

Low-cost Innovative Instant Soup Powder from Banana Peels: Valorisation, Development, Standardization and Process Optimization

Malvika Choudhary* and Nilambari Dave

Department of Foods and Nutrition, Saurashtra University, Gujrat, India

Abstract

Banana peel is a major waste product of banana chips and figs processing industry. Many researchers have found that this peel is rich in antioxidants, antimicrobial, antibiotic, antifungal and other functional properties which make it an industrially important waste. However, it has been not exploited commercially yet. This study was conducted in Saurashtra University, Gujarat and utilized this industrial waste for development and Standardization of instant soup powder. The final product was evaluated for its sensory qualities, shelf life, statistical and biochemical properties. The product was concluded as highly acceptable and profitable for micro industries due to its low production cost.

Keywords: Banana peel; Instant soup; Sensory qualities; Shelf life; Statistical; Micro industries

*Corresponding author:

Malvika Choudhary, Department of Foods and Nutrition, Saurashtra University, Gujrat, India, E-mail: choudharymalvika99@gmail.com

Citation: Choudhary M, Dave N (2021) Low-cost Innovative Instant Soup Powder from Banana Peels: Valorisation, Development, Standardization and Process Optimization. J Clini Nutr Diet.Vol. 7 No. 8: 01

Received: June 10, 2021; **Accepted:** September 02, 2021; **Published:** September 09, 2021

Introduction

Banana is a major fruit crop of Gujarat state holds for about 53% of the total fruit production next to mango crop and holds 2nd rank after Tamilnadu in production as per Ministry of food processing industries 2013 report [1]. The consumption of banana fruit as compared to other fruits is higher in India due to two main reasons, its availability throughout the year and low cost. It is consumed as fresh fruit as well as in processed form like chips, flakes, powder etc. Banana processing wastes include banana peels, leaves, pseudo stem, sheath, pith, male bud. Banana peels represents 40% of the total weight of fresh banana and has been underutilized and discarded as waste. They are rich source of nutrients as well as contains some value added

Component such as starch (3%), pectin (21%), dietary fibre (50%), protein (11%), crude fat (11%), lipid (10.9%), vitamins (20%) and maximum amounts of dietary fibre [2]. Banana peels can potentially be used in new products with standardized composition for various food and other industrial uses. Banana peels were used to produce soup, alcohol, wine, citric acid, biogas, cattle feed, bread, antibiotic, extracellular enzymes, biomass, medicine, desserts, pudding, gum, bio-plastic, and other functional foods [3]. Despite of the huge potential, there is negligible amount of research has been done to develop banana peel based processed foods. Karthikeyan and Divakar developed

dried soup powder from banana peels with highly acceptable organoleptic, biochemical and shelf life values. In the present study, banana peels were utilized to produce an industrially important and low cost instant banana peels soup mix powder.

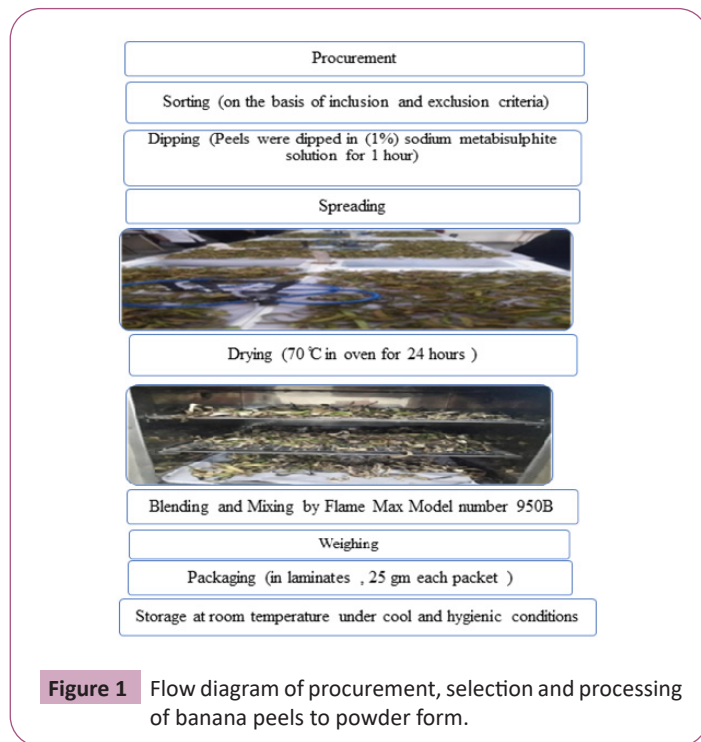
Materials and Methods

Procurement and selection of banana peels

Raw green banana peels were collected from Hari Om Dairy Farm and Kisan Farm (from banana wafer industry), Saurashtra region, Amreli Gujarat – 365601. After procurement of raw banana peels from banana wafer industry, the peels were sorted out on the basis of below mention inclusion and exclusion criteria mentioned in **Table 1**. Inclusion and exclusion criteria were decided on the basis of FAO report 2018. If raw bananas were handled roughly then it may result into cuts and wounds which can serve as entry points of microorganisms so the peels with cuts and bruises were excluded. Moreover, rough handling during transportation can lead to damage of peels which can increase the respiration and ethylene production rate of the fruit. This rapid deterioration can affect the peels quality. After the complete process of sorting, good quality banana peels were collected and subjected for further processing after yield calculation of obtained peels (**Figure 1**).

