***Original Research Article***

**Assessment of Nutritional Values of some Wild Vegetables Consumed by Tribes of Southern Gadchiroli of Maharashtra State, India**

**Abstract-**

Wild edible plants are those that naturally grow in forests, fields, and other uncultivated areas that have edible components. Wild vegetables contribute to people’s food security and health in many rural areas of the world. Wild edible plants are nutritionally rich and can especially supplement vitamins and micronutrients. Present paper reveals nutritional values of some wild vegetables consumed by tribes of Southern Gadchiroli District. From this region total 53 Species were listed as wild vegetables. Among these, three plants namely *Celastrus paniculatus, Cucumis melo* and *Dendrocalamus strictus* were proceeded for nutritional value assessment. Among these, *Celastrus paniculatus* was found rich in protein content and *Dendrocalamus strictus* was found rich in fiber contents.

**Key Words:** Nutritional values, Wild vegetables, Tribes, Carbohydrates, Protein, Fats.

**Introduction**

The plants with edible parts that grow naturally on farm land and in forest or uncultivated land are called as Wild edible plants (Addis, 2009, Ruffo et. al. 2002). A significant role in different geographical regions of the world has been played by different wild edible plants throughout human history (Sekeroglu, et. al. 2006). Wild vegetables contribute to people’s food security and health in many rural areas of the world (Cavender, 2006). They may have remarkable nutrient values and can be an important source of vitamins, fibers, minerals, and fatty acids; they may also show important medicinal properties (Dansi, 2008). Wild edible plants have always been an essential and widespread food source for food-insecure families living in poverty in developing countries (Mavengahama, 2013). They are relevant to household food security and nutrition in some rural areas and are relied on to supplement the staple food, to fill seasonal food shortages, and to serve as emergency food during famine (FAO, 2010, Guinand, and Lemessa, 2001). About one billion people in the world use wild foods (mostly from plants) on a daily basis (Lulekal et al. 2011). Wild edible plants are nutritionally rich and can especially supplement vitamins and micronutrients. They can also supplement nutritional requirements due to their better nutritional value (Awas, 2007).

From the various studies carried out on wild vegetables in different parts of the world (India, Turkey, Tanzania, Nigeria, etc.) have shown that many of these species have higher protein, mineral and vitamin contents than the cultivated vegetables like spinach and cabbage (Turan et al. 2003; Gupta et al. 2005). Compared to cultivated green vegetables, these wild veggies typically have a higher protein content. Phytates and oxalates, two non-nutritive bioactive chemicals found in several of these plants, have been demonstrated to have health-promoting and protecting qualities. Certain green leafy vegetables have also been shown to have bioactive phytochemicals that have been connected to protection against degenerative and cardiovascular diseases, according to recent studies (Watson, 2015; Uusiku, 2010).

Thus, the primary aim of this study was to document diversity of wild vegetables consumed by tribes from southern region of Gadchiroli district of Maharashtra state, India. The second aim was to explore nutritional potential of some wild vegetables and estimating their potential contribution to recommended dietary requirements.

**Material and Methods**

*Listing of plants*

Following extensive fieldwork in Sironcha and Aheri Tahsil of Gadchiroli district, a list of plants used as vegetables was compiled, including the parts of the plant consumed and seasonal availability. The plants were collected during different seasons and brought into laboratories for identification using standard flora. (Singh et al.2000; Singh et al.2001, Ugemuge, 1986).

*Collection of samples*

Among the listed plants, 3 plants were selected for nutritional value assessment. The three plants were *Celastrus paniculatus, Cucumis melo* L., var *agrestis, Dendrocalamus strictus* (Roxb.) Nees. The plant samples were collected in zip-lock polythene bags during various seasons from study area. Freshly collected samples were immediately processed for evaluating moisture content. Remaining samples were washed thoroughly to remove soil debris and air dried in shade for other nutritional studies.

*Nutritional Analysis*

The samples' chemical composition (moisture, proteins, lipids, carbs, and energy) was examined using the AOAC protocols (AOAC, 1975).

**Moisture Content**

The fresh material was weighed to a 100 grammes in a clean, known-weight beaker. Next, the sample was dried for 8 hours at 105°C in an oven. The beaker was cooled and weighted to determine water loss in fresh sample.

**Total fats content**

The total fat was extracted with petroleum ether using Soxhlet extractor. To determine the percentage of fat, 2 g of the dried plant part was extracted with 1 L of petroleum ether. The plant part powder was dried and the percent loss of weight was calculated.

