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Evaluation of nutritional parameters in medicinal plants of Assam

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Abstract

A substantial number of herbs have been used as dietary source and plays a vital role in improving our health. Across the globe, there are several local and wild vegetables which are underexploited because of inadequate scientific information on knowledge of their nutritional potentials. The objective of the study was to determine the nutritional values as various parameters such as fats, carbohydrate, protein, and lipid and to detect the presence of heavy metals in four selected medicinal plants of Assam viz., Centella asiatica (L) (Indian pennywort), Pogostemon benghalensis (Patchouli), Stellaria media (L) (Chickweed) and Cinnamomum tamala (Bay leaf). On nutritional analysis, results revealed that the whole plant of C. asiatica plant contains 97.67%w/v carbohydrate, 1.9%w/w fat and 4.98%v/v protein. In case of P. benghalensis percentage of carbohydrate was found to be 78.02%w/v, fat 1.55%w/w and protein 6.38%v/v. The calculated values of carbohydrate, fat and protein in case of S. media and C. tamala was found to be 75.27%w/v, 19.71%w/v; 2.9%w/w, 13.7%w/w and 10.05%v/v, 10.64%v/v respectively. The calculated nutritive value of C. tamala, P. benghalensis, S. media and C. tamala were found to be 355.7Kcal, 351.55Kcal, 367Kcal & 176.2Kcal respectively. The findings of this research work revealed that S. media, C. asiatica & P. benghalensis possess a high and significant level of nutritional values while C. tamala had minor value as compared to other three varieties. It was also found that the plant parts did not contain any heavy metals. Thus, it could be stated that these native plants could be a crucial source for the isolation of nutrients and can be used for the preparation of nutritional products and diets.

Keywords: Nutritional value, *Centella asiatica, Pogostemon benghalensis, Stellaria media, Cinnamomum tamala,* Assam

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Introduction

Food is a part of a human culture which is filled with different meanings and symbolism for an individual of different age groups. The food should be nutritious, rich in flavour and aesthetically appealing to be consumed. Green leaves contain a significant amount of iron and leaf concentrates made from fractionating fresh green leaves is one of the richest sources of this element. Besides, it also contains large amounts of ß carotene, folic acid and protein as well as a considerable amount of pyridoxine, riboflavin and copper[1]. In the recent years, there is a growing concern over the nutritive value of foods to nourish the ever-increasing population. Secondly; the inadequacy of essential nutrients can be improved through fortifications and enrichment of food vehicles.

A balance of nutrients may be obtained by including whole cereals, vegetables, pulses and milk products etc. Such a diet provides a large proportion of our need for energy, carbohydrate, protein, dietary fiber, amino acid and minerals. Green leafy vegetables have generated interest in worldwide as they exhibit multiple benefits for the health of human beings. Vegetables can form the cheapest and most readily available source of important vitamins, minerals, fibers and essential amino acids. Across the globe, there are several local and wild vegetables which are underexploited because of inadequate scientific information on knowledge of their nutritional potentials[2]. Keeping in mind the importance of nutritional knowledge and nutritional value of foods four plants viz. *Centella asiatica* (L) (Indian pennywort), *Pogostemon benghalensis* (Patchouli), *Stellaria media* (L) (Chickweed) and *Cinnamomum tamala* (Bay leaf) were selected and subjected to proximate, nutrient analysis along with detection of heavy metals. The aim of this present study was to collect and identify the medicinal plants from Nonoi, Nagaon, Assam and determine their physicochemical properties and nutritional values. This study also analyses the presence of heavy metal content by various chemical methods. This study signifies to access the nutritional values of *C. asiatica, P. benghalensis*, *S. media* and *C. tamala* which are economically important medicinal plants. The determination of proximate, nutritional constituents and ascertaining their existence could be used to improve nutrition values and can also be used as a medicine. This study also provides a scientific data which would be of particular importance for the local practitioners as well as for the local people using these herbs for treating a variety of nutritional problems.

Materials and methods

Collection of plant material:

Plants were collected from the village Nonoi, Panigaon under Nagaon district in the month of February 2018. Those were washed thoroughly with running water to remove the earthy materials or adherent impurities and kept in the clean area. All plant material was subjected to drying at normal temperature under sunlight and shade condition for some days. The dried material was grinded into coarse powder and stored in the airtight containers.

Preparation of crude extracts:

10 gm of each sample was soaked in conical flasks containing 100 ml of distilled water separately. Then the conical flasks were placed in orbital shaker for 6 hours at 135rpm. After that, the solutions were filtered through Whatman No.1 filter paper. The filtrate was kept in the refrigerator and used in further processes.

