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NUTRITIONAL AND MINERAL ELEMENT EVALUATION IN YOUNG SHOOTS OF DIFFERENT BAMBOO SPECIES OF MANIPUR, INDIA

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ABSTRACT

Bamboo shoots constitute one of the traditional food resources of Manipur. These are extensively used as a vegetable for their exquisite taste as well as many associated health benefits. Fresh tender shoots of 15 commonly consumed bamboo species of Manipur were evaluated for their nutrient and mineral element contents. For all the analysed species, protein content ranged from 3.08 to 4.57 g/100g while amino acid content ranged from 2.03 to 3.68 g/100g. As of carbohydrate, starch and fat, the contents ranged from 2.22-3.42, 0.72-1.18 and 0.34 to 0.53 g/100g respectively. For the contents of moisture and ash in the shoots, the range varied from 91.27-93.42 and 0.55-0.79 g/100g respectively. Vitamin C and E of all the shoots showed a variable quantity of 1.44-3.12 and 0.40-0.83 mg/100g respectively. Mineral elements *viz*., calcium (62-188), potassium (2250-4680), magnesium (108-273), sodium (13-50), copper (0.41-1.45), iron (2.47-4.10), manganese (1.12-3.23) and zinc (3.11-5.22) were detected from the selected shoots and ranged in mg/100g d.w. Among the investigated species, *C. callosa* emerged as the most nutritious species as it has the highest contents of protein, amino acid, vitamin C, calcium, potassium and copper. *M. baccifera, B. nutans, D. hamiltonii, D. latiflorus* and *D. sikkimensis* were also found to have higher nutritional and mineral values than the rest of the species.
***Keywords*:** Bamboo shoots, traditional food, nutrients, mineral elements.

INTRODUCTION

Vegetables are considered to be protective foods and are important for good health (Sheela *et al*., 2004, Parida and Parida, 2021). These are the sources of vitamins, minerals, essential amino acids, dietary fibres and many important phytochemicals (Fasuyi, 2006; Bhavithra *et al*., 2021). However, the increasing human population has accelerated the demands of food, leading to soaring prices of food and forcing the poorer household to adapt to a low-grade diet of staple crops. To fulfil the required food demands and essential nutrients, there is a necessity to diversify our current food crops and explore the possibilities of using locally available plant resources. Traditional food crops and wild edible plants which have been in use since generations by the localized communities can provide the most effective solution to the spread of the hidden hunger because of their superior nutritional credentials. Manipur, a pristine hilly state situated in the North Easternmost corner of India, is home to several such traditional and underutilized food resources such as leafy vegetables, fruits, pseudo-cereals, roots, rhizomes, *etc*. Here, local communities have been incorporating many such underutilized food crops in their daily dietary regimes and are reaping the benefits of healthy and nutritious diet since generations (Yumnam and Tripathi, 2012).

Bamboo, a member of grass family Poaceae, is a versatile plant known for its multifarious utility. Bamboo shoots, the tender culms of bamboo plant emerging from the latent buds of the underground rhizome, are edible and constitute one such traditional food resource of the state which are revered for their exquisite taste as well as many associated health benefits (Devi and Chakma, 2016; Premlata *et al*., 2020). These are consumed in various forms *viz*., boiled, soaked, pickled, fermented, etc. Apart from being an indispensable component of traditional food across Manipur, shoots have also been scientifically proven for their health and nutritional credentials along with having a tremendous potential of providing majority of the dietary mineral elements essential for maintaining our bodily functions (Wang *et al*., 2020; Sadananda *et al*., 2021). Hence, the present study was conducted to evaluate the various nutrient and mineral element contents in fresh juvenile shoots of 15 commonly consumed bamboo species of Manipur. These species are selected based on the survey study conducted on edible bamboo species of Manipur by Premlata *et al*. (2020). The outcome of this study will highlight the existing nutrient and mineral wealth of bamboo shoots of Manipur and their potential in combating the spread of hidden hunger and malnutrition.

MATERIAL AND METHODS

Plant materials: Young tender shoots of 15 edible bamboo species were collected during shoot growing season (May to October) from different areas of Manipur. The list of bamboo species selected for analysis is given in Table 1. Shoots were harvested when they are of about 25-35 cm height. The outer culm sheaths were removed and the lower hard basal portions were discarded. As a main sample material, the succulent inner soft portion of the shoots were cleaned thoroughly with water and kept at 4ºC for further analysis.

