
Studies on Development of Whey Protein Fortified Fruit Bar from Bael (*Aegle marmelos*)

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ABSTRACT:

Fortified fruit bar was made using bael pulp with an objective to optimize the product in various terms and to estimate the cost of fruit bar. Bael was used for fruit bar due to its high nutritional value and due to its popularity in India. Fruit bar is a concentrated fruit product with good nutritive value. Fruit bar principally made from fruit pulp retain most of the nutrients, minerals and flavor constituents thus forming a good nutritional supplement besides being a confectionery product. Fortification of this product with whey protein may increase its nutritional as well as market value. In this study nine different treatments were used whose physio-chemical analysis viz. moisture%, TS%, ash %, protein%, fat%, carbohydrate% and acidity% was studied along with organoleptic test. The study also included microbiological analysis of different treatment. From all the treatment it was concluded that the fruit bar T₂ (100:20:5) and T₅ (100:25:5) received highest score for colour and appearance, flavor & test, body & texture. Fruit bar samples of all treatments were found maximum in T₆ (100:25:5) for fat, T₉ (100:30:7.5) for protein, T₇ (100:30:2.5) for carbohydrate was found to be the best in chemical analysis. Samples of treatment T₉ was found the best in microbial analysis, minimum SPC, no Coli form and no yeast and mould count present research during in whey protein fortified fruit bar from bael.

Keywords –fruit bar, bael, fortification, treatment.

INTRODUCTION

Fruit bar is a concentrated fruit product with good nutritive value. It is classified as a confectionary product with longer shelf life. Fruit bars are considered to be hygienic as they are produced mechanically. Fruit bar is a nutritious product, has a chewy texture, similar to dried raisins and is a good source of dietary fiber and natural sugar. For the preparation of good quality jam, jelly and fruit bar, the fruit should contain adequate amounts of pectin. Fruit bar means the product prepared by blending pulp/puree from sound ripe fruit, fresh or previously preserved nutritive sweeteners, butter or other vegetable fat or milk solids and other ingredients appropriate to the product and dehydrated to form sheet which can be desired shape or size. Fruit bars are high calorie foods and are a rich source of the vitamins and minerals. Fruit bars being principally made out of fruit pulps, retain most of these ingredients and form a good nutritional supplement. The fruit bars or fruit-slabs or fruit-leathers are the terms used for the products prepared by dehydration of fruit pulps. 'Bael tree' is native to India and a sacred plant to Hindus. It has got immense medicinal values. All the parts of the plant are useful and used in ayurvedic medicines. The plant is of medium sized hard and the fruits are yellowish or green with soft pulp inside of medicinal value. The bael

fruit has a smooth, woody shell with a green, gray, or yellow peel. It takes about 11 months to ripen on the tree and can reach the size of a large grapefruit or pomelo, and some are even larger. The shell is so hard it must be cracked with a hammer or machete. The fibrous yellow pulp is very aromatic. It has been described as tasting of marmalade and smelling of roses. It resembles a marmalade made, in part, with citrus and, in part, with tamarind."Numerous hairy seeds are encapsulated in slimy mucilage. *Aegle marmelos* has been used as an herbal medicine for the management of diabetes mellitus in Ayurvedic, Unani and Siddha systems of medicine in India, Bangladesh and Sri Lanka. The main usage of the parts of this tree is for medicinal purposes. The unripe dried fruit is astringent, digestive, stomachic and used to cure diarrhea and dysentery. Sweet drink prepared from the pulp of fruits produce a soothing effect on the patients who have just recovered from bacillary dysentery. The ripe fruit is a good and simple cure for dyspepsia. The fruit is of considerable medicinal value when it just begins to ripen. The ripe fruit is aromatic, astringent, cooling and laxative. The unripe or half ripe fruit is astringent, somatic (a drug that strengthens the stomach and promotes its action), antiscorbutic (a drug which prevents or cures scurvy), and digestive. The fruit is said to act as a tonic for heart and brain. It is best given in sub acute or chronic cases of diarrhea and dysentery and in irritation of the alimentary canal. A 'Sherbet' of the ripe fruit is given for chronic constipation and dyspepsia. Due to the presence of seeds and mucilage in the pulp, the ripe fruit cannot be eaten comfortably. Also due to the presence of oxidative enzymes, the pulp readily turns brown on exposure. To enhance its palatability and homogeneity, it is necessary to add water to the pulp (up to 50% of the pulp) and heat it up to 70°C with constant heat to kill the harmful germs. The mass is then sieved while hot to separate the seeds, mucilage and fiber and is cooled immediately to prevent loss of flavour.

WPC_s is the cheapest form of whey. It's been concentrated to primarily contain protein (hence the name). The quality varies on this kind of product immensely, with lower end concentrates being 29% protein and higher end concentrates being 89% (called WPC29 and WPC89, for obvious reasons). We found the following information in a study on whey proteins: Interestingly enough, WPC-70 and WPC-80 (70% and 80% concentrations of protein, respectively) are the most common forms of whey PRO used within sports supplements, largely due to current raw material pricing and possibly improved taste characteristics when compared to either WPI or various forms of WPH. Dehydrated food processing is going to be an important area in the coming years for the reasons like long shelf life, light weight, better handling during export and providing variety to the consumers.

