Original Research Article

DEVELOPMENT OF JACKFRUIT-PAPAYA BLENDED FRUIT BAR

ABSTRACT

Aims: Consumers today are increasingly health-conscious, seeking products that offer health benefits and functional properties. Fruit bars serve as a natural, healthier alternative to sugary snacks like cookies, cakes, and candies. Preparation of fruit bar by blending multiple fruit pulps can enhance their nutritional values, sensory qualities and health benefits. The present study aims to develop a jackfruit-papaya blended fruit bar with superior nutritional and sensory qualities that meets the growing demand of consumer preferences for natural, plant based options, supporting both health and sustainability.
Study design: Completely Randomized Design by using GRAPES (General R based Analysis Platform Empowered by Statistics)
Place and Duration of Study: Department of Postharvest Management, College of Agriculture, Vellayani, Thiruvananthapuram, Kerala Agricultural University between February 2022 and July 2024.
Methodology: In the present study, the pulps of jackfruit (J) and papaya (P) were blended in different ratios *viz.,* 90J:10P (B_1), 80J:20P (B_2), 70J:30P (B_3), 60J:40P (B_4), 50J:50P (B_5) and 100J (B_6) (control) for the production of fruit bars as per the FSSAI specifications. The prepared pulp was dried at 55°C temperature till it attained a moisture content of 15-20%. The blended fruit bars were compared with pure jackfruit bar (100J) for various chemical, nutritional and organoleptic quality parameters (100J) to explore the possibility of efficient blending and for the selection of a superior blending ratio.

Results: The blended fruit bar prepared with 50% jackfruit pulp and 50% papaya pulp (B_5) had superior chemical, nutritional and organoleptic quality parameters. Hence, 50% jackfruit pulp and 50% papaya pulp (B_5) was selected as the best blending ratio of jackfruit-papaya blended fruit bar. The blended fruit bar prepared with B_5 recorded the highest TSS (55.53 ^{0}Brix),reducing sugar (42.86%), total sugar (67.58%), ascorbic acid (29.76mg 100g^{-1}), carotenoid content (1.41mg 100g^{-1}), crude fibre (9.30%) and lowest acidity (0.93%) and protein content (0.20mg 100g^{-1}) with superior organoleptic quality parameters.

Conclusion: The fruit bar offers several health benefits by blending different fruit pulps, each rich in essential nutrients. In this study, the blended fruit bar prepared with 50% jackfruit pulp and 50% papaya pulp (B_5) was selected as the best blending ratio. This blend was selected due to its superior chemical, nutritional, and organoleptic properties, making it a promising option for a healthy and nutrient-packed snack.

Keywords: Blended fruit bar, jackfruit, papaya, varikka, pulp

1. INTRODUCTION

Fruit bars are dried confectionery products that offer a long shelf life, making them a convenient and stable snack option. Fruit bars often referred to as fruit leathers or fruit slabs, are said to be a healthier, more affordable, and nutrient-dense alternative to other sweets, cookies or cakes that are loaded with sugar or fat. Fruit purees and other ingredients are dried into a thin layer to form fruit bars [1]. Fruit leathers also allow left over ripe fruits to be preserved [2]). To make fruit bars, ingredients like sugar, citric acid, pectin, and permitted preservatives are combined, and the mixture is dried in a cabinet dryer until it forms firm sheets. A fruit bar's colour and sensory appeal are determined by the proper ratio of acid to sugar [3].

These fruit bars are regarded as a wholesome snack, especially for those seeking a nutritious, low-calorie snack option. It is readily available, easy to eat and very convenient products in terms of packaging and distribution [4].

Fruit bars made from fruit pulp will retain the majority of the nutrients, minerals and flavouring components, thus considered as a dietary supplement. