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Original Research

Proximate and vitamin C analysis of wild edible plants consumed by Bodos of Assam, India

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ABSTRACT

Aim: The State of Assam is gifted with diverse flora including thousands of wild edible plants. The consumption of a large variety of wild plants by Bodos, an ethnic group and dominant inhabitant of Bodoland Territorial Area Districts of Assam of North-East India, is a common practice since time immemorial. The objective of this study was to investigate the nutritional values of wild edible plants consumed by the Bodos of this region. Materials and Methods: In this study, twelve wild edible plants *viz. Blumea lanceolaria* (Roxb.) Druce, *Stellaria media* (L.), *Glinus oppositifolius* (L.) Aug. DC., *Cryptolepis sinensis* (Lour) Merr., *Polygonum perfoliatum* L., *Oenanthe javanica* (Blume) DC., *Tetrastigma angustifolium* (Roxb.), *Antidesma acidum* Retz., *Drymaria cordata* (L.) Willd.ex Schult., *Eryngium foetidum* L., *Lippia javanica* (Burm.f.) Spreng. and *Enhydra fluctuans* Lour. consumed by the Bodos were selected, scientifically identified and their proximate and vitamin C contents were determined using standard food analysis methods. Results: Proximate compositions were presented and the vitamin C content was found highest in *T. angustifolium* (79.06 ± 0.02 mg) and lowest in *A. acidum* (11.39 ± 0.0002 mg). All the results were based on 100 g fresh weight of the sample. Conclusion: In the present study, all the twelve plants have shown variable values of proximate composition and vitamin C contents. These plants could be a promising alternate food sources which are easily available, affordable and could provide several health benefits on consumption.

KEY WORDS: Wild edible plants, proximate analysis, vitamin C, Bodos, North-East India.

INTRODUCTION

Plants have always been a source of inspiration and way of livelihood to human kind since time immemorial. Plant-derived and other natural product provided many novel bioactive molecules that are available in market today as medicines or food. The wild edible plants growing in their natural conditions have been a source of food to the rural people inhabiting to the remote areas of the world including India. With the explosion of human population, rapid urbanization as well as climatic changes, the agricultural lands are decreasing rapidly leading to the decrease of major crop productivity affecting our daily lives which ultimately may cause nutritional deficiency disorders and diseases [1]. The botanicals and nutritional content of a plant depends on the season, geography and climatic conditions of the habitats. Fresh, nutritious and healthy foods are the sole source of energy for proper growth and maintenance of physiological homeostasis in the body. It also acts as a defense system to many diseases by boosting the immune system of our body. Like other plants, wild edible plants also act as a vital component of human food that is consumed throughout the year. These plants not only serve as an alternative to staple food during periods of food deficit but also act as a valuable supplement for balanced diet and provide source of income generation to the poor families [2,3]. The importance of wild plants as food as well as medicines against many diseases such as jaundice, malaria, epilepsy, asthma *etc.* has been established by several ethnopharmacological studies all over the world [4,5]. In addition to meeting nutrient intake levels, consumption of fruits, vegetables and derived food products has several health benefits against chronic diseases including cardiovascular disease, stroke and certain types of cancer [6]. Plants are potential sources of carbohydrates, fats, proteins, and other important botanicals. Hence, wild edible plants are considered as one of the cheapest sources of energy for human consumption [7].

North-East (NE) India is known for its multi-ethnicity and rich biological diversity. With the geographical location of 89°50′ E to 96°10′ E and 24°30′ N to 28°10′ N, Assam is one among the richest biodiversity zones in NE India. As per Forest Survey of India 2011, the total area of Assam is 78,438 sq. km out of which 26,832 sq. km is outlined as forest area. The study area of the present work is Bodoland Territorial Area Districts (BTAD) in Assam of NE India. BTAD consisting of four districts *viz*. Kokrajhar, Chirang, Baksa and Udalguri of Assam is occupied by *Bodo*, *Rava*, *Garo*, *Nepali*, *Santhal*, *Rajbongshi*, *Orao* etc. Bodos are an ethnic group, early settlers of Assam and they are the major and dominant inhabitant of the BTAD area [8,9]. Situated at the northern part of the River Brahmaputra and foothills of the Great Himalayas, BTAD is endowed with rich flora

