reach several IFs that are found in the woods and other regions. Some examples of Local roots and tubers are Jat sanga, while GLVs include Katai, Phutkal, Garkha, Senna obtusifolia, Pot Cassia, and Mata.

Preservation & Conservation of Food and Seeds at the Community Level Among Residents

The community claimed that IF preservation and conservation was prevalent because to the meals' appealing taste and perceived nutritional advantages. Preserving delicious GLV types, fruits and vegetables that are only available at certain times of the year is the major focus of this local tradition. Various Local varieties of GLVs are preserved using traditional sun-drying methods. These include Phutkal ara, Koinaar ara, Chokke ara, Sweet potato ara, Garlic ara, and many more. You may make a curry with these sun-dried GLVs by rehydrating them in rice water (Maad) and then serving them over rice. Conversely, pickling techniques are used to preserve Local fruits such as "Dahu" (Artocarpus lakoocha), Ambada ("Amda": Spondias pinnata), and Zizyphus (Godaari). For an extra burst of flavour, try these fruit pickles with your main course.

The locals use a sun-drying method to preserve not just IF but also the native grains and pulse seeds. It is common practice to preserve these sun-dried seeds in bags, wrap them with Neem leaves, and utilise them in the following planting cycle.

Local Peoples' Obstacles to Eating Well

It was shown that 55% of IFs were underutilised in the community, even if there were multiple facilitators linked to IF consumption. Using our theoretical framework, we were able to isolate three major obstacles to IF consumption. Some of these factors include: (i) the influence of local climate on agroforestry systems, which reduces "IF production, availability, and consumption; (ii) the ease of access to foods bought from local marketsand/or provided through government food security programmes; and (iii) the promotion of high-yielding hybrid varieties by local agricultural organisations towards achieving food security."

Poor IF Production, Access, and Consumption as a Local Result of Climate Variability on Agroforestry

One of the key obstacles to the production and use of IF is the fluctuation of local climate. There is a brief rainy season followed by protracted dry seasons, according to the Munda community's reports of the unpredictable rainfall pattern. The community's agricultural practices have been greatly affected by these climate-change caused occurrences, since they rely largely on rain-fed agriculture. Acute water deficit for agricultural irrigation has emerged as a serious concern in the area as a result of insufficient rainfall, which has exacerbated water scarcity. Because of this, agricultural cycles have become later, and the yields of crops grown on farms and in kitchen gardens have decreased. "Our farming is totally dependent on rain water," is what one person said. If there is enough rain, our crops yield enough. If there isn't enough rain, our crops fail. (Male, participant 2, "from Study Village 1, Torpa Block, on June 21, 2021).

Earlier, people would grow a lot of crops in their farms and kitchen gardens, but now they grow fewer crops due to the water shortage, which has reduced crop diversity (Respondent number 4, male, study village 1, Torpa block, 21st June, 2021). While in the past the community's fields and kitchen gardens grew a variety of Local crops such millets, GLVs, and vegetables," rice farming has become the dominant crop in the last twenty years. "We are unable to cultivate crops at the right time due to less rainfall," one responder said. We were unable to cultivate a great deal of agricultural land last year because of a lack of water for irrigation purposes. According to Respondent 1, a female from

Study Village 4, Murhu Block, on June 22, 2021, the paddy crop output was likewise quite low.

Markets and food security programmes make it easy to buy non-Local foods.

Many locals are unable to sell or consume the farm's or forest's goods because of the effects of climate change on agroforestry. As a result, many in the community have turned to wage labour, taking jobs in factories, retail, hotels, etc., to supplement their income. The majority of the revenue from these occupations goes towards stocking up on non-Local pulses like green gramme and lentils, veggies like brinjal, cabbage, cauliflower, tomato, and onion, green leafy vegetables (GLVs) like spinach and bathua leaves, and tubers and roots like potatoes. Additionally, the tribal population may take use of the food distribution system (PDS), which provides them with non-Local rice (along with other basic commodities like wheat, sugar, and salt) at heavily discounted prices. Many individuals aren't getting enough IFs because they rely too much on meals bought from markets and food security programmes and don't have enough access to forest foods. A male respondent from Study Village 2, Torpa Block, said the following: "Since the farming yield has reduced, we need to do labour work to earn money so that we can buy food from the market and eat" (Respondent number 2, male, 23rd June, 2021).

