

## ANTIHYPERTENSIVE ACTIVITY OF BAMBOO SHOOT: A REVIEW

JIMMY DEVI O<sup>1\*</sup>, PRIYANKA PAMBA<sup>2</sup>

<sup>1</sup>Department of Pharmacy Practice, Acharya & BM Reddy College of Pharmacy, Bengaluru - 560 107, Karnataka, India. <sup>2</sup>Department of Pharmacology, Acharya & BM Reddy College of Pharmacy, Bengaluru - 560107, Karnataka, India. Email: ojimmydevi10@gmail.com

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## ABSTRACT

Bamboo shoots contain various protein, carbohydrates, amino acids, minerals, fat, sugar, fiber, and inorganic salts. They contain 17 amino acids, 8 of which are essential for the human body. Tyrosine amounts to 57-67% of the total amino acid content. Aqueous extracts of bamboo shoot were found to contain bamboo shoot angiotensin converting enzyme inhibitory peptide (bamboo shoot peptide [BSP]) fraction. On identification of the fraction, Asp-Tyr was found as the key active component. It reduces systolic blood pressure. The phenolic compound present in BSP is having vasodilatory effect, which can decrease hypertension.

**Keywords:** Bamboo extract, Antihypertensive, Bamboo shoot peptide, Angiotensin converting enzyme inhibitor.

## INTRODUCTION

Basically a grass, belonging to family Poaceae, bamboo is spread over 1,250 species under 75 genera in the world [1]. Bamboo or tree grasses comprise a diverse group of plants in the grass family. A new emerging young Culm from a network of rhizomes is known as bamboo shoot. The young shoots are tightly covered with overlapping sheaths that must be removed to extract the edible part.

At present, there are about 3000 companies around the world engaged in the production of various bamboo-based products such as panels, flooring, pulp, charcoal, edible shoots, and other daily-use articles. Though more popularly known for industrial usage, a lesser known fact of bamboos is the utilization of its shoots as food [2].

Fresh shoots have a crisp, crunchy taste, and sweet flavor, imparting a unique taste. Shoots are used as an extender, because the tissue takes on the flavor of the ingredients in which it is cooked. In addition to being delicious, bamboo shoots are rich in some nutrient components, mainly proteins, carbohydrates, and minerals, but have a low fat content. It is rich in hydrocyanic and benzoic acids [2,3].

Bamboo shoots should be properly processed before they are consumed as freshly harvested shoots have high content of toxic cyanogenic glycosides, which may pose serious health problems [3,4]. Cyanogenic glycosides can produce both acute and chronic toxicity, but degrades readily by boiling in water. Nearly, 70% of hydrogen cyanide is removed by boiling bamboo shoots for 20 minutes at 98°C and about 96% is removed by boiling at this temperature for longer interval [1].

## GLOBAL AND INDIAN SCENARIO

The edible bamboo shoots have a unique taste and flavor. In many parts of the world, bamboo shoots form a part of the conventional cuisine and are consumed in various forms. However, cultivation of bamboo is one of the underestimated natural resources in the international scenario [1].

In India, in spite of the fact that it is among one of those countries, which produces large number of bamboos, not much importance has been given to the use of bamboo shoots as food due to lack of awareness of the edible characteristics of the shoots. Consumption of tender shoots is confined mainly to the Northeastern states of India where they are part of the traditional cuisine. The prospect of bamboo shoot

industry in Northeast India is bright due to its rich genetic resources of bamboos [3].

All species of bamboo shoots available in the world are not edible. Out of 136 species available in India, the most commonly edible bamboo species are *Bambus pallida*, *Bambusa tulda*, *Bambusa polymorpha*, *Bambusa balcooa*, *Dendrocalamus hamiltonii*, *Dendrocalamus giganteus* and *Melocanna bambusoides* [1].

## NUTRIENTS PRESENT IN BAMBOO SHOOT

The main nutrients in bamboo shoots are protein, carbohydrates, amino acids, minerals, fat, sugar, fiber, and inorganic salts. The shoots have a good profile of minerals, consisting mainly of potassium, calcium, manganese, zinc, chromium, copper, iron, plus lower amounts of phosphorus, and selenium. Fresh shoots are a good source of thiamine, niacin, vitamin A, vitamin B6, and vitamin E. They contain 17 amino acids, 8 of which are essential for the human body. Tyrosine amounts to 57-67% of the total amino acid content. Fat content is comparatively low (0.26-0.94%) and the shoots contain important essential fatty acids. The total sugar content, 2.5% on average, is lower than that of other vegetables. The water content is 90% or more [2].

Bamboo leaves are a rich source of hydrocyanic and benzoic acids. Tender bamboo shoots contain various enzymes such as nuclease, deamidase, proteolytic enzyme, amylase, amigdalain splitting and silicon splitting enzymes. Besides, the juice of the pressed bamboo-shoots possesses protease activity which helps digestion of proteins (Table 1) [5].

