Bamboo: A prospective Ingredient for Functional Food And Nutraceuticals

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BAMBOO

Has come a long way from……..

"Cradle to Coffin Plant"

"Poor Man's Timber"

"Friend of the People"

"The Green Gold"

"The plant with a thousand faces"

"Green Gasoline"

To ……

A Rich Man's delicacy

BAMBOO THE MULTI-UTILITY PLANT

Construction purposes
Paper industry
Furniture
Clothing
Utensils and household items
Medicine
Vehicles
Beaverages
(Tea, Beer and Wine)
Oils
Toiletries
Cosmetics
Food
Ecology and Environment

Consumed as vegetable by rural people

Delicacy in up-scale markets, speciality restaurants and five star hotels

Bamboo shoots as a Functional Food and Nutraceutical

Bamboo shoots are ranked amongst the five most healthy food

(Institute of Geriatrics, World Health Organization)

Health Enhancing Properties of Bamboo Shoots

- **Rich in Nutrients**
- **High content of bioactive compounds**
- **Low in fat and calories**
- **Free from residual toxicity**

With their high nutritive value and bioactive compounds, bamboo shoots hold great promise for utilization as a functional food and nutraceuticals

Bamboo in Traditional Medicinal System

Ayurveda, Tibetan and Unani traditional medicine

S. No.	Name	Constituents/Ingredients	Health benefits
1.	**Tabasheer**	Siliceous secretion often called bamboo-manna or bamboo silica. Chalky, translucent/transparent. Silicic acid (upto 96.9%)	Stimulant, astringent, febrifuge, relieving asthma, cough, cooling tonic, antispasmodic and aphrodisiac.
2.	**Sitopaladi Churna**	Powder made with tabasheer as the main ingredient, plus small amounts of long pepper, cardamom, and cinnamon in a base of sugar.	Common cold, sore throat, sinus congestion, tuberculosis, coughs and other lung diseases.

Chinese traditional medicine

Sl. No.	Name	Constituents/Ingredients	Health benefits
1.	**Chenjin Wan**	Bamboo shaving and Tabasheer, arisaema, citrus, hoelen, salvia, silkworm, chrysanthemum, apricot seed, ophiopogon, fritillaria, ginger	For phlegm mist obstructing the orifices yielding symptoms of insomnia, restlessness, and blurred vision.
2.	**Gualou Zhishi Tang**	Bamboo shaving and sap, fritillaria, platycodon, trichosanthes seed, chih-shih, citrus, saussurea, licorice, scute, gardenia,	For reducing thick phlegm that is difficult to expectorate.
3.	**Jupi Zhuru Tang**	Bamboo shavings, citrus, pinellia, licorice, hoelen	Relieving phlegm
4.	**Qinggong Tang**	Bamboo leaf, ophiopogon, scrophularia, rhino horn, forsythia, lotus plumule	Fever with dryness, penetrating to the pericardium, with delirium
5.	**Qingluo Yin**	Bamboo leaf, lotus leaf, luffa, mirabilitum, dolichos flower, lonicera	Fever with light-headedness, blurry vision, or headache.
6.	**Xiaoer Qizhen Dan**	Tabasheer, arisaema, cinnabar, realgar, scorpion, croton seed	For phlegm, wheezing, coughing.
7.	**Zhuye Shigao Tang**	Bamboo leaf, gypsum, pinellia, ophiopogon, ginseng, licorice, oryza	Fever with dryness, irritability and insomnia

Functional food & Nutraceuticals

An emerging class of natural products that makes the line between food and drugs to fade.

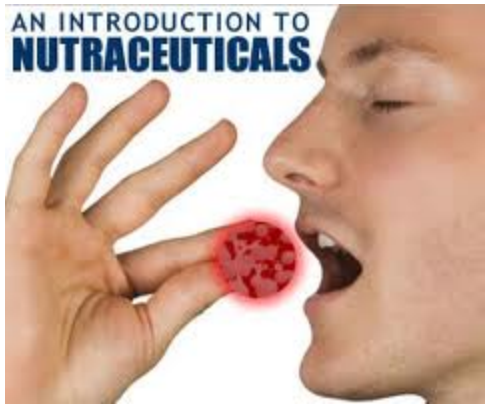
New foods designed specifically to enhance health

Whole, fortified or enriched food

Dietary supplements from a bioactive agent from food

Present in a non-food matrix - capsule, powder or solution

Functional Food Products



Derived from
“Nutrition and “Pharmaceutical”

A food or part of food or nutrient, that provides health benefits, including the prevention and treatment of a disease.”

