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Sustainable use of ethnobotanical resources

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The study demonstrates the significance of ethnobotanical resources used for ensuring the food and nutritional security conserved by the tribal women of Chattisgarh state. The study was conducted among the tribal women of *Halba, Mandiya, Bhatra* and *Muriya* communities of Jagdalpur-Bastar district, Chhatisgarh. Data pertaining to study were recorded by using the participatory approach. Study revealed that there are more than 20 major ethnobotanical resources prevalent in the tribal community, which is being consumed in the forms of leaves, bulbs, plants and fruits. Few of the ethnic vegetables, like *charoti, koliari, siliari, chench, bodi* and *jheera* are mostly available in the rainy season and vary in its consumption percentage on account of extent of availability. Few of these ethnic plants are wild and few are domesticated in the kitchen garden for its conservation and sustainable use. Wild indigenous mushroom species namely, *banse, jam* and *mane chhati* are the nutritious source of foods and are available in the month of July-August. These ethnobotanical resources provide nutritional security as well as play a multifunctional role in curing several diseases. These varieties are economically sustainable on account of stable marketing. However, there was variation (15-90%) in the consumption of these ethnic plants depending upon availability and duration. No cost nature, stable source of income, compatibility to culture and local availability are the factors responsible for continuous consumption of the identified ethnic vegetables. Different socio-cultural, spiritual and high ethical values attached with these ethnobotanical resources play a pivotal role in its sustainable use and conservation.

Key words: Tribal women, Ethnobotanical resources, Ethnic vegetables, Forest resources, Conservation, Sustainability, Chattisgarh, *Halba* tribe, *Mandiya* tribe, *Bhatra* tribe, *Muriya* tribe

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More than half of the world's population directly depends on natural resources for part or all of their livelihoods, food, nutrition, medicines, water and many other needs – and this include a high proportion of the poorest groups[1]. Indeed, most traditional societies have belief systems and practices that demonstrate such an interest. However, in many areas traditional systems of indigenous resources use and management have broken down in response to the processes of globalization, inappropriate policies, and a host of threats from wider economic and political forces[1-5]. Plant based biodiversity conservation efforts by traditional communities, primarily by women, include continuation of traditional conservation of local crops' species, collecting and using the forest based plants in daily dietary and medicines[6-8]. These women have sustained and even revived and/or modified traditional plant based practices when faced with the pressure from various natural and social forces to their indigenous resources[1-6]. It is well documented that traditional women and rural communities derive both their socio-cultural and spiritual identity from biodiversity; and have developed their coexistence based on the sense of harmony with natural environment[3,7]. In many rural societies of developing countries like India, women carry the burden of farm labour, arrange for household energy (mostly firewood from forest), collect food products from forest and arrange local plant based medicines to care their children. During the period of hunger, women use the locally available indigenous plants for meeting the needs and help keeping their family alive[3,8,9,10]. Women have developed local provisions of insurance of livelihoods for local communities, ethnomedicine for family health, growing of staple food crops, exploration of plant based innovations for food and biodiversity conservation[8-10]. In many communities and societies, women are at the forefront of conservation initiatives and a number of forest protection committees or natural resource management committees are all women, or have significant female leadership and

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numerous studies highlight that women suffer most when resources are degraded[1,11,12]. An attempt has been made to know the use pattern and sociocultural and environmental sustainability of various indigenous vegetable plants and related forest resources used by tribal women for ensuring the food security.

The investigation has been carried out in the selected tribal communities of Jagdalpur-Bastar district of Chhatisgarh state. The area comes under Bastar plateau having the sub-tropical climate. Monsoon onsets in this region by 10th June and rainfall varies from 1,400-1,600 mm with total rainy days from 65-82 days in a year. About 80% of the women population depends on agriculture and forest based activities for their livelihoods. Almost all local tribal communities ranging from agriculture to livestock adopt diversified complex farming system and collection of forest based products for subsistence survival. Thus, economic condition of local communities is poor and agriculture only does not meet out the food security of tribal people, hence to women for collecting and depending on forest based resources. Women of these communities play significant role in performing agricultural activities, collection of forest based products and maintenance of kitchen gardens for food and economic security. To achieve the objectives of study, tribal communities *Halba* (Jagdalpur-Bastar and Londigura blocks), *Mandiya* (Londigura), *Bhatra* (Bankawad block) and *Muriya* (Tokapal) from Jagdalpur-Bastar district, Chhatisgarh were selected based on their dependency on natural resources. A sample of 153 tribal women having various age and experience was taken randomly to learn about their wisdom towards ethnobotanicals and indigenous plants/crops used, conserved and maintained for food security. Participatory approach (PRA) was followed to carry out the research work[13]. Primarily, the focus group discussion (FGD) as a tool of PRA was organized with the tribal women to arrive at a consensus to know the use pattern; local availability of forest and non-forest based indigenous resources used in preparation of various kinds of ethnic foods. Later on youths were also involved in the study process. The objective of the process was to make aware youth about their wealth of traditional heritage and food systems. A semi structured interview schedule was adopted as a guideline to discuss the subject with women and obtain the requisite information of perception towards using locally available indigenous plant based resources.

