



International Journal of Herbal Medicine

Available online at www.florajournal.com



E-ISSN: 2321-2187
P-ISSN: 2394-0514
IJHM 2015; 3(5): 25-32
Received: 11-10-2015
Accepted: 14-11-2015

Sangita Horo
Research Scholar, Kolhan
University Chaibasa, Dist-W.
Singhbhum (Jharkhand), India

Salomi Topno
Asst. Professor, Mahila College,
Chaibasa, Dist-W. Singhbhum
(Jharkhand), India.

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.

Correspondence:
Sangita Horo
Research Scholar, Kolhan
University Chaibasa, Dist-W.
Singhbhum (Jharkhand), India

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. vesicaries*, *L. sativus*, *C. arietinum*, *B. monniari*, *E. hirta*, *T. indica*, *B. purpuria*, *P. plebesum*, *A. spinosus*, *C. antiquorum*, *A. sessilis*, *C. argentia*, *C. viscosa*, *B. diffusa*, *T. terrastris* were collected from several places of W. Singhbhum 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 uses are provided.

1. **Botanical name:** *Amaranthus gangeticus* Roxb. 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 use 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. Caesalpiniaceae, 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-39mg Vitamin 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. **Botanical name:** *Cicer arietinum*. Linn., Fabaceae, But aa [9, 12]

Nutritional value: (Per 100 gm.) Protein -7.0gm, calories-97gm, carbohydrates- 14.1gm, Minerals - 2.1gm, calcium - 340mg, Iron- 23.8mg, Phosphorous-120mg Vitamin 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 argentea* Linn. Amaranthaceae
Ho. Sirgiti aa [9, 11, 12]

Nutritional value: (Per 100 gm.) Protein -3.8gm, calories-45gm, 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.

12. Botanical name: *Cleome viscosa* Linn. Capparidaceae Ho. Hurhuria aa [9, 10, 12]

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.

13. Botanical name: *Euphorbia hirta*. Linn. Euphorbiaceae, Towa aa [9, 12]

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.

14. Botanical name: *Lathyrus sativus*. Linn. Kansari aa, Fabaceae [9, 13, 12]

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 venomous 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.

19. Botanical name: *Solanum tuberosum* Linn. Solanaceae, Aloo aa [9, 12]

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.

20. Botanical name: *Vanguria spinosa* Roxb. Compositae, Sarli aa [9, 12, 13]

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* (60mg) and *Amaranthus spinosus*, Calories are good in *Antidesma diandrum* (303mg), mineral content for *Colocasia antiquorum* (608gm), *Antidesma diandrum* (1717mg), 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 habitats. 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].