Hybrid crop varieties are becoming more prevalent.

Changes to the Munda people's traditional subsistence farming techniques have resulted from poor crop yields linked to Local seeds and a focus on modern farming methods by local agricultural organisations. Therefore, local farmers are improving agricultural output by using chemical fertilisers and high-yielding hybrid seeds. Respondent 2 (male), from Study Village 2 in the Murhu Block, said, "Mainly hybrid paddy is being cultivated as compared to Local varieties because it gives twice or thrice more yields than Local varieties" (Respondent 2, 20th June, 2021).

IV. DISCUSSION

Members of the Munda tribe have TEK on a wide variety of IFs. Among them were several types of native rice, GLVs, meat, mushrooms, fruits, vegetables, pulses, and various roots and tubers. Farms, kitchen gardens, open fields, roadsides, wastelands, local bodies of water, and woods were the primary sources of IFs for the community. Fewer than half of the IFs were regularly ingested, even though they were known about. Despite this, researchers discovered that a number of often eaten and seldom utilised items were really rather good suppliers of micronutrients. Some socio-cultural and environmental elements were identified via investigations into the variables that encourage and those that discourage the intake of IFs.

The Munda people now live in rural areas where rice is grown and eaten as a main food source. Pearl millet, finger millet, small millet, and sorghum were all cultivated and eaten in the area in the past, according to the community. There is a general downward tendency in the consumption of different coarse grains and an upward trend in the consumption of a small variety of cereals across other tribal people in Jharkhand and India (23, 40, 57). It has been shown that the iron intake of the population has been significantly lowered due to the elimination of coarse cereals like millets from the typical Indian diet. This is especially true in states where rice has replaced coarse cereals (58). While certain Local rice types were still grown and consumed in our study community, hybrid kinds made up the majority of their production and consumption. Consistent with the general trend of paddy production in Jharkhand and among tribal tribes, this tribal community cultivates high-yielding hybrid rice types. According to the state's published statistics, traditional Local cultivars only account for around 13% of the overall rice output (59). Even when creating hybrid types with desired qualities, it is crucial to recognise the importance of preserving conventional pure lines. Jharkhand is not alone in seeing a rapid loss of

traditional varieties as a result of agricultural modernization in the nation. This could have consequences for the traditional farming methods of tribal communities, such as the Mundas, and ultimately lead to the loss of ancestral knowledge about how to preserve the seeds of these varieties (23, 57, 60-62). The ecological and social resilience of Local communities might be jeopardised as a result of this (20). Additionally, this research is in line with others conducted in the area that have shown certain native rice types to have a better nutritional value (63-65). Therefore, it is critical to protect the native variety that this Local group continues to grow, but on a smaller scale. To encourage and revitalise the production of Local varieties with improved and guaranteed yields, this community requires information and tools.

Even though the Mundas had a wealth of traditional edible knowledge (TEK) derived from natural foods, many of them were either not utilised very often or were eaten by them in the past. Munda and other tribal populations of Jharkhand have also shown similar contradictory results regarding knowledge of IFs and their low usage (23, 30, 57, 60).

The Munda people knew their IFs were the best because of their cultural, nutritional, agroecological, and flavorful qualities. Hence, it is essential to thoroughly investigate and record these elements, and to supplement informal food literacy with formal learning environments based on structured curricula. This will help future generations add value to these foods and consume them. The Local crop kinds that the group was growing were known to be resistant to climate change. Local farmers and locals may see the effects of climate change differently than the general public, but they are taking steps to adapt, according to the literature (71). It is well known that in order for modern agriculture to adapt to climate change, it would be necessary to preserve and introduce wild relatives of crops from the abundant "native" or Local biodiverse stocks that are maintained by Local peoples across the world (72). While many Local communities in India, like the Kondhs (who live in forest villages in the districts of Odisha, Koraput, Rayagada, and Kandhamal), are ignorant of the scientific basis of Local farming methods, they are successfully fighting climate change, preserving soil quality, and protecting biodiversity in their local areas (73). To protect their natural resources from sudden weather changes, the Adi people of Arunachal Pradesh use traditional agronomic, cultural, and harvesting practices; they also draw on their extensive knowledge of the region's biodiversity to access a wide variety of native plant and animal species (20, 74-78). From a nutritional and environmental perspective, it is concerning that IF availability is diminishing in other parts of Jharkhand as well (79, 80). Agricultural groups' push for high-yield paddy varieties and the availability of non-Local commercial goods on the market and in government food security programmes' mono-diets were both named as obstacles. In addition to reducing output, studies have shown that climatic uncertainty affects Local farmers' decisions about planting time, soil management, and the usage and distribution of a limited range of crop types (81, 82). To add insult to injury, major natural and climatic resources used in home processing methods for preserving and detoxifying local foods are themselves susceptible to climate change (81). Research has also shown that agricultural groups have a role in reducing IF usage and production (80, 83). Not only has agricultural productivity changed, but it is also well-documented that tribal people in Jharkhand now include non-Local market foods—often high in sugar, fat, and salt—into their daily meals (84). There has been a noticeable change in the diet of Local peoples in India and across the world, with a move away from nutrient-dense IFs and towards energy-dense meals (85-87). Local, resilient food systems in these areas may be impacted by changing tastes towards market foods, overreliance on PDS, and movement towards mono-cropping patterns, all of which may lead to lower consumption of nutrient rich IFs.