Products produced from food but sold in the medicinal form
- capsule, tablet, powder
- solution or potion

“A Nutraceutical a day may keep the doctor away”

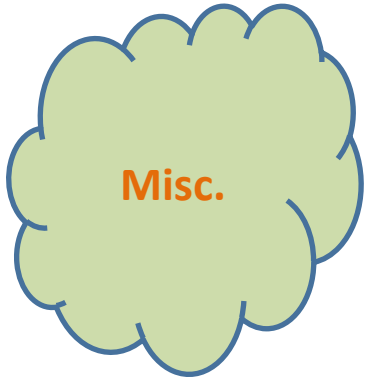
Bamboo shoot in the Food Industry

Bread, pretzels, cookies, ice cream cones, cakes, Wafers etc

Milk, yogurt, ice cream, cheese

Chicken, pork

Tea, soft drinks, juices



Sauces, ketchup, Pasta, noodles, Mustard, nuggets, Chocolates

Macronutrients (g/100 g fresh weight), vitamins (mg/100 g fresh weight), moisture and ash content in the juvenile shoots.

Name of species	Amino acids	Protein	Carbohy-drates	Starch	Fat	Vitamin C	Vitamin E	Ash	Moisture
B. bambos	3.98	3.57	5.42	0.25	0.50	1.90	0.61	1.38	89.83
B. kingiana	3.70	3.57	5.45	0.34	0.35	2.10	0.50	1.38	90.00
B. nutans	3.89	2.84	5.47	0.21	0.40	1.19	0.47	0.68	92.00
B. polymorpha	3.42	3.64	5.44	0.38	0.46	2.60	0.49	0.76	90.26
B. tulda	3.65	3.69	6.92	0.59	0.48	1.42	0.61	0.85	83.60
B. vulgaris	3.57	3.64	6.51	0.27	0.50	4.80	0.52	1.01	90.60
D. asper	3.12	3.59	4.90	0.36	0.40	3.20	0.91	0.95	89.40
D. brandisii	3.01	2.31	4.90	0.49	0.24	1.59	0.42	0.61	89.80
D. giganteus	3.86	3.11	5.10	0.51	0.39	3.28	0.69	0.89	90.70
D. hamiltonii	3.18	3.72	5.50	0.47	0.41	2.45	0.71	0.86	92.51

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
Bambusa tulda	3.65	3.69	6.92	0.48	1.42	0.61	3.97
D. asper	3.12	3.59	4.90	0.40	3.20	0.91	3.54
Dendrocalamus hamiltonii	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