and fauna. A large variety of wild plants grow well and readily available in their natural habitats which are mostly consumed by *Bodo* people and other tribal communities of this region in their daily diet since the time unknown [3,10]. Bodos have a rich tradition of enjoying the flavor of several wild plants in the form of mixture locally known as "*Gwka-Gwkwi*" (meaning bitter and sour) during the festive season of *Rongjali Bwisagu* (a New Year festival of *Bodo* people; *Rongali Bihu* in *Assamese*). There is also a traditional belief that *Gwka-Gwkwi* act as a medicine for many diseases for the whole year. In view of its food and medicinal significance, the present study is designed to evaluate the proximate composition and vitamin C content of selected wild edible plants consumed by the Bodos of BTAD area.

MATERIALS AND METHODS

Collection and identification of plants

Different parts of the 12 wild edible plants *viz*. *B. lanceolaria*, *S. media*, *G. oppositifolius*, *C. sinensis*, *P. perfoliatum*, *O. javanica*, *T. angustifolium*, *A. acidum*, *D. cordata*, *E. foetidum*, *L. javanica* and *E. fluctuans*. were collected from Kokrajhar and Chirang Districts of BTAD during their seasonal availability. All the samples were identified and authenticated at Botanical Survey of India, Shillong, Meghalaya. After collection, the samples were washed with distilled water and processed for moisture and vitamin C contents of the fresh sample on the same day. For other parameters, samples were dried at 55 °C in a hot-air oven, ground into fine powder and kept in the air-tight container for further use. All the chemicals used were of analytical grade.

Determination of moisture content

The moisture content was determined following AOAC method [11]. Briefly, 5 g of fresh sample was completely dried in a hot air oven at 105 °C for 3 h, cooled in desiccator, weighted and the moisture content was calculated by the following formula.

$$\text{Moisture (\%)} = \frac{\text{(Fresh weight - Dry weight)}}{\text{Fresh weight of the sample}} \times 100$$

Determination of ash content

The ash content was determined by the AOAC method [11]. Silica crucible was first heated in a muffle furnace, cooled in a desiccator and the initial weight was taken. 2 g of the sample was incinerated in a muffle furnace at 550 °C for 6 h, cooled in desiccator, weight of the ash was taken and ash content calculated.

$$\text{Ash (\%)} = \frac{\text{Weight of ash}}{\text{Weight of the sample}} \times 100$$

Determination of crude fat

The crude fat content was determined following AOAC method [11]. The initial weight of the flask was taken by heating in a hot air oven for overnight at 105 °C followed by cooling in a desiccator. 3–5 g of the sample was extracted with petroleum ether using Soxhlet apparatus for about 6 h. The extracted fat was dried in a rotary evaporator and the weight was measured.

$$\text{Crude fat (\%)} = \frac{\text{Weight of fat}}{\text{Weight of the sample}} \times 100$$

Determination of crude protein

Crude protein was determined by Kjeldhal method following the AOAC method [11]. 1 g of the sample was digested with 20 mL concentrated H_2SO_4 and Kjeldhal catalyst (9 parts of K_2SO_4 and one part of $CuSO_4$) in a digestion chamber until it becomes clear. The blank test was performed without the sample. After digestion, it was distilled in Kjeldhal distillation chamber (Buchi Kjelflex K-360). The evaporated ammonia was condensed and then titrated against the known concentration (0.1 N) of HCl. The concentration of nitrogen was calculated by the following formula.

$$\text{Nitrogen (\%)} = \frac{\text{(A - B) x N of HCl x 14}}{\text{Weight of the sample}} \times 1000$$

Where, A = Volume (mL) of (0.1 N) HCl used in sample titration

B = Volume (mL) of (0.1 N) HCl used in blank titration

14 = Atomic weight of Nitrogen.

The nitrogen content thus determined was multiplied by a protein conversion factor of 6.25 to get the amount of crude protein.

Protein (%) = Nitrogen (%) x 6.25.

