Study and analysis of nutritional value of some wild and semi wild edible plants consumed by “HO” tribes of W. Singhbhum district, Jharkhand, India

Sangita Horo, Salomi Topno

Abstract
The present study deals with ethno-botanical exploration, documentation and food potential of some wild edible leafy vegetables consumed by “Ho” tribes. There are 20 wild leafy plant species which were investigated by their botanical name, local name, plant part used as a vegetable, medicinal uses and nutritional values which have been documented. These wild leafy vegetables are delicious, refreshing and rich in minerals. They may provide minerals like protein energy, carbohydrates, potassium, magnesium, iron, calcium, phosphorus, vitamin A and Vitamin C as well as used as remedy for various diseases. This type of study could contribute to educate and bring awareness to the young generations as well as urban communities to practice in their daily life for prevention against the chronic diseases and about the importance of wild leafy vegetables. These plants can be incorporated in commercial crop plants in future and will tend to minimize food scarcity as well as economy in tribal areas for their livelihood and help in regeneration of barren lands.

Keywords: Nutrition value, Wild leafy vegetables, “Ho” tribes, W. Singhbhum

Introduction
The wild plants have been a main source of food and medicine for tribal people. These plants have rich nutrition and medicinal values. The livelihood of rural people does not depend only on the agricultural and animal products, but also natural resources, such as plants and the forests [1]. Non cereal plant foods from forests as well as agricultural and non-agricultural places contribute significantly to the diet supplement of local residents in Africa (Getachew et al., 2005). These wild plants provide health benefits as well as nutritive values. This is not totally a novel concept, for even in ancient times, people added spices to their dietary items not only to impart color, taste or favoring but also their health benefits. A functional food is that which not only serves to provide nutrition but also can be a source for prevention and cure of various diseases. The functional foods are often also termed food supplements or nutraceuticals [2]. They are inexpensive, easy to cook and are rich sources of macro and micro nutrients [3-4]. Regular consumption of vegetables is also recommended for better health and management of chronic diseases. Production over population growth and conventional crops, recurrent food deficits, and higher prevalence of macro and micronutrient malnutrition with increasing cases of chronic diseases make diversification of food sources a worthwhile endeavor wherein wild edible plants claim their share [5]. Tribal people consume the wild edible plant which is the source of their food, income and considered a healthy diet. Diets consumed by tribal population have been subject of interest since antiquity, with more recent investigations focused on their evident health benefits. [6]
Loss of traditional knowledge regarding wild edible plants has been documented, the indigenous knowledge of these plant taxa evaluated and nutritional value benefit for urban communities.

Method and Materials
1. Study area
West Singhbhum district is situated in the Southern part of the Jharkhand. The district spreads over 21° 58’ & 23° 36’ North latitude and 85° 0’ & 86° 54’ East Longitude. The district is situated at a height of 244 Meters above the sea level and has an area of 5351.41 Sq. Kilometers. Majority of the tribals in this district contribute to the ‘Ho’ tribe who reside among the rich flora and fauna.
2. Enumeration of plants
The ethno-botanical field series survey occurred in 2012 - 2013 in the tribal residing villages. During this period, many interviews were undertaken in a way to explore the wild edible plants. Carefully field notes were taken about the botanical name, family, local name, flowering and fruiting times, part of the plant used as food and their mode of uses. The collected plants were identified based on the flora of H.H. Hains, Bressers, other relevant scientific literature and standard floras [7, 8, 9, 10, 11].

3. Specimen collection
There are carried out of 20 wild leafy plants collected of A. gangeticus, M. oleifera, C. tora, A. diandrum, M. minuta, S. tuberosum, R. vescareies, L. sativus, C. arietinum, B. monniari, E. hirta, T. indica, B. purpura, P. pleb sum, A. spinosus, C. antiquorum, A. sessilis, C. argentia, C. viscosa, B. diffusa, T. terrastri were collected from several places of W. Singbhum district and taxonomically identified [12, 13]. The collected plants are dried and preserved for further analysis of nutritional values of parameters like protein, calories, carbohydrates, potassium, iron, calcium, vitamin A, vitamin C were determined using standard methods of AOAC. Carbohydrates and protein were determined using the neutral detergent. Minerals, calcium, iron, phosphorous AOAC official method [14, 15] and also reviewed the book Nutritive value of Indian foods. Hyderabad [16].

