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Sensory and Nutritional Analysis of Formulated Red Banana and Sprouted Black Gram-Based Health Drink and Health Bar

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Abstract

Aim: The study focused on the development and quality analysis of red banana and sprouted black gram-based health drink and health bar. **Materials and Methods:** Formulated products were evaluated for appearance, taste, texture, consistency, and overall acceptability. The physicochemical properties, nutrient content, and microbial activity were also assessed. **Result:** The study revealed that V3 (70%) of the health drink and V2 (20%) of the health bar were highly acceptable due to their better flavor and taste. The health mix contained high amounts of dietary fiber, protein, fat, and phosphorus. Studies have also shown that red banana and sprouted black gram have antioxidant, anti-inflammatory, and anti-ulcer properties.

Keywords: Anti-inflammatory, Antioxidant, Anti-ulcer Properties, Microbial Activity, Phytochemical Components, Red Banana, Sprouted Black Gram

1. Introduction

Red banana (*Musa acuminata*) is one of the important varieties of banana with reddish-purple skin, plumpier and sweeter than the common Cavendish banana. Red banana, also called Red Dacca banana. At the fully ripening stage, the flesh of red banana is cream to light pink, having a slight raspberry flavour with higher nutritive and calorific value, containing large amounts of potassium, iron, Vitamin C, and β- β-carotene. The fruits are available throughout the year and tend to cost about 50% more than yellow bananas. Red bananas provide many essential nutrients and the health benefits are rich in essential nutrients, lower blood pressure, support eye health, rich in antioxidants, support immune system, improve digestive and heart health and delicious diet. As compared to yellow bananas, red bananas will ripen in a few days at room temperature. They are frequently eaten raw, whole or chopped and added to desserts and fruit salads, and also baked, fried, and toasted. It is grown in a few countries like India, Australia, Central America, and Brazil etc. It is normally found in Kerala and some parts of Tamil Nadu[1]. Bananas are a very delicate commodity for economic, social, environmental, and political reasons[2]. When bananas are still unripe, they are easily transported and can be stored longer. Unripe banana has thus been considered an ideal product for industrialization, in addition to its high reducing sugar content and low soluble sugar concentrations[3]. An innovative approach has been taken to exploring unripe banana flour as a functional ingredient, and its regular consumption can be expected to confer health benefits in humans[4].

Black gram, also known as urd bean, mash, mah, or black maple, is an important short-duration pulse crop grown in many parts of India. This crop is grown in cropping systems as a mixed crop, cash crop, sequential crop, besides growing as a sole crop under residual moisture conditions after the harvest of rice and before and after the harvest of other summer crops under semi-irrigated and dry land conditions. This legume is consumed in many forms, like whole, dehusked and split form. The legume is used in the preparation of many popular dishes like idli, dosa, vada, papad, wadian, etc[5]. Black gram flour and powder are used as major ingredients

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for several kinds of foods, such as cakes, biscuits, snacks, cookies, and doughnuts. Sprouts produced from black gram are also consumed as a vegetable source of vitamins and minerals[6].

This study is an attempt to formulate health drink and bar as alternatives to commercial products which can be consumed by all age groups. Thus red banana and sprouted black gram based health drink and bar were formulated which has high potassium, fiber and a low starch content. The objectives of the study are to develop red banana and sprouted black gram based health mix, to determine the nutritional composition of the formulated health mix, to assess the shelf life of formulated health mix, to standardize the red banana and sprouted black gram based health drink and health bar.

2. Materials and Methods

2.1 Processing of Red Banana and Black Gram

The raw materials of best quality, namely red banana, black gram, gram flour, nuts such as almond, cashew, and cardamom, were purchased from the local supermarket. The selected whole black gram is soaked overnight at normal room temperature. Then place them on a muslin cloth to drain the water and let them dry for about 24 hours. After being completely dried, grind them into fine powder. The processing of black gram flour is given in Figure 1.

Select unripe red bananas and cut them into small slices. Let them oven dry for about 180°C for 30 minutes. Check for crisp texture, and after being completely dried, grind them into a fine powder. The processing of red banana flour is given in Figure 2.

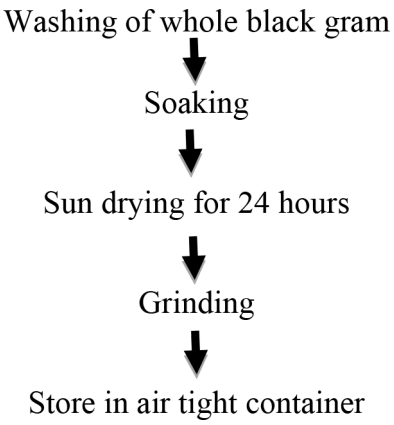


Figure 1. Processing of black gram flour.

