ISSN: 2347-467X, Vol. 09, No. (3) 2021, Pg. 855-865

Current Research in Nutrition and Food Science

www.foodandnutritionjournal.org

Development of Functional Candy with Banana, Ginger and Skim Milk Powder as a source of Phenolics and Antioxidants

NEHA YADAV, APARNA KUMARI, ANIL KUMAR CHAUHAN* and TARUN VERMA

Department of Dairy Science and Food Technology, Institute of Agricultural Science, Banaras Hindu University, Varanasi, India.

Abstract

The present pandemic situation has increased the demand for plant-based functional foods that enhancing the immunity of all aged groups against COVID-19. This factor has led to innovation in confectionery market because healthy and good quality confectionery products are lacking. In this study, an attempt has been made to develop functional candy from various combinations of banana, ginger, skim milk powder, and honey at 2-10% and evaluated its sensory, nutraceutical, functional properties and microbial stability for 60 days. Among various combinations of banana and ginger pulp, candy prepared from 96:6 w/w (banana: ginger) ratio was found better than other combinations in respect to organoleptic and nutritional quality. Ginger and skim milk powder addition increased the contents of protein (4.54%), ash (2.82%), phenolic (8.59 mgGAE/g), flavonoid (2.43 mQ/g), and antioxidant activity (36.15% DPPH activity) of functional candy. Microbial studies of functional candy revealed that it could be stored up to 60 days without microbial contamination and acceptable by the consumer. The cost of functional candy was Rs.1.53 per candy, which was less than market candy. This study showed that candy manufactured from banana, ginger, skim milk powder, and honey was nutritionally and economical improved with acceptable sensory properties. Developed functional candy increases the market's revenue and enables confectionary market to develop a new candy type.

Article History
Received: 03 July 2021
Accepted: 17 October 2021

Keywords
Banana;
Bioactive Compound;
Candy;
Ginger;
Skim Milk Power.

CONTACT Anil Kumar Chauhan anilchauhancfst@gmail.com Department of Dairy Science and Food Technology, Institute of Agricultural Science, Banaras Hindu University, Varanasi, India.

Doi: http://dx.doi.org/10.12944/CRNFSJ.9.3.13

Introduction

Consumers are interested in functional food that is beneficial for the body and contributes to a healthy lifestyle and the present pandemic situation (COVID-19) accelerates the increasing demand for functional food and beverages.[1] According to the functional food and beverages report (2021), 31% of people take more supplements, and 29% consume more functional foods and beverages. These factors influence the confectionary market and are improving their product with technologies and ingredients that meet consumers' needs.[2, 3] Candy is a top-rated confectionery product among all age groups, especially in children, because it has high organoleptic indicators and low price. However, candy has low nutritional value, so it is worthwhile to develop a good quality candy to add functional ingredients according to the market demand.[4]

Pulpy fruits like banana, guava, mango, jackfruit, papaya, etc., are very popular and can be used as functional ingredients for candy development. Candies prepared from fruit pulp are very nutritious as they contain most of the constituents of fruit from which they are prepared and also a great opportunity to take advantage of fruits that highly perishable and cannot be stored for a longer period.[5, 6]

Banana (*Musa acuminata* Colla) is a delicious and widely consumed fruit all over the world. India is the largest producer of bananas, next to mango.[7] The pulp of banana provides significant health benefits as it contains low fat, an excellent source of dietary fiber, ascorbic acid, flavonoids, vitamin B_6, and potassium.[8] The presence of fiber and potassium in large amounts in banana pulp may help combat atherosclerosis.[9] In addition, its pulp is alkaline in nature, so used for treating gastric problems, neutralizes the acid conditions, and helps in the formation of a thick protective mucus layer.[10] However, one of the limiting factors is that banana fruit has a short shelf life and is affected by different microbial contaminates.

Ginger (*Zinziber officinale* Ros. cv. zhugen)is a perennial plant of the *Zingiberaceae* family, whose rhizome is commonly used as a spice in foods and beverages, promotes metabolism and digestion. In addition, ginger up our immune system and is effective against cold, cough, nausea, vomiting, arthritic pain, and food poisoning.[11] Furthermore, ginger has anti-oxidant, anti-microbial, and anti-cancerous properties due to the presence of bioactive compounds named 6-shogaol and 6-gingerol.[12]

Protein is a building block of the body. Generally, fruits and vegetables have a low level of protein that why the candy prepared from fruit pulp has low protein content.[13] Doctors and dietitians recommend skimmed milk powder over whole milk powder for people because of having an enormous amount of protein, low fat and longer shelf life.[14, 15] It was also reported that skim milk powder increases the flavor, color, texture, taste, and shelf stability of candy. So, skim milk powder can be the best supplement to increase protein content in candy.[16, 17] Sugar causes many dental problems and diabetes, so sugar can be replaced with honey because honey acts as a sweetener and contributes to increasing the total phenolic content in candy.

