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RESEARCH ARTICLE

Development of a tastemaker from bamboo shoot and traditional nutritional spices of North-East India

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ABSTRACT

Development of a new product is a challenging area in the field of food processing. Consumers today are very enthusiastic to try ready-to-make products that are delicious as well as nutritious. On the other hand, North East India is a hub of indigenous spices known for their unique flavor and health benefits. Keeping these into consideration this study was designed to formulate a spice mix using bamboo shoot and traditional nutritional spices from North East India that adds a good flavor to the dishes. Along with it the physico-chemical and organoleptic attributes of the developed product was analyzed for consumer acceptability. From the results it can be concluded that the developed spice mix has a great potential in today's market scenario where delicious, ready-to-make, nutrients packed and low-fat products are on huge demand. The study also highlights the need of further exploration of locally available foods in the North-East India.

Keywords: Bamboo shoot, spices, product development, taste maker

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INTRODUCTION

With the changing lifestyle there has been an increase in the consumers' demand for ready-to-make products that are healthy and tasty. Spice is an important ingredient in Indian cuisine that adds flavour to our dishes. Traditional spices such as ginger, garlic, turmeric etc, apart from improving flavour, are beneficial to human health in many ways and North East India is a hub of these. In addition to it, bamboo shoot has been gaining recognition in the recent years for its unique taste and nutritional values. Thus, the aim of this study is to develop a taste enhancer with bamboo shoot as the base ingredient and spices as secondary ingredient. Spices include king chilly, aromatic ginger, naga garlic, lakadong turmeric, star anise and maroi nakupi.

Bamboo shoot is widely available in the states of North-East India. Bamboo shoots are reported to contain nutrients such as protein, carbohydrates, minerals and fibres. It can be utilized to reduce the prevailing problem of malnutrition (Basumatary et al., 2017). Bamboo shoots are claimed to have a lot of mineral elements such as copper, zinc, magnesium, cobalt, chromium and manganese (Choudhury et al., 2010). The presence of lignin in them helps them act against bacteria, viruses and cancer

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(Tamang et al., 2012). Its high content of potassium helps in maintaining blood pressure and reduces body fat (Chongtham et al., 2011). Chongtham et al. mentioned the use of 'Heart protective vegetable' for bamboo because of the presence of potassium (K). Fresh bamboo shoots are known to have high protein content (Sharma et al., 2008). The presence of hormones like leucine, tyrosine and arginine facilitates biochemical metabolism and production and regulation of hormones in human body (Nongdam et al., 2014). These characteristics have attributed to its increasing acceptance among the consumers for its raw form or its products such as fermented bamboo shoots, bamboo beer, pickle, etc. "King Chilli' (Capsicum chinense) is considered as the hottest chilli in the world (Guinness World Record, 2006). It is native to the states of Northeast India particularly Assam, Meghalaya, Nagaland and Manipur. King chilli has a highly pungent taste and a unique aroma because of which it has been gaining importance. People of Nagaland use the chilli after a heavy exercise as they believe it has muscle toning property (Bhagowati et al., 2009). Capsaicinoids, a biochemical compound, is the compound that is responsible for the burning sensation of chilli (Hoffman et al., 1983). A study reported that the fruits of King chilli have a much higher amount of capsaicin than the other varieties (Sanatombi et al., 2008). Studies mention king chilli as a food having anti-obesity property (Yoshioka et al., 1999). It is also rich in antioxidants (Shobana et al., 2000). Many studies highlight its other pharmaceutical properties. Some studies confirm that Indians who consume spices that are rich in antioxidants regularly have lower risk of Alzheimer's disease in the long run (Ganguli et al., 2000). Though king chilli has been found to have many health beneficial properties but researchers are still working on finding king chilli's properties to fight against cancer (Meghvansi et al., 2010). North-east Indian people have been using King chilli since ages and its potential are not completely known yet. Hence, there is a requirement of more scientific research on king chilli to find out its other beneficial characteristics. Star anise (Illicium verum) is widely cultivated in the state of Arunachal Pradesh of India. It is one of the major ingredient of garam masala, which is a popular spice mix used in Indian cuisines. Start anise are said to aid in digestion and has been used as additive to traditional medicine (Boota et al., 2018). A study reported that star anise contain anti-carcinogenic agents. The anticancer action is due to the presence of flavonoids, resveratrol and curcumin (Huang et al., 2009). Maroi nakupi (Allium odorosum) is an indigenous herb of Manipur and is used as a spice. A study found that Maroi nakupi is a good source of various nutrients. It is rich is phenols, Vit C, fibre and protein and low in fat content. The same study highlighted its socio-economic role as Manipuri people are financially supported from the cultivation of the plant (Ayam et al., 2011). Ginger is an important crop grown in the Northeast region of India. The ethnic groups of the region have been using ginger in their diets since ages. The ginger variety available in the Northeast region are reported to have great potentialities against certain diseases and shows powerful anticancer activity due to the presence of compounds like Allicin and other sulphur compounds. It also has antimicrobial, antifungal, cardioprotective, antioxidant and antidiabetic properties (Borborah et al., 2014). Lakadong turmeric is an indigenous turmeric variety of Meghalaya, India and is considered one of the best turmeric variety in the world (Janani et al., 2019). Turmeric rhizomes are used as spice and contain yellow pigments called curcuminoids which have antibacterial, antidiabetic, anti-asthmatic, blood purifying and healing properties (Ammon et al., 1991).

