Emir. J. Food Agric. 2011. 23 (6): 554-560
http://ejfa.info/

Nutritional analysis of indigenous wild edible herbs used in eastern Chhattisgarh, India

Kanchan Lata Vishwakarma* **and Veenapani Dubey**

C.M.D. Post Graduate College, Bilaspur, Chattishgarh, India

Abstract: The communication deals with the native uses of ethnobotanical species identification and chemical analyses of different edible parts of wild plant species consumed by the local people inhabiting in the tribal areas of Bilaspur district, situated in the eastern part of Chhattisgarh state of India. Total seventy wild edible plant species were identified and recorded. Out of seventy plants species 25 are chemically analyzed and presented in this paper. The methods employed in this study were designed with the purpose of providing baseline information on the wild edible plant species in local system through surveys (field visits) and there nutritional potential through chemical analysis of different edible parts. Plants were collected, photographed, identified and voucher specimens prepared for the herbarium. The proximate nutritional composition, ash, moisture, carbohydrate, crude protein, crude fat, crude fiber, energy and iron were determined. The results of nutritional composition showed that the leaves have high moisture content from 93.45 ± 0.182% to 56.96 ± 0.255% which is highest in the leaves of *Carthemus tinctorius* and lowest in *Cissus quadrangularis*. Crude protein contents in the samples varied from 1.2 ± 0.602% to 17.84 ± 0.892%. *Ipomoea aquatica* showed the highest value of 17.84 ± 0.892%. Leaves of *Amaranthus virdis*, *Chenopodium album*, *Centella asiatica*, *Commelina benghalensis*, *Moringa oleifera* have also been found to be very good sources of protein. Out of 25 vegetables, crude lipid content ranged from 0.72 ± 0.409% to 30.02 ± 0.461.The lowest value of crude lipid was found in *Aegle marmelos* 0.77 ± 0.046% which was low as compared to the previously reported value of 2.66% in *Momordica* species. Energy in terms of calorific value was found to be in the normal range of 134.6 kcal/100 gm to 431.6 kcal/100 gm. Iron content in these samples ranged from 21 ppm to 869 ppm. All the values are statistically analyzed and compared with previously reported values.

Key words: wild edible herbs, tribal areas, protein contents, nutritional composition

التحليل الكيميائي للأعشاب البرية المحلية القابل للأكل والمستخدمة في المنطقة الشرقية من ولاية شاتيسجاره الهندية

