

The Healing Touch of Bamboo

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Bamboo

Bamboo the “Miracle Grass” has fascinated all since ancient times

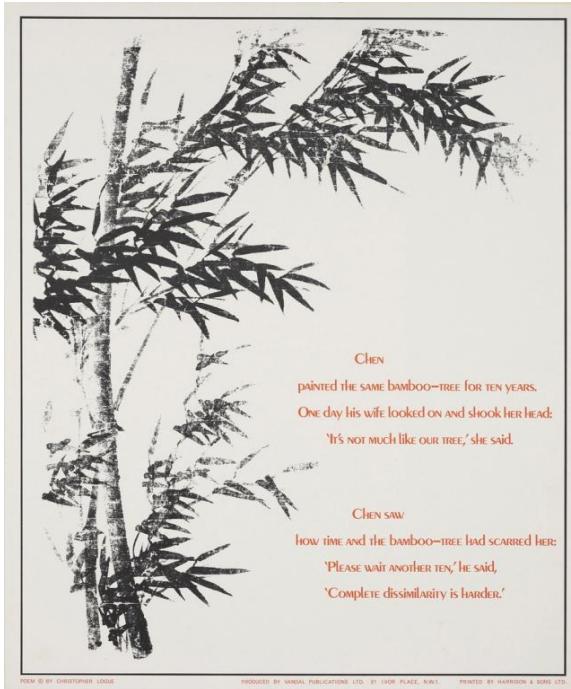
Symbolic of constancy, integrity and purity, they are a versatile, organic and renewable raw material used for a variety of purposes

A hardy, adaptive and resilient plant, it is the first plant which emerged after the atomic bomb devastation in Hiroshima and Nagasaki



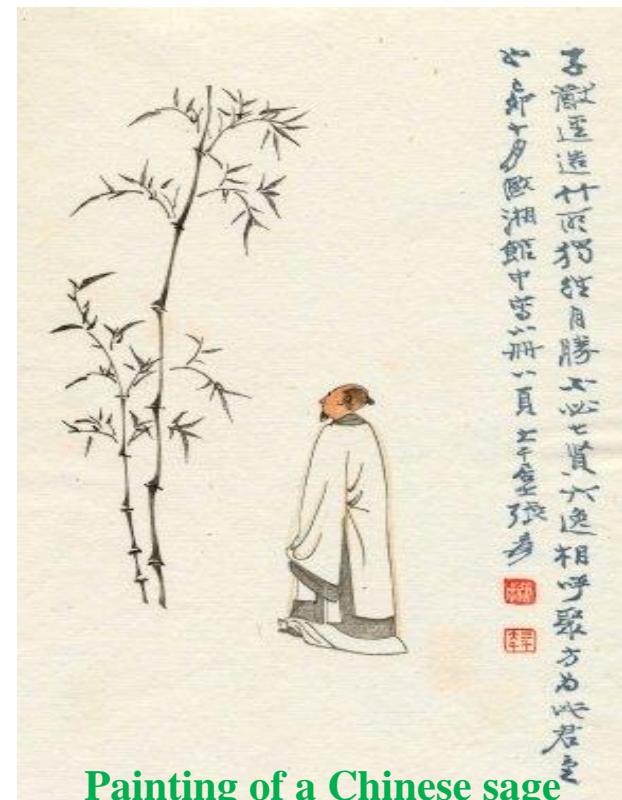
East Asian civilization is also called “bamboo civilization” due to deep involvement of bamboo in every sphere of life of the people





Subject and inspiration of countless poets, artistic endeavors and musical masterpieces

Folklores, stories, dramas and cultural activities of many regions depict the use of bamboo as food by animals and humans.



Painting of a Chinese sage contemplating bamboo

India – Bamboo is equated to



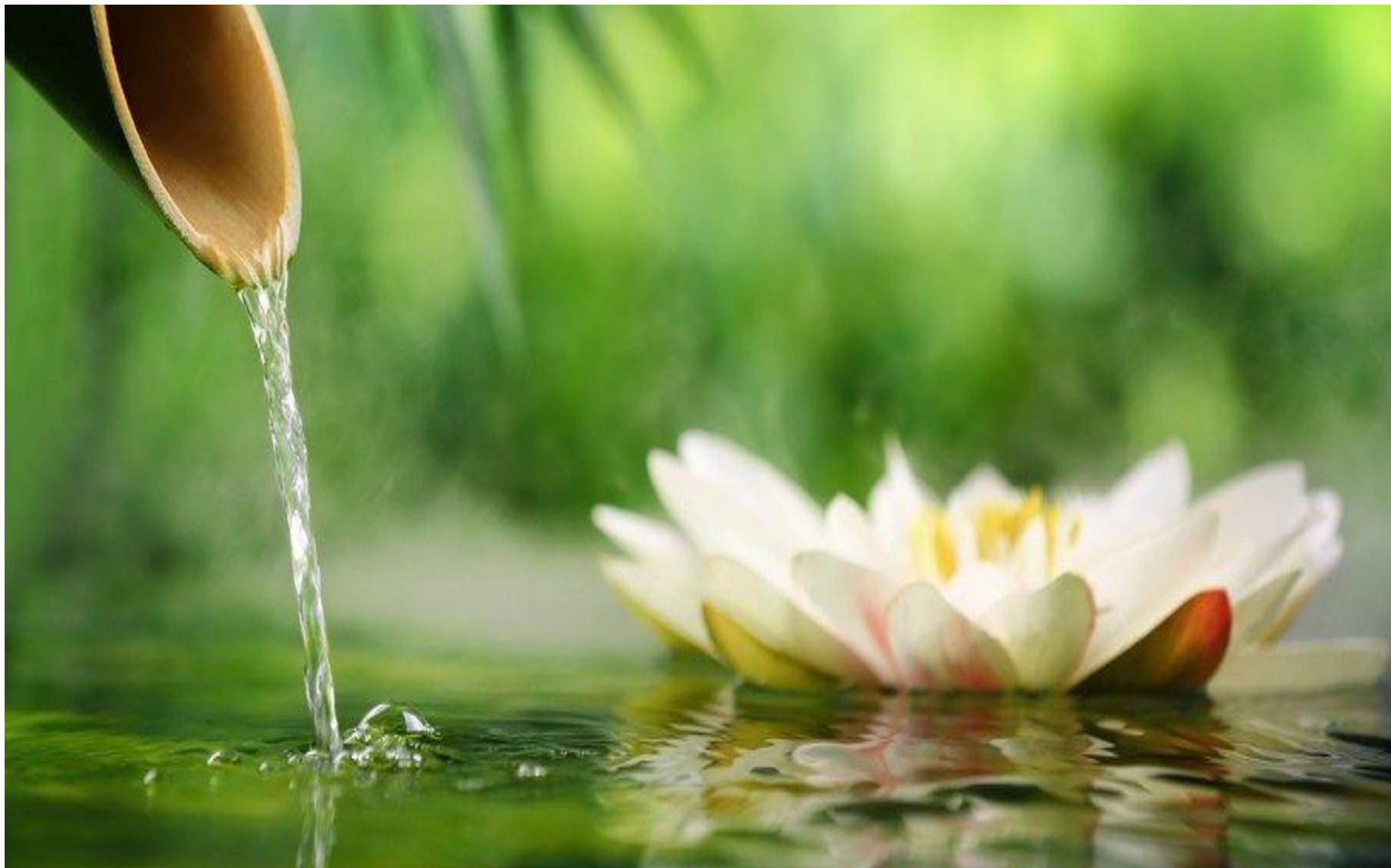
Kalpavriksha

(The Divine Tree)

“Rig Veda” (5000 BC) where Rishi prays to God Indra:

**“BESTOW UPON US A HUNDRED BAMBOO
CLUMPS”**

Spiritual Healing of Bamboo





Enhances spiritual development

Rustling of the leaves in the wind
is magical and gives a very
soothing feeling

Clears negative energy and
brightens the mood

It bolsters self-worth and self-
esteem

Combines upright integrity with
accommodating flexibility

Has the perfect balance of grace
and strength

Bamboo grooves are considered
a favorite place for meditation

Bamboo represents one of the four seasons



Plum (Winter)



Orchid (Spring)



Bamboo (Summer)



Chrysanthemum (Autumn)



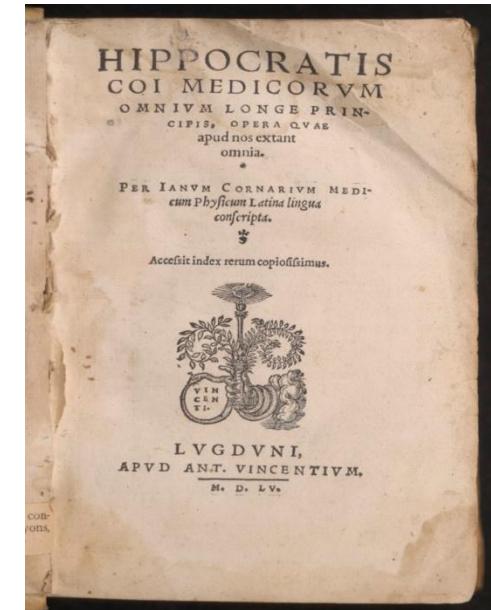
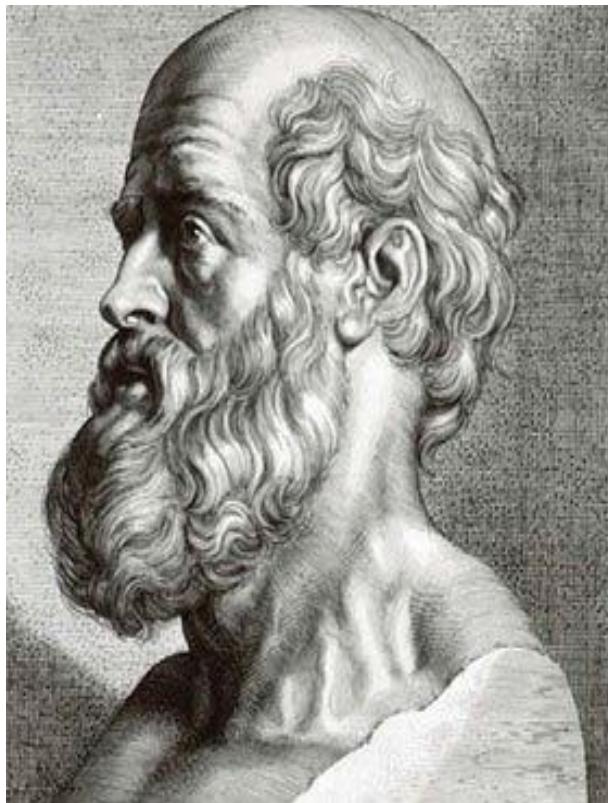
Japanese paintings of Bamboo with plum and Orchid