Table 1: Inclusion and exclusion criteria for selection of raw banana peels for study.

Inclusion criteria	Exclusion criteria
Green colored	Blackened
Clean	Dirty
Fresh	Dried
Free from cuts, bruises and infections or any other visible deformity	Any visible deformity



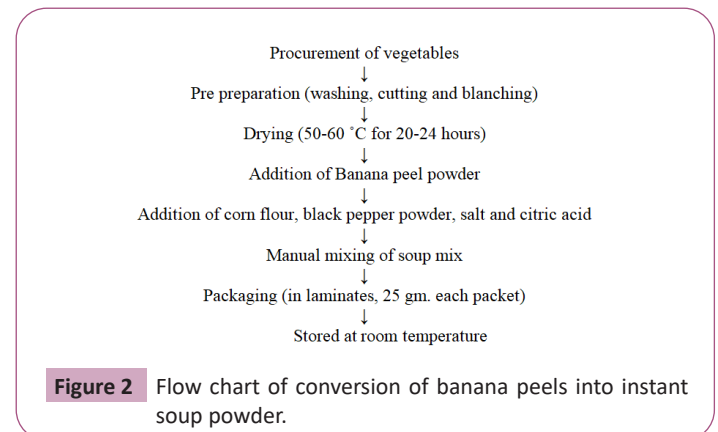
Processing of banana peels: Banana peels were washed with distilled water to remove unwanted impurities. Peels were dipped in 1% (w/v) sodium Meta bisulphite solution for 1 hour then it was drained and dried in hot air oven (at 55°C for 24 hours). The dried peels were powdered in grinder and sieved with 20-micron size sieve after that flour was stored in air tight bottle at room temperature for further analysis [4].

Formulation and standardization of instant banana peels soup powder: Banana peel powder is used with a variety of vegetables and spices to produce instant banana peel soup powder in two major phases -Formulation and Standardization.

Formulation

All the vegetable samples were sorted and washed properly under tap water to remove soil or other impurities and chopped or peeled by sterile knife (Krishna Stainless Steel, Model 32) under sterile conditions at Department of Foods and Nutrition, Saurashtra University, Rajkot. All the samples were then subjected to blanching (3 replications for each method) to avoid any enzymatic browning which can effect sensory attributes of final product. Immediately after blanching, the vegetables were soaked in distilled water, which contained ice cubes (0°C for 15 minutes) to stop further cooking as mentioned in **Figure 2**. Mohammed and Hussein [5] used the above temperature, time and additives and they concluded that this treatment is

best preserving the nutritional content of vegetables. Salt, black pepper, corn flour and citric acid were used in powdered form as procured The hot air oven temperature varying from 50-60 °C and time varying between 20-24 hours were optimized for drying of banana peels and vegetable samples. Pandhre et al, also optimized drying temperature for drumsticks leaves at 60°C for oven drying method [6].



Standardization

Banana peel powder was mixed with varieties of vegetables and spices in dried powdered form. A total of five samples were prepared as S1, S2, S3, S4 and S5 in which fortification of banana peel powder was done with other vegetables in different amounts and variation in B.P.P. quantity to obtain most acceptable instant banana peel soup. In S1 (8% B.P.P), S2 (14.8%B.P.P), S3 (20% B.P.P), S4 (26% B.P.P), S5 (31% B.P.P) with other vegetables in dried form and in fixed quantities as below mentioned (**Table 2**).

Table 2: Standardization of instant soup mixture from banana peel powder.

