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Popular Article

Bamboo shoot and their benefits as well as their impact in human health

Anil Deka^{1*} and D.J. Kalita²

¹Assistant Professor, Department of Anatomy & Histology, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati, Assam, India

²Professor cum HoD, Department of Veterinary Biochemistry, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati, Assam, India

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Abstract

Bamboo shoot is considered as a traditional cuisine in different countries. As bamboo shoots content low fat, high potassium content, carbohydrate, vitamins and minerals etc., it is widely used by the people of India and outside. Bamboo shoots are consumed in different form. It is having good nutritional qualities as well as medicinal value. It is largely consumed by the tribes as they collect from the forest and consumed as a vegetable. 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 dietary fiber possesses number of health benefits as it controls blood pressure, hypertension, and obesity and also protects our body from coronary diseases and potential carcinogens. These bamboo shoots uplift the rural economy of the country.

Introduction

Bamboos belonging to family Poaceae are considered as one of the most versatile multiutility forest tree grasses. Though distribution of bamboos is worldwide with over 1250 species, their presence is predominantly found in Southeast Asia. They are known to have more than 1500 uses and are considered as one of the most economically important plants in the world. The applicability of bamboos is highly diverse as they are employed immensely in paper, handicraft industry, house construction, and making furniture, water pipes, storage vessels and other important household items. 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, fiber, 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. The people of Northeast India with their mongoloid features are endowed with rich bamboo culture and the plants are 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. The bamboo shoots are the integral constituents of many of the popular traditional cuisines. The present review explores the nutritive values and health benefits of bamboo shoots and the necessity of proper processing methods to generate nontoxic consumable bamboo products. The use of bamboo shoots as traditional foods of Northeast India and the potential and prospect of bamboo shoot industry in the region along with the importance of effective bamboo conservation through micropropagation are also highlighted.

Nutritious value of Bamboo shoot and health benefit:

Bamboo shoots have immense potential of being used as important health food as they contain high proteins, amino acids, carbohydrates, many important minerals, and vitamins. Freshly collected bamboo shoots have good amount of thiamine, niacin, vitamin A, vitamin B6, and vitamin E. Also, the bamboo shoot based diets are rich source of dietary fibers and phytosterols as well as less cholesterol contents which make them one of the popular natural health foods. Bamboo shoots contain generally tyrosine, arginine histidine, and leucine as amino acids. The presence of tyrosine facilitates biochemical metabolism of our body as it is a major constituent of adrenals which are precursors for adrenaline, necessary for active body metabolic activities. It also plays important role in function of thyroid and pituitary glands which are involved in producing and regulating hormones in human body. Presence of high fiber and phytosterols in bamboo shoot reduces fat and cholesterol levels of blood making them one of the most sought-after health foods among patients with life style related disorders. The dietary fiber possesses number of health benefits as it controls blood pressure, hypertension, and obesity and also protects our body from coronary diseases and potential carcinogens. Some ethnic tribes of Northeast India used bamboo shoots to control high blood pressure and cardiovascular ailments. The high dietary fibers and low fat in bamboo shoot help in reducing the thickening of arteries maintaining the blood pressure. Bamboo shoots had reducing effect on serum content of total cholesterol and low-density lipoprotein. There was increase in the frequency of bowel movement and fecal volume indicating its role in cholesterol lowering and diabetes prevention in individuals provided with bamboo diets. There are instances of using bamboo shoots by Karbi Anglong tribes of India to control early stage of cancer. The anticancer property of bamboo shoots might be attributed to the presence of lignans and phytosterols. The production of carcinogens, growth of cancer cells, cell invasion, and metastasis are inhibited by phytosterol. Bamboo shoots are used by local tribes belonging to Bodo, Thadau, Mosang, and Tiwa for treatment of irregular menstrual cycle, heavy bleeding after delivery, infertility problems, reducing labour pain, and also for inducing puberty in young female. Chinese people used bamboo shoots to treat the alcoholic liver diseases. Bamboo shoot is a good source of potassium,



