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Standardization for development of Musa chocolate balls by the utilization of banana pulp powder

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Abstract

The musa chocolate ball is a confection, based on utilization of banana pulp powder stuffed with nuts viz. groundnut, cashew nut, coconut and jaggery with dark chocolate coating. The objectives of investigation were to standardize the formulation for the same and to study its quality characteristics. The different samples were prepared viz. T₁, T₂ and T₃ with varying quantity of groundnut and sweetening agent i.e. sugar or jaggery. All the samples were organoleptically evaluated for color, appearance, taste, texture and overall acceptability. Sample T₃ got the highest score for the overall acceptability containing banana pulp powder 60g, groundnut 20g, cashew nut 5g, coconut 10g and jaggery 5g. Furthermore, the sample was fetched for chemical composition and the results for moisture, fat, protein, carbohydrates, dietary fibres, reducing sugar, non-reducing sugar and ash content were 5.8, 19.94, 12.41, 51.12, 8.15, 33.66, 12.46 and 2.74 g/100g respectively. Moreover, it founds a good source of Calcium 68.18 mg/100g and Vitamin C 11.5 mg/100g. Further, the microbial quality showed that Total plate count (TPC) and Yeast and Mold count was 9.7×10^2 and 4.5×10^2 cfu/ml respectively and are within the acceptable limits. However, the textural profile analysis (TPA) of Musa chocolate balls by TA-XT2 PLUS analyser showed that the sample T₂ had highest hardness 0.491 kg followed by sample T₁ 0.368 kg and T₃ 0.411 kg. In due course, according to processing technology and nutritional content, the product has potential for commercialization and acquaintance to society.

Keywords: banana, chocolate, nuts, pulp powder, texture

Introduction

Musa spp., comprising dessert bananas and plantains, are one of the world's foremost fruit crops as source of energy in the diet of people living in humid tropical regions. Banana is a term of number of hybrids in the genus *Musa*, dessert bananas and plantains [2]. Leading banana growing states are Tamil Nadu, Maharashtra, Gujarat, Andhra Pradesh and Karnataka. The global production of banana is around 102028.17 thousand tons of which India contributes 27.57%. Besides India, other major banana producing countries are China, Philippines, Ecuador, Brazil and Indonesia. The major producing varieties of banana in India are Grand Naine, Robusta, Dwarf Cavendish, Red Banana and Nendran [5]. Plantains as well as dessert bananas and their various plant parts such as roots, pseudostems, stems, leaves, and flowers have long been used in local and traditional medicine in America, Asia, Oceania, India and Africa [14].

Traditionally, the fruit, stem juice, flowers of banana plants were used for treating diarrhoea (unripe), dysentery, menorrhagia, diabetes, antilithic, antiulcerogenic, hypoglycemic, hypolipidemic, antioxidant actions and inflammation, pain and snakebite [15]. Moreover, banana is a good source of energy i.e. carbohydrate with a good amount of minerals and important vitamins viz. Phosphorous (34 mg), Iron (0.81 mg), Riboflavin (0.07 mg) and Vitamin C (6.5 mg) [8].

Peanut has conventionally been used as a source of oil; however, its universal annual protein harvest has reached nearly 4.5 million tons. India is leading producer of peanut followed by China and the United States. Cereals and legumes based foods are being fortified with peanuts as protein supplements to alleviate protein calories malnutrition problem [12]. Coconut being the most important commercial crop in tropical areas and usually referred as 'tree of heaven' or 'tree of abundance' is commercially used for various purposes. India is the third largest producer of coconut in the world with 10.56 million tonnes of coconut per year [11]. Jaggery is unrefined chemical free natural sugar. India is a largest producer of jaggery producing more than 70% of the total world jaggery production. Jaggery is prevalently known as the "medicinal sugar" and is nutritionally analogous to honey. It has been used as a sweetener in Ayurvedic Medicine for 3000 years.

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Moreover, jaggery has good content of minerals and vitamins which lacks in the refined sugar viz. calcium, phosphorus, magnesium, potassium and iron and traces of zinc and copper. The vitamin content includes folic acid and B complex vitamins^[6].

