



Studies on formulation and preparation of banana peel powder bar incorporated with psyllium husk

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Abstract

Banana peel bar produces for the nutritional quality to improve or replace the morning and afternoon snacks as a complement to main meals. Banana peel bar contain banana peel powder, psyllium husk, black dates, almond powder, muskmelon seeds and Honey. All ingredients are good source of micro nutrients. Psyllium is widely used to reduce the cholesterol levels. Dietary fiber from psyllium has been used extensively in processed food to aid weight reduction, for glucose control in diabetic patients. Banana especially peels provide excellent nutritional status to contribute various health benefits it comprises diarrhoea, dysentery, intestinal lesion, in ulcerative colitis, diabetes, nephritis, gout, cardiac disease, hypertension. Banana peel bar prepared by mixing of all the ingredients with Honey, after mixing sheeting was done and cut to make a proper shape than molding with melted chocolate to make a proper Banana peel bar. Proximate analysis of Banana peel bar that moisture content, fat, Protein, Carbohydrate, ash and Energy value in Banana peel bar was found to be (9.32 %), (23.12 %), (8.75 %), (62.71 %), (2.28 %), Fiber (4.7%) and (493.92 kcal) respectively. Banana peel bar prepared with Honey recorded highest sensory score in all quality attributes and good storage stability. It concluded that the Banana peel bar can be stored for 60 Days at refrigeration and room Temperature. So, the Banana peel bar can be satisfy the consumer in accepts and Quality.

Keywords: Banana peel, psyllium husk, banana peel powder, proximate analysis, sensory evaluation, storage study

Introduction

The food bars are snacks of good sensory and nutritional characteristics due to their high carbohydrates, proteins, lipids, and minerals contents. Snack foods such as potato chips, extruded products, chocolates bars available in market cannot meet the requirement of balanced diet. Increasing demand from consumers for nutritious snacks has provoked the food manufacturers to develop food bars that provide nutrition and convenience. The imported fruit bars are available at super stores only in the big cities. Some popular brands are Kellogg's Nutri Grain, Nature Valley, and so forth. The market price for these bars is exorbitant and ranged from rupees 85–130 per 35–45 g bar. This price is out of reach for low- and middle-income families. Quality and price are key factor for the development of a competitive product. To achieve this objective, economical and underutilized food sources with good nutritional value should be explored. (Nadeem *et. al.*, 2012) ^[17].

Psyllium husk is obtained from the seed of the *Plantago ovate* plant belongs to the family of Plantaginaceae. (Khaliq *et. al.*, 2015) ^[11]. Psyllium is also recognized as ispaghula and is abgol widely used as a laxative. Is abgol comes from the Persian words as band ghoul, meaning "horse flower" which is descriptive of the shape of the seed. Psyllium was an indigenous plant of Persia, currently grown in the western states of India. Gujarat, Rajasthan, Madhya Pradesh, Haryana is main crop psyllium producing states in India. The plant of is abgol is generally 10 to 18 inches in height, with numerous small and white flowers. Psyllium is cultured for its mucilage content, which is a white fibrous material with hydrophilic characteristic. The mucilage can be obtained by mechanical milling/grinding, and is usually

referred to as husk. (Kumar *et. al.*, 2017) ^[14]. Psyllium seeds are ovoid-oblong in shape, about 2–3 mm long and 0.8–1.5 mm wide. They are pinkish gray to brown in color with a convex dorsal surface and concave ventral surface with a deep groove running lengthwise along the center. (Rao *et. al.*, 2014) ^[24].

In psyllium husk, total dietary fiber and arabinoxylan contents were 76.63±1.32 and 46.71±2.14%, respectively. Mean values for moisture (6.43±0.05), ash (3.85±0.04), crude protein (2.08±0.06), crude fat (0.09±0.01), crude fiber (3.83±0.02) and nitrogen free extract (NFE) (83.72±0.08%). Values of husk are protein (35.0), ash (33.5), and total carbohydrates (902.4mg/g). (Qaisrani *et. al.*, 2014).