MATERIALS AND METHODS

Raw Materials

The ingredients used for the production of this innovative product called Taste Enhancer are bamboo shoot, king chilli, aromatic ginger, lakadong turmeric, star anise, naga garlic and maroi nakupi. These ingredients were collected from different parts of North East India. Then it was washed, dried, powdered and packaged for further processing.

Raw materials were collected from various parts of North-east India. Seven different ingredients are used namely bamboo shoot

from Arunachal Pradesh and Meghalaya, king chilli and lakadong turmeric from Meghalaya, aromatic ginger and star anise from Arunachal Pradesh, Naga garlic from Nagaland and Maroi nakupi from Manipur and were collected from local markets of the mentioned places. All the ingredients harvested fresh were carefully selected to be uniform in appearance, fresh and free from any defect.

Sorting, Peeling, Washing, and Cutting

The ingredients procured from the different states were sorted, graded and then disinfected with sodium hypochlorite (0.01% v/v), washed and cut into thin slices.

Drying

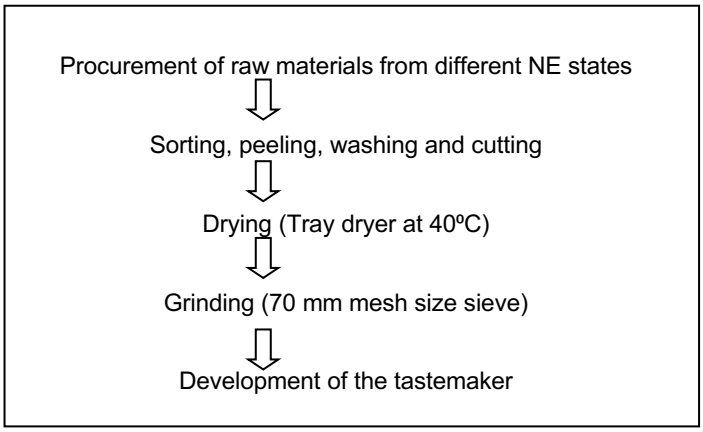
The sliced ingredients were then allowed to dry to ensure that spices are free of microbial and other contamination and to extend their shelf life. A tray drier at 40ºC was used to ensure minimum loss of nutritional content of the spices. 15–20% moisture content was maintained throughout the drying process.

Grinding

The dried ingredients were then grinded using a Philips grinder (750W), sieved in a 70 mm mesh size sieve shaker and stored in tightly packed containers in refrigerated condition.

Development of the tastemaker

All the grinded spices along with bamboo shoot is now ready for development of the tastemaker. Different combinations were made in order to attain the best formulation. The ingredients were mixed in different proportions with different trials.



Optimization of the different formulations

Different combinations were made to obtain the ultimate formulation. Trials were made changing the quantity of ingredients creating an impact on sensorial parameters of the final product. Thirty different combinations were made, coded from C_1 to C_{30}. From the trials made, 3 different combinations- each for meat, fish and veg were finalized.

