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Studies on evaluation of physicochemical and mineral composition of fresh bamboo shoot

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Abstract
The present investigation was carried out to study the physicochemical and mineral composition of fresh bamboo shoot. Results obtained indicated that colour of bamboo shoot was whitish brown in colour, the length and circumference of bamboo shoot were recorded 28.26 cm and 6.87cm respectively. The average weight of bamboo shoot was observed to be 390.80g. The peel percentage was recorded to be 61.26 per cent respectively. Further, chemical and mineral composition was reported and results showed that the moisture content 87.25 per cent, fat 0.48 per cent carbohydrate 3.65 per cent, protein 2.59, ash 1.36 and crude fiber 5.20 respectively. Potassium content of bamboo shoot was found to be highest (220.78mg) than the rest of other minerals; phosphorus 170.22 and calcium content 120.02mg/100g and sodium 60.23 mg/100g. Finally, it can be concluded from the results that fresh bamboo shoot is highly nutritious and make it potentially useful in preparation and value addition of food products.

Keywords: Evaluation, physicochemical, mineral composition, fresh bamboo

Introduction
India is one of the rich genetic resources of bamboo with 136 indigenous exotic species and 23 genera under cultivation. Assam is one of the richest biodiversity zones in the world and consists of tropical rainforests, deciduous forest, revering grasslands and bamboo orchards. Bamboos play an important role in the daily life of rural people especially tribal's in numerous ways, from house construction, agricultural implements to provide food, fodder etc. The edible parts of bamboo, i.e. shoots are highly nutritious and potentially rich sources of dietary fibres, antioxidants', amino acids, minerals, vitamins and low in calories. The protein content of the shoots is also high, and contains fewer amounts of fats; however, it is rich in essential fatty acids. Presence of high-quality vitamins, carbohydrates, proteins and minerals in the bamboo shoot and their easy availability to common man may help in solving nutritional deficiency of rural poor. All this indicate the vast potential of the bamboo shoot as a food resource.

Basically, bamboo is a grass, belonging to family *Poaceae*, bamboo is spread over 1,250 species under 75 genera in the world (Upreti and Sundriyal 2001) [21]. Out of these, about 136 species under 23 genera are available only in India. The versatile and evergreen plant is found almost everywhere in the world, but the frozen poles (Sharma 1980) [16]**.** Bamboo shoots are the new culms that just emerge from the ground and constitute a range of traditional delicacies. The freshly harvested bamboo shoot is cream-yellow in colour. When a newly harvested bamboo shoot is peeled, it gives a strong smell and bitter taste (Sharma 1987) [17].

Bamboos are a unique group of giant arborescent grasses in which the woody culms arise from underground bamboo shoots. They are shrubs and have tree-like a habit; their culms are erect and sometimes climbing. Bamboos are characterized by woody, mostly hollow culms with internodes and branches at the culm's nodes going to the tribe Bambuseae of family *Poaceae* (Mehar *et al*., 2012) [9]. India is the second largest resource of bamboos next only to China with 130 species covering an area of 96,000km2 (Scurlock *et al*., 2000 and Yuming *et al*., 2004) [15, 22]. Bamboo is also used for producing edible shoots. These are high-value agricultural products that are produced simultaneously with culms. They are described as the juvenile shoots that emerge from the pseudo-bamboo shoot bamboo plants in the ground. The shoots consist of meristematic cell tissue with massive cell division and variation.

Bamboo is not merely a poor man's timber but is also the rich man's delicacy. It is one of the fastest growing commercial plants, which makes it ideally suited for promotion as a food crop for local consumption as well as for export. The use of edible tender bamboo in Indian formulae has been confined to North- East, Chhattisgarh and Orissa. Fresh, fermented and

roasted tender bamboo shoots are considered culinary treats. They are consumed as vegetables, pickles, salads and in various forms in several countries.

The total area under bamboo plantation in Himachal Pradesh is estimated to be 11,120 hectares out of which an area of 6039.76 acres is covered by *Dendracalamus strictus, D. Hamilton, Bambusa arundinaceous B. nutans, Sinarundinaria falcate and Thamnocalamus spathiflora* species in Kangra, Hamirpur and Una districts (Anonymous 2008) [2]. The bitter taste in bamboo shoots is due to the presence of cyanogenic glycoside taxiphyllin, which is toxic in nature. All species of bamboo shoots available in the world are not edible. Out of 136 species available in India, the most common edible bamboo species are *Bambus pallida*, *Bambusa tulda*, *Bambusa polymorpha*, *Bambusa balcooa*, *Dendrocalamus hamiltonii*, *Dendrocalamus giganteus* and *Melocanna bambusoides* (Sharma 1980) [16].