Table 1 : List of bamboo species selected for analysis

S.N.	Botanical name	Shoots collection site
1.	*Bambusa balcooa* Roxb.	Jiribam
2.	*B. cacharensis* Majumdar	Jiribam
3.	*B. manipureana* Naithani & Bisht	Khongkhang
4.	*B. nutans* Wall. ex Munro	Wabagai
5.	*B. tulda* Roxb.	Churachandpur
6.	*B. vulgaris* Schrad. ex Wendl.	Jiribam
7.	*Cephalostachyum capitatum* Munro	Bishnupur
8.	*Chimonobambusa callosa* (Munro) Nakai	Leimaram
9.	*Dendrocalamus hamiltonii* Nees & Arn. ex Munro	Khongkhang
10.	*D. hookeri* Munro	Wabagai
11.	*D. latiflorus* Munro	Thoubal
12.	*D. longispathus* Kurz	Wabagai
13.	*D. manipureanus* Naithani & Bisht	Thoubal
14.	*D. sikkimensis* Gamble	Bishnupur
15.	*Melocanna baccifera* (Roxb.) Kurz	Churachandpur

Nutrient analysis: Young shoots were analysed for various nutrient components using different established methods. Protein content was estimated by the method of Bradford (1976) with Bovine Serum Albumin (BSA) as standard. Total free amino acid content was estimated by Lee and Takahashi (1966) method using ninhydrin as reagent and glycine as standard and carbohydrate content by Whistler (1971) method using anthrone reagent. The starch content in the samples was estimated by the method of Meccreddy *et al.* (1958) using anthrone as reagent and glucose as standard while fat content was estimated by Soxhlet method given by AOAC (1990). Vitamin C content of the shoots was also estimated by using dinitrophenyl hydrazine with the method of Riemschneider (1976) and vitamin E by the method of Baker *et al*. (1980) which uses α-tocopherol as standard. Ash and moisture content of the shoot was also determined by the dry-ashing method of Harbers (1994) and the percentage weight lost during dryness.

Mineral element analysis: Mineral elements *viz*., potassium (K), magnesium (Mg), manganese (Mn), Iron (Fe), copper (Cu) and zinc (Zn) in the selected shoot samples were analysed by using AAS (atomic absorption spectrophotometer) while Calcium (Ca) and Sodium (Na) were estimated by using flame photometer. 1 g of dried bamboo shoot powder was digested with 1 ml of perchloric acid, 2 ml of nitric acid and 1 ml of sulphuric acid and heated the mixture until the appearance of dense white fumes of sulphuric acid. The digested sample was diluted to 10 times with double distilled water and used for the determination of mineral elements through AAS and flame photometer.

Statistical analysis: Results were expressed as mean of three replicates ± standard deviation. One way analysis of variance (ANOVA) was implemented for data analysis using SPSS ver.18.

RESULTS AND DISCUSSION

Nutrient composition

Nutrient contents in fresh tender shoots of 15 edible bamboo species are given in Table 2 and Table 3. It is found that the young shoots contain a good amount of protein, amino acids, carbohydrate, vitamins and a small amount of fat. The contents of protein varied from 3.08 to 4.57 g/100g f.w. with highest content in *C. callosa* and lowest in *D. longispathus.* This value is higher than the protein content of some vegetables such as carrot (1.53%), tomato (0.86%) and spinach (2.23%) (Naz *et al*., 2018). Similar amount of protein content was reported by Bhatt *et al.* (2005) in different bamboo species, which was subsequently supported in the studies conducted by Badwaik *et al*. (2015).

In terms of total free amino acid content, the shoots of *C. callosa* (3.68 g/100g f.w.) along with *D. hamiltonii* (3.66 g/100g f.w.) were observed to have insignificantly different amount of amino acids which was higher than the rest of the sample under analysis. The lowest content was 2.03 g/100g f.w. and found in *D. latiflorus.* Young shoots of *B. nutans* and *C. capitatum* were also seen to contain comparatively higher amount of amino acids i.e. 3.45 and 3.14 g/100g f.w. respectively. The present finding is in line with the reports of amino acid content in different bamboo species i.e. 3.01-3.98 g/100g f.w. by Chongtham *et al*. (2011).