Sr. No.	Soup mix	Ingredients	Proportion of ingredients (gm)
1	S1	Banana peel powder+corn flour+ tomato +cabbage+onion+garlic+capsicum+pea+citric acid+black pepper+salt	2:5:5:5:2:2:0.5:0.5:1:1:1 =25 gm
2	S2	Banana peel powder+corn flour+ tomato + cabbage+onion+garlic+capsicum+pea+citric acid+ black pepper+salt	4:5:5:5:2:2:0.5:0.5:1:1:1 =27 gm
3	S3	Banana peel powder+corn flour+ tomato + cabbage+onion+garlic+capsicum+pea+citric acid+ black pepper+salt	6:5:5:5:2:2:0.5:0.5:1:1:1 =29 gm
4	S4	Banana peel powder+corn flour+ tomato + cabbage+onion+garlic+capsicum+pea+citric acid+ black pepper+salt	8:5:5:5:2:2:0.5:0.5:1:1:1 =30 gm
5	S5	Banana peel powder+corn flour+ tomato + cabbage+onion+garlic+capsicum+pea+citric acid+ black pepper+salt	10:5:5:5:2:2:0.5:0.5:1:1:1 =32 gm

Evaluation of instant banana peels soup mix proximate and nutritional analysis: Proximate and nutritional analysis of instant soup mixture was performed in duplicate. Amount of different parameter such as moisture content, ash content, crude fibre and fat content were analysed from instant soup mixture AOAC [7-9].

Sensory analysis of banana peel powder instant soup mixture: Ranganna [8] performed sensory evaluation of the dry instant soup mix sample was carried out on 9 point hedonic rating scale. A semi trained panel from the 171members of Food Engineering and Technology department were used for the purpose. Panellists were obtained the instructions regarding the evaluation procedure in both written and verbal form before quoting their judgments. The sensory attributes considered in the evaluation were sensory colour, mouth feel, flavour and overall acceptability. In our present study, banana peel powder instant soup mixture samples were five. Sensory attributes including appearance, colour, flavour, taste and consistency were analysed based on 5 point hedonic scale with five trained and five semi trained panellists.

Shelf life and Microbial analysis: The samples of banana peel powder instant soup mixture were stored at room temperature (35°C), refrigeration temperature (7°C ± 20°C) were assessed at regularly of 1 to 120 days, Microbial analysis of each sample was performed on the subsequent dilutions of the homogenized

samples. The microbial count (total plate count and yeast and mold count) was used to check shelf life of soup powder. Samples were analysed for the presence of various microorganisms such as bacteria, mold and yeast. N- Agar and Potato Dextrose Agar (PDA) was used for microbial growth. Sample was streaked on nutrient media respectively and incubated at 37°C for 24-48 hours for analysis.

Results and Discussion

Five combinations of instant soup mixes were formulated keeping the banana peel powder as the major ingredient and varying the amount and proportion of adjuncts used as mentioned in the methodology. After standardization banana peel powder soup sample dissolve in concentration was obtain in each sample-S1-8%, S2- 14.8%, S3-20.68%, S4-26.6%, S5-31.25% with corresponding amount of banana peels powder 2 g, 4 g, 6 g, 8 g and 10 g respectively.

Proximate and nutritional analysis: Parameters such as moisture content, ash content, crude fibre and fat content were analysed in duplicates and results depicted in **Tables 3 and 4**. Where, Observed value stands for obtained value by performing tests in the study and expected value stands for standard value, B.P.I.S.M. stands for banana peel instant soup mix and C.S.M stands for commercial soup mix.

Table 3: Proximate analysis of banana peel instant soup mix.

Parameters	Mean ± SD		Difference
	(100gm)		
	Observed value(B.P.S.M)	Expected value(C.S.M)	(Mean ± SD)
Moisture content	4.38 ± 0.17	3.9 ± 1.20	0.48 ± 0.03
Ash content	15.74 ± 0.14	17.24 ± 0.065	1.5 ± 0.075
Crude fibre	53.8 ± 0.79	1.5 ± 0.01	52.3 ± 0.78
Carbohydrates	68.8 ± 0.33	60 ± 0.56	8.8 ± 0.23
Protein	6.74 ± 0.22	6.52 ± 0.59	0.22 ± 0.37
Fats	6.35 ± 0.43	0.9 ± 0.1	5.45 ± 0.33

Table 4: Sensory analysis of banana peel instant soup mixture.

Sample	Mean ± SD			Difference (Mean ± SD)	
	Observed value		Expected value		
	Trained	Semi trained		Trained	Semi trained
S1	4.6 ± 0.82	4.2 ± 0.69	8.1 ± 0.23	3.5 ± 0.59	3.9 ± 0.46
S2	3.8 ± 0.74	4.2 ± 0.4	6.6 ± 0.27	2.8 ± 0.47	2.4 ± .13
S3	2.8 ± 1.86	3.6 ± 0.80	6.9 ± 0.16	4.1 ± 1.7	3.3 ± .65
S4	2.6 ± 0.92	3.6 ± 1.05	5.9 ± 0.33	3.3 ± 0.59	2.3 ± 0.72
S5	1.2 ± 0.4	3.4 ± 1.2	5.1 ± 0.11	3.9 ± 0.29	1.7 ± 1.09

Optimization of cooking time and sensory analysis

The most optimum cooking time was selected from the five timings namely 3 minutes (T1), 6 minutes (T2), 9 minutes (T3), 12 minutes (T4) and 15 minutes (T5). The overall acceptability of formulated soup samples were evaluated by panel of 10 judges and the values obtained ranged from 10.7-23.3. T2 scored the minimum mean rank value (23.3) with 6 minutes cooking time, followed by T3 with the mean rank value (19.1) with a cooking time of 9 minutes. T1 obtained the maximum mean rank value (10.7). After complete analysis, T2 was concluded as the optimum cooking time for banana instant soup mix by panellists.