In the study, emphasis was given on a specific cultural food significance index (CFSI) by using the described method[14]. To determine the CFSI, interviews were carried out with 153 local women from *Halba*, *Mandiya*, *Bhatra* and *Muriya* tribes, ranging between 34-48 yrs in age and having extensive experience of collecting ethnobotanicals and food plants and living skills. Majority (> 95.0%) of these women were illiterate with joint family system, came from poor income group and depended both on agricultural crops (rice, maize, pulses, tubers and millets) as well as wild resources for the food and income security. These women were asked to spontaneously list the names of wild edibles and indigenous crop varieties that are gathered and grown for consumption, their parts used, method of preparation, perception of its availability, frequency of its use at present, taste appreciation and its potential health benefits as food. The CFSI, specifically elaborated to evaluate the cultural significance of indigenous plants collected from forest and grown in the kitchen garden, was calculated as: CFSI = $QI \times AI \times FUI \times PUI \times MFFI \times TSAI \times FMRI \times 10^2$, where, QI expresses the positive frequency of quotation, AI reflects the availability of a crop or plant, FUI represents the frequency of utilization, PUI indicates the plant part used, MFFI designates the multifunctional food use, TSAI is the taste score appreciation and FMRI represents the medicinal role or health value of the foods. These values are multiplied by 100 to yield the final index.

These 7 indices were multiplied, not added together, in order to amplify the differences in the cultural food significance indices (CFSI). CFSI values have been categorized into six classes: very high significance, high significance, moderate significance, low significance, very low significance, and negligible significance[14]. Looking to the nature of community's food habit and culture, a range (maximum score minus minimum score divided by 3) statistics as a prime statistical parameter for developing categories of cultural significance for indigenous crop species and edible ethnobotanicals was adopted. First, the range CFSI value was calculated and the foods with maximum CFSI values equal to or exceeding this score were assigned to the category of "very high cultural significance". Those with a calculated CFSI score value in between

maximum and minimum were designated as having "high cultural significance". Similarly, by following same method, the "moderate" cultural significance was determined. The qualitative approach was adopted to facilitate the understanding of exploratory data through the use of non-parametric descriptive statistics, viz. frequency, percentage, mean score and ranks, in order to draw general inferences from the study.

Result and discussion

After the participant observation and group discussions with the tribal women, some interesting and important indigenous vegetable plants complemented by various indigenous fruits and ethnozoological resources were identified, which are being used as sustainable sources of food security and for fulfilling the basic needs to maintain the health. There are 20 major ethnic vegetables, which are used by the tribal women in different seasons and are consumed year round. Few of them are wild vegetable plants; some are domesticated and grown in the kitchen garden, while few are partially wild and domesticated as well as grown in the kitchen gardens. Tender leaves plant, *charoti bhajee*, which is locally found in the month of June-July are used as vegetable (Table1). The pulp of *kareel* (*Bambusa arundinacia*) bamboo shoots (Fig. 1) are boiled with water on low flame, cut into small pieces and cooked with a variety of spices. Sometimes, it is mixed with local fishes to make tasty and flavoured dish. The consumption percentage of *kareel* is more during June-July, because of fresh availability. Similarly, the indigenous plants like *koliyari bhajee siliari bhajee, chench bhajee* (Fig. 3), *bodi bhajee, jheera bhajee* and *jangali choulai* are the locally available plants and are considered integral parts of tribal food system. Tender leaves of wild cucurbit, *kundru* (*Coccinea grandis* L.) found near by fencing and forest groves during the months of September-October, is used in making vegetable. Its fruits are consumed in the month of November and December. The corns of *keshur kand* (*Scirpus grossus* L.), *boda kand* (*Colocasia esculanta* L.) and leaves & corns (Fig. 2) of *suran* (*Amorphophallus campanulatus* Blume) are used and highly preferred by women. Women have explored three wild edible and popular indigenous species of mushroom, *mane chhati, banse chhati* and *jam chhati*, which are rich source of protein during rainy season (June-July). Green leaves of *Purpuri* plant found during the end of rainy season are used as vegetable. The matured seeds of the plant are stored and made into flour. The *chapatti* made from *purpuri* flour is given to patient suffering from fever and other sickness for quick recovery.