Thus present work is carried out to develop functional candy from banana pulp, ginger pulp, skim milk powder, and honey and its physiochemical, sensory, and bioactive properties were evaluated.

Materials and Methods

Fully matured banana (*Musa acuminata* Colla) cultivar Cavendish G9, fresh ginger rhizome (Zingiber officinale Roscoe), skim milk powder (Farmer fresh), honey (Dabar), butter (Amul), and salt (Tata) were procured from the local market of Varanasi district (U.P.). Most of the chemicals and additives used in this research were of analytical grade.

Extraction of Pulp

After sorting out damaged and bruised gingers, it was washed thoroughly with running tap water to remove soil and foreign materials. After washing and peeling, cut into 0.5-1.0 cm cubes using knife and passed through the mixer until obtaining a homogeneous ginger pulp (GP). Selected fully ripened banana fruits were peeled, cut into pieces, and passed through the home-scale pulping machine to obtain banana pulp.

Preparation and Standardization of Candy

The formula used to prepare control candy was as follows: 100g banana pulp, 55 ml honey, 20 g butter, 0.5g salt and 3g pectin. Six combinations were prepared for development of functional candy (FC) with replacement of banana pulp(BP) by ginger pulp

(GP) at different levels was 100:0 (control); 98:2; 96:4; 94:6;92:8 and 90:10 w/w. Skim milk powder (150g) added to combinations of banana and ginger pulp to increase the protein content and reduce ginger's spicy flavor. The amount of other ingredients such as honey, butter, salt and pectin content were same as in control candy (Table 1).

Table 1: Different level of pulp and ingredients for standardization of functional candy

Treatment number	Concentration of pulp		Skim milk powder (g/100g of pulp)	Butter (g/100g of pulp)	Salt (g/100g of pulp)	Honey levels (ml/100g	Pectin (g/100g of pulp)	Water (ml)
	Banana pulp (%)	Ginger pulp (%)						
Control	100	0	0	20	0.5	55	3	50
T1	98	2	150	20	0.5	55	3	50
T2	96	4	150	20	0.5	55	3	50
T3	94	6	150	20	0.5	55	3	50
T4	92	8	150	20	0.5	55	3	50
T0	90	10	150	20	0.5	55	3	50

Flow diagram for preparation of functional candy was shown in Fig.1. To prepare functional candy, the blended banana and ginger pulp were cooked till its contents became 1/2 of their original volume. Then skim milk powder was dissolved in a small quantity of water and mixed with the above mixture and again heated till TSS of content reached 70–75^0 Brix. Then other ingredients such as honey, butter fat, and salt were added as per the treatment, and the mixture was heated until the TSS content reached 80-82^{0}Brix. Just before the finish point, potassium sorbate @ 200 ppm was added, which acts as a preservative for candy. The heated mass was spread into a stainless steel plate that was already smeared with fat. The thick paste was rolled into round shape, dusting with coconut powder and left for 5 to 6 hours for cooling and setting. Prepared functional candy (FC) and control candy (CC) were packed in metallic-coated polythene wrappers for further analysis (Fig. 2).