Determination of crude fibre

Crude fibre was also determined according to AOAC method [11]. 1 g of the dry sample was boiled with 0.25 N H_2SO_4 for 30 min followed by filtration with muslin cloth, washed with hot water and again boiled with 0.313 N NaOH. It was again filtered, washed with hot water followed by 0.5 N H_2SO_4 and 50% ethanol. The residue was

dried in an oven at 130 °C for 2 h. The dry weight of the digested sample was taken, incinerated in a muffle furnace at 600 °C for 30 min, cooled in a desiccator and weight of the ash was measured. The crude fibre content was calculated based on 100 g fresh weight of the sample using the following formula.

$$\text{Crude fibre (\%)} = \frac{\text{(Dry weight of digested sample - Weight of ash)}}{\text{Weight of sample}} \times 100$$

Determination of total carbohydrate

It was determined by the difference method based on traditional carbohydrate determination [12].

Carbohydrate (%) = 100 – [Moisture (%) + Ash (%) + Crude protein (%) + Crude fat (%)].

Dry matter of plants

The dry matter or total solid was determined by subtracting percentage of moisture from the hundred [12]. Dry matter = 100 – Moisture (%).

Calorific value of plants

Calorific value or nutritive value or the total energy value of plants in kcal/100 g was calculated [13] on the basis of data of proximate analysis with the help of following equation.

Calorific value (kcal/100 g) = 4 x Protein (%) + 9 x Fat (%) + 4 x Carbohydrate (%).

Determination of vitamin C

The vitamin C content was estimated by the titration method [14]. It was determined by titrating against 2, 6-dichlorophenol indophenol which is a blue color dye and gives pink color at end point. The dye solution was prepared by dissolving 52 mg of 2, 6-dichlorophenol indophenol in distilled water. Pure ascorbic acid was taken as standard by preparing 1 mg/mL in 4% oxalic acid and was diluted to 100 μg/mL as working standard. 1–2 g of the fresh sample (crushed) was prepared by 4% oxalic acid. It was diluted to 100 mL with distilled water, filtered and the filtrate was taken as test solution. 5 mL of the standard solution was taken and 10 mL of 4 % oxalic acid was added to it. It was then titrated against the dye solution that gives pink color at end point which persists for few minutes.

$$\text{Vitamin C (mg/100 g)} = \frac{0.5 \text{ mg} \times V_2 \times 100 \text{ mL}}{V_1 \times 5 \text{ mL} \times \text{Weight of test sample}} \times 100$$

Where, V_1 = mL of dye required to neutralized the standard.

V_2 = mL of dye required to neutralized the sample.

0.5 mg = Concentration of standard ascorbic acid present in 5 mL.

Statistical analysis

All the experiments were carried out in triplicate and data were expressed as mean ± standard deviation per 100 g of the fresh sample. Relative significant differences among the means of different parameters were determined by one-way ANOVA at $P < 0.05$. All the statistical calculations were carried out at Microsoft Excel and Origin pro8 software.