Bamboo Shoot:

The edible genera of bamboo shoots available in the USA are *Phyllostachys*, the important being *Phyllostachys Dulcis*, *Phyllostachys edulis*, *Phyllostachys bambusoides*, *Phyllostachys pubescens*, *Phyllostachys nuda* and *Phyllostachys viridis* (Rubatzky and Yamaguchi 1997) [14]. People from different countries address bamboos in different names because of their highly multipurpose properties. The Chinese called bamboos as "Friends of the people," Vietnamese as "My brother," and Indians as "Green Gold." Bamboos in addition to their multiple applications have another important usage in utilizing their juvenile shoots as popular food items. The presence of high content of protein, amino acids, minerals, fibre, carbohydrates, and low fat makes the bamboo shoot one of the *widely acclaimed nutrient-rich food items. Also, the presence of phytosterols in young shoots provides youthful feeling, athletic energy, and longevity to regular consumers. Bamboos shoots are popular in Asiatic countries and form a major component of their traditional cuisines (Bao 2006) [3].

Bamboo shoots are seasonal, perishable, short-lived and unpreserved but are becoming one of the preferred food items among the people all over the world. Implying thereby a need to explore a well-organized bamboo shoot processing scheme making them available throughout the year. The edible bamboo shoots are of two types- winter and spring (Choudhury *et al*., 2012) [7]. The people of Northeast India with their mongoloid features are endowed with rich bamboo culture and the plants are an inseparable part of several diverse traditions and religious beliefs of many ethnic people residing at both hilly and plain areas. Consumption of bamboo shoots as food in India is mainly confined to the Northeast states where they are taken either fresh at the time of harvesting season or dried, fermented or pickled forms during offseason (Nirmala *et al*., 2008) [11].

In earlier times, people were forced to find edible alternatives in the surroundings and from the forests when food was scarce and access to foodstuff was minimal, and bamboo shoot is one such 'food from the forest' that they soon began to relish. Hence, began the use of bamboo shoot as a food substance. The consumption of the harvested shoot of bamboo, as it emerges out of the ground, in various forms, has been more of a necessity rather than a delicacy, for the native rural population. There is a growing demand for processed and packaged bamboo shoots in the national and international markets. Bamboo shoots form a traditional and one of the most favourite food items in many countries like China, Japan, US, North East India, Thailand, Nepal, Bhutan, Korea, Australia, New Zealand, Malaysia and Indonesia (Choudhury 2012) [7].

A new emerging young Culm is edible and is known as bamboo shoot or juvenile shoot. It is actually a Culm that emerges from the ground in full diameter and contains nodes and inters modes in a vertically miniaturized form. The young shoots are tightly clasped with overlapping sheaths that have to be removed to extract the edible part. New culms or juvenile shoots in bamboos usually emerge with the beginning of the monsoon season and are harvested for edible purposes (NMBA, 2004) [12]. Bamboo shoots have been eaten as a vegetable for thousands of years in many Asian countries and are becoming more and more popular due to their immense health benefits (Nirmala *et al*., 2011) [10]. Bamboo shoot offers various health benefit likes anti-oxidant, anti-free radical, anti-ageing, anti-cancer, cardiovascular disease, weight loss, to improve digestion, decrease blood pressure, and anti-microbial activity (Rai., 2007; Choudhury *et al*., 2012; Bisht *et al*., 2013) [13, 7, 4].

India is next to China and Japan in its diversity of bamboo species. There are about 136 bamboo species distributed in 75 genera, 25 species among these are edible types and are consumed by tribal communities. The study estimated that 10.3 million hectares or 12.8 per cent of the country's total forest cover are under bamboo plantations. Currently, China and Taiwan are the main exporters of bamboo shoots. There is perceptible untapped demand for bamboo shoots in countries like Japan, Thailand, Denmark, Philippines, Malaysia, Singapore and Australia. The tribal economy revolves generally around bamboo because of its multifarious uses for food, shelter, furniture, handicrafts, medicines and for various religious purposes. Bamboo shoots are excellent vegetable food and find the place in culinary delicacies in many countries. They are crisp, tender and delicious. They contain about 90 per cent water, low fat and calories but good in fibre and a rich source of phytosterol. It is also reported that bamboo shoots have cancer prevention properties. The regular use of bamboo shoots as food is known to prevent many physiological disorders and diseases. The high cellulosic content of bamboo shoot stimulates appetite and prevents constipation. The fresh bamboo shoots provide resistance against a cough, phlegm, fever and sore throat. It is also found to be effective in decreasing blood pressure and cholesterol (Shi, 1990) [18]. In Kerala, it is mostly the tribal communities who utilize bamboo shoots. Though usage of bamboo shoot in urban areas, especially in Chinese food is gaining popularity, all the demand is met through canned products from North Eastern states. However, bamboo shoot farming has immense potential in the rural sectors of Kerala. This can provide job opportunities and additional income to women. There is a high demand for bamboo shoots in the international market, so promising edible species should be introduced in forest plantations and in agroforestry to boost farm income (Kumar, 2009) [8].