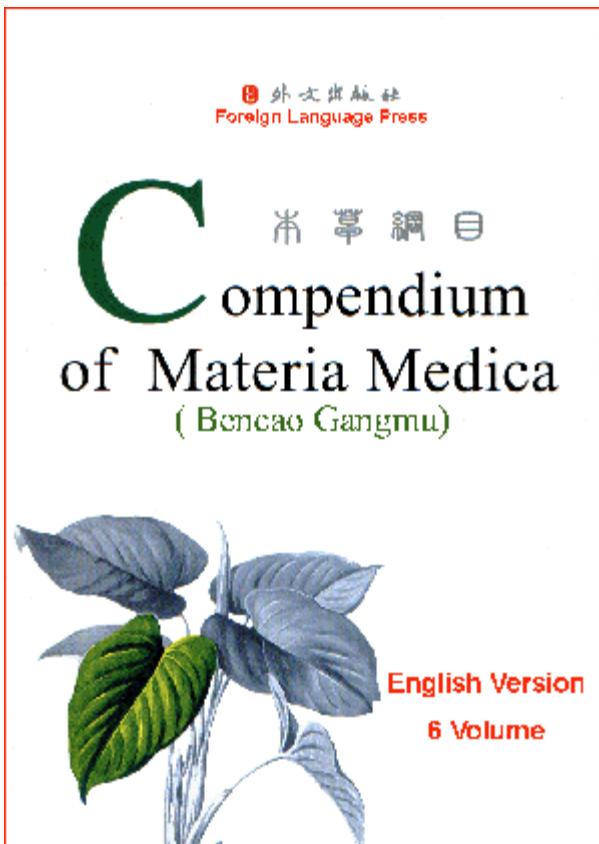
Bamboo as Food and Medicine

“Let thy food be thy medicine, and
let thy medicine be thy food.”

Hippocrates, father of medicine



Bamboo plays a significant role in traditional Asian medicine and therapeutic applications being mentioned around 500 AD



“It's slightly cold, sweet, nontoxic, and it quenches thirst, benefits the liquid circulatory system and can be served as a daily dish”

“Ben Chao Qui Zheng”

“Ben Jing Feng Yuan”

“Yao Pin Hua Yi”

“Jing Yue”,

Promote peristalsis of the

of the stomach and intestine,

Digestion

Relieve hypertension

Prevent cardiovascular

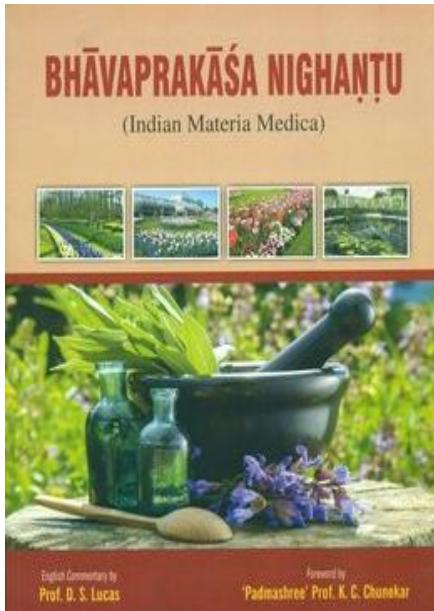
disease and cancer

Promote the excretion of

urine

Ming Dynasty (1368 to 1644)

Ayurveda – Traditional system of Indian medicine



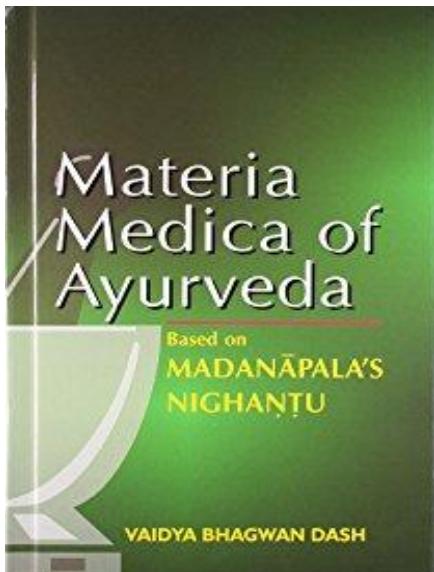
Ancient Ayurvedic, Indo-Persian and Tibetan system of Medicine recommend bamboo and its products for treatment of various ailments

“Bamboo by nature is laxative, frigid seminal curative, palatable, bladder purifier and full of astringent juice. It splits cough, subsides bile and cures leprosy, flux, wounds and swellings”

Bamboo medicinal applications were first mentioned in India around 10,000 years

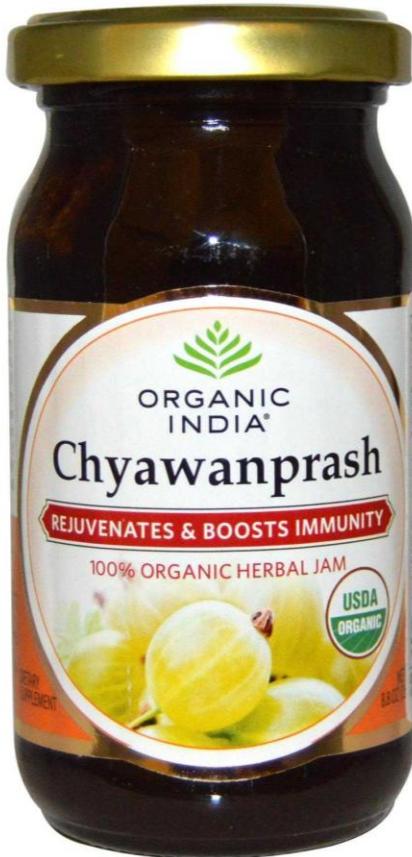
“Tabasheer” “Banslochan” “Bamboo mana” has been used since ancient times as a cooling tonic and aphrodisiac and in asthma, cough and other debilitating diseases.

It is a siliceous secretion found in the culms of bamboos.



Chyawanprash, a health tonic prepared from a number of herbs, including **bamboo manna** after Rishi, or a sage by the name of Chyawan, who was the first person to prepare this tonic.

He regained his youthfulness and vitality with the use of this herbal tonic.



Rejuvenates all tissues in the body*

Supports overall strength and energy*

Promotes muscle mass*

Helps in supporting a healthy immune response and youthfulness*

Supports healthy function of the heart and respiratory systems*

Imparts youth, beauty and longevity.

Kindles agni (digestive fire)*

Traditional uses of Bamboo as Medicine

Chinese medicine – Leaves are used as a component to reduce the energy of “fire” (inflammation) and treat hypertension, arteriosclerosis and cardiovascular disease

Fermented bamboo shoot mixed with crushed leaves of *Allium porrum* Linn was used to cure influenza.

The paste made can also be applied to treat fungal infection

Decoction of tender shoots of *Bambusa nutans* is applied on wounds and poisonous bites.

The shoots are boiled in water and the soup is taken in cases of stomach ulcer.

Tender shoots of *Bambusa tulda* are boiled in water and the soup is taken in cases of poxes and other skin diseases and the paste is applied on poisonous bites and injuries

The juice of *Dendrocalamus strictus* has been reported to be used as an anti-inflammatory agent near joints.

It is also used as astringent and eardrops, and in cooling and healing of cuts

Sap of bamboo shoots has been found to contain hydrocyanic acid leading to antiseptic and larvicidal properties.

Bamboo shoots are used to ease labor and the expulsion of the placenta by inducing uterine contractions.

A poultice of the shoots is often used for cleaning wounds and healing infections

Bamboo in Ayurveda, Tibetan and Unani medicines

Name	Constituents/Ingredients	Health benefits
Tabasheer	Bamboo silica found in the hollow internodes. Tabasheer may be chalky, translucent, or transparent, mainly composed of silicic acid.	Stimulant, astringent, febrifuge, relieving asthma, cough, cooling tonic, antispasmodic and aphrodisiac.
Sitopaladi Churna	Tabasheer and small amounts of pepper, cardamom, and cinnamon in a base of sugar.	Common cold, sore throat, sinus congestion, tuberculosis, coughs and other lung diseases.

Bamboo in Chinese traditional medicine

Chenjin Wan	Bamboo shaving and Tabasheer, arisaema, citrus, salvia, silkworm, chrysanthemum, apricot seed, ophiopogon, biota, fritillaria, ginger	For phlegm mist obstructing the orifices yielding symptoms of insomnia, restlessness, and blurred vision.
Gualou Zhishi Tang	Bamboo shaving and sap, fritillaria, platycodon, trichosanthes seed, chih-shih, citrus, saussurea, licorice, scute, gardenia, etc.	Reducing thick phlegm that is difficult to expectorate.
Jupi Zhuru Tang	Bamboo shavings, citrus, pinellia, licorice	Relieving phlegm
Qinghuo Ditan Tang	Bamboo shaving and tabasheer, arisaema, citrus, salvia, silkworm, chrysanthemum, apricot seed, ophiopogon, biota, fritillaria, ginger	Relieving phlegm insomnia, restlessness, and blurred vision
Qinggong Tang	Bamboo leaf, ophiopogon, scrophularia, rhino horn, forsythia, lotus plumule	Fever with dryness, penetrating to the pericardium, with delirium

Benefits of Warm Bamboo Massage



Relieves sore muscle tension

Increases Circulation

Flushes body of metabolic wastes (i.e. lactic acid) for faster healing time and detoxification

Decreases muscle spasms

Breaks up tissue adhesions

Releases endorphines to promote relaxation and pain reduction

Bamboo Spa





Bamboo leaf extract

Bamboo shoots: a nutritious healthy vegetable



A source of both food and medicine

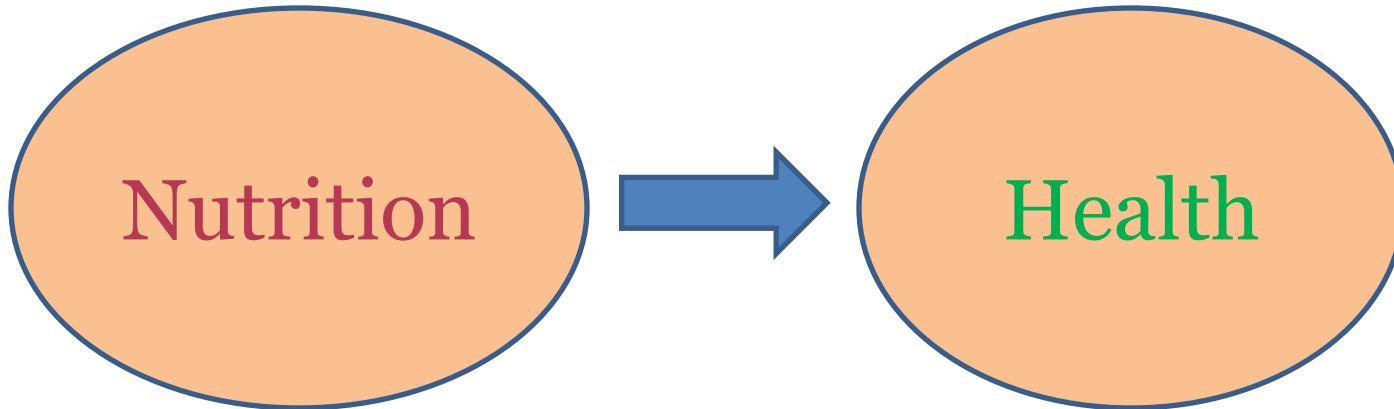
Not only delicious but rich in nutrients and health promoting phytochemicals

Low in fat and sugars

“King of Forest Vegetables.”