كانش لتا فيشواكارما* و فيناباني دوبي

سي. ام. دي. كلية ما بعد التخرج ، بيلاسبور ، شاتيسجاره الهندية

الملخص: تهدف هذه الدراسة إلى تبادل المعلومات عن الاستخدام المحلي لبعض النباتات البرية والتي تصنف من ضمن علم النبات البشري (ethnobotanical) وذلك بتصنيفها والتعرف على التركيب الكيميائي لمختلف الأجزاء الصالحة للأكل والتي يستهلكها السكان المحليين الذين يقطنون في المناطق القبلية في منطقة بيلاسبور، والتي تقع في الجزء الشرقي من ولاية شاتيسجاره الهندية. فقد تم في هذه الدراسة تصنيف وتسجيل ما مجموعه ٧٠ من النباتات البرية القابلة للأكل ، وقد تم إجراء التحليل الكيميائي لعدد ٢٥ نبات من مجمع هذه النباتات. وقد تم تصميم الأساليب المستخدمة في هذه الدراسة وذلك بغرض توفير بعض المعلومات الاساسية بشأن الأنواع البرية النباتية الصالحة للأكل والتي تستخدم محليا وذلك عن طريق الدراسات الاستقصائية (الزيارات الميدانية)، وكذلك بالتعرف على القيمة الغذائية الكامنة لهذه النباتات عن طريق التحليل الكيميائي لمختلف الأجزاء الصالحة للأكل. عند بدء الدراسة فقد تم جمع النباتات وتصويرها وتصنيفها مع أخذ عينات لمعالجتها ووضعها في المعشب. التحاليل التي تم إجراءها هي الرماد ، الرطوبة ، المواد الكربوهيدراتية ، البروتين الخام ، الطاقة وعنصر الحديد. وقد أظهرت نتائج التحليل الكيميائي بان اوراق النبات التي تم تحليها تحوى على نسبة اعلى من الرطوبة تتراوح بين ٩٣,٤٥ ± ٠,١٨٢% إلى ٥٦,٩٦ ± ٠,٢٥٥% حيث كانت نسبة الرطوبة الاعلى في اوراق نبات *Carthemus tinctorius* والادنى في نبات *Cissus quadrangularis*. كما تراوحت نسبة البروتين الخام بين ١,٢ ± ٠,٦٠٢% إلى ١٧,٨٤ ± ٠,٨٩٢% . حيث كانت نسبة البروتين الاعلى في نبات Ipomoea aquatic وهي ١٧,٨٤ ± ٠,٨٩٢%. كما بينت النتائج إن اوراق النباتية التالية تعتبر ذات مصدر جيد للبروتين وهي *Amaranthus virdis* و *Chenopodium album* و *Centella asiatica* و *Commelina benghalensis* و *Moringa oleifera*. واظهرت نتائج تحليل الدهن الخام ان نسبته تتراوح بين ٠,٧٢ ± ٠,٤٠٩% إلى ٣٠,٠٢ ± ٠,٤٦١ %. القيمة الدنيا للدهن الخام كانت في نبات *Aegle marmelos* وهي ٠,٧٧ ± ٠,٤٠٩% وهي نسبة منخفضة عند مقارنتها بالنتائج السابقة والتي تم الحصول عليها وهي ٢,٦٦% لأنواع *Momordica*. نتائج تحليل الطاقة(بالكالوري) كانت ضمن المعدل الطبيعي وهي ١٣٤,٦ كالوري/١٠٠ غرام إلى ٤٣١,٦ كالوري/١٠٠ غرام. كما تراوحت نسبة عنصر الحديد في العينات التي تم تحليها لتكون بين ٢١ جزء بالمليون إلى ٨٦٩ جزء بالمليون. جميع نتائج التحليل تم تحليها إحصائيا ومقارنتها مع نتائج التحاليل المنشورة سابقا.

*Corresponding Author, *Email*: ms.kanchan14@rediffmail.com
Received 15 March 2011; Revised 08 May 2011; Accepted 08 May 2011

Introduction

Wild plants have since ancient times, played a very important role in human life. They have been used for food, medicine, fiber and other purposes and also as fodder for domestic animals. In search for wild edible food plants many of which are potentially valuable for human being has been identified to maintain a balance between population growth and agricultural productivity, particularly in the developing countries. In these regions starch based foods are the main staple food which supply both energy and protein requirements. Thus protein deficiency is generally found among these people. To alleviate the situation, efforts are underway to explore the lesser-known wild edible plants as sources of nutrient supplements. Increasing the utilization of wild edible herbs in our diet known to be rich source of nutrients as well as dietary fiber can be a food based approach for ensuring the intake of these nutrients. It is essential that the locally available these edible hrbs and plant parts are rich source of protein, iron, calories and they are also recognized for their characteristic color, flavor and therapeutic value,be used in the diets to prevent the nutrient deficiency and degenerative diseases. Gupta et al. (1974) have emphasized that analyzing such plants for various nutrients would enable identification of unconventional food resources. Some of the commonly consumed leafy vegetables and fruits are *Amaranthus virdis*, *Aegle marmelos* (fruit) *Chenopodium album*, *Centella asiatica*, *Cissus quadrangularis*, *Commelina benghalensis*, *Moringa oleifera* etc., apart from these there are various types of underutilized plant parts which are available seasonally, and practically no information is available on the nutritional value of such edible plants. Many researchers (Gopalan et al., 1971; Lockeett et al., 2000, Ogle et al., 2001) have also reported nutritional composition of various types of wild edible plants used in the developing countries. Kulkarni et al. (2003) has performed an ethno-botanical survey in western Maharashtra. (Gupta et al., 1989) analysed the nutrient content of few of the green leafy vegetables grown in north India. Analysis of proximate composition of the unconventional leafy vegetables found in the forest and wetlands of Konkan region of Maharastra, India, revealed that some of the green contained comparatively higher amounts of crude protein (Shingade et al., 1995).

