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NUTRITIONAL EVALUATION OF FEW SELECTED MEDICINAL PLANTS OF NORTH EASTERN REGION

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ABSTRACT

Six Medicinal plants species viz. *Homalomena aromatica, Clerodendrum indicum, Elsholtzia communis, Zanthoxylum alatum, Drymaria cordata and Gnetum gnemon* of the North Eastern region of India were estimated for their proximate composition and minerals content on dry matter basis. The crude protein content of different plant species in descending order were *Drymaria cordata* (20.57%) followed by *Homalomena aromatica* (20.5%), *Elsholtzia communis* (16.19%), *Zanthoxylum alatum* (10.94%), *Clerodendrum indicum* (7.88%) and *Gnetum gnemon* (6.7%). The crude fat content ranged from 0.31%-1.27% and crude fibre 7.31%-20.0% in different plant species. These plants/herbs were also rich in mineral content. While the Moisture content was highest in *Clerodendrum indicum (15.4%)*and Carbohydrate content was in *Gnetum gnemon* (65.61%). Among the trace element constituents iron was found to be the highest (10 to 792ppm) followed by Zinc(0.65-6.72ppm) and Copper(0.01-1ppm). However the percentage of calcium and phosphorus were found to be optimum level in comparison to other conventional plant species. The study revealed the fact that these six wild edible plants species could be used as a nutritional supplement.

KEYWORDS: Wild edible plants, Proximate and mineral constituents.

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INTRODUCTION

Assam is endowed with a rich botanical wealth and a large number of diverse types of plants grow in different parts of the North Eastern region. Out of 3895 economically significant plant species reported from North east India, nearly 7.34% are used as wild vegetables, fruits and ethno-medicine[1].The inhabitants of the hill tribes mostly tribal people still depend on the forest for various edible products and the day to day activities as a source of food security and materials for shelter, ritual and healthcare system. According to Food and Agricultural Organization (FAO), at least one billion people are thought to use wild food in their diet[2]. These non conventional (wild) food plants have been recognized to have a potential source of nutrients than conventionally eaten crops[3]. Each of these plants species have therapeutic properties and are nutritionally important because of high content of minerals, essential fatty acids, fibers and proteins[4],[5,6].The present study deals with the estimation of six selected ethnobotanical plants for their proximate constituents and certain mineral elements. The traditional and ethnobotanical use of these plants are described below: *Homalomena aromatica* Schott (Araceae) commonly called 'Sugandhmantri' is a rhizomatous aromatic perennial herb commonly found in Assam and adjoining states of the sub-Himalayan regions of India. Its aromatic rhizomes contain an essential oil which is extensively used in perfumery and cosmetic industries. Besides having aromatic value, the plant also possesses medicinal properties. In Northeast India, leaves and rhizomes were commonly used in traditional medicine for treating joint-pain and skin infections[7]. It has also been reported that the petiole part of *Homalomena aromatica* is also used as commodities among the Mizo communities in the North East region[8]. It also possesses many pharmacological properties such as analgesic, antidepressant, anti-inflammatory, antiseptic, antispasmodic, sedative, antifungal and insecticidal[9].We have found potent antioxidant property in ethanolic extract in roots of *Homalomena aromatica*[10] along with anti ulcer activity [11]. *Clerodendrum indicum* is a perennial bushy plants distributed widely in south east Asia, India, Nepal, Bhutan, Srilanka and Southern China[12]. Among the Zomi tribes in the North East India Anphui (Clerodendrum) is also being used as a dish/curry and the shoots of Clerodendrum are eaten boiled by the Mizo tribe which minimize the high blood pressure[13].The juice of the fresh leaves act as a blood purifier in GI tract ailments[14]. It has also been reported to possess antimicrobial properties [15]. Furthermore, we have found significant antioxidant[16], anti-ulcer[17]and anti-arthritis activity in the whole plant in an ongoing study. *Drymaria cordata* which belongs to the plant family Caryophyllaceae is a creeping herb and is widely distributed in the foothills of the North East Region is used as medicine and non conventional edible vegetable not only in India but also in other countries[18]. It is also used as an antidote, appetizer, depurative, emollient, febrifuge, laxative and stimulant in both humans and animals[19]. We have reported the anxiolytic[20], analgesic[21], anti-inflammatory[22], CNS depressant and anti-convulsant[23] activity of leaf extract of *Drymaria cordata. Gnetum gnemon* is an important agro forest species in Southeast Asia and Melanosia. It is also found widespread in the eastern India particularly in Assam and hills of Meghalaya and Manipur. In addition to its potential medicinal benefits it has also been reported that the tender leaves are consumed by Khasi and Naga tribes in some places of Cachar district of Assam[24]. Flowers and fruits are used as vegetables, eaten raw or roasted in North East as well as in other countries[25].*Elsholtzia communis*(Lamiaceae),an aromatic plant, widely distributed in East Asia, Africa, North America, and European countries. Since time immemorial it has been used as domestic folk medicine, herbal tea, food, spices, beverages, perfumeries, cosmetics, aromatherapies, and the source of honey manufacture. Apart from medicinal and ornamental value *E. communis* is eaten by the local people as a vegetable in their diet**.** This herb gained its popularity for their ability to act as a flavoring agent in various food items [26.] *Zanthoxylum alatum* Roxb. is a synonym of *Zanthoxylum armatum* var. armatum and is found mostly in the mountainous region of North East. It has been reported to possess high neutraceutical value and is used for wide range of ailments (cancer, diabetes, inflammatory and cardiovascular diseases)[26a,26b]due to high antioxidant property.