2.2 Formulation of Health Mix

The proportions of ingredients used in the preparation of the health mix are listed in Table 1.

2.3 Nutrient Analysis of Formulated Health Mix

The nutritive value of formulated health mix was calculated in terms of macronutrients such as carbohydrate, Protein, fat, and dietary fiber, and micronutrients such as potassium, phosphorous. The phytochemicals, such as flavonoids and steroids, were analyzed for the formulated health mix bag using standard procedures. Also, the antioxidant capacity of the health mix was assessed with a standard procedure.

2.4 Preparation of Health Drink

Add 15g of health mix in 50ml of water and mix well in a saucepan and making sure there is no lump formation in the mixture. Then place them in the stove on medium flame and stir them continuously to prevent lump formation. With continuous stirring, the mix becomes thick and glossy. Then lower the flame and add 50ml preboiled milk into the mix. Stir them well for a few minutes and add brown sugar to taste.

2.5 Formulation of Health Bar

The proportions of ingredients used in the preparation of the health bar are listed in Table 2.

2.6 Preparation of Health Bar

In a heavy-bottomed pan, add 50g of sugar and 10g of water. Keep stirring the mixture continuously and cook

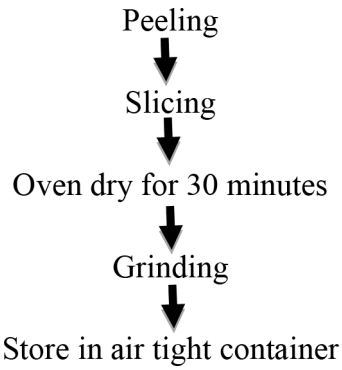


Figure 2. Processing of red banana flour.

Table 1. Proportion of ingredients used in health mix

S. No.	Ingredients	Variation I (50%)	Variation II (60%)	Variation III (70%)
1.	Red banana flour (g)	50	60	70
2.	Black gram flour (g)	30	20	10
3.	Almond Cashews flour (g)	10	10	10
4.	Brown sugar (g)	10	10	10
5.	**Total weight (g)**	**100**	**100**	**100**

Table 2. Proportion of ingredients used in a health bar

S. No.	Ingredients	Variation I (25%)	Variation II (20%)	Variation III (15%)
1.	Red banana flour (g)	25	20	15
2.	Black gram flour (g)	5	10	15
3.	Gram flour (g)	20	20	20
4.	Sugar (g)	50	50	50
5.	Ghee (ml)	50	50	50
	Total weight (g)	**150**	**150**	**150**

until it reaches a one-string consistency. In another pan, heat 50ml of ghee on medium heat. Meanwhile, mix the dry ingredients in a separate bowl. Add the flour mixture to the syrup and mix it well. Reduce the heat to low and add the heated ghee to the flour-sugar syrup mixture. Keep stirring continuously for around 10-15 minutes, until the mixture thickens and turn off the heat, and pour the mixture into a greased plate or tray. Let them cool for a few minutes and cut it into desired shapes and sizes while they're at a warm temperature. Allow it to cool completely and then remove the pieces from the plate or tray.

2.7 Sensory Evaluation of Formulated Health Drink and Bar

The formulated health drink and bar were organoleptically evaluated by 25 semi-trained panel members for appearance, colour, flavour, taste, texture, and overall acceptability. The hedonic rating test was used for the evaluation of overall acceptability.

3. Results and Discussion

3.1 Nutrient Content of Health Mix

The nutrient content of red banana and sprouted black gram based health mix were analyzed using standard procedures and the values per 100g are presented in comparison to dehydrated banana flour in Table 3.

The carbohydrate content for dehydrated banana flour was higher and found to be 88.28g, whereas for red banana and sprouted black gram-based health mix, it was found to be 64.3g. The dietary fibre content for dehydrated banana flour was found to be 9.9g, whereas for red banana and sprouted black gram-based health mix, it was 12.5g. The protein content for dehydrated banana flour was found to be 3.04g, whereas for red banana and sprouted black gram-based health mix, it was 19.5g. The fat content for dehydrated banana flour was found to be 1.41g, whereas for red banana and sprouted black gram-based health mix, it was 12.8g. The potassium content for dehydrated banana flour was higher and found to be 1491mg, whereas for red banana and sprouted black gram-based health mix, it was 1320mg. The phosphorus content for dehydrated banana flour was found to be 74mg, whereas for red banana and sprouted black gram-based health mix, it was 274mg.