Materials and Methods

Bamboo shoots were obtained from local area of Parbhani region. Chemicals and reagents (analytical grade) and standards taken from laboratory, Department of Food Engineering, College of Food Technology, Parbhani.

Methods

Chemical analysis of fresh bamboo shoot

All samples were analysed for the moisture, ash content, protein content, fat content, minerals and yield of fresh bamboo shoot.

Moisture content

Moisture content of bamboo shoot pickle was estimated by drying the samples in an oven at 105°C till constant weight is obtained. It can also be done by digital moisture meter (AACC, 2000 [1]; Method No. 44-15A).

Total ash

Ash was estimated by direct incineration of sample; igniting it in a Muffle Furnace at 550°C till greyish white residue (AACC, 2000 [1]; Method No. 08-01).

Protein

Protein content was determined by using Kjeldhal Apparatus as described in AACC (2000) [1] Method No. 46-30.

Total fat

Total fat content was determined using hexane as a solvent in Soxhlet apparatus as per the procedure given in AACC (2000) [1] Method No. 30-25.

Crude fiber

The fiber content was estimated by acid alkali method as suggested by Chopra and Kanwar (1978) [6].

Mineral contents

The sample were analysed for its mineral profile following AACC (2000) [1].

Result and Discussion

Physical properties of fresh bamboo shoot

Different physical properties such as length, circumference, weight of shoot, edible portion and peel percent of fresh bamboo shoot were evaluated and results obtained are presented in Table 1.

Table 1: Physical Parameters of Fresh Bamboo shoot (Var. Selam)

Physical Parameters	***Observation***
Colour	Whitish brown
Length (cm)	28.26
Circumference (cm)	6.87
Edible portion percent	37.27
Peel Percent	61.26
Weight (g)	390.80

*Each value represents the average of three determinations

The physical characteristics of fresh bamboo shoot were observed to be whitish brown in colour. The length and circumference of bamboo shoot were recorded 28.26 cm and 6.87cm respectively. The average weight of bamboo shoot was observed to be 390.80g. The peel percentage was recorded to be 61.26 per cent. Which revealed that suitability of bamboo shoot for further processing. Similar results were obtained by (Chauhan *et al.* 2016) [5].

Chemical properties of fresh bamboo shoot

Data pertaining to various chemical properties like moisture, fat, carbohydrates, protein, ash, and crude fiber were investigated and results obtained are depicted in Table 2

Table 2: Chemical composition of fresh bamboo shoots

Chemical Parameters	**Mean Value***
Moisture (%)	87.25 ± 0.23
Total Fat (%)	0.48 ± 0.13
Total carbohydrates	3.65± 0.10
Total Protein (%)	2.59 ±0.07
Ash	1.36 ± 0.01
Crude Fiber	5.20 ± 0.03

*Each value represents the average of three determinations

The data in the above table showed that the moisture content 87.25 per cent, fat 0.48 per cent carbohydrate 3.65 per cent, protein 2.59, ash 1.36 and crude fiber 5.20 respectively. Similar results were obtained by (Chauhan *et al.* 2016) [5], (Suresh Kumar *et al.* 2017) [20] and (Choudhury *et al.* 2012) [7]

Mineral composition of fresh bamboo shoots

The results given with respect to various minerals such as Ca, P, Na, K, Mg, Fe, Zn and Cu were determined and accordingly results presented in Table 3.

Table 3: Mineral content in fresh bamboo shoots

Minerals	**Average value (mg/100g)**
Calcium	120.02
Phosphorus	170.22
Sodium	60.23
Magnesium	12.28
Potassium	220.78
Iron	0.28
Zinc	0.11
Copper	0.23

*Each value is an average of three determinations

The table 3 showed that the potassium content of bamboo shoot was found to be highest (220.78mg) than the rest of other minerals; phosphorus 170.22 and calcium content 120.02mg/100g and sodium 60.23 mg/100g. The study showed that bamboo shoot was good sources of potassium, phosphorous and calcium. However, differences in their mineral availability for absorption were observed and may be due to its mineral content and/or mineral-mineral interaction (Singhal *et al.* 2011) and (Nirmala *et al.* 2011) [10].