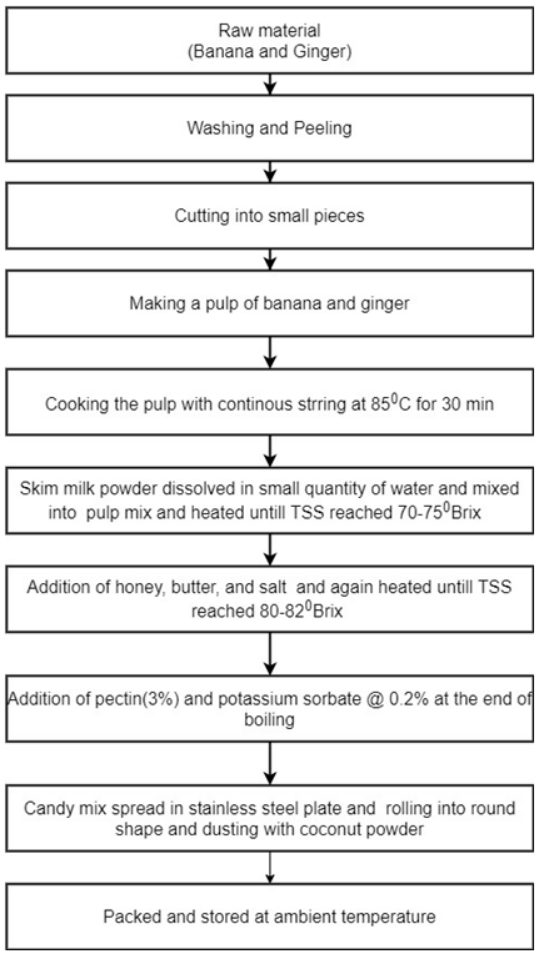

Fig. 1: Flow chart for preparation of functional candy

Optimization of Functional Candy (FC) by Sensory Evaluation

The optimization of the level of banana pulp, ginger pulp, skim milk powder, and other ingredients for the preparation of functional candy was based on sensory analysis according to the procedure explained by Kohinkar*et al*.6 on a 9 point hedonic scale. The mean score of 12 semi-trained judges for each quality parameter viz., aroma, flavor, color and appearance, texture, and overall acceptability was recorded.

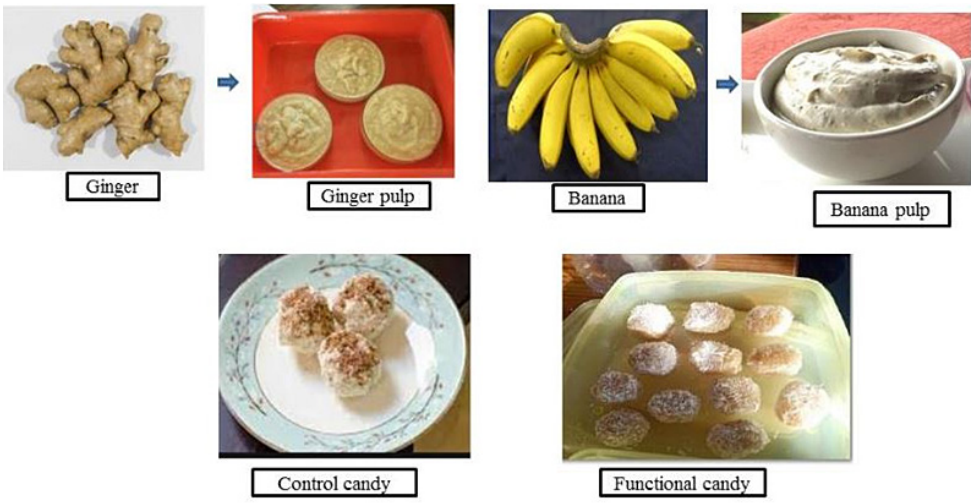

Fig. 1: Flow chart for preparation of functional candy

Proximate Analysis of GP, CC and FC

Moisture, protein, and ash content in fruit candy were analyzed by the method given in AOAC18. The energetic value was estimated by bomb calorimeter (Hunan Sundy Science and Technology Development Co., Ltd).

Physicochemical Characteristics of GP, CC and FC

Total Sugar

Total sugar contents were determined by according to the standard methods as described in AOAC.[18]

Water Activity

Water activity (Aw) was analyzed using a water activity analyzer (AquaLab LITE, Decagon Devices Inc., USA).

TSS, pH and Titratable Acidity

Total soluble solid, pH and titratable acidity of candy were determined according to the standard method described by Ranganna.[19] A hand refractometer was used to determination of TSS at 25°C. Titratable acidity determined by titration against 0.1N NaOH using few drops of phenolphthalein indicator, and a Cyber scan 510 pH meter was used for the determination of pH.

Water Activity

Water activity (Aw) was analyzed using a water activity analyzer (AquaLab LITE, Decagon Devices Inc., USA).

Color and Texture

Consumer acceptability is significantly influenced by color and texture of candy. Color Flex EZ, Hunter Lab was used for determining the color values in terms of L* (0 = black; 100 = white), a* (negative = green; positive = red), and b* (negative = blue; positive = yellow).