Vitamin E (α -Tocopherol), Vitamin C, Vitamin B6, thiamin riboflavin, niacin, iron, phosphorus and dietary fibers like hemicelluloses, cellulose, pectin, lignin . With 17 different types of amino acids, bamboo shoots contain about ten types of minerals like Cr, Zn, Mn, Mg, Ni, Co, Cu, etc. and lysine, one of the limited amino acids, which is helpful for growth and development of children is found in bamboo shoots (Fu *et al.* 2002). Germaclinium in shoots has been reported to carry anti-aging properties (Sarangthem and Singh 2003). Ash of bamboo shoots has been reported in use in Ayurveda medicines in India (Puri 2003).

Harmful effect of Bamboo shoot:

Bamboo shoots contain certain anti-nutrients (cyanogens) like hydrogen cyanide and may cause cyanide poisoning. They also contain toxins like tannins, oxalate, and heavy metals, which may damage the pancreas, central nervous system, and thyroid gland. Regular intake of bamboo shoots reduces reproductive health related problems in female. Though scientifically not proven some tribes believe bamboo shoot causes abortion in pregnant women. They are often advised not to consume bamboo shoot during the first trimester of pregnancy.

Taste and flavors of Bamboo shoot:

The edible bamboo shoots have a matchless taste and flavor. The bamboo shoots of some species, owing to the presence of cyanides, develop an acrid flavor (Sue 1995). The new shoots are free from acrid taste and are brilliant for human consumption. HCN is a crash product of cyanogenic glycosides which breakdown upon disruption of the plant cell. During storage, a bitter taste develops in the bamboo shoots, if stored for a longer period of time, or exposed to sunlight.

Processing of Bamboo Shoot:

The quantity of cyanides in bamboo shoots, however, varies depending upon the species, for instance, the number of cyanides is 894 mg/kg in *Dendrocalamus giganteus* (Ferreira *et al.* 1995). It has been reported that up to 0.16% of total cyanide is contained in the tip of the shoot, reducing to 0.01% in the base (Haque and Bradbury 2002). Cyanogenic glycosides can produce both acute and chronic toxicity, but degrades readily by boiling in water. Nearly 70% of HCN is removed by boiling bamboo shoots for 20 min at 98 °C and about 96% is removed by boiling at this temperature for longer interval (Ferreira *et al.* 1995). There is a growing demand for processed and packaged bamboo shoots in the national and international markets. Shelf life of freshly harvested bamboo shoots is 9 and 23 days in water and brine, respectively (National Mission for Bamboo Applications, India 2009)

Income and utilization of Bamboo shoot in different part of world

Bamboo shoot is considered as a traditional cuisine in different countries. As bamboo shoots content low fat, high potassium content, carbohydrate, vitamins and minerals etc., it is widely used by the people of India and outside. Bamboo shoots are consumed in different form. It is having good nutritional qualities as well as medicinal value. It is largely consumed by the tribes as they collect from the forest and consumed as a vegetable. The present article gives an insight how the indigenous bamboo shoots used as a food, as a medicine and various home decoration purpose. Modern research has revealed that bamboo shoots have a number of health benefits: improving appetite and digestion, weight loss, and curing



