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Traditional food consumption pattern and nutritional status of Oraons: An Asian Indian indigenous community

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Introduction: Food consumption is an intensive social activity and can be considered a cultural artifact, reflecting the intricate process of sociocultural differentiation in shaping eating habits. Food has a positive effect on a person's health, physical performance, and state of mind. The nutritional composition of a person's diet plays a significant role in their overall health and development. Moreover, tribal cuisine is incomplete without a traditional drink. Rice beer, or *handia*, is one such indigenous alcoholic-fermented beverage that serves as a staple food.

Methods: This exploratory cross-sectional study was conducted from January, 2018 to December, 2020 to explore the traditional food practices of the Oraon community through a combination of one-to-one interviews, focus group discussions, and measurements. This study also involved the documentation of individual food recipes, from collection to preparation. To assess nutrient intake, we used a 24-h dietary recall method for 200 Oraon families comprising 466 adults and 193 children. Anthropometric measurements, such as body mass index (BMI) for adults and height-for-age and BMI-for-age z-score methods for children, recommended by the WHO, were taken and recorded using standard procedures. Additionally, the nutrient content of *handia* was analyzed.

Results: The mean (SD) height, weight, mid-upper arm circumference (MUAC), and BMI of the Oraon people were analyzed. The combined overall prevalence of chronic energy deficiency (CED) (BMI $<$ 18.5 kg/m^2) was 39% (37% in men and 40.3% in women). The prevalence of overweight and obesity (BMI $\geq$ 25.0 kg/m^2) was found to be 7.1% among only women. The average daily energy intake was calculated to be 2,290 kcal per capita. It is worth noting that the food and nutrient consumption of the Oraon tribe was largely consistent with the recommended daily allowances/intakes (RDA/RDI). The consumption of root and tuber products was particularly high. The Oraon tribe was found to have a familiar intake of animal protein in the form of meat, including common periwinkles (*Littorina littorea*). The study also discovered a remarkable array of unique, region-specific festive foods. The consumption of nutrient-rich fermented rice beer was especially noteworthy.

Conclusion: The present study provides insight into the traditional food practices of the Oraon tribe in West Bengal. It also highlights that their indigenous food consumption patterns have undergone significant changes as a result of admixture with other communities. To address these dietary issues, it is recommended that regional, need-based planning, and effective intervention programs be

implemented. To ensure the proper maintenance of the Oraon tribe's traditional food practices, the cultivation of kitchen gardens and the domestication of wild, edible plants, such as seeds and tubers, may be helpful. Moreover, promoting the consumption of macronutrient-fortified *handia,* an indigenous beverage with high medicinal benefits, could be effective in combating hidden hunger among adults.

KEYWORDS

Oraon, tribe, traditional, food, nutrition, *handia*, West Bengal

Introduction

Food consumption is an intensive social activity and can be considered a cultural artifact, reflecting the intricate process of sociocultural differentiation in shaping eating habits. Food has a positive effect on a person's health, physical performance, and state of mind. The nutritional composition of a person's diet plays a significant role in their overall health and development. When all nutrients are consumed in the appropriate proportion required by the body, it is known as "good" or "optimum" nutrition, which helps to maintain good health.

However, malnutrition, that is, undernourishment, micronutrient deficiencies, and obesity, is a result of an ongoing nutrition transition and poses a significant threat to public health (Pinstrup-Andersen, 2007; von Grebmer et al., 2014). Thus, studying food and eating habits is important as food plays a fundamental role in human survival.

Tribal communities are closely connected to nature and its resources, and this connection is reflected in their simple and respectful approach to food.

The same reverence is reflected in their cuisine; tribal communities consider their food sacred. Tribal cuisine is not only interesting but also nutritious and well-balanced. Tribal food systems are an integral part of their cultural heritage and traditions. Food is an important part of their identity and culture. It reflects the geography to which they belong and the locally available resources used in their cuisine.

The dietary patterns of the tribes in India living in various regions and agro-climatic conditions may vary greatly due to their secluded lifestyles, food habits, dietary practices, and attitudes toward food. Beliefs, customs, and traditions influence the general pattern of living in any community. It is well known that the geological composition of the soil determines the occurrence of local flora, cropping patterns, and the associated agricultural practices in a given area. Knowledge of the food resources available to humans has been crucial in allowing them to survive in adverse conditions.