Enumeration and nutrient analysis value of plants
The wild plants, used as food by the tribal people, are given under their respective families, under each family Binomial name, Local name, parts use, nutritional values and medicinal

value are provided.

Amaranthaceae, Ho. Jenga leper aa [9, 10, 11, 12]

2. Nutritional value: (Per 100 gm.)
Protein -4.0gm, calories-45gm, carbohydrates – 6.1gm, Minerals - 2.7gm, calcium -397mg, Iron- 6.3mg, Vitamin A-5520mg, Vitamin C-99mg

Medicinal value: Leaves are eaten as potherb and whole plant extract is used in

Women leucorrhoea, used by women to increase the flow of breast

Milk. It is also used for kidney stone, constipation, and high blood

Pressure, in heavy bleeding during menstrual period, applied as

Emollient poultice in ulcerated condition of throat and mouth.

2. Botanical name: Amaranthus spinosus Linn.,
Amaranthaceae, Ho. Janum leper aa [9, 12]

Nutritional value: (Per 100 gm.)
Protein -3.0gm, calories-43gm, Carbohydrates–7.0gm, Minerals-3.6gm, Calcium-800mg Phosphorous-50mg, Iron- 22.9mg, Vitamin A-3564mg, Vitamin C-33mg

Medicinal value: Leaves used for dog bite, for stomach complaints and kidney stone, urinary tract infection, high blood pressure, constipation, piles, hair fall, and increasing lactation.

3. Botanical name: Antidesma diandrum Roxb. Euphorbiaceae,
Ho. Matta aa [9, 11, 12]

Nutritional value: (Per 100 gm.)
Protein -72gm, calories-303gm, carbohydrates – 5.5gm, Minerals - 57.8gm, calcium -1717mg, Iron- 28.4mg, Phosphorous-80mg, Vitamin A-101520mg, Vitamin C-825mg

Medicinal value: Leaves are used for proper digestion, anti-
dysenteric, Sunstroke

4. Botanical name: Alternanthera sessilis Linn.
Amaranthaceae, Ho. Garundi aa [9, 11, 12]

Nutritional value: (Per 100 gm.)
Protein -2.5gm, calories-13gm, Carbohydrates–11.6gm, Minerals-2.5gm, Calcium-510mg, Phosphorous-60mg, Iron- 1.63mg, Vitamin A-1926mg, Vitamin C-17mg

Medicinal value: Leaves use for increasing hemoglobin, root is used for any swelling.

5. Botanical name: Bauhinia purpuria Linn, Ceasalpinaceae,
Ho. Sing aa [9, 12]

Nutritional value: (Per 100 gm.)
Protein -3.6gm, calories-62gm, Carbohydrates–9.7gm, Minerals-2.1gm, Calcium-212mg, Phosphorous-92mg.

Medicinal value: Leaves used for stomach ulcer.

6. Botanical name: Bacopa monniari Linn., Portulacaceae,
Dali aa [9,12]

Nutritional value: (Per 100 gm.)
Protein -2.9gm, calories-33gm, Carbohydrates 4.9gm, Minerals – 2.2gm, calcium -290, Iron- 4.6.8mg, Phosphorous- 140mg Vitamin A -2803mg, Vitamin C-13mg.

Medicinal value: Leaves are used as vegetable. All plants are useful. Beneficial as Memory enhancer, headache and acidity.

7. Botanical name: Boerhavia diffusa Linn., Nyctaginaceae,
Ho. Kecho aa [9, 10, 12]

Nutritional value: (Per 100 gm.)
Protein -1.2gm, calories-37gm, Carbohydrates–7.3gm, Minerals-2.6gm, Calcium-650mg, Phosphorous-50mg, Iron-21mg, Vitamin C-70mg

Medicinal value: After child birth the soup is given to mother to regain strength, useful in anemia, cardiac trouble, treat urinary tract problems.