cardiovascular diseases and cancer. The shoots are reported to have anticancer, antibacterial, and antiviral activity. Shoots have antioxidant capacity due to the presence of phenolic compounds. The increasing trends of health consciousness among consumers have stimulated the field of functional foods and bamboo shoots can be one of them. Bamboo fiber is now a common ingredient in breakfast cereals, fruit juices, bakery and meat products, sauces, shredded cheeses, cookies, pastas, snacks, frozen desserts, and many other food products. In many parts of the world, bamboo shoots form a part of the conventional cuisine and are consumed in various forms (Bal *et al.* 2008). However, bamboo grows naturally or is cultivated in homesteads and farms, and is one of the underestimated natural resources in the international scenario. In international markets, China earns 6,500 million Indian rupees every year from export of edible bamboo shoots, with import of USA at around 44,000 tonnes accounting for 14.5% of the total world import (Lobovikov 2003). Every year USA imports 30,000 tonnes of canned bamboo shoots from Taiwan, Thailand, India and China for domestic consumption as food items (Daphne 1996). *Dendrocalamus asper*, and *Dendrocalamus lactiferous* and *Bambusa oldhami* are the most important edible species in Thailand (Fu *et al.* 1798) and Taiwan (Tai 1985), respectively. The import of Australia is estimated about 8,000 tonnes per annum (Cahill 1999). Taiwan consumes about 80,000 tonnes of bamboo shoots annually constituting a value of 2,500 million Indian rupees, covering 30,000 ha of land of bamboo shoots under cultivation, producing total 380,000 tonnes of bamboo shoots per year (Tai 1985). In Japan, the present annual consumption of bamboo shoots is 3 kg per person, compared to 1.2 kg per person in 1950s (Yang *et al.* 2008). At present, over two million tonnes of edible bamboo shoots are consumed in the world in each year (Yang *et al.* 2008). It was noticed that 26.2, 435 and 426.8 tonnes of bamboo shoots are harvested annually in the north eastern states of India like Sikkim, Meghalaya and Mizoram, respectively, where about 20–30 million tonnes of bamboo shoots are utilized for production of canned bamboo shoots annually (Bhatt *et al.* 2003). India's size of domestic bamboo economy currently is estimated at 2,000 million Indian rupees. The market potential of bamboo in India is estimated at present at 450 million Indian rupees, which will increase to 26,000 million Indian rupees by 2015, thus enabling five million families of artisans and farmers, crossing the poverty line (Farooquee *et al.* 2007). (Nirmala *et al.* 2008). Although bamboo shoots are found during the monsoons, there are normally two types of bamboo shoots available in a year; winter shoots and spring shoots depending on the seasons of a year. The spring shoots are normally larger, tougher and more superior compared to the winter shoots. Fermented shoot processing is an ancient knowledge system existing in the tribal communities from decades and fermented shoots are not only used in homes for domestic use but also sold in the markets in the packaged form prepared by small groups of women at home. So basic fermented bamboo shoot products made by local villagers are sold in the markets but a variety of these products with proper labeling and commercial packaging is not available. India is the second largest country with Bamboo diversity and has a great potential to commercialize bamboo shoot products especially fermented shoots. We need to provide proper training to the women workforce of the villages and build their capacities to take up the preparation, packaging and marketing of fermented shoot products so as to build a global marketplace. Government policies should integrate bamboo cultivation in



kitchen gardens, employment generation with bamboo shoot products by providing proper training and funding, and conservation of traditional knowledge systems pertaining to bamboo products and maintaining the food security as it remains the food of the future showing greatest environmental sustainability.