Packaging and sealing

Suitable packaging material, in consultation with CIPET, Guwahati was used for packing the optimized product. For sealing hand operated impulse sealer was used. FSSAI registration procedure was completed. (Reg. No. 21718002000043) as shown in Figure 1.

Figure 1 Meat, Fish, and Veg tastemaker after suitable packaging and FSSAI registration.

Physico-chemical analyses

Moisture content: 2g of each sample was taken in a flat-bottom dish and kept overnight in a hot air oven at 100–110°C and weighed. The loss in weight was regarded as a measure of moisture content (AOAC).

$$\boldsymbol{Moisture\ content}\ (\%) = \frac{\boldsymbol{weight\ of\ fresh\ sample - weight\ of\ dry\ sample}}{\boldsymbol{weight\ of\ fresh\ sample}} \times \mathbf{100}$$

Ash content: 5g of each sample was weighed in a silica crucible and heated in muffle furnace for about 5-6h at 500°C. It was cooled in a desiccator and weighed. It was heated again in the furnace for half an hour, cooled and weighed. This was repeated consequently till the weight became constant (Ash became white or grayish white). Weight of ash gave the ash content (AOAC).

$$\text{Dry matter}\ (\%) = \frac{(\text{weight of dish} + \text{weight of dried sample}) - \text{weight of dish}}{\text{weight of sample before drying}} \times 100$$

Protein: The crude protein was determined using micro Kjeldahl method. This method is a 3 steps process which include digestion, distillation and titration. In this method by finding out the amount of ammonia formed, from a known amount of sample, the amount of protein present (Note: 1ml of 0.1N acid=1.40mg N) is calculated. The reagents used were concentrated H_2SO_4, 0.1N standard HCl, 40% NaOH, 4% boric acid solution, mixed indicator solution (mixture of 2 parts of 0.2% methyl red in ethanol with 1 part of 0.2% methylene blue in ethanol) and catalyst mixture [Na_2SO_4:$CuSO_4.5H_2O$]=5:1. Formula used for calculating amount of nitrogen and protein content-

$$\%\ \text{Nitrogen} = \frac{14(\text{N of acid}) \times (\text{Titrant value}) \times 100}{\text{Sample weight (g)} \times 1000}$$

The total protein was calculated multiplying the evaluated nitrogen by 6.25.

$$\% \text{ Protein} = \% \text{ Nitrogen} \times 6.25$$

Carbohydrate: 100 mg of the sample was taken into a tube and 5 ml of 2.5 N HCl was added into it. The mixture was allowed to hydrolyze by keeping a tube into a water bath for 3 hrs and then cooled to room temperature. Neutralization with solid sodium carbonate was done until the effervescence ceases and the volume was then made upto 100 ml. The mixture was centrifuged and the supernatant was then collected and used for analysis. The standards were prepared by taking 0, 0.2, 0.4, 0.6, 0.8 and 1ml of the working standard. '0' serves as blank. About 0.5 ml of the sample extract was taken for the analysis. The volume was then made up to 1ml in all tubes including the sample tubes by adding distilled water and 4 ml of anthrone reagent was added to it. The mixture was then heated for 8 min in a boiling water bath and cooled rapidly. The green to dark green color was finally measured at 630 nm against the blank. A standard graph was drawn by plotting concentration of the standard on X-axis versus absorbance on Y-axis. The amount of sugar present in the sample tube was then calculated from the graph and total carbohydrate was determined by the following formula.

$$\text{Carbohydrate in sample (\%mg)} = \frac{\text{sugar value from graph (mg)}}{\text{aliquot sample used (0.5 or 1ml)}} \times \frac{\text{total volume of extract (ml)}}{\text{wt of sample (mg)}} \times 100$$