Due to the dramatic loss of traditional knowledge regarding wild edible herbs our objective was to document and evaluate the indigenous knowledge and chemical analysis (nutrient composition of which has not been reported in literature from this area) of these plant species grown in and around eastern part of Chhattisgarh state of India. This geographic area was never fully investigated during previous studies. Shukla et al. (2001) reported 52 wild plant species from Bilaspur district of Chhattisgarh, India. He has described the botanical name, local name, family and edible plant parts used, but their nutritional value part has not been done.

Materials and Methods

Study sites and sample collection

Bilaspur district, situated in the eastern part of Chhattisgarh state of India (Figure 1). Bilaspur district lies between 21°37'to 21°7'N latitude and 81°12' to 83°40' E longitude in Chhattisgarh state. The study is carried out in November 2004 to February 2008 in 26 different villages and 11 weekly village markets of Bilaspur district, through semi structured interviews with 86 local informants including male and female. Plants were collected, photographed, identified and voucher specimens prepared for the herbarium. Ethnobotanical information about leafy vegetables was gathered through personal observations and discussions with the villagers. Markets of tribal villages called as "Haat Bazar" were also surveyed. Identification was done with the help of authentic books and Flora (Haines, 1925; Roy and Shukla, 1992; Maheshwari, 1962) and voucher specimens were preserved in Botany Department of Central University Bilaspur, Chhattisgarh, India.

Chemical analysis

Plant material was collected in bulk for chemical analysis.The leaves were washed with

distilled water and oven dried in paper envelop at 50°C. for 24 hrs. and grinded into fine powder. This dried powdered sample in triplicates was used for the analysis. The recommended methods of the Association of Official Analytical Chemists (AOAC, 1990) were used for the determination of moisture, ash, crude lipid, crude fiber and carbohydrate.

Ash was determined in silica crucibles by incineration in a muffle furnace at 550°C for 5hrs. Crude lipid was extracted by continuous soxhlet method AOAC(1990) with petroleum ether (b.p.40-60°C).Crude fiber was estimated by acid-base digestion with 1.25% H_2SO_4 and 1.25% NaOH solution. Nitrogen was estimated by Kjeltec system 1002 with steam distillation, titrated with standard 0.01 M HCl solution. Crude protein was estimated by multiplying the sample percent Nitrogen content by a factor 6.25.

%Protein = % Nitrogen × 6.25

Available carbohydrates were estimated by the anthrone method, with spectrophotometric measurement (Osborne 1986). Calorific value was estimated by Digital Bomb calorimeter. Iron was analyzed after wet digestion of 1gm. powdered sample with HNO_3/ $HClO_4$/ H_2SO_4 (9:2:1) mixture using absorption spectrophotometer at 508mu.