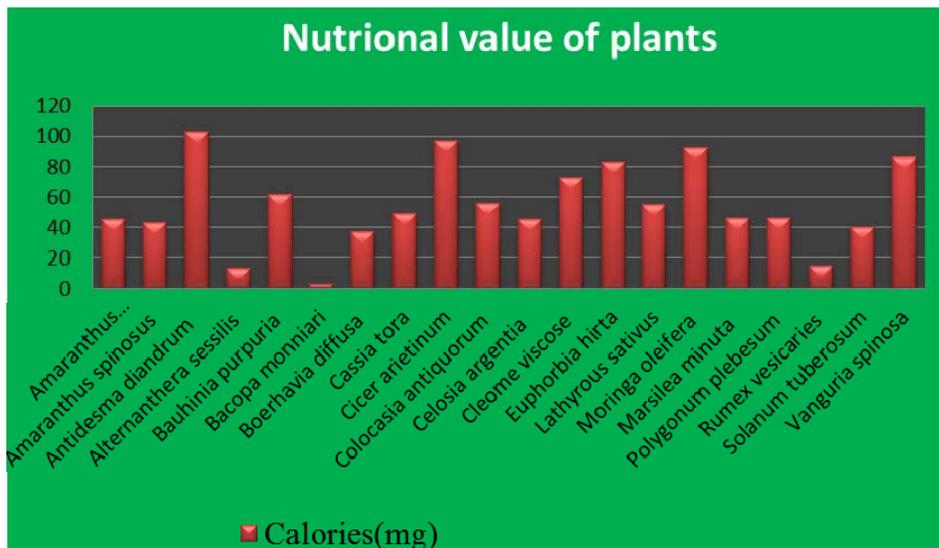


Fig-A

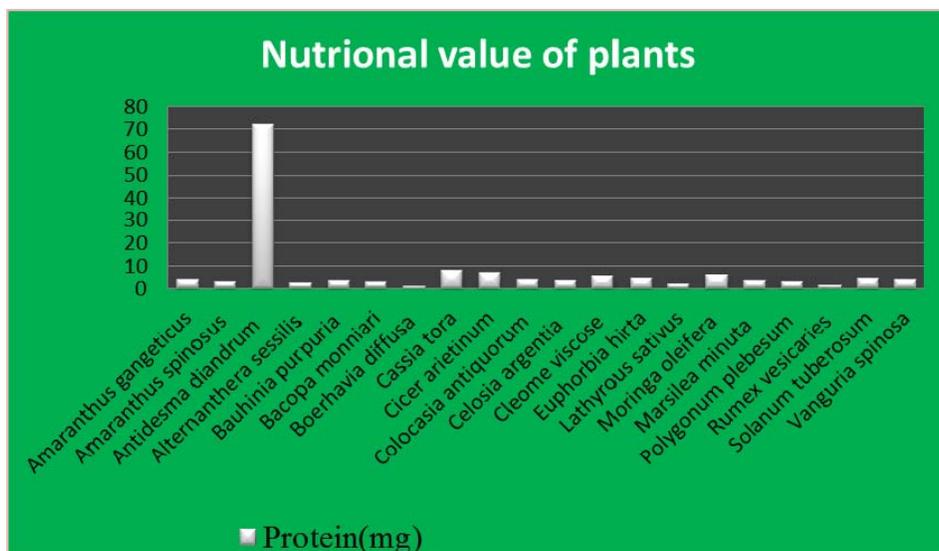


Fig-B

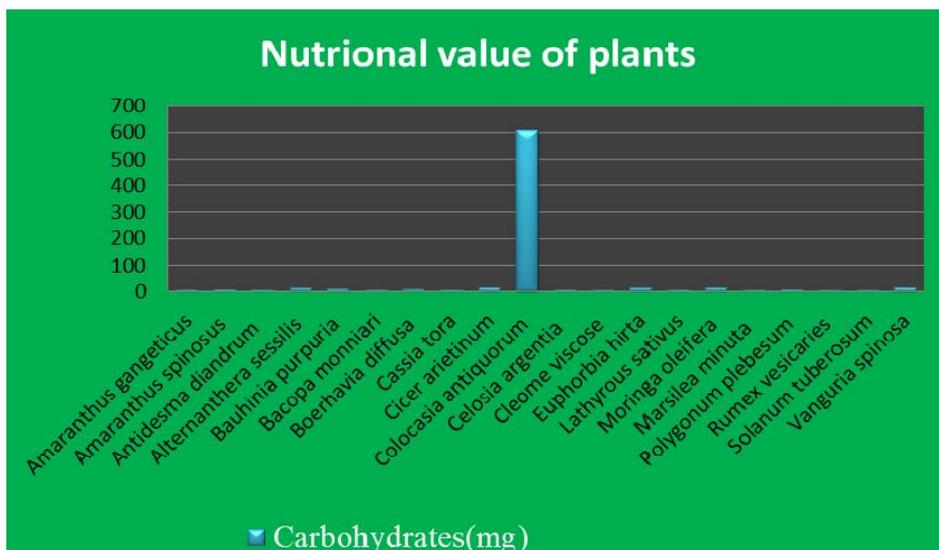


Fig-C