The natural vegetative growth of these plants varies from July to August. These indigenous vegetables used in traditional food system by tribal women indicate their way of interaction with local ecosystem from where the plants are identified and used. It is not a simple process but needs years of experience to blend one leaf with others for making foods in which old women were found to be competent[15]. The different methods of harvesting and processing of biodiversity products in food are also significant in terms of the nutrients they provide. Informal knowledge of women about blending the two products accessed from local biodiversity helps in neutralizing the oxalate percentage in corn of *suran* to make it eatable. Due to high percentage of calcium oxalate in the indigenous foot yam, neck itching is a common problem during eating and to neutralize this, women mix the tender green leaves of *imli* (*Tamarindus indica*) in elephant foot yam pieces while boiling. Similarly, harvesting and collecting tender shoots of *chench bhajee* in the month of July-August is more appropriate (due to odd smell of leaf) and can be eaten in more quantity. These ethnic plants provide good sources of nutrients and fulfill the basic needs of vegetable during the lean period when the market prices of commercial vegetables are high. These are substantially contributing to the food system during the lean period when agricultural produce is scare. In case of surplus availability of these wild edible resources, they are preserved for the later use. For example, the tender green leaves of local plants like *chench bhajee* (*Cassia tora*) and *koliyari bahajee* are dried in shade and preserved with common salt in the basket made of *tendu* leaves (*Diospyrous melanoxylon* Roxb. While seeds of *chench,* collected in November and December are used with leafy vegetables. The seeds after roasting with *Ghee* is made into powder and taken as coffee with milk. It is perceived to be beneficial for controlling stomach disorders and muscles pain. Similarly, surplus amount of *kacharia* vegetable (Fig. 4) is also preserved in the same basket after making into pieces and drying in sunlight. These 3 preserved vegetables are good sources of local foods during the rainy season.

Apart from leafy vegetables and tuber, a range of forest and non-forest based food products are used by

the tribal women based on their years of informal experience of preparing a variety of ethnic foods. These ethnobotanical resources include different fruits, rhizomes, tubers, leaves, bulbs, etc. During the lean period of March to April, fruits of *mahua* (Fig. 5), *ber*, (*Ziziphus jujuba*), *goolar* (*Ficus glomerata*), *pipal* (for making ethnic food, *laddu*), *amla* (*Emblica officinalis*), *imli* (*Tamarindus indica*) and *jamun* (*Syzygium cumini*) are major forest based food resources, which are primarily collected and processed by women. The matured fruits of *amaltas* (*Cassia fistula*) are collected from forest and dried pulp of pods are crushed and mixed with jaggery solution for drinking during the summer. The form of using these indigenous resources varies from season to season. These indigenous fruits are either used in direct or semi processed/cooked forms and are good source of income for the tribal women. *Imli, ber* and *amla* are used for making pickles. Juice of *mahua* flowers is used for making varieties of local food items like *thukwa, laddu, lata* and *puri*, which are considered rich in nutrition and eaten during the lean period, i.e. rainy season and early winter. The unripe fruits of *mahua* are used as vegetable during the month of April. Juice of *jamun* is taken during breakfast especially by the patients suffering from diabetes and high blood pressure. Beside, the eggs of red ant (*Oecophyla smaragelina*) and grub of *khajur* or date palm *Leucopholis coneophora* Burn are also used as delicious food consumed after frying or mixed with different vegetables.