V. STUDY LIMITATIONS

Despite our best efforts, we were unable to conduct taxonomic categorization for all 102 IFs of the Munda community. This prevented us from documenting their nutritional values due to constraints around the seasonal availability and accessibility of certain items. In addition, although it is true that certain IFs are nutrient dense, it is critical to evaluate the toxicity levels and anti-nutritional elements in these meals. Still, more research within the study group may fill in these gaps.

VI. CONCLUSION

The Munda tribal community in Jharkhand, India, possesses a profound connection with their traditional food systems, underscored by a rich TEK and a reliance on a variety of indigenous foods for nutrition. However, the consumption of these nutrient-rich foods is hindered by environmental changes, shifting agricultural practices, and socio-economic factors leading to an increased reliance on non-local food sources. This study underscores the critical need to safeguard indigenous food systems and knowledge as pivotal components for nutritional security, environmental sustainability, and the preservation of cultural heritage within tribal communities. By promoting local food literacy and supporting adaptive agricultural practices, there is potential to enhance the resilience of traditional food systems against the backdrop of global environmental changes.

VII. REFERENCES

[1]. HLPE Report - Nutrition and Food Systems. Rome (2017).

[2]. Turner C, Aggarwal A, Walls H, Herforth A, Drewnowski A, Coates J, et al. Concepts and critical perspectives for food environment research: a global framework with implications for action in low- and middle- income countries. Glob Food Secur. (2018) 18:93–101. doi: 10.1016/j.gfs.2018.08.003

[3]. Lartey A, Hemrich G, Amoroso L, Remans R, Grace D, Albert JL, et al. Influencing food environments for healthy diets. In: Influencing Food Environments for Healthy Diets. Rome: Food And Agriculture Organization Of The United Nations (2022), 154.

[4]. Downs SM, Ahmed S, Fanzo J, Herforth A. Food environment typology: advancing an expanded definition, framework, and methodological approach for improved characterization of wild, cultivated, and built food environments toward sustainable diets. Foods. (2022) 9:532. doi: 10.3390/foods9040532

[5]. Swinburn B, Sacks G, Vandevijvere S, Kumanyika S, Lobstein T, Neal B, et al. INFORMAS (International network for food and obesity/non-communicable diseases research, monitoring and action support): overview and key principles. Obes Rev Off J Int Assoc Study Obes. (2013) 14 Suppl 1:1–12. doi: 10.1111/obr.12087

[6]. United Nation System Standing Committee on Nutrition. The Decade of Action on Nutrition 2016-2025. (2016). Available online at: https://www.unscn.org/en/topics/un-decade-of-action-on-nutrition (accessed February 11, 2022).