The hardness of the candy was measured using a texture analyzer (TA-TX2 plus, M/s Stable Micro Systems Ltd, Godalming, Surrey, England)) in a compression mode with a cylindrical aluminum probe with flat ends. The results were reported in terms of the mean from 7 replicates of each candy sample.

Nutraceutical Characteristics of GP, CC and FCTotal Phenolic Content (TPC)

TPC and TFC in the test sample extracts were determined by spectrophotometrically according to the Folin–Ciocalteu and quercetin standard method respectively, as described by Mir *et al*.[20] The results obtained were expressed as mg GAE/g for TPC and (QE)/g for TFC.

Antioxidant Activities (DPPH)

DPPH radical scavenging activity was measured by slightly modifying the method reported by Mir *et al*.[20] The results were expressed as percent inhibition using the formula.

DPPH Inhibition percentage (%I) = A_0-A_S/A_0 *100

Where A_0 is the absorbance of the control, A_S is the absorbance in the presence of the sample.

Microbial Quality of Candy

All the samples were subjected to microbiological analysis for total plate count, yeast and mold count (YMC) and coliform count. Total plate count was estimated using plate count agar (PCA, HiMedia, Mumbai, India), whereas yeasts and molds were estimated using the potato dextrose agar (PDA, HiMedia, Mumbai, India). Coliforms count was determined using violet red bile agar (VRBR, HiMiedia, Mumbai, India) after incubation at 37 °C for 48 hrs.

Cost Analysis

The cost of functional candy was calculated using the standard methods by considering all cost of raw material and processing (labor and electric) charges at the laboratory level.

Statistical Analysis

All the experiments were carried out in triplicate, and the results were expressed as mean ± SD (Standard deviation).Calculation of means and standard deviations were performed using Microsoft Excel 2018. Statistical analysis was performed using one way ANOVA in statistical analytical software (Graph pad prism 5.0).

Table 2: Sensory acceptability of control candy (CC) and functional candy (IBC)

Sensory attributes	CC 0%	T1 2%	T2 4%	T3 6%	T4 8%	T5 0%
Flavor	8.17±0.68	7.87±0.64	7.03±0.72	6.53±0.64*	5.60±0.50	4.93±0.96
Aroma	7.76±0.62	7.44±0.63	7.19±0.74	7.02±0.64	6.77±0.64	6.07±0.59
Color& Appearance	8.36±0.74	7.87±0.83	7.73±0.70	7.54±0.74**	7.21±0.68	6.13±0.74
Texture	8.04±0.59	7.83±0.74	7.64±0.73	7.12±0.74***	7.04±0.79	6.90±0.82
Overall acceptability	7.91±0.74	7.62±0.70	7.14±0.63	7.04±0.83	6.76±0.86	5.83±1.01

Values are Mean ± Standard deviation (SD) of triplicates (*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$; CC compared with FC)

Result and Discussion

Sensory Analysis of Functional Candy

The sensory score of the different attributes and overall acceptability of candy with different levels of ginger pulp are shown in Table 2. The sensory scores for flavor, taste, texture, color and appearance decreased with increasing ginger pulp concentration from 0-10% because ginger pulp gives candy to very spicy and bitter taste, darker color, more viscous and sharper spicy aroma. Skim milk powder reduces the dark, pungent and bitter taste of ginger pulp in candy and makes balances the taste, aroma and color between banana and ginger. However, at 8% and 10% levels, the candy showed a significant unacceptable change from control candy in all sensory attributes. In the case of all attributes, ginger pulp-6% scored very near to control samples. Hence, supplementation of ginger pulp at a 6% level was found to be acceptable in candy without causing any adverse effect on the sensory attributes and considered as optimized functional candy. Akib *et al*.[21] also observed a similar trend in herbal candy, where when the concentration of red ginger extract (1–2.5%) was increased, decreased in sensory scores are given by the panelists.

Proximate Analysis of Control and Functional Candy

The results of the nutritional composition of ginger pulp, control candy and immunity boost candy are presented in Table 3. The moisture content of CC and FC ranged between 10.92 and 11.06 per cent, respectively. The moisture content is partially affected by fiber content in a sample. However, in our study, there was no significant difference between the moisture content of control candy and functional candy. Ginger and banana pulp has a protein content of 1.82% and 1.87%, respectively. Functional candy has higher protein content (4.54%) when compared to control candy (2.33%) which may be explained by the fact that skim milk powder was added during the formulation of the functional candy, which has

good protein contents as well as has a positive impact on color, flavor, texture and shelf stability. The results regarding the change in protein are similar to the findings of Munir*et al*.,[17] who observed that protein contents were significantly increased with the addition of skim milk powder in the fruit bar.

