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Evaluation of Nutritional Potential of Some wild Vegetables Consumed by Tribes of Korchi and Dhanora Tahsil of Gadchiroli District, Maharashtra State, India

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Abstract

On one hand the global population, food product waste, postharvest losses, storage facilities, marketing strategies, financial and technical limitations are among the major factors for increasing food demand. To fulfil the increasing food demand, there is higher pressure on crop yield which some where compromise with nutritional properties of crop plants. On the other hand, tribal people depend on wild edible plants to fulfil their nutritional demand. Present investigation was undertaken to explore nutritional potential of some wild vegetables consumed by tribes of Gadchiroli district. Total 44 species were reported from Korchi and Dhanora Tahsil of Gadchiroli district. These species were listed with seasonal availability and plant part used. Among these, nutritional values of 3 plants namely *Amaranthus tricolor, Holorrhena pubescens, Nelumbo nucifera* are presented in this paper.

Keywords: Nutritional values, wild vegetables, Tribes, Nutritional potential, *Amaranthus tricolor, Holorrhena pubescens, Nelumbo nucifera*

Introduction

During the 5th decade of 19th century human introduced Green Revolution, in which they adapt different technologies, mechanics, synthetic fertilizers, pesticides and herbicides, different breeding methods to improve crop yield. They developed irrigation methods to improve efficient irrigation. They also developed plant transfer techniques to produce Genetically Modified plants, which are disease resistant and high yielding. To develop genetically modified crops, they use number of vectors like plasmids, viruses and bacteria by recombinant DNA technology to transfer genes (Ayesha et al., 2017). Due to Green Revolution, world grain production increased by over 250%, between 1950 to 1984 (Thurner, 2013). While in India, annual wheat production rises from 10 million tons in the 1960 to 73 million in 2006. India also became one of the

world's most successful rice producer and major rice exporter, shipping nearly 4.5 million tons in 2006 (Hicks, 2011). But there are lot of challenges to agriculture and green revolution like, uncertain whether condition, global population, food product waste, postharvest losses, storage facilities, marketing strategies, financial and technical limitations are among the major factors for increasing food demand. The global population expected to rise to about 8.5 billion by the year 2030, which is currently about 7.5 billion (UN-DESAPD, 2015). This increasing population is exerting a pressure of food demand. It is estimated that, one-third of edible part of food produce from human consumption, which is about 1.3 billion tons get wasted or lost every year globally (FAO, 2011). This leads to lack of consistent access to food and it reduces dietary quality, interrupts normal eating pattern and can have negative consequence for nutrition, health and well-being. While in severe food insecurity, people faces run out of food, hunger and, at the most extreme, gone for days without eating, putting their health and well-being at grave risk (FAO, IFAD, UNICEF, WFP and WHO, 2019).
In recent years food security is worsening by the COVID-19 pandemic, with the full scope of the impacts still not fully known. The pandemic is increasing food insecurity in various ways, including through lost income caused by infection, quarantine, or government-imposed lockdowns or movement restrictions, disruptions to food systems or food supplies, and increases in food prices caused by these disruptions (Amare et al. 2021).

On the other hand tribal people living in particular areas depend on the use of wild plants or plant parts to fulfil their nutritional needs. The people generally depend on nearby forest areas

to supply their needs. Among them, wild edible plants play a major role in supplying food for poor communities in many rural parts of the world (Sundriyal et al. 2003).A very important role in the livelihoods of tribal communities is played by wild edible vegetables which are obtained from forests or wild areas. Apart from serving as an alternatives to staple food during periods of food scarcity, wild edible vegetables play a vital role for supplement of a nutritionally balanced diet (Narzary et al. 2013). Now a days research undertaken in different part of the world shows that underutilized leafy vegetables have great nutritional values and antioxidant properties. wild vegetables play a major role in the tribe's diet, probably due to the influence of traditional herbal medicine, easy accessibility and low cost (Afolayan et al. 2009; Glew et al. 2005; Choudhury et al. 2017).

Considering above things in mind, present investigation was carried out in two tahsils namely Korchi and Dhanora of Gadchiroli district of Maharashtra state, India. Gadchiroli district is situated on the North-Eastern side of Maharashtra State. It is located between 18.43` to 21.50' North latitude and 79.45' to 80.53' East longitude. The district is well-known for the forest resources. This district is also known for tribal habitats and their cultural and food practices. These two tahsils are situated at the extreme North-East of the district and known for domestication of tribes. The tribes living in these tahsils are Gond, Rajgond, Kawar, etc. Keeping this in mind, the present investigation is to explore ethnobotanical knowledge of tribes from Gadchiroli district. Present studies also carried out to enlist biodiversity of plants used as vegetables by tribes and to estimate nutritional values of some common wild plants (https://gadchiroli.gov.in/).