In terms of carbohydrate content, the highest amount (3.42 g/100g f.w.) was depicted by *D. latiflorus* and the lowest by *M. baccifera* (2.22 g/100g f.w.). *D. sikkimensis* (3.23 g/100g f.w.) and *D. manipureanus* (3.18 g/100g f.w.) were also seen to have a good amount of carbohydrates and were falling within the range of earlier reports (2-7 g/100g f.w.) in various bamboo species by Bhatt *et al*. (2005) and Kumbhare and Bhargava (2007). However, the carbohydrate contents of these bamboo species are lesser than the values reported from carrot (11.25%) and spinach (4.67%) by Naz *et al*. (2018).

Table 2 : Macronutrient content in fresh tender shoots of 15 edible bamboo species in g/100g fresh weight

Species	Protein	Amino acid	Carbohydrate	Starch	Fat
B. balcooa	3.42±0.06[cd]	2.43±0.01[h]	2.77±0.03[g]	1.01±0.01[d]	0.47±0.01[bc]
B. cacharensis	3.19±0.04[ef]	2.42±0.03[h]	2.40±0.04[l]	0.72±0.03[g]	0.46±0.04[c]
B. manipureana	3.45±0.04[c]	2.80±0.02[e]	2.81±0.02[fg]	0.82±0.02[f]	0.41±0.01[de]
B. nutans	3.45±0.03[c]	3.45±0.05[b]	2.70±0.03[h]	1.03±0.01[cd]	0.47±0.01[bc]
B. tulda	3.67±0.01[b]	2.73±0.05[f]	2.92±0.02[e]	1.11±0.01[b]	0.51±0.04[a]
B. vulgaris	3.39±0.03[cd]	2.57±0.02[g]	2.69±0.01[h]	0.72±0.02[g]	0.50±0.02[ab]
C. capitatum	3.70±0.04[b]	3.14±0.02[c]	2.53±0.02[j]	0.83±0.03[f]	0.39±0.03[def]
C. callosa	4.57±0.06[a]	3.68±0.06[a]	2.48±0.03[k]	0.93±0.01[e]	0.37±0.03[fg]
D. hamiltonii	3.73±0.11[b]	3.66±0.06[a]	3.00±0.02[d]	1.02±0.02[d]	0.46±0.03[c]
D. hookeri	3.33±0.06[d]	2.44±0.01[h]	2.83±0.02[f]	1.10±0.01[b]	0.53±0.04[a]
D. latiflorus	3.15±0.04[efg]	2.03±0.02[i]	3.42±0.02[a]	1.18±0.02[a]	0.38±0.01[ef]
D. longispathus	3.08±0.01[g]	2.96±0.03[d]	2.62±0.01[i]	1.02±0.02[d]	0.47±0.01[bc]
D. manipureanus	3.38±0.06[cd]	2.59±0.01[g]	3.18±0.01[c]	1.06±0.03[c]	0.42±0.03[d]
D. sikkimensis	3.11±0.03[fg]	2.78±0.04[ef]	3.23±0.04[b]	1.13±0.02[b]	0.42±0.02[d]
M. baccifera	3.22±0.02[e]	2.43±0.05[h]	2.22±0.01[m]	0.85±0.02[f]	0.34±0.02[g]

Data are displayed as Mean ± S.D. (n=3). Values which are with different alphabets are significantly different (p<0.05)

Starch content in the selected bamboo shoots varied from 0.72 to 1.18 g/100g f.w. with *D. latiflorus* being the highest and *B. cacharensis* and *B. vulgaris* being the lowest. The highest content was followed by *D. sikkimensis, B. tulda* and *D. hookeri* with insignificantly different values. Zhang *et al.* (2011) reported a range of 0.21 to 2.38 g/100g of starch content in different species of bamboos which is comparable to the results of our study.

Shoots of all the analysed species contained a very low amount of fat ranging from 0.34 to 0.53 g/100g f.w. with *D. hookeri* and *B. tulda* being the highest with insignificantly different values and *M. baccifera*, the least. Similar to our findings, less amount of fat were also reported from different bamboo species i.e. 0.31-0.67 g/100g f.w. by Badwaik *et al.* (2015) and these values can also compared with the values reported from other vegetables by Naz *et al.* (2018).