RESULTS

In this study, twelve wild edible plants *viz*. *B. lanceolaria*, *S. media*, *G. oppositifolius*, *C. sinensis*, *P. perfoliatum*, *O. javanica*, *T. angustifolium*, *A. acidum*, *D. cordata*, *E. foetidum*, *L. javanica* and *E. fluctuans* have been selected for nutritional analysis. The informations *viz*. botanical name, local name (*Bodo*), family, parts used, test, time of availability and consumption practices of wild edible plants selected for the study are summarised in Table 1. The results of nutritional analysis of the plants are presented in Table **2** and **3**. It is observed from Table 2 that the moisture content of each plant species is different and ranges from 81.96 ± 0.45 g to 90.84 ± 0.16 g per 100 g of plant sample. The moisture content was found to be highest in *S. media* (90.84 ± 0.16 g) and lowest in *C. sinensis* (81.96 ± 0.45 g). The ash content of the plants studied ranges from 1.15 ± 0.001 g to 3.15 ± 0.003 g with the highest being in *L. javanica* (3.15 ± 0.003 g). *T. angustifolium* showed the lowest ash content of 1.15 ± 0.001 g. All the wild edible plants studied were found to contain poor amount of crude fat which is below 1% based on 100 g fresh weight of the sample and ranges from 0.16 ± 0.001 g (*O. javanica* and *D. cordata*) to 0.76 ± 0.002 g (*P. perfoliatum*). *P. perfoliatum*, *A. acidum* and *C. sinensis* showed high fat content of 0.76 ± 0.002 g (highest), 0.70 ± 0.003 g and 0.64 ± 0.001 g, respectively. It is found from the Table **2** that *L. javanica* has the highest protein content of 4.38 ± 0.0005 g and the lowest being in *O. javanica* (1.22 ± 0.0004 g). The fibre content found in the present study (Table 3) varied from 1.07 ± 0.004 g in *O. javanica* to 6.80 ± 0.01 g in *P. perfoliatum*. *S. media*, *C. sinensis* and *L. javanica* showed fibre content of 3.44 ± 0.009 g, 2.67 ± 0.003 g and 2.63 ± 0.002 g, respectively based on 100 g of the fresh sample. The total solid or dry matter was found to be highest in *C. sinensis* (18.03 ± 0.45 g) and lowest in *S. media* (9.15 ± 0.03 g). The dry matter found in other plants like *L. javanica*, *P. perfoliatum*, *E. foetidum*, *A. acidum* and *T. angustifolium were* 15.46 ± 1.40 g, 14.76 ± 0.32 g, 12.75 ± 0.53 g, 12.42 ± 0.96 g and 12.53 ± 0.71 g, respectively.

Table 1. Wild edible plants collected for the study

Botanical name	Local Name (*Bodo*)	Family	Parts used, Test	Availability	Uses
B. lanceolaria	Jwglaori	Asteraceae	Leaves, Spicy	May – September	Contain aromatic smell & are eaten as vegetable.
S. media	Nabiki	Caryophyllaceae	Whole plants, Bitter	June – September	Eaten as chutney or vegetable.
G. oppositifolius	Balamwiki	Molluginaceae	Tender shoot, Bitter	March – May	The leaves are bitter in test & used as vegetable.
C. sinensis	Parukia	Apocynaceae	Tender shoot, No significant test	March – July	Used as vegetable.
P. perfoliatum	Mwitasikla	Polygonaceae	Young leaves & shoot, Sour	March – June	Eaten as vegetable with fish or meat or edible insect.
O. javanica	Daopenda	Apiaceae	Leaves & petiole, Slightly bitter	March – June	Eaten as vegetable cooked with chicken.
T. angustifolium	Dousrem	Vitaceae	Young Leaves, Sour	March – June	Eaten as vegetable.
A. acidum	Lapasaiko	Euphorbiaceae	Tender shoot, Sour	March – May	Used as vegetable & for curing headache, jaundice, stomach pain *etc*.
D. cordata	Tuntini	Caryophyllaceae	Whole plants, No significant test	November – February	Eaten as vegetable.
E. foetidum	Gongar-dundia	Apiaceae	Leaves, No significant test but flavours	May – August	Used to flavour food items.
L. javanica	Ontaibajab	Verbenaceae	Young leaves, No significant test but flavours	March – June	Eaten as vegetable with meat or fish.
E. fluctuans	Alangshi	Asteraceae	Leaves & stem, Bitter	March – July	Eaten as vegetable.