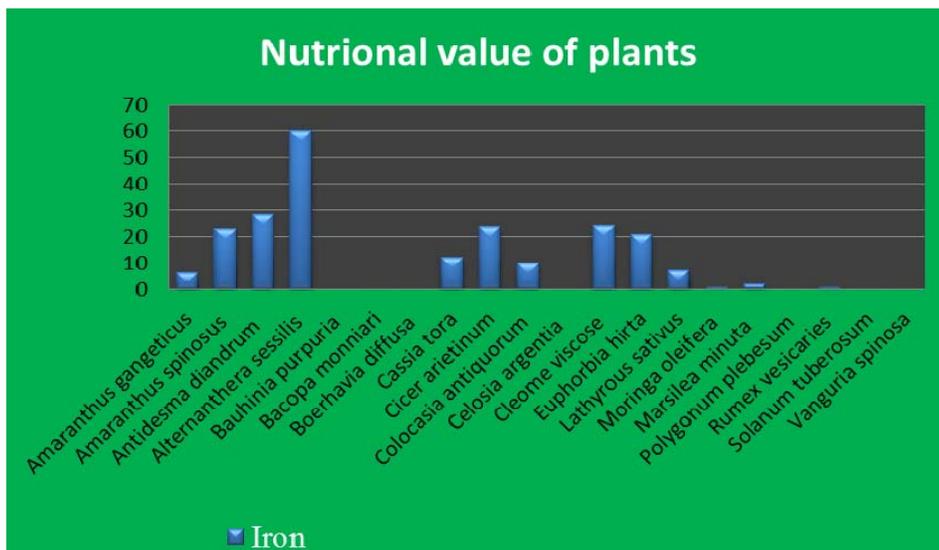


Fig-D

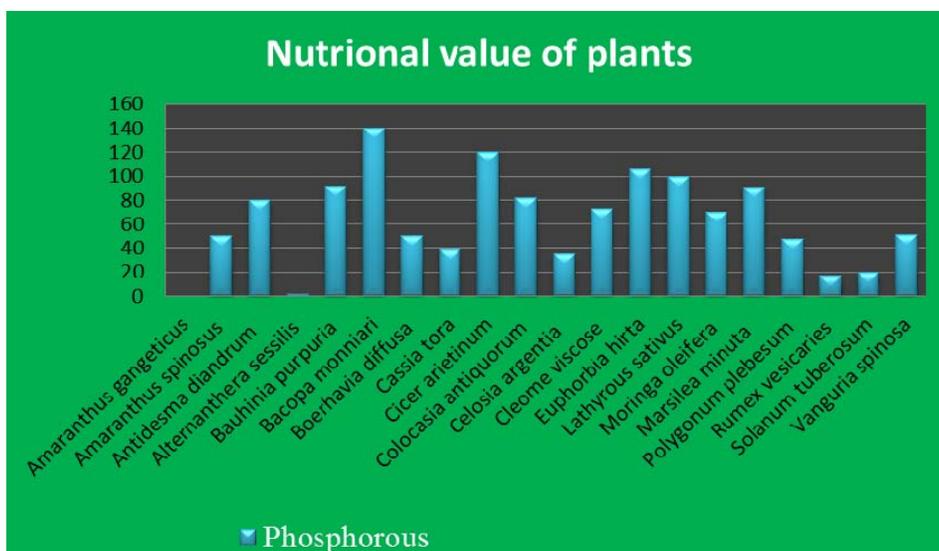


Fig-E

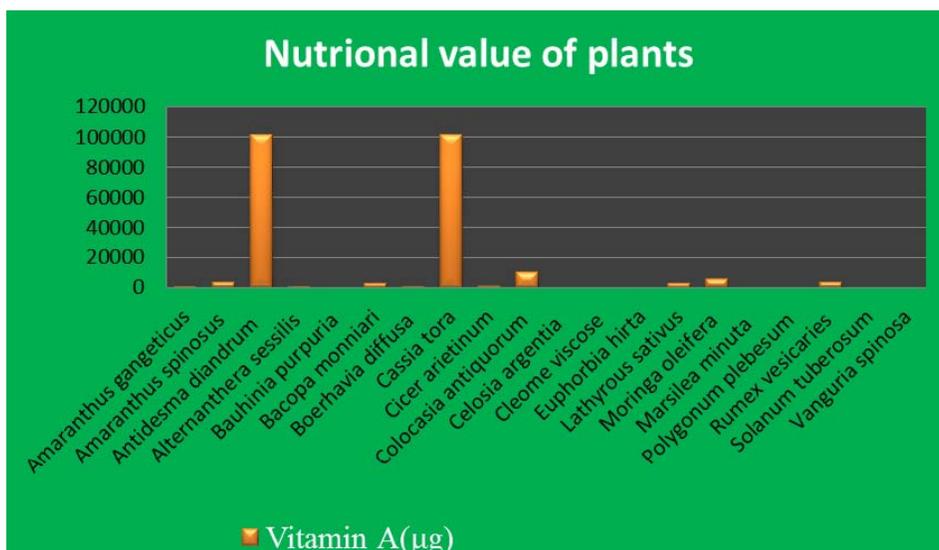


Fig-F

