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Phytosterols Content in Different Bamboo Species of Manipur, India

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ABSTRACT

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Bamboo shoots have a long history of being used as a source of both food and medicine. The use of bamboo shoots as a food and delicacy has been among the people of Manipur since time immemorial. Bamboo shoots are regarded as potential sources of sterols. In the present investigation some twelve bamboo species grown in Manipur were assessed for their phytosterols content and it was found that the phytosterols level varied in bamboo shoot samples of different species- ranging from 293.8 to 40.5 mg/100 g dry wt. Maximum content were found in the top apex portion of the bamboo shoots which were soft and tender but not used for consumption. The outer culm sheaths (covering the soft portion of the shoot) which are discarded also showed a significant amount of phytosterols ranging from 119.7 to 35.5 mg/100g dry wt. The bamboo shoots show a gradual decrease in the total phytosterol content from top apex portion to base tissues of the bamboo shoots and lowest in the culm sheath. Lieberman-Burchard reaction was the basis for spectrophotometric estimation of total phytosterols.

Introduction

Phytosterols, which are the precursors of many pharmaceutically active steroids, are found in many plants (Martin, 1997; Jain *et al.*, 1980). As of now 200 types of sterols exist in nature (Lagarda *et al.*, 2006). In the recent advancement, there is considerable interest in phytosterols as dietary supplements as they are shown to inhibit the absorption of cholesterol in the small intestine and also effectively lowers the cholesterol level (Ostlund *et al.*, 2003). There are also reports that phytosterol seems to have a positive impact on cardiovascular diseases (Patel and Thompson, 2006; Weingartner *et al.*, 2009).

Bamboo shoots are used by the people of south-east Asia as a food in different types of delicacies and also considered as a medicinal food (Bao, 2006; Baiyi *et al.*, 2009). The emerging fresh young bamboo shoots which are used in numerous Asian dishes are available in markets in various sliced forms, fresh, fermented and canned version (Tai, 1985; Fu *et al.*, 1987; Midmore, 1998). At present over two million tons of edible bamboo shoots are consumed in the world in each year (Yang *et al.*, 2008). In Manipur, a state located in the north eastern part of India, the fresh succulent bamboo

shoots slices and the fermented shoot slices done in large scale are highly prized vegetable food items. More than 700,000 culms are extracted every year in Manipur (Statistical bulletin of Manipur forest, Govt. of Manipur, 1999-2000). Young delicate bamboo shoots are of favourite because of its high fiber content and its delicacy (Fuchigami, 1990). They are rich in minerals, have adequate amount of glucose, low in fat and is brittle, tender, delicious and nutritive (Yamaguchi and Kusama, 1976; Yamaguchi, 1983; Park and John, 2009). Bamboo also contains many secondary metabolites which can be used as precursors of many pharmaceutical industries (Sarangthem and Singh, 2003).

Bamboo shoot contain a number of phytosterol (Srivastava,1990; Sarangthem and Srivastava ,1997 ; 1998; Sarangthem and Singh,2002; Baiyi *et al*, 2009). But the available literatures are from a limited number of bamboo species. Furthermore, comprehensive phytosterol content of various bamboo shoots of different species of bamboo is not available. Hence,in this paper, the phytosterols content in bamboo shoots of twelve species (*Dendrocalamus brandisii* Kurz, *D. strictus* *D. giganteus* Munro, *D. flagellifer* Munro *D.hamiltonii* Nees & Arn.ex Munro, *D. sericeus* Munro De *Bambusa tulda* Roxb, *B. balcooa* Roxb. *B. nutans* Wall, *B. kingiana* Gamble, *B. Khasiana* Munro and *Cephalostachyum pergracile* Munro) were assessed for their phytosterols content in order to facilitate recommendations for utilization of the bamboo shoot as phytosterol resources.

Materials and methods

Sample collection

The emerging young fresh succulent bamboo shoots of *Dendrocalamus brandisii*

Kurz, *D. strictus* *D. giganteus* Munro, *D. flagellifer* Munro *D.hamiltonii* Nees & Arn.ex Munro, *D. sericeus* Munro De *Bambusa tulda* Roxb, *B. balcooa* Roxb. *B. nutans* Wall, *B. kingiana* Gamble, *B. khasiana* Munro and *Cephalostachyum pergracile* Munro were collected during peak sprouting season (May-August) from different district of Manipur, India.

Collection of these bamboo shoots were made in the afternoon and processed the same day. The outermost scale portions of the fresh succulent bamboo shoots and the inner soft delicate shoots which are edible were taken out and kept separately for the experiment. For differentiation of the portion of the succulent bamboo shoots, the shoot are divided into 4 portions i.e. apex top, middle, base portion and the culm sheath covering the soft shoots.

The allocation of theses apex, middle and base portion is based purely on simple measurement. 1/4th of the total length (from the base) of the shoot is considered as base. 1/3rd of the total (after removing the base) is taken as middle portion and the remaining is taken as the apex.

The outer portions of the shoots are removed after peeling off the cover culm sheath and the remaining portions are divided into apex, middle and base portion. These portions separately are then sliced and oven air dried in an oven at 50- 60°C. The dried bamboo shoot slices were grinded using a grinder and then again dried to minimise the moisture content prior to the weighing for the estimation of phytosterol.