Table 2. Proximate analysis of wild edible plants

Sample no.	Plant name	Moisture (g)	Ash (g)	Crude fat (g)	Crude protein (g)	Total carbohydrate (g)
1	*B. lanceolaria*	88.87 ± 0.52^{a1}	1.96 ± 0.001	0.31 ± 0.0006	1.84 ± 0.0001	7.00 ± 0.52^{e1}
2	*S. media*	90.84 ± 0.16^{a2}	2.09 ± 0.001^{b1}	0.24 ± 0.0009	1.83 ± 0.0004	4.97 ± 0.02^{e2}
3	*G. oppositifolius*	90.53 ± 0.05^{a3}	2.17 ± 0.05	0.20 ± 0.0007	1.58 ± 0.0001^{d1}	5.50 ± 0.09^{e3}
4	*C. sinensis*	81.96 ± 0.45	1.97 ± 0.001	0.64 ± 0.001	2.92 ± 0.003	12.48 ± 0.45
5	*P. perfoliatum*	85.23 ± 0.32^{a4}	1.37 ± 0.003	0.76 ± 0.002	3.38 ± 0.003	9.23 ± 0.32^{e4}
6	*O. javanica*	90.44 ± 0.26^{a5}	1.60 ± 0.001	0.16 ± 0.001	1.22 ± 0.0004^{d2}	6.55 ± 0.26^{e5}
7	*T. angustifolium*	87.46 ± 0.71^{a6}	1.15 ± 0.001	0.52 ± 0.0007^{c1}	1.86 ± 0.0006	8.99 ± 0.71^{e6}
8	*A. acidum*	87.57 ± 0.96^{a7}	1.32 ± 0.002	0.70 ± 0.003	1.47 ± 0.0006	8.92 ± 0.96^{e7}
9	*D. cordata*	89.23 ± 0.04^{a8}	2.71 ± 0.001	0.16 ± 0.001	2.58 ± 0.0004	5.29 ± 0.04
10	*E. foetidum*	87.24 ± 0.53	1.44 ± 0.07^{b2}	0.33 ± 0.001	2.09 ± 0.13	8.87 ± 0.63^{e8}
11	*L. javanica*	84.53 ± 1.40	3.15 ± 0.003	0.27 ± 0.007	4.38 ± 0.0005	7.65 ± 1.39^{e9}
12	*E. fluctuans*	89.28 ± 0.60	1.51 ± 0.001	0.51 ± 0.02	1.39 ± 0.0001	7.29 ± 0.58

Values are expressed as mean ± standard deviation per 100 g of fresh sample ($n = 3$). All the data given in the table are significant at $p < 0.05$. Non-significant data are shown with superscript for each parameter.
Moisture content: *a1*= sample 1 with 6, 7, 8, 9, 10 & 12; *a2* = 2 with 3, 6, & 12; *a3* = 3 with 6 & 12; *a4* = 5 with 11; *a5* = 6 with 10 & 12; *a6* = 7 with 8, 10 & 12; *a7* = 8 with 10 & 12; *a8* = 9 with 6, 7, 8, 10 & 12. Ash content: *b1* = sample 2 with 3; *b2* = 10 with 5, 8 &12. Fat content: *c1* = sample 7 with 12 only. Protein content: *d1* = sample 3 with 8 & 12; *d2* = 6 with 1 & 2. Total carbohydrate: *e1* = sample 1 with 3, 6, 9, 11 & 12; *e2* = 2 with 3 & 9; *e3* = 3 with 9 & 12; *e4* = 5 with7, 8, 10 & 11; *e5* = 6 with 3, 9, 11 & 12; *e6* = 7 with 8, 11 & 12; *e7* = 8 with 11 & 12; *e8* = 10 with 7, 8 & 11; *e9* = 11 with sample 12.

Total carbohydrate content (Table 2) was determined by following the difference method and found highest in *C. sinensis* (12.48 ± 0.45 g) and lowest in *S. media* (4.97 ± 0.02 g). The calorific value per 100 g of fresh sample was ranged from 29.48 ± 0.12 kcal (*S. media*) to 67.42 ± 1.82 kcal (*C. sinensis*). High calorific value was also found in *P. perfoliatum* (57.38 ± 1.29 kcal), *L. javanica* (50.64 ± 5.63 kcal), *T. angustifolium* (48.13 ± 2.84 kcal g), *A. acidum* (47.96 ± 3.67 kcal) and *E. foetidum* (46.90 ± 2.03 kcal). The vitamin C content estimated in the fresh sample was found highest in *T. angustifolium* (79.06 ± 0.02 mg) and the lowest in *A. acidum* (11.39 ± 0.0002 mg). The variation of vitamin C content per 100 g fresh sample of twelve different wild edible plants is shown in Figure 1. The high amount of vitamin C was also detected in *S. media* (37.40 ± 0.0007 mg), *P. perfoliatum* (57.74 ± 4.34 mg) and *D. cordata* (39.51 ± 5.64 mg).