Semi-domesticated and wild ethnobotanical resources provide foods, such as fruit, oil, and medicines. For example, *mahua* flowers are rich source for making local beer by the tribal women. The local beer from *mahua* is used in curing many gynecological disorders. The mixture of boiled *mahua* flowers along with goat milk is used in curing the waist and joint pain of both men and women. Beside, it is a very good locally available indigenous natural product to use in improving the fertility and inducing heat period in cows and buffalos. In most of the cultural occasions, beer and food from the flowers of *mahua* are used. Sometimes, it is exchanged for buying cloths, oil and spices from market. Similarly, the leaves and flowers of *munga* (drumstick) are cooked with rice *mand* (the water separated after boiling the rice having high percentage of starch) and given to the anaemic patients and women having irregular menstruation cycle and waist pain. To pursue protection and collection of *mahua* flowers, *harra, kusum*, bamboo, mango, *jamun* and *ber*, rural women form informal institution early in the morning to go to the forest for collection of these resources. These informal institutions also play a significant role in ensuring the sustainable harvest and maintaining the proper population of these resources in the common land and community forest. Apart from the these hidden harvested vegetables and forest based food products, a variety of indigenous beans and pulses form an integral part of traditional food system of tribal women (Fig. 6).

More than 90% local women use *charoti bhajee, jheera bhajee, boda kand* and *munga* (drumstick) as local vegetables in their traditional foods items (Table 2). *Charoti bhajee* and *boda kand* are found in the community forest and are also conserved in and around the kitchen gardens. *Jheera bhajee* and *munga* are found wild and women have domesticated and conserved them in their kitchen garden. These ethnic plants are economically viable to generate additional income. The indigenous mushroom species called *banse chhati, mane chhati* and *jam chhati* needs special skill to be identified for their edibility, hence their use percentage is less than the leafy vegetables. However, it plays quite important role in local market to generate cash income. The leafy vegetables, *chench bhajee, koliyari bhajee* and *kareel* (bamboo shoots) are adopted below 80% but more than 40-80% of the total local food materials are prepared from these indigenous plants. Use of *siliyari bhajee, bodi bhajee, keshur kand, suran,* and *purpuri* vary from 10-40%. Though these plants are not commonly available, but play a significant role in ensuring food and income security of local women. On the basis of cultural importance and use value, identified ethnobotanical resources were assessed. The mean value of CFSI for these resources was found to be 880.81 with the coefficient of variation 77.96% indicating a range of variability in the existing diversified indigenous resources used for various foods, cultural and medicinal purposes. It was found that *jhirra, kumhda, suran, jangli choulai, keshur kand, bada kand, bans chhati, jam chhati, bhejari, kundru, amla, pipal, jamun, imli, kacharia, sharifa* and mango often used as ethnobotanicals are having moderate cultural food significance values among tribal women (Table 3). Whereas, *charoti, kareel, koiliyari, siliyari, chench, munga, mane chhati, mahua, amaltas,* and *gular* were having high cultural food significance index. Two

Fig. 1- Dried bamboo shoots

Fig. 2- S*uran* rhizome

Fig. 3- Preserved dried leaves of *chench* and *koiliyari bhajee*

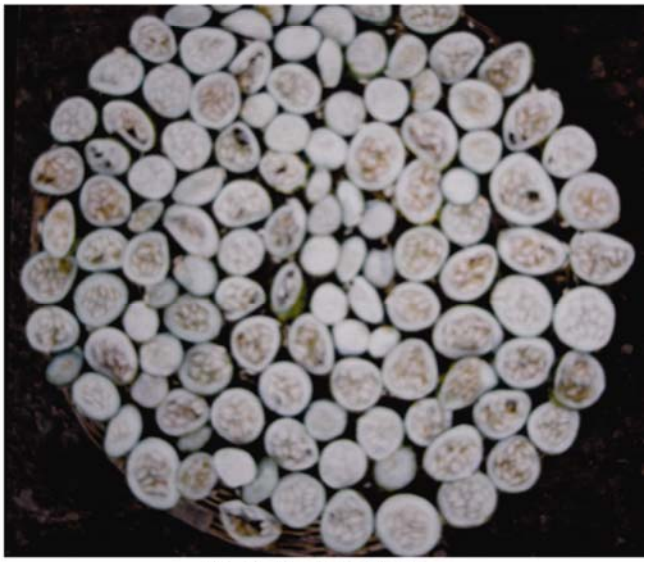

Fig. 4- *Kacharia* fruits

Fig. 5- Dried *Mahua* flowers

Fig. 6- Indigenous varieties of pulses, beans & vegetables

Table1—Ethnobotanicals and ethnozoological used by women for ensuring food security

