

Original Research Article

Nutritional Profile of a Few Selected Wild Edible Plants of Papum Pare District of Arunachal Pradesh, India

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Abstract: Despite self-sufficiency of food at national level, a considerable population who thrive in the rural areas of India is still undernourished. As shifting cultivation remained the major cultivation practice in Arunachal Pradesh with limited and insufficient crop yield, majority of the common people rely on several hundreds of wild edibles to meet their food requirements. Present study was carried out in Papum Pare district of Arunachal Pradesh, India, where, many ethnic tribes of the state inhabit in both rural and urban areas. Several hundreds of wild edible plants and animal resources are consumed and also sold in the market places. This study has determined the nutritional quality of most commonly consumed three wild edible plants namely, *Polygonum runcinatum*, *Pilea bracteosa* and *Elatostema platyphyllum* which grow in the wild. Plant samples were collected from natural habitats and oven-dried, ground and further detail analyses for nutritional parameters were carried out following standard methods. Findings of this study revealed that, all the three wild edible plants were rich in total carbohydrate, protein and minerals with higher values than most of the reported wild edible plants including few common vegetables. Fat and sodium content was low but fibre and potassium content was higher than many wild edible plants and common vegetables. Hence, these three wild edible plants may be recognized as a good source of essential nutrients and may also qualify to serve as promising food plants for human consumption, particularly for the persons who are suffering from hypertension, liver, gastro-intestinal and chronic diseases.

Key words: Arunachal Pradesh, Minerals, Nutrition, Protein, Wild edibles

Introduction

Wild edible plants are the plant resources, which are harvested or collected for the purpose of human consumption from forests and other landmass outside agricultural field. In India, more than 800 species of wild plants are consumed as foods and vegetables (Sasi *et al.*, 2011). Most of the people in remote areas depend on several wild edible plants during the scarcity of staple food. Depending upon certain factors, such as, availability of the plants, taste and their socio-economic and cultural importance, most of these plants are regularly

consumed as food and food additives. They are also recognized as potential source of nutrients than the conventional vegetables, which not only nourish the hunger but also meet the food requirements during famine (Nazarudeen, 2010). These resources remained underutilized due to the lack of proper knowledge on their nutritional values and cultural methods in contrary to the exotic and hybrid ones. Intake of unbalanced diet particularly vegetables with poor nutrients as major food components resulted to global annual death of

around 2.7 million people (The World Health Report, 2007). In most developing countries, shortage of food is a major problem due to rapid growth of human population, shortage of land for cultivation, high price of available staple foods and their limited import. The ethnic tribes in Papum Pare district of Arunachal Pradesh, India are living an intricate life, where most of them are dependent on wild edible plants to meet their daily food requirements. Knowledge of the ethnic people on such plants and their properties are immense, where, innumerable numbers of wild plants are consumed in raw form or after cooking and roasting that compensate their daily calorie requirement and essential nutrients. Most of the plants consumed in the rural areas are in high local demand and are also sold in the market places. Immense ethnobotanical studies were carried out on wild plants of Arunachal Pradesh, but researches on nutritional values of those plants are very meager. As there is no simple and concrete solution to the problems of food scarcity, an interdisciplinary approach is the need of the hour to resolve this issue.

Considering the above facts, the present study was conducted for the evaluation of nutritional values of three most commonly consumed wild edible plants, namely, *Polygonum runcinatum* (vern. Rungri-Nyshi), *Pilea bracteosa* (vern. Gungi-Nyshi) and *Elatostema platyphyllum* (vern. Huj-Nyshi) in Papum Pare district of Arunachal Pradesh (Fig. 2A, B & C).

