

Original Research Article

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## Sensory Parameters of Bamboo Shoot Powder Fortified Yoghurt

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### ABSTRACT

The growing health consciousness globally has led to the increasing public demand for the bamboo shoots due to its therapeutic and nutritional values and plays an important role in the food, pharmaceutical and cosmeceutical industry. Therefore, there exists a great opportunity especially, for utilization in food products as therapeutic agent. The bamboo shoot powder prepared from *Dendrocalamus hamiltonii* was used for enrichment in yoghurt. The bamboo shoot powder was added at 0% (Yoghurt without enrichment), 0.5, 1.0, 1.5, 2.0 and 2.5 % level to the milk. The yoghurt prepared with different treatments was evaluated for sensory parameters. Yoghurt with 1.0 % bamboo shoot powder was found to be the best among the treatments with appearance, texture, aroma, taste and overall acceptability scores of 8.13, 8.12, 8.13, 8.11 and 8.15, respectively. Results showed that up to 1.0 % level of enrichment with bamboo shoot powder, the yoghurt was acceptable with improved functional and nutraceutical properties compared to the control yoghurt.

#### Keywords

Bamboo shoot powder, Yoghurt, Fortification, Sensory characteristics

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### Introduction

Bamboos are shrubs and have a tree-like habit. Their culms are erect and sometimes climbing. They are characterized by woody and mostly hollow culms (Meher *et al.*, 2012). The most commonly grown edible bamboo species in India are *Bambusa pallida*, *B. tulda*, *B. polymorpha*, *B. balcooa*, *Dendrocalamus hamiltonii*, *D. giganteus* and *Melocanna bambusoides* (Choudhury *et al.*,

2012 and Chauhan *et al.*, 2016). Some species with special highlight for the industrial processing are *Bambusa*, *Dendrocalamus*, *Phyllostachys*, *Pseudosasa*, *Sasa* and *Sinoarundinaria* (Manhães, 2008 and Pereira and Beraldo, 2016). Bamboo is recognized as nutraceutical (Xuhe, 2003; Lo *et al.*, 2008 and Chongtham *et al.*, 2011) because of its rich composition in phytosterols and high fibre content. The bamboo shoots have functional properties such as weight reduction,

prevention of constipation and bowel cancer and reduction of cholesterol level. Consumer interest in wholesome/nutritious foods and beverages continues, and one category with potential for fast growth is foodstuff fortified with fibre. Previously referred to as roughage, bulk, or ballast, fibre is now termed dietary fibre. They are a potential ingredient in a healthy diet and have positive connection with human health.

Food fortification is a mean of overcoming micronutrient deficiency of some foods. It is also used to enrich some kind of foods by incorporation of nutritionally rich entities. Foods to be fortified are chosen in a way that it is commonly and regularly used by the target consumers. But during fortification, it should also strictly be kept in mind that the sensorial characteristics of the food are not hampered much, or it may not be acceptable to the consumers (Akhtar *et al.*, 2008).

Yogurt is an important dairy product, particularly for consumers with lactose intolerance, and is considered a healthy food because it contains viable bacteria that are considered probiotics (Hashim *et al.*, 2009). Yoghurt is a coagulated product obtained from pasteurized or boiled milk or concentrated milk, pasteurized skimmed milk and/ or pasteurized cream or a mixture of two or more of these products by lactic acid fermentation through the action of *Lactobacillus delbrueckii* spp. *Bulgaricus* and *Streptococcus thermophiles* (FSSAI, 2011). It shall contain milk fat not less than 3.00 per cent, milk solids not fat not less than 8.50 per cent, milk protein not less than 3.20 per cent, and titratable acidity (lactic acid) not less than 0.60 per cent. There is no fibre in yoghurt and dairy products (Lunn and Buttriss, 2007). So, fortifying yoghurt or dairy products with fibre is of increasing interest to create functional foods with health benefits and improve their functionality without compromising the taste and texture (Pal, 2008). Consumption of high

fibre yoghurt may prevent or reduce obesity, diabetes, cancer, hypercholesterolemia, gastrointestinal disorders, colonic diverticulosis and constipation, ulcerative colitis, hyperlipidemia, hypertension, coronary artery disease, but also promote intestinal microflora and gastrointestinal immunity (Sah *et al.*, 2016; Dello Staffolo *et al.*, 2017 and Tomic *et al.*, 2017).

## **Materials and Methods**

The bamboo shoots of *Dendrocalamus hamiltonii* species was procured from Anu, Giripul, Karganu, Lakothi, and Nauni villages of District Solan, in Himachal Pradesh, India. Milk was purchased from local market. The packaging material such as Polystyrene cup was purchased from International Scientific and Surgicals, Solan.

## **Sensory analysis**

The yoghurt with different treatments were subjected to sensory evaluation (9-point hedonic scale) following standard procedure described by Ranganna (2009). Ten judges comprising of faculty members and post graduate students of the department of Food Science and Technology, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan (HP) were selected to evaluate the products. The parameters considered for the evaluation were appearance, texture, aroma, taste and overall acceptability.

## **Statistical analysis**

Data on sensory characteristics of bamboo shoot powder enriched yoghurt was analysed by Completely Randomized Design (CRD) suggested by Cochran and Cox (1967). While Randomised Complete Block Design (RBD) as described by Mahony (1985) was used to analyze the data pertaining to sensory evaluation. The experiment for recipe standardization was replicated three times.