Table 3 : Moisture and ash (g/100g fresh weight), vitamin C and E (mg/100g fresh weight) content in fresh tender shoots of 15 edible bamboo species

Species	Moisture	Ash	Vitamin C	Vitamin E
B. balcooa	92.89±0.44[ab]	0.63±0.04[ef]	2.32±0.04[f]	0.48±0.03[de]
B. cacharensis	92.60±0.06[abcd]	0.65±0.00[de]	2.10±0.03[g]	0.47±0.04[e]
B. manipureana	91.68±0.08[de]	0.69±0.00[bcde]	2.50±0.03[d]	0.55±0.03[cd]
B. nutans	91.27±0.98[e]	0.78±0.09[ab]	1.90±0.02[h]	0.78±0.02[a]
B. tulda	91.90±0.14[cde]	0.72±0.03[abcd]	2.45±0.04[de]	0.57±0.04[c]
B. vulgaris	91.44±0.14[e]	0.76±0.01[ab]	2.80±0.03[c]	0.52±0.05[cde]
C. capitatum	92.70±0.24[abc]	0.65±0.02[cde]	2.43±0.05[de]	0.71±0.04[b]
C. callosa	91.76±0.52[cde]	0.72±0.03[abcde]	3.12±0.05[a]	0.79±0.02[a]
D. hamiltonii	92.61±0.21[abcd]	0.66±0.03[cde]	2.93±0.05[b]	0.83±0.02[a]
D. hookeri	92.11±0.12[bcde]	0.71±0.02[abcde]	2.90±0.03[b]	0.52±0.03[cde]
D. latiflorus	91.39±0.87[e]	0.79±0.08[a]	2.95±0.02[b]	0.55±0.03[cd]
D. longispathus	91.36±0.75[e]	0.78±0.07[ab]	3.08±0.02[a]	0.78±0.06[a]
D. manipureanus	91.62±0.33[e]	0.74±0.02[abc]	2.27±0.04[f]	0.80±0.03[a]
D. sikkimensis	91.47±0.58[e]	0.77±0.06[ab]	2.40±0.05[e]	0.56±0.02[c]
M. baccifera	93.42±0.84[a]	0.55±0.09[f]	1.44±0.04[i]	0.40±0.07[f]

Data are displayed as Mean ± S.D. (n=3). Values which are with different alphabets are significantly different (p<0.05)

Shoots of all the analysed species contained a significantly higher amount of moisture ranging from 91.27 to 93.42 g/100g f.w. and showed less variability among them. *M. baccifera* shoots exhibited the highest moisture content and *B. nutans* depicted the lowest. For ash content, *D. latiflorus* was seen to have an amount of 0.79 g/100g f.w. which is the highest while *M. baccifera* was observed to have the least content of 0.55 g/100g f.w. Moisture and ash content of our findings is in line with earlier findings of Chongtham *et al.* (2011) and also with Badwaik *et al.* (2015) in different bamboo species.

Among the 15 species, *C. callosa* and *D. longispathus* contained the highest amount of vitamin C i.e. 3.12 and 3.08 mg/100g f.w. respectively with insignificantly different values whereas *M. baccifera* contained the lowest amount (1.44 mg/100g f.w). *D. latiflorus, D. hamiltonii* and *D. hookeri* were also recorded to have an almost equal amount of vitamin C in their juvenile shoots. A higher amount of vitamin C (3.0-12.9 mg/100g f.w.) has been reported by Bhatt *et al.* (2005) in 11 bamboo species but a comparable amount of vitamin C has been reported by Badwaik *et al.* (2015). The observed values of vitamin C were also found higher than the values reported from amaranth (1.0 mg/100g) and carrot (1.2 mg/100g) (Chongtham *et al.*, 2011). For vitamin E, *D. hamiltonii, D. manipureanus*, *C. callosa*, *B. nutans* and *D. longispathus* contained higher amount of vitamin E than the rest of the species and their variations were statistically insignificant while the least content (0.40 mg/100g f.w.) was depicted by *M. baccifera*. Similar range of vitamin E content in bamboo shoots has also been reported by Chongtham *et al*. (2011) i.e. 0.42-0.91 mg/100g f.w.

Mineral elements

Minerals are inorganic nutrients that are needed in small quantity for growth, maintenance and support of human life. They are classified as essential macro and micro elements and availability of these minerals are accomplished from our diet. Young shoots of 15 analysed bamboo species are rich in mineral elements *viz*., calcium (Ca), potassium (K), magnesium (Mg), sodium (Na), copper (Cu), iron (Fe), manganese (Mn) and zinc (Zn). The contents of mineral element in 15 edible bamboo species are depicted in Table 4.