**Crude fiber content**

For estimation of crude fiber, one gram of plant part powder was subjected to acid and subsequent alkali digestion for degradation of native cellulose and lignin. The residue obtained after final filtration was weighed, incinerated, cooled and weighed again. The loss in weight gives the crude fiber contents.

**Total Protein content**

The Kjeldahl technique was utilised to estimate the total protein contents. For this sample was digested by boiling with strong sulfuric acid in the presence of catalyst copper sulphate. All of the nitrogen is transformed during digestion into ammonia, which is then trapped as ammonium sulphate. The development of the clear solution often indicates that the digesting step is over. The ammonia is released by the addition of excess sodium hydroxide and is removed by steam distillation. Utilising methylene blue as an indicator, it is gathered in boric acid and titrated with regular hydrochloric acid. The nitrogen proportion was multiplied by 6.25 to determine the total protein.

**Estimation of Carbohydrate** (Sadasivam and Manickam, 2018)

The estimation of carbohydrate was done by the Anthrone method. In this method free, storage and structural carbohydrates was estimated by the hydrolyzing sample with acid.

**Energy value**

After estimation of protein, fat and carbohydrate, the energy value was calculated as per the following formula.

Energy value (Kcal per 100 g) = 4 (Protein %) + 9 (Fat %) + 4 (Carbohydrate %)

**Result and Discussion**

The wild plants that the tribes consumed were enumerated based on the extensive field trips conducted in several session each year. These plants were matched to the list that Setiya et al. (2016) had documented. Fruits, vegetables, flowers, inflorescences, corms, rhizomes, and other natural plants are included in this list. For the purposes of this study, only the wild plants that are prepared and eaten as vegetables have been chosen. The botanical names, families, local/Gondi names, plant parts used, and sessional availability of these wild vegetables are given. There are 33 Families, 45 Genera, and 53 Species among the recorded plants. Amaranthaceae was the most prevalent family with eight species, followed by Ceasalpineaceae with six. Families having two species each included Araceae, Convolvulaceae, Cucurbitaceae, Fabaceae, Liliaceae, Lythraceae, Marseliaceae, Portulaceae, and Tiliaceae. While, remaining families were with only 1 species (Table 1).

Similar studies have been carried out in Maharashtra state also (Prabha et al., 2010; Jadhav et al., 2011; Reddy, 2012; Setiya et al., 2016). In the Maharashtra state's Kolhapur district, Jadhav et al., (2011) recorded 50 wild edible plants, whereas Prabha et al., (2010) recorded 42 and Reddy (2012) reported 61 from the Melghat forest in the Amravati and Chandrapur districts, respectively. Additionally, Setiya et al., (2016) documented 61 wild edible plants in the Gadchiroli district.

From the above listed plants, 3 plants namely *Celastrus paniculatus, Cucumis melo* L., var *agrestis, Dendrocalamus strictus* (Roxb.) Nees were selected for nutritional value assessment (Table 2). The studied plants were found rich in moisture content. The maximum moisture content was reported in *D. strictus* (92.69 g), followed by *N. nucifera* (91.06 g), *Cucumis melo L., var agrestis* (90.39 g). Similar amount of moisture was reported in *Basella alba* (92.60) (Gupta and Yadav 2016), *Basella alba* (92.77), *Talinum triangularae* (92.47), *Basella rubra* (92.19), *Polygonum chinense* (91.14), *Chrysopogon coronerium* (91.27), *Eclipta alba* (91.09) (Choudhury et al., 2017), *Euphorbia radians* Benth (90.1) (Sotelo et al., 2007), *Telfaria occidentalis* (92) (Ajiboye et al., 2014).

The shoot of *D. strictus* (34.78 g) possesses more fibre than those of *Smilax ovalifolia* (25.65) (Shah 2016), *Costus specious* (12.77) and *Pureria tuberosa* (18.9) (Singh 2011),*Diplazium esculentum* (12.69), *Maianthemum purpureum* (10.16), *Oenanthe javanica* (7.58) (Tag et al., 2014), *Asparagus officinalis* (18.55) (Aberoumand 2011). Also, the fruit of *C. melo L., var agrestis* (33.62 g) and *C. paniculatus* (32.58) also contains more fibre than the fruit of *Elaeagnus umbellate* (21.80) (Tag et al., 2014), *Momordica dioica* (21.3), *Cordia myxa* (25.7) (Aberoumand, 2011).