### **Preparation of bamboo shoot powder**

The bamboo shoot of *Dendrocalamus hamiltonii* was used for preparation of powder. The shoot with sheath was washed to remove any adhering dirt, dust or any other foreign material. The sheath was removed for extraction of tender shoot. The bamboo shoots were cut into thin slices. The fresh shoots contain hydrogen cyanide (HCN), a toxic substance which needs to be removed prior to use for edible purposes. The method described by Dhiman *et al.*, (2017) was followed to remove HCN from fresh bamboo shoots. The bamboo shoot slices were soaked in water for 24 hours. These slices were then boiled for 90 minutes. The water was drained and the slices were allowed to cool down at room temperature. The bamboo shoot slices were dried in a mechanical dehydrator at  $60 \pm 2^\circ\text{C}$  for 5 hours i.e. until it reached equilibrium moisture content. The slices were converted into powder with the help of a grinder. The powder was passed through a sieve of 36 mesh size and stored in polyethylene pouches with proper sealing until further use.

### **Preparation of yoghurt**

The procedure described by Issar *et al.*, (2016) was followed for the preparation of yoghurt. The standardized cow's milk was boiled and allowed to cool to room temperature. The milk was poured into polystyrene cups uniformly. Then the combined culture was added to the milk with continuous stirring to ensure proper mixing of the combined culture with milk. The cups were covered with aluminium foil for incubation. The cups were incubated and refrigerated.

### **Optimization of level of bamboo shoot powder enrichment in yoghurt**

The procedure followed for preparation of yoghurt enriched with bamboo shoot powder

was similar as described above. Bamboo shoot powder was added at different levels (Table 1). The bamboo shoot powder enriched yoghurt of different treatments was subjected to sensory evaluation by a panel of ten judges. The best treatment was selected on the basis of highest sensory scores for further studies.

## **Results and Discussion**

### **Sensory scores of bamboo shoot powder enriched yoghurt**

Bamboo shoot powder was incorporated in yoghurt at different six levels (Table 1). The prepared yoghurt was subjected to sensory evaluation by a panel of ten judges. The data (Table 2) of sensory evaluation clearly indicated that T<sub>3</sub> (100:1.0) got the highest rating for appearance (8.19), texture (8.21), aroma (8.19), taste (8.17) and overall acceptability (8.19) and thus was selected for further studies.

El Sayed *et al.*, (2002) have observed that colour and flavour acceptability score decreased with the increase in concentration of fibre beyond 5 per cent level. As per the observation of DelloStaffolo *et al.*, (2004), yoghurts fortified with 1 per cent dietary fibre of bamboo, inulin, apple and wheat were found to be acceptable, representing high scores for colour, flavour and texture. Hashim *et al.*, (2009) have observed that sensory ratings and acceptability of yogurt decreased significantly when increasing date fibre to 4.50 per cent or using 1.50 per cent wheat bran. Thus, fortifying yoghurt with 3 per cent date fibre and 1.45 per cent wheat bran produced acceptable yoghurt with beneficial health effects. The research of Crispín-Isidro *et al.*, (2015) demonstrated an improvement in taste and texture of yoghurt with inulin. They noticed that yoghurt enriched with 4 per cent inulin was perceived as having significantly more desirable flavour than control yoghurt. According to Issar *et al.*,

(2016), the sensory evaluation of apple pomace fibre enriched yoghurt indicates that the addition of fibre upto 5 per cent level resulted in acceptable colour, flavour and overall acceptability, and a slight decrease in overall acceptability was noted with further

increase in concentration (10 %). Among the different fibres incorporated in yoghurt, the enrichment with 2 per cent wheat fibre was the most acceptable followed by 2.50 per cent pea fibre as per the findings of (Dabija *et al.*, 2018).

**Table.1** Optimization of level of bamboo shoot powder enrichment in yoghurt

Treatment	Bamboo shoot powder (%)
T <sub>1</sub>	0
T <sub>2</sub>	0.5
T <sub>3</sub>	1.0
T <sub>4</sub>	1.5
T <sub>5</sub>	2.0
T <sub>6</sub>	2.5

**Table.2** Sensory scores\* of bamboo shoot powder enriched yoghurt

Treatments	Appearance	Texture	Aroma	Taste	Overall acceptability
T <sub>1</sub> (100:0)	8.01	8.03	7.89	7.99	8.02
T <sub>2</sub> (100:0.5)	8.11	8.14	8.11	8.08	8.13
T <sub>3</sub> (100:1.0)	8.19	8.21	8.19	8.17	8.19
T <sub>4</sub> (100:1.5)	8.13	8.19	8.12	8.11	8.15
T <sub>5</sub> (100:2.0)	8.15	8.17	8.15	8.14	8.16
T <sub>6</sub> (100:2.5)	8.17	8.19	8.17	8.15	8.17
CD <sub>0.05</sub>	<b>0.09</b>	<b>0.10</b>	<b>0.09</b>	<b>0.07</b>	<b>0.10</b>

Treatments (M: Milk; BSP: Bamboo shoot powder)

T<sub>1</sub>: Control (100M:0BSP) T<sub>2</sub>: (100M:0.5BSP)

T<sub>3</sub>: (100M:1.0BSP)

T<sub>4</sub>: (100M:1.5BSP)

T<sub>5</sub>: (100M:2.0BSP)

T<sub>6</sub>: (100M:2.5BSP)

In conclusion, bamboo shoot powder is rich in minerals, protein, total carbohydrates and water holding capacity. Therefore, yoghurt enriched with bamboo shoot powder showed higher appearance, texture, aroma, taste and overall acceptability than the control sample. It may be concluded from the study that bamboo shoot powder could be added up to a level of 1.0 % in the formulation of yoghurt without affecting the overall quality. Thus, bamboo shoot can be utilized for preparation of protein rich yoghurt with improved functional properties.

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