Value of Bamboo tree

Bamboo is a long-lived, strong, versatile and highly renewable woody-stemmed perennial species of grasses found mostly in moist deciduous, semi-evergreen, tropical, subtropical and temperate areas of forest (Tewari, Negi, & Kaushal, 2019). More than 1250 species belonging to 75 genera have been reported to be distributed worldwide. Bamboo shoots exhibit a great potential as a food resource and is one of the commonly collected, consumed and sold nutritious vegetable amongst the tribal and rural communities of the North Eastern India. They are not only a storehouse of nutritional elements but also contain some important antioxidants and medicinal components which can help prevent the onset of metabolic disorders. They are consumed in fresh, fermented, canned and dried forms. As a giant perennial arborescent grass, bamboo belongs to the family Poaceae and subfamily Bambuseae. It is native to China and widely distributed across continents, especially in tropical, subtropical and temperate regions with a mostly mesic to wet season. To date, more than 1642 species in 75 genera of bamboo have been evidenced to be distributed throughout the world, in which over 500 species in 39 genera grow in China. As estimated, the global area of bamboo forest is up to 31.5 M ha, accounting for approximately 1% of the total forest area. Over the last 30 years, the global forest area declines continuously, while the bamboo forest area shows an average annual growth rate of 3% (FAO, 2010). In terms of the bamboo forest area, India and China are the first two countries with the largest total areas of 9.57 M ha and 6.01 M ha, respectively. Bamboo is regarded as the fastest-growing plant on the planet. The fast growing and quick maturation, as well as the short production cycle, high biomass productivity and wide adaptability make bamboo valuable in rapid forest establishment, sustainable construction, environment-friendly furniture making and ecological foodstuff producing. Notably, it has been proved that moderate harvesting could benefit the productivity of bamboo. Thus, bamboo is regarded as one of the most culturally, ecologically and economically important plant or grass especially for the livelihoods of some rural populations in Asia, Latin America and Africa. In gross, approximate 2.5 billion people worldwide utilize various bamboo-related products. The annually bamboo economic sector worth in China was estimated up to USD 11.8 billion. Regarding the food applications, the leaves and shoots of edible bamboo have been under consideration for many years. Published articles had announced the anti-oxidant, anti-microbial, anti-inflammatory, anti-helminthic, anti-diabetic and anti-ulcer activities of various extracts and components from bamboo leaves. This was mainly ascribed to the phenolic components in



bamboo leave such as orientin, homoorientin, iso-orientin, vitexin, homovitexin, and triclin and phenolic acids. Since 2004, the bamboo leave extract has been authorized by The Chinese Ministry of Health as a novel food antioxidant with a maximum addition of 0.5 g/ kg in edible oils, meat products, aquatic products, cereal products, puffed food fruit and vegetable juices and tea beverage. Besides its wide use as animal fodders, the leaves of bamboo have been used up to thousands of years as wrapping materials for Chinese rice-pudding and Japanese sushi. In China, the bamboo leaves were also made into a tea form for drinks.

Value of fermented bamboo shoots

Fermentation of bamboo shoots not only makes it palatable in terms of flavor, aroma, texture and appearance but also makes it highly nutritious and extends its shelf life because of the action of lactic acid bacteria making the product acidic and good for digestion. Fermented bamboo shoots are widely eaten by many tribal communities of the North-Eastern region with varied preparation method. In India, the fermentation of bamboo shoot has extensively been carried out in the states of Manipur, Meghalaya, Sikkim, Mizoram etc. since ancient times. They are eaten as curry, pickle or soup in different communities. Fermented shoots have also been supplemented in the preparation of nuggets enhancing its physicochemical, microbiological and keeping quality. Bamboo shoots contain certain anti-nutrients (cyanogens) like hydrogen cyanide and may cause cyanide poisoning. They also contain toxins like tannins, oxalate, and heavy metals, which may damage the pancreas, central nervous system, and thyroid gland. Though scientifically not proven some tribes believe bamboo shoot causes abortion in pregnant women. They are often advised not to consume bamboo shoot during the first trimester of pregnancy. Research on the different preparation style of fermented bamboo shoots has been reviewed and compiled by various researchers in the past. But there is no systematic approach which has documented the investigation of the nutrients, antinutrients and anti-oxidant potential of a locally available and edible species of India. Therefore, the present study was undertaken to examine the physicochemical changes occurring during the fermentation of young bamboo shoots and presents a detailed report aiming to determine and compare the nutritional and functional qualities as well as harmful effect of fresh and fermented bamboo shoot. The bitter taste of young shoots is due to the cyanogenic compound called Taxiphyllin which can be reduced by fermenting the shoots. During fermentation there is rapid utilization of sugars by the microbes and breakdown of large sugar molecules results into the formation of acids. The accumulated acids catalyse the degradation of taxiphyllin into hydrogen cyanide. The moisture content in the fresh shoots was found to be 90.57 % which increased to 91.08% on fermentation which might due to the release of water and other metabolites as by-products by the fermenting microorganisms. Ash content reduced during fermentation from 0.99% to 0.8% (few basis) suggesting a decline in the total mineral content. Fermented shoots are a good source of digestible proteins.