Macro minerals

For all the selected species, calcium content ranged from 62-188 mg/100g dry weight. The highest content was shown by *C. callosa* and the lowest content with insignificantly different values by *B. manipureana* (62 mg/100g) and *B. tulda* (66 mg/100g). The observed values fall within the range of earlier reports (14.98-267 mg/100g) in bamboo shoots by Waikhom *et al.* (2013) and Karanja *et al.* (2016). While comparing with other vegetables, calcium contents in the selected bamboo shoots are found higher than the values reported from brinjal (4.0 mg/100g) and cucumber (5.5 mg/100g) by Hossain *et al.* (2010). Shoots contained a significantly higher amount of potassium that ranged from 2250 to 4680 mg/100g d.w. where *C. callosa* showed the highest content and *B. balcooa*, the least. This result is in line with the reports of Karanja *et al.* (2016) in bamboo shoots and is also comparable with the values reported from common bean, soya bean and tomato that ranged from 1300-4833 mg/100g d.w. by Marles (2017).

Magnesium content in shoots varied from 108 to 273 mg/100g d.w. where the highest content was shown by *M. baccifera* followed by *B. nutans* (219 mg/100g) and the lowest content was depicted by *B. vulgaris*. The observed range of magnesium content is little higher than the values reported from bamboo shoots by Waikhom *et al.* (2013) while it is comparable with the magnesium content reported from common bean (100-326 mg/100g) and tomato (116.7-206.9 mg/100g) by Marles (2017). Sodium content in the shoots varied from 13 to 50 mg/100g d.w. with *D. sikkimensis* being the highest and *B. balcooa* being the least. Similar range of sodium content in bamboo shoots (22-53 mg/100g) has also been reported by Waikhom *et al.* (2013) which supports the results of our study. While comparing with some vegetables, sodium content in bamboo shoots is higher than the contents reported from brinjal (8 ppm) and cucurbits (12 ppm) (Hossain *et al.*, 2010).

Micro minerals

Copper content in shoots of all the analysed species ranged from 0.41-1.45 mg/100g d.w. where the highest content was found in *C. callosa* and the lowest in *B. manipureana*. This result is in line with the reports of Christian *et al.* (2015) and Karanja *et al.* (2016) that ranged from 0.37-1.23 mg/100g in bamboo shoots. These values are also comparable with the values reported from sweet potato (0.5-0.7 mg/100g) and tomato (0.67-1.07 mg/100g) by Marles, (2017). Iron content in shoots ranged from 2.47 mg/100g d.w. in *D. latiflorus* to 4.10 mg/100g d.w. in *D. sikkimensis* which falls within the range of earlier reports of 1.03-4.32 mg/100g in bamboo shoots (Christian *et al.*, 2015). While comparing with some common vegetables, iron content in bamboo shoots are comparatively lesser than that of common bean, soya bean, tomato, spinach and amaranth, (Singh *et al.*, 2001; Marles, 2017).

Table 4 : Mineral element contents in young shoots of 15 edible bamboo species (mg/100g dry weight)