The ash content represents minerals present in a food. The ash content of the candy ranged from 2.37 % in the control sample to 2.82% in functional candy. It was observed that the ash content of the samples increased with the addition of ginger pulp and skim milk powder. These results correlated with Arinzechukwuand Nkama[22] findings that observed a gradual increase in ash content with increasing concentration of cashew apple in banana-cashew apple fruit bar.

The mean values of total energy estimated by bomb calorimeter for control candy and functional candy were 311.42 and 365 kcal respectively.

Physico-Chemical Analysis of Control and Immunity Boost Candy

Water Activity

Water activity (a_w) plays an important role in growth of microorganism and cause spoilage in food. Water activity should be below 0.6 to avoid the surface mold growth that usually spoils confectionery products.[23, 24] From Table 3, there was a significant difference observed between the water activity of control and functional candy because the presence of skim milk powder in FC reduced the water activities (0.54) in FC in comparison to control candy (0.62). Proteins, carbohydrates and salts play a significant role in lowering water activities by binding water in the food system. Water molecules bind with some specific sites like an NH_2^+ group of amino acids in protein and OH^- a group of polysaccharides with hydrogen bonding and dipole bonds, and they do not act as a solvent.[25]

Table 3: Nutritional, physico-chemical and nutraceuticals characteristic of GP, CC, and FC

Parameter	Ginger pulp	CC	FC
Moisture %	82.39±1.12	10.92±0.14	11.06±0.19
Protein%	1.82±0.09	2.33±0.12	4.54±0.15***
Ash%	1.42±0.05	2.37±0.07	2.82±0.04
Energy Value (kcal)	80.48 ± 1.11	311.42±1.54	365±1.62***
Water activity	0.97±0.01	0.538±0.07	0.622±0.01**
TSS (0Brix)	12.43±0.19	82.5±0.11	84.10±0.14***
Acidity (%)	0.38±0.001	0.248±0.004	0.255±0.002
pH	5.79± 0.05	6.94±0.01	6.78±0.07
Total sugar (%)	1.70±0.12	51.87±0.23	55.45±0.17***
Color			
L*	59.93±0.18	63.21 ±0.11	55.16±0.09***
a*	2.01±0.02	8.73±0.09	11.64±0.03***
b*	22.95±0.19	23.89±0.12	28.25±0.21***
Texture			
Hardness(kg)	-	14.31±0.948	15.87±1.08
Chewiness(Nmm)	-	779±5.694	886±6.714
TPC (mgGAE/g)	12.27± 0.12	3.97± 0.17	8.59± 0.14***
TFC(mQ/g)	3.88± 0.02	1.76± 0.08	2.43± 0.07
Antioxidant activity (%)	67.5 ±.041	25.05±.004	36.15±.009***

Values are Mean ± Standard deviation (SD) of triplicates (*p < 0.05; **p < 0.01; ***p < 0.001; CC compared with FC)

TSS, pH and Titratable Acidity

TSS, pH and titratable acidity value for CC and FC are depicted in Table 3. TSS content of control candy and functional candy was 82.5 and 84.1^{0}Brix. The TSS of FC was more than CC because of ginger pulp and skim milk powder.

pH signifies the survival and growth of microorganisms during processing, storage and distribution.[26] The pH of the control candy was 6.94 and 6.78 after the addition of ginger pulp and skim milk powder in functional candy. pH value decreased due to the addition of ginger paste.

Titrable acidy and pH are inversely proportional with each other as pH increased titrable acidity decreased. In connection with oral health, determination of titrable acidity is important because acidity and sweetness implicated in dental problems.[27, 28] Titrable acidity also denotes acidic taste of candy which is important parameter for consumer acceptability. The titrable acidity of control and functional candy was 0.25 and 0.26 %, respectively. The acidity of candy increased with ginger paste, but honey and skim milk powder counteract ginger acidity. This work shows that TA is in acceptable range and it is possible to mixing of different fruit pulpwhich would finally lead to obtaining functional candy that is attractive to the consumer.

