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Original Article

NUTRITIONAL ANALYSIS OF SOME SELECTED WILD EDIBLE SPECIES CONSUMED BY THE *BODOS* TRIBES OF KOKRAJHAR DISTRICT, BTC, ASSAM

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ABSTRACT

The paper deals with the native uses of ethno botanical species, identification and chemical analysis of some selected wild edible plants consumed by the *Bodo* tribes inhabiting in various areas of Kokrajhar district. A total of one eighty-one wild edible plant species were identified and recorded of which ten species are chemically analyzed and presented in this paper. The results revealed that the leaves contain moisture content in the range of (81-94.5% fw); ash content (20-43% dw); crude protein (13.81-23.66%dw); total solids (11.5-19 dw); carbohydrates (7.6-48.4% dw) and crude fat (0.54-2.37% dw). Mineral content ranges were Zn (0.245-10.96ppm), Mg (1.10-6.433), Mo (1.18-6.58ppm), Cu (0.168-0.551), Fe (15.97-27.44) and Mn (0.424-3.488). Comparing the nutritional contents with recommended dietary allowances (RDA), the results indicated that these wild edible plants could act as a good supplement for various nutrients like proteins, carbohydrates and micronutrients.

Keywords: Wild edibles, *Bodos*, nutritional analysis, micronutrients.

INTRODUCTION

In many tropical countries, rural people traditionally harvest wide range of leafy vegetables, roots, tubers, fruits from the wild because of its taste, cultural uses, as food supplements or to tide over food shortages. Wild edible plants are those that are neither cultivated nor domesticated, but are available from their natural habitat and are used as food sources (1). Labeled as famine or hunger food, wild plants have been recognized to have potential source of nutrition than conventionally eaten crops (2). According to food and agricultural organization (FAO) report, at least one billion people are thought to use wild food in their diet (3). In India, Malaysia and Thailand, about 150 wild plant species have been identified as source of emergency food (4). Besides food and nutrition, utilization of wild foods as coping strategies during scarcity is prevalent, particularly in developing countries where food insecurity is more accurate. As a result in recent years a growing interest has emerged to evaluate various wild edible plants for their nutritional features (5-9). Inventory of wild food resources, ethno botanical information on its adaptability coupled with nutritional evaluation can only establish the non-cultivated variety as real substitute for domesticated or cultivated species. It is therefore worthwhile to note that the incorporation of edible and semi cultivated plant resources could be beneficial to nutritionally marginal population especially in developing countries where poverty and climatic changes causes havoc to the rural population. Hence, proximate and nutrient analysis of wild edible plants plays a crucial role in assessing their nutritional signifance (10). Since most of the wild edible vegetables were collected from wild, information on their nutritional and anti-nutritional properties are lacking. In spite of their importance as food source, there are no published studies on nutritional composition and nutritional utility of these wild edible varieties. In general, information on edibility and therapeutic properties of wild plants is scanty and data on their nutritional composition is negligible (11, 12). The present study explores the nutritional status of ten wild edible plants reportedly consumed by the Bodo tribes of Kokrajhar district by profiling their biochemical attributes i.e. protein, carbohydrate, fats and mineral elements.

MATERIALS AND METHODS

Kokrajhar district is the Head Quarter of BTC that lies roughly between 26^0 25' N Longitude and 99^0 16' 38'' E Latitude, respectively. It covers an area of 3,169.2 sq. km with a population of 8,86,999 that constitute about 30% of the total population of Bodoland Territorial Council (13). Dominant population of this region being the Bodo tribes mostly relies on the wild edible plants for their daily consumption. Ten wild edible plants were collected from the study area and various standard methods as mentioned below were followed for analyzing the nutrient parameters. Collected plant materials were thoroughly washed and then dried under shade at 25±2^{o}C for about 8-10 days. The dried plant samples were grounded well into a fine powder in a mixer grinder and these powdered samples were then stored in air tight containers at room temperature. The mixture is then filtered and the filtrate is taken for experiments whenever applicable (14). Herbarium was identified and deposited for authenticity by the experts of Department of Botany, Gauhati University, Assam.