Conclusion

Overall it can be concluded that nutritional status in fresh bamboo shoot may vary from species to species significantly. The nutritional and mineral composition in bamboo shoot may be of great use for the development and value addition in food products. It was observed from the results that fresh bamboo shoot had good amount of carbohydrates, protein and minerals and it is low in fat as well. Being a smaller known food, fresh bamboo shoot processing and valued addition has very large scope in future for developing new products.

Reference

1. AACC. Approved Methods of the American Association of Cereal Chemists, 10th Edition. AACC, St. Paul, MN, USA. Method, 2000, 1-46.
2. Anonymous. Vansandesh magazine of State department of Forest, Himachal Pradesh, 2008.
3. Bao J. The nutrition and bioactive function of bamboo shoots. Food Nutrition in China. 2006; 4(1):2-3.
4. Bisht MS, Chongtham PN. Bamboo shoot as a resource for health food, food security and income generation in North- East India, 2013.

5. Chauhan OP, Unni LE, Kallepalli C, Pakalapati SR, Batra HV. Bamboo shoots: composition, nutritional value, therapeutic role and product development for value addition. International Journal Food Fermentation Technology. 2016; 6(1):1-12.
6. Chopra SL, Kanwar JS. Analytical Agricultural chemistry. Kalyani Publishers, Ludhiana, 1978, 210.
7. Choudhury D, Sahu JK, Shamra GD. Value addition to bamboo shoots a review. Journal Food Science Technology. 2012; 49(4):407-414.
8. Kumar M. Establishment of a piolet scale bamboo stand for edible bamboo shoot production in Kerala, KFRI, Research Report No. 311, 2009, 19.
9. Mehar PG, Vanalkar AV, Khandare V. Utility of bamboo in different sectors and development of integrated bamboo processing machine. Golden research thoughts. 2012; 2(3):1-8.
10. Nirmala C, Bisht MS, Haorongbam S. Nutritional properties of bamboo shoots, potential and prospects for utilization as a health. Comprehensive Reviews in Food Science and Food Safety. 2011; 10(1):153-169.
11. Nirmala C, Sharma ML, David E. A comparative study of nutrient component of freshly harvested, fermented and canned bamboo shoots of Dendrocalamus giganteus Munro. The Journal of the American Bamboo Society. 2008; 21(1):33-39.
12. NMBA. Bamboo shoot composition. National Mission on Bamboo Application, India, 2004.
13. Rai S. Edible Bamboo Shoot – A Review. Bulletin of Arunachal Forest Research. 2007; 23(2):39-44.
14. Rubatzky VE, Yamaguchi M. World vegetables: principles, production and nutritive values. New York: Chapman and Hall, 1997, 658-660.
15. Scurlock JMO, Dayton DC, Hame B. Bamboo: An overlooked biomass resource? Biomass and bio energy, 2000; 19(4):229-244.
16. Sharma YML. Bamboos in the Asia-Pacific region. In: Lessard G, Chouinard A Bamboo research in Asia. Proceedings of a workshop held in Singapore. International Development Research Centre, Ottawa, Canada, 1980, 99-120.
17. Sharma YML. Inventory and resource of bamboos. International Development Research Centre, Ottawa, Canada, 1987, 14-17.
18. Shi QT. Studies on relationship between nutrients in bamboo shoots and human health. *Bamboo and its uses*. International symposium on industrial uses of bamboo, International tropical timber organization CAF, Nishi-ku, Yokohama, 1990, 32-35.
19. Singhal P, Bal LM, Satya S, Sudhakar P, Naik SN. Bamboo shoots: A Novel source of nutrition and medicine, Food science and nutrition. 2013; (53):517-534.
20. Suresh kumar P, Kumari UK, Devi PM, Choudhary VK, Sangeetha A. Bamboo shoot as a source of nutraceuticals and bioactive compounds: A review, Indian journal of natural products and resources. 2017; 8(1):32-46.
21. Upreti TC, Sundriyal RC. Indigenous resources and community dependence: a case study from Arunachal Pradesh, India. Grassroots Voices - A J Resource Development. 2001; 6(2):28-39.
22. Yuming Y, Kanglin W, Shengji P, Jiming H. Bamboo diversity and traditional uses in yumman, China. Mountain Research development. 2004; 24(2):157-165.