Fat: Fats and oils are glyceride ester of either saturated or unsaturated fatty acids. 2-3g moisture free sample was weighed in a thimble (prepared from Whatman No. 41 filter paper) and placed in the Soxhlet apparatus. Then connected a dry pre-weighed solvent flask ('a') beneath the apparatus and add the required volume of solvent (petroleum ether) and connect to condenser. And heating rate was adjusted to give condensation rate of 2-3 drops and extract for 16 hours to remove the thimble and retain ether from the apparatus. After that excess of ether was evaporated from the solvent flask on a hot water bath and dry the flask at 105ºC for 30 min and cool the flask in desiccators and weigh ('b'). The estimation of the crude fat was calculated by-

$$\text{Crude fat (\%dry wt. basis)} = \frac{\text{b} - \text{a}}{\text{weight of sample}} \times 100$$

Sensory analysis

The sensory attributes such as appearance, texture, flavor, aftertaste and overall acceptability were evaluated by distributing samples randomly among a group of people comprising of faculties, students and other staffs of the university. Nine-point hedonic scale was used for the evaluation. Scores were given on hedonic scale ranging from 9 to 1 representing 'like extremely' to 'dislike extremely' respectively. The feedbacks were analysed and put in graph.

RESULTS AND DISCUSSION

Basic composition of the tastemaker

Table 1 shows the chemical composition of the 3 different tastemakers which is a blend of bamboo shoot and six other spices. All the samples were analyzed for moisture content, ash content, protein, fat, carbohydrate and calories. The moisture content of the spices ranged from 14.12, 15.25 and 15.66% in veg, meat and fish tastemakers respectively. There is no such significant difference observed in moisture content among the different formulations which may be due to containment of dehydrated ingredients in the tastemaker. Ash content, regarded as an index of mineral concentration in the sample ranged from 3.69, 4.02 and 4.54% in veg, meat and fish tastemakers respectively. The maximum amount of protein 13.12 % is found in the fish

tastemaker which may be due to more of bamboo shoot incorporation into it. It is followed by meat tastemaker 12.25% and veg tastemaker 9.62 %. Similarly, values of fat content ranged from 2.5, 3.1 and 3.8 % in meat, veg and fish tastemakers respectively. Carbohydrate plays an essential role as energy source in the form of starch or sugar. Carbohydrate content was found highest 13.1 % in fish taste maker followed by 12.01% in meat and 11.25 % in veg tastemaker. Hence, the study reveals that the tastemaker is good source of protein and carbohydrate compared to commercial spices available.

Table 1: Chemical composition of the optimized sample

Parameter	Tastemaker (Meat)	Tastemaker (Fish)	Tastemaker (Veg)
Moisture Content	15.25%	15.66%	14.12%
Ash Content	4.54%	4.02 %	3.69 %
Protein	12.25%	13.125 %	9.62 %
Fat	2.5%	3.8 %	3.1 %
Carbohydrate	12.01%	13.1 %	11.25 %
Calories	4019.150cal/gm	4352.483 cal/gm	4240.443 cal/gm

Sensory scores of the optimized formulations

The three optimized formulations were evaluated for sensory analysis. The sensory evaluation was carried out on 0-9 hedonic scale by judging on the parameters like appearance, taste, aroma and color. Result of this analysis is presented in Table 2. The tastemaker got the highest score for flavor followed by aftertaste and overall acceptability. From the sensory scores we can conclude that that target group has a liking for the product and may find a place in the market in the future.

Table 2: Hedonic rating of the optimized sample

Parameter	Tastemaker (Meat)	Tastemaker (Fish)	Tastemaker (Veg)
Appearance	7	7	7
Texture	7	7	7
Flavour	9	8	8
Aftertaste	8	8	7
Overall Acceptability	8	8	8

CONCLUSION

The study was aimed at developing a tastemaker out of ingredients available in the North East region of India. And from the sensory evaluation it can be concluded that it has a potential to gain a significant position in the current market. The tastemaker made of aromatic ginger, naga garlic, king chilli, lakadang turmeric, star anise, maroi nakupi in combination with dried bamboo shoot proves to be highly nutritional in nature making a mark for its high demand in the market. The tastemaker having negligible percentage of fat and sugar and high fibre content have the potential to attract people dealing with weight issues, diabetes and other health issues. Its weight loss attributes and cardiac friendly properties make the spice mix stand out from the rest of the commercially available mixed spices in the market. It's extremely mild, subtly, earthy, woody and nutty flavour works as a taste enhancer making it a good flavouring agent with added nutritional properties over the other available mixed spices.

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