Materials and Methods

Listing of plants

Extensive field visits were carried out to Korchi and Dhanora Tahsil of Gadchiroli district and the plants which are used as vegetables are listed with plant part consumed and seasonal availability. The listed plants were collected in various season and brought in laboratories for identification. The plants were identified using standard flora (Singh et al.2000; Singh et al.2001, Ugemuge, 1986).

Among the listed plants 3 plants viz. *Amaranthus tricolor, Holorrhena pubescens, Nelumbo nucifera*were evaluated phytochemically to estimate nutritional values.

Amaranthus tricolor (Family- Amaranthaceae)

An erect, often stout herb up to 2.5m in height with long stalked leaves. It is generally red or bright pink in colour. The leaves are up to 6 inch long, ovate, oblong and are notched or rounded at the tips and decurrent at the base into petioles. The flowers are small clusters, whitish-green or red while the seeds are very small, black or red-brown.

Local name- Lal math, Ranmaath, Chawlai

Part Used- Young leaves

Seasonal Availability- September to April.

Holorrhena pubescens(Apocynaceae)

Small deciduous trees; to 8 m high; bark rough, pale brown, to 8 mm, latex milky white. Leaves simple, opposite, estipulate; petiole 4-6 mm, pubescent, stout; lamina 7-18 x 3-12 cm, broadly ovate, ovate-oblong or ovate-lanceolate; base obtuse, apex acute or acuminate, margin entire, glabrous or puberulent beneath, membranous; lateral nerves 10-14 pairs, prominent, arched, puberulous; intercostae reticulate. Flowers bisexual, creamy-white, slightly fragrant, in terminal and axillary corymbose cymes, appear along with new leaves; calyx lobes 5, 2.5 mm long, oblong-lanceolate, ciliate, glandular within at base; corolla salvar shaped, lobes 5, oblong, obtuse, as long as the tube, tube 1.3 cm long, puberulous, mouth with a ring of hairs; stamens 5, included, attached towards the base of the corolla tube, anthers sagitate; disc absent; ovaries 2, apocarpous; ovules many in each carpel, style 2 mm long; stigma fusiform, bifid. Fruit of 2 terete elongated follicular mericarps connected at the tip and then free, 25 x 1 cm; seeds 8 mm, oblong, with tuft of silky brown hairs at the apex.

Local name- Kuda, Pandhara Kuda

Part Used- Flowers

Seasonal Availability- April to July.

Nelumbo nucifera(Nelumbonaceae)

Perennial aquatic herb. Roots adventitious. Leaves simple, solitary; stipulate; petioles ca. 2 m long, beset with scattered hard minute papillae; lamina ca. 20-80 cm across, suborbicular, dark green above, paler beneath, glabrous and glaucous on both surface, coriaceous, shallowly notched and apiculate at one side, terminating in a simple vein, membranous when dry. Flowers solitary on long, peduncles ca. 8-25 cm across, rose-pink or white, expanding and emerging above water; Sepals ca. 1.5-2.5 x 0.5-0.6 cm, linear-elliptic, concave, obtuse, with midrib distinct near at apex and produced into a 3-5 cm long tail, greenish purple outside, purplish inside; corolla shorter than sepals, green outside, purplish inside, lobes broadly or narrowly oblong; inner stamens ca. 2-2.5 mm long, fertile, incurved. Fruit berry, ca. 1-1.5 cm across. Seeds globose, ca. 1 mm across, brown, spinulose; spines radiating, tufted at micropylar region.

Local name- Bhise Kande

Part Used- Rhizome

Seasonal Availability- April to June.

Collection of Sample

The plant samples were collected in zip-lock polythene bags during various seasons. Freshly collected samples were immediately processed for evaluating moisture content. Remaining samples were dried in shade for other nutritional studies.

Nutritional Analysis

The samples were analysed for chemical composition (moisture, proteins, fats, carbohydrates and energy) using the AOAC procedures (AOAC, 1975)

1. Moisture Content

100 gram of the powdered sample was weighed in a clean beaker of known weight. The sample was then dried inoven at 105°C for 8 h. The beaker was cooled and weighted to determine water loss in powdered sample.