Banana scientifically is known as *Musa paradisiaca* belonging to family *Musaceae*. It is the major source of proteins and energy. It is a powerful antioxidant and anti diabetic potential. (chitkara *et. al.*, 2017). Musa fruits are variable in size, shape, and color. They are generally elongate-cylindrical, straight to strongly curved, 3–40 cm (1.2–16 in) long, and 2–8 cm (0.8–3 in) in diameter. The fruit apex is important in variety identification; it may be tapered, rounded, or blunt. The skin is thin and tender to thick and leathery, and silver, yellow, green, or red in color. Inside the ripe fruit, the flesh ranges from starchy to sweet, and in color from white, cream, yellow, or yellow-orange to orange. Bananas also vary in peel thickness. (Nelson *et. al.*, 2006) ^[19].

Banana is one of the rich source of the nutrient such as Energy 371 kJ (89 kcal), Carbohydrate (22.84 g), Sugars (12.23 g), Dietary fiber (2.6 g), Fat (0.33 g), Protein (1.09 g), Thiamine (B1) (3%) 0.031 mg, Riboflavin (B2) (6%)

0.073 mg, Niacin (B3) (4%) 0.665 mg, Pantothenic acid (B5) (7%) 0.334 mg, Vitamin (B6) (31%) –0.4 mg, Folate (B9) (5%) 20 µg, Choline (2%) 9.8 mg, Vitamin C (10%) 8.7 mg, Iron (2%) 0.26 mg, Magnesium (8%) 27 mg, Manganese (13%) 0.27 mg, Phosphorus (3%) 22 mg, Potassium (8%) 358 mg, Sodium 1 mg Zinc (2%) 0.15 mg, Flouride (2.2 µg). (Elayabalan *et. al.*, 2017).

Dates are composed of Moisture (15.2g/100g), Protein (2.14g/100g), Fat (0.38g/100g), Ash (1.67g/100g), Carbohydrate (80.6g/100g), Total sugar (64.1g/100g), Fructose (29.4g/100g), Glucose (30.4g/100g), Energy (314 kcal/100g). Dates also contain vitamins like B1 (Thiamine), B2 (Riboflavin), B3 (Niacin), B5 (Pantothenic acid), B9 (Folic acid). The Niacin content is very high and it varies between 1.27 and 1.61 mg/100g. (Ahmed *et. al.*, 2014).

Nuts such as almonds are considered to be an important component of a healthy diet, and increased consumption. Almonds provide a nutrient-dense source of vitamin E, riboflavin, manganese, magnesium, calcium, phosphorus, potassium, copper, iron and zinc as well as protein, dietary fibre and MUFA. Almonds naturally contain high levels of monounsaturated and polyunsaturated fatty acids, protein and dietary fibre, as well as a variety of essential nutrients including vitamin E and several trace elements. Almonds are very low in sodium and high in potassium, and they contain a range of phytoprotective constituents. Almonds also provide an excellent source of bioavailable α -tocopherol (vitamin E), and increasing their intake enhances the resistance of LDL cholesterol to oxidation. Almonds bring significant benefits regarding the lowering of blood cholesterol and the health of the cardiovascular system, particularly when eaten as part of a diet low in saturated fat. (Richardson *et. al.*, 2009).

Honey mainly consists of sugars and water. Apart from sugars, honey also contains several vitamins, especially B complex and vitamin C, together with a lot of minerals. Some of the vitamins found in honey include ascorbic acid, pantothenic acid, niacin and riboflavin; while minerals such as calcium, copper, iron, magnesium, manganese, phosphorus, potassium and zinc are also present. Honey has been used for its healing, nutritional and therapeutic properties since ancient times. Honey is well known for its anti-inflammatory and antioxidant capacities, which may be useful for the prevention of chronic inflammatory processes like atherosclerosis, diabetes mellitus and cardiovascular diseases. (Vallianou *et. al.*, 2014).

