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Studies on Development and Quality Evaluation of Mixed Fruit Bar Fortified with Whey Protein Concentrate

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ABSTRACT: When choosing food snacks, consumers tend to select highly nutritious and natural product which is made from more nutritious fruits and fruit bar has all that qualities to fulfil the market demand. In the present study, to standardize the protocol for preparation of fruit bar fortified with whey protein concentrate. From previous studies, various types of fruit bar have been prepared. Drying of pulp is the most vital steps in fruit bar preparation but due to excess drying loss in colour of natural fruit pulps and degradation of nutrients. Therefore to overcome these problems add whey protein concentrate which help to reduce the drying time because of its water binding capacity. Fruits are well-known for providing energy, vitamins, minerals, antioxidants, and fibre. Fruit puree is dehydrated into a sheet to make these fruit bars. Fruit bars can also be fortified with nutrients like concentrated protein sources to boost their nutritional value. Mango and guava pulp was blended in ratio 60:40 with different proportions of WPC i.e. 3% (W_1), 5% (W_2) and 7% (W_3). With addition of 10% sugar and 5% tamarind heating the mixture in cabinet dryer at 60°C for 5 to 6 hrs. The prepared bar was analysed for chemical composition such as moisture, protein, fat, carbohydrate, ash, fibre, pH, acidity, TSS, and ascorbic acid. Organoleptic evaluation of fortified bar was done by 9 point hedonic scale assessing the parameters i.e. appearance, colour, flavour, taste, texture and overall acceptability were evaluated. The results showed that sample containing 5% of Whey protein concentrate exhibits superior sensory attributes.

Keywords: Fruit bar, mango, guava, whey protein concentrate (WPC), Chemical composition, sensory attribute.

INTRODUCTION

Consumers have become more health conscious in their food choices in recent years, but they have less time to cook healthy meals. As a result, market demand for "slightly processed" or "partialy processed" meals has increased, while the expanding health and wellness trend has generated high demand for functional and fortified meals (Take *et al.*, 2012). Fruits are well-known for providing energy, vitamins, minerals, antioxidants, and fibre. Fruits' nutritional value is mostly determined by the quality and amount of their nutritious components. Fruits can be used and processed in a variety of ways, including juice, jams, concentrates, pulp, dehydrated products, jellies, and fruit leather (Mounika and Mashewari 2019). Fruit bars can also be fortified with nutrients like concentrated protein sources to boost their nutritional value. Fruit bars are a type of confectionary made by drying fruit pulp and blending them with sugar, pectin, acid, and colour in the proper proportions (Narayana *et al.*, 2007). It is also called fruit slab or fruit leather (Chauhan *et al.*, 1993).

The mango is India's most important fruit crop. It is recognized as the "King of Fruits" because of its wonderful taste, exceptionally agreeable flavour, beautiful colour, and excellent nutritional content (Nagaharshitha *et al.*, 2014). Mangoes (*Mangifera indica*) belong to the genus Mangifera, which includes roughly 30 tropical fruiting trees in the flowering plant of family Anacardiaceae. It is the most important commercially farmed fruit crop and ranks second in terms of production among tropical crops. Mango is one of the most widely grown fruits in the world, with 46.50 million tonnes produced year. India is the world's largest producer and exporter of mangoes. Mango fruit conquers the 2nd position as a tropical crop that is grown in nearly 87 countries in the world. The major mango producing countries in the world are India (42.02 per cent), China (10.69%), Thailand (7.69 %), Mexico (4.92%) and Indonesia (4.89 %). India had 22.67 lakh hectares under mango cultivation, with a production of roughly 202.95 lakh tonnes, accounting for 42.02 per cent of global production. The major mango producing states are Uttar Pradesh (23.06%), Andhra Pradesh (16.07%), Karnataka (9.29%), Bihar (7.52%), Gujarat (6.31%) and Tamil Nadu (5.88%) (Mukund *et al.*, 2019).