Treasure dish - Tang Dynasty (618 to 907)
“there is no banquet without bamboo.”

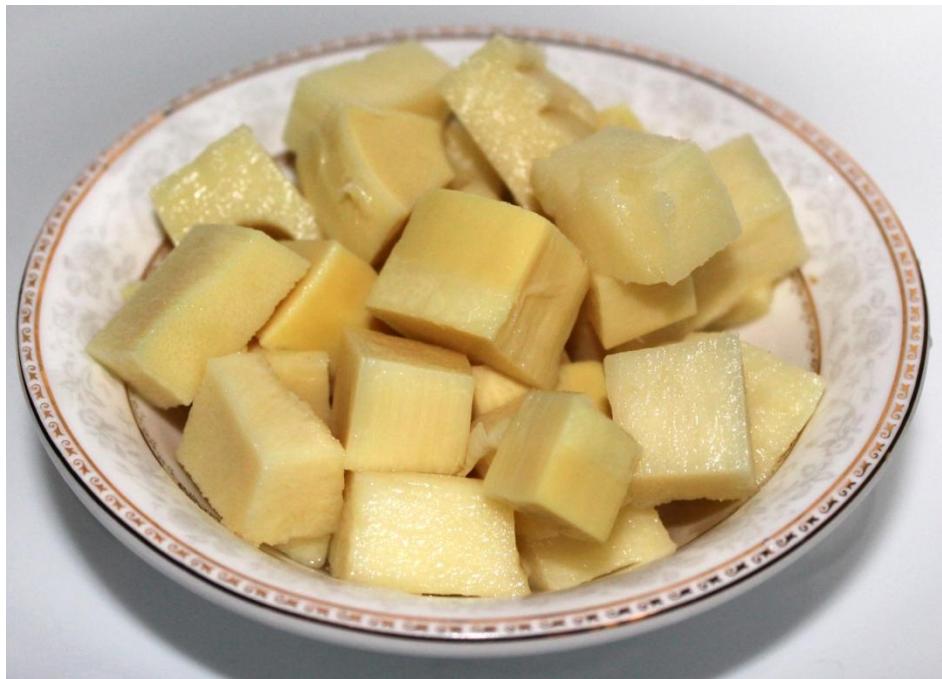
No longer “poor man’s timber” but a “rich man’s delicacy.”



Obesity, diabetes, cardiovascular diseases and some forms of cancer are major contributions to the global burden of diseases

Food has a direct and substantial impact on health

Fresh Shoots





Shoots gaining importance as a health food

“Poor man’s timber”



“A rich man’s delicacy”

Delicacy in up-scale markets, specialty restaurants and five star hotels though in India, it is consumed as a vegetable by rural people,



Bamboo shoots consumption is concentrated to South east Asia where it is a popular ingredient in their cuisine

Shoots are a part of the traditional cuisine of the North Eastern states of India

Nutritive value of bamboo shoots

Juvenile shoots are

- ❖ Rich in proteins, carbohydrates, amino acids, minerals, vitamins
- ❖ High content of minerals like K, P, Mg, Na, Fe, Ca and Se.
- ❖ Rich in dietary fibers
- ❖ Low in fat and sugar.



Fig.1. a. freshly harvested shoots; b. peeled shoots; c. Sliced shoots.

Comparative account of various nutrients (g/100 g) present in fresh bamboo shoots and some common vegetables

Plant	Amino acids	Proteins	Carbohydrates	Fat	Vitamin C (mg/100 g)	Vitamin E (mg/100g)	Dietary Fibre
<i>Bambusa tulda</i>	3.65	3.69	6.92	0.48	1.42	0.61	3.97
<i>D. asper</i>	3.12	3.59	4.90	0.40	3.20	0.91	3.54
<i>Dendrocalamus hamiltonii</i>	3.18	3.72	5.5	0.41	2.45	0.71	3.90

SOME COMMON VEGETABLES

Cauliflower	0.4	5.9	7.6	0.4	2.5	46.4	2.0
Cabbage	0.3	1.8	5.6	0.1	2.6	32.2	1.0
Carrot	0.2	0.9	10.6	0.2	1.2	3.0	1.2
Radish	0.1	0.7	3.4	0.1	1.6	15.0	0.6
Spinach	0.3	2.0	2.9	0.7	0.6	28.1	2.0
Potato	0.2	1.6	22.6	0.1	0.4	19.7	0.4

Traditional dishes with bamboo shoots



Bamboo Shoot Fortified Food Items



One of World's most expensive tea

Panda Dung Tea

\$ 70,000 per kg,
\$ 200 for a cup of tea!!

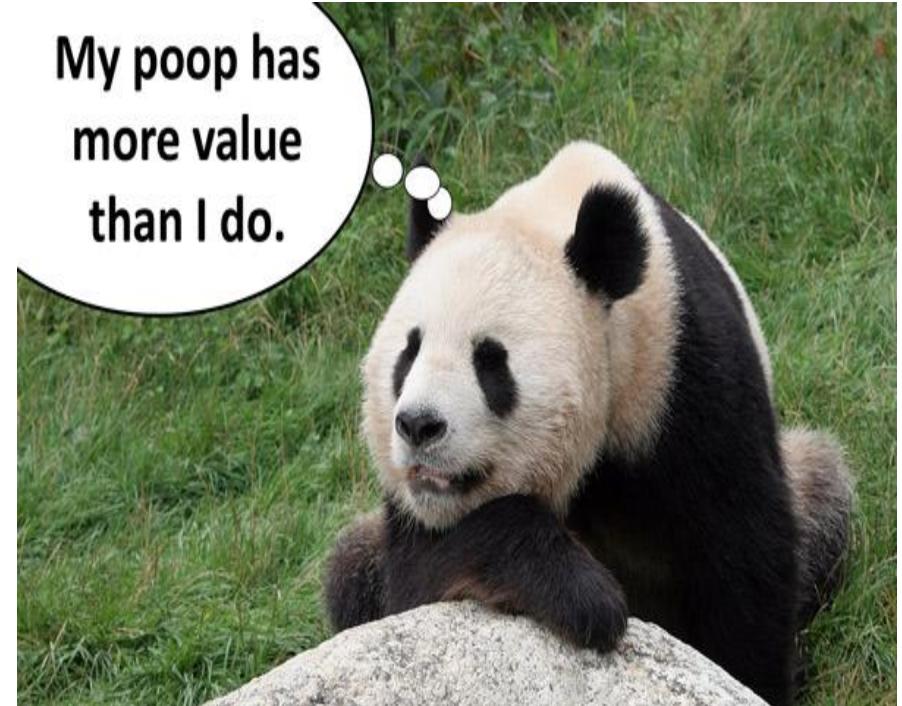
Ya'an Sichuan Province of China

Fertilized by the dung of Pandas who feed only on bamboos

The tea is considered healthy as Pandas absorb only 30% of the nutrients

Excrement is rich in fibers and nutrients and it has anti-cancerous property

My poop has more value than I do.



INVENTOR: An Yanshi, a panda enthusiast from Sichuan and a lecturer at Sichuan University



Natural Bamboo Wine

A forest of bambrew!

Chinese villagers use new way to make alcohol - by leaving liquor to purify inside BAMBOO

A bamboo forest at Baishuijian village outside Lin'an city, eastern China, is being used to brew alcohol

Workers at the site inject primary liquid of liquor into bamboo shoot and leave it inside for a year and half