Local name	Plant name	Parts used	Season of availability
Charoti bhajee	Small shrub	Leaves	June-July
Kareele	*Bambusa arundinacea* Willd.	Young shoot	June-July
Koliari bhajee	*Bauhinia variegata* L.	Leaves	March
Siliari bhajee	Small shrub	Leaves	July-Aug
Chench bhajee	*Cassia tora* L.	Leaves	July-Aug
Bodi bhajee	Herb	Leaves	Rainy-winter
Jeera bhajee	Shrub	Leaves	Winter
Kumhda		Fruits	July-Aug
Suran	*Amorphophallus campanulatus* Blume ex Decne	Corn	Oct-Nov
Jangali choulai	*Amaranthus paniculatus* L.	Leaves	July-Aug
Keshur kand	*Scirpus grossus* L.	Tuber	Oct-Nov
Boda kand	*Colocasia esculanta* L.	Tuber	July-Sep
Munga	*Moringa oleifera* L.	Leaves & fruits	March
Mane chhati	Indigenous mushroom	Whole plant	June-July
Banse chhati	Indigenous mushroom	Whole plant	June-July
Jam chhati	Indigenous mushroom	Whole plant	June-July
Bhejri	*Solanum suratense* Burn f.	Leaves & fruits	October
Kundru	*Coccinea grandis* L.	Fruits	Rainy winter
Purpuri bhaji	*Amaranthus viridis* L.	Leaves & seeds	Rainy-winter
Mahua flower	*Madhuca indica* J.F. Gmel.	Flowers, fruits	March- April
Amaltas	*Cassia fistula* L.	Fruits	April-May
Red ants egg	*Oecophyla smaragelina*	Eggs	Year round
Khajur root grub	*Leucopholis coneophora* Burn	Larvae	Year round
Amla	*Emblica officinalis* L.	Fruits	Feb-Mar
Gular	*Ficus glomerata* Roxb.	Fruits	March-April
Pipal	*Ficus religiosa* L.	Fruits	April-June
Imli	*Tamarandus indica* L.	Fruits	April-June
Beans	Leguminous crops and plants	Seeds	Year round
Kacharia	Indigenous cucurbit	Fruits	Sep-Oct
Sharifa	*Annona squamosa*	Fruits	Oct-Nov
Ber	*Ziziphus jujuba* Mill.	Fruits	Feb-March
Aam	*Mangifera indica* L.	Fruits	May-June

*Identification of the indigenous vegetable plants was done by using the PRA approach

ethnozoologicals, red ant's egg (*Oecophyla smaragelina*) and grub of *khajur* (*Leucopholis coneophora* Burn) and one ethnobotanical resource, *purpuri saag* were of very high cultural food significance values and play significant role as delicious and nutritious foods. Some of these are used as food with an intention to cure some disease like malaria and improving weakness.

Majority of the women have reported that no-cost of the local plants (86.96%), its compatibility with local culture and food habits (82.61%) and stable source of income (82.61%) are positive factors in order of importance, which provide an assured environment for continuous consumption of the ethnic vegetables data (Table 4). Local availability (80%), rich sources of nutrition (76.25%), resistance of the plants against disease and pests (69.57%) and compatible to existing resource (65.22%) were found to be the important factors for continuance of ethnobotanical resources in food systems. These factors encourage and act as bonding role for continuous use and conservation of indigenous plant based foods. In the traditional communities of tribal women, use of social, cultural, spiritual and natural resources are the integral parts of food production system and means for sustainable livelihood. The wise women revealed that they were culturally accustomed to follow the diversity of ethnic food plants from different sources. These women preferred to cook the food in different season by using the local beans grown in their kitchen garden, forest products collected from the forest and the preserved leaves of *charoti* and *koilari.* These women preserve *Cassia tora* seeds and plant *Bahunia variegata* L. with the consciousness of sustaining these resources. They also sell the seeds and leaves of locally available plants for ensuring the income. Traditional foods prepared from the reported ethnobotanicals are significantly excellent in taste and important to community life & income. These women have learned about these

Table 2—Adaptation and sustainability of ethnobotanicals and ethnozoologicals resources (n = 120)