Many studies have confirmed the nutritional benefits of dietary fibers, the main aim of production of banana peel bar is to prevent diabetes mellitus, cardiovascular diseases, various types of cancer, and improving immune functions as it contains psyllium husk and banana peel which provide dietary fibers. Psyllium is widely used to reduce the cholesterol levels. Dietary fibers from psyllium have been used extensively in processed food to aid weight reduction, for glucose control in diabetic patients. Banana peels provide excellent nutritional status to contribute various health benefits it comprises diarrhea, dysentery, intestinal lesion, in ulcerative colitis, diabetes, nephritis, gout, cardiac disease, hypertension. According to current recommendations (Food and Nutrition Board, Institute of Medicine, 2001)^[9], the average daily requirement of dietary fiber is 25 g per day for women younger than 50, 21 g per day for women older than 50; 38 g per day for men younger

than 50, and 30 g per day for men older than 50. The nutritional value and technological properties of dietary fibers are important in the potential development of a wide range of fiber-enriched foods for example: bakery products, snacks, sauces, drinks, cereals, cookies, dairy products, meat products. (Staffolo *et. al.*, 2012).

Material & Methods

Procurement of Raw Material

Raw materials required during present investigation were procured from local market of Saralgaon such as banana, psyllium husk, black dates, honey, almond, muskmelon seeds etc. Most of the chemicals and equipments used in this investigation were of analytical grade which are obtained from College of Food Technology Saralgaon, Thane.

Physical Properties of Ingredients and banana peel powder bar incorporated with psyllium husk

The colour of banana peel powder bar was determined by visual observations, the length, breadth and width of banana peel powder bar was measured by vernier caliper. The weight of banana peel powder bar was measured on analytical weighing balance

Chemical Properties of ingredients and banana peel powder bar incorporated with psyllium husk

Proximate composition such as moisture, ash, crude fat, crude protein and crude fiber of all the Ingredients and Bar was determined according to the procedures given in AOAC (2000). For moisture determination samples were dried in oven at 130°C for 60 minutes. For ash determination samples were placed in muffled furnace at 550°C to burn out all carbon compounds leaving in organic part (ash). Fat was determined by fat extraction unit by using n. Hexane. For fiber determination, samples were treated with 1.25% Sulphuric acid and Sodium Hydroxide solution. After filtration of digested material it was washed with hot water and then ignited. By calculating loss of weight after ignition, crude fiber contents were determined. Protein contents were determined by using Kjeldahl's unit.

Sensory Evaluation-

Prepared product were evaluated for sensory characteristics in terms of appearance, color, flavor, aftertaste, texture and overall acceptability by 10 semi-trained panel members comprised of academic staff members using 9-point Hedonic scale. Judgments were made through rating the product on a 9 point Hedonic scale with corresponding descriptive terms ranging from 9 'like extremely' to 1 'dislike extremely'. The obtained results were recorded in sensory score card.

Storage of Banana Peel Bar

Storage of banana peel bar was done at two different conditions viz., ambient storage (30°C) and cool storage (4 °C) for a period of two months.

Statistical Analysis

The analysis of variance of the data obtained was done by using completely randomized design (CRD) for different treatments as per the method given by Panse and Sukhatme (1967). The analysis of variance revealed at significance of $p < 0.005$ level S.E and C.D. at 5 percent level is mentioned wherever required.

Pretreatment of Raw Material

Flow sheet for preparation of banana peel powder

(Carvalho *et. al.*, 2017)

Banana peels

Cutting

Drying (In tray dryer at 60°C for 8-10 hrs)