Customers can purchase the brewed liquor or wine for 500 yuan (£56) per stick,

Bamboo wine

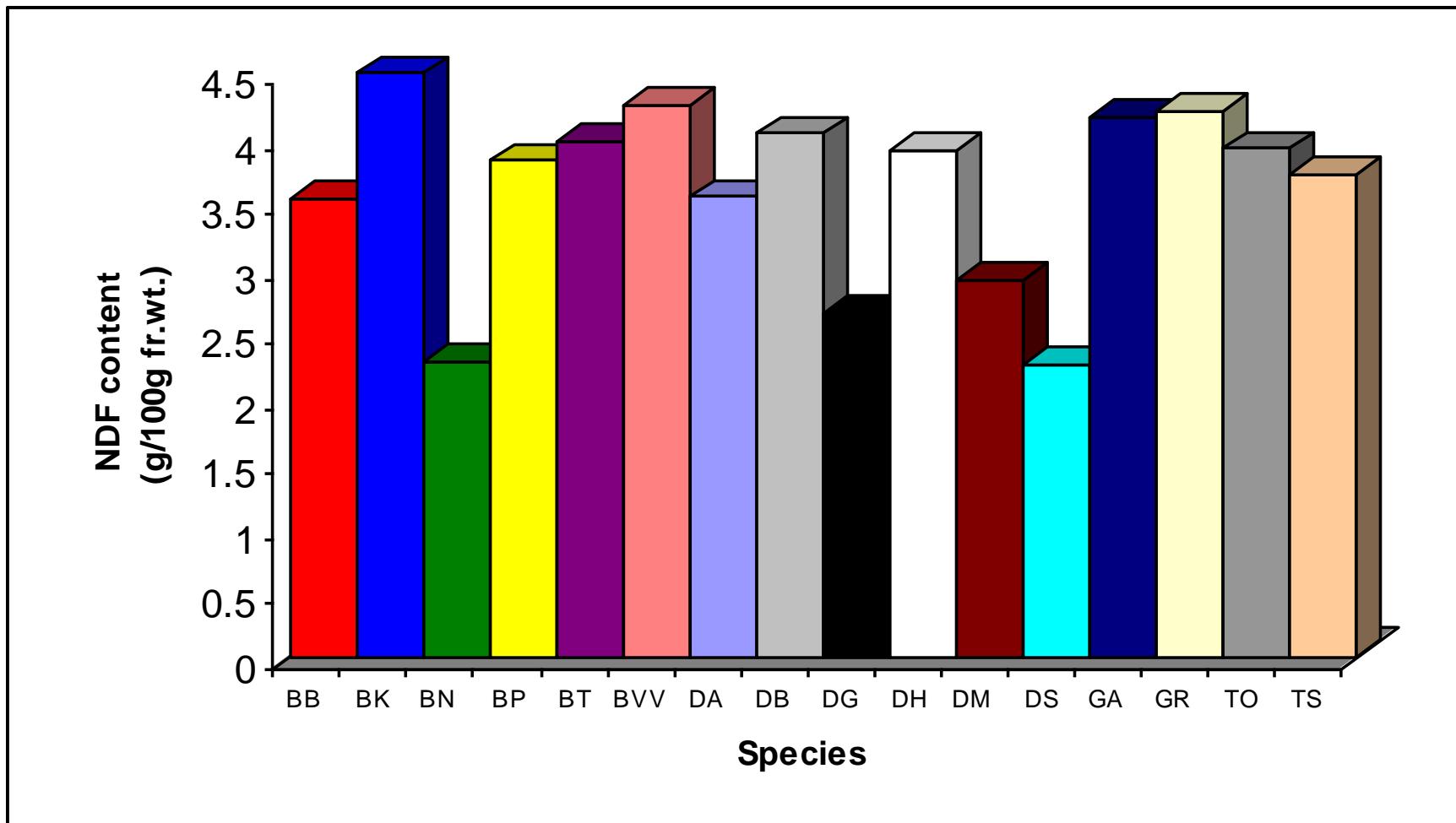


Collecting the matured alcohol from a small hole in the bamboo culm

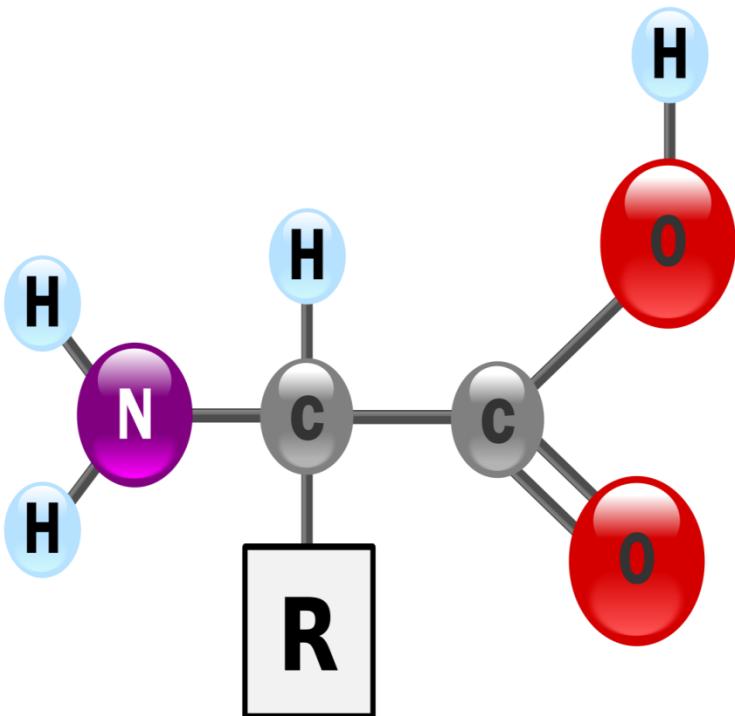
Tapping the bamboo to check that the alcohol is ready for sale



Dietary fiber content in juvenile shoots



Amino acids



Synthesis of proteins

Precursors of secondary metabolites

Types of amino acids

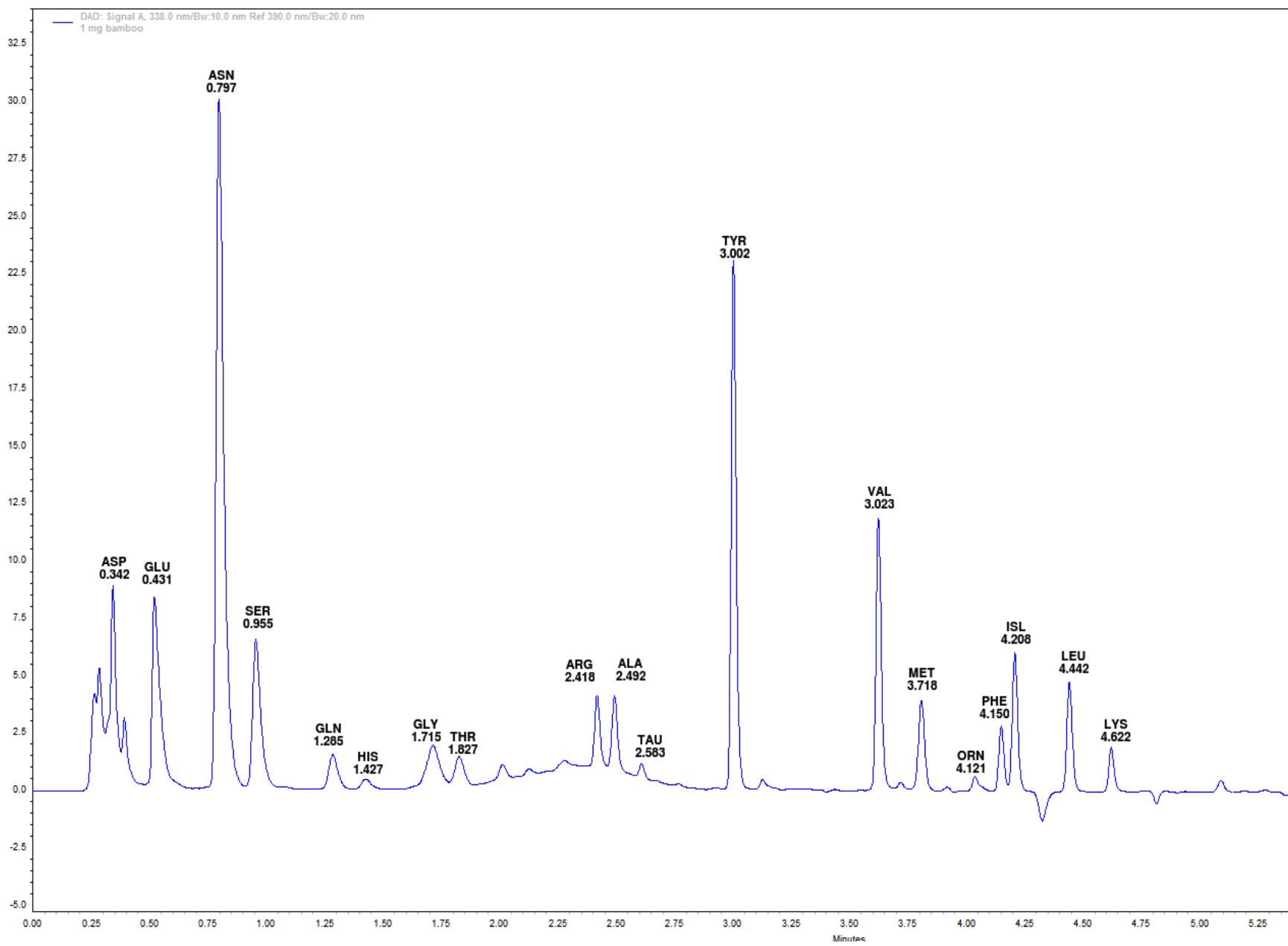
Essential and non-essential amino acids

- Cannot be produced by body
- Must be obtained from food

- Can be produced by the body
- Not necessary to obtain from food

Amino acid content (ug/mg d.w) in edible shoots of five bamboo species

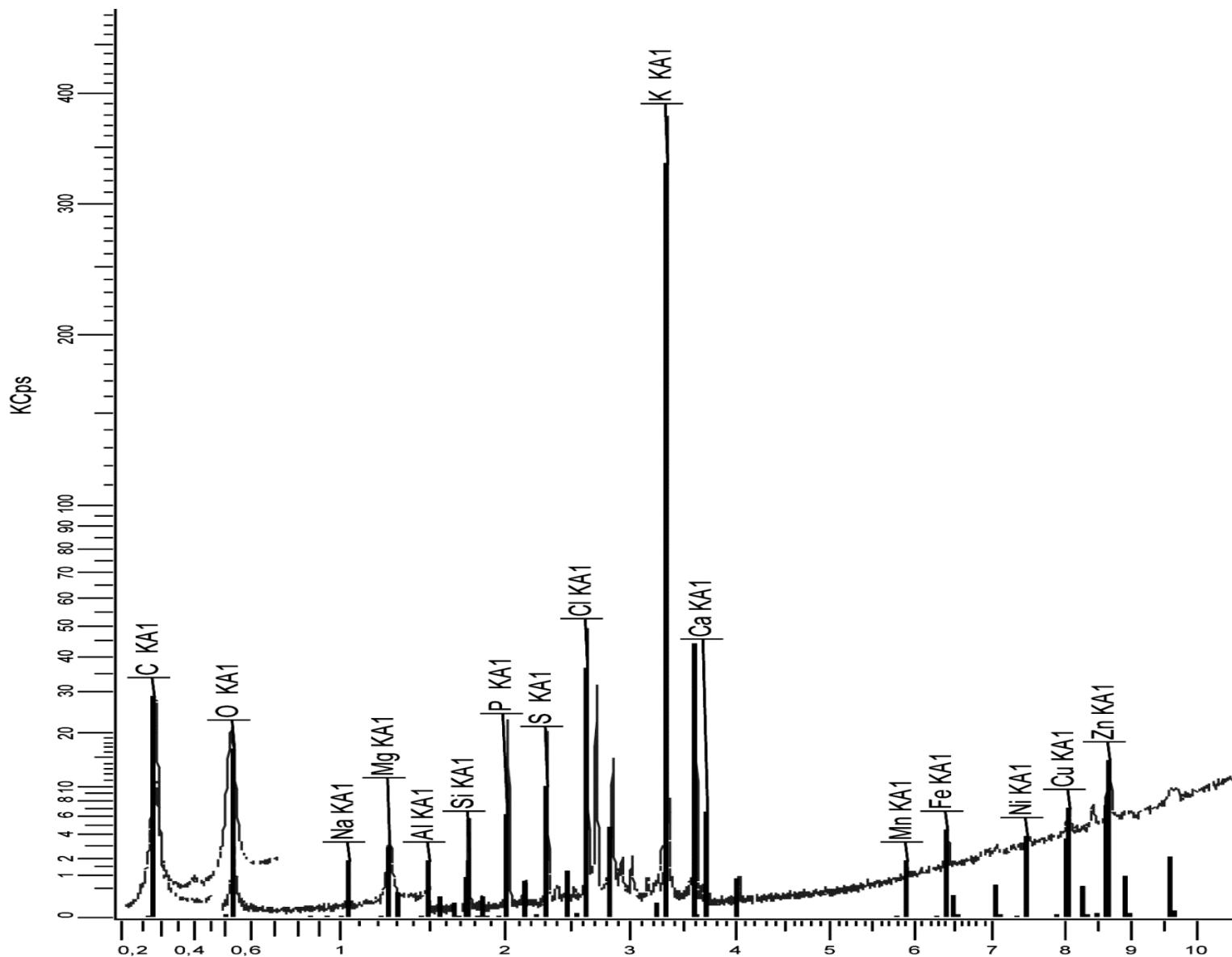
Amino acids	<i>Bambusa balcooa</i>	<i>Dendrocalamus giganteus</i>	<i>D.hamiltonii</i>	<i>D. membranaceus</i>	<i>Phyllostachys mannii</i>
Aspartic acid	6.74	5.69	7.53	7.86	16.28
Glutamic acid	2.49	3.39	3.83	4.06	10.81
Asparagine	12.81	24.73	36.43	47.11	111.04
Serine	1.97	4.29	2.62	7.82	9.57
Glutamine	3.53	5.05	9.72	3.40	5.48
Histidine	1.63	3.66	2.41	1.77	4.21
Glycine	4.84	3.85	3.68	3.95	3.62
Threonine	0.46	2.74	1.28	-	8.91
Arginine	7.39	2.50	2.67	1.64	14.70
Alanine	4.49	5.30	6.66	4.71	10.22
Taurine	2.33	7.77	1.33	1.42	9.77
Tyrosine	29.41	38.25	33.81	74.64	41.21
Valine	2.51	9.60	2.89	3.78	21.11
Methionine	5.48	9.02	5.01	4.58	6.39
Phenylalanine	1.98	3.63	2.74	4.03	7.54
Isoleucine	1.65	2.45	2.64	2.26	7.80
Ornithine	1.68	3.46	1.98	2.68	1.05
Leucine	2.77	4.36	1.59	2.97	12.84
Lysine	1.71	2.11	1.05	1.50	3.96