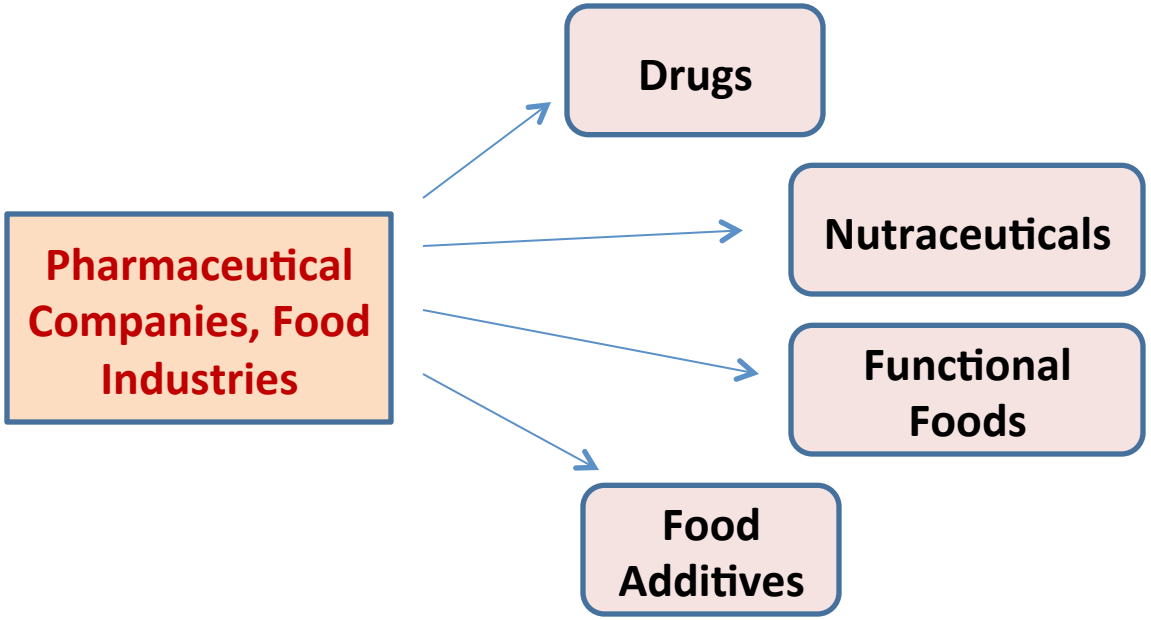
Therapeutic potential of Bamboo

- Cardiovascular diseases
- Anti-fatigue
- Anti-cancer
- Anti-microbial
- Anti-diabetic
- Anti-obesity
- Anti-inflammatory
- Anti-hyperlipidemic

Bioactive compounds

Secondary metabolites known to elicit pharmacological and toxicological effects in humans and animals

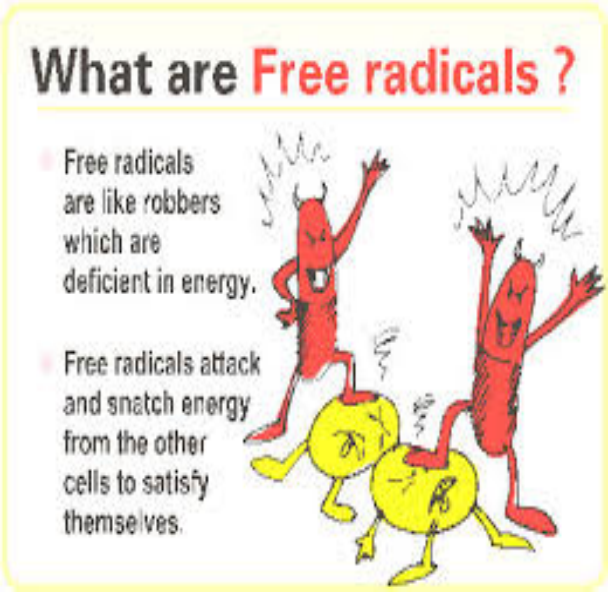
Extranutritional constituents in food occurring in small quantities that provide health benefits beyond the basic nutritional value of the product



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

Prevent food rancidity & spoilage of medicine

Food

Prolong shelf-life

Pharmaceutical products

Enhance stability of therapeutic agents

Synthetic antioxidants have raised certain health issues

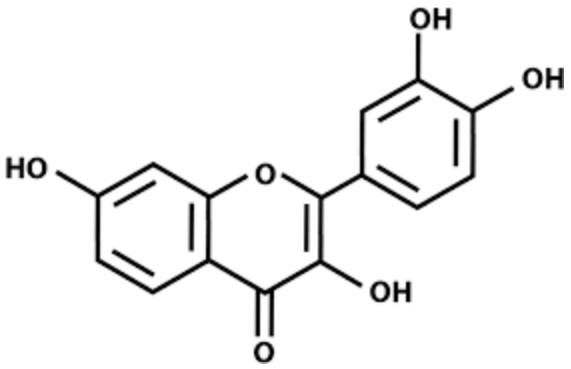
Search of natural antioxidants to replace synthetic ones

Antioxidants in bamboo leaves

Dietary supplement

Cosmetic ingredient

Food antioxidant



Flavonoids

Attracted much attention due to the health effects

Cardiovascular diseases and cancer

Pharmaceutical intermediate & Food Additive

Have protective effects in mice with liver injury

Natural alternatives to synthetic antioxidants as functional food ingredients

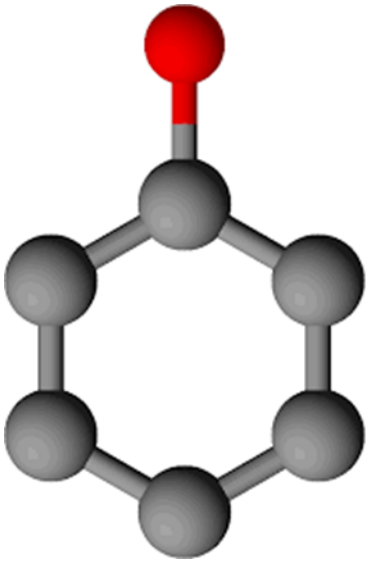
Table: Vitamin C and E content (mg/100g fresh weight) in bamboo shoots