8. Botanical name: Cassia tora Linn. Caesalpinaceae, Ho.
Kanyur aa [9, 11, 12]

Nutritional value: (Per 100 gm.)
Protein -8.0gm, calories-49gm, carbohydrates – 5.5gm, Minerals - 1.7gm, calcium -520mg, Iron- 12.4mg, Phosphorous-39mgVitamin A- 101520mg, Vitamin C-82mg

Medicinal value: Leaves are used for skin diseases, helps in removing worms from Children`s stomach, leaves helpful for proper digestion, Effective in Intestinal disorder, popular drug for Jaundice, cures night blindness.

[9, 12]

Nutritional value: (Per 100 gm.)
Protein -7.0gm, calories-97gm, carbohydrates– 14.1gm, Minerals – 2.1gm, calcium -340mg, Iron- 23.8mg, Phosphorous-120mgVitamin A- 978mg, Vitamin C-61mg

Medicinal value: The leaf juice is used to treat swelling of gums and teeth and Immunity enhancement

10. Botanical name: Colocasia antiquorum Linn, Araceae
Ho. pechki aa [9, 11, 12]

Nutritional value: (Per 100 gm.)
Protein -3.9gm, calories-56gm, Carbohydrates–608gm, Minerals-2.2gm, Calcium-227mg, Phosphorous-10.0mg, Iron- 82mg, Vitamin A-10278mg, Vitamin C-12mg

Medicinal value: Leaves use for stomach cooling, for stomach complaints and as liver tonic and for increasing eyesight.
11. Botanical name: *Celosia argenta* Linn. Amaranthaceae
   Ho. Sirgiti aa [9, 11, 12]
   Nutritional value: (Per 100 gm.) Protein -3.7gm, calories-46gm, Carbohydrates–6.0gm, Minerals-2.3gm, Calcium-268mg, Phosphorous-35mg,
   Medicinal value: Juice of leaves is used for curing of dysentery, paste of the plant for burns and useful in tuberculosis.

   Nutritional value: (Per 100 gm.) Protein -5.6gm, calories-73gm, Carbohydrates–3.8gm, Minerals-8.3gm, Calcium-881mg, Phosphorous-73mg, Iron-24.4mg
   Medicinal value: Juice of leaves is used as vegetable.

   Nutritional value: (Per 100 gm.) Protein -4.7gm, calories-83gm, Carbohydrates –12.3gm, Minerals – 3.2gm, calcium-456mg, Iron- 21.1mg, Phosphorous-106mg, Vitamin C-44mg
   Medicinal value: Leaves are used as vegetable. Leaves are used for cardiac and respiratory system. Helps in removing worms from children’s stomach, cold, cough, increase the flow of breast milk.

   Nutritional value: (Per 100 gm.) Protein -2.1gm, calories-55gm, carbohydrates 5.5gm, Minerals-55gm, calcium-160mg, Iron-7.3mg, Phosphorous-100mg Vitamin A-3000mg, Vitamin C-41mg
   Medicinal value: Leaves are used vegetable.

15. Botanical name: *Moringa oleifera* Linn. Moringaceae, Mulga aa [9, 10, 11, 12, 13]
   Nutritional value: (Per 100 gm.) Protein -6.1gm, calories-92gm, carbohydrates – 12.5gm, Minerals - 2.3gm, calcium - 440mg, Iron- 0.85mg, Phosphorous-70mg Vitamin A-5520mg, Vitamin C-99mg
   Medicinal value: All parts of the tree are used in the treatment of venemous bites, leaves are used by women to increase the flow of breast milk, rheumatism and as cardiac and circulatory stimulant. Leaves are used in scurvy and catarrhal infection, also used as emetic and helpful in hypertension, night blindness, missals.

16. Botanical name: *Marsilea minuta* Linn, Marsiliaceae, Chatom aa [9, 12, 13]
   Nutritional value: (Per 100 gm.) Protein -3.7gm, calories-46gm, carbohydrates – 4.6gm, Minerals - 5.3gm, calcium - 53mg, Iron- 2.1mg, Phosphorous -91mg.
   Medicinal value: Leaves are used for hypertension, swellings of body and helpful in having a sound sleep.

17. Botanical name: *Polygonum plebesum* Willd., polygonaceae, Ho. Mui aa [9, 12, 13]
   Nutritional value: (Per 100 gm.) Protein -3.2gm, calories-46gm, Carbohydrates–6.9gm, Minerals-3.9gm, Calcium-194mg, Phosphorous-48 mg
   Medicinal value: Leaves use for Jaundice.