Guava is a popular fruit crop that has increased in popularity due to its high nutritious value, low cost, appealing aroma, and delicious taste. It's also referred to as the "poor man's apple" (Dinesh and Vasugi 2010). It is commonly grown in tropical and subtropical climates around the world. It is a member of the huge

Myrtaceae or Myrtle family that originated in tropical America, ranging from Mexico to Peru, and evolved into a commercially important crop in numerous nations due to its hardiness, prolific bearing, high vitamin C content, and high recompense even without much care. Guava fruits are utilised for both fresh and processed consumption. Guava cultivation has been increasingly popular in recent years due to growing international commerce, nutritional value, and value-added goods. Guava has a strong presence in over 60 countries. India, Mexico, Brazil, Cuba, Venezuela, the United States, Australia, New Zealand, and China are the leading producers (Negi and Shailendra 2007).

Whey is a substantial and abundant by-product of the dairy industry, derived from the processing of milk. It is created as a by-product in the production of cheese, and it contains half of the total milk solids (Kumar *et al.,* 2018).

Whey output in the globe is expected to be at 165 million tonnes. Cheese whey accounts for around 95% of the total. Whey is mostly obtained in India via the manufacturing of chhana and paneer. In the absence of regular survey/statistics, whey output is believed to be around 5 million tonnes per year (Gupta, 2008). In Europe, the utilisation rate was 75%, and possibly less than 50% in the rest of the world, resulting in the waste of a substantial amount of material that could be used as food or feed (Aneja *et al.,* 2002).

MATERIAL AND METHODS

The present investigation was carried out in Department of Food Engineering with collaboration of Department of Food Chemistry and Nutrition, College of Food Technology, VNMKV, Parbhani during year 2020-21.

A. Materials

The fresh and ripe mango, guavas and whey protein concentrate were obtained from local market of Parbhani. The present research was carried out in Department of Food Engineering, College of Food Technology, VNMKV, Parbhani.

Chemicals and glasswares. The chemicals of analytical grade and glasswares required during investigation were used in the department of Food Engineering.

B. Methods

Preparation of Mango pulp. Fresh mangos were selected, wash properly then outer skin was peeled off and the mangos were cut into the pieces then remove the stones. Mango pulp was extracted by using pulper and then it was filtered through the muslin cloth for the further clarification.

Preparation of Guava pulp. Ripe guavas were selected, wash properly to remove dirt. Cut the fruit into two equal halves and pulp was extracted by using pulper and then it was filtered through the muslin cloth to remove seeds.

Organoleptic evaluation of mixed fruit bar fortified with Whey protein concentrate. The organoleptic evaluation of prepared mixed fruit bar fortified with whey protein concentrate was done by a panel of 10 semi-trained judges' having the prior experience of sensory evaluation adopting 9 points hedonic scale for assessing the organoleptic properties such as appearance, color, flavor, taste, texture and overall acceptability.

Proximate analysis. Prepared samples were analyzed for moisture, protein, fat, ash, total carbohydrate, crude fibre, TSS, pH, acidity, and ascorbic acid contents according to respective standard methods as described (A.O.A.C., 2005).

Preparation of mixed fruit bar fortified with whey protein concentrate. The Mango and Guava pulp was blended in the ratios 60:40 with the addition of sugar (10%) and tamarind (5%). The mixed fruit bar prepared from this blend was considered to be the controlled bar. The fortified bar was prepared with the incorporation of Whey protein concentrate (WPC) in different proportions i.e. 3%, 5% and 7%. Heating the mixture at 70-80℃ up to 50 (°Bx) After that poured boiled puree in trays layered with glycerin then keep the trays in cabinet dryer at 60° for 4 to 5 hrs. After proper drying cut the bar into small pieces and packed into air tight packaging material and stored at room temperature (Avad *et al.,* 2019).

Table 1: Standardized recipe for the preparation of mixed fruit bar fortified with Whey protein concentrate.