Materials and methods

Study area

Present study was carried out in Papum Pare district of Arunachal Pradesh, which is located between 26°30'N - 29°30'N Latitude and 91°30'E-97°30'E Longitude (Fig.1). Topographically, the district is mountainous with hilly terrain and forming a part of the Eastern Himalaya. The area covered by Papum Pare district comprises a cross section of the foothill region adjoining to the border of Assam to the east, the lower Hills and the towering mountain extending towards Lower Subansiri district to the north. Geographically, the district

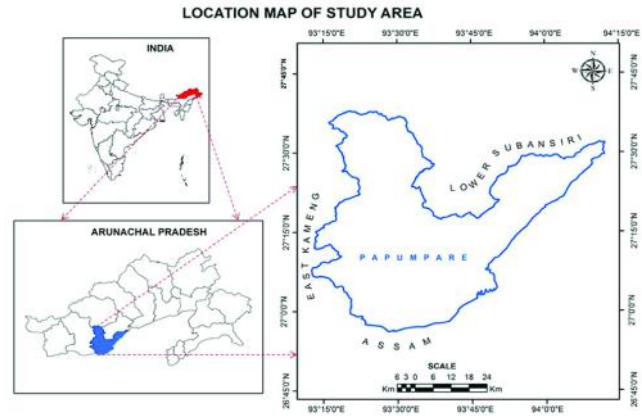


Fig.1. Map of Papum Pare district of Arunachal Pradesh in India

occupies an area of approximately 2,875 sq km and inhabited by approx. 1.76 Lakh populations as per the census (2011), where, Nyishi or Nishing is the dominant ethnic tribal community.

Nutritional analysis

Randomly sampled fresh edible parts of the three selected wild plants were collected from their natural habitats in Papum Pare area of Arunachal Himalaya, India. The samples were thoroughly washed with distilled water and oven dried using paper envelop at 70 ± 5 °C for a week. Dried samples were ground into fine powder using an electric grinder and stored in room temperature in airtight container for detail chemical analysis. Moisture content, ash, crude fat, crude fibre and crude protein in the plant samples were determined following standard methods as outlined in Association of Official Analytical Chemists (1990). Total Carbohydrate was determined by Anthrone method using spectrophotometer (Sadasivam and Manickam, 1996). Minerals were analyzed through wet digestion using tri-acid (Sulphuric acid, Perchloric acid and Nitric acid) in KEL PLUS block digester following Allen *et al.* (1974). Phosphorus content was determined using UV-VIS Spectrophotometer following molybdenum blue method; potassium, calcium and sodium were determined using flame photometer, whereas magnesium content was determined through EDTA titration method (Allen *et al.*, 1974). Energetic value of edible portion of the plants was determined

by multiplying the protein, fat and carbohydrate content by 4.0, 9.0 and 4.0, respectively (FAO, 2003). All the analyses were carried out in triplicates and the data were statistically analyzed using one-way ANOVA for their significant levels.

Results

Moisture content of the three wild edible plants viz. *Polygonum runcinatum*, *Pilea bracteosa* and *Elatostema platyphyllum* was significantly different ($p < 0.05$), where highest moisture content was recorded in *P. runcinatum* with 89.9% and lowest in *Elatostema platyphyllum* with 87.3% (Table 1). Fibre and ash

dry tissue, respectively ($p < 0.05$). Sodium and potassium content in the six wild edible plants were also significantly different ($p < 0.01$), where highest sodium content was recorded in *P. bracteosa* with 53.3 mg/100 g dry tissue, whereas highest potassium content was observed in *P. runcinatum* with 3738 mg/100 g dry tissue (Table 2). Calcium and magnesium content was recorded to be significantly highest in *E. platyphyllum* with 1412 mg/100 g and 1633 mg/100 g dry tissue, respectively and lowest in *P. runcinatum* with 631 mg/100 g and 1253 mg/100 g dry tissue, respectively ($p < 0.01$). Phosphorus content was significantly highest in *P. runcinatum* with 323 mg/100 g

Table 1. Proximate composition of three wild edible plants on oven dry basis (Mean \pm SD)

Plant species	Moisture* (%)	Crude fibre** (%)	Ash** (%)	Total carbohydrate** (%)	Crude protein** (%)	Crude fat** (%)	Energy* (Kcal/100g)
<i>Polygonum runcinatum</i>	89.9 \pm 1.5	7.67 \pm 0.95	14.6 \pm 0.6	51.63 \pm 2.48	24.72 \pm 2.90	1.43 \pm 0.06	163 \pm 9.9
<i>Pilea bracteosa</i>	89.3 \pm 0.5	9.67 \pm 1.30	18.9 \pm 0.2	53.01 \pm 1.24	16.96 \pm 1.27	1.50 \pm 0.10	134 \pm 6.0
<i>Elatostema platyphyllum</i>	87.3 \pm 0.4	12.00 \pm 1.73	21.5 \pm 0.6	46.61 \pm 1.20	18.56 \pm 1.15	1.33 \pm 0.06	133 \pm 3.7