As per the 2011 census, the total scheduled tribes in India make up 8.6% of the country's total population. The census records 705 different tribes, with 75 of them designated as particularly vulnerable tribal groups (PVTGs). West Bengal is the 9th-most highly populated state in India by tribes, accounting for 5.1% of the country's tribal population. Approximately 5.8% of the state's total population of 9.13 crores includes scheduled tribes (Bisai et al., 2014). In West Bengal, the total population of the Oraon tribe is 643,510, of which 322,933 are men and 320,577 are women. The sex ratio of the Oraon community is 993 women per 1,000 men. The literacy rate in the Oraon community is 59.0%. This rate is higher for men, at 68.1%, compared to that of women, which is 49.9% (Dutta and Bisai, 2020). The population of Oraon people has grown by 4.27% in the decade between 2001 and 2011. The Oraon tribe is a Dravidian-speaking agricultural community from Chhota Nagpur. They have their own language, Kurukh, and follow strict marriage customs that involve clan exogamy and tribe endogamy. The Oraon tribe practices strict exogamy within their clans and endogamy within the tribe. They have a rich cultural heritage and a multitude of exogamous septs such as Ikka, Minz, Kujur, Bura, Turkey, Beck, Khess, Bandh, Bakura, Bahula, Khakha, Tigga, Toppo, Lakra, Bakhla, Bando, Bara, Barwa or Khoea, Kerketta, Khalko, Kindo, Kispota, Munjini, Pana, and Runda, each with a unique totem that serves as a symbol of identity and is considered taboo by its members. With the aim of preserving the flavors of ingredients, they cook with very few spices and consume food that is mostly raw, semi-cooked, roasted, or fermented. Additionally, many members of the Oraon tribe have diversified into other occupations, including trade and commerce, and some have taken up professional jobs. However, agriculture remains a significant part of their livelihood and is deeply intertwined with their cultural identity. They consume non-vegetarian diet. Rice is their staple food, while mutton, fowl, fish, and eggs are eaten with great pleasure. They also consume some locally available pulses, green leafy vegetables, and vegetables with rice. Tea has gained popularity as a beverage. Haria (in Bengali) or Handia (in Hindi) plays an important role in its consumption in everyday life and on different occasions. Handia is prepared from parboiled rice and a mixture of fermented inoculums called *Ranu* or *Bakhor*. Geographical variations may create a distinction in the nutritional value of this fermented brew. In view of the above, the present study was undertaken to examine the impact of traditional food patterns on the nutritional health of the Oraon tribe, the second-largest tribal community in West Bengal, India.

Materials and methods

This exploratory cross-sectional study was conducted in six districts of West Bengal: Birbhum, Dakshin Dinajpur, Jalpaiguri (undivided), North 24 Parganas, Purulia, and Paschim Medinipur.

Abbreviations: BMI, body mass index; CED, chronic energy deficiency; CU, consumption unit; MUAC, mid-upper arm circumference; PC, per capita; PVTGs, particularly vulnerable tribal groups; RDA, recommended dietary allowance; RDI, recommended dietary intake; and GLV, green leafy vegetable.

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TABLE 1 List of common food items consumed by Oraon people of West Bengal.

Food group	English name	Scientific name	Kurukh/ Oraon term	Seasonality	Food intake type
Cereal/grain	African Millet	*Eleusine coracana*	Kodai	All season	Process
	Barley	*Hordeum vulgare*	Yab	All season	Process
	Khoi	*Oryza sativa*	Irika	All season	Fry
	Maize or Corn	*Zea mays*	Jinhor	Rainy	Process
	Puffed rice/Muri	*Oryza sativa*	Irika tixil/Murhi	All season	Process
	Rice	*Oryza sativa*	Tixil	All season	Process
	Rice flacks	*Oryza sativa*	Chepte, Alkhara	All season	Process, Non-process
	Sorghum/Jorar	*Sorghum bicolor*	Jowar	All season	Process
	Semolina	*Triticum turgidum*	Adar	All Season	Process
	Tapioca seeds	*Manihot esculenta*	Sabugota	All season	Process
	Vermicelli	*Vermicellini*	Sewai	All season	Process
	Wheat flour (refined)	*Triticum aestivum*	Gohom gunda	All Season	Process
	Wheat flour (whole)	*Triticum aestivum*	Gohom gunda	All season	Process
Pulses	Arher Dal	*Cajanus cajan*	Rahri	All season	Process
	Bengal gram whole	*Cicer arietinum*	Boot	All season	Process, Non-process
	Bengal gram	*Cicer arietinum*	Boot	All season	Process
	Besan (Gram flour)	-	Boot gunda	All season	Process
	Black gram (whole)	*Vigna mungo*	Maasi	All season	Process
	Field bean seeds	*Vicia faba*	Beangota	Winter	Process
	Green gram	*Vigna radiata*	Hariyar boot	All season	Process
	Khesari Dal	*Lathyrus sativus*	Khesari daali	All season	Process
	Lentils	*Lens esculenta*	Kensa	All season	Process
	Soyabean	*Glycine max Merr.*	Seya	All season	Process
Vegetables	Bamboo	*Bambusoideae*	Bans	All season	Process
	Beet	*Beta vulgaris*	Xenso murai	Winter	Process, Non process
	Bitter gourd	*Momordica charantia*	Karela	All season	Process
	Bottle gourd	*Lagenaria siceraria*	Lauwa	Winter	Process
	Brinjal	*Solanum melongena*	Bhetango	All season	Process
	Broad beans	*Vicia faba*	Simbi	Winter	Process
	Capsicum	*Capsicum annum*	Kapsikam	Winter	Process
	Carrot	*Daucus carota*	Xenso murai gajar	Winter	Process, Non-process
	Cauliflower	*Brassica oleracea var. botrytis*	Kubi	Winter	Process
	Colocasia stem	*Colocasia esculenta*	Kisgo/Pechki donre	Rainy	Process
	Cow Peapods	*Vigna unguiculata*	Oye batar choppa	Rainy	Process
	Cucumber	*Cucumis sativas*	Palxanja	Rainy, Winter	Non process
	Drums stick	*Moringa oleifera*	Munga donrey	Rainy	Process
	Drums stick flower	*Moringa oleifera*	Munga poomp	Rainy, Winter	Process
	Elephant foot yam	*Amorphophallus paeoniifolius*	Koha sakhin	All season	Process
	French Beans	*Phaseolus vulgaris*	Kat simbi	Winter	Process
	Jack fruits seeds	*Artocarpus heterophyllus*	Kathar kowa	Summer	Process

(Continued)

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TABLE 1 (Continued)