The Indian market is with thirst of various processed banana products like Banana Fruit Candy/Stem Candy, Banana Fig, Banana Flour, Banana Powder, Banana Juice, Banana Fruit Bar, Banana Biscuits, Banana Jam and Jelly, Banana Wine, Health drinks and Baby food and Banana Fiber. Next to the mentioned products, banana is utilized in various confections for producing healthy banana based products. The Musa Chocolate Balls is an innovative idea generated after observing the confectionary products stuffed with various stuffing's. Moreover, a banana being a leading fruit crop of state with its marginal post-harvest loss, we came to an aim to reduce post-harvest loss and better utilization of banana at commercial level. In response to produce healthy confection, the sincere efforts were made to produce musa chocolate balls using banana pulp powder, nuts, jaggery and chocolate.

Materials and Methods

Materials

The musa chocolate balls is newly developed confectionary product prepared by using banana pulp powder, chocolate, jaggery, cashew nut, groundnut, coconut etc. All the required raw materials and packaging material viz. Aluminum foil and High Density Polyethylene (HDPE) molded containers (Well type) were procured from the local market.

Preparation of Banana Pulp Powder

Drying is treatment of holding fruits and vegetables at a high temperature to remove its moisture to an acceptable level. Drying is mainly characterized by sun drying, shade drying or cabinet drying. However, in order to obtain best results, it is necessary to judge the suitability of different drying methods on the basis of color characteristics of final products^[4]. The banana pulp powder is prime ingredient of musa chocolate balls, prepared by following procedure.

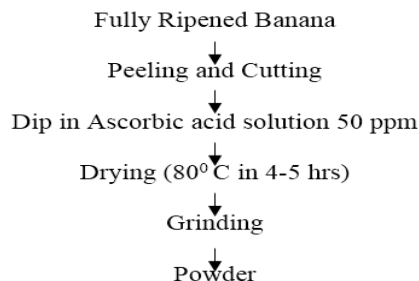


Fig 1: Preparation of banana pulp powder

Standardization of recipe for preparation of musa chocolate balls

The trials were taken for the formulation of ultimate recipe, the prime ingredient banana pulp powder was formulized with varying quantity of nuts and combination of sweetening ingredient i.e. sugar and jaggery (As per requirement/ TSS of banana pulp powder). The trial samples were nominated as T₁, T₂ and T₃, whose formulations are depicted in following Table 1.

Table 1: Standardization of Musa Chocolate Balls

Samples	Ingredients (g)					
	Banana Powder	Groundnut	Cashew Nut	Coconut	Sugar: Jaggery (5g)	Chocolate
T ₁	60	10	5	10	1:0	For Coating
T ₂	60	15	5	10	1:1	For Coating
T ₃	60	20	5	10	0:1	For Coating

Preparation of Musa chocolate balls

After standardization of recipe, the Musa chocolate balls were prepared as per the method presented in Fig 2.

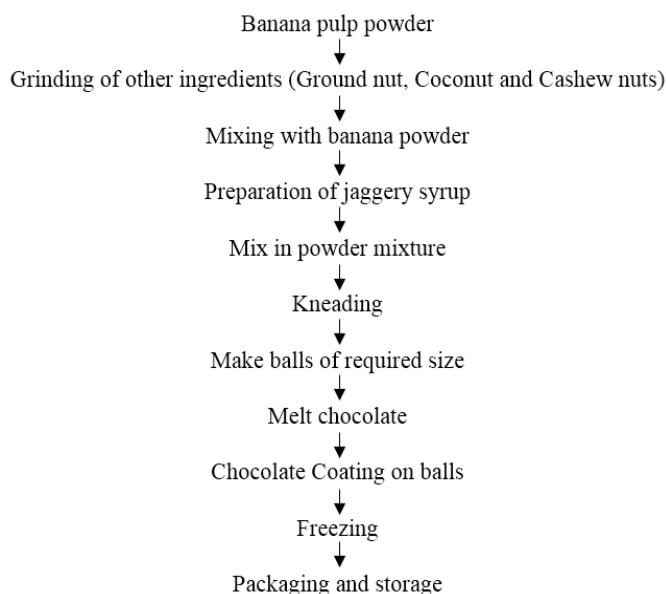


Fig 2: Preparation of Musa Chocolate Balls

Sensory evaluation of Musa Chocolate Balls

The different sensory attributes such as color, taste, texture, appearance and overall acceptability were evaluated by using 9 point Hedonic scale method by semi-trained panel members as per the method given by^[13].