Local plant name	Use (%)	Environmental status	Economic value (Rs)
Charoti bhajee	90.0	Conserved in kitchen garden	02-03.0
Kareel	50.0	Conserved in kitchen gardening	08-10.0
Koliari bhajee	40.0	Conserved as living fence and naturally grown in forest	03-04.0
Siliari bhajee	30.0	Forest and fallow lands	Save money*
Chench bhajee	40.0	Kitchen garden and forest	03-04.0
Bodi bhajee	30.0	Forest	Save money
Jhirra bhajee	90.0	Forest	4-6.0
Kumhda	80.0	Kitchen garden	10-12.0
Suran	10.0	Kitchen garden and forest	20-25.0
Jangali choulai	12.0	Forest and fallow lands	Save money
Keshur Kand	15.0	Forest	10-12.0
Boda kand	90.0	Forest	10-12.0
Munga	95.0	Kitchen garden and forest	10-15.0
Mane chhati	40.0	Forest	60-70.0
Banse chhati	35.0	Forest	40-50.0
Jam chhati	40.0	Forest	60-80.0
Bhejri	12.0	Forest	Save money
Kundru	20.0	Forest	10-12.0
Purpuri bhajee	80.0	Kitchen garden and fallow land	08-10.0
Mahua flower	100.0	Community forest	50.0.0
Amaltas	90.0	Community forest	10-15.0
Red ants egg	100.0	Community forest	Not sold
Khajur root grub	100.0	Community forest	Not sold
Amla	75.0	Community forest	20-25.0
Gular	90.0	Community forest	25-30.0
Pipal	65.0	Community forest	5-10.0
Imli	58.0	Community forest	8-10.0
Beans	68.0	Kitchen garden	35-30.0
Kacharia	55.0	Kitchen garden and community forest	40-50.0
Ber	22.0		08-10.0
Sharifa	35.0	Community forest and Kitchen garden	15-20.0
Aam	80.0	Community forest	15-20.0

*The plants directly do not provide the income but save the money of tribal people as well as fulfill the requirements of vegetables during food crises

Table 3—Cultural Food Significance Index (CFSI) of used ethnobotanical resources

Categories	CFSI score range	Ethnobotanicals
Moderate CFSI	27.60-893.61	*Jhirra, kumhda, suran, jangli choulai, keshur kand,bada kand, bans chhati, jam chhati, bhejari, kundru, amla, pipal, jamun, imli, kacharia, sharifa ber,* and *aam*
High CFSI	893.62-1787.22	*Charoti, kareel, koiliyari, siliari, chench, munga, mane chhati, mahua, amaltas,* and *goolar*
Very high CFSI	1787.23-2680.83	Red ants egg (*Oecophyla smaragelina*), white *khajur* root grub (*Leucopholis coneophora* Burn) and *purpuri*

Mean= 880.81, SD= 686.67, CV= 77.96%

traditional foods from their ancestors through chain of learning. The local proverbs, folk songs, taboos, customs, informal groups, various socio-cultural occasions, weekly market and different ecological and cultural edges were found to play significant role in transferring the knowledge from place to place and generation to generation. The evaluation and decision competency about food-based plants is affected by cultural backgrounds and degree of dependency on traditional knowledge. Women have domesticated some of these plants in their kitchen garden to conserve them[16]. Now, it is time to recognize the women wisdom and carryout research work to identify the nutritional values of wild edible resources. It will help to add value to these resources and provide income to women[15].

The ethnobotanicals accessed from forest areas, fallow lands and conserved in the kitchen garden not only provide a substantial amount of food security to the tribal women but also play a significant role in securing the household economy. The indigenous plants from forest, fallow lands and kitchen garden

Table 4—Perception of the tribal women regarding the factors responsible for the continuous consumption of the ethnic plants (n=120)

Identified factors	Percentage of response	Rank order
No cost of the plants	86.96	I
Fulfill the basic needs	67.83	VI
Compatible to the culture and food habits	82.61	II
Compatible to the existing resources	65.22	VII
Eco-friendly	52.17	IX
Easy in the cultivation and collection	56.52	VIII
Plants are compatible to existing ecosystems	69.57	V
Nutritious	76.52	IV
Locally available	80.00	III
Stable source of income	82.61	II