Besides these, seeds and young leaves are used as condiments in various dishes[27].In general, information on edibility and therapeutic properties of wild plants is scanty and data on their nutritional composition is negligible[28,29].Proximate and nutrient analyses of edible plant and vegetables play a crucial role in assessing their nutritional significance[30].So evaluating their nutritional significance can help to understand the worth of these plants species[30].Thus keeping in mind the importance of food component these six plants viz., *Homalomena aromatica, Clerodendrum indicum*, *Elsholtzia communis, Zanthoxylum alatum, Drymaria cordata and Gnetum gnemon ,* which are otherwise popularly used as a medicinal plant for their diverse medicinal properties were taken up to study their proximate and mineral constituents for ascertaining their suitability for use as supplementary food plants.

MATERIALS AND METHODS

Plants sample collection and Processing: All the selected plant species were collected during the month of January and February 2012, from different states of Assam and botanical identification was carried out in Agronomy Department, Assam Agricultural University, Jorhat. The fresh plants were washed and the edible parts were dried in the shade and then ground to fine powder. The dried powdered samples were used for estimation of proximate composition and mineral content. Proximate Analysis: Moisture, protein, fat, carbohydrate, fiber, and ash content were done by following AOAC [31].

(i) Estimation of total ash

About 2g of the sample was weighed and taken in a vitreosil basin. The basin was heated in a low flame at the beginning till no fumes were given off by the charred mass. The charred mass was broken by a glass rod carefully and burnt in a muffle furnace at 550- 600°C for 4-5 hrs. The muffle was allowed to cool to 150°C. The basin was then cooled in a desiccator and the ash content was then weighed. The total ash was calculated as follows:

% of total ash = weight of the ash × 100 / weight of the sample

(ii)Estimation of moisture content

Fresh sample materials were taken in a flat bottom dish and kept overnight in a hot airoven at 100-110°C and weighed. The loss inweight was regarded as a measure ofmoisture content.

(iii)Estimation of crude protein (Micro-Kjeldahl Method)

Digestion: About 2g of the sample was taken in a Kjeldahl flask, 10gms of sodium sulphate and 0.5 gm of copper sulphate was added and mixed well. A few glass beads were added into the flask to prevent spurting while heating. Then 25 ml of concentrated H_2SO_4 was added and then heated at least for 15-20 minutes in inclined position. The solution was boiled until a greenish colour was obtained. It was allowed to cool.

Distillation

About 100 ml of distilled water was added to the Kjeldahl flask, shaken properly and transferred it into a 250 ml volumetric flask. Then the final volume was made 250 ml by adding distilled water. In a conical flask 10-15 ml of 2% Boric acid was taken and the flask was placed below the condenser of the distillation apparatus. Then 5 ml of aliquot was transferred to the Micro Kjeldahl steam distillation apparatus and added 1 drop of phenolphthalene and 10-15 ml 40% NaOH. The distillation was carried out atleast for 5-10 minutes until ammonia was free from aliquot. Titration: The distillation product was then titrated against N/10 H_2SO_4

Calculation is done as follows:

$$\% \text{ of Nitrogen} = \frac{\text{ml of N/10 } H_2SO_4 \text{ used up} \times 250 \times 0.0014 \times 100}{\text{Volume of aliquot} \times \text{gm of the substance taken}}$$

% of crude protein=% Nitrogen ×6.25

iv)Estimation of crude fat (Ether extract)