Food group	English name	Scientific name	Kurukh/ Oraon term	Seasonality	Food intake type
	Jack fruits Tender	*Artocarpus heterophyllus*	Kathar (bolo)	Summer	Process
	Ladies Finger	*Abelmoschus esculenta*	Bhrewa	Summer, Rain	Process
	Lotus stem	*Nelumbo nucifera*	Purni donrey	On collection	Process
	Mango green	*Mangifera indica*	Tatxa (xeyna)	Summer	Process, Non process
	Mushroom	*Agaricusbisporus*	Oosa	Rainy	Process
	Onion	*Allium cepa*	Peyanch	All Season	Process, Non-process
	Papaya green	*Carica papaya*	Papita (xeyna)	All season	Process
	Parwar	*Trichosanthes dioica*	Parwal	Winter	Process
	Plantain Flower	*Plantago major*	Kera poomp	On collection	Process
	Pea green	*Pisum sativum*	Hariyar batar	Winter	Process
	Plantain Green	*Plantago major*	Kera (hariyar/xeyna)	On collection	Process
	Plantain Stem	*Plantago major*	Kera xosga	On collection	Process
	Potato	*Solanum tuberosum*	Aluwa	All season	Process
	Pumpkin	*Cucurbita moschata*	Tumba/Konhra	All season	Process
	Radish	*Raphanus sativus*	Rasri, Nasri	Winter	Process, Non-process
	Ridge Gourd	*Luffa*	Konhra	Rainy	Process
	Snake Gourd	*Trichosanthescucumerina*	Chihnga	All season	Process
	Spinney yam	*Diascorea esculenta*	Kisgo, aru	All season	Process
	Sweet Potato	*Ipomoea batatas*	Sakar kanda	All season, winter	Process
	Tomato	*Solanum lycopersicum*	Bilaichi/Bhejri	All season	Process, Non-process
	Turnip	*Brassica rapa*	Salgam	Winter	Process
	Yam	*Dioscorea*	Pechki	Rainy	Process
Leafy vegetables	Amaranth	*Amaranthus virdis*	Arkha	Rainy	Process
	Bathua Leaves	*Chenopodium album*	Puchchhu arxa	Rainy	Process
	Bottle gourd Leaves	*Lagenaria siceraria*	Tumba arxa	Rainy	Process
	Cabbage	*Brassica oleracea var. capitata*	Atxa kubi	Winter	Process
	Cauliflower leaves	*Brassica oleracea*	Pomp kubi	Winter	Process
	Colocosia Leaves	*Colocasia esculenta*	Kisgo/ Pichke atxa	Rainy	Process
	Coriander Leaves	*Coriander sativum*	Dhaniya atxa	Rainy	Process
	Fenugreek Leaves	*Tribonellafoenum-graecum*	Methi arkha	Winter	Process
	Mustard Leaves	*Brassica juncea*	Mani arxa	Rainy	Process
	Pumpkin Leaves	*Cucurbita moschata*	Tumba arxa	Rainy	Process
	Radish Leaves	*Raphanus sativus*	Murai arxa	Rainy	Process
	Spinach	*Spinacia oleracea*	Palak arxa	Rainy	Process
	Susni Sag	*Marsilea quadrifolia Linn*	Suinsuin arxa	Rainy	Process
	Turnip Greens	*Brassica rapa*	Gutand murai arxa	Rainy	Process
	Tea Flower	*Camellia sinensis*	Chah poomp	Winter	Process
	Bata	*Labeobata*	Padaru injo	All season	Process
	Chingri	*Dendrobranchiate*	Choppo	All season	Process
	Crab	*Brachyura*	Kakro	All season	Process
	Hilsa	*Tenualosailisha*	Hilsa	Rainy	Process

(Continued)

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TABLE 1 (Continued)

Food group	English name	Scientific name	Kurukh/ Oraon term	Seasonality	Food intake type
Fish	Katla	*Catlacatla*	Koha jhila injo	All season	Process
	Khoyra	*Sardine*	Khiira	All season	Process
	Koi	*Cyprinus rubrofuscus*	Kusma	All season	Process
	Koocha Machli	-	Chanachka injo	All season	Process
	Lata	*Channa punctatus*	Leta	All season	Process
	Mackrel	*Scomberscombrus*	Gujali	All season	Process
	Magur	*Clariasbatrachus*	Maigra	All season	Process
	Mrigal	*Cirrhinuscirrhosus*	Koha xensoxann injo	All season	Process
	Pabda	*Ompokbimaculatus*	Choyen Malka injo	All season	Process
	Pangas	*Pangasius*	Pengas	All season	Process
	Pomfrets	*Bramidae*	Pomfret	All season	Process
	Puti	*Puntius sophore*	Puthi	All season	Process
	Rohu	*Labeorohita*	Bilchina injo	All season	Process
	Singhi	*Heteropneustesfossilis*	Maigra	All season	Process
	Sole	*Soleasolea*	Chhuddi	All season	Process
	Sorputi	*Puntius*	Koha puthi	All season	Process
	Tapsi	*Polynemusparadiseus*	Tatxa injo	All season	Process
	Telapia	*Oreochromis niloticus*	Isung injo	All season	Process
	Tengra	*Sperataseenghala*	Tengra	All season	Process
Meat	Beef	*Bos taurus*	Addo ahra	All season	Process
	Chicken	*Gallus gallusdomesticus*	Xeyr ahra	All season	Process
	Duck meat	*Anatidae*	Gerey ahra	All season	Process
	Egg	*Gallus gallus*	Bee	All season	Process
	Goat	*Capra aegagrus hircus*	Eyra	All season	Process
	Monitor lizard	*Varanus*	Guinh tetenga	On hunting	Process
	Pork	*Sus scrofa domesticus*	Kiss ahra	All season	Process
	Rabbit	*Oryctolagus cuniculus*	Kharha, muyan	All season	Process
	Snail/periwinkles	*Littorina littorea*	Ghonghi	On collection	Process
Milk	Cow Milk	*Bos taurus*	Oye dudhi	All season	Process
	Milk Powder	-	Paudardudhi	All season	Process
Spices	Black Mustard	*Brassica nigra*	Lutni/moxaaro mani	All season	Process
	Black pepper	*Piper nigrum*	Moxaaro maircha	All season	Process
	Cardamom	*Elettaria cardamomum*	Jira	All season	Process
	Clove	*Syzygiumaromaticum*	Lawang	All season	Process
	Coriander	*Coriander sativum*	Dhaniya	All season	Process
	Dry chili	*Capsicum annuum*	Xaika maircha	All season	Process
	Fennel	*Foeniculum vulgare*	Ond kita gahi xoppa	All season	Non process
	Garlic	*Allium sativum*	Rasri	All season	Process
	Ginger	*Zingiber officinale*	Adxi	All season	Process
	Myrobalan	*Terminalia chebula*	aonra	All season	Process
	Turmeric	*Curcuma longa*	Baalka	All season	Process