Table 3. Proximate analysis and Vitamin C content of wild edible plants

Sample no.	Name of sample	Crude fibre (g)	Dry matter (g)	Calorific value (kcal)	Vitamin C (mg)
1	*B. lanceolaria*	1.23 ± 0.003	11.12 ± 0.52^{g1}	38.24 ± 2.08	11.45 ± 0.0006^{i1}
2	*S. media*	3.44 ± 0.009	9.15 ± 0.03^{g2}	29.48 ± 0.12^{h1}	37.40 ± 0.0007^{i2}
3	*G. oppositifolius*	1.75 ± 0.01	9.46 ± 0.05^{g3}	30.19 ± 0.39	27.41 ± 4.31^{i3}
4	*C. sinensis*	2.67 ± 0.003	18.03 ± 0.45	67.42 ± 1.82	30.16 ± 6.53^{i4}
5	*P. perfoliatum*	6.80 ± 0.01	14.76 ± 0.32^{g4}	57.38 ± 1.29	57.74 ± 4.34
6	*O. javanica*	1.07 ± 0.004	9.55 ± 0.26	32.61 ± 1.03^{h2}	13.77 ± 2.16
7	*T. angustifolium*	1.28 ± 0.001^{f1}	12.53 ± 0.71^{g5}	48.13 ± 2.84^{h3}	79.06 ± 0.02
8	*A. acidum*	1.19 ± 0.007	12.42 ± 0.96^{g6}	47.96 ± 3.67	11.39 ± 0.0002^{i5}
9	*D. cordata*	1.19 ± 0.001	10.76 ± 0.04^{g7}	33.00 ± 0.19	39.51 ± 5.64
10	*E. foetidum*	1.19 ± 0.01	12.75 ± 0.53	46.90 ± 2.03^{h4}	16.72 ± 5.57^{i6}
11	*L. javanica*	2.63 ± 0.002	15.46 ± 1.40	50.64 ± 5.63^{h5}	22.42 ± 0.001^{i7}
12	*E. fluctuans*	1.11 ± 0.002	10.71 ± 0.60	39.38 ± 2.55^{h6}	14.094 ± 3.23

Values are expressed as mean ± standard deviation per 100 g of fresh sample ($n = 3$). All the data given in the table are significant at $p < 0.05$. Non-significant data are shown with superscript for each parameter.
Fiber content: *f1*= sample 7 with 8, 9 & 10; Dry matter: *g1* = sample 1 with 2, 3, 6, 7, 8, 9, 10 & 12; *g2* = 2 with 3, 6, 7, 8, 9 & 12; *g3* = 3 with 6 & 9; *g4* = 5 with 11; *g5* = sample 7 with 8 & 10; *g6* = 8 with 10; *g7* = 9 with 6, 7 & 8; Calorific value: *h1* = 2 with 3; *h2* = 6 with 1, 2, 3 & 9; *h3* = 7 with 8; *h4* = 10 with 7 & 8; *h5* = 11 with 4, 7, 8 &10; *h6* = 12 with 1, 6, 9 & 10; Vitamin C: *i1* = 1 with 6, 8, 10, 11 & 12; *i2* = 2 with 2, 4 & 9; *i3* = 3 with 4, 10 & 11; *i4* = 4 with 9 & 11; *i5* = 8 with 6, 10, 11 & 12; *i6* = 10 with 6, 11 & 12; *i7* = 11 with 6 & 12.

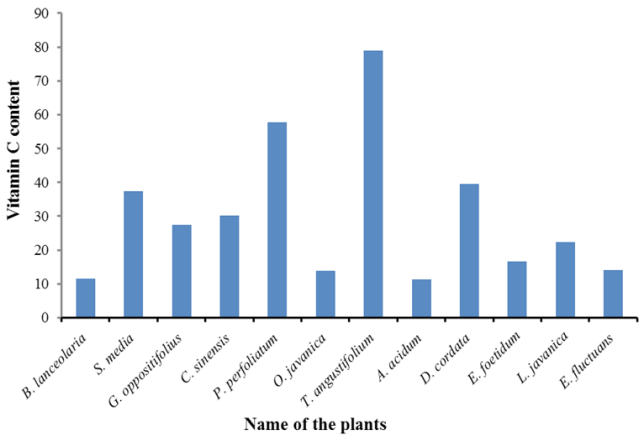

Figure 1. Variation of vitamin C content in mg/100 g of fresh sample of twelve different plants.