Sl.no.	Species	Vit C	Vit E
1.	*Bambusa. arundinacea*	7.50	-
2.	*B. balcooa*	6.60	-
3.	*B. kingiana*	2.10	0.50
4.	*B. polymorpha*	2.60	0.49
5.	*B. tulda*	1.42	0.61
6.	*B. vulgaris*	4.80	0.52
7.	*Dendrocalamus asper*	3.20	0.91
8.	*D. giganteus*	3.28	0.69
9.	*D. hamiltonii*	2.45	0.71
10.	*D. hookerii*	9.90	-
11.	*D. longispathus*	23.0	-
12.	*D. membranaceus*	1.58	0.65
13.	*D. strictus*	2.43	0.58
14.	*Gigantochloa. rostrata*	3.20	0.49
15.	*Melocanna. bacciferra*	7.60	-
16.	*Phyllostachys. amarus*	15.4	-

Phenolic content in bamboo shoots

Phenols

Benzene Rings with an OH group



Species	Phenols (mg/100 g, fresh weight)
B. bambos	360.0
B. balcooa	191.37
B. tulda	390.0-443.97
B. nutans	275.36-489.83
D. asper	580.0
D. giganteus	347.27
D. hamiltonii	505.93-586.36
D. latiflorus	612.24
B. membranaceus	302.73
D. strictus	271.23-630.0

Antioxidant property is of interest for both nutritional and health benefits

Table. Mineral elements with antioxidant activities in bamboo shoots

Species	Selenium μg/100g	Zinc mg/100g	Copper mg/100g	Iron mg/100g	Manganese mg/100g
B. balcooa	-	-	-	1.02	-
B. pallida	-	-	-	1.11	-
B. polymorpha	-	-	-	1.53	-
B. tulda	0.4	0.72	0.44	3.19	0.70
D. hamiltonii	0.8	0.70	0.29	2.69	0.16
D. giganteus	-	-	-	1.06	-
D. strictus	-	-	-	2.917	-
M. bambusoides	-	-	-	0.879	-
Pl. amarus	-	5.379	2.454	18.642	-
*P. aurea**	-	12.2-45.0	5.2-35.0	26.4-43.2	11.5-27.3
*P. aureasulcata**	-	19.8-37.1	3.9-4.4	24.3-35.4	47.4-85.0
*P. bissettii**	-	18.3-40.5	4.2-6.5	15.0-25.4	15.4-25.3
*P. glauca**	-	15.8-30.1	4.8-5.6	20.3-31.8	13.5-17.8
*P. nuda**	-	22.4-37.1	5.6-6.2	25.6-33.4	12.3-18.4
*P. rubromarginata**	-	22.9-54.6	0.6-7.8	18.1-25.4	117.4-176.7

B = *Bambusa*; D = *Dendrocalamus*; M = *Melocanna*; Pl = *Pleoblastus*; P = *Phyllostachys*

*** μg/g**

Value added products with bamboo shoots

Sl No.	Bamboo Species	Shoot type	Product	Reference
1.	*Bambusa bambos, B. tulda, Dendrocalamus asper, D. strictus*	Fresh	Crackers, nugget, pickle	Pandey et al., 2012
2.	*D. hamiltonii*	Fresh	Candy, chutney, chukh, cracker, nugget	Sood et al., 2013
3.	*D. hamiltonii*	Fresh	Cookies, parantha	Bisht et al., 2013
4.	*B. auriculata*	Fermented	Chicken nugget	Das et al., 2013
5.	*B. polymorpha*	Fermented	Pork nugget	Thomas et al., 2014

Nutraceutical Potential of Bamboo

Sl. No.	Potential Benefit	Species	Reference
1.	**Anticancerous**	*Caulis bambusae, Phyllostachys pubescens, Pseudosasa japonica, Sasa quelpaertensis, S. sinensis,*	Tsunoda et al 1998., Seki et al., 2010, Hong et al., 2010, Hiromichi 2007. Kim et al, 2013
2.	**Antidiabetic**	*P. pubescens, Sasa borealis, Pseudosasa japonica, Bambusa vulgaris*	Ding et al., 2007, Koide et al, 2011, Nam et al, 2013
3.	**Anti-obesity**	*Sasa borealis, S. quelpaertensis*	Yang et al., 2010
4.	**Anti-inflammaotory**	*Bambusa arundinacea*	Lu et al., Hwang et al., 2007, Carey et al., 2009
5.	**Anti-fatigue**	*Phyllostachys nigra, Pseudosasa japonica, Bambusa tuldoides*	Yu et al., 2006, Zhang et al., 2006
6.	**Antihyperlipidemic**	*Phyllostachys pubescens*	Ding et al., 2010
7.	**Antimicrobial**	*Phyllostachys pubescens, P. nigra, B. arundinacea, P.heterocycla*	Park and Jhon 2010, Tanaka et al., 2011, Jin et al, 2011
8	**Caridiovascular diseases**	*P. pubescens, P.nigra*	Fu et al., 2006, Liu et al, 2012, 2013
9.	**Cholesterol lowering**	*P. pubescens, P.nigra, P. edulis, B. oldhami, D. Latiflorus*	Park and Jhon 2009, Lachance and He., 1998