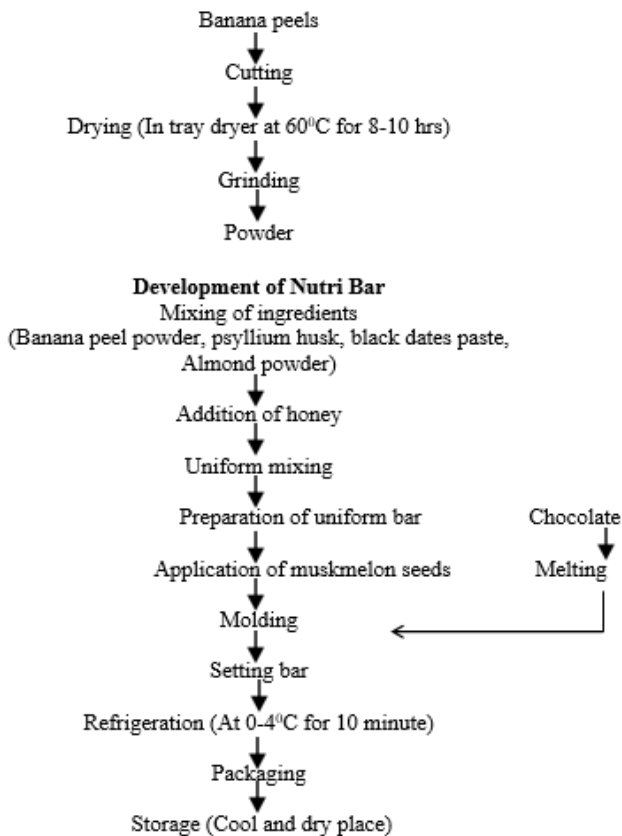
Grinding

Powder

Development of Nutri Bar

Mixing of ingredients

(Banana peel powder, psyllium husk, black dates paste, Almond powder)



Results and Discussion

Physical and chemical properties of ingredients

Physical and chemical properties of Psyllium husk

Table 1: Physical and chemical properties of Psyllium husk

Physical properties		Chemical properties	
Parameters	Values	Parameters	Values
Colour	Pinkish gray	Ash	4.05 %
Length	2.7 mm	Moisture	6.76 %
Breadth	0.76 mm	Fat	0.12 %
Width	1.47 mm	Protein	2.3 %
Weight (1000 seeds)	1.6 gm.	Fiber	70.63 %

The physical properties of psyllium husk were carried out which shows values colour were Pinkish gray, Length (2.7 mm), Breadth (0.76 cm), Width (1.47 cm) and Weight (1.6 gm). These physical parameters were found more or less similar with result found by Ziemichód *et. al.*, (2018). The chemical parameters were found more or less similar with

result found by AOAC 1990 standard method. The chemical properties of Psyllium husk were carried out which shows moisture content (6.76%), Fat (0.12 %), Ash (4.05 %), Protein (2.3 %) and Fibre (70.63 %). (Qaisrani *et. al.*, 2014) [23].

Physical and chemical properties of banana peel

Table 2: Physical and chemical properties of banana peel

Physical properties		Chemical properties	
Parameters	Values	Parameters	Values
Colour	yellow	Ash	15.40 %
Length	15 cm	Fat	12.75 %
Diameter	4 cm	Protein	5.4 %
		Fiber	47.63 %

The physical properties of banana peel were carried out which shows values colour were yellow, Length (15 cm), Diameter (4 cm). These physical parameters were found more or less similar with result found by Nelson *et. al.*, (2006) [19]. The chemical parameters were found more or less similar with result found by AOAC 1990 standard method. The chemical properties of Banana peel powder bar were carried out which shows Fat (12.75 %), Ash (15.40 %), Protein (5.4 %) and Fibre (47.63 %). (Wachira Siri *et. al.*, 2008) [28].

Physical and chemical properties of banana peel powder bar incorporated with psyllium husk

Table 3: Physical and chemical properties of banana peel powder bar incorporated with psyllium husk

Physical properties		Chemical properties	
Parameters	Values	Parameters	Values
Colour	Brown	Ash	2.28 %
Length	7.4 cm	Moisture	9.32 %
Breadth	2.6 cm	Fat	23.12 %
Width	1.1 cm	Protein	8.75 %
Weight	20 gm.	Carbohydrate	62.71 %
		Fiber	4.7%
		Energy	493.92 kcal

The physical properties of banana peel powder bar were carried out which shows values colour were brown, Length (7.4 cm), Breadth (2.6 cm), Width (1.1 cm) and Weight (20 gm). The chemical parameters were found more or less similar with result found by AOAC 2000 standard method. The chemical properties of Banana peel powder bar were carried out which shows moisture content (9.32 %), Fat (23.12 %), Ash (2.28 %), Carbohydrate (62.71 %), Protein (8.75gm), Fiber (4.7%) and Energy (493.92 kcal) respectively.