Sensory evaluation is an essential concept in food product development as it reduces the risk of product failure and links the consumer perception about the quality of food. Anita et al. [9] formulated instant soup mixture with mean \pm SD 8.1 ± 0.23 was found to be highly acceptable with significant difference when compared to other commercial formulation. While in our study formulated banana peel instant soup mixture sample 1 (S1) with mean \pm SD 4.6 ± 0.82 found to be higher acceptable according to trained panellist and semi trained panellist sample 1 (S1) with mean \pm SD 4.2 ± 0.69 respectively. Appearance, colour, flavour, texture and taste was evaluated using a score card ranging from 1-5 was used to rate the product, 5 corresponding to excellent quality and 1 for poor. Where, Observed value stands for obtained value by performing tests in the study and expected value stands for standard value from above mentioned reference.

Storage stability, shelf life and costing: The shelf life of the developed product was evaluated by assessing moisture content, microbial profile and sensory parameters for 3 months at monthly intervals. The moisture content was found to be 68.4 per cent which increased to 70.2, 71.7 and 72.5 per cent respectively after 1st, 2nd and 3rd month. Banana peel instant soup mixture powder was stored in plastic laminates at room temperature, and microbial analysis performed after 30 days intervals up to 3 months. Colonies were counted for growth of bacteria and yeast, mold by serial dilution of sample followed by pour plating techniques using Nutrient Agar (NT), Potato Dextrose Agar (PDA) After 3 months of analysis, one colony of bacteria was visible in dilution on the plate without any other pathogenic microorganism as shown in **Figure 3**. So it can be concluded that after 3 months also the product lies in permissible limits.



Figure 3. Pictorial depiction of microbial analysis of Banana peel instant soup mixture.

The product was remained acceptable by panellist after 3 months of sensory evaluation at regular intervals with a little decrease in overall acceptability the cost of the product was calculated to be Rs.57/kg. The cost included the individual cost of ingredients and 10% overhead charges.

Statistical analysis

Statistical analysis of instant mix of banana peel powder soup was conducted in the study for acceptance of sample by sensory panellists. T-Test was performed for 5 samples of soup to check statistical significance at p value ≥ 0.05 and obtained values of Mean \pm SD as 104.4 ± 5.10 and t value of 2.23. From obtained values of statistical tests it can be concluded that the developed instant soup mix is accepted by sensory panellists as the obtained value is less than p value. Hence the product is statistically significant.

Conclusion

This study affirms the fact that commercial and industrially important food products can be manufactured from banana peels at low cost. Also, banana peels are not more a food industrial waste anymore as this study has confirmed the acceptability of banana peel soup powder, which is found to be convenient, nutritive and appealing to consumers.

References

1. Anonymous (2007) District-wise Area, production and yield of important food & non-food crops in gujarat state. Directorate of agriculture Gujarat state, India.
2. Emaga TH, Robert C, Ronkart SN, Wathélet B, Paquot M (2008) Dietary fibre components and pectin chemical features of peels during ripening in banana and plantain varieties. *Bioresour Technol* 99:4346-54.
3. Hirenpatel A, Tejassurati GS (2012) Potential use of banana peel for the production of fermentation products.
4. Israel KATC, Diasanta BSF, Lizardo MDB, Dizon RCM, Mejico MIFM (2015) Extraction and characterization of pectin from Saba banana [Musa 'saba'(Musa acuminata x Musa balbisiana)] peel wastes: A preliminary study. *Int Food Re J.* 22: 202-207.
5. Ali K, Muhammad A, Hussain I, Hyder MZ (2020) physicochemical, yield potential and sensory evaluation of banana cultivars introduced in pakistan. *Pak J Agri Sci* 57:1581-1589.
6. Pandhre GR, Satwase AN, Hashmi SI (2011) Effect of different pretreatments and drying methods on color characteristics fenugreek leaves. *Int J Cur Sci Res* 1: 115- 119.
7. AOAC (1990) Official Method analytical chemist, Washington, D.C./?
8. Rang AS (2000) Handbook of Analysis and quality control for Fruit and Vegetable Products. 2nd edn. New Delhi, India, Tata McGraw Hill Publishing Company Ltd.
9. Anita S, Sameshwari T, Kalpana B (2016) Formulation and evaluation of instant soup powder using millets. *Int J Current Res* 8:35668-73.