

## Short Communication

### Bamboo Shoot – Is it Edible or Poisonous?

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#### ABSTRACT

Bamboo is just another grass with an endless list of uses. Bamboo shoot contains a cyanogenic glycoside ‘amygdalin’ composed of glucose, benzaldehyde and cyanide. We present a case of a 14 year old female patient with history of consumption of bamboo shoot extract (juice) who was brought in an unconscious state and admitted to the Department of Medicine in our hospital. She was treated symptomatically with supportive therapy after conducting relevant laboratory investigations. The patient recovered consciousness after 2 days and was discharged after 10 days of admission.

**Key Words:** Bamboo shoot; Cyanide; Cyanogenic glycoside; Amygdalin

#### Introduction

Bamboo is a type of grass. It has different names in different languages. According to one source the “bamboo” is derived from the Malayalam word “mambu.”<sup>1</sup> Bamboo shoot contains amygdalin composed of glucose, benzaldehyde and cyanide. Amygdalin is also present in bitter almonds, kernels of apple, cherry, plum and peach. Fresh vegetables and fruits contain nutrients, vitamins and minerals essential for growth and health and are important components of a healthy diet. However some plants, vegetables and fruits may contain natural toxins, which are potentially harmful to human health. There are occasional reports of poisoning suspected to have been caused by consumption of raw vegetables and fruits containing natural toxins.

**The Case:** A 14 year old female patient was brought to JSS Hospital, Mysore with a history of sudden onset of convulsions, vomiting, respiratory distress and loss of consciousness. The complete history was unavailable at the time of admission of the patient. Her mother was a known epileptic and was on treatment with long acting phenobarbitone. On examination, the patient appeared to be in altered sensorium with a Glasgow Coma Score of 3 (E<sub>1</sub>M<sub>1</sub>V<sub>1</sub>). Corneal and deep tendon reflexes were absent, while the plantar reflex was exaggerated. Blood pressure was 90/60 mm Hg, and pulse rate was 80 beats per minute. Arterial blood gas analysis revealed metabolic acidosis. She was put on assisted ventilation. Barbiturate poisoning was suspected initially and the patient was treated on that line. The patient regained consciousness after two days of admission, and gave a history of consumption of water in which bamboo shoots had been soaked.

#### Discussion

The scientific literature on cyanide in bamboo shoots is scanty. Toxicologists have known for a considerable time that some species of bamboo from which bamboo shoots are derived can contain cyanide – or more precisely a cyanogenic glycoside. Cyanogenic glycosides are present in more than 2000 different plant species. When plant parts are disrupted by cutting or chewing by herbivorous animals for example, tissues containing cyanogenic glycosides are hydrolyzed by a specific enzyme (glucosidase) to make glucose, an aldehyde or ketone, and hydrogen cyanide (HCN). Normally, in live intact tissues,

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the enzyme is stored by the plant in a location separate from the glycoside. As soon as the tissue is cut, the enzyme can get into contact with the cyanogenic glycoside thereby causing the rapid release of hydrogen cyanide.

Cyanide (hydrogen cyanide, HCN, prussic acid) is a potent metabolic poison. It is a small molecule composed of a carbon and nitrogen atom joined by a stable triple bond. This poison is best known for its inhibition of many enzymes that are important in animal metabolism. Cyanide most notably inhibits cytochrome oxidase, one of a group of enzymes important in cellular respiration.<sup>2,4</sup> Respiration is the process by which both animals and plants break down glucose in the presence of oxygen to yield carbon dioxide and water and produce valuable energy to maintain cellular processes and growth. Without functioning cytochrome oxidase, respiration is inhibited. Cyanide binds tightly to the enzyme and permanently inhibits its functioning. Nature has made cyanide in the form of a compound that discourages plant consumers. It is most often attached to other molecules in the form of cyanogenic glycosides. The cyanogenic glycoside present in bamboo shoots is taxiphyllin [2-( $\beta$ -D-glucopyranosyloxy)-2-(4-hydroxyphenyl) acetonitrile]

There are now simple kits to determine the presence of cyanide in bamboo shoots. Together with colleagues, Howard Bradbury from the Australian National University has developed a range of practical kits that can be used by an unskilled person for looking at cyanide levels in cassava roots and products, as well as other cyanogenic plant parts such as sorghum leaves, bamboo shoots and flax seed meal. The general principle is that a small sample of the plant or product is placed in a container with filter paper containing the required catalyst and a piece of picrate paper that reveals the amount of poison produced. The bottle is left overnight at room temperature. The next morning, when the breakdown to poisonous gas is completed, the colour of the picrate paper indicates the level of toxicity.<sup>2</sup>

In India and many countries around the world, the processing of bamboo shoot for food consists of peeling the tuber (the peel contains the highest amount of cyanide) (**Fig 1**) and soaking the whole or sliced tubers in water for 24-48 hours (**Fig 2**). This process does not completely remove HCN. The residue is then cooked. This procedure produces an acceptably poison-free material.

When raw or inadequately-cooked tender bamboo shoots are ingested, the toxin will be transformed into hydrogen cyanide, which may result in food poisoning. Symptoms of cyanide poisoning occur within a few minutes and may include constriction of the throat, nausea, vomiting, abdominal pain, headache, confusion, convulsions and coma. Pupils are often dilated and sluggish in reaction. The initial bradycardia and hypertension are followed by tachycardia and hypotension. Bradycardia supervenes once again as a terminal event. Cyanide inhibits cytochrome oxidase at the aa<sub>3</sub> portion of the enzyme. Metabolic acidosis occurs due to conversion of pyruvic acid to lactic acid.<sup>2,4</sup>

The cyanogen in bamboo is taxiphyllin which is a p-hydroxylated mandelo-nitrile triglochinin, one of the few cyanogenic compounds that decomposes quickly when placed in boiling water. Bamboo becomes edible because of this instability.<sup>2</sup> Ferreira et al (1995) found that boiling bamboo shoots for 20 minutes at 98°C removed nearly 70% of HCN. With higher temperatures and longer intervals, the HCN is removed progressively up to 96%. Thus even the highest quoted figure (800 mg/100g) would be de-toxified by cooking for two hours.



**Fig 1:** Tender bamboo shoots after removing the outer covering



**Fig 2:** Pieces of tender bamboo shoots soaked in water

### Conclusion

People who consume bamboo shoots as a part of their traditional diet are aware that the extract is dangerous but they do not know the reason. The water in which the bamboo shoots are soaked should be discarded immediately. Bamboo shoots should be cooked thoroughly at boiling temperature after thorough soaking in clean water.<sup>2</sup>

Bamboo shoots contain toxic concentrations of cyanogens (amygdalin), which can cause cyanide poisoning. Thus, they must always be cooked before canning or eating. Perhaps this is why an ancient Chinese proverb says, “When eating bamboo shoots, remember the men who planted them”<sup>3</sup>

### REFERENCES

1. The New Sunday Express. New age living. September 25, 2005.
2. [http://www.inbar.int/publication/txt/INBAR\\_Working\\_Paper\\_No39.htm](http://www.inbar.int/publication/txt/INBAR_Working_Paper_No39.htm). Accessed on 05-03-2011 at 12.30 pm
3. <http://www.soupsong.com/fbamboos.html>. Accessed on 27-06-2011 at 11.30 am
4. Pillay VV. Comprehensive Medical Toxicology. 1<sup>st</sup> edn, 2003. Hyderabad: Paras Medical Publisher. 209-210.