(Continued)

TABLE 1 (Continued)

Food group	English name	Scientific name	Kurukh/ Oraon term	Seasonality	Food intake type
Sugar	Honey	*Apis cerana indica*	Tiini	All season	Non process
	Jaggery	-	Gulley	Winter	Non process
	Sugars	-	Chini	All season	Process
Beverage	Handia	-	Jharaa, boryey	All season	Process (Fermented)
	Tea	*Camellia sinesis*	Chahamm	All season	Process

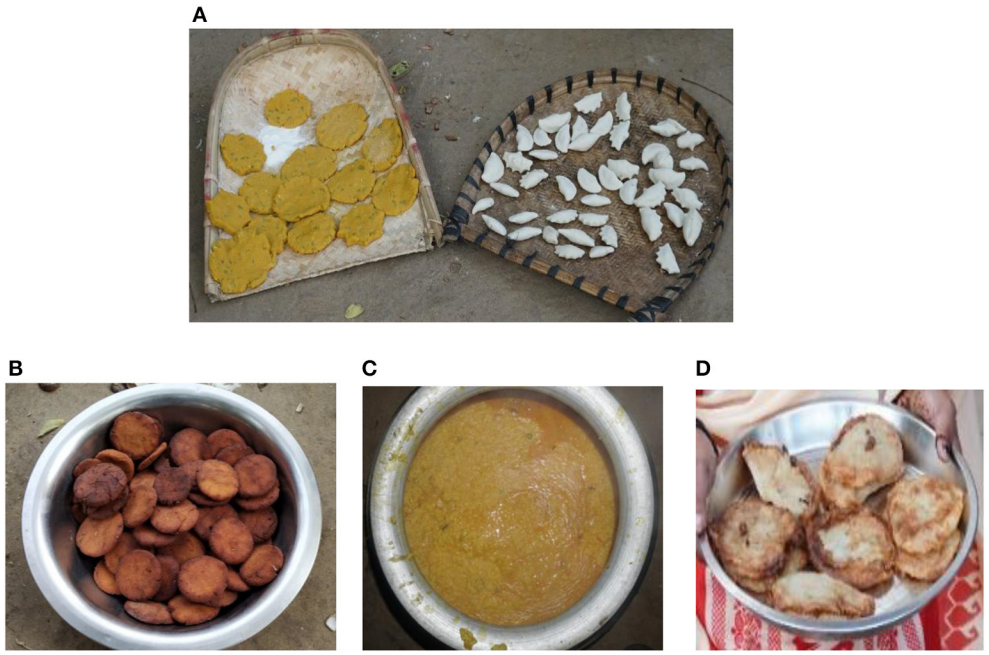

FIGURE 1
Festive foods: **(A)** Different types of *pitha (cake).* **(B)** Gur-pitha. **(C)** Bhog is made for god. **(D)** Aske-pitha.

The tribal villages in these districts were strategically selected based on their high concentration of Oraon communities, as well as their diverse geographical settlements and variations. This study aimed to document the role of indigenous foods in promoting good nutrition and balanced eating habits among the Oraon tribal community in West Bengal. Fieldwork for this study was carried out from January, 2018 to December, 2020. To accurately compare the CED between men and women in the studied community, the minimum sample size was calculated using a standard formula:

$$n = \frac{2 \times \overline{p}\left(100 - \overline{p}\right) \times \left(Z_{\alpha} + Z_{\beta}\right)^2}{\left(p1 - p2\right)^2}$$

The prevalence of CED among men and women was 47% and 31%, respectively (Mittal and Srivastava, 2006). With a 95% confidence interval and 80% power, a minimum estimated sample size was 146 from each group. Therefore, a total of 200 households were selected through a simple random sampling method for food analysis and assessment of nutritional status. Anthropometric data were collected from 466 adults (men = 203 and women = 233) and 193 children. Informed consent was obtained from all the participants before data collection. All data were collected by trained investigators.