Chemical analysis of Musa Chocolate Balls

Chemical constituents like Moisture, Fat, Protein, Carbohydrate, Reducing Sugar, Non-Reducing Sugar, Saturated Fatty acids and Unsaturated Fatty acids, Total Ash, Calcium and Vitamin C content were determined as per the methods quoted by^[1, 10].

Microbial Examination of Musa Chocolate Balls

Microbial quality i.e. Total plate count (TPC) and Yeast and Molds (YM), were examined as per the methods given by^[7].

Statistical analysis

The data obtained from various parameters were recorded and statistically analyzed as per method of^[9].

Result and Discussion

The results recorded during the present investigation narrated herewith suitable headings and subheadings.

Organoleptic evaluation of prepared Musa Chocolate Balls

The prepared Musa chocolate balls were organoleptic ally evaluated by the semi-trained panelist for the different sensory attributes and the responses recorded by the panelist were presented in the following Table 2 and Graph 1.

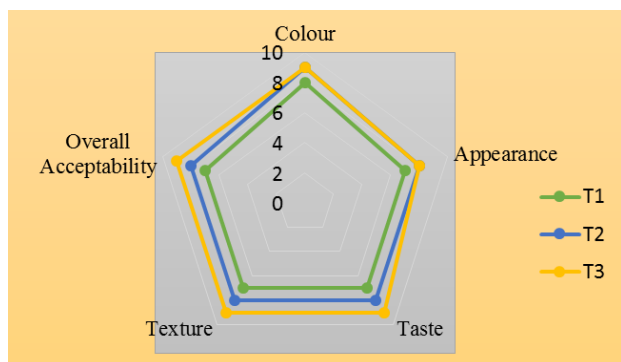
Table 2: Sensory evaluation of Musa Chocolate Balls

Sensory Attributes	Samples					
	T ₁	T ₂	T ₃	Mean	SE	CD at 5%
Color	8	9	9	8.6	0.083	0.250
Appearance	7	8	8	7.6	0.228	0.687
Taste	7	8	9	8	0.166	0.501
Texture	7	8	9	8	0.097	0.292
Overall acceptability	7	8	9	8.3	0.101	0.305

*Each value is an average of ten determinations

The results represented in above Table 2 reveals that, the trials are made with change in quantity of ingredients creating an impact on sensorial parameters of the final product. The color of any kind of food is a prime parameter which gives first sight impression on consumers. According to score given by panelists, the T₃ and T₂ samples found more appropriate color than sample T₁. Furthermore, an appearance of food products is one of the important sensorial parameter, which decides the quality of final product. The sample T₂ and T₃ got equal score for appearance followed by T₁. Panelist recorded the highest score to the sample T₃ for taste as compared to other samples i.e. T₁ and T₂.

Consequently, the panelists scored the formulations for texture parameter showed that the sample T₃ is superior than T₁ and T₂. All samples of Musa chocolate balls are up to the mark of satisfaction level, but the overall acceptability of product justifies final judgment on products. Further, the score for overall acceptability from the Table 2 depict that the sample T₃ is highly acceptable than other two samples. Conferring to sensory evaluation of various formulations of Musa chocolate balls, it could be visualized and confirmed that the sample T₃ founds better and hence, the same one was finalized for production and further investigation. The results obtained are comparable with the results noted by the [12] that, peanut in the form of flour, protein isolates, and meal in a mixed product have been found to be very desirable from a sensory quality point of view.