18. Botanical name: *Rumex vesicaries* Linn., polygonaceae, Ho. Tissa palak aa [9, 12]
   Nutritional value: (Per 100 gm.) Protein -1.6gm, calories-15gm, carbohydrates –1.4gm, Minerals - 0.9gm, calcium - 63mg, Iron- 0.75mg, Phosphorous-17mg Vitamin A-3660mg, Vitamin C-12mg
   Medicinal value: Leaves are used vegetable.

   Nutritional value: (Per 100 gm.) Protein -4.4gm, calories-40gm, carbohydrates – 3.6gm, Minerals - 1.8gm, calcium - 120mg, Phosphorous -20mg.
   Medicinal value: Leaves are used against cold and cough, fever, Grinded fresh leaves are applied on burnt skin.

   Nutritional value: (Per 100 gm.) Protein -4.0gm, calories-86gm, carbohydrates – 14.9gm, Minerals - 1.6gm, calcium - 127mg, Phosphorous -51mg.
   Medicinal value: Leaves are used against heatstroke, dysentery

Result

Among the total, 20 wild plants to taxonomical assayed, belong to a wide group in 13 families and 19 genera (Table-1). They are rich in protein, calories, carbohydrates, potassium, iron, calcium, vitamin A and vitamin C. Nutritional compositions of the edible plants are presented ((Fig1.A-H)). Relatively high protein contents were recorded for *Antidesma diandrum* (72gm), iron content for *Alternanthera sessilis* (50mg) and *Amaranthus spinosus*, Calories are good in *Antidesma diandrum* (303mg), mineral content for *Colocasia antiquorum* (608gm), *Antidesma diandrum* (171mg), phosphorous content for *Bacopa monniari* (140 mg), vitamin A and C content for *Antidesma diandrum* (Vit A-101520 μg) (Vit C-825mg) respectively. Indigenous wild leafy vegetables are adapted to the marginal agro climatic conditions of their common occurrence. Wild vegetables can easily be harvested from any other habitants. Promotion of vegetables tends to be less expensive all the way from production to processing and developed as future crops under the scenario of fast climate change deterioration of natural resources, thus need for effective and aggressive multifaceted programs of conservation, promotion and sustained utilization of wild edibles are in the best interest of rural development in our country. This should be supported by an all-around strategy that includes promotion and educational intervention at local community [25].
Fig 1: (A-H) Nutritional concentration of protein, calories, iron calcium phosphorus, vitamin A and vitamin-C(mg%) in wild edible leafy vegetable plants.

Table 1: List of some important nutritional compositions (mg%) of wild edible leafy vegetable plants.