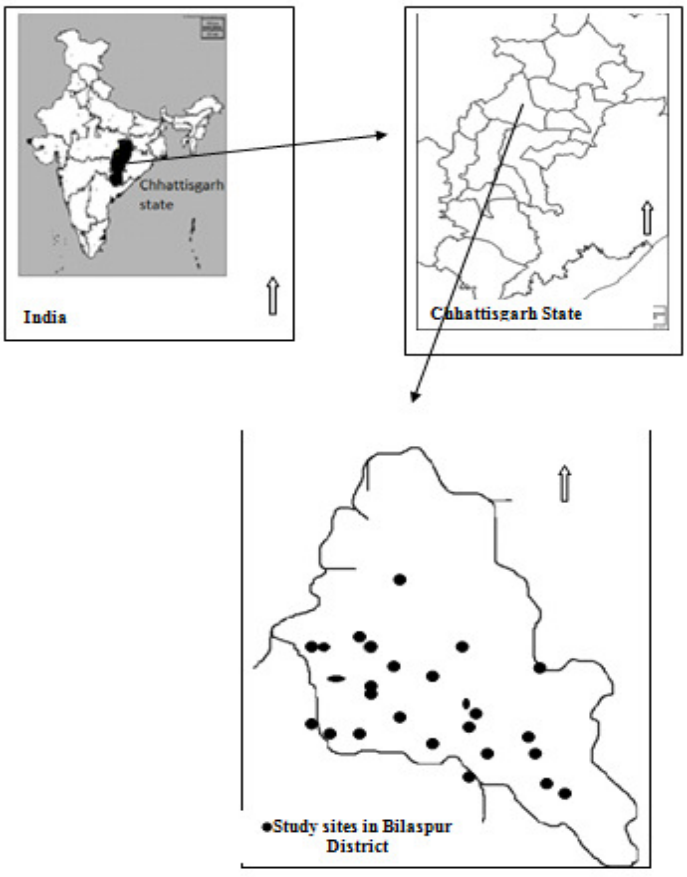

Figure 1. Study area.

Results and Discussion

Total seventy wild edible plant species were identified and recorded. Out of seventy plants species twenty five are chemically analyzed and presented in this paper.

The results of nutritional composition of twentyfive plant species (Table 1.) shows that the leaves have high moisture content from 93.45 ± 0.182% to 56.96 ± 0.255% which is highest in the leaves of *Carthemus tinctorius*

and lowest in *Cissus quadrangularis*. These values support the previously reported findings of Ladan et al. (1996) as 93.4 ± 0.7% to 58.0 ± 2.5% in some leafy vegetables consumed in Nigeria.

Crude protein contents in the samples varied from 1.2 ± 0.602% to 17.84 ± 0.892%. *Ipomoea aquatica* showed the highest value of 17.84 ± 0.892% while *Portulaca oleracea* shows the lowest protein value 1.2 ± 0.602%. Gopalan et al. (1971) has also reported 7% to 32% protein in common leafy vegetables in India. Kulkarni (2003) found the highest value of crude protein 29.6% in *Emilia sonchifolia*. Leaves of *Amaranthus virdis*, *Chenopodium album*, *Centella asiatica*, *Commelina benghalensis*, *Moringa oleifera* have also been found to be very good sources of protein.

Out of 25 vegetables, crude lipid content in leaves of *Commelina benghalensis*, *Centella asiatica*, *Bauhinia perpurea* and *Colocasia esculenta* have shown higher values (20.72 ± 0.409% to 30.02 ± 0.461%). The previously reported values range between 8.3-27.0% in some vegetables consumed in Nigeria (Ifon and Bassir, 1980; Sena et al., 1998). The lowest value of crude lipid was found in *Aegle marmelos* i.e. 0.77 ± 0.046% which was low as compared to the previously reported value of 2.66% in *Momordica* species.

Available carbohydrate content ranges between 18.72 ± 0.163% to 90.01 ± 0.797%. *Moringa oleifera* showed the lowest value and *Aegle marmelos* showed. Gopalan et al. (1996) reported 20.0 to 66.8% carbohydrate in some convetnional Indian leafy vegetables. Asibey-Berko and Tayie (1999) found 82.8% carbohydrate in sweet potatoes leaves from Ghana.

It is observed that tuber of *Dioscorea bulbifera*, leaves of *Oxalis corniculata*, *Barella rubra*, *Cissus quadrangularis*, *Hibiscus sabdiriffa*, *Cassia tora* are very good source of carbohydrate. They exhibited 79.03 ± 0.805%, 69.59 ± 2.805%, 65.51 ± 0.151%, 71.01 ± 1.158%, and 64.83 ± 0.434% respectively. These values are higher than 6.42% and 63.9% found in the leaves of *Ampelocissus tomentosa* and *Spondias pinnata* reported by Kulkarni et al. (2003).

Energy in terms of calorific value was found to be in the normal range of 134.6 kcal/100 gm to 431.6 kcal/100 gm. The highest value was found in the leaves of *Ipomoea aquatica* which is lower than the value of 449 kcal % reported by Kulkarni et al. (2003) in *Launea intybacia* but higher than the value of 189.22 kcal% reported by Hassan et al. (2006) in *Momordica balsamia* and 248.8 - 807.1 kcal% in some Nigerian leafy vegetables reported by Isong et al. (1999).