Primary data on commonly consumed Indigenous food items were collected through interviews with a pre-validated questionnaire and focus group discussions. The questionnaire underwent a pilot survey before the main study was conducted to ensure its accuracy and effectiveness (Bisai and Dutta, 2021a). These data were used to assess the extent of food options available to the Oraon community and evaluate the significance of wild, indigenous foods in their regular diets. The 24-h dietary recall method was used to collect data on food and nutrient consumption. The tribal households were contacted through their respective district administrations. Most of the respondents were homemakers with extensive knowledge and experience in food preparation techniques. All recipes were collected through audio-visual methods while the female member of the household was cooking food.

The food item information was recorded by its most common English name, its availability during certain seasons, and how it was consumed. The items were grouped together based on their edible part, providing an organized description. The nutritional value of each food item was determined using the method outlined by Gopalan et al. (1989).

The total carbohydrate content of *handia* was determined using the Anthrone method (Yemm and Willis, 1954). The level of glucose was estimated using the standard biochemical method: the DNS method (Lv et al., 2021). Protein content was estimated using Lowry's method (Ledoux and Lamy, 1986). Moreover, fat content was quantified using the standard extraction-titration method (Frankel and Tarassuk, 1955). The level of alcohol was determined according to the colorimetric method described by Sumbhate et al. (2012). All the chemicals used in this experiment—Anthrone, DNS, Folin–Ciocalteu reagent, and others—were of analytical grade and purchased from Himedia and SRL in India. Distilled water was used in all the experiments. The instruments used in the study were a microprocessor-based UV-VIS double-beam spectrophotometer (model LI-2700) and a μP photocolorimeter (S. No. 17010015), both of which were purchased from Haryana, India.

Anthropometric characteristics such as height, weight, and mid-upper arm circumference (MUAC) were measured using standard methods (Lohman et al., 1988). The research personnel underwent comprehensive training to ensure accurate measurement techniques were used as part of the multi-pass strategy. Adult nutritional status was assessed using the BMI cutoffs recognized internationally (WHO., 1995). The children's nutritional status was evaluated using height-for-age and body mass index-for-age z-scores, calculated using the WHO Anthro-Plus software. Stunting and thinness were classified as Z-score values less than the −2 standard deviation of the reference median. All statistical analyses were performed using SPSS and MedCalc software. A p-value of <0.05 was considered statistically significant.

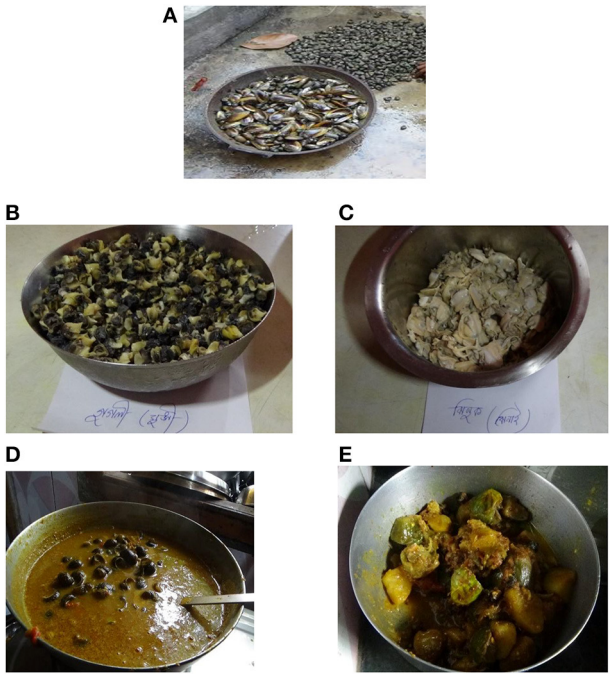

FIGURE 2
Protein rich foods: **(A)** The *Ghungi* (Common Periwinkles). **(B, C)** Meat of periwinkles. **(D, E)** Common periwinkles being cooked in a different way.

FIGURE 3
Seasonal foods: **(A)** Cooked tea flower. **(B)** Raw (preserved) tea flower.

Results

The food practices of indigenous communities, such as the Oraon tribe, are characterized by their rich cultural traditions and the utilization of locally available resources and techniques. The population under study also displays their unique dietary patterns in various geographical locations. While the food values of many indigenous foods, such as plants, insects, and fungi, have been explored (DeFoliart, 1992; Boa, 2004; Kuhnlein et al., 2009; Rathode, 2009), there is still a lack of research on the nutrient intake pattern of the tribes in India. The present study aimed to explore the food habits of the Oraon tribal community, particularly with respect to their varied geographical habitat, use of, nutritional value, and traditional knowledge of indigenous foods.

A list of commonly consumed food items by the Oraons is presented in Table 1. The dietary practices of the Oraon community, which resides in a diverse ecological area, are mentioned in the following text. Data on the recipes were gathered from the interviews and recorded as part of the documentation process.

The Oraon community of the Purulia district cohabits with other communities, leading to significant changes in their eating habits. Rice is the staple food for the Oraon community. They generally obtain vegetables from nearby markets. Due to the rocky terrain of the adjacent hills, they are unable to collect any wild food. They only collect the *jeerhol* flower in March and April and consume it on the day of their *nabanna* festival. They eat *khichdi* on the day of their *Sarul puja*, a seasonal festival. The Oraon tribe residing in Paschim Medinipur has a history of migration from the Chhota Nagpur region dating back several generations. They refer to themselves as the heirs of those who helped Lord Rama fight Ravana. They celebrate *Goyal puja* (worshiping the cowshed) in *Kartik* (from October to November). They prepare a special dish made from *Dhoan moong dal* (yellow lentils) and chicken that has been offered as a sacrifice at the cowshed. On the same day, they prepare a dish called *khichdi* with rice and biri dal, which they offer to the cow after worshiping it (except for

TABLE 2 Anthropometric characteristics of adults Oraons of West Bengal.