The dry weight of *C. paniculatus* (51.47g) inflorescence had rich carbohydrates contents. While, the fruit of *C. melo L., var agrestis* contains 53.41g of carbohydrates which is more than *Momordica dioica* (47.92) but less than *Cordia myxa* (57.08) (Aberoumand 2011) and *Elaeagnus umbellate* (62.45) (Tag et al., 2014) *Melodinus khasianus* (80.88) (Seal et al., 2017). *C. melo L.,* var *agrestis*, on the other hand, has more carbohydrates when compared to the fresh weight of some conventional vegetable fruits like *Trichosanthes dioica* (3.54), *Cucurbita maxima* (4.22), *Luffa acutangula* (2.24), *Cucurbita pepo* (2.33) (Longvah et al., 2017), *Momordica charantia* (11), *Solanum melongena* (4), *Cucurbita pepo* (5), *Artocarpus heterophyllus* (9) (Gopalan et al., 2004). The shoots of *D. strictus* (50.91 had high carbohydrate contents compared to *Asparagus officinalis* (34.69) (Aberoumand, 2011), *Smilax ovalifolia* (31.40) (Shah, 2016), *Diplazium esculentum* (37.65), *Maianthemum purpureum* (42.45), *Oenanthe javanica* (42.58) (Tag et al., 2014), *Costus specious* (44.51) (Singh 2011).

The shoot of *D. strictus* (11.59g) are rich in protein content. The protein content in studied rhizome higher than the tuber of *Panax bipinnatifidus* (2.13) and that of stem is higher than *Nymphaea stellata* (4.55) (Satter et al., 2016), *Pureria tuberosa* (9.99) (Singh, 2011).The fruits of *Cucumis melo L., var agrestis* (9.84g) is rich in protein content than that of *Randia dumetorum* (9.24) (Singh, 2011), *Momordica charantia* (2.15) (Parvathi and Kumar 2002), *M. khasianus* (7.20) (Seal et al., 2017), *Cordia myxa* (8.32) (Aberoumand, 2011), *Rhus parvifolia* (5.11) (Jain and Tiwari, 2012). While the inflorescence of *C. paniculatus* possess 12.61g of protein. These values of protein are less than that of *Balanites aegyptiaca* (10.8) (Umar et al., 2014), *Erythrina americana* (26.2), *Erythrina caribaea* (27.4), *Yucca filifera* (25.9), *Aloe vera* (16.4), *Arbutus xalapensis* (11.3), *Agave salmiana* (16.4), *Euphorbia radians* (25.1) and *Cucurbita pepo* (21.9) (Sotelo et al., 2007), *M. oleifera* (18.9), *C. fistula* (13.13) (Jain and Tiwari, 2012).

The inflorescence of *C. paniculatus* possess 2.89g fats. However, the flowers of *M. oleifera* (21.5) and *C. fistula* (23.75) (Jain and Tiwari, 2012), *Balanites aegyptiaca* (4.50) (Umar et al., 2014) contains high amount of fat. The fruit of *Cucumis melo L.,* var *agrestis* contain 2.29 g and *D. stictus* contains 2.09g of fats. This fat content was found less compared to *M. dioica* (4.7) (Aberoumand, 2011, Aberoumand and Deokule, 2009), *R. parvifolia* (24.5), *P. cineraria* (19.75) (Jain and Tiwari, 2012), *E. umbellate* (4.36) (Tag et al., 2014), *M. khasianus* (6.39) (Seal et al., 2017). Although, *Cucumis melo L.,* var *agrestis* contain high fat compared to *C. myxa* (2.2) (Aberoumand, 2011), *R. dumatorum* (1.7) (Singh, 2011).

The energy value in *Cucumis melo L.,* var *agrestis* fruit was 273.81 Kcal and inflorescence of *C. paniculatus* was 282.33 Kcal. This value was found lower than that of *Momordica dioica* (311.5) and *Cordia myxa* (281.4) (Aberoumand 2011), *M. khasianus* (409.90) (Seal et al., 2017), but higher than that of *Abelmoschus esculentus* (127.12) (Ubwa et al., 2014) and *Randia dumatorum* (126.46) (Singh, 2011). The shoot of *D. strictus* had 268.81 Kcal energy on dry weight basis.