Species	Ca	K	Mg	Na	Cu	Fe	Mn	Zn
B. balcooa	125±3.61^{d}	2250±10^{l}	192±7.21^{de}	13±2.65^{g}	0.62±0.03^{def}	3.62±0.05^{d}	1.52±0.05^{g}	3.48±0.06^{i}
B. cacharensis	73±3.00^{j}	2600±20^{i}	152±5.57^{g}	24±3.61^{f}	0.62±0.04^{def}	2.88±0.02^{i}	1.42±0.02^{h}	3.65±0.05^{h}
B. manipureana	62±2.65^{k}	4570±26^{b}	183±6.24^{e}	32±3.00^{cde}	0.41±0.04^{h}	2.91±0.03^{i}	1.12±0.04^{j}	4.35±0.05^{c}
B. nutans	108±1.73^{f}	3460±17^{f}	219±5.00^{b}	30±2.00^{cdef}	0.63±0.03^{de}	3.85±0.03^{b}	3.23±0.03^{a}	4.05±0.04^{ef}
B. tulda	66±3.00^{k}	3300±26^{g}	164±5.29^{f}	15±2.65^{g}	0.61±0.04^{ef}	3.52±0.05^{e}	1.65±0.03^{f}	3.97±0.04^{f}
B. vulgaris	74±2.00^{j}	2280±10^{k}	108±3.46^{i}	28±1.73^{def}	0.56±0.03^{fg}	3.40±0.03^{f}	1.62±0.02^{f}	3.11±0.10^{k}
C. capitatum	145±2.00^{c}	3740±20^{e}	135±6.24^{h}	34±5.29^{cd}	0.68±0.04^{cd}	3.42±0.04^{f}	3.10±0.06^{b}	4.60±0.02^{b}
C. callosa	188±3.00^{a}	4680±30^{a}	193±4.36^{d}	32±5.29^{cde}	1.45±0.06^{a}	3.27±0.03^{g}	2.27±0.03^{d}	4.11±0.04^{de}
D. hamiltonii	96±1.73^{h}	3220±17^{h}	126±3.61^{h}	30±2.65^{cdef}	0.74±0.02^{bc}	3.73±0.02^{c}	1.20±0.03^{i}	3.38±0.02^{j}
D. hookeri	119±1.00^{e}	3850±30^{d}	192±4.00^{de}	43±6.08^{b}	0.76±0.02^{b}	3.10±0.03^{h}	1.48±0.02^{gh}	4.32±0.03^{c}
D. latiflorus	85±3.61^{i}	2500±10^{j}	134±4.36^{h}	15±3.61^{g}	0.50±0.01^{g}	2.47±0.03^{j}	2.34±0.04^{c}	4.16±0.04^{d}
D. longispathus	94±2.65^{h}	3710±20^{e}	172±5.29^{f}	27±3.61^{ef}	0.53±0.05^{g}	3.42±0.02^{f}	1.42±0.05^{h}	4.27±0.03^{c}
D. manipureanus	103±2.00^{g}	4310±36^{c}	210±4.58^{c}	36±4.00^{c}	0.52±0.02^{g}	3.51±0.02^{e}	2.15±0.05^{e}	4.61±0.06^{b}
D. sikkimensis	120±1.73^{e}	3320±17^{g}	205±5.57^{c}	50±2.00^{a}	0.63±0.02^{de}	4.10±0.05^{a}	2.14±0.04^{e}	3.86±0.02^{g}
M. baccifera	175±1.00^{b}	4590±30^{b}	273±5.57^{a}	42±1.73^{b}	0.74±0.05^{bc}	3.61±0.05^{d}	3.06±0.07^{b}	5.22±0.07^{a}

Data are displayed as Mean ± S.D. (n=3). Values which are with different alphabets are significantly different ($p<0.05$)

Manganese content in present study showed a variation ranging from 1.12-3.23 mg/100g d.w. where the highest content was shown by *B. nutans* and the lowest by *B. manipureana*. A wide range of manganese content (1.15-11.6 mg/100g) has also been reported by Christian *et al.* (2015) within which our results fall. The observed values are more or less similar with the values of some vegetables such as beans, tomato, amaranth and carrot that ranged from 1.8-3.10 mg/100g (Singh *et al.*, 2001; Marles, 2017). Young shoots of all the analysed species contained a good amount of zinc.

The maximum value was found in *M. baccifera* with an amount of 5.22 mg/100g d.w. and the least value was seen in *B. vulgaris* (3.11 mg/100g d.w.). This finding is in line with the reports of Christian *et al.* (2015) and Karanja *et al.* (2016) where a range of 1.22-5.46 mg/100g has been reported. The result of this current study is also comparable with the values reported from spinach, cauliflower, amaranth, and carrot that ranged from 2.4-6.0 mg/100g (Singh *et al.*, 2001).

CONCLUSION

Recent scientific advances in the field of health and nutrition have highlighted the significance of non-conventional and underutilized sources of food against the evils of malnutrition and hidden hunger. Bamboo shoots have emerged as a promising source of various nutrients and mineral elements. As per our findings, tender shoots of all the 15 edible bamboo species of Manipur contain significant quantities of nutrients and majority of the mineral elements. Among the 15 investigated species, *C. callosa* emerged as the most nutritious species as it has the highest contents of protein, amino acid, vitamin C, calcium, potassium and copper. *M. baccifera, B. nutans, D. hamiltonii, D. latiflorus,* and *D. sikkimensis* were also found to have higher nutritional and mineral values than the others. Their nutrient values can also compare with the values of some vegetables that we commonly consumed. Therefore, it is concluded that bamboo shoots are well armed to play a crucial role in combating the problem of nutrient and mineral deficiencies. Hence, popularisation and wide scale consumption of bamboo shoots as a nutrient rich food resource need to be expanded and this can go a long way in securing a nutritious and healthy future for all mankind.

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