Anthropometry	Sex	*n*	Mean	SD	*t*-value
Height (cm)	Men	203	160.6	6.5	18.611
	Women	263	149.5	6.3	$P < 0.001$
Weight (kg)	Men	203	50.5	7.9	8.075
	Women	263	44.2	8.5	$P < 0.001$
MUAC (cm)	Men	203	25.5	2.8	6.934
	Women	263	23.6	3.1	$P < 0.001$
BMI (kg/m2)	Men	203	19.5	2.7	0.791
	Women	263	19.8	3.6	$P > 0.05$

TABLE 3 Nutritional status based on BMI (WHO., 1995) of adult Oraons of West Bengal.

Nutritional status	Men	Women	Total
CED Grade-III	14 (6.9)	26 (9.9)	40 (8.6)
CED Grade-II	20 (9.9)	35 (13.3)	55 (11.8)
CED Grade-I	41 (20.2)	45 (17.1)	86 (18.5)
Normal	120 (59.1)	132 (50.2)	252 (54.1)
Overweight	8 (3.9)	23 (8.7)	33 (6.7)
Obese	0	2 (0.8)	2 (0.4)
Total	203	263	466

pregnant cows). During the *Agrahan–Poush* months (November to January), when the new harvest is brought into their homes, they celebrate the *nabanna* festival with different types of *pitha* (rice cake), especially *mangshopitha* (made from rice powder and chicken) (Figure 1A). On the last day of *Poush* month (mid-January), they celebrate *Poush Sankranti*. They make *poushkush* or *pooshladdu* with rice powder and fill them with coconut crumbs, sesame, ginger, jaggery, or sugar. On the occasion of *Rash Purnima* in the *Kartik–Agrahan* (November) month, they make *gur pithas* (Figure 1B), which they distribute to their relatives. While visiting the nearby forest in the rainy season, if found, they collect Kham aalu, Kurkuri Chhatu, Bon kundri, cashew nuts, and yams. They consume *handia* daily, including at festivals. The Oraon tribe residing in the Birbhum district reveres "Nagpur-Dhanpur" as their chief god, which they worship in the Chhota Nagpur region of Jharkhand. The Oraon community receives a letter each year listing the names of those who are required to attend a yearly pilgrimage to the Chhota Nagpur region of Jharkhand. During this pilgrimage, it is mandatory for participants to wear traditional clothing and speak in their mother tongue, Kurukh, also known as *Thaar Bhasa*. Each clan has its own puja, called the *Basanti Puja*, which takes place every 10 years. During the year when the Basanti Puja is held, no marriages are arranged within that particular year. They sacrifice four kinds of animals for this puja: *boroboli*, *mejoboli*, *sejoboli,* and *chhotoboli*. A fully grown-up buffalo with large horns is sacrificed as *boroboli*. A pig is sacrificed as *mejoboli*. A male goat is sacrificed as *sejoboli,* and a hen is sacrificed as *chhotoboli*. They observe a 24-h long fast, which they break with *bhog* made from rice and a sacrificed hen (Figure 1C). While celebrating the *Karam puja* in the *Bhadra* month (from August to September), they offer three hens of different colors as a sacrifice. The meat is then cooked with rice without the use of any oil. The red hen, or *khayer,* and the *tamakatu* hen are consumed by the male members of the village, while the white hen is consumed by the female members of the village. The head and leg portions are reserved for the elders, referred to as *morobbi*. On the occasion of *Poushsankranti*, they prepare various types of pitha (Figure 1A), including a rice cake made with *kalokolai* paste. On the day of *poilaMagh* (mid-January), they celebrate their *Shalgram puja*, during which they prepare *askepithe* (Figure 1D) using rice powder and jaggery. They cook it in an earthen pot. It is customary that postpartum mothers do not receive any cooked food after giving birth. They are allowed to eat only *muri* (puffed rice) or chiwda and drink lukewarm water. For up to 21 days after delivery, they can only have boiled food without any spices or oil once a day. Consumption of meat, fish, eggs, or fruits is strictly prohibited during this postpartum pollution period. After the *Nokhna* ceremony, on the 21st day after childbirth, the mother is allowed to enter the kitchen and resume her normal diet. The consumption of *Paatsaak* (jute leaves) and periwinkles (a species of small edible whelks) is a common dietary habit among the Oraons community of Dakshin Dinajpur (Figures 2A–E). They celebrate *Ashari Maayer Pujo* in the month of *Ashar* (from June to July) with the belief that it will bring prosperity through rainfall. The ritual of *Dandakatta* holds significance in this festival. The Oraon people perform it before any ceremony or to purify the house. The main occupation of the Oraon people residing in the Jalpaiguri and Alipurduar districts is tea gardening. The main issue with the Oraon people in this region is that most families adopted Christianity as their religion due to the inclusion of missionaries. Thus, they have undergone many cultural changes. Food patterns have also changed. Only the consumption of tea flowers could be found among them, which solely depends on availability (Figure 3A). They preserve it for longer use (Figure 3B). It tastes bitter and is cooked with tomatoes and other vegetables. The Oraon tribe in the North 24 Parganas district of West Bengal has adapted the tropical climate of mangrove area in this delta region. They cook the *shalukful* (water lily), *bunoamra* (wild mombins), and *keora* fruit. They catch rodents and cook them with different spices.

Table 2 summarizes the anthropometric characteristics expressed as the mean and standard deviation of weight, height, MUAC, and BMI of adult Oraon men and women. As

TABLE 4 Average foodstuff consumption (g/pc/day) of Oraons of West Bengal.