Conclusion

This study will be helpful to know details about the beneficial effect of fermented bamboo shoot



product. To know details about the side effect of fermented bamboo shoot product for long term use. After scientific validation of fermented bamboo shoot products, provide training to the rural women for preparation and packing of bamboo shoot for selling in market. Ultimately it helps in the uplift of the rural economy.

References

- Puri, H.S. (2003). Rasayana ayurvedic herbs for longevity and rejuvenation. Taylor and Francis, London, pp 71–73
- Fu, S., Yoon, Y. and Bazemore, R. (2002). Aroma-active components in fermented bamboo shoots. *J Agric Food Chem* 50(3):549–554.
- Sarangthem, K. and Singh, T.N. (2003) Microbial bioconversion of metabolites from fermented succulent bamboo shoots into phytosterols. *Curr Sci* 84(12):1544–1547
- Sue, T. (1995) Bamboo shoots = good food. *Temp. Bamboo Q.* 2(1):1–2, and 8–11.
- Ferreira, V.L.P., Yotsuyanagi, K. and Carvalho, C.R.L. (1995) Elimination of cyanogenic compounds from bamboo shoots *Dendrocalamus giganteus Munro*. *Trop Sci* 35:342–346.
- Haque, M.R. and Bradbury, J.H. (2002) Total cyanide determination of plants and foods using the picrate and acid hydrolysis methods. *Food Chem* 77:107–114.
- National Mission on Bamboo Applications (2009) Bamboo shoot composition. NMBA, India.
- Bal, L.M., Sahu, J.K. and Prusty, S.R. (2008) Opportunity of bamboo shoots for nutritional security and socio-economical prosperity of north eastern region of India. Proceedings of the conference on Agricultural Engineering inputs for the development of the NR region. Assam University, Silchar on 3rd December, 2008, pp. 108–114.
- Lobovikov, M. (2003) Bamboo and rattan products and trade. *J Bamboo Rattan* 2(4):397–406.
- Daphne, L. (1996) Bamboo shoots: delicious to eat, easy to sell. *Washington Tilth*. Autumn. 7–9.
- Fu, M.Y., Ma, N.X. and Qui, F.G. (1998) Bamboo production and scientific research in Thailand [Chinese]. *J Bamboo Res* 6(1):54–6.
- Tai, K.Y. (1985) The management and utilization of shoot-producing bamboos in Taiwan [Chinese]. *Q J Chin For* 18(2):1–46.
- Cahill, A. (1999) Field Day to explore edible bamboo shoot market. News Release, Dept of Primary Industries Queensland.
- Yang, Q., Duan, Z., Wang, Z., He, K., Sun, Q and, Peng, Z. (2008) Bamboo resources, utilization and ex-situ conservation in Xishuangbanna, South-eastern China. *J Forest Resour* 19(1):79–83.
- Bhatt, B.P., Singha, L.B., Singh, K. and Sachan, M.S. (2003) Some commercial edible bamboo species of North East India: production, indigenous uses, cost-benefit and management strategies. *J Am Bamboo Soc* 17 (1):4–20.
- Farooquee, N.A., Dollo, M. and Kala, C.P. (2007) Traditional Wisdom of Apatani Community in the management and sharing of natural resources in North Eastern India. In: Misra KK (ed) *Traditional knowledge in contemporary societies: challenges and opportunities*. Pratibha Prakashan, Delhi, pp 110–126.
- Nirmala., Sharma, M.L. and David, E. (2008) A comparative study of nutrient components of freshly harvested, fermented and canned bamboo shoots of *Dendrocalamus giganteus* Munro, bamboo science and culture. *J Am Bamboo Soc* 21(1):41–47.
- Tewari S., Negi H. and R. Kaushal. (2019). Status of Bamboo in India. *International Journal of Economic Plants* 6(1):030-039.