Sensory Evaluation

Table 3; Sensory evaluation of banana peel powder bar incorporated with psyllium husk

Sample	Colour	Flavour	Taste	Texture	Appearance	Overall Acceptability
Control	9	9	9	9	9	9
T ₁	8	7	7	8	8	7.6
T ₂	8	7.5	7.5	8	8	7.8
T ₃	9	8.5	8.5	9	9	8.8

Prepared various formulations of banana peel powder bar was evaluated for sensory characteristics in terms of parameters like Colour, Flavour, Taste, Texture and Appearance. In this evaluation sample T₃ is more acceptable than sample T₁ and T₂ because sample T₃ contain 5 g of banana peel powder which gives better flavor and taste as compared to sample T₁ and T₂ which gives excessive banana flavor as it contain 15g and 10g of banana peel powder respectively. Sample T₃ contain 5g of psyllium husk which gives better texture than T₁ (2g) and T₂ (4g). The sensory score given for selected sample T₃ by panel members was Colour (9), Flavour (8.5), Taste (8.5), Texture (9) and Appearance (9).

Storage Study

Organoleptic Evaluation of Banana peel powder Bar Stored at Ambient Temperature (30°C)

On the basis of results of organoleptic evaluation of Banana peel powder bar, it was clear that sample Banana peel powder bar prepared with honey was organoleptically acceptable and hence it was selected for further storage study. Sample T₃ was packed in aluminum foil and stored up to 60 days for specific time interval of 15 days kept at ambient temperature (30°C). The data on changes in organoleptic properties are depicted in Table.

The data in the below Table revealed that there was significant change in sensorial parameters during 60 days storage period. Changes in organoleptic qualities were observed at 15 days interval. It was observed that fresh energy bar scored highest score (8.6) as compare to stored Banana peel powder Bar.

Table 3: Organoleptic Evaluation of Banana peel powder Bar Stored at Ambient Temperature (30°C)

Storage Days	Colour	Flavour	Taste	Texture	Appearance	Overall Acceptability
0	8.6	8.6	8.6	8.6	8.6	8.6
15	8.6	8.5	8.6	8.5	8.6	8.6
30	8.5	8.4	8.4	8.5	8.5	8.5
45	8.4	8.3	8.3	8.4	8.4	8.4
60	8.3	8.2	8.2	8.3	8.3	8.3

From the Table it was clear that color recorded lowest score (8.3) on 60th days of storage. During storage of Banana peel powder bar from 0 to 60 days there was decrease in sensory score for overall acceptability (8.3) which was found to be at par with fresh sample. However on 60th day of storage, there was significant decrease in sensory score for texture, taste and overall acceptability (8.2) was observed but liked moderately by the panel members.

Organoleptic Evaluation of Banana peel powder Bar Stored at Refrigeration Temperature (4°C)

The sensory evaluation of selected Banana peel powder bar (T₃) was further carried out for storage study of 60 days at refrigerated condition. The different sensory attributes like color and appearance, taste, texture and overall acceptability were evaluated by panel members.

Table 3: Organoleptic Evaluation Of Banana peel powder Bar Stored At Refrigeration Temperature (4°C)

Storage days	Colour	Flavour	Taste	Texture	Appearance	Overall acceptability
0	8.6	8.6	8.6	8.6	8.6	8.6
15	8.6	8.6	8.6	8.6	8.6	8.6
30	8.6	8.5	8.5	8.5	8.6	8.5
45	8.5	8.5	8.4	8.5	8.5	8.5
60	8.4	8.4	8.3	8.3	8.4	8.4

The data in the above Table revealed that there was slight change in sensorial parameters of sample stored at refrigeration temperature (4°C) for 60days. Changes in organoleptic qualities were observed at 30 days interval. It was observed that fresh Banana peel powder bar scored the highest score (8.6) as compared to stored energy bar. From the above Table it was clear that there was slight variations in taste of the Banana peel powder bar (8.6 to 8.3) observed during the storage period of 60 days. During storage of Banana peel powder Bar from 0 to 60 days there was decrease in sensory score for overall acceptability was found from 8.6 to 8.4 on 60th day of storage. There was significant decrease in sensory score for texture; taste and overall acceptability were reported by the panel members. There was no significant evidence of microbial spoilage. It could be concluded from the table that Banana peel powder bar can be stored for 60 days at refrigerated temperature (4°C) without affecting sensorial parameters. However, its acceptability score was slightly decreased and liked moderately. Similar results were reported during storage of increase shelf life of Banana peel powder Bar.

Conclusion

It can be concluded from the result that banana peel powder bars made with incorporation of psyllium husk can improve the nutritional value of bar and was found acceptable by the panel members. Banana peel powder bar packed in aluminum foil was found stable and acceptable upto two months of storage.

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