Food intake	RDA (ICMR 1990)	West Bengal (NNMB, Tribal 2009)	Birhor (Bisai and Dutta, 2021a)	Lodha (Bisai and Dutta, 2021b)	Toto (Bisai and Dutta, 2021c)	Oraon (present study)
Cereals	460	610.4	396.2	378.5	401.5	477.2
Pulses	40	10.1	46.7	66.7	34.8	19.0
GLV	40	77.7	39.1	38.3	42.6	18.7
Other vegetables	60	44.0	73.6	76.5	91.8	48.4
Roots and tubers	50	86.1	227.4	182.9	320.2	223.5
Milk	150	1.8	2.9	-	25.8	5.0
Fat and oils	40	7.7	18.5	16.9	34.1	11.4
Sugar and jaggery	30	3.7	7.6	4.7	11.4	3.4

TABLE 5 Average nutrient consumption (pc/day) of Oraons of West Bengal.

Nutrient intake	RDA (ICMR 1990)	West Bengal (NNMB, Tribal 2009)	Birhor (Bisai and Dutta, 2021a)	Lodha (Bisai and Dutta, 2021b)	Toto (Bisai and Dutta, 2021c)	Oraon (present study)
Energy (kcal)	2,425	2,303	1,934	1,727	2,175	2,290
Protein (g)	60	50.2	50.2	43.9	59.9	56.0
Fat (g)	20	10.6	23.1	18.8	36.9	17.3
Calcium (mg)	400	195.0	155.2	140.4	231.2	323.1
Iron (mg)	28	11.1	9.2	7.1	12.7	13.8
Thiamine (mg)	1.2	1.5	0.7	0.6	0.8	1.7
Riboflavin (mg)	1.4	0.4	0.4	0.4	0.4	1.5
Niacin (mg)	16	24.5	12.1	10.8	12.2	23.4
Vitamin-C (mg)	40	37.8	62.1	57.7	65.5	65.6
Folic acid (μg)	200	61.4	84.4	76.3	86.2	72.1

expected, mean weight, height, and MUAC were significantly higher among men than women. The nutritional status of the adult Oraons of West Bengal is presented in Table 3. The overall prevalence of CED and overweight/obesity was 39% (men: 37% and women: 40.3%) and 7%, respectively. It was observed that the prevalence of CED and overweight/obesity among Oraon women is higher than that among men. Moreover, the prevalence of stunting and thinness (CED) among children aged under 18 years was found to be 34.2 and 32.6%, respectively.

It was revealed that *handia* consumption improves the nutritional status of men and women, and there is a relationship between the nutritional status of mothers and infants. However, the present data are not sufficient, and further research is required. Table 4 summarizes the average food intake in a day for the Oraon tribe. Comparing the present study with other national-level tribal studies, we observed that the Oraon tribe consumes a good number of tubers, vegetables, and green leafy vegetables. Their average food intake seems adequate, and it is in accordance with the RDA, except for milk, fat, oil, sugar, and jaggery.

Table 5 displays the average daily nutrient intake (CU/day) of an adult Oraon compared to other studies conducted in West Bengal (NNMB., 2009; Bisai and Dutta, 2021a,b,c) and the RDA. It is worth noting that energy intake among the Oraon tribe is better than that of the PVTGs (Birhor, Lodha, and Toto) of West Bengal; however, it falls below the RDA.

Handia, a rice-based fermented drink, is integral to their lives. They consume *handia* on every occasion. It has medicinal and nutritional benefits. The analysis of the nutrient composition of raw (before mixing water) *handia* is presented in Table 6. The analysis shows that raw *handia* has a high protein content (162 mg/100 ml), followed by carbohydrates (55 mg/100 ml), alcohol (11.3%), glucose (10.2 mg/100 ml), and fat (5.6 mg/100 ml). The appearance of raw and consumable *handia* is depicted in Figures 4A, B.

Discussion

The rich knowledge of indigenous food practices among tribal communities in India highlights a wide range of cultural diversity, traditions, and environments (International Fund for Agricultural Development., 2003; Singh et al., 2007). The fascinating use of natural foods in Indian tribal communities highlights the diversity of their cultural traditions and environments. This knowledge has the potential to improve food security, nutrition, and health. Indigenous tribes hold a colossal responsibility for preserving 80% of the world's biodiversity (FAO., 2021). Their traditional food systems are important not only for cultural, social, and economic reasons but also for preserving their cuisine and way of life, as well as maintaining their cultural heritage within the community (Bhat, 2012; Durst and Bayasgalanbat, 2014). Tribal communities cultivate a variety of food crops, including a few uncommon ones. They also preserve wild foods such as mushrooms, bamboo shoots, caryota, palm pith, and so on (Rajyalakshmi, 1991). A recent study found that the Oraon community is aware of indigenous varieties of green leafy vegetables (GLVs) and consumes them during certain months or throughout the year (Ghosh-Jerath et al., 2018). Other indigenous food items from different food groups, such as cereals, roots and tubers, other vegetables, mushrooms, fruits, meat and fish, oil, and alcoholic drinks, were also reported. Fermented rice beer is a nutritious and energy-boosting beverage that is widely recognized among indigenous people worldwide but is mainly found in a few tropical Asian countries, including India. It has been reported that rice is a good source of carbohydrates (77–89%) and energy (350–475 kcal) (FAO., 1993). The fermentation process makes rice more nutritious as microbes partially digest the substrate into simple sugar and facilitate the bioavailability of lactic acid, alcohol, minerals, and bioactive compounds. Handia is a cheap, high-calorie, mild, fermented alcoholic beverage made from broken rice and consumed as a staple food by the ancestral and low-income communities of lateritic West Bengal, Assam, Bihar, Orissa, Jharkhand, and different areas of eastern and central India (Ghosh et al., 2014). Earlier studies reported that the alcohol and sugar content of raw fermentation increases with the prolongation of the fermentation time due to the presence of yeast that produces alcohol. This is achieved through the process of anaerobic fermentation, where the yeast converts simple sugars into alcohol. This increase in alcohol and sugar content is observed after the mixture has been diluted with drinking water. By the time it is consumed, the alcohol content reduces to only 2–3% (Ghosh et al., 2014, 2015). It has been well documented that the parts of plants used to prepare *handia* may increase the shelf-life of microbes by acting as preservatives. Moreover, the parts of the plant contain many bioactive compounds (Mallavadhani et al., 2004; Manikandan and Doss, 2010). Handia is used as a starter culture by tribal people in the tropical region, including India. Moreover, haria is a rice-based fermented beverage that is consumed as a staple food by the tribal people of central and eastern India (Ghosh et al., 2015).