Proximate analysis

Determination of crude protein

The crude protein was determined using micro Kjeldahl method (15). 2g of sample material was taken in a Kjeldahl flask and 30ml concentrated sulphuric acid (H_2SO_4) was added followed by addition of 10g potassium sulphate and 1g copper sulphate. The mixture was heated gently and then strongly once the frothing had ceased. When the solution became colourless or clear, it was heated for another hour, allowed to cool, diluted with distilled water and then transferred to 800 ml Kjeldahl flask. Three or four pieces of granulated zinc and 100 ml of 40% caustic soda is added and the flask is connected with the splash heads of the distillation apparatus. Next 25 ml of 0.1N sulphuric acids is added in receiving flask and then distilled. The flask is removed and titrated against 0.1N caustic soda solution using methyl red indicator for determination of Kjeldahl nitrogen which in turn gives the protein content. The nitrogen percent is calculated by the following formula-

$$N\ \% = \frac{1.4\ (V_1 - V_2) \times \text{Normality of HCL}}{\text{Weight of the sample}} \times 250\ (\text{dilution})$$

The protein content were estimated by conversion of nitrogen percentage to protein (16). Thus,

Protein % = N% x conversion factor (6.25)

Estimation of Oils and Fats

The fat content is determined gravimetrically after extraction with diethyl ether ethoxyethane and petroleum ether from an ammonium alcoholic solution of the sample (17). About 10 gm of the sample is taken into a Mojonnier tube, to which is added 10 ml ethanol, mixed well and cooled. Then 25 ml diethyl ether along with 25 ml of petroleum ether is added and the tube is left to stand for 1 hour. The extraction is repeated thrice using a mixture of 5 ml ethanol, 25 ml diethyl ether and 25 ml petroleum ether. This extraction is transferred into the distillation flask. The solvent is then distilled off and the flask is dried by heating for 1 hour at 100 ^{o}C and reweighted. The percentage of fat content of the sample is calculated by the following formula which gives the difference in the weights of the original flask and the flask plus extracted fat which represents the weight of the fat present in the original sample. Hence,

% of fat content of the sample = W_2 W_1 / W_3 x 100

Where,W_1 = weight of the empty flask (g)

W_2 = weight of the flask + fat (g)

W_3 = weight of the sample taken (g)

Determination of moisture content

Since the analysis results are expressed on oven dry weight basis, it becomes necessary to determine the moisture content of air dried tissue (18). Duplicate determinations are made on each sample of the plant tissue. The results of air dried tissue analysis are then converted to oven dry basis. 20 gm of the samples of ground air dried tissue is dried in an oven at 105^{o}C for overnight or for 12 to 16 hour. The samples are then cooled in desiccators and weighed. The differences in weight are then taken to represent the loss of moisture and are expressed as a percentage of oven dry weight (19). Hence,

Moisture % = Fresh weight – Dry weight x 100

Fresh weight

Determination of Total solids

Total solids were estimated by deducting moisture percent from hundred as described by James, 1995. Hence,

% of total solids = 100 - percentage of moisture

Determination of Ash content percentage

For determination of ash content, method of AOAC, 1984 were followed. According to this method, 10 gm of each sample were weighted out in a silica crucible, this crucible are heated in muffle furnace at 300^{o}C for one hour, and then it is cooled in a desiccator, waited for completion of ash and then again cooled. When the ash becomes white or grayish in colour, weight of the ash content is calculated out by using the following formula-

Weight of the ash sample

Ash % = ---------- x100

Weight of the sample taken

Determination of Carbohydrates

Determinations of available carbohydrates in the sample were calculated by difference method as described by James (1995). Thus,

% of carbohydrates = 100 – (Protein + Ash + Moisture + Fat)

Determination of nutritive value

The total energy value in kcal/100g were estimated by using the method described by FAO, 2003 (20) as shown below:

Nutritive value = 4 x percentage of protein + 9 x percentage of fat + 4 x

percentage of carbohydrate

Mineral analysis

Test for the presence of minerals were carried out after acid digestion with HNO_3 and perchloric acid (21). The supernant was decanted and the liquid is analyzed for measuring the levels of Magnesium, Manganese, Iron, Zinc, Copper and Molybdenum present using standard procedures using Atomic Absorption Spectrophotometer (AAS).