Amino acids in Bamboo shoots (HPLC chromatograph)

MINERAL ELEMENTS

X-ray fluorescence spectra of fresh shoots of *B. balcooa*



Silica in bamboo shoot



Silica

Silicon in the form of silica, or silicon dioxide (SiO_2), is an essential mineral mainly for bone formation and maintenance

It is also vital for healthy skin, fingernails, hair, ligaments, tendons

Dietary sources of bioavailable silicon include whole grains, cereals, beer, and some vegetables such as green beans and bamboo.

It is used as a common food additive

Silica content in Bamboo and other Plants

Sl. No.	Plant	Silica content (mg/100 g)
1.	High bran cereals	10.17
2.	Banana	5.44
3.	Green beans	2.44
4.	Carrot	2.26
5.	Brown rice	2.07
6.	White rice	1.24

Sl. No.	Bamboo species	Silica content (mg/100 g)
1.	<i>Dendrocalamus hamiltonii</i>	190
2.	<i>D. sikkimensis</i>	160
3.	<i>Bambusa nutans</i>	160
4.	<i>B.tulda</i>	160
5.	<i>D. membranaceous</i>	150
6.	<i>D. latiflorus</i>	140
5.	<i>B. bambos</i>	130
6.	<i>D. giganteus</i>	120
7.	<i>B. balcooa</i>	110
8.	<i>Phyllostachys manii</i>	70

Selenium



Essential micronutrient for several metabolic pathways

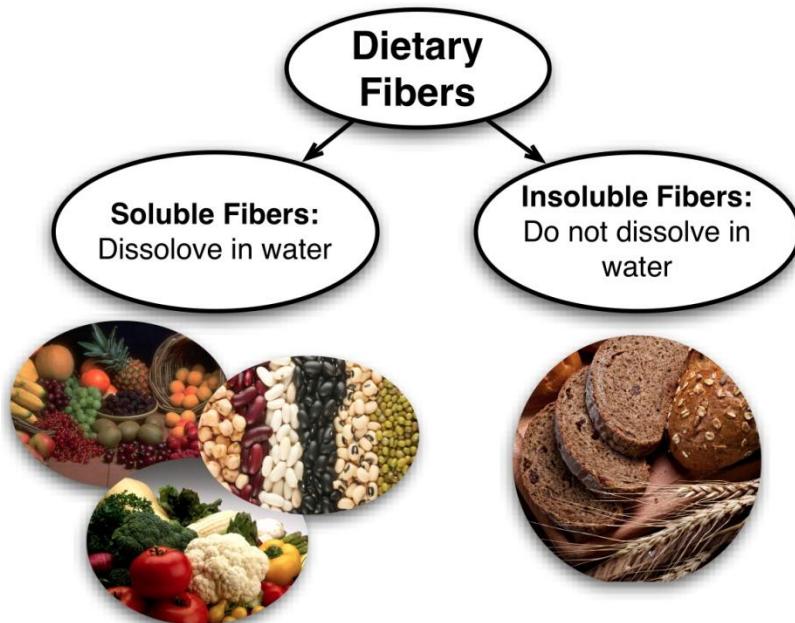
- **Thyroid hormone metabolism**
- **Antioxidant defense system**
- **Immune function**

Protective effects against

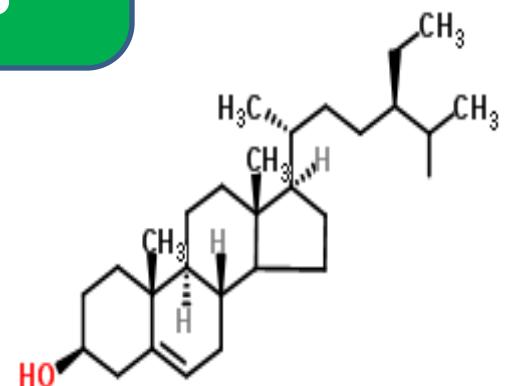
- **Prostate, colon and lung cancer**
- **Cardiovascular disease**
- **Asthma**



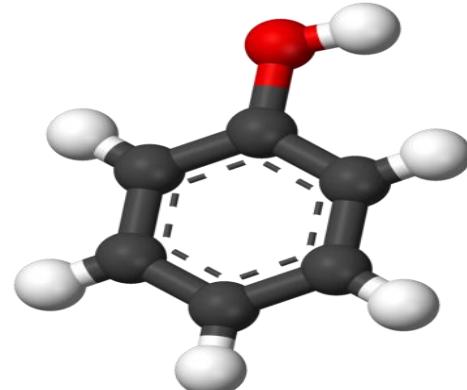
Health Promoting Bioactive compounds in Bamboos



Dietary fibers

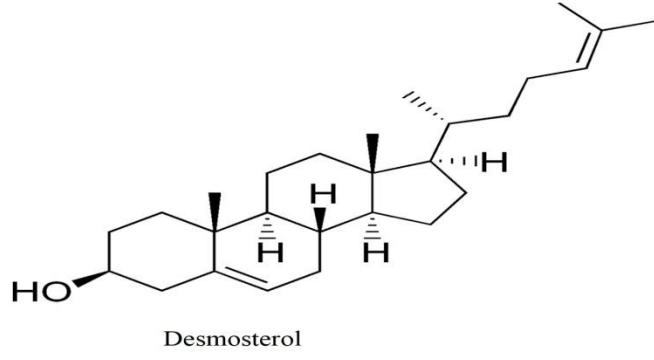
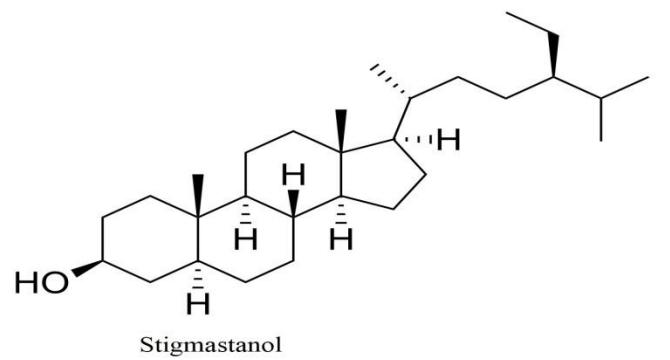
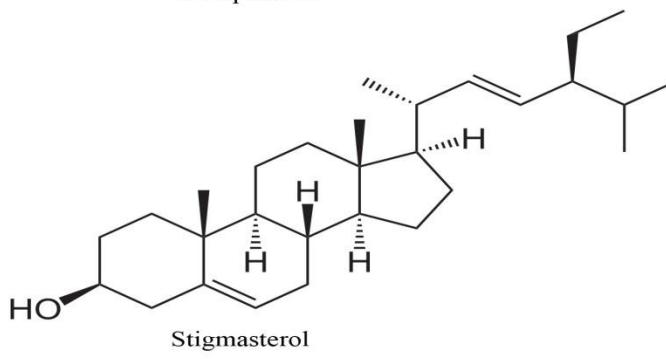
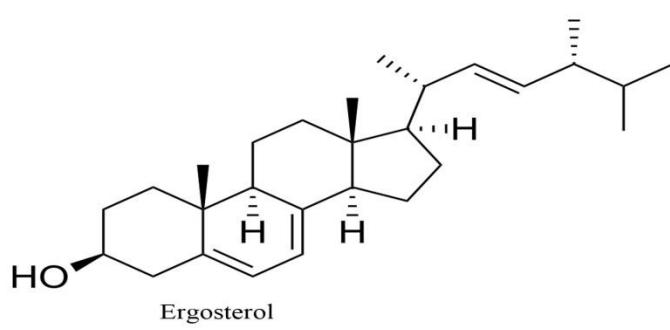
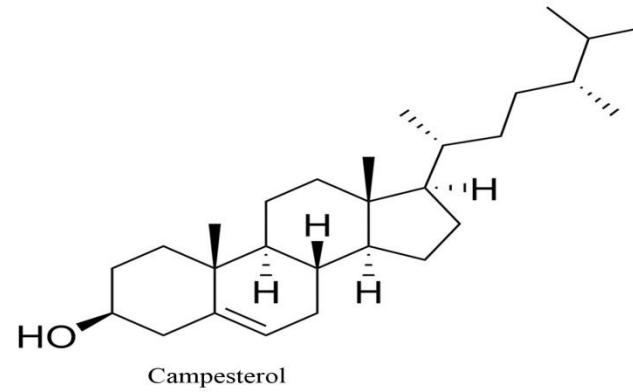
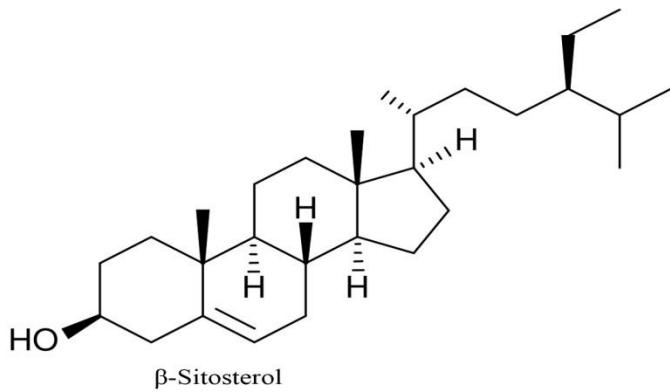


Phytosterols



Phenols

Phytosterols in Bamboo Shoots



Antioxidants



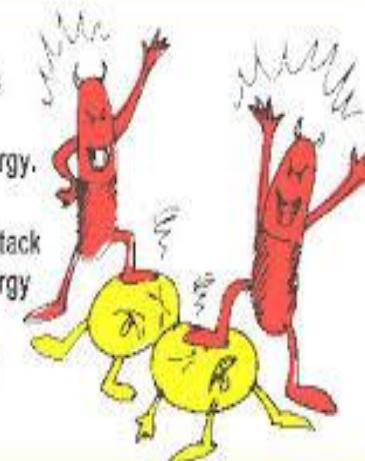
Substance that neutralizes free radicals or their actions

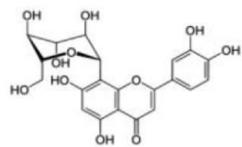
Decreases the adverse effects of reactive oxygen species (ROS)

Dietary antioxidants in shoots are vitamin C, vitamin E, and phenols

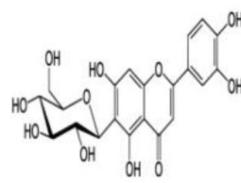
What are Free radicals ?