Ingredients (%)	Quantity			
	Control (W_0)	W_1	W_2	W_3
Mango pulp	60	60	60	60
Guava pulp	40	40	40	40
WPC	-	03	05	07

Control = 60% mango pulp + 40% guava pulp
W_1= 60% mango pulp + 40% guava pulp + 3% whey protein concentrate
W_2 = 60% mango pulp + 40% guava pulp + 5% whey protein concentrate
W_3 = 60% mango pulp + 40% guava pulp + 7% whey protein concentrate

Flow sheet for preparation of mixed fruit bar fortified with whey protein concentrate

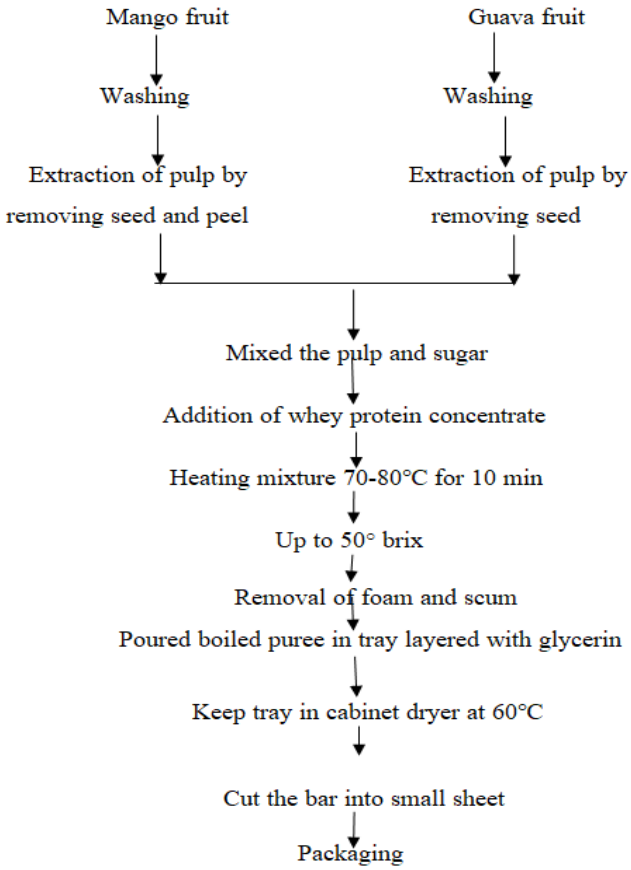


Fig. 1. Process flowchart for preparation of mixed fruit bar fortified with Whey protein concentrate.