Observation shows that some leafy vegetables are very good source of energy. Some plants, such as, *Colocasia esculanta* (410.1 kcal/100 gm), *Oxalis corniculata* (371.90 kcal/100 gm), *Moringa oleifera* (336.4 kcal/100 gm), *Cassia tora* (362.9 kcal/100 gm) and *Cissus quadrangularis* (369.1 kcal/100 gm). Some plants are moderate sources of energy, e.g. *Chenopodium album* (271.4 kcal/100 gm), *Marsilea minuta* (293.7 kcal/100 gm), *Chorchorus trilocularia* (280.0 kcal/100 gm).

Iron is an essential trace element for haemoglobin formation. From Table 1, it is evident that iron content in these samples ranged from 21 ppm to 869 ppm. It also clearly indicates that *Portulaca oleracea* Linn.,has maximum iron content, i.e. 869 ppm, followed by *Centella asiatica* Linn. 838 ppm, *Corchorus trilocularis* Linn. 752 ppm, and *Cassia tora* Linn. 565 ppm.

Kulkarni et al. (2003) found 14.6-87.8 mg% iron in Indian green leafy vegetables. Ifen and Bassir (1980) found 110-325 mg/100 gm in Nigerian leafy vegetables.

The present results indicate the potentiality of some leafy vegetables and some fruits as source of non-conventional foods. We believe that these plants could be used for nutritional purposes due to their demonstrated good nutritional qualities and can help to overcome the nutritional deficiency especially in rural areas. Nutritional values of wild plant foods are of considerable significance, as they help to pinpoint traditional food resources of tribals. Due to lack of awareness and negative approach towards the wild food plants, it is important to create community awareness to accept wild food plants as useful as the cultivated ones.

Table 1. Nutritional analysis of some wild edible plants.

S.No.	Plant with Family, Local Name & Part used	Moisture	Crude Fibre (%)	Crude Lipid (%)	Crude Protein (%)	Available Carbohydrate (%)	Iron (ppm)	Energy kcal/100 gm
1	*Amaranthus virdis* Linn. Amaranthaceae (Chaulai) Leaf	80.15 ± 0.640	11.66 ± 0.971	9.00 ± 0.615	7.95 ± 0.965	67.78 ± 0.870	318	336.6
2	*Aegle marmelos* Corr. Rutaceae (Bel) Fruit	68.09 ± 0.370	1.21 ± 0.702	0.77 ± 0.046	6.23 ± 0.834	90.02 ± 0.797	42	134.6
3	*Amaranthus caudatus* Linn. Amaranthaceae (Rajgir bhaji) Leaf	81.6 ± 0.526	5.92 ± 0.887	11.00 ± 0.293	6.36 ± 0.062	61.03 ± 0.772	316	326.7
4	*Achyranthus aspera* Linn. Amaranthaceae (Chirchita) Leaf	80.54 ± 1.099	8.32 ± 1.235	8.22 ± 0.303	4.37 ± 0.359	58.84 ± 0.795	374	337.5
5	*Beta vulgaris* Linn. Chenopodiaceae (Shalgam) Leaf	87.35 ± 0.253	4.16 ± 0.939	5.2 ± 0.776	12.33 ± 0.814	61.11 ± 0.464	238	339
6	*Basella rubra* Linn. Basselaceae (Poi) Leaf	92.27 ± 1.024	9.01 ± 1.192	11.34 ± 0.281	7.8 ± 0.483	69.59 ± 0.403	545	270.6
7	*Chenopodium album* Linn. Chenopodiaceae (Bathua) Leaf	81.08 ± 0.459	11.00 ± 0.936	4.00 ± 0.295	12.34 ± 0.986	51.04 ± 0.879	288	271.4
8	*Carthemus tinctorius* Linn. Compositae (Barre) Leaf	93.45 ± 0.182	6.70 ± 0.846	6.00 ± 0.511	14.07 ± 0.924	61.71 ± 0.459	294	317.6
9	*Centella asiatica* Linn. Umbelliferae (Brahmi) Leaf	81.04 ± 0.461	21.78 ± 0.888	28.2 ± 0.414	7.16 ± 0.673	27.03 ± 0.309	838	324.1
10	*Commelina benghalensis* Linn. Commelinaceae (Kena) Leaf	89.00 ± 0.444	13.69 ± 1.461	20.72 ± 0.409	8.05 ± 0.891	43.09 ± 1.151	230	320.9
11	*Cassia tora* Linn. Caesalpiniaceae (Charouta) Leaf	78.03 ± 0.322	15.26 ± 0.930	6.3 ± 0.173	5.57 ± 0.246	64.83 ± 0.434	565	362.9
12	*Corchorus trilocularis* Linn. Tilliaceae (Chench) Leaf	80.32 ± 0.673	17.46 ± 1.067	3.54 ± 0.3724	8.7 ± 0.493	65.04 ± 0.408	752	280
13	*Dioscorea bulbifera* Linn. Dioscoreaceae (Dang kanda) Tuber	91.9 ± 0.353	6.04 ± 0.104	2.1 ± 0.836	2.1 ± 0.262	79.03 ± 0.805	317	304.7
14	*Ficus benghalensis* Linn. Moraceae (Bad) Fruit	79.54 ± 0.453	12.13 ± 0.861	10.36 ± 0.231	5.96 ± 0.465	65.12 ± 0.493	232	333.1
15	*Bauhinia purpurea* Linn. Papilionaceae (Koilar) Leaf	66.5 ± 0.412	20.16 ± 0.8161	29.00 ± 0.486	7.12 ± 0.591	35.60 ± 0.393	147	378.1
16	*Hibiscus sabderiffa* Linn. Malvaceae (Khatta) Leaf	83.98 ± 0.472	9.15 ± 0.731	10.36 ± 0.469	3.18 ± 0.4291	71.01 ± 1.158	306	348