* $p < 0.05$, ** $p < 0.01$

content in the edible parts among the three plants was significantly highest in *Elatostema platyphyllum* with 12.0% and 21.5% and lowest in *P. runcinatum* with 7.67% and 14.6% ($p < 0.01$) (Table 1). Carbohydrate, crude protein and fat content among the three wild edible plants were also significantly different ($p < 0.01$) (Table 1). Total carbohydrate content ranged between 46.61-53.01% and was highest in *Pilea bracteosa*, whereas it was lowest in *Elatostema platyphyllum*. Crude

dry tissue and lowest in *E. platyphyllum* with 215 mg/100 g dry tissue ($p < 0.01$) (Table 2).

Discussion

Fibre content in the three wild edible plants considered for this study was close to the range of *Amaranthus*, *Achyranthes*, *Chenopodium*, *Oxalis* etc. (Vishwakarma and Dubey, 2011). High ash percent recorded in this study revealed rich source

Table 2. Mineral contents of three wild edible plants on oven dry basis (Mean \pm SD)

Plant species	Sodium** (mg/100g)	Potassium** (mg/100g)	Calcium** (mg/100g)	Magnesium** (mg/100g)	Phosphorus** (mg/100g)
<i>Polygonum runcinatum</i>	38.0 \pm 1.9	3738 \pm 146	631 \pm 15	1253 \pm 122	323 \pm 27
<i>Pilea bracteosa</i>	53.3 \pm 1.9	3135 \pm 22	1091 \pm 252	1347 \pm 35	285 \pm 21
<i>Elatostema platyphyllum</i>	52.0 \pm 2.9	3287 \pm 31	1412 \pm 163	1633 \pm 102	215 \pm 9

** $p < 0.01$

protein content was highest in *Polygonum runcinatum* with 24.72% and lowest in *Pilea bracteosa* with 16.96% ($p < 0.01$). Fat content was highest in *Pilea bracteosa* with 1.50% and lowest in *Elatostema platyphyllum* with 1.33% ($p < 0.01$). Energetic value of the edible parts was significantly highest in *Polygonum runcinatum* followed by *Pilea bracteosa* and lowest in *Elatostema platyphyllum* with 163, 134 and 133 Kcal/100g

of mineral content and it was within the range of few commonly consumed domestic leafy vegetables, such as species of *Amaranthus*, *Chenopodium* and *Urtica* (Pradhan *et al.*, 2015). This study has confirmed that all the three wild plants were rich in carbohydrates and was higher than that of *Amaranthus* sp. that contained 9.7-21.2% carbohydrates and close to *Chenopodium album* having 53.3% (Srivastava, 2011;