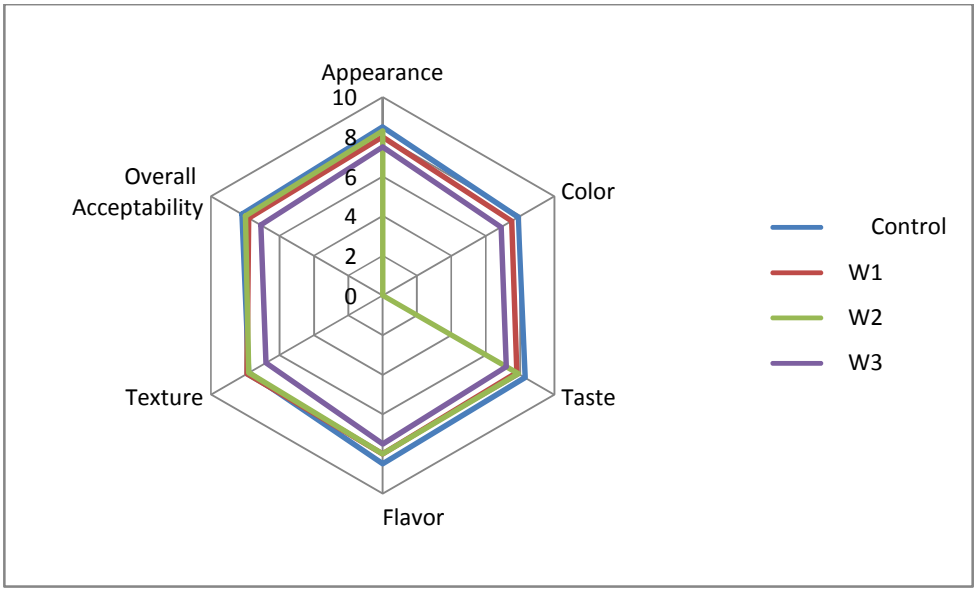
RESULT AND DISCUSSION

The result of Table 2 revealed that the sample Control and W_2 is the most acceptable product. The selected sample W_2 ranked highest due to significant addition of (5%) of whey protein concentrate with sensory score (i.e., 8.0). Control sample secured highest score in case of flavor (i.e. 8.5) followed by W_1 (i.e. 8.0), W_2 (i.e. 8.0) and W_3 (i.e.7.5). In case of visual appearance control sample got highest score (i.e. 8.5) while W_3 got very lowest score (i.e. 7.5). In case of taste control and selected sample W_2 secured highest score i.e. 8.3 and 7.9 while W3 got lowest score i.e. (7.2). In case of flavor control sample got highest score (8.5) while sample W_1 and W_2 got equal score (8.0) while W3 secured lowest score (7.5) sample control and selected sample got same score for texture (i.e. 7.8) and W_3 got very lowest score i.e. 6.8, slightly increase in hardness of product due to addition of 7% whey protein concentrate respectively. In terms of maximum overall acceptability score was recorded for control sample (8.2) and selected sample W_2 (8.0) for color, appearance, flavor, taste and texture which was higher than samples W_1 and W_3 respectively From the above discussion we can conclude that sample W_2 showed near about same score of sample Control. Therefore, sample Control and W_2 were selected for further studies.

Table 2: Organoleptic evaluation for mixed fruit bar fortified with Whey protein concentrate.

Sample code	Sensory Attributes					
	Appearance	Colour	Taste	Flavour	Texture	Overall Acceptability
Control	8.5	7.9	8.3	8.5	7.8	8.2
W_1	8.0	7.5	7.8	8.0	7.9	7.8
WW_2	8.3	8.2	7.9	8.0	7.8	8.0
WW_3	7.5	6.9	7.2	7.5	6.8	7.1
SE±	0.11726	0.08498	0.12528	0.12638	0.08079	0.04564
CD@5%	0.34393	0.24926	0.36745	0.37069	0.23698	0.13388

*Each value is an average of three determinations



The data pertaining to Table 3 showed the chemical composition of control (W_0) and selected (W_2) samples were carried out with respective constituents like moisture, protein, fat, total carbohydrate, ash, pH, TSS, crude fibre, acidity and ascorbic acid of mixed fruit bar fortified with whey protein concentrate.