are collected by women and sold in the local market for generating cash income. Since, local people depend more on agriculture and livestock, hence agriculture and livestock contribute major percent of income in the household economy. But the role of forest and kitchen based ethnobotanicals cannot be underestimated, which act as buffering sources for survival during lean period. Women have expressed their feelings about various dimensions associated with collection, use, ecology, conservation, management and sustainability (Table 5). Women see forest resources and other indigenous biodiversity as a precious wealth and have developed a set of informal experience of ecology and place of availability. They see plants in a dynamic use mode, i.e. for food, medicine, agriculture, animals, sacredness, spirituality and culture. This group not only helps each other in plant collection, but also plays an important role in exchanging the traditional knowledge to cope up the food crisis during scarcity. The informal exchange of food-based products collected from forest is grounded with the codified knowledge in local dialect and processed at inter-and-intra communal level of exchanging the genetic materials[17]. Several local custom of celebrating seasonal biodiversity based worships is performed by community *Vaidya* (traditional healer) to wish for better availability of plants in the forest areas. In some cases due to spiritual fear, the community women have to take the prior permission from *vaidya* to harvest/extract certain indigenous plants from the forest and contribute in environmental sustainability of biodiversity[12,15,18]. Cultural and spiritual values attached with biodiversity

Table 5—Socio-cultural, spiritual and environmental dynamics of indigenous plants and rources used by tribal people (n=120)

Recorded indicators as perceived by women	Response (%)
We like collecting indigenous vegetables	38.0
It feels good to be out there in forest for collecting forest products and vegetables	31.0
We see/and hear others expressing their feelings and proud to be the well-being in respect to forest based products use to satisfy the ethnicity	56.0
It's good for our family's food and medicine	68.0
Some of the vegetables plants are used in farming as well as food also (*charota* and *koilari*)	59.5
Some of the vegetables are used in medicines also (*charota*)	46.0
It is part of our way of life to cope with existing environment and economic crisis using indigenous resources	40.0
Certain places are known and famous for a particular types of plants and vegetables to be used in foods	51.0
A proper and appropriate knowledge is required to harvest and use the indigenous plants and products available from the locality	65.0
We share information through our informal women group regarding where and when to find forest based food products	32.0
Going in group and extracting the forest based food resources ensure to avoid the overexploitation also	25.0
It's good for our family and the whole community to be going and collecting and together for forest based indigenous products for eating	23.0
Some times we use to exchange some of the forest based vegetables and fruits to ensure other food products from other community in the region	55.0
We respect certain myth and spiritual power who are authority of forest and local resources	62.0
While plugging and extracting forest resources for vegetables and foods, we need to pray to the almighty of forest (*bandevi*)	72.0
Our extracting rules of plants and forest products are cared by other community members also	28.0
We need to take care of our land forest and local biodiversity for future needs	58.0
Forest is the communal property and should be preserved and used in that manner only	69.0

based knowledge decide the preparation and use of different kinds of traditional foods by women and it significantly contribute to access level and sustainable conservation of indigenous biodiversity to support life system to a given community[19,21,22].

Conclusion

Tribal women maintain a wide range of ethnically and culturally important vegetables for their food and livelihood security. Variation in traditional foods and market foods contribute to total diet. Seasonal, age, gender, cultural and geographical differences exist in traditional foods use. The resources are used for food security and medicine. Some wild plants are conserved in kitchen garden and agricultural farms due to their customary values. Majority of the women have been utilizing the ethnic vegetables not only for vegetable purpose in their diet but also for generating income. Women are well experienced in identifying local plants for food & nutritional security as well as to sustain & maintain the socioenvironmental sustainability, conservation and domestication of ethnic vegetables. The contribution of ethnobotanicals to food security and socioeconomic development can only be fully acknowledged when entire local supply chain and conservational dynamics of women are taken into account. The knowledge of wild plants based food collection, processing, preservation & use and their learning through folk stories, folk songs, proverbs, and their relationships with plants, animals, etc. can be enhanced among new generations through various educational progammes[22]. There is a paramount need to create awareness about meaning and importance of traditional foods and associated knowledge systems and impart the location specific need based scientific training especially to the newer generation of tribal women. Due to many internal and external factors the learning bonds and knowledge transfer from one generation to another has reduced among newer generation. For this, participatory research and extension would be required. The question on the creation and development of knowledge is important with regards to the nature of community-based conservation of ethnobotanicals, which not only provide invaluable sources of food and nutritional security. Non-governmental organizations, research bodies, funding agencies and the United Nations systems must lend support to locally prioritized research and development efforts that value, investigate and protect the women's knowledge systems of plants used for foods and nutritional security.

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