Several treatments were used for manufacturing experimental whey protein fortified fruit bar by using bael. Thus the present attempt was to prepare the product and optimize the product by using bael pulp with the objective to optimize the product in terms of various quality parameter (physio-chemical, microbial, sensory) and to estimate the cost of the fruit bar.

MATERIALS AND METHODS

The experiment "**Studies on Development of Whey Protein Fortified Fruit Bar from Bael (*Aegle marmelos*)**" was conducted in the Student Research Laboratory, Warner School of Food and Dairy Technology, SHIATS, Allahabad (U.P.). Procurement and collection of the ingredients for manufacturing experimental whey protein fortified fruit bar by using bael was done. Experimental material such as **Bael (*Aegle marmelos*)** was collected from the local

market of Allahabad, **Sugar-** Brand name- **Triveni** sugar was collected from the local market of Allahabad, **WPC_s**- Brand name- **Scortis Protis 100% WPC_s** was collected from the Jaipur, Rajasthan. Three replicates were applied to twenty seven samples.

CHEMICAL ANALYSIS

- **Moisture-** This was estimated as per the procedure given AOAC, 1990 method.
- **Total Solids-** This was estimated by AOAC, 1990.
- **Ash-** This was estimated by Muffle Furnace as per the procedure given in Ranganna, 1986.
- **Protein-** This was estimated by Kjeldhal Apparatus by AOAC 1984 method.
- **Fat-** This was estimated by Soxhlet Apparatus by AOAC, 1984 method.
- **Carbohydrate-** This was estimated by {100-(Moisture+Ash+Fat+Protein)% }
- **Acidity-** This was estimated by AOAC, 1990 method.

MICROBIOLOGICAL ANALYSIS

- **Standard plate count-** This will be determined as per the procedure given in APHA Standard Methods for the Examination of Dairy Products 1992.
- **Coli form count-** This will be determined as per the procedure given in APHA Standard Methods for the Examination of Dairy Products 1992.
- **Yeast and mould count-** This will be determined as per the procedure given in ISO Standard.

STATISTICAL ANALYSIS

The data was analyzed statistically by analysis of variance at 5% level of significance.

Number of treatments	-	9
Number of replications	-	3
Total number of samples	-	27

RESULT AND DISCUSSION

The various observation were recorded for physiochemical, organoleptic and microbiological analysis:

Parameters	Score / Value based on mean value of different parameter of treatment									C.D. Value
	T ₁	T ₂	T ₃	T ₄	T ₅	T ₆	T ₇	T ₈	T ₉	
1. Physio-chemical Analysis (in percent)										
% Moisture	16.50	14.90	13.30	16.20	14.60	12.90	15.90	14.20	12.50	1.10
% Total Solids	83.50	85.10	86.70	83.80	85.40	87.10	84.10	85.80	87.50	1.10
% Ash	1.08	1.13	1.18	1.10	1.15	1.20	1.13	1.18	1.23	0.29
% Protein	3.55	5.48	7.23	3.56	5.47	7.22	3.53	5.50	7.24	0.06

% Fat	0.42	0.55	0.68	0.41	0.54	0.70	0.43	0.55	0.65	0.05
% Carbohydrate	78.45	77.94	77.61	78.73	78.24	77.98	79.01	78.01	78.38	1.14
% Acidity	0.64	0.76	0.92	0.65	0.72	0.90	0.62	0.71	0.88	0.14
2. Organoleptic Analysis (9-point Hedonic scale)										
Colour & Appearance	7.47	8.70	6.53	7.13	8.00	6.43	6.80	6.20	5.87	0.81
Flavour & Taste	7.50	8.67	6.77	7.23	7.97	6.87	7.27	7.13	6.13	0.68
Body & Texture	7.40	8.70	6.23	7.37	8.03	6.00	6.87	6.37	5.87	0.75
Overall Acceptability	7.42	8.69	6.51	7.24	7.99	6.43	6.98	6.56	5.93	0.61

3. Microbial Analysis										
S.P.C (x 10 ³ cfu/gm)	13.67	14.67	12.67	15.33	15.00	14.67	12.33	17.33	12.00	3.34
Coli form	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Yeast & Mould	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Cost analysis in Rs.	13.51	19.22	24.93	13.71	19.42	25.13	13.91	19.62	25.33	

PHYSIO-CHEMICAL PARAMETERS

Moisture

The highest mean moisture percentage was recorded in the whey protein fortified fruit bar from bael sample of T₁ (16.50), T₄ (16.20), T₇ (15.90), T₂ (14.90), T₅ (14.60), T₈ (14.20), T₃ (13.30), T₆ (12.90), followed by T₉ (12.50). There was significant difference between all the treatments which may be ascribed by the different levels of fruit bar.

Total Solids

The highest mean total solids percentage was recorded in the whey protein fortified fruit bar from bael sample of T₉ (87.50), T₆ (87.10), T₃ (86.70), T₈ (85.80), T₅ (85.40), T₂ (84.10), T₇ (84.10), T₄ (83.80), followed by T₁ (83.50). There was significant difference between all the treatments which may be ascribed by the different levels of fruit bar.