Figure 1- Comparison of Nutritional Content of Studied Plants

**Conclusion**

The analysis of the nutritional content of a few wild vegetables shows that the plants under study, when measured dry weight, are excellent sources of several vitamins, protein, and carbs. Additionally, plants have a considerable dry weight. Numerous plants under study fully meet the RDA recommended by the ICMR, FAO/WHO, and both. There are reports that the vitamin content of many plants is reduced. This might be the result of the collected plants being dried and stored.

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| **Table 1- List of Reported Wild Vegetables** |
| **Sr. No.** | **Botanical Name** | **Family** | **Local Name/****Gondi Name** | **Seasonal Availability** | **Part Used** |
|  | *Alangium salviifolium*(L.f.) Wangerin | Alanginaceae | Ankol/Aakola/Aakwal | March-October | Fruit |
|  | *Allmania nodiflora* (L) R. Br. ex Wall. | Amaranthaceae | Dhanbhaji/Londga Bhaji | July-October | Tender Leaves |
|  | *Amaranthus cruentus* L. | Amaranthaceae | Lalmath, Lal math | June-March | Leaves and Young Shoot |
|  | *Amaranthus polygamous* L. | Amaranthaceae | Tandulka | July-August | Young Leaves |
|  | *Amaranthus spinosus* L. | Amaranthaceae | Chawli Bhaji/Kaate math/ Kaata Bhaji | July-March | Young Leaves |
|  | *Amaranthus tricolor* L. | Amaranthaceae | Lalmath/Chawlai | September-April | Young leaves |
|  | *Amaranthus viridis* L. | Amaranthaceae | Math/Chawali/ Khedabhaji | July - April | Young leaves |
|  | *Digera muricata* L. | Amaranthaceae | Chenchali Koora | July-November | Leaves |
|  | *Alternanthera sessilis* L. | Amarantheceae | Patur Bhaji/ Mirngal Bhaji | July-September | Young Shoot |
|  | *Holarrhena pubescens* Wall. & G.Don | Apocynaceae | Pandhara kuda/ Palor Pungar | April-July | Flowers |
|  | *Colocasia esculenta*(L.) Schott | Araceae | Kochai/ Dhopa/ Gundeng | October-February | Tender leaves & Tuber |
|  | *Amorphophallus paeoniifolius* (Dennst.) | Araceae | Suran/Surund | October-June | Corm |
|  | *Basella rubra* L. | Basellaceae | Bacchali koora | Throughout the Year | Leaves and Young Shoot |
|  | *Oroxylum indicum* (L.) Kurz | Bignoniaceae | Tetu | May-August | Flower and Fruits |
|  | *Cordia dichotoma* G. Forst | Boraginaceae | Shelwat/Shembdi/Shelod | February-April | Unripen Fruits |
| 1.
 | *Bauhinia purpurea* L. | Caesalpiniaceae | Kowdel/Kolari/Chehera | Throughout the year | Young leaves |
|  | *Bauhinia racemosa*Vahl | Caesalpiniaceae | Apta/ Kondal | March-June | Young leaves |
|  | *Cassia fistula* L. | Caesalpiniaceae | Bahava/Rela pungar | March-July | Flowers |
|  | *Senna occidentalis* (L.) Link | Caesalpiniaceae | Marha (Bacca) | August-December | Young Pods |
|  | *Cassia tora* L. | Caesalpiniaceae | Tarota bhaji/Cherota | July-September | Tender leaves |
|  | *Tamarindus indica* L. | Caesalpiniaceae | Chinch/Hitta | Throughout the Year | Ripened fruits |
|  | *Capparis zeylanica* L. | Capparaceae | Varaakli/ Vaarkula | May-July | Young fruits |
|  | *Celastrus paniculatus* Willd. | Celastraceae | Pimpal Baar/ Warandul/Gorgel Pungar | March-May | Inflorescence |
|  | *Chenopodium album* L. | Chenopodiaceae | Dhawali Bhaji /Batwa | Throughout the year | Leaves and stem |
|  | *Ipomoea aquatica* Forssk. | Convolvulaceae | Panbhaji | June-February | Young leaves |
