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## Influence of bamboo shoot powder supplementation on sensory characteristics of cookies

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### Abstract

Bamboos are becoming one of the preferred food items among the people all over the world. Latest advancement proves bamboo shoot as a functional food due to the presence of biochemical components like dietary fibre, polyphenols and sterols. Therefore, there exists a great opportunity especially, for utilization in food products as therapeutic agent. The bamboo powder prepared from the shoots of *Dendrocalamus hamiltonii* was evaluated for chemical and functional characteristics and used for incorporation in pasta. Bamboo shoot powder was analyzed for moisture, ash, fat, protein, total dietary fibre, total carbohydrates, energy value, hydrogen cyanide and water holding capacity. The bamboo shoot powder was incorporated at 0% (Cookies with 100% refined wheat flour), 2, 4, 6, 8 and 10% level by substituting wheat flour. The prepared cookies with different treatments were evaluated for sensory parameters. Variations were detected in appearance, texture, aroma, taste and overall acceptability scores from 7.79 to 8.16, 7.84 to 8.13, 7.75 to 7.96 and 7.78 to 7.92, respectively. Results showed that up to 6% level of fortification with bamboo shoot powder, the cookies were acceptable with improved functional and nutraceutical properties compared to the control cookies.

**Keywords:** Bamboo powder, cookies, fortification, sensory characteristics

### Introduction

Bamboo is one of the fastest growing plants with the ability to survive in a wide range of climatic and soil conditions. The most commonly grown edible bamboo species in India are *Bambus pallida*, *B. tulda*, *B. polymorpha*, *B. balcooa*, *Dendrocalamus hamiltonii*, *D. giganteus* and *Melocanna bambusoides* (Choudhury *et al.*, 2012 and Chauhan *et al.*, 2016)<sup>[6, 4]</sup>. Some species with special highlight for the industrial processing are *Bambusa*, *Dendrocalamus*, *Phyllostachys*, *Pseudosasa*, *Sasa* and *Sino arundinaria* (Manhães, 2008 and Pereira and Beraldo, 2016)<sup>[12]</sup>. Bamboo is recognized as nutraceutical (Xuhe, 2003; Lo *et al.*, 2008 and Chongtham *et al.*, 2011)<sup>[14, 9, 5]</sup> 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 micro nutrient 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)<sup>[1]</sup>.

Cookies are small, flat, baked treat, usually containing fat, flour, eggs and sugar. In most English-speaking countries except for the United States and Canada, crisp cookies are called biscuits. The chewer biscuits are also called cookies in the United Kingdom. The term cookie is sometime used for plain bun (Anonymous, 2013)<sup>[2]</sup>. Due to taste, crispness and eating convenience, cookies hold an important place in snacks and are popular among all age groups especially in children. There is a growing demand for different types of health-oriented food products in the food industry. Therefore, fibre enriched cookies can help fulfil this need, considering cookies are one of the most popular snacks around the world due to their ready to eat and easy to store nature, availability in different varieties and low cost (Baumgartner *et al.*, 2018)<sup>[3]</sup>.

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## Materials and Methods

The bamboo shoots of *Dendrocalamus hamiltonii* specie was procured from Anu, Giripul, Karganu, Lakothi, and Nauni villages of District Solan, in Himachal Pradesh, India. Semolina was purchased from local market. The packaging material such as Low Density Polyethylene (LDPE) pouches was purchased from International Scientific and Surgicals, Solan.