- Free radicals are like robbers which are deficient in energy.
- Free radicals attack and snatch energy from the other cells to satisfy themselves.

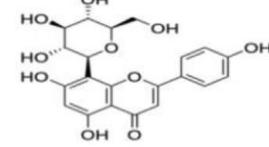




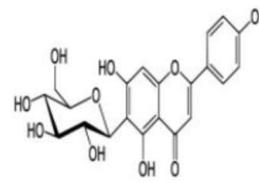
Orientin



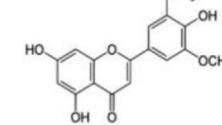
Isoorientin



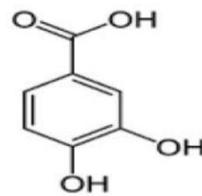
Vitexin



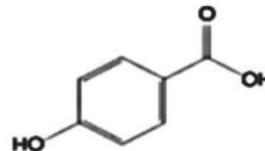
Homovitexin



Tricin

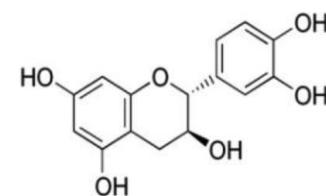


Protocatechuic acid

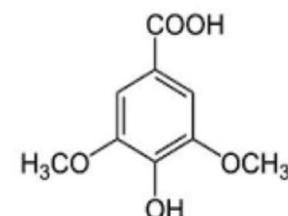


p-Hydroxybenzoic acid

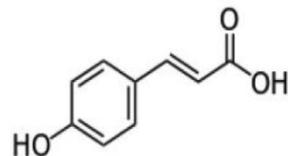
Flavanoids



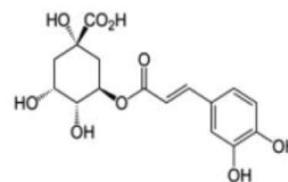
Catechin



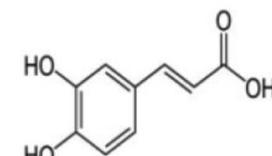
Syringic acid



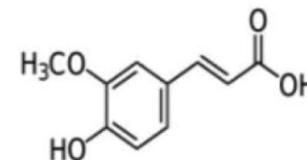
p-coumaric acid



Chlorogenic acid



Caffeic acid



Ferulic acid

Phenols

Phenolic compounds in Bamboo shoots

Exhibit numerous positive effects beneficial to health

- Anti-oxidant,
- Anti-inflammatory,
- Anti-allergic,
- Antimicrobial,
- Cardioprotective properties

Antioxidants – Scavenging free radicals, quenching of ROS and inhibition of oxidative enzymes.

Anti-diabetic properties

*Sasa borealis, Phyllostachys edulis,
Bambusa vulgaris, Pseudosasa japonica*

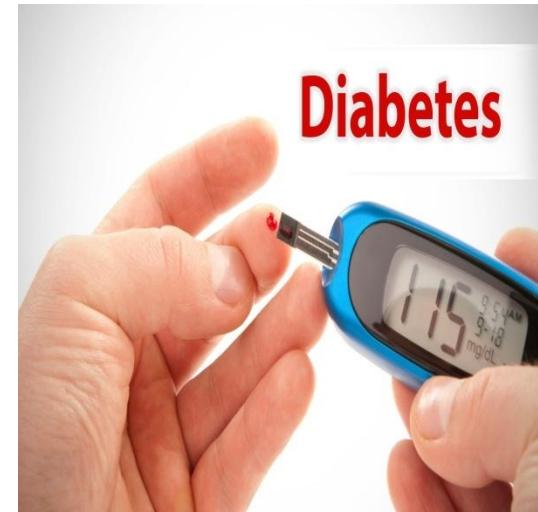
Ko et al 2006, Yang et al 2010, Nam et al 2013

Exhibit anti-hyperglycemic and anti diabetic activities by increasing insulin secretion

The extract significantly reduced blood glucose and triglyceride levels in streptozotocin (STZ) induced diabetic mice.

AMP-activated protein kinase (AMPK) was activated in both skeletal muscle and liver cells and increased insulin sensitivity

When meat in hamburger patties was substituted by *S. borealis* leaf extracts, plasma glucose was significantly reduced



Anticancer effects

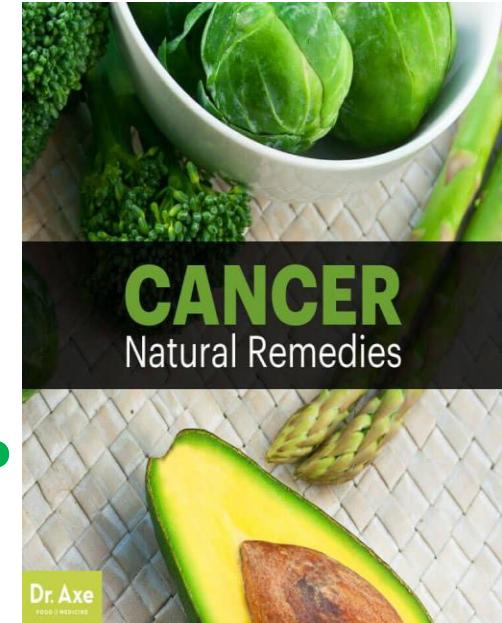
*Phyllostachys pubescens, Sasa sinensis
S.borealis* (Hiromichi, 2007, Patil et al 2017)

Alcohol extracted prepared from moso bamboo has an excellent antitumor effect

Mice with malignant sarcoma cells were fed with the extract for 25 days

Tumor growth was suppressed

If a health food comprising such extract of bamboo is orally consumed on a regular basis, the progression of malignant tumors may be prevented or limited



Anti-fatigue properties

B. tuldaoides Munro, *Phylostachys nigra* var *hermonis*, *Sasa borealis*

Extract from bamboo shavings and leaf extract was tested on mice

Body weight, swimming and climbing test and oxidative metabolism

Accumulation of plasma lactate was delayed and fat utilization was increased

Metabolic capacity was increased through the upregulation of energy generating genes



Anti-obesity

Sasa borealis (Yang et al 2010)

Decreased body weight and adipose tissue



S. quelpaertensis (Kang et al 2012)

Decreased the body weight, adipose tissue weight, serum cholesterol

Anti-obesity effect of extract is mediated by the activation of AMP-activated protein kinase (AMPK) in adipose tissue

B. textilis (Liu et al. 2016)

Decreased the levels of Total cholesterol (TC), Triglycerides (TG) and Low density lipoprotein (LDL) in the serum and effectively increase serum High Density Lipoprotein (HDL) concentration

Anti-microbial

Traditionally, culm sheaths have been used for packaging foods such as rice balls, sushi and meat in Japan

In India, young shoots and seeds are used as food and medicine

Phyllostachys pubescens

(Tanaka et al 2010), Fujimura (2005)

- i) 2,6-Dimethoxy-p-benzoquinone
- ii) Pp-AMP1 and Pp-AMP2

Aspergillus niger, Bacillus subtilis, Escherichia coli, Staphylococcus aureus, Pseudomonas aeruginosa, Enterococcus faecalis, Fusarium oxysporum



Prevention of Cardiovascular diseases

Bamboo shoot is known to prevent hypertension

Park and Jhon (2009)

Studied effect of bamboo shoot consumption on lipid profile, hepatic function and blood glucose in healthy young women

TC, LDL decreased but HDL were not affected

Lu et al (2010) investigated the hypolipidemic effect of Bamboo shoot oil in Sprague Dawley rats

TC, TG, LDL, atherogenic index in serum decreased

Liu et al (2012, 2013) evaluated cardiovascular protective functions of bamboo Shoot on hypersensitive rats

TC, TG LDL and MDA level was decreased



In- vivo antioxidant studies



BALB/c Mice

Bamboo shoot forms used for experiments



Fresh shoots
(Group II)



Boiled
(Group V)



Brine treated
(Group IV)

Fermented
(Group III)

Effect of fresh bamboo shoot extract on body and organ weight of Balb/c mice

Weight (g)	Control		FBSE (mg/kg bw.) treated group					
			400		800		1600	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Initial body weight	32	0.58	36	0.77	28	0.51	37	0.39
First week	36	1.53	35	0.36	28	0.23	36	1.22
Second week	37	0.67	35	1.78	29	1.22	36	0.78
Third week	36	1.00	34	1.45	29	1.09	37	0.55
Fourth week	36	0.89	34	0.81	30	1.48	39	0.19
Liver weight	1.27	0.27	1.62	0.17	1.39	0.29	1.93	0.22
Kidney weight	0.300	0.082	0.287	0.067	0.258	0.039	0.291	0.071

Values are expressed as mean \pm SD (N = 5)

Effect of fresh and processed shoot extract on glucose, lipid profile and lipid peroxidation level

Parameter	Group I		Group II		Group III		Group IV		Group V	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Glucose (mg/dl)	68	2.92	76	2.35	107	2.24	79	3.85	84	2.54
Lipid profile (mg/dl)										
Total cholesterol	118	3.67	106	4.25	82	3.22	100	1.13	97	2.23
HDL	90	0.94	94	0.53	97	1.13	93	1.33	91	0.61
LDL	21	3.44	16	1.52	8	0.74	13	2.84	10	2.73
Triglycerides	228	0.81	131	1.35	119	1.87	211	3.84	176	1.45
MDA (nmoles /min/mg protein)	3.19	0.12	0.897	0.06	2.63	0.11	1.09	0.21	1.56	0.22