2. 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.

3. 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.

4. Total protein content

Total protein contents were estimated by Kjeldahl method. For this sample was digested by boiling with concentrated sulfuric acid in the presence of catalyst copper sulfate. The digestion converts all the nitrogen to ammonia which is trapped as ammonium sulfate. Completion of the digestion stage is generally recognized by the formation of the clear solution. The ammonia is released by the addition of excess sodium hydroxide and is removed by steam distillation. It is collected in boric acid and titrated with standard hydrochloric acid using methylene blue as an indicator. Total protein was calculated by multiplying nitrogenpercentage by 6.25.

5. Estimation of Carbohydrate

Percentage of carbohydrate was given by: 100-(percentage of fat + percentage of protein + percentage of crude fibre)

6. 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 %)

Results and Discussion

Exploration and documentation of wild edible plants from various tribes in India has regularly been carried out by various researchers (Narayanan et al., 2011; Negi et al., 2015; Ajesh et al. 2012; Hazarika et al., 2012). Similar studies have been carried out in Maharashtra state also (Prabha et al. 2010; Jadhav et al. 2011; Reddy, 2012; Setiya et al. 2016). Jadhav et al. (2011) documented 50 wild edible plants from Kolhapur district of Maharashtra state, while Prabha et al. (2010) documented 42 and Reddy (2012) reported 61 wild edible plants from Melghat forest of Amravati district and Chandrapur district respectively. Also, from Gadchiroli district Setiya et al. (2016) documented 61 wild edibles plants. In present investigation among the above listed wild edible plant only those plants which are consumed by after cooking are explored. In this investigation total 44 wild plants which are consumed by tribes of Gadchiroli district particularly from Korchi and Dhanora tahsil are explored and documented. Among these listed plants 3 plants viz. *Amaranthus tricolor*, *Holorrhena pubescens, Nelumbo nucifera* were evaluated phytochemically to estimate nutritional values.

The proximate nutritive content of three wild vegetables are given in Table 1. The results showed highest energy content was fond in *H. pubescence* (290.35±0.69) and lowest in *N. nucifera* (273.12±0.47). These three wild vegetables show less energy value (dry weight) compared to *M. khasianus* (409.90±0.66), *Solanum nigrum* (334.95±0.53), *P. acinose* (325.83±0.38),*P. pedicellatum* (325.83±0.38), *Bauhinia purpurea* (306.67±0.38), *Arbutus pavarii* (790.00 ± 19.92) *Nitraria retusa* (490.33 ± 64.36) *Ficus palmata*(565.67 ± 75.18) *Achyranthes aspera* (418±9.89) but higher than *Sesbania grandiflora* (266.38±0.26) *Smilax zeylanica* (267.77±0.54), *Celosia argentea* (220±0.45) (Hegazy et al. 2013; Gupta et al. 2016; Seal et al. 2017; Madavi et al. 2021)

The moisture content was ranges from 78.19±0.22 (*H. pubescence*) to 91.06±0.34 (*N. nucifera*) of fresh weight. The rhizomes of *N. nucifera* had high moisture content (91.06±0.34) compared to *M. khasianus* (84.63±0.12), *Solanum nigrum* (6.31±0.12), *P. acinose* (72.37±0.32), *Phyllanthus niruri* (78±1.17), *Digera arvensis* (79.9±0.10), *Sesbania grandiflora* (81.26±0.46) *Smilax zeylanica* (86.94±0.76) (Gupta et al. 2016; Seal et al. 2017; Madavi et al. 2021). But *A. tricolor, H. pubescence* and *N. nucifera*had less moisture content compared to *Basella alba*(92.6±0.14), *Celosia argentea* (84.4±0.13), *Ipomoea aquatic* (84.2±0.44), *P. pedicellatum* (89.44±0.11). All these three wild vegetables have high moisture content than *Arbutus pavarii*(68.06 ± 1.65) *Nitraria retusa* (76.25 ± 2.68) and *Ficus palmate* (67.82 ± 2.07) (Hegazy et al. 2013; Gupta et al. 2016; Seal et al. 2017).