DISCUSSION

The results of nutritional analysis of the plants (Table 2) shows that the moisture content of each plant species is different and close to the values reported by Saha *et al.* [15] in some underutilized green leafy vegetables. The moisture content depends on the environmental conditions such as humidity, temperature and harvest time. Higher moisture content affords greater activity of water soluble enzyme and co-enzyme needed for metabolic activity of leaves [16]. The ash and crude fat contents found in this study were compared with the works of Odhav *et al.* [1] and Gupta *et al.* [17] and the reported values were found similar to the values obtained in this work. The Table 2 showed that the crude protein ranged from 1.22 ± 0.0004 g (*O. javanica*) to 4.38 ± 0.0005 g (*L. javanica*) and the value obtained in this study was almost similar to the values of some underutilized green leafy vegetables reported by Gupta *et al.* [17]. The values of crude fibres found in this study (Table 3) are close to the values reported by Saha *et al.* [15]. Fibres in the food are necessary for digestion and effective elimination of wastes. Fibres can lower the serum cholesterol, the risk of coronary heart disease, hypertension, constipation, diabetes, colon and breast cancer [7,18,19]. Total carbohydrate content presented (Table 2) ranged from 12.48 ± 0.45 g (*C. sinensis*) to 4.97 ± 0.02 g (*S. media*). The carbohydrate contents of some green leafy vegetables of Sonitpur district of Assam, India reported by Saha *et al.* [15] ranged from 11.16 g – 5.45 g per 100 g which is close to the values obtained in this study. Vishwakarma *et al.* [20] also reported similar values of carbohydrate contents in wild edible herbs used in Eastern Chattisgarh, India. Carbohydrates, fats and proteins are the key nutrients of life. High carbohydrate content indicates high energy content in food. The main function of carbohydrate in the body is to supply energy and it is responsible for doing activities in our daily life [21]. In the present study, the calorific value ranged from 29.48 to 67.42 kcal per 100 g of fresh sample. Similarly, Ullah *et al.* [22] studied the calorific value of selected medicinal plants of Tank and South Waziristan Area of Pakistan and reported to be ranged from 261.33 to 485.70 kcal per 100

g of dry sample. The plants with a high calorific value can be considered as a good diet. High calorific value suggests that these wild plants can be used in the formulation of various dietary supplements. Vitamin C also known as ascorbic acid is a powerful free radical scavenger and is an important vitamin which plays a vital role in maintaining a healthy life style [23]. The highest amount of vitamin C was found in *T. angustifolium* (79.06 ± 0.02 mg) and the lowest being in *A. acidum* (11.39 ± 0.0002 mg). The vitamin C contents obtained are similar with the works of Gupta *et al*. [17] reported for some underutilized green leafy vegetables except *Delonix elata* (295 mg/100 g). In the present investigation, all the twelve wild edible plants have shown variable values of proximate composition and vitamin C content which may be due to different species from different locations, different climatic conditions and also may be due to different age of the plants. The plant showing the highest vitamin C level can be suggested as the plant of choice to the people of Assam due to high vitamin C content. These plants can be used as the reasonable part of the diet as a whole and can be included in the daily food.

CONCLUSION

In the present study, all the twelve wild edible plants were found to contain variable compositions of nutritional and vitamin C content. These plant species consumed by Bodos in Assam of North-East India are easily available, affordable and promising alternate food sources for the human consumption. The local people depend on these plant species for food and medicines. Consumption of these plants could provide several health benefits and thus can be used as the reasonable part of the diet as a whole and can be included in the daily food. The present study can be useful for selecting promising species in further investigation to meet the nutritional requirements and for use in formulation of various dietary supplements.

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