RESULTS AND DISCUSSION

Ethnobotanical survey

Information on wild edible plants, their local name, botanical name and consumption practice of the selected plants is presented in table 1.

Proximate analysis

Proximate composition of selected wild edible plants is presented in table 2. Moisture content was found to vary from 81% to 94.5% in fresh weight. The ash content of these plants ranged from 20% to 43% in dry weight. Out of ten wild edible plants studied, highest nutritive value was recorded in *Amorphophallus campanulatus* (284.8Kcal/100g) and the lowest in *Lippia alba* (124.03Kcal/100g). Occurrence of high protein content thus indicated its nutritional superiority over other conventionally consumed crops. Presence of low fat content varying from 0.54 to 2.37% in dry weight is an indication that it can be used as an important source of good dietary habit and can be recommended to individuals suffering from overweight or obesity. The carbohydrate content of the wild edible plant samples varied considerably ranging from 7.6% of dry weight in *Lippia alba* and highest with 48.4% of dry weight *in Amorphophallus campanulatus.* Similarly, total solid refers to matter suspended or dissolved in water or wasteland and is related to both specific conductance and turbidity. The amount of total solids ranged in between 11.5 to 34 of dry weight with highest recorded in *Lippia alba* and *Lasia spinosa* respectively. Thus, high protein, carbohydrate and nutritive content can make a good diet for children, lactating mothers, pregnant women and adults.

Micronutrient analysis

The micronutrients in studied wild edible plants were appreciably high. Results of mineral nutrients (Table 3) shows remarkably high amounts of Iron (27.44±0.07) in *Lippia alba* followed by *Hibiscus cannabinus* (23.02±0.34) and *Hibiscus sabdariffa* (22.50±0.25). Molybdenum was undetected in *Drymeria cordata, Hibiscus sabdariffa, Lippia alba, Cayratia trifolia, Ipomoea aquatic and Amorphophallus campanulatus.* Magnesium level varies between 1.10±0.02-6.433±0.26 in *Lippia alba* and *Hibiscus sabdariffa.* Similarly highest content of copper was found in *Lippia alba* (0.551±0.02). The level of Manganese was found to be highest in followed by highest level of zinc in *Blumera lanceolaria* (10.96±0.08) and *Hibiscus sabdariffa* (8.838±0.09). Thus, the use of wild edible leaves in our diet could help boasting in blood level especially in anemic conditions.

CONCLUSION

The result highlighted significance of wild edible plants as a cheap source of nutrient for the rural poor. Analysis of 10 wild edible plants focuses the rich nutritional composition of indigenous plants and their scope to be used as an alternate source of bio-nutrients and dietary supplement. Thus, results suggest that these famine foods can be used as a good source of food to alleviate hunger and malnutrition.

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Table 1: Ethnobotanical information of selected ten wild edible plant species.