Phytochemicals present in red banana and sprouted black gram-based health mix are analysed in aqueous extract, and the results showed that flavonoids and steroids were present in the water extract.

The antioxidant activity of red banana and sprouted black gram-based health mix and red banana flour is represented in Table 4.

It is evident that the antioxidant capacity of red banana flour was found to be 27.95±0.88 mg AAE/g whereas the antioxidant capacity of red banana and sprouted black gram-based health mix was found to be 250 µg AAE /g. It is noticed that the antioxidant capacity of red banana flour was low when compared to red banana and sprouted black gram health mix.

Table 3. Nutrient content of red banana and sprouted blackgram-based health mix (per 100 g)

S. No.	Nutrients	Dehydrated banana flour*	Red banana and sprouted black gram-based health mix
1.	Carbohydrate (g)	88.28	64.3
2.	Dietary fibre (g)	9.9	12.5
3.	Protein (g)	3.04	19.5
4.	Fat (g)	1.41	12.8
5.	Potassium (mg)	1491	1320
6.	Phosphorus (mg)	4	274

*Source: www.medindia.net[7]

3.2 Overall Acceptability of Health Drink and Health Bar

The health drink and health bar were organoleptically evaluated by the panel members and the mean scores for both are presented in Tables 5 and 6.

Table 4. Antioxidant activity of red banana and sprouted blackgram-based health mix

Total Antioxidant Activity	Value
Red banana flour (mg AAE/g)*	27.95±0.88
Red banana and sprouted black gram based health mix (µg AAE /g)	250

*Source: Suniati and Purnomo (2019)[8]

Table 5. Mean acceptability of health drink

Criteria	Mean± Standard deviation		
	V_1 (50%)	V_2 (60%)	V_3 (70%)
Taste	7.68 ± 0.62	8.36 ± 0.89	8.8 ± 0.5
Colour	7.84 ± 0.61	8.20 ± 0.81	8.56 ± 0.712
Flavour	7.76 ± 0.71	8.24 ± 0.72	8.88 ± 1.27
Consistency	8.04 ± 0.78	8.16 ± 0.62	8.60 ± 0.64
Overall acceptability	7.83 ± 0.4	8.24 ± 0.38	**8.71 ± 0.32**
Groups compared	V_1 and V_2	V_2 and V_3	V_1 and V_3
't' value	2.67^{NS}	6.86**	3.58**

** - Significant at 1% level
^{NS} - Not significant

Table 6. Mean acceptability of health bar

Criteria	Mean± Standard deviation		
	V_1 (25%)	V_2 (20%)	V_3 (15%)
Taste	7.88 ± 0.78	8.68 ± 0.55	7.88 ± 0.88
Colour	7.96 ± 0.67	8.56 ± 0.65	8 ± 0.64
Flavour	7.72 ± 0.93	8.6 ± 0.57	7.8 ± 0.707
Texture	7.48 ± 0.87	8.4 ± 0.64	7.24 ± 0.83
Overall acceptability	7.76 ± 0.53	8.56± 0.47	7.73 ± 0.53
Groups compared	V_1 and V_2	V_2 and V_3	V_1 and V_3
't' value	7.15^{**}	4.65**	0.15^{NS}

** - Significant at 1% level
^{NS} - Not significant

From Table 5 it is noted that health drink V_3 (with 70% red banana and sprouted black gram) received the highest overall acceptability score when compared to V_1 (50%) and V_2 (60%) due to its maximum score for the criteria such as taste, colour, flavour and consistency.

From Table 6, it is noted that health bar V_2 (with 20% red banana and sprouted black gram) received the highest overall acceptability score when compared to V_1 (25%) and V_3(15%) due to its maximum score for the criteria such as taste, colour, flavour, and texture.

4. Conclusion

From the above study, it is concluded that V_3 of the health drink and V_2 of the health bar received maximum scores in overall acceptability, and they were accepted by the panel members due to the flavour and taste. From the nutrient analysis, it is noted that the health mix contains a high amount of dietary fibre, protein, fat, and phosphorus. The formulated health mix and health bar have many benefits, such as anti-oxidant, anti-inflammatory, and anti-ulcer properties. Also, they are rich in dietary fiber, protein, potassium, and phosphorus. The health drink and health bar can be consumed by all age groups as a replacement for commercially available brands.

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