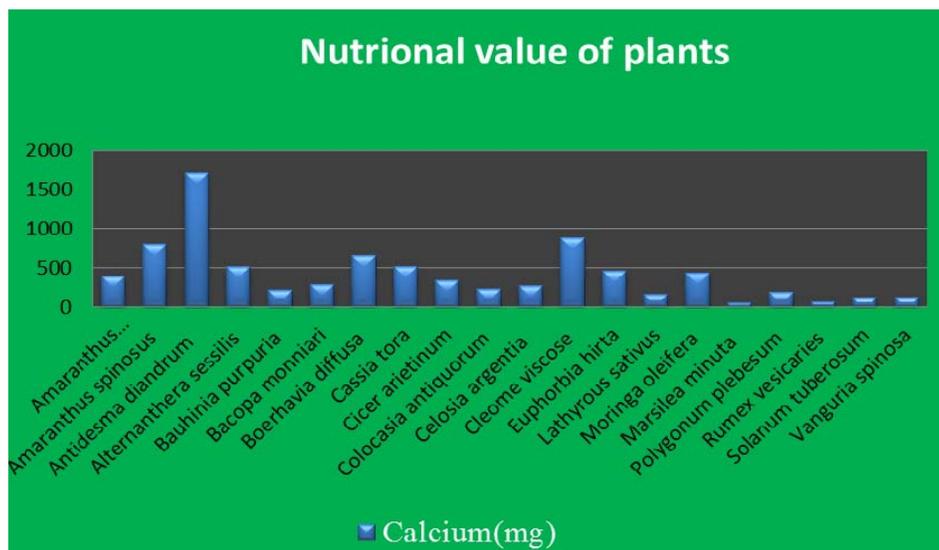


Fig-G

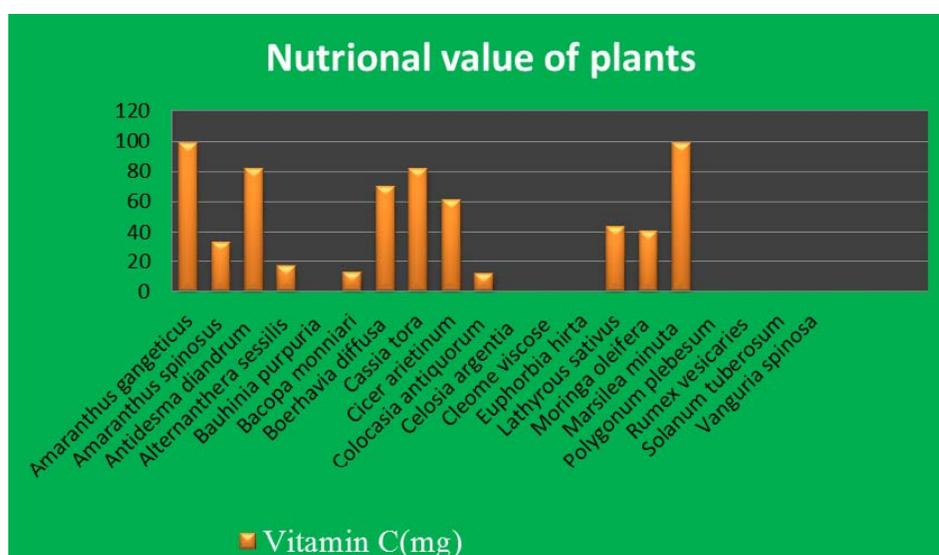


Fig-H

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.