Five gm of dry sample was weighed on a piece of glazed paper and transferred into an extraction thimble. The thimble was introduced into soxhlet extractor over a pad of cotton wool, so that top of the thimble is well above the top of the siphon. A clean dry flask was taken, weighed and was fitted with the extractor. Ether was poured along the side of the extractor until it begins to siphon off. Then another half-a siphonful of ether was added. The equipment thus assembled with the flask was placed on a water bath at 60-80°C and the extractor was connected with the condenser. Cool water circulation was started in the condenser and allowed the extraction for 8 hours. Then the thimble with the material was removed from the extractor. The apparatus was assembled again and heated on a water bath to recover all the ether from the receiver flask. The receiver flask was disconnected and dried it in a hot air oven at 100°C for 1 hour, cooled and weighed.

$$\% \text{ of Ether extract} = \frac{(\text{Wt.of oil flask with ether extract-Wt. of the oil flask}) \times 100}{\text{gm of the substance taken}}$$

(v) Determination of crude fibre

About 2 gm of moisture and fat free sample was weighed and transferred to the spout less one litre beaker. Thereafter, 200 ml 1.25% H_2SO_4 was added. The beaker was placed on a hot plate and allowed to reflux for 30 minutes, timed from onset of boiling. The content was shaken after every 5 mins. The beaker was removed from the hot plate and filtered through a muslin cloth using suction. The residue was washed with hot water till it was free from acid. The material was transferred to the same beaker and added 200ml of 1.25% NaOH solution and refluxed for 30 minutes. Again filtered and the residue was washed with hot water till it was free from alkali. The total residue was transferred to a crucible and placed in hot air oven, allowed to dry to a constant weight at 80-110°C and weighed. The residue was ignited in muffle furnace at 550-600°C for 2-3 hrs, cooled and weighed again. The loss of weight due to ignition was the weight of crude fiber.

$$\% \text{ of Crude Fiber} = \frac{(\text{Wt of the crucible with dry residue -Wt of crucible with ash}) \times 100}{\text{gm of the substance taken}}$$

(vi) Determination of carbohydrate

Carbohydrate content is calculated by following formula-

% of Carbohydrate =100 - (Crude Protein % + Moisture%+ Crude Fiber % + Ether Extract % + Total ash %)

Procedure for Mineral analysis

(i). Estimation of Fe, Zn and Cu:

For this study, 0.5 gm of the powdered dried sample was taken in a crucible and converted to ash in the muffle furnace at 580°C for 3 hrs. After cooling in a desiccators 10 ml of concentrated Nitric acid, 4 ml of Perchloric acid and 1ml of Sulphuric acid was added and digestion at high temperature was carried out until the content became clear, then the tube was cooled and the solution was transferred quantitatively to 50 ml volumetric flask and the final volume was adjusted to 50 ml by adding distilled water. The solution was used for determination of Fe, Zn and Cu through the atomic absorption spectrometry (AA203D) and Calcium and Phosphorous was done as per method described by Talapatra,[29a].

RESULTS AND DISCUSSION

A Proximate composition

The results obtained from proximate analysis of the selected wild edible vegetables are presented in the Table I. Proximate analysis of the six medicinal plants for moisture, protein, fat, fibre, NFE and total ash were carried out as per the method AOAC[31] on DM (basis).The overall results differed for each species of plants. It was observed that moisture content was maximum in *Clerodendrum* (15.4%) followed by *Z.alatum*(12.80%) and minimum in

E.communis (8.86%) which indicates the stability of the plants/herbs. Similarly Sarwat of Pakistan reported highest moisture content of *Z alatum* (8%).The minimum moisture content was found in seeds and fruits of *Z alatum* on fresh weight basis as reported by Shad of Pakistan. According to AOAC[31]low moisture content signifies high food value. The ash content (total minerals) in these plants ranged from 5.0 to 14.5%, the highest percentage being found in *E.communis.* However the ash content are relatively high as compared to commonly available vegetables like lettuce (0.4% DM) and spinach (0.7% DM)[32]. Carbohydrate content ranged from 42.87% (*H.aromatica*) to 65.61% (*G.gnemon*). High content of carbohydrate suggests the rich source of energy supply and these may be a veritable tool for the rural people as a source of body nourishment[33]. The plant is regularly consumed by the local people of Karbi Anlong district in Assam[7]. The crude protein content was found to be the highest in *D.cordata* (20.57%) and lowest in *G.gnemon* (6.7%). The crude protein content of *D.cordata* is close to the findings of Gogoi and Kalita[34] (19.37%). Occurrence of high protein indicates nutritionally superior over other consumable crops like Spinach (2%), lettuce (2.1%), cabbage (1.8%), susni sag (3.7%) etc.[35]. Very high protein content in *Drymaria cordata* indicates that the species can be a very good source of protein as well. All the six selected species have a moderate value of fat which ranged from 0.31% (*C.indicum*) to 1.27% (*Z alatum*). The present finding is similar with Sarwat and Shad of Pakistan [36, 37]. Presence of low fat can be recommended for individuals suffering from obesity. The gross energy value ranged from 111Kcal in *G.gnemon* to 283Kcal in *E.communis.* A diet providing 1 to 2% its calorie of energy as fat is said to be sufficient to human being as excess fat consumption may lead to Cardio vascular disorder, atherosclerosis and cancer[38]. Fibre is useful for maintaining bulk, motility and increasing the intestinal peristaltic movement[39]. High fibre has health promoting properties as they lower the plasma and Cholesterol concentration[40]. There is a variation in the value of Crude fibre and it ranged from 7.31% (*E.communis*) to 20% (*H.aromatica*) which is much higher than the reported value (8.54%) in *H.aromatica*[41]. There may be many reasons for such differences viz. due to climate, soil composition, season of collection as the samples were collected during winter season when the fibre content was very high. The studied plants have a moderate fat percentage with good sources of carbohydrates, protein and fiber. Hence, they can be used as a nutritional supplement over other conventional crops and vegetables. Due to the presence of low fat in few plants, can be recommended to individuals suffering from obesity.