Graph 1: Organoleptic evaluation of Musa Chocolate Balls

Chemical analysis of Musa Chocolate Balls

The chemical composition of any food product is an indication of nutritive value and ultimately the health benefits. The different chemical parameters are depicted in Table 3.

Table 3: Chemical analysis of Musa Chocolate Balls

Chemical analysis of Musa Chocolate Balls		
Sr. No.	Parameters	Value (g per 100g)
1.	Moisture	5.8
2.	Fat	19.94
3.	Protein	12.41
4.	Carbohydrate	51.12
	i. Dietary Fiber	8.15
	ii. Reducing Sugar	33.66
	iii. Non-reducing sugar	12.46
5.	Ash	2.74
	i. Calcium (mg/100g)	68.18
6.	Vitamin C (mg/100g)	11.5
7.	Energy value (Calories)	425

*Each value is of three determinations

The results presented in the Table 3 reveals that the Musa chocolate balls is a very good source of energy as it contains fat and carbohydrates 19.94 and 51.12 g/100g respectively. Besides the energy source it founds that it is a good source of protein which contains about 12.41g/100g proteins. As, the banana and other ingredients i.e. nuts are decent source of dietary fibers, the Musa chocolate balls contains an ample amount of dietary fiber i.e. about 8.15g/100g. Moreover, reducing sugar and non-reducing sugar content was 33.66 and 12.46 g/100g respectively. Furthermore, it was analyzed that the Musa chocolate balls founds good source of minerals which contains about 2.74 g/100g ash. Consequently, it was analyzed for calcium and shows 68.18 mg/100g calcium. Ultimately the sample was analyzed for vitamin C and it bring into notice that Musa chocolate balls is good source of vitamin C, and contains about 11.5 mg/100g.

Microbial examination of Musa chocolate balls

The TPC and Yeast and Mold count was examined in microbial examination study. The microorganisms play an important role in shelf life of food products. Moreover, microbial growth in foods indicates the severity of contamination and sources of contamination. The microbial qualities of Musa chocolate balls were examined and the results are elaborated in the Table 4.

Table 4: Microbial Examination of Musa Chocolate Balls

Sr. No.	Microbial Quality	cfu/ml
1.	TPC (Total Plate Count)	9.7×10^2
2.	Yeast and Mold	4.5×10^2

*Each value is of three determinations

The data expressed in Table 4, reveals that the TPC and yeast and mold count of Musa chocolate balls was 9.7×10^2 and 4.5×10^2 cfu/ml respectively. The results of microbial qualities of Musa chocolate balls were within the acceptable limit as mentioned by the International Commission on Microbiological Specifications for Food (ICMSF).

Texture profile analysis of Musa Chocolate balls product by using TA-XT2 Texture analyser