Determination of moisture content:

10 gm of the fresh sample of each plant material was placed in the crucible and heated at 105˚ C until a constant weight was attained. The moisture content of each variety was calculated as a loss in weight of the original sample and expressed as the percentage moisture content (FAO, 1980)[3]. Hence, Moisture % = (Fresh weight – Dry weight/ Fresh weight) ×100.

Determination of Total solids:

A clean dry lined Petri dish along with lid was weighed. 5 gram of the sample was placed in the weighed Petri dish with a lid. The Petri dish with the sample was weighed with the lid. The sample was placed in the oven at 105 - 110° C for one hour. After one hour the sample was taken out from the oven and placed in the desiccator for cooling. After cooling, the sample was again weighed[4]. The moisture content was determined as % Moisture = Loss in weight /Weight of sample× 100. So, % of total solids = 100 - % of moisture.

Determination of Ash content percentage:

For determination of ash content, a method of AOAC (1984) was followed. According to this method, 3 g of the pulverized plant samples were placed in a crucible and ignited in a muffle furnace at 550˚C for 6 hours. It was then cooled in

a desiccator and weighed at room temperature to get the weight of the ash[5]. The weight of the ash content was calculated out by using the following formula:

Ash % = (Weight of the ash sample / Weight of the sample taken) ×100.

Quantitative estimation of protein by Lowry's Method[6]:

Different dilutions of BSA solutions were prepared by mixing BSA stock solution (1mg/ml) and water in the test tube. The final volume of each test tube was made up to 5 ml. The value of BSA ranges from 0.05 to 1.0 mg/ml. From these different dilutions, 0.2 ml protein solution was pipette out to different test tubes and 2 ml of analytical reagent was added (alkaline copper sulfate reagent). After mixing the solution, it was incubated at room temperature for 10 min. Then 0.2 ml of Folin-Ciocalteau reagent solution was added to each tube and incubated for 30 min. The optical density of the blank was taken in the colorimeter (measure the absorbance) at 660 nm. The values of absorbance were plotted against protein concentration to get a standard calibration curve. The absorbance of the unknown sample was checked and the concentration of the unknown sample was determined using the standard curve.

Determination of percentage of fat:

2 gm of moisture and fat-free material were treated with 200 ml of 1.25% H_2SO_4. After filtration and washing, the residue was treated with 1.25% NaOH. Similarly, the residue was filtered and washed again with hot distilled water and subjected to 1% HNO_3 treatment. The residue was ignited and the ash was weighed after filtration and washing of the residue. The loss in the weight gives the weight of crude fiber[7].

Determination of percentage carbohydrates:

Total carbohydrate content in medicinal plants had been calculated by calculating the difference between other constituents. In this study, the other constituents in the medicinal plants (protein, fat, moisture, ash content) were determined individually, summed and subtracted from the total weight of the food. This is referred to as total carbohydrate by difference and is calculated by the following formula[8]: % of carbohydrates = 100 – (Protein + Ash + Moisture + Fat).

Determination of nutritive value:

To determine the nutritive value of the medicinal plants, an appropriate amount of crude sample was taken and weighed. Protein, carbohydrate, fats were analyzed by the methods which are discussed earlier in this study. The nutritional value of the plants was calculated as per the formula used by Nile *et al.,*2009[9]. Nutritive value = 4 × percentage of protein + 9 × percentage of fat + 4 × percentage of carbohydrate

Heavy metal analysis:

Test for lead:

a) Dilute HC1 was added in a sample solution. A white precipitate of $CaCl_2$ is absent indicates the absence of lead.

b) KI was added to a sample solution. The yellow precipitate is absent indicates the absence of lead.

Test for cadmium:

a) NH_4OH was added in a sample solution. The white precipitate is absent indicates the absence of cadmium.

b) Potassium ferricyanide was added. The white precipitate is absent indicates the absence of cadmium.

Results and Discussion

The result of the proximate analysis shows variant concentration/proportions of biochemical and other contents. After shade drying the moisture contents of each species are different. Looking at the overall percentage of moisture contents, it was highest in *C. tamala* (47.25%) followed by *C. asiatica* (11.15%), *P. benghalensis* (8%), *S. media* (7.98%). In case of ash content, it was also highest in *C. tamala* (8.7%) and *P. benghalensis* (6.05%) and lowest in *C. asiatica* (2.3%) (Table 1).