### Sensory analysis of cookies

The cookies with different treatments were subjected to sensory evaluation (9-point hedonic scale) following standard procedure described by Ranganna (2009) [13]. 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 chemical and functional characteristics of bamboo shoot powder was analysed by Completely Randomized Design (CRD) suggested by Cochran and Cox (1967) [7]. 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) [8] 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 cookies

The ingredients such as refined wheat flour, vegetable ghee, powdered sugar, skim milk powder, salt and sodium bicarbonate were used to prepare the cookies. A total of six treatments of cookies were prepared, each of a batch of 100 g wheat flour. While one sample was kept as control having only 100 g wheat flour, and in the other five samples, the refined wheat flour was replaced with bamboo shoot powder at a level of 2, 4, 6, 8 and 10%. The powdered sugar was mixed with vegetable ghee and the mixture was beaten until light and fluffy. The sieved refined wheat flour and sodium bicarbonate alongwith salt and skimmed milk powder were added to the fluffy mass and mixed thoroughly to form soft dough. The mixture was kneaded properly for about 10 minutes and wrapped in an aluminium foil. The dough was

allowed to stand at room temperature for about 30 minutes and after that it was converted into small balls. The balls were flattened into sheet of about 0.6 cm thickness. The flattened sheet was cut into circular shapes with the help of cookie cutter having diameter of 4.0 cm. The cut shapes were placed on a baking tray lined with butter paper and baked in an oven at  $200^\circ\text{C}$  for 20 minutes. The time-temperature combination for baking was decided on the basis of preliminary experiments and overall baking quality of cookies.

### Optimization of level of bamboo shoot powder supplementation in cookies

The refined wheat flour was replaced with bamboo shoot powder for preparation of bamboo shoot powder supplemented cookies (Table 1). The cookies were prepared and 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.

**Table 1:** Optimization of level of bamboo shoot powder supplementation in cookies

Treatment	Refined wheat flour : Bamboo shoot powder
T <sub>1</sub>	100:0
T <sub>2</sub>	98:2
T <sub>3</sub>	96:4
T <sub>4</sub>	94:6
T <sub>5</sub>	92:8
T <sub>6</sub>	90:10

## Results and Discussion

### Sensory scores of cookie supplemented with bamboo shoot powder

The refined wheat flour was replaced with bamboo shoot powder at six different levels for preparation of cookies (Table 2). The prepared cookies were subjected to sensory evaluation by a panel of ten judges. The data clearly indicate that the highest mean scores for all the parameters i.e. appearance (8.16), texture (8.13), aroma (7.96), taste (7.92) and overall acceptability (8.09) were received by the cookies of treatment T<sub>4</sub> (94:6). The results reflected that 6 per cent bamboo shoot powder was found to be the best combination in comparison to 2, 4, 8 and 10 per cent. Therefore, T<sub>4</sub> (94:6) was selected for further studies.

**Table 2:** Sensory scores\* of cookies supplemented with bamboo shoot powder

Treatments	Appearance	Texture	Aroma	Taste	Overall acceptability
T <sub>1</sub> (100:0)	7.79	7.84	7.75	7.78	7.79
T <sub>2</sub> (98:2)	8.03	7.89	7.79	7.81	7.81
T <sub>3</sub> (96:4)	8.09	8.02	7.85	7.85	7.84
T <sub>4</sub> (94:6)	8.16	8.13	7.96	7.92	8.09
T <sub>5</sub> (92:8)	8.12	8.07	7.89	7.86	7.87
T <sub>6</sub> (90:10)	8.15	8.11	7.93	7.89	7.96
CD <sub>0.05</sub>	0.03	0.07	0.07	0.08	0.07

\* Nine point hedonic scale

### Treatments (RWF: Refined wheat flour; BSP: Bamboo shoot powder)

- T<sub>1</sub>: Control (100RWF:0BSP)
- T<sub>2</sub>: (98RWF:2BSP)
- T<sub>3</sub>: (96RWF:4BSP)
- T<sub>4</sub>: (94RWF:6BSP)
- T<sub>5</sub>: (92RWF:8BSP)
- T<sub>6</sub>: (90RWF:10BSP)

## Conclusion

Bamboo shoot powder is rich in minerals, total dietary fibre, total carbohydrates and water holding capacity. Therefore, cookies 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 incorporated up to a level of 6% in the formulation of cookies without affecting the overall quality. Thus, bamboo shoot can be utilized for preparation of protein rich cookies with improved functional properties.

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