Phytosterol estimation

The total phytosterol was estimated using the Liberman Burchard reaction (Katayama, 1974).

Table.1 Level of total phytosterols in fresh succulent shoot samples of different species of bamboo

Name of the species	Portion of the bamboo shoots	Concentration of total phytosterols (mg/100g dry wt.)
<i>Dendrocalamus brandisii</i>	Apex	276.6± 1.60
	Middle	234.0± 0.31
	Base	185.8± 7.6
	Culm sheath	61.8 ± 1.6
<i>Dendrocalamus strictus</i>	Apex	212.4±12.1
	Middle	187.0± 2.1
	Base	142.5±14.5
	Culm sheath	34.2± 14.6
<i>Dendrocalamus giganteus</i>	Apex	198.7± 1.3
	Middle	173.0± 1.8
	Base	155.0±71.9
	Culm sheath	109.5± 50.7
<i>Dendrocalamus flagellifer</i>	Apex	144.3± 15.8
	Middle	109.5± 2.6
	Base	88.0± 9.4
	Culm sheath	69.3± 3.0
<i>Dendrocalamus hamiltonii</i> .	Apex	293.8±16.1
	Middle	218.5± 6.6
	Base	187.3± 8.6
	Culm sheath	119.7±22.0
<i>Dendrocalamus sericeus</i>	Apex	266.0± 14.5
	Middle	180.8± 5.0
	Base	159.2± 13.7
	Culm sheath	85.8± 17.3
<i>Bambusa tulda</i>	Apex	190.0±15.7
	Middle	167.7± 3.3
	Base	76.5± 6.9
	Culm sheath	45.8± 2.5
<i>Bambusa balcooa</i> .	Apex	190.0±10.5
	Middle	180 ± 5.0

	Base	126.5± 3.9
	Culm sheath	60.0± 1.5
<i>Bambusa natans</i>	Apex	94.0± 7.4
	Middle	57.5± 4.4
	Base	48.3± 2.5
	Culm sheath	35.5± 1.0
<i>Bambusa kingiana</i>	Apex	222.0±10.8
	Middle	127.1± 12.0
	Base	101.8± 8.0
	Culm sheath	40.5 ± 8.5
<i>Bambusa khasiana</i>	Apex	289.0± 5.8
	Middle	240.3± 12.1
	Base	199.0± 3.5
	Culm sheath	153.5± 2.6
<i>Cephalostachyum pergracile</i>	Apex	215.0± 31.8
	Middle	193.1± 11.2
	Base	132.0± 26.5
	Culm sheath	67.7± 4.0

1 gram of the dried and powdered and sieved at 100mesh were used for extraction with 10 ml of the solvent (ethanol: acetone in the ratio of 1:1). The mixture is then centrifuged at 2000 rpm for 10 min and then 2ml of the supernatant is taken and allowed to get dried of the solvents in an air dried oven at 80°C and then 2 ml of chloroform is added and then allowed to dissolve properly. This 2 ml of the mixture is used for the estimation of total phytosterol in the sample. Liberman Burchard reagent is prepared by the addition of H₂SO₄ to Acetic Anhydride in the ratio of 1:30. The reagent is prepared for each test freshly and used within 10 minute. For the reaction to proceed, to the 2 ml of the mixture, 3ml of the reagent is added. The reaction mixture will give a characteristic green colour and the O.D is taken within 5-10 minute in a Spectrophotometer (Spectroquant) and recorded. The process is done in triplicate for each sample and the mean total

phytosterol is taken. The amount of phytosterol present in the sample was calculated from the standard curve prepared by using cholesterol as the standard.

Results and Discussion

The bamboo shoots of the different bamboo species shows a varying content of phytosterols . The highest concentration was obtained with *Dendrocalamus hamiltonii* apex portion of the bamboo shoot with 293.8 mg/100g dry wt. , the middle portion with 218.5 mg/100g dry wt. ,base portion with 187.3 mg/100g dry wt. and 119.7 mg/100g dry wt. in the culm sheath . The lowest content in phytosterols were observed with that of *Bambusa nutans* having 94.0 mg/100g dry wt. in the apex portion , 57.5 mg/100g dry wt. in the middle portion , base 48.3 mg/100g dry wt. and 35.5 mg/100g dry wt. as shown in table 1. The

concentration of total phytosterol in the parts of the bamboo shoots show a general trend with the top apex portion having the highest concentration and keeps on decreasing towards the base portion. This shows that the apex young meristematic tissue can be used for phytosterols extraction. The culm sheath cover of the shoot also show the presence of phytosterol but the content was much lower than the base of the bamboo shoot.

The current findings showed that bamboo shoots of *Dendrocalamus hamiltonii* has the highest content of phytosterol. These bamboo species can be further propagated and the use of its fresh bamboo as a food in the region can help in curbing the problem of high cholesterol in body (Patel and Thompson, 2006; Weingartner *et al.*, 2009). *Bambusa khasiana* which propagate very fast also shows high level of phytosterol. These phytosterol act as nutraceuticals and are precursors of many pharmaceutically active steroidal drugs (Ostlund *et al.*, 2003; Sarangthem and Singh, 2003). Hence it can be concluded that bamboo shoots may be promoted as health enhancing food due to its rich phytosterol components which can be of high value to the pharma industries eyeing on potent nutraceuticals.

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