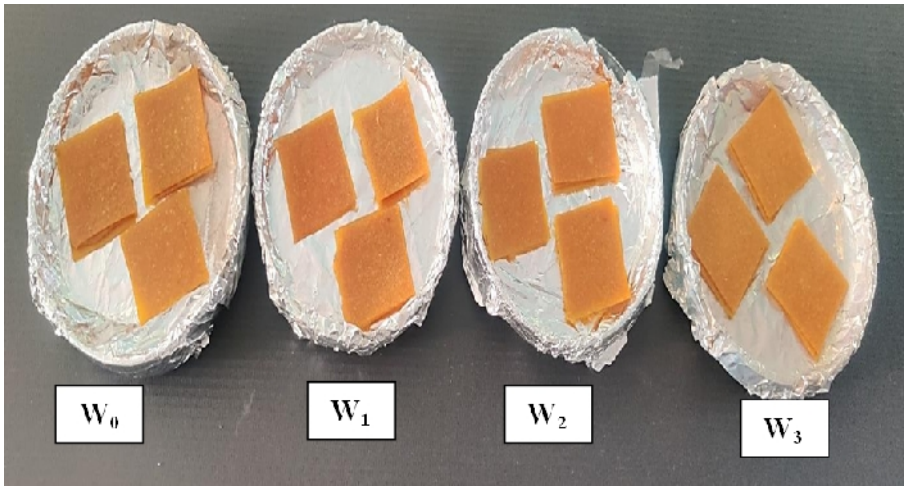
The data in table 3 showed that the chemical composition of mixed fruit bar fortified with whey protein concentrate and result revealed that moisture content in control sample (W_0) was found to be 20.15%, protein was 5.2%, fat, carbohydrate and ash content was noted to be 1.21%, 68.12% and 0.64%. The pH content 4.23, TSS 77.1 (◦Bx), crude fibre 2.11, acidity was 0.8% and ascorbic acid content was found to be 132.41 mg/100g. Whereas selected sample (W_2) had moisture content 19.80%, protein content 13.86%. The protein content was increased in (W_2) due to addition of whey protein concentrate. Fat, carbohydrate and ash content was 2.4%. 59.42% and 1.92%. pH was 4.12, TSS 77.6 (◦Bx), crude fibre 2.15%, acidity 0.92 and ascorbic acid 131.54 mg/100g.The results were in close resemblance with Parimita and Arora (2015) and Szydlowska *et al.,* (2020).

Table 3: Chemical composition of mixed fruit bar fortified with whey protein concentrate.

Constituents	Mean value	
	W_0 (Control)	**W_2 (Selected sample)**
Moisture (%)	20.15±0.03	19.80±0.48
Protein (%)	5.2±0.1	13.86±0.28
Fat (%)	1.21±0.03	2.4±0.04
Total carbohydrate (%)	68.12±0.02	59.42±0.39
Ash (%)	0.64±0.08	1.92 ± 0.01
pH	4.23±0.02	4.12±0.01
TSS (◦Bx)	77.1	77.6
Crude fibre (%)	2.11±0.41	2.15±0.01
Acidity (%)	0.8±0.05	0.92±0.008
Ascorbic acid mg/100g	132.41	131.54

*Each value is an average of three determinations

Parimita and Arora (2015) reported physicochemical composition of whey protein fortified fruit bar from Bael (*Aegle marmelos*) and data obtained to be moisture 12.90 per cent, protein 7.23 per cent, fat 0.70, total carbohydrate 78.24 per cent, ash 1.20 per cent, acidity 0.90 per cent and TSS 83.50 °Bx respectively. Szydlowska *et al.,* (2020) reported the physicochemical composition of high protein organic bars with addition of whey protein concentrate and data obtained on addition of 12% whey protein concentrate to be moisture content 19.7 per cent, total protein content 17.3 per cent and ash 2.3 per cent respectively.



CONCLUSION

From the above result it could be concluded that fruits are poor source of protein so due to the addition of whey protein concentrate increased the food value of prepared mixed fruit bar. Now a days consumers always looking for more natural snacks from fruits and fruit bar has all that nutrients quality, the organoleptic characteristics of mixed fruit bar fortified with whey protein concentrate viz., colour, flavor, taste, texture and overall acceptability. It can be finally concluded that mixed fruit bar fortified with 5 % whey protein concentrate received highest sensory score (i.e., 8.0) after control sample in case of all sensory attributes. The treatment (W_2) with 60% mango pulp and 40% guava pulp noticed as best blending ratio,

FUTURE SCOPE

Fruits are available only up to certain seasons, so to increase its availability throughout the years, it can be preserved by making value added product such as fruit bar and it is the most popular method of fruit preservation. Due to addition of some of the best protein sources we can increase the nutrition profile of fruit bar and also reduces malnutrition problems.

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Conflict of interest. The authors declare that there is no conflict of interest.

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