|  | *Merremia gangetica* L. | Convolvulaceae | Undirkani | July-October | Leaves |
|  | *Cheilocostus speciosus* (J.Koenig) C.D.Specht | Costaceae | Halduli kande/ Bese Mati | June-October | Corm |
|  | *Cucumis melo* L., var *agrestis* Naud | Cucurbitaceae | Bodele/Bodelang | October-January | Ripened fruits |
|  | *Momordica dioica* Roxb. ex Willd | Cucurbitaceae | Katwal/ Katwel | August-October | Green fruits |
|  | *Dioscorea bulbifera* L. | Dioscoreaceae | Mataru/Kaya Mati | September-June | Stem tubers |
| 1.
 | *Canavalia gladiata* (Jacq.) DC. | Fabaceae | Chemma kaaya | October-April | Green fruit |
|  | *Sesbania grandiflora* L. | Fabaceae | Heti | October-December | Flowers |
|  | *Asparagus racemosus* Willd. | Liliaceae | Shatawari/ Kedavaari | June-February | Roots |
|  | *Chlorophytum tuberosum* (Roxb.) Baker | Liliaceae | Langdabhaji | June-September | Leaves |
|  | *Ammannia baccifera* L. | Lythraceae | Dhan bhaji | June-October | Young leaves |
|  | *Woodfordia fruticosa* Kurz. | Lythraceae | Zilbuli/Pitte pungar | January-April | Flowers |
|  | *Marselia quadrifolia* L. | Marseliaceae | Tipani/Chichoda Bhaji | July-September | Young Leaves |
|  | *Glinus oppositifolius* L. | Molluginaceae | Koud bhaji / Kadubhaji | July-November | Young shoot |
|  | *Moringa oleifera* Lam. | Moringaceae | Shevaga/Mungna | January- May | Fruits |
|  | *Nelumbo nucifera* Gaertn. | Nelumbonaceae | Bhise Kande/Powad Mati | April-June | Rhizome |
|  | *Boerhavia diffusa* L. | Nyctaginaceae | Khaparkhuti/Khaparfuti | July-October | Tender leaves |
| 1.
 | *Olax scandens* Roxb. | Olacaceae | Arakfari / Korpa jappi | May-July | Tender leaves |
|  | *Oxalis corniculate* L. | Oxalidaceae | Tinpaani/ Chiwda Bhaji | July-December | Leaves |
|  | *Dendrocalamus strictus* (Roxb.) Nees | Poaceae | Vaste/Kark | August-October | Young Shoot |
| 1.
 | *Portulaca oleracea* L. | Portulaceae | Ghol Bhaji/Lodiya Bhaji | July-September | Whole Plant |
|  | *Dentella repens* (L.) J. R. & G. Forst | Rubiaceae | Kadubhaji | July-October | Whole plant |
|  | *Tamilnadia uliginosa* (Retz.) Tirveng. & Sastre | Rubiaceae | Kharfendre/Kharfendra | June-October | Fruits |
| 1.
 | *Smilax zeylanica* L. | Smilacaceae | Sherdire | July-September | Young Shoot |
|  | *Solanum nigrum* L. | Solanaceae | Kamoni | July-November | Tender Leaves |
|  | *Tacca leontopetaloides* (L.) O. Ktze. | Taccaceae | Dev kanda | April-October | Tuber |
|  | *Corchorus capsularis* L. | Tiliaceae | Fotokani/Godel Bhaji | July-October | Tender Leaves |
|  | *Corchorus olitorius* L. | Tiliaceae | Mundki Chechi | July-October | Tender Leaves |
|  | *Clerodendrum multiflorum* G.Don | Verbenaceae | Taagar | August-March | Flowers |

|  |  |  |  |
| --- | --- | --- | --- |
| **Proximate Contents** | ***Celastrus paniculatus*** | ***Cucumis melo* L., var *agrestis*** | ***Dendrocalamus strictus* (Roxb.) Nees** |
| **Moisture****(g/100g) (FW)** | 61.71±0.46 | 90.39±0.56 | 92.69±0.41 |
| **Fibre****(g/100g) (DW)** | 32.58±0.39 | 33.62±0.81 | 34.78±0.53 |
| **Carbohydrates****(g/100g) (DW)** | 51.47±0.51 | 53.41±0.35 | 50.91±0.42 |
| **Proteins****(g/100g) (DW)** | 12.61±0.17 | 9.87±0.26 | 11.59±0.33 |
| **Fats****(g/100g) (DW)** | 2.89±0.19 | 2.29±0.46 | 2.09±0.11 |
| **Energy (Kcal/100g)** | 282.33 | 273.81 | 268.81 |

Table 2. Nutritional contents of some wild vegetables