## MEDICINAL VALUE

With different flavones, glycosides, bamboo shoots have good anti-oxidant, anti-free-radical and anti-aging agents [1].

Bamboo shoots contain tyrosine, arginine, histidine and leucine as amino acids. The presence of tyrosine facilitates biochemical metabolism of our body. Adrenaline is synthesized in the medulla of the adrenal gland in an enzymatic pathway that converts the amino acid tyrosine into a series of intermediates and, ultimately, adrenaline. Thus it can be beneficial in patients with Parkinson's disease. It also plays important role in function of thyroid and pituitary glands which are involved in producing and regulating hormones in human body [6].

Presence of high fiber and phytosterols in bamboo shoot reduces fat and cholesterol levels making them one of the important healthy

**Table 1: Various constituents in processed bamboo shoots [1]**

S. No.	Constituents quantity	Per 100 g
1	Dietary fibers	1.5 g
2	Lignin	46 mg
3	Proteins	21.45 g
4	Essential amino acids	7.51 g
5	Non-essential amino acids	10.08 g
6	Cellulose	850 mg
7	Monosaccharide	307 mg
8	Polysaccharides	288 mg
9	Saturated fatty acids	50 mg
10	Monounsaturated fatty acids	0.7 mg
11	Polyunsaturated fatty acids	120 mg
12	Long chain fatty acids	181 mg
13	Sodium	268 mg
14	Potassium	224 mg
15	Calcium	17 mg
16	Iron	0.5 mg
17	Zinc	0.18 mg
18	Sodium chloride	68 mg
19	Uric acid	25 mg

foods in patients with lifestyle related disorders. The dietary fiber has a number of health benefits as it can protect our body from coronary diseases and potential carcinogens. Bamboo shoot was found to show increased gastro-intestinal movement, indicating its role in cholesterol lowering in individuals provided with bamboo diets [3].

Bamboo extracts have anti-inflammatory, anthelmintic, antibacterial, diuretic property, antiulcer, antifertility, antimicrobial and hypoglycaemic activities. Leaves decoction is used as an antispasmodic in dysmenorrhea and amenorrhea. Bamboo leaf juice is given for strengthening the cartilage in osteoarthritis and osteoporosis [6-8].

#### ANTIHYPERTENSIVE PROPERTY OF BAMBOO SHOOT

The extracts of bamboo shoot were evaluated for antihypertensive property and other cardiovascular protective properties by different researchers.

The aqueous extract of bamboo shoot when further extracted with ethyl acetate and n-butanol, it gives bamboo shoot angiotensin converting enzyme (ACE) inhibitory peptide (bamboo shoot peptide [BSP]). This fraction shows higher antioxidant capacities than the aqueous fraction, which can be due to the presence of higher amount of phenolic acid, such as ferulic acid and p-coumaric acid, which when combined with ACE inhibitor exert a synergistic effect. Flavonoid content of both fractions is similar; but the aqueous extract exhibited maximum ACE inhibitory activity. On further purification of bamboo shoot ACE inhibitory peptide (BSP) from aqueous extract Asp-Tyr was found as the key active component. In *in-vivo* animal study, BSP could significantly reduce the systolic blood pressure [4,9].

Ferulic acid have vasodilatory effect by increasing the nitric oxide level in serum and improve oxidant stress by its antioxidant activity in response to free radicals by donating one hydrogen atom from its phenolic hydroxyl group [10].

Presence of phytosterol decreases cholesterol level in blood as it inhibits the absorption of dietary cholesterol and cholesterol esterification in the intestinal mucosa that in turn protect cardiovascular activity [9].

Friedelin, a major triterpenoid compound from bamboo shaving, has a vasodilator function in thoracic aortas of the rats, which proved the antihypertensive effects of bamboo shaving extract [11].

In another study conducted by Kaikini Aakruti, *et al.* diuretic property was evaluated in rats. It was found to have a diuretic effect that can also be one of the antihypertensive properties of bamboo shoot [6].

#### DISCUSSION AND CONCLUSION

The health beneficial properties of bamboo extracts have been discussed in many literatures. Extracts of bamboo shoots and parts of the plant contain numerous nutritive values, which can be used in and as a part of treatment of various disorders and diseases. It has cardio-protective properties. *In-vivo* rat studies have confirmed the various pharmacological activities of bamboo extracts. The antihypertensive activity has been proved in rats, but appropriate clinical study has not been done in hypertensive patients.

At present many antihypertensive drugs are available in the market. However, all the drugs have some or other side-effects and can be economically burden to the patient. As bamboo shoots are easily available at lesser cost and least side-effect, thus it can be used to control blood pressure as a dietary intake. In future, clinical study can be done to prove the anti-hypertensive property of bamboo extracts.

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