Table 1- Nutritional values of some wild vegetables

Particulars	*Amaranthus tricolor*	*Holorrhena pubescens*	*Nelumbo nucifera*
Moisture (g/100g) (FW)	82.57±0.21	78.19±0.22	91.06±0.34
Fibre (g/100g) (DW)	31.78±0.33	29.93±0.69	36.98±0.14
Carbohydrates (g/100g) (DW)	48.46±0.19	58.77±0.41	47.82±0.55
Proteins (g/100g) (DW)	16.26±0.38	8.62±0.84	13.89±0.63
Fats (g/100g) (DW)	2.84±0.11	2.31±0.41	2.92±0.78
Energy (Kcal/100g) (DW)	284.44±0.91	290.35±0.69	273.12±0.47

The fibre content of dry weight was 29.93±0.69, 31.78±0.33 and 36.98±0.14 in *H. pubescence, A. tricolor* and *N. nucifera* respectively. Comparing with fresh weight of fibre content of *Phyllanthus niruri* (9.78±0.74), *Digera arvensis*(6.29±0.08), *Arbutus pavari i*(5.28 ± 0.57) *Nitraria retusa* (2.68 ± 0.50) and *Ficus palmate* (2.88 ± 0.47) (Hegazy et al. 2013; Gupta et al. 2016).

The dry weight of these plants were found rich in carbohydrate, highest in *H. pubescence* (58.77±0.41) and lowest in *N. nucifera* (47.82±0.55). The total carbohydrate contents were similar to *Piper pedicellatum* (63.06±0.06), *Solanum nigrum* (58.02±0.12), *Carpesium cernuum* (17.22±0.03%) and *Pouzolzia hirta* (60.47±0.17), *Bauhinia purpurea* (49.96±0.14), *Sesbania grandiflora* (56.23±0.71), *Smilax zeylanica* (46.61±0.52), *Arbutus pavarii* (41.18 ± 1.79%) (Hegazy et al. 2013; Seal et al. 2017; Madavi et al. 2021)

The protein contents were lowest in *H. pubescence* (8.62±0.84) and highest in *A. tricolor* (16.26±0.38). Compared to other wild plants, the crude protein contents in all three wild vegetables were found less than the leaves of *Piper pedicellatum* (21.22±0.03%), *Solanum nigrum* (21.18 ±0.02 %), *Carpesium cernuum* (17.22±0.03%) and *Pouzolzia hirta* (19.19±0.02%),but more than that of lesser-known wild leafy vegetables such as *Momordica balsamina* (11.29±0.07%), *Eurya acuminata* (14.72±0.04 %) and *Ardisia humilis* (12.71±0.33%) (Seal et al. 2013; Seal et al. 2014, Seal et al. 2015; Seal et al. 2017).

While the fat content was ranged from2.31±0.41, 2.84±0.11 and 2.92±0.78 in *H. pubescence*, *A. tricolor* and *N. nucifera* respectively. The crude fat contents are quite similar to *Oxalis corniculate* (2.6±0.42), *Ficus infectoria* (2.1±0.19), *S. nigrum* (2.01±0.02) (Gupta et al. 2016; Seal et al. 2017). But fats content are higher than *S. grandiflora* (1.98±0.33), *P. acinose* (1.32±0.03), *P. pedicellatum* (0.60±0.05), *P. hirta* (1.31±0.02), *P. niruri* (1.86±0.36), *Arbutus pavarii* (1.33 ± 0.14) *Nitraria retusa*(0.75 ± 0.15) and *Ficus palmata*(1.12 ± 0.11) and lower than *B. purpurea* (4.31±0.52), *S .zeylanica* (3.09±0.36), *M. khasianus* (6.39±0.03) (Gupta et al. 2016; Hegazy et al. 2013; Seal et al. 2017; Madavi et al. 2021).

Tribal people of the district are well aware about nutritional values and delicious test of wild vegetables. That's why now a days many wild vegetables being are sold in the market. Similarly, these three plants (*H. pubescence*, *A. tricolor*and *N. nucifera*) are also commercialised now a days. Among these tender leaves of *A. tricolor*is sold at rate of 80 Rs. Per Kg, while flowers of *H. pubescence* and rhizomes of *N. nucifera* are sold at 200 Rs. and 100 Rs. per Kg respectively. Also, in some part of the district *A. tricolor*is now added in cultivation practices.

Conclusion

The present study showed that the wild vegetable plants collected from Gadchiroli district of Maharashtra state in India were rich in protein, available carbohydrate, total dietary fibre. These plants fulfil Recommended Dietary Allowance requirements up to large extent. Present investigation was carried out with dry powdered material of plant. Investigation with fresh weight of is recommended. Some of the plants are over exploited by commercial uses. A sustainable harvesting of plants are also recommended. There is need of exploration wild edible plants in district with antinutritional properties.

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