<table>
<thead>
<tr>
<th>Name of Species</th>
<th>Protein</th>
<th>Calories</th>
<th>Carbohydrates</th>
<th>Minerals</th>
<th>Calcium</th>
<th>Iron</th>
<th>Phosphorus</th>
<th>Vitamin A</th>
<th>Vitamin C</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Amaranthus gangeticus</em> Roxb.</td>
<td>4.0gm</td>
<td>45gm</td>
<td>6.1gm</td>
<td>2.7gm</td>
<td>397mg</td>
<td>6.3mg</td>
<td>-</td>
<td>520 μg</td>
<td>99mg</td>
</tr>
<tr>
<td><em>Amaranthus spinosus</em> Linn.</td>
<td>3.0gm</td>
<td>43gm</td>
<td>7.0gm</td>
<td>3.6gm</td>
<td>800mg</td>
<td>22.9mg</td>
<td>50mg</td>
<td>3564 μg</td>
<td>33mg</td>
</tr>
<tr>
<td><em>Antidesma diandrum</em> Roxb.</td>
<td>72gm</td>
<td>303gm</td>
<td>5.5gm</td>
<td>57.8gm</td>
<td>1717mg</td>
<td>28.4mg</td>
<td>80mg</td>
<td>101520 μg</td>
<td>825mg</td>
</tr>
<tr>
<td><em>Alternanthera sessilis</em> Linn.</td>
<td>2.5gm</td>
<td>13gm</td>
<td>11.6gm</td>
<td>2.5gm</td>
<td>510mg</td>
<td>60mg</td>
<td>1.63mg</td>
<td>192 μg</td>
<td>17mg</td>
</tr>
<tr>
<td><em>Bauhinia purpurea</em> Linn.</td>
<td>3.6gm</td>
<td>62gm</td>
<td>9.7gm</td>
<td>2.1gm</td>
<td>212mg</td>
<td>92mg</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><em>Bacopa monniari</em> Linn.</td>
<td>2.9gm</td>
<td>2.9gm</td>
<td>4.9gm</td>
<td>2.2gm</td>
<td>290mg</td>
<td>4.68mg</td>
<td>140mg</td>
<td>2803μg</td>
<td>13mg</td>
</tr>
<tr>
<td><em>Boerhavia diffusa</em> Linn.</td>
<td>1.2gm</td>
<td>37gm</td>
<td>7.3gm</td>
<td>2.6gm</td>
<td>650mg</td>
<td>-</td>
<td>50mg</td>
<td>21 μg</td>
<td>70mg</td>
</tr>
<tr>
<td><em>Cassia tora</em> Linn.</td>
<td>8.0gm</td>
<td>49gm</td>
<td>5.5gm</td>
<td>1.7gm</td>
<td>520mg</td>
<td>12.4m</td>
<td>39mg</td>
<td>101520μg</td>
<td>82mg</td>
</tr>
<tr>
<td><em>Cicer arietinum</em> Linn.</td>
<td>7.0gm</td>
<td>97gm</td>
<td>14.1gm</td>
<td>2.1gm</td>
<td>340mg</td>
<td>23.8mg</td>
<td>120mg</td>
<td>978 μg</td>
<td>61mg</td>
</tr>
<tr>
<td><em>Colocasia antiquorum</em> Linn.</td>
<td>3.9gm</td>
<td>56gm</td>
<td>608gm</td>
<td>2.2gm</td>
<td>227mg</td>
<td>10.0mg</td>
<td>82mg</td>
<td>10278 μg</td>
<td>12mg</td>
</tr>
</tbody>
</table>
Discussion

Malnutrition is a major health burden in developing countries, and recognition that nutritional security and biodiversity are linked in fundamental for enlisting policy support to secure wild food use and habitats for wild edible species. Calcium and potassium are found in major concentrations in these plants and potassium is necessary for muscle contraction and the minerals are essential part of nucleoproteins, metallo-proteins, chromo-proteins, etc., the determination of minerals are important in the case of a disease. Calcium is needed in the development of bone and teeth it regulates heart rhythm, helps in normal blood clotting, maintain proper nerve and muscle functions and lower blood pressure. It is also an interesting observation that tribal communities not only use for self-consumption but they also sell wild edible products to earn income and commonly sold by tribal women seasonally in weekly markets. These ‘Ho’ tribes consume different wild leafy vegetables throughout the year as per their availability but some edible plant products like fruits, leafy vegetables, roots and tubers are prohibited from consumption before their festival (Porob). So after celebration of the festival (porob) they may consume. These interesting observations have been done by author, i.e. consuming of wild edible plant by ‘Ho’ tribes, they included the consuming habits and patterns with their beliefs, and due to these beliefs during prohibition time the plants grow well, so they have knowledge of conservation of plant, which the present finding explores prohibition time the plants grow well, so they have knowledge of conservation of plant, which the present finding explores.

Conclusion

Documentation of indigenous greens from ethno botanical approach is important for enhancing the understanding of Indigenous knowledge system. The wide consumption and availability of wild plants attest their value, and are especially visible among indigenous culture. Balancing agro biodiversity is major challenge in the study area due to several factors like promotion of mono crops and perennial plantation which results adverse impact on plant biodiversity. There are many wild greens which are still unexplored and they have to be studied scientifically. Since a number of plants have been identified, which can serve the dual purposes of medicinal and nutritive values they can be targeted for mass cultivation and conservation. At the same time, the population can be made aware of the consumption values of these plants or plant parts, which in turn can lead to reduced health costs, prevention and cure of a number of prevalent diseases, and an improved diet. Thus need to be practice as a staple food of these wild leafy vegetables for decreases of malnutrition as well as prevention from diseases to remain healthy.

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