Values are expressed as mean \pm SD (N = 5);

Group I: Control, Group II: Fresh shoots; Group III: Fermented shoots;

Group IV: Brine treated shoots; Group V: Boiled shoots

Effect of fresh and processed shoot extract on lipid profile and lipid peroxidation level

Parameter	Group I		Group II		Group III		Group IV		Group V	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Lipid profile (mg/dl)										
Total cholesterol	118	3.67	106	4.25	82	3.22	100	1.13	97	2.23
HDL	90	0.94	94	0.53	97	1.13	93	1.33	91	0.61
LDL	21	3.44	16	1.52	8	0.74	13	2.84	10	2.73
Triglycerides	228	0.81	131	1.35	119	1.87	211	3.84	176	1.45
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Values are expressed as mean \pm SD (N = 5);

Group I: Control, Group II: Fresh shoots; Group III: Fermented shoots;

Group IV: Brine treated shoots; Group V: Boiled shoots

Effect of fresh and processed shoots extract on the liver functions in Balb/c mice

Parameter	Group I		Group II		Group III		Group IV		Group V	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Billirubin (mg/dl)	0.273	0.02	0.283	0.04	0.362	0.03	0.282	0.03	0.330	0.05
Proteins (mg/dl)	79	1.50	66	1.55	69	1.36	72	1.81	76	1.18
Albumin (mg/dl)	16	0.76	15	1.25	16	1.75	17	0.95	16	0.71
Globulin (mg/dl)	63	0.61	52	0.90	55	1.32	56	0.58	62	1.21
Alkaline phosphatase (U/L)	62	6.24	91	9.36	64	4.92	76	7.70	87	9.25
SGOT (U/L)	109	4.85	93	9.12	69	4.51	125	9.72	105	5.33
SGPT (U/L)	58	7.31	45	9.66	35	3.82	93	5.64	54	5.11
LDH (U/L)	998	18.9	984	26.8	647	6.70	976	6.98	968	15.0

Values are expressed as mean \pm SD (N = 5);

Group I: Control, Group II: Fresh shoots; Group III: Fermented shoots;

Group IV: Brine treated shoots; Group V: Boiled shoots

Effect of fresh and processed shoots on the kidney functions in Balb/c mice

Parameter (mg/dl)	Group I		Group II		Group III		Group IV		Group V	
	Mean	SD								
Creatinine	0.306	0.01	0.335	0.04	0.437	0.03	0.321	0.03	0.363	0.01
Blood urea	56	1.01	51	0.43	49	0.50	62	0.33	63	0.30
Blood urea nitrogen	24	0.52	26	0.20	23	0.41	29	0.53	30	0.14

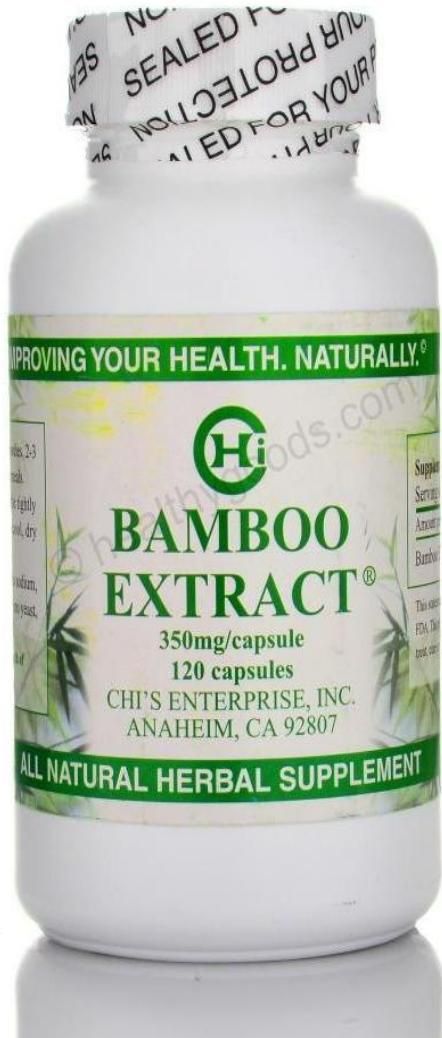
Values are expressed as mean \pm SD (N = 5);

Group I: Control, Group II: Fresh shoots; Group III: Fermented shoots;
Group IV: Brine treated shoots; Group V: Boiled shoots

Bamboo based Nutraceutical products

Product Name	Content	Health benefits
Bamboo Nutra	Bamboo fiber	Anti-ageing, Anti-obesity
Bamboo silica	Bamboo silica	Anti ageing, preserves skin youthfulness
Bamboo flex	Bamboo leaf	Anti-inflammatory, remineralization and development of bone structure
Bonusan forte	Tabashir exudates	Anti-fatigue, supports energy metabolism, good for nervous system
Guozen bamboo leaf essence	Bamboo leaf	Purifies blood and strengthens bones
Hawlik Cappillary capsules	Bamboo shoot	Improves hair health
Lambert silica capsules	Tabashir exudates	Contributes to structure and resilience of connective tissue, synthesis of bone collagen and cartilage
Sanacel	Bamboo fiber	Improves digestion
Silice de Bambou	Tabashir exudates	Prevents premature ageing, preserves skin youthfulness, promotes strong hair, healthy bones and teeth
Solary bamboo capsules	Culm powder	Stimulates collagen synthesis in bone and connective tissue

Bamboo as a nutraceutical



Transcends the body, mind and soul



Conclusion

The Healing Power of bamboo transcends body, mind and soul

Rapid changes in diets and lifestyles due to industrialization, urbanization and economic development are having a significant impact on nutritional status and overall health of population worldwide

Bamboo is a very good source of Food and Medicine being rich in nutrient and health enhancing bioactive compounds

Regular consumption of bamboo shoots can help in promoting health and prevention of a number of disease

Efforts should be made to select bamboo species with high nutritive and medicinal value which can be used for the development of Functional foods and Nutraceuticals

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Vivek Sharma



Kanchan Rawat



Natasha Saini



**Premlata
Thounaujam**



Santosh Oinam



Aribam Indira

2018



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Review

Bamboo: A rich source of natural antioxidants and its applications in the food and pharmaceutical industry

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ARTICLE INFO

ABSTRACT

Keywords:
Bamboo
Natural antioxidant
Functional food
Free radicals

Background: Bamboo is a multipurpose plant known mostly for its industrial uses but is now being recognized as a potential source of bioactive compounds and natural antioxidants. All the parts of the bamboo plant such as rhizome, culm, shaving, leaves, roots, shoots and seeds have clinical applications. Studies have revealed that bamboo is a rich source of antioxidants and regular consumption of bamboo-based products may reduce the risk of age-related chronic diseases including cardiovascular diseases, Alzheimer's disease, Parkinson's disease, cancer and diabetes.

Sope and approach: This review article reports a comprehensive insight concerning antioxidants and anti-oxidant properties of bamboo shoots and leaves and their prospects for utilization in the development of functional foods and nutraceuticals. Antioxidants are vital constituents in the food and pharmaceutical industry as they scavenge free radicals that cause deterioration of products during processing and storage. They also promote human health by neutralizing cell damage caused by free radicals.

Key findings and conclusion: Antioxidants are known to confer health benefits such as prevention of cancer and degenerative diseases, slowing down the aging process and promotion of cardiovascular health. The main antioxidants in bamboo leaves and shoots are phenols, vitamin C & E and mineral elements such as selenium, copper, zinc, iron and manganese. At present, natural antioxidants are in great demand as synthetic antioxidants being used in food and pharmaceuticals may be deleterious to health. Hence, bamboo a fast growing plant with huge biomass can serve as an alternative for the production of natural antioxidants.

2018



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Research Article

MOJ Food Processing & Technology



Freeze-dried bamboo shoot powder for food fortification: enrichment of nutritional content and organoleptic qualities of fortified biscuits

Abstract

Background: Bamboo shoots are low-calorie vegetables rich in nutrients and phytochemicals. Due to the presence of anti-nutrients and short shelf life, the shoots need to be processed for long term usage. Vacuum freeze-drying is the best method of water removal from perishable vegetables compared to other methods of drying. Edible portions of shoots were freeze dried in three forms, fresh, 20 minutes boiled and 24 hours soaked and compared with wheat flour. Freeze dried bamboo shoot powder was used for fortification of biscuits. Nutrients, bioactive compounds and minerals were increased in bamboo shoot fortified biscuits as compared to control biscuits. Nutritional content was observed to be maximum in fresh freeze dried fortified biscuits with 0.70g/100g amino acids, 1.27g/100g protein, 20.45g/100g carbohydrate, 0.22g/100g phenol, 0.18g/100g phytosterol, 52.44g/100g neutral detergent fiber (NDF) and 5.16g/100g acid detergent fiber (ADF) whereas anti-nutrients content was minimum in 20 minutes boiled shoot fortified biscuits with 5.98g/kg amongst the fortified biscuits. Anti-nutrient content in all the fortified biscuits were much below the permissible level. Sensory analysis showed higher acceptability in 20 minute boiled fortified biscuits. Compared to the control, minerals such as K, P, S, Na, Ca, Zn, Fe, Mn, increased in fortified biscuits. Freeze-dried bamboo shoot fortified biscuits were better in nutritional quality as well as better organoleptic properties compared to the control.

Keywords: bamboo shoot, processing, freeze-dried, biscuits, nutrients, fortification

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2017

82

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10 WBC Reports

Bamboo: A prospective ingredient for functional food and nutraceuticals*

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Abstract

Bamboo is a multi-utility plant being used as a building material, for industrial purposes, as a food source and a versatile raw material for various products. In recent times, it is gaining importance for its health benefits and is emerging as a potential ingredient for modern functional foods and nutraceuticals. The leaves possess antioxidant properties due to the presence of phenolic compounds and have been used for enhancing immunity, preventing degenerative diseases and also in the food industry. The young shoots in addition to being used as a vegetable in the conventional form in various cuisines are now being used as an ingredient in functional foods. The shoots have anti-hypertensive, anti-tumour and anti-oxidant properties and have also been proven to possess cholesterol-lowering activity. Bamboo salt is used as a medicinal food in many Asian countries and provides a wide range of health benefits and has attracted many pharmaceutical scientists worldwide. Thus, bamboo is an ideal plant and has great promise for the pharmaceutical, nutraceutical, cosmeceutical and the food industry.