B Micronutrient analysis

The Results of micronutrient analysis of six wild edible medicinal plants and herbs are presented in table II. Ca and P play an important role in various physiological functions like development of skeletal structure, bones, teeth etc. Ca is required for blood clotting and various cellular function of the body [42]. A good amount of Ca (1.7%) and P (0.708%) are found in *Z.alatum* followed by *H aromatica, C indicum* and *D cordata*. Results of mineral estimation shows remarkably high amount of iron (792ppm) in *Drymaria cordata* followed by *Zanthoxylum alatum*(186ppm) and *H.aromatica* (136ppm).The higher level of iron implies that consumption of these herbs/plants in their diet can act as a haematinic in patients suffering from anaemia[43]. In the human body, Cu and Zn are essential trace elements for various metabolic processes and enzyme activity. A sufficient amount of Cu (1.0ppm) and Zn (10.76ppm) is also present in *D cordata* along with high iron content. Deficiency of Zn leads to poor growth and gonadal function[44].Non availability of adequate minerals in the diet may affect growth and cause nutritional deficiency diseases. Thus these edible medicinal plants under study, in addition to treating various diseases as reported earlier, can also overcome malnutritional health related problems due to their high nutrient composition.

TABLE I
PROXIMATE COMPOSITION OF SIX SELECTED PLANTS SPECIES on (DM) basis

Specimens	Moisture (%)	Crude protein (%)	Ether extract (%)	Crude fiber (%)	Total ash (%)	Carbohydrate (%)	Gross energy (Kcal/ 100g)
1.Clerodendrumm indicum	15.400	7.880	0.314	11.000	5.500	59.900	273.940
2.Homalomena aromatica	10.700	20.500	0.931	20.000	5.000	42.870	261.850
3.Elsholtzia communis	8.86	16.19	1.25	7.31	14.50	51.89	283.57
4.Zanthozylum alatum	12.80	10.94	1.27	12.5	8.5	53.99	271.15
5.Drymaria cordata	10.67	20.57	0.32	15.00	9.00	44.44	262.92
6.Gnetum gnemon	9.99	6.70	1.20	7.50	9.0	65.61	111.00

TABLE II
MINERAL CONTENT OF SIX SELECTED PLANTS SPECIES

Specimens	Calcium (%)	Phosphorous (%)	Zinc (ppm)	Iron (ppm)	Copper (ppm)
1.Clerodendrum indicum	1.000	0.641	5.600	42.000	0.620
2.Homalomena aromatica	1.200	0.654	6.720	136.000	0.470
3.Elsholtzia communis	0.800	0.560	2.040	10.000	0.310
4.Zanthozylum alatum	1.700	0.708	1.470	186.000	0.170
5.Drymaria cordata	0.978	0.600	10.760	792.000	1.000
6.Gnetum gnemon	0.95	0.20	0.65	10.00	0.01

CONCLUSION

The present study indicated that among the six wild edible medicinal plants/herbs, *Drymaria cordata, Homalomena aromatica, Elsholtzia communis* are good sources of protein and moderate sources of fat, can serve as a good nutritional source in combating malnutrition and obesity. They are also rich sources of certain mineral elements and among them the herb *Drymaria cordata* has shown the higher concentration of protein,carbohydrate and mineral constituents. So far *Drymaria cordata* is commonly reported as a medicinal herb by many researchers, and its use is limited to its medicinal property only. Nevertheless, this plant can also be used as a food supplement or as an alternate source of bio-nutrient to promote health.

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