17	*Ipomoea aquatica* Forsk. Convolvulaceae (Kermatta) Leaf	88.52 ± 0.2752	28.08 ± 1.31	9.01 ± 0.466	17.84 ± 0.892	35.34 ± 0.385	353	367.6
18	*Ipomoea batatas* Lam. Convolvulaceae (Kanda) Leaf	84.33 ± 0.436	1.42 ± 0.5071	6.4 ± 0.403	13.5 ± 0.264	67.8 ± 0.385	196	328.1
19	*Marsilea minuta* Marsileaceae (Sunsuniya) Leaf	84.97 ± 0.407	28.59 ± 1.68	15.5 ± 0.225	7.24 ± 0.558	41.09 ± 1.151	191	293.7
20	*Oxalis corniculata* Linn. Oxalidaceae (Tinpaniya) Leaf	89.00 ± 0.424	8.7 ± 0.686	0.8 ± 0.057	2.3 ± 0.429	75.69 ± 0.567	365	371.9
21	*Portulaca oleracea* Linn. Portulaceae (Ghol) Leaf	65.85 ± 0.380	15.28 ± 0.915	4.65 ± 0.471	1.2 ± 0.602	62.07 ± 0.472	869	331.2
22	*Moringa oleifera* Lam. Moringaceae (Munga) Leaf	77.5 ± 0.240	0.900 ± 0.078	10.40 ± 0.434	9.94 ± 0.008	18.72 ± 0.163	537	336.4
23	*Cissus quadrangularis* Linn. Vitaceae (Singari) Leaf	56.96 ± 0.285	3.43 ± 0.726	12.16 ± 0.372	3.97 ± 0.106	65.51 ± 0.151	532	369.1
24	*Colocasia esculenta* Linn. Araceae (Kochai) Leaf	90.00 ± 0.276	9.43 ± 0.920	30.02 ± 0.461	3.23 ± 0.615	57.04 ± 0.481	316	410.1
25	*Zizyphus jujuba* Lam. Rhamnaceae (Ber) Fruit	73.16 ± 0.634	4.00 ± 0.797	1.2 ± 0.425	2.6 ± 0.439	84.00 ± 0.470	21	306.2

Acknowledgement

The author (KLV) is very thankful to Dr. Mrs. Veenapani Dubey, (Prof. and Head of Department of Botany C. M. D. P. G. College Bilaspur) Dr. M. Sellote and Dr. A. M. Agrawal (Rtd. Prof. and Head of Department of Botany C. M. D. P. G. College Bilaspur) for their constant guidance and providing all the facility. We are grateful to the tribal people of Bilaspur district for providing us with their valuable ethnobotanical information and co-operation, without them this work would not have been possible.