There are several health benefits of the lactic acid content of *handia*, such as immunostimulation, cholesterol reduction, increased endocrine secretion, stress relief, and brain stimulation. It also helps protect overall intestinal function (Cory Holly Institute., 2005). In this study, the Oraon people consumed, on average, 50 ml of *handia* daily, which highlights the cultural significance of this traditional beverage in their community. The adult male member of the family consumes a good amount of *handia* before going to work. School-aged children also consume *handia* occasionally, primarily during festivals and marriage ceremonies. Currently, scholarly interest in rice-based fermented products is growing globally due to their high caloric value, accessibility, and widespread acceptance among the general population. Handia holds a notable cultural significance among the indigenous communities of India, who view it as an essential part of their dietary culture, survival, and maintenance of good health. The promotion of macronutrient-fortified *handia* may be an effective means of combating hidden hunger among adult indigenous people in India.

TABLE 6 Nutrient content of *handia* (raw).

Sl. no.	Parameters tested	Results
1	Carbohydrate	55 mg/100 ml
2	Glucose	10.2 mg/100 ml
3	Protein	162 mg/100 ml
4	Fat	5.6 mg/100 ml
5	Alcohol	11.3%

FIGURE 4
Fermented food: **(A)** Raw *handia*. **(B)** Consumable *handia* in a bottle with other festive foods.

A recent systematic review reported that approximately 45% and 49% of men and women, respectively, in India suffered from CED (Dutta et al., 2021). The present study found an overall prevalence of CED and overweight/obesity of 39 and 7%, respectively. A previous study found that 47% of males and 30.7% of females suffer from CED (Mittal and Srivastava, 2006). Another study reported 39.2% CED among Oraon women from Jharkhand (Ghosh-Jerath et al., 2018). Another study from the Alipurduar district of West Bengal revealed that the prevalence of CED was 34.5% in men and 53.5% in women (Bhattacharya et al., 2019). The present study found the prevalence of malnutrition, as indicated by stunting and thinness, was comparatively lower among Oraon children compared to adults and children of other tribal communities in the state (Bisai et al., 2010; Das et al., 2012).

The present study highlights the considerable consumption of tubers, vegetables, and green leafy vegetables by the Oraon community. However, several factors, such as geographical limitations, limited access to agricultural technology, sociocultural practices, and community conditions, may contribute to poor

nutrition and health outcomes in these communities (Bhattacharjee et al., 2009). Indigenous communities continue to face food shortages and poor diets, leading to chronic diseases (Egeland and Harrison, 2013). The lack of diversity and nutrient density in their diets has been identified as a major concern. Mittal and Srivastava (2006) reported that the diets of all Oraon tribal populations in West Bengal were deficient in all food groups, with women and children particularly vulnerable to undernourishment. The minimal consumption of milk and fruits further highlights their susceptibility to protein-energy malnutrition (Bisai and Dutta, 2021b). This lack of essential nutrients in their diets (protein, vitamins, and iron) results in poor nutritional status and a negative impact on their overall health (Gole, 2015). However, the Oraon community consumes indigenous foods that are rich sources of micronutrients, namely calcium, iron, vitamin A, and folic acid (Ghosh-Jerath et al., 2015, 2018). It has been well documented that the nutritional status of Oraon tribal adults and children in Sambalpur, Orissa, was not satisfactory, with all the children suffering from different levels of malnutrition (Beck and Mishra, 2011). Studies across the globe have suggested that there has been a shift in dietary patterns, a phenomenon known as "nutrition transition" (Popkin, 2006). In present times, many tribal communities, especially those with tourist attractions, are experiencing a shift toward westernized diets instead of their traditional diets due to the influence of modern society and the growth of "ethno-tourism" (Dutta, 2014). The shift has resulted in a significant change in the indigenous pattern of food consumption among the Oraon community due to the mixing of other communities.

In conclusion, effective intervention programs should be implemented based on regional needs. Effectively maintaining kitchen gardens and domesticating wild edible plants, seeds, tubers, and so forth may help improve nutrition. Moreover, the promotion of macronutrient-fortified rice-based beverages such as *handia* may be useful in combating hidden hunger among adults, as it is an indigenous beverage with high calorie content and medicinal properties.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The study was conducted according to ICMR guidelines and informed consent was obtained from each participant to participate in this study.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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