While analyzing the protein contents in the selected four medicinal plant varieties, the results showed that *C. tamala* and *S. media* had the highest concentration of protein as compared to other plant varieties (Table 2). During analysis of fat contents, it was observed that the level of fat was also very high in *C. tamala* followed by *S. media, C. asiatica* and *P. benghalensis* (Table 3). Looking at the results obtained from carbohydrate analysis, *S. media, C. asiatica* and *P. benghalensis* had higher concentration compared to *C. tamala* (Table 3).

Table 1: Proximate analysis of *C. asiatica* (Indian pennywort), *P. benghalensis* (Patchouli), *S. Media* (Chickweed) and *C. tamala* (Bay leaf).

Plant name	Moisture content (%w/w)	Ash (%w/w)	Solid (%w/w)
C. asiatica	11.15±0.9	2.3±0.25	88.85±1.75
P. benghalensis	8±0.5	6.05±0.75	92±1.2
S. media	7.98±0.55	3.8±0.75	92.02±2.1
C. tamala	47.25±1.5	8.7±1.1	52.5±1.1

Values are mean ± SD of triplicate (*n=3*) determinations

Table 2: Estimation of total protein content in the studied plants

Plant varieties	Total protein content (% v/v)
C. asiatica (Indian pennywort)	4.98±0.15
P. benghalensis (Patchouli)	6.38±0.17
S. media (Chickweed)	10.05±0.18
C. tamala (Bay leaf)	10.64±0.19

Values are mean ± SD of triplicate (*n=3*) determinations

Table 3: Estimation of fat & carbohydrate content in different plants.

Plant name	Fat content (%w/w)	Carbohydrate content (%w/v)
C. asiatica (Indian pennywort)	1.9±0.21	97.67±0.56
P. benghalensis (Patchouli)	1.55±0.25	78.02±0.64
S. media (Chickweed)	2.9±0.15	75.27±0.45
C. tamala (Bay leaf)	13.7±0.51	19.71±0.37

Values are mean ± SD of triplicate (*n=3*) determinations

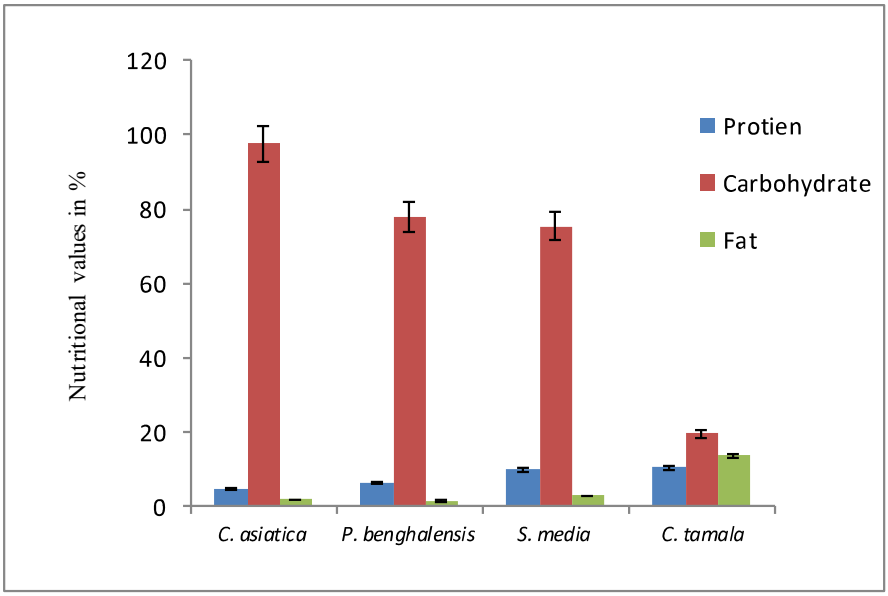

Fig 1: Graphical representation of nutritional components estimated in different plants

According to the results revealed, *S. media, C. asiatica* and *P. benghalensis* had highest and significant level of energy values, while resting of the plant that is *C. tamala* had minor values. The highest calorific value of 367.38 kcal/100g was recorded in *S. media*, followed by 355.7kcal/100 g in *C. asiatica* and *C. tamala* had the lowest calorific value of 176.2 kcal/100 g (Table 4, Fig. 2).