Authors' Contributions

Author KV is the main author performed field work, data collection, identification, chemical analysis, literature survey, drafting and finalized the manuscript. Author VPD supervised the research work.

References

A. O. A. C. 1990. Official methods of analysis of Association of Official Analytical Chemists 14th edition. Washington DC.

Asibey-Berko, E. and F. A. K. Tayie. 1999. Proximate analysis of some underutilized Ghanaian vegetables. Ghana J. Sci. 39:91-92.

Ifon, E. T. and O. Bassir. 1980. The nutritive value of some Nigerian leafy green vegetables Part 2. The distribution of protein, carbohydrates (including ethanol-soluble simple sugars), crude fat, fibre and ash. Food Chem. 5:231-235.

Kulkarni, D. K., V. V. Agte and M. S. Kumbhojkar. 2003. Leafy vegetables consumed by Mahaadeokoli tribe in Western Maharastra with their nutritional Potential. Ethnobotany 15:34-38

Gupta, M. C., B. M. Gandhi and B. N. Tondon. 1974. Unconventional legume *Prosopis cineraria*. Am J. Clin. Nutr. 17:1035-1036.

Gupta, K., G. K. Barat, D. S. Wagle and H. K. L. Chawla. 1989. Nutrient Contents and anti nutritional factors in conventional and

nonconventional leafy vegetables. Food Chem. 31:105-116.

Gopalan, C., B. V. Rama and Sastri. 1971 Nutritive value of Inidan food (Reprinted Edition1885) National Iinstitute of Nutrition. Indian Council of Medical Research Hydrabad.

Gopalan,C., R. B. V Sastri, S. C. Balasubramaniam, B. S. Narasinga Rao, Y. G. Deosthale and K. C. Pant. 1996. Nutritive value of Indian foods. Hyderabad, India: National Institute of Nutrition, Indian Council for Medical Research.

Haines, H. H. 1921-1925. The Botany of Bihar and Orissa. London.

Hassan, L. G. and K. J. Umar. 2006. Nutritional value of Balsam Apple (*Momordica balsamia* L.) leaves. Pak. J. Nutrition 5(6):522-529.

Isong, E. U., E. U. Nkanga, E. E, Umoh and E. E. Offong. 1999. Nutritional and phytogeriatological studies of three varieties of *Gnetum africanum* ("afang"). Food Chem. 64:489-493.

Ladan, M. J., L. S. Bilibis and M. Lawal. 1996. Nutrient composition of some green leafy vegetables consumed in sokoto. Nig. J. Basic Appli. Sci. 5:39-44.

Lockeett, C. T., C. C Calvert and L. E. Grivetti. 2000. Energy and micronutrient composition of dietary and medicinal wild plants consumed during drought. Study of rural Fulani, Northeastern Nigeria. Int. J. Food Sci. Nutr. 51:95-208.

Maheshwari, J. K. 1963. Flora of Delhi, Council of Scientific and Industrial Research, New Delhi.

Ogle, B. M., H. T. A. Dao, G. Mulokozi and L. Hambraeus. 2001. Micronutrient composition and nutritional importance of gathered vegetables in Vietnam. Int. J. Food Sci. Nutr. 52:485-499.

Osborne, D. R. 1986 Analysis de los nutrientes de los alimentos. Acribia, Zaragoza, 131-153.

Roy, G. P. and B. K. Shukla. 1992. Flora of Madhya Pradesh. Ashish Pub., New Delhi.

Shukla, K. M. L., A. A. Khan, S. Khan and A. K. Verma. 2001. An ethnobotanical survey for certain wild edible plants of district Bilaspur, M. P., India. Adv. Plant Sci. 14(1):57-60.

Shingade, M. Y., K. N. Chavan and D. N. Gupta. 1995. Proximate omposition of unconventional leafy vegetables from Konkan region of Maharashtra. J. Food Sci. Tech. 32:429-431.