Name of Species	Protein	Calories	Carbohydrates	Minerals	Calcium	Iron	Phosphorous	Vitamin A	Vitamin c
<i>Amaranthus gangeticus</i> Roxb.	4.0gm	45gm	6.1gm	2.7gm	397mg	6.3mg	-	520 µg	99mg
<i>Amaranthus spinosus</i> Linn.	3.0gm	43gm	7.0gm	3.6gm	800mg	22.9mg	50mg	3564 µg	33mg
<i>Antidesma diandrum</i> Roxb.	72gm	303gm	5.5gm	57.8gm	1717mg	28.4mg	80mg	101520 µg	825mg
<i>Alternanthera sessilis</i> Linn.	2.5gm	13gm	11.6gm	2.5gm	510mg	60mg	1.63mg	192 µg	17mg
<i>Bauhinia purpuria</i> Linn.	3.6gm	62gm	9.7gm	2.1gm	212mg		92mg	-	-
<i>Bacopa monniari</i> Linn.	2.9gm	2.9gm	4.9gm	2.2gm	290 mg	4.6.8mg	140mg	2803µg	13mg
<i>Boerhavia diffusa</i> Linn.	1.2gm	37gm	7.3gm	2.6gm	650mg	-	50mg	21 µg	70mg
<i>Cassia tora</i> Linn.	8.0gm	49gm	5.5gm	1.7gm	520mg	12.4m	39mg	101520µg	82mg
<i>Cicer arietinum</i> Linn.	7.0gm	97gm	14.1mg	2.1gm	340mg	23.8mg	120mg	978 µg	61mg
<i>Colocasia antiquorum</i> Linn.	3.9gm	56gm	608gm	2.2gm	227mg	10.0mg	82mg	10278 µg	12mg

<i>Celosia argentia</i> Linn.	3.8gm	45gm	6.0gm	2.3gm	268mg	-	35mg	-	-
<i>Cleome viscosa</i> Linn.	5.6gm	73gm	3.8gm	8.3gm	881mg	24.4mg	73mg	-	-
<i>Euphorbia hirta</i> Linn.	4.7gm	83gm	12.3gm	3.2gm	456mg	21.1mg	106mg	-	44mg
<i>Lathyrus sativus</i> Linn.	2.1gm	55gm	5.5gm	55gm	160mg	7.3mg	100mg	3000 µg	41mg
<i>Moringa oleifera</i> Linn.	6.1gm	92gm	12.5gm	2.3gm	440mg	0.85mg	70mg	5520 µg	99mg
<i>Marsilea minuta</i> Linn.	3.7gm	46gm	4.6gm	5.3gm	53mg	2.1mg	91mg	-	-
<i>Polygonum plebesum</i> Willd.	3.2gm	46gm	6.9gm	3.9gm	194mg	-	48 mg	-	-
<i>Rumex vesicaries</i> Linn.	1.6gm	15gm	1.4gm	0.9gm	63mg	0.75mg	17mg	3660 µg	12mg
<i>Solanum tuberosum</i> linn.	4.4gm	40gm	3.6gm	1.8gm	120mg	-	20mg	-	-
<i>Vanguria spinosa</i> Roxb.	4.0gm	86gm	14.9gm	1.6gm	127mg	-	51mg	-	-

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 [17]. 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, metalloproteins, chromo-proteins, etc., the determination of minerals are important in the case of a disease [18]. Calcium is needed in the development of bone and teeth and it regulates heart rhythm, helps in normal blood clotting, maintain proper nerve and muscle functions and lower blood pressure [19, 20, 21, 22, 23, 24]. 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 and preserves, the traditional knowledge as well as their nutrient value has been analyzed. The "Ho" tribe use wild plant species in various ways for their daily needs including food and medicine. They consume a large number of wild leafy vegetables for food but this knowledge has been found only with the elder people rather than the younger generation. Excess anthropogenic activities, lack of proper documentation and lack of practices are to be minimized and this traditional knowledge has to be transferred from generations to generations among these indigenous people. Resulted today the socio-culture of their heritage has been very much affected due to the emergence of the modernized culture. These people are adapting all types of the modern culture and living styles from outside of their own heritage.

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.

Acknowledgment

The authors sincerely thank the UGC, the RGNF fellowship for the financial support imparted to complete the research. Authors fully acknowledge "Ho" tribe women and men who have shared their knowledge and demonstrations on various traditional food plant recipes.