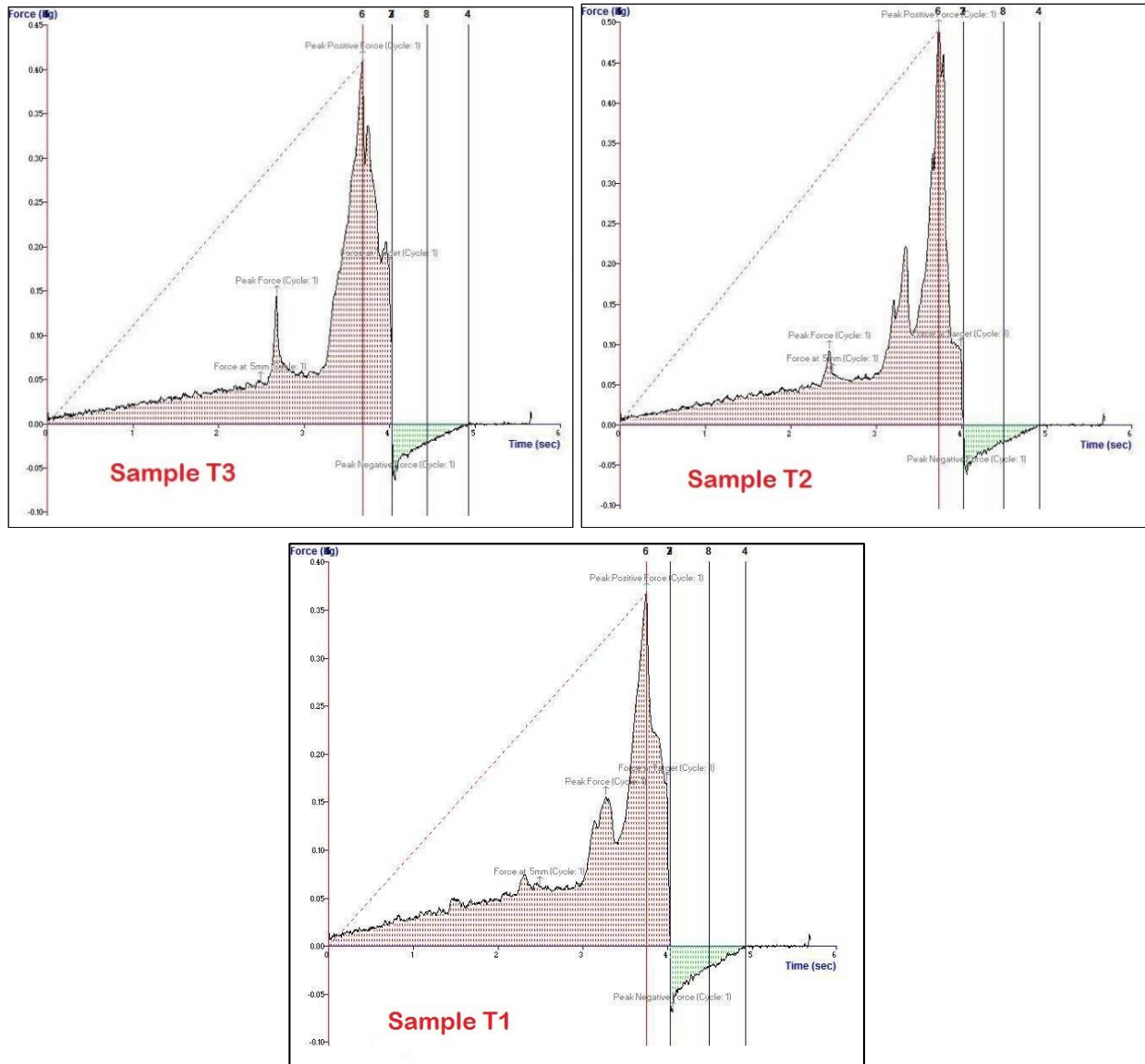
The texture of Musa Chocolate balls was determined by using the TA-XT2 PLUS (Stable Micro system, Surrey, UK) texture profile analyser. The prime textural characteristic i.e. hardness of all Musa Chocolate balls was analysed by using cutting test blade and 5kg load cell. Results obtained are presented in Table 5 and Graph 2.

Table 5: Textural profile analysis (TPA) of Musa Chocolate balls by TA-XT2 PLUS

Texture profile analysis of Musa Chocolate balls	
Sample	Hardness (kg)
T ₁	0.368
T ₂	0.491
T ₃	0.411
SE±	0.0013
CD at 5%	0.0039

Hardness is the most commonly evaluated characteristic in determining the texture of the chocolate balls. Hardness is the

highest force required to cut the sample or to break the sample into two halves by cutting or Warner–Bratzler test blade. The changes in the hardness with varying level of the nuts, sugar and jaggery concentrate are presented in Table 5. The hardness of Sample T₁ (0.0368kg) was found lowest compared to other samples. Whereas, the highest hardness was recorded the Sample T₂ having sugar and jaggery combination (0.491kg) followed by sample T₃ (0.411 kg). The finding of the texture profile analysis of the current study are in relation with the³ who reported the TPA for the baked cake balls.

**Graph 2:** Texture profile analysis of Musa Chocolate balls

Conclusion

The Musa chocolate balls is new product developed within the framework of fruit based confection. The product will help in uplifting the processing scenario of banana fruit in country. In terms of nutrition, it is collected source of nutrients with longer shelf life.

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