[7]. Fanzo J. Healthy and sustainable diets and food systems: the key to achieving sustainable development goal 2? Food Ethics. (2021) 4:159–74. doi: 10.1007/s41055-019-00052-6

[8]. Kuhnlein H, Eme P, de Larrinoa YF. Local food systems: contributions to sustainable food systems sustainable diets. In: Sustainable Diets: Linking Nutrition Food Systems, Burlingame S, Dernini Q, editor. (Wallingford: CABI), 64–78. doi: 10.1079/9781786392848.0064

[9]. Davis KF, Chhatre A, Rao ND, Singh D, Ghosh-Jerath S, Mridul A, et al. Assessing the sustainability of post-green revolution cereals in

India. Proc Natl Acad Sci USA. (2021) 116:25034–41. doi: 10.1073/pnas.1910935116

[10]. Burlingame B, Dernini S. Nutrition and Consumer Protection Division. Sustainable Diets and Biodiversity - Directions and Solutions for Policy Research and Action Proceedings of the International Scientific Symposium Biodiversity and Sustainable Diets United Against Hunger. Rome: Food and Agriculture Organization (2012).

[11]. Kuhnlein HV. Food system sustainability for health and well-being of Local Peoples. Public Health Nutr. (2015) 18:2415–24. doi: 10.1017/S1368980014002961

[12]. FAO. 5 Ways Local Peoples Are Helping the World Achieve #ZeroHunger. Food Agric Organ UN (2021) Available online at: http://www.fao.org/fao-stories/article/en/c/1203793/ (accessed November 3, 2021).

[13]. Frison EA, Cherfas J, Hodgkin T. Agricultural biodiversity is essential for a sustainable improvement in food and nutrition security. Sustainability. (2011) 3:238–53. doi: 10.3390/su3010238

[14]. IUCN Director General's Statement on International Day of the World's Local Peoples 2021. IUCN (2021) Available online at: https://www.iucn.org/news/secretariat/202108/iucn-director-generals-statement-international-day-worlds-indigenous-peoples-2021(accessed November 24, 2022).

[15]. Local Peoples. World Bank. (2021) Available online at: https://www.worldbank.org/en/topic/indigenouspeoples (accessed August 20, 2022).

[16]. Kattides MLM, Lima MGB. Changing food systems and implications for sustainable communities: Cyprus, Canada, and Brazil. Environ J. (2008) 36:45–59.

[17]. Shelef O, Weisberg PJ, Provenza FD. The value of native plants and local production in an era of global agriculture. Front Plant Sci. (2017) 8:2069. doi: 10.3389/fpls.2017.02069

[18]. Tshering K, Thapa L, Matsushima K, Minami M, Nemoto K. Edible wild plants of Bhutan and their contribution to food and nutrition security. In: Durst, P, Bayasgalanbat N, editor. Promotion of Underutilized Local food resources for food security and nutrition in Asia and the Pacific. Bangkok: Food and Agriculture Organization (2014), 60–7.

[19]. Kuhnlein HV, Erasmus B, Spigelski D. Local Peoples' Food Systems: the Many Dimensions of Culture, Diversity and Environment for Nutrition and Health. Rome: Food and Agriculture Organization of the United Nations (2009).

[20]. Singh RK, Kumar A, Singh A, Singhal P. Evidence that cultural food practices of Adi women in Arunachal Pradesh, India, improve social-ecological resilience: insights for sustainable development goals. Ecol Process. (2022) 9:29. doi: 10.1186/s13717-020-00232-x

[21]. Fanzo J, Bellows AL, Spiker ML, Thorne-Lyman AL, Bloem MW. The importance of food systems and the environment for nutrition. Am J Clin Nutr. (2022) 2022:1–10. doi: 10.1093/ajcn/nqaa313

[22]. Magni G. Local Knowledge and Implications for the Sustainable Development Agenda - UNESCO Digital Library. (2016) Available online at: https://unesdoc.unesco.org/ark:/48223/pf0000245623.

[23]. Ghosh-Jerath S, Singh A, Magsumbol MS, Kamboj P, Goldberg G. Exploring the potential of Local foods to address hidden hunger: nutritive value of Local foods of Santhal Tribal community of Jharkhand, India. J Hunger Environ Nutr. (2016) 11:548–68. doi: 10.1080/19320248.2016.1157545

[24]. Kumar A, Gautam RK, Singh A, Kumar V, Singh R, Bhullar GS, et al. Nutritional evaluation of

wild food plants and their contribution to dietary intake of Santhal tribal community of Jharkhand, India. J Food Sci Technol. (2021) 56:4853–62. doi: 10.1007/s13197-019-03922-1

[25]. Tsutsui T. Culture and nutrition: a methodological approach to the study of Local food habits. Curr Anthropol. (1989) 30:104–8. doi: 10.1086/203755