Reference

1. Sundriyal M, Sundriyal RC. Wild edible plants of the Sikkim Himalaya; Marketing value addition and implication for management. *Econ. Bot.*, 2004; 58(2):300-315.
2. Rahmatullah M. A survey of medicinal plants in two areas of Dinajpur district, Bangladesh including plants which can be used as functional food., *AEJSA*, 2009; 3(4):862-876.
3. Laxmi B, Vimala V. Nutritive value of dehydrated green leafy vegetable powder *Food Sci. Technol.* 2000; 37:465-471.
4. Grivetti LE, Ogle BM. Value of traditional foods in meeting macro- and micronutrient needs: the wild plant connection, *Nutrition Research Reviews*, 2009; 13:31-46.
5. Rathore M, Nutrient content of important fruit trees from arid zone of Rajasthan. *J Horti Forestry.* 2009; 1(7):103-108.
6. Gupta K. nutrient contents and antinutrients factors in conventional and non conventional leafy vegetables. *Food Chem.* 1989; 31:105-116.
7. Getachew *et al.*, Dietary values of wild and semi-wild

- edible plants in southern Ethiopia; African Journal of food, Agriculture Nutrition and Development; 2013, 7485-7503.
8. Dogan Y. Wild plants sold in the local markets of Izmir, Turkey; Pak. J Bot. 2013; 45(SI):177-184.
 9. Hains HH. The Botany of Bihar and Orissa I-VI vols., BSI, Howrah, 1925.
 10. Topno S. Studies on plants used in Traditional Herbal Medicine System of Khunti sub division of Chotanagpur. Ph. D Thesis, Ranchi University Ranchi, 1996.
 11. Topno S, Ghosh Tk. Co-relation of Uses of Medicinal Plants by Tribal of Chotanagpur with other Tribals of India, Jour Econ. Tax. Bot. 1999; 23(1):143-146.
 12. Rev Bressers J SJ. The Botany of Ranchi District Bihar, India, Catholic press Ranchi Bihar India, Published by the Govt. of Bihar, 1951.
 13. Hoffmann J. Encyclopedia Mundarica, 1950, 1-13.
 14. AOAC, Official methods of analysis of Association of Official. Agricultural Chemist, 15th edn, Washington, DC, 1990.
 15. Mahapatra AK. Nutrient analysis of some selected wild edible fruits of deciduous forest of India: an explorative study towards non conventional bio nutrition., 2012, 15-21.
 16. AOAC official methods of the AOAC International. Determination of lead, cadium and minerals in foods by Atomic Absorption Spectrophotometry (method 999.11/985. 35) Association of Official Analytical Chemists, Gaithersburg, 2000.
 17. AOAC Official Methods of Analysis. Herlich, K(ed), 15th edn. Association of official Analytical Chemists Intn., Arlington and VA, 1995.
 18. Gopalan C, Sastri BV, Balasubramanian SC. Nutritive value of Indian, 1989. FOODS. Hyderabad, India: Indian Council of Medical Research 2(1)2011; (1):392-396,
 19. Ajesh TP. Ethnobotanical documentation of wild edible fruits used by *Muthuvan tribes* of Idukki, Kerala- India., 2012, 480-487.
 20. Gopalan C, Rama BV, Balasupramanian SCV. National institute of nutrition Indian council of medical research Hydrabad, India.
 21. Ekinci NR, Ekinci, R. Polat, G. Budak., Analysis of trace elements in medicinal plants with energy dispersive X-ray fluorescence Journal of Radioanalytical and Nuclear Chemistry, 2004; 260:141-143.
 22. Bibi S. Dastagir G. Hussain F. Sanaullah P. Element composition of *Viola odorata* Linn. Pak J Pl Sci 2006; 12:127-131.
 23. Beluhan S, Ranogajec A. Chemical composition and non-volatile components of Croatian wild edible mushrooms, Food Chemistry, 2010; 124:1076-1082.
 24. Borah S, Baruah AM, Das AK. Determination of mineral content in commonly consumed leafy vegetables. Food Anal. Methods, 2009; 2:226-230.
 25. Getachew Addis G, Asfaw Singh, Woldu Z, Baidu-Forson JJ, Bhattachacharya. Dietary Values of Wild and Semi -Wild Edible Plants in Southern Ethiopia., African Scholarly Science Communication Trust., 7485-7503.