Color and Texture Analysis

The result of color and texture analysis of GP, CC, and FC are shown in Table 3. Color values of GP showed yellowish to light brownish indicated by a value for L* (59.93), a*(8.73) and b*(22.95). b* and a* value of candy significantly increased with the increase in the level of ginger pulp in candy. The change in L* value, which indicates the whiteness, gradually declined with an increase in GP level. But not much difference in color of both candies because skim milk powder counters the color change. The result conforms with Kohinkar *et al*.6, who reported the decrease in color (L*and a* value) of candy with an increase in fig pulp.

The addition of ginger pulp and skim milk powder has affected the textural quality. It was noticed that the hardness and chewiness of candy increased upon the addition of ginger pulp and skim milk powder. The hardness and chewiness of control candy are 9.32 kg and 779 Nmm, respectively, which are increased to 11.23kg and 886 Nmm in optimized functional candy. The hardness of the final toffees was increased both by the casein content and the lactose content of the skim milk powders, and high fiber content in the ginger pulp.

Nutraceutical characteristics of CC and FC

The Phenolics and Flavonoid Contents

Table 3 shows the total phenolic content (TPC), total flavonoid content and antioxidant activity of ginger pulp, CC, and FC. Phenolic compounds are natural antioxidants that have many health benefits and improve the oxidative stability of foods23. Plant-based food products are rich sources of polyphenols and flavonoid having antioxidant and nutraceutical properties. Unprocessed food products have generally higher phytochemical than the processed product.[24] The same trend was observed in the present investigation, also as evident from a decline in the control candy. Total Phenolic content in ginger pulp was 12.27 mg GAE/g which reduced 30% in optimized candy (8.59mgGAE/g), but it was significantly ($p<0.05$) higher than control candy (3.97mgGAE/g). TFC of GP and FC against quercetin was found to be 3.88 and 2.43 mQ/g of dry weight, respectively, which was significantly higher than control candy (1.76mQ/g of dry weight). Sharma and Gujral[24] suggested that a heating or cooking process could change the chemical structure of a phenolic compound, particularly by polymerization, and consequently reduce extractable polyphenols in cooked products. A similar result was also by Samakradhamrongthai andJannu[30] in velvet tamarind (*Dialium indium* L.) chewy candy.

Antioxidant Activity

Determining antioxidant capacity is useful for evaluating the action of bioactive compounds that protect the body against harmful effects caused by reactions and processes involving free radicals and other oxidizing agents.[31] In this study, we applied DPPH assay to determine antioxidant activity, which was widely applied for many foods and food products such as apple, banana, strawberry, extra virgin olive oil, pomace olive oil, soybean oil, and palm oil.[32, 33] Antioxidant activity in terms of DPPH for GP, CC, and FC was found to be 77.5%, 25.05%, and 36.15 %, respectively (Table 3). When the result of CC and FC were compared with each other, significantly

higher DPPH values of FC were obtained because of the presence of phytoconstituents in the ginger pulp. Identical results for DPPH values were also reported by Gaur *et al*.[34] that the antioxidant power of herbal milk incorporated with ginger juice and turmeric powder was higher than the control milk.

Table 4: Effect of storage on sensory attributes

Storage time (In days)	Flavor		Aroma		Color and appearance		Texture		Overall acceptability	
	CC	FC	CC	FC	CC	FC	CC	FC	CC	FC
0	7.85 ± 0.42	7.65 ± 0.53	7.41 ± 0.52	7.33 ± 0.48	7.79 ± 0.42	7.70 ± 0.48	7.44 ± 0.52	7.35 ± 0.48	7.47 ± 0.53	7.39 ± 0.52
30	7.22 ± 0.63	6.94 ± 0.32	7.20 ± 0.63	7.08 ± 0.57	7.40 ± 0.52	7.33 ± 0.48	7.11 ± 0.57	6.98 ± 0.42	6.78 ± 0.57	6.67 ± 0.63
60	6.42 ± 0.53	6.30 ± 0.48	6.46 ± 0.70	6.35 ± 0.53	7.21 ± 0.74	7.10 ± 0.67	6.56 ± 0.53	6.40 ± 0.52	6.67 ± 0.53	6.53 ± 0.52