Botanical names	Family	Local names	Parts used	Local preparation or uses.
Blumea lanceolaria Druce	Asteraceae	Jaglaori	Leaves	Cooked as vegetable and decoction used in fever and cold.
Drymaria cordata (L.)Roem.& Schult.	Caryophyll-aceae	Jabshri	Leaves	Mostly cooked as pot herb, decoction taken in stomach problems in combination with other herbs.
Hibiscus sabdariffa L.	Malvaceae	Maitha	Leaves	Leaves cooked with fishes as delicacy and also used in fever, hypertension & general debility.
Lippia alba (Mill.) N.E.Br.	Verbenacea-e	Onthai bazab	Leaves	Leaves mostly used as aromatic herb and decoction used for hypertension and digestive problems.
Cayratia trifolia Domin	Vitaceae	Dausrem	Leaves	Mostly cooked as pot herb
Hibiscus cannabinus L	Malvaceae	Maitha bangal	Leaves	Used as vegetables.
Premna herbacea Roxb.	Verbenacea-e	Mathi gadab	Leaves	Cooked as vegetable and decoction used for fever & body ache in cold & cough.
Ipomoea aquatica Forssk.	Convolvulaceae	Mandey	Leaves	Mostly used as pot herb and in arsenic poisoning.
Amorphophallus campanulatus Blume ex Decne.	Araceae	Alodor	Leaves	Cooked as vegetables and given in stomach problem & acute rheumatism.
Lasia spinosa Thwaites	Araceae	Sibru	Leaves	Cooked as vegetable and given in respiratory disorder, intestinal disorder and other gastric problems.

Table2: Proximate composition of selected ten wild edible plant species.

Specimens	Protein (%)	Moisture (%)	Fats (%)	Ash (%)	Total solids	Carboh-ydrates (%)	Caloric value
Blumea lanceolaria Druce	23.66	84	0.54	32	16	40	259.5
Drymeria cordata (L.) Roem.& Schult	13.81	86	0.54	23	14	23.35	153.5
Hibiscus sabdariffa L.	15.18	91.5	1.83	35	8.5	43.51	251.23
Lippia alba (Mill.)N.E.Br	20.28	66	1.39	20	34	7.6	124.03
Cayratia trifolia Domin	19.57	83	1.61	22	17	26.18	197.49
Hibiscus cannabinus L	21	86	2.01	30	14	39.01	258.13
Premna herbacea Roxb.	15.38	81	2.37	43	19	41.75	249.85
Ipomoea aquatica Forssk.	14.39	88.5	1.2	30	11.5	34.9	207.96
Amorphophallus campanulatus Blume ex Decne.	17.58	94.5	2.32	34	5.5	48.4	284.8
Lasia spinosa Thwaites	17.66	17.66	83	1.16	34	17	224.04

Table3: Mineral composition of selected ten wild edible plant species.

Specimen name	E L E M E N T S					
	Zn	Mg	Mo	Cu	Fe	Mn
Blumea lanceolaria	10.96±0.08	2.571±0.09	3.034±0.05	0.301±0.06	15.97±0.15	2.432±0.07
Drymeria cordata	7.791±0.08	2.149±0.05	ND	0.377±0.01	22.06±0.73	0.721±0.09
Hibiscus sabdariffa	8.838±0.09	6.433±0.26	ND	0.431±0.03	22.50±0.25	1.986±0.01
Lippia alba	0.783±0.02	1.10±0.02	ND	0.551±0.02	27.44±0.07	3.348±0.26
Cayratia trifolia	5.113±0.87	4.107±0.13	ND	0.291±0.41	21.59±0.36	1.645±0.49
Hibiscus cannabinus	6.385±0.07	3.038±0.07	6.58 ±0.10	0.287±0.01	23.02±0.34	0.424±0.06
Premna herbacea	7.763±0.17	5.044±0.26	4.364±0.47	0.305	18.27±0.90	0.530±0.08
Ipomoea aquatica	0.360±0.03	1.13±0.16	ND	0.168±0.02	22.42±0.29	3.451±0.01
Amorphophallus campanulatus	0.245±0.01	1.116±0.14	ND	0.499±0.01	20.94±0.2	3.488±0.01
Lasia spinosa	7.442±0.01	6.228±0.11	1.180±0.06	0.316±0.02	17.06±0.87	1.334±0.08

N.B. 1. Carbohydrates calculated by difference method. 2. Values of mineral in ppm(parts per million)