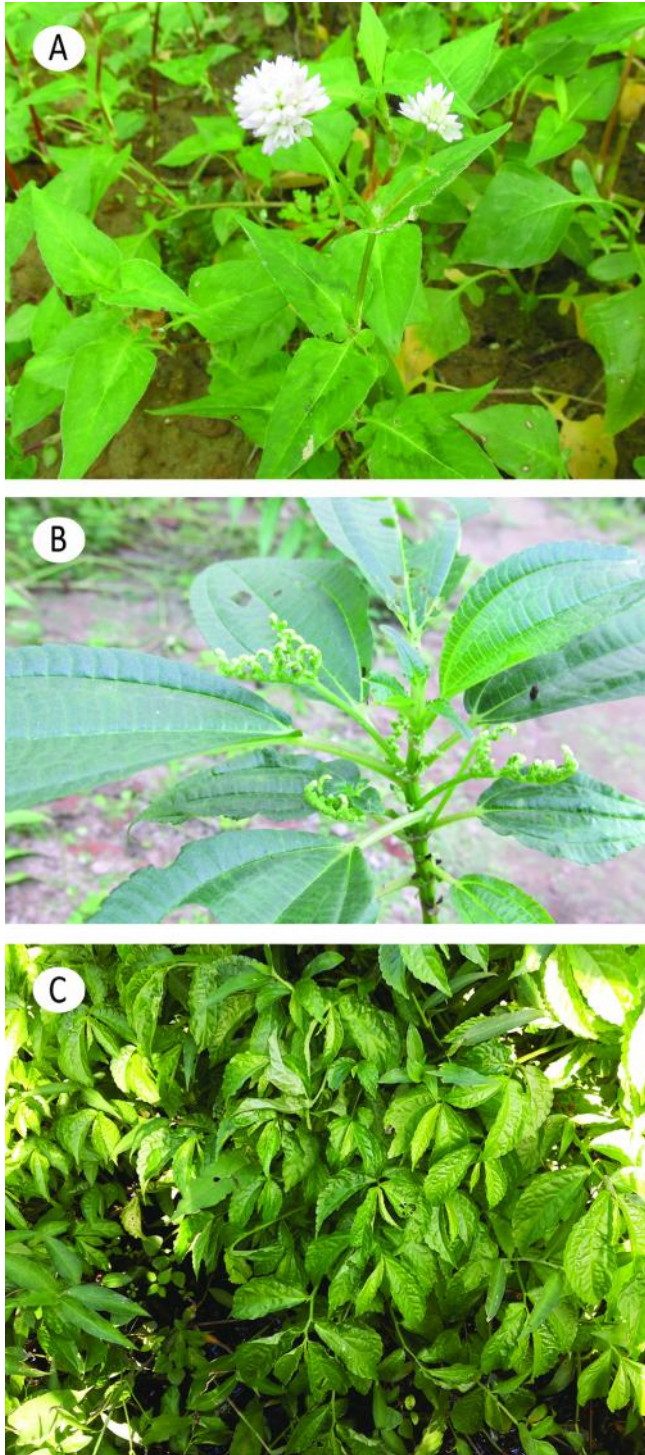


Fig. 2: Wild edible plants in their natural habitat (A) *Polygonum runcinatum*, (B) *Pilea bracteosa* & (C) *Elatostema platyphyllum*

Pradhan *et al.*, 2015). This study also revealed that the three wild edible plants were rich in carbohydrates and may be recognized as a substitute source of carbohydrates. Protein content in the three wild edible plants was close to the range

of the findings reported by many authors in other wild plants, such as, species of *Oxalis*, *Moringa* and *Chenopodium* etc. (Jain and Tiwari, 2012; Pradhan *et al.*, 2015). As proteins are one among the most essential components in the diet of human being and other organisms, findings of this study has revealed that, all the three wild edible plants may act as moderate protein source. This study also revealed that all the three wild edible plants were poor in fat content than other wild edible plants reported so far and may be considered as healthier foods for human consumption (Pradhan *et al.*, 2015; Tag *et al.*, 2014 and Brahma *et al.*, 2014). Sodium content in the three wild edible plants was on the lower side but close to the species of *Basella*, *Brassica*, *Moringa*, *Chenopodium*, *Amaranthus* etc., whereas potassium content was higher than these species (Saha *et al.*, 2015; Srivastava, 2011). A considerable concentration of sodium and potassium were present in all the three wild plants, where, both minerals are the major electrolytes in the blood and serum, and potassium is also an essential component of many enzymes. Concentration of both calcium and magnesium in these three wild plants was also higher than the species of *Basella*, *Brassica*, *Moringa*, *Chenopodium*, etc. (Saha *et al.*, 2015), whereas, phosphorus content was close to other wild edible plants such as *Oroxylum*, *Garcinia*, *Smilax*, *Commelina* etc. where phosphorus content was reported between 130-270mg/100g dry tissue (Mahadkar *et al.*, 2012).

The present study revealed that all the three wild edible plants namely, *Polygonum runcinatum*, *Pilea bracteosa* and *Elatostema platyphyllum*, which were widely consumed by the ethnic tribes of Papum Pare district of Arunachal Pradesh, India were rich in total carbohydrate, protein and minerals and can serve as an easily accessible nutritional source. In addition to other superior nutritional parameters, low fat and sodium content with high fibre and potassium content in these three wild edible plants compared to other edible plants, made them to be recognized as promising food plants for human consumption, particularly for the patients suffering from hypertension, intestinal and other related chronic diseases. Further, studies are required to determine the nutritional

potential including medicinal properties of the remaining wild edible plants that are commonly consumed in the state and rest of the Eastern Himalayas.

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