Table 4: Nutritive values found in different plant varieties

. **Plant name**	**Nutritive value (Kcal/100g)**
C. asiatica (Indian pennywort)	355.7±0.45
P. benghalensis (Patchouli)	351.55±0.53
S. media (Chickweed)	367.38±0.6
C. tamala (Bay leaf)	176.2±0.51

Values are mean ± SD of triplicate ($n=3$) determinations

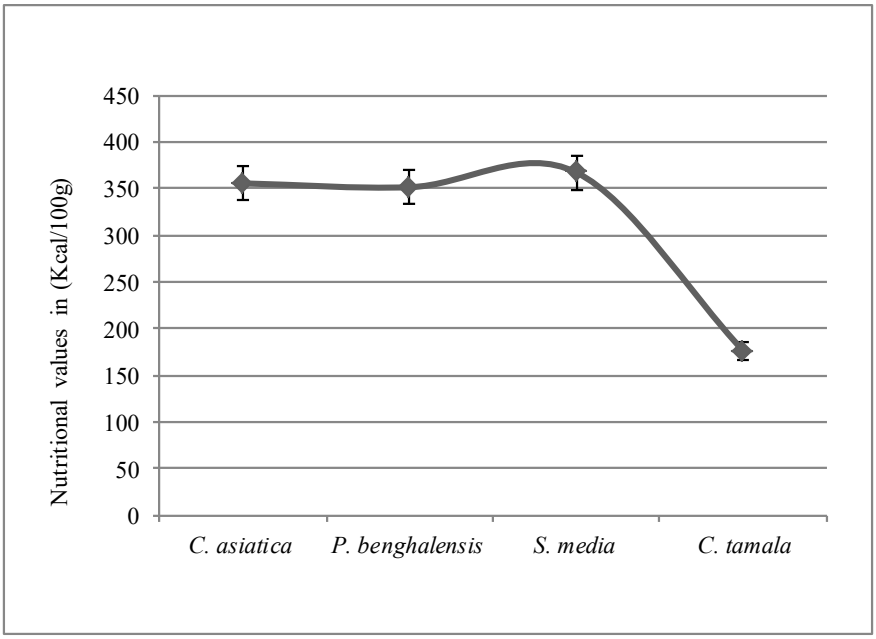

Fig 2: Graphical representation of nutritive values estimated in different plants

The results found in this study is similar to Siddiqui *et al.*, (2009) where the percent level of ash (8.06%), moisture (7.15%), fat (1.98%), protein (32.55%), carbohydrate (50.26%) and nutritive value 349.06 Kcal/100g in *Centella asiatica*[10]. Similarly, Sharma *et al.,* (2012) also reported the percent level of various ingredients of *Stellaria media* was carbohydrate (17.37±0.37)%, protein (3.32±0.15)% and fat (13.44±0.53)%[11]. Kumar *et al.,*(2012) reported the percent level of ash (9.6±1.12)%, moisture (50.50±1.0)%, carbohydrate (9.5±0.5)%, crude fibre (30.5±0.6)%, crude fat (6.0±0.5)%, protein (8.5±0.18)% and nutritive value 143.5±0.53 Kcal/100g in *Cinnamomum tamala*[12]. So, the results of this present study resemble with the previous studies performed in this regards.

In the detection of heavy metals, all the four candidate plants were free from heavy metals (lead and cadmium). Generally, the plants are consumed as vegetables or used for various nutritional benefits contain heavy metals. And, the presence of heavy metals creates problems in biotransformation in respect of nutritional uptakes from vegetable source by the body[13]. Thus these four candidates plant with no heavy metals and having high nutrition values would be the sources of nutritional uptakes in comparison to commercially cultivated vegetables.

Conclusion

In the present study, the nutritive value of *S. media* was highest followed by *C. asiatica*, *P. benghalensis* and *C. tamala.* All these plants can be recommended as a good source of nutrients (protein and carbohydrate), which supports their use as a food and a good source of various important nutrients. *C. tamala* leaves have comparatively high protein and fat contents. Other three also have sufficient amount of protein and fat contents but the amount of carbohydrate is high as compared to *C. tamala*. With good nutrition value, these plants serve as constituents of human diet supplying the body with minerals, proteins and energy. It seems to be good for younger and anemic people of our society. The outcome of this study suggests that the plants can be incorporated in different varieties of food products to make them more nutritious, healthier as well as consumer-oriented, due to the presence of biologically important compounds, it contributes to its nutritive value. Hence, conservation and use of these wild medicinal plants having good nutritional values have taken a considerable amount of attention in recent years. Mostly nutritious food products are very costly in the market which isn't possible to access for all sections people due to their economic problems. In that case, they can consume these plants as nutritious food, which is easily available and cheaper in price.

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