Antitumor activity

(US Patent 20040185124 Hiromichi, 2004).
Phyllostachys nigra* var. *henonis*, *P. bambusoides*, *P. pubescens*, *Gigantochloa apus

Cholesterol lowering activity

(Patent 1998057545; Wo, 1998)
Bambusa oldhami, Bambusa edulis, Dendrocalamus latiflorus Phyllostachys edulis, Phyllostachys pubescens, Phyllostachys makinoi.

Antimicrobial peptide Pp-AMP1

(Fujimura et al., 2005)
Phyllostachys pubescens

Antibacterial activity

(Zhang et al 2010)
Phyllostachys nigra, Sinocalamus beecheyana, Bambusa tuldoides

PHYTOSTEROLS

Bioactive components representing the major part of the nonsaponifiable fraction of lipids

Reduces or inhibits cholesterol absorption and synthesis
Increases fecal excretion of neutral and acid sterols

Indicated to have anticancer properties

Precursors of pharmaceutically important steroidal products - corticosteroids, sex hormones and oral contraceptives

Bamboo shoots which are easily available in large amounts can be used as a source of phytosterols

Cholesterol lowering activity (Phytosterols)

Lachanche & He, 1998

Bamboo shoot extract – Wistar rats

(*B. oldhami, D. latiflorus, P.pubescens, P.edulis*)

Reduced serum total cholesterol, LDL cholesterol & liver lipids

Park&Jhon, 2009

Bamboo shoot – Young women

Serum total cholestrol, LDL cholesterol and atherogenic index decreased

Bowel movement frequency significantly increased

Anti-diabetic effect of bamboo extract

(Koide et al., 2011)

Phyllostachys edulis

Ethanol/water bamboo extract

- **Improved glucose tolerance**
- **Inhibited hyperinsulinemia**
- **Lowered hepatic fat content**
- **Inhibits obesity associated chronic systemic inflammation**

Potential application as an anti-diabetic nutraceutical

Bamboo Silica:
The Ultimate Anti-Aging Superfood

Bamboo extract:
The richest known source of silica

Silica has a restorative effect on many of the body's tissues.

- ❖ **Build healthy bones, nails and teeth**
- ❖ **Prevent premature aging and preserve skin youthfulness**
- ❖ **Maintains vascular and heart health**
- ❖ **Supports nervous and glandular system health**

Bamboo extract

Used for treatment of:

- Acute and Chronic Throat or Lung Conditions
- Cough
- Phlegm
- Sore Throat
- Runny Nose
- Ear Irritation in Children

Bamboo salt

- Prevention or treatment of inflammatory diseases.
- Helps purifying blood thus lowering the risk of blood pressure.
- Assists the absorption of calcium and maintains fluid balance
- Contraction of muscle
- Calcium, magnesium and zinc protect against the development of diabetes

Dietary fiber from Bamboo

Bamboo dietary fiber is inert, has zero calories and is a white tasteless powder; the content of dietary fiber can be up to 75%

Application:

Food additives

Slimming food supplements

Weight loss food

Medicine material

Shennong Honey Bio-Tech Co., Ltd.

Changsha Winner Bio-Tech Co., Ltd.

Harbin Yeekong Herb Inc.

Bamboo Tea : Polyphenols

- Antioxidant
- Constipation
- Weight loss
- Relaxing and soothing to stomach
- Respiratory problems

Conclusion

With ever increasing public health consciousness, demand for Functional Food and Nutraceuticals and related health products has grown tremendously over the past few decades

Modern scientific research which has provided conclusive evidence toward their beneficial role of against several chronic diseases

Bamboo shoots rich in nutrient components and bioactive compounds have great potential in both the food industry and pharmaceuticals.

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Bamboo Team

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Eat Bamboo Shoots and be

"Healthy & Happy"

THANK YOU!