Ash

The lowest mean ash percentage was recorded in the whey protein fortified fruit bar from bael sample of T1 (1.08), T₄ (1.10), T₂ (1.13), T₇ (1.13), T₅ (1.15), T₃ (1.18), T₈ (1.18), T₆ (1.20), followed by T₉ (1.23). There was non-significant difference between all the treatments which may be ascribed by the different levels of fruit bar.

Protein

The highest mean protein percentage was recorded in the whey protein fortified fruit bar from bael sample of T₉ (7.24), T₃ (7.23), T₆ (7.22), T₈ (5.50), T₂ (5.48), T₅ (5.47), T₄ (3.56), T₁ (3.55), followed by T₇ (3.53). There was significant difference between all the treatments which may be ascribed by the different levels of fruit bar.

Fat

The highest mean fat percentage was recorded in the whey protein fortified fruit bar from bael sample of T₆ (0.70), T₃ (0.68), T₉ (0.65), T₂ (0.55), T₈ (0.55), T₅ (0.54), T₇ (0.43), T₁ (0.42), followed by T₄ (0.41). There was significant difference between all the treatments which may be ascribed by the different levels of fruit bar.

Carbohydrate

The lowest mean carbohydrate percentage was recorded in the whey protein fortified fruit bar from bael sample of T₃ (77.61), T₂ (77.94), T₆ (77.98), T₈ (78.01), T₆ (78.24), T₉ (78.38), T₁ (78.45), T₄ (78.73), followed by T₆ (79.01). There was non-significant difference between all the treatments which may be ascribed by the different levels of fruit bar.

Acidity

The highest mean acidity percentage was recorded in the whey protein fortified fruit bar from bael sample of T₃ (0.92), T₆ (0.90), T₉ (0.88), T₂ (0.76), T₅ (0.72), T₈ (0.71), T₄ (0.65), T₁ (0.64), followed by T₇ (0.62). There was significant difference between all the treatments which may be ascribed by the different levels of fruit bar.

ORGANOLEPTIC PARAMETERS**Colour & Appearance**

The highest mean colour & appearance percentage was recorded in the whey protein fortified fruit bar from bael sample of T₂ (8.70), T₅ (8.00), T₁ (7.47), T₄ (7.13), T₇ (6.80), T₃ (6.53), T₆ (6.43), T₈ (6.20), followed by T₉ (5.87). There was significant difference between all the treatments which may be ascribed by the different levels of fruit bar.

Flavour & Taste

The highest mean flavor & taste percentage was recorded in the whey protein fortified fruit bar from bael sample of T₂ (8.67), T₅ (7.97), T₁ (7.50), T₇ (7.27), T₄ (7.23), T₈ (7.13), T₆ (6.87), T₃ (6.77), followed by T₉ (6.13). There was significant difference between all the treatments which may be ascribed by the different levels of fruit bar.

Body & Texture

The highest mean body & texture percentage was recorded in the whey protein fortified fruit bar from bael sample of T₂ (8.70), T₅ (8.03), T₁ (7.40), T₄ (7.37), T₇ (6.87), T₈ (6.37), T₃ (6.23), T₆ (6.00), followed by T₉ (5.87). There was significant difference between all the treatments which may be ascribed by the different levels of fruit bar.

Overall Acceptability

The highest mean overall acceptability percentage was recorded in the whey protein fortified fruit bar from bael sample of T₂ (8.69), T₅ (7.99), T₁ (7.42), T₄ (7.24), T₇ (6.98), T₈ (6.56), T₃ (6.51), T₆ (6.43), followed by T₉ (5.93). There was significant difference between all the treatments which may be ascribed by the different levels of fruit bar.

MICROBIAL PARAMETERS**S.P.C (x 10³ cfu/gm)**

The lowest mean S.P.C (x 10³ cfu/gm) percentage was recorded in the whey protein fortified fruit bar from bael sample of T₉ (12.00), T₇ (12.33), T₃ (12.67), T₁ (13.67), T₂ (14.67), T₆ (14.67), T₅ (15.00), T₄ (15.33), followed by T₈ (17.33). There was non-significant difference between all the treatments which may be ascribed by the different levels of fruit bar.

Coli form

It is evident from the experiment that the coli form test in experimental fruit bar samples were 100 percentages negative.

Yeast & Mould

It is evident from the experiment that the yeast & mould count in experimental fruit bar samples were 100 percentages negative.

CONCLUSION:

In view of experimental results obtained during the present investigation, it may be concluded that the fruit bar T₂ (100:20:5) and T₅ (100:25:5) received highest score for colour and appearance, flavor & test, body & texture was liked very much by the judges in the organoleptic evaluation.

Fruit bar samples of all treatments were found maximum in T₆ (100:25:5) for fat, T₉ (100:30:7.5) for protein, T₇ (100:30:2.5) for carbohydrate was found to the best in chemical analysis. Samples of treatment T₉ was found the best in microbial analysis, minimum SPC, no Coli form and no yeast and mould count present research during in whey protein fortified fruit bar from bael.

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