2017



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Qualitative and Quantitative Mineral Element Variances in Shoots of two Edible Bamboo species after Processing and Storage Evaluated by Wavelength Dispersion X-ray Fluorescence Spectrometry

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ABSTRACT: Bamboo shoot, a neglected and less known traditional delicacy is gaining popularity for health-promoting properties; generally consumed fresh but requires processing to remove acidity, improve palatability and for long term preservation. Processing affects the nutrient and phytochemical composition. In this study, fresh, processed (boiled, soaked and fermented) and stored shoots of *Bambusa multiplex* and *B. bambos* were analyzed for macro and microminerals by using wavelength dispersion X-ray fluorescence spectrometry. Results depicted the presence of eight macrominerals (P, K, Ca, Mg, S, Cl, Na, Si) and five microminerals elements (Mn, Zn, Fe, Cu, Ni). Macrominerals and microminerals elements showed significant ($p < 0.05$) near constant macromineral elements while minimally the micromineral elements. Soaking was appropriate to retain maximum content of K (64.87%), P (80.95%), Mg (83.86%) and increased Ca, Na and S while unaltering Zn and Cu content. With fermentation, micromineral elements were better retained or negligible change was observed.

KEYWORDS: Bamboo shoots, Macromineral, Micromineral, Processing, Storage.

1. INTRODUCTION

Bamboo hunger is one of the most prevalent challenges of 21st century which is ascribed to inadequacy of vitamins and minerals that often remain less noticeable than macromineral deficiencies such as protein and calories. Presently, around two billion people are lacking in one or more microminerals which is more than double to 795 million

2016



Journal of Pharmacognosy and Phytochemistry 2016, 7(4): xx-xx

Available online at www.phytojournal.com



Spectral analysis of fresh and processed shoots of an edible bamboo *Dendrocalamus hamiltonii* (Nees & Arn.)

Harjit Kaur Bajwa, Oinam Santosh, C Nirmala, Ashwani Koul and MS Bisht

Abstract

Objectives: Bamboo shoots are reported to have great nutritional and therapeutic value. Processing and preservation bring about physical changes which alter the nutritional and therapeutic values of the shoots. The aim of the present study was to determine the chemical profile of fresh and processed shoots of *Dendrocalamus hamiltonii* by various spectral analysis.

Method: Spectral analysis was done by different analytical methods such as UV-VIS, FT-IR, NMR and GC-MS.

Results: In NMR analysis, aqueous extract of shoots showed a number of peaks in between 6 to 10 indicating the increase in aliphatic and acidic content after processing. In GC-MS analysis, 110 compounds were detected in the ethanol extract of fresh and processed shoots with different pharmacological properties. The highest number of compounds was detected in the extract of fermented shoots.

Conclusions: The results of this study may act as biochemical markers for processed shoots in the food and pharmaceutical industry.

Keywords: *Dendrocalamus hamiltonii*, NMR, GC-MS, Spectral analysis

1. Introduction

Bamboo is one of the most valuable plant taxa worldwide because of its immeasurable uses including food and medicine. The fresh juvenile bamboo shoot has been used from ancient times as food and medicine and has gained worldwide reputation for various functional merits as a dietary supplement, food antioxidant, cosmetics ingredient and as a nutraceutical component for managing diseases. Due to its high nutritional value and presence of bioactive compounds, the shoots are considered as an important food for health benefit. Bamboo shoot is also used as a potential ingredient for modern functional foods and nutraceuticals.^[1,2] But fresh juvenile bamboo shoots are seasonal, highly perishable and cyanogenic. Processing is a must to remove anti-nutrients, acidity and make the shoots palatable, increase the shelf life and for value

2016

Journal of Food Processing and Preservation ISSN 1745-4549

CHANGES IN ORGANOLEPTIC, PHYSICOCHEMICAL AND NUTRITIONAL QUALITIES OF SHOOTS OF AN EDIBLE BAMBOO *DENDROCALAMUS HAMILTONII* NEES AND ARN. EX MUNRO DURING PROCESSING

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ABSTRACT

Bamboo shoot has attracted significant attention worldwide due to its nutritive value and health promoting properties. But, a limitation is the short shelf life of the shoots which requires the shoots to be processed for long-term usage. Processing brings about changes in organoleptic and physicochemical qualities along with nutritional values but such studies are limited. The aim of the present study was to investigate the effects of boiling, salting and fermenting and drying on organoleptic, physicochemical and nutritional values of shoots of an edible bamboo *Dendrocalamus hamiltonii*. Results showed that boiling, salting and fermenting had significant effects on texture and taste of the shoots. Boiling for 15 min decreased the cyanogenic content upto 72% but carbohydrates, protein and starch were retained. Fermentation caused increase in total phenols (4.3%) and phytosterols (11%), while decrease in total ash (52.42%), acid insoluble ash (31.25%), water soluble ash (55.14%) and pH value.

Thank You



**Eat Bamboo shoots and be
Healthy!**

Nirmala Chongtham



Thank You



Eat Bamboo shoots and be
Healthy and Young!

Nirmala Chongtham



WORLD BAMBOO
AMBASSADOR

Bamboo represents one of the four seasons



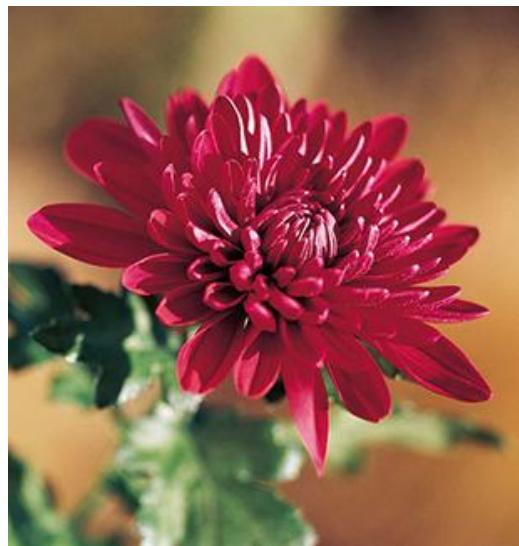
Plum (Winter)



Orchid (Spring)



Bamboo (Summer)



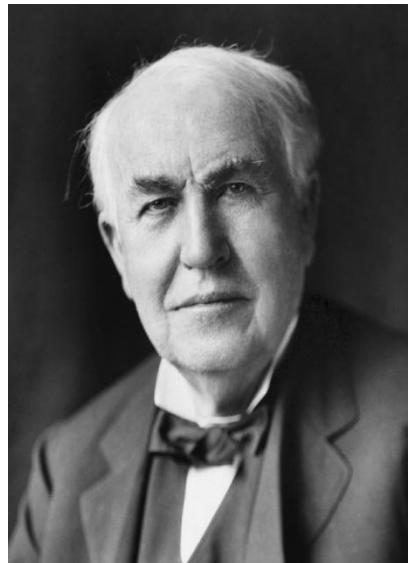
Chrysanthemum (Autumn)

The Healing Touch of Bamboo

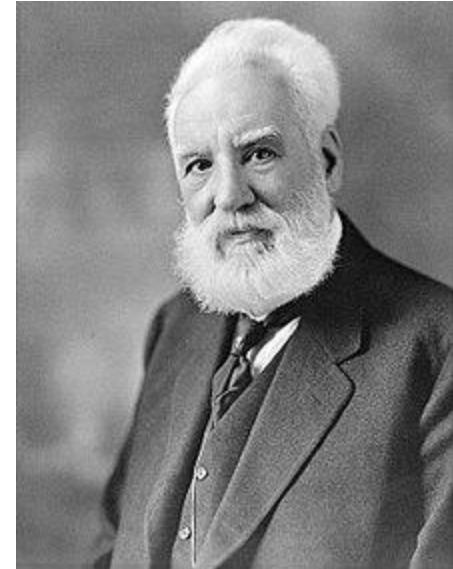
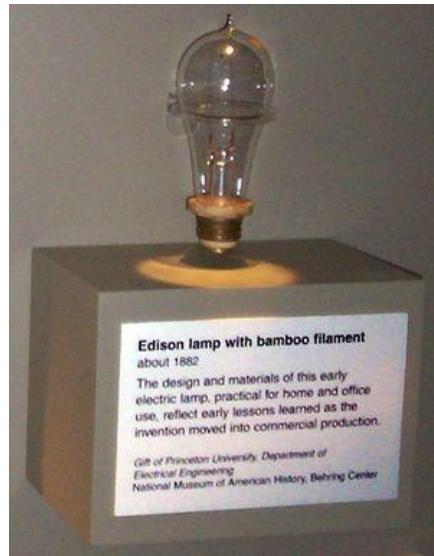
**Dr. Nirmala Chongtham
Professor
Department of Botany
Panjab University
Chandigarh, INDIA**



Used by scientists in their inventions



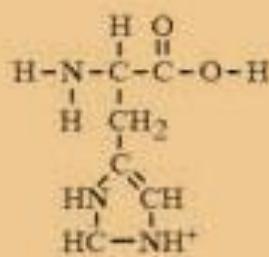
Thomas Edison used Bamboo as a filament for his glass bulb



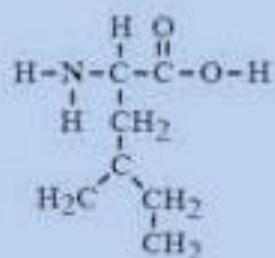
The needle in **Alexander Graham Bell's** first Phonogram was made of bamboo

THE ESSENTIAL AMINO ACIDS

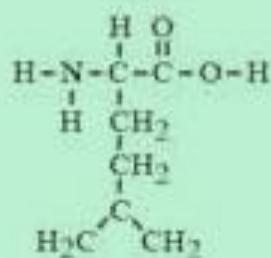
(WHICH OUR BODIES CANNOT MAKE):



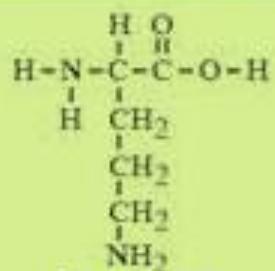
Histidine



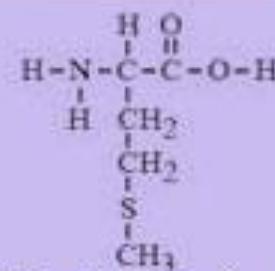
Isoleucine



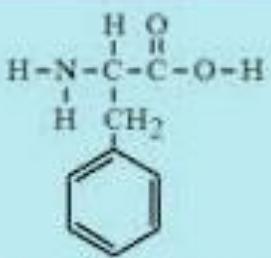
Leucine



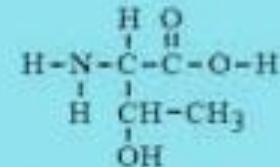
Lysine



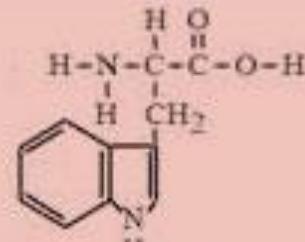
Methionine



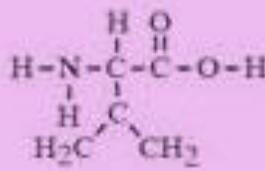
Phenylalanine



Threonine



Tryptophan



Valine