Effect on Storage on the Sensory Quality

Scored results of sensory acceptability with all parameters (flavor, aroma, color & appearance, texture, and overall acceptability) during storage are presented in Table 4 and found to be declined with increasing storage period, but the consumers accepted both the candies during storage of 60 days. Comparing the result of control candy (CC) and functional candy (FC) from 0 to 60 days, a non-significant change was noticed for all sensory parameters. The product's color became darker and had a bitter taste because of some chemical reaction between constituents of candy. The texture was also affected adversely during storage due to the loss of moisture from the product. The overall assessment showed average scores between 6-7, meaning "liked moderately" at the end of shelf life. The results of the sensory evaluation indicate that functional candy can be stored for up to 60 days. And a similar pattern of decrement in the sensory quality with an increase in storage period (up to 6 months) of mixed fruit candy (fig and Guava) was noticed by Kohinkar*et al*.[6]

Effect of Storage on Microbial Growth

TPC, coliform, yeast, and mold count is the simplest test for the safety of food from a microbiological stand point. The result of total plate count, coliform count, and yeast and mold count of functional and control candy are shown in Table 5. TPC and coliform unit increased gradually during storage. The result shows that FC has a lesser total plate and coliform count than the control candy because of the presence of ginger pulp in FC, whereas yeast and mold count was nil for both. Previous research confirms that ginger has antimicrobial activity against *E Coli, Salmonella Typhi,* and *Bacillus Subtilis* due to the bioactive compound gingerol and shagelol.[35, 36] A similar result was reported by Arinzechukwu and Nkama 22 in banana apple fruit bar, where decrease in TVC as the concentration of cashew apple pulp increased. The data obtained from the microbial analysis showed that the candy was shelf-stable for up to 60 days at room temperature and safe for human consumption.

Cost Estimation of Optimized Candy

The cost of ingredients used in the preparation of candy is shown in Table 6. The cost of optimized candy that formulated in the laboratory was Rs.1.53/ candy that lowers than market candy. So the use of

ginger pulp, skim milk powder, and honey to prepare optimized candy was found to be economical and healthy than marketed candy. These costs did not include transport, rent, local taxes, sale commission, etc. The present investigated cost result is parallel to the finding of Kohinkar *et al*.[6] in mixed fruit toffee from Fig and Guava fruits and Sucheta *et al*.[38] in mixed fruit toffee from Guava and mango blend.

Table 5: Comparative values for microbial analysis content of FC after 60 days

Storage time (In days)	Total plate count(CFU/g)		Coliform count (CFU/g)		Yeast and mold count(CFU/g)	
	CC	FC	CC	FC	CC	FC
0	x	x	x	x	x	x
30	1.3 x 10^2	1 x 10^2	3.3x 10^2	3.0x 10^2	x	x
60	1.5x 10^2	1.2x 10^2				
	3.8 x 10^2	3.6 x 10^2	x	x		

*x=Not visible growth

Table 6: Cost of functional candy

Ingredient	Quantity (g)	Rate(Rs/100g)	Total cost of developed candy (Rs/-)
Banana pulp	94g	10	9.4
Ginger pulp	6g	20	1.2
Skim milk powder	150 g	38	57
Butter	20	48	9.6
Honey	55	43	23.65
Pectin	3	150	4.5
Salt	0.5	2	0.01
Water	50	2	1
Sub total	378.5		106.36
Processing charges (L.P.G +miscellaneous) +Packaging charges of 378.5 g of developed candy			10.0
Total cost of 378.5g developed candy			Rs. 116.36

*100g material of candy is equivalent to 20 candies. So, the cost of one candy is 1.53

Conclusion

Healthy and good quality candy are lacking in the market. This study has shown that the utilization of banana, ginger and skim milk powder in preparation of candy to improve the nutritional and functional properties of candy. Sensory evaluation showed that better quality candy with banana and ginger pulp could be prepared using 94:6 percent pulp, 150 g skim milk powder, 20 g butter, 55 ml honey, 3 g pectin and 0.5 g common salt per 100 g pulp. The addition of ginger pulp and skim milk powder improved mineral content, proteins, dietary fibers, mainly antioxidants, phenolics contents of the formulated fruit candy. The cost of production of functional candy was Rs.1.405/candy which lowers than market candy. Candy could be stored in good condition beyond 60 days at ambient temperature. This type of functional candy increases the market's revenue with ayurvedic goodness, boosts immunity, and is advantageous to people of all ages, especially

children. Further research is needed for the shelf stability of banana ginger fruit candy and the best packaging material that may contribute to its stability.

Acknowledgements

The authors acknowledge Department of Dairy Science and Food Technology, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi for the support in the work related to this research article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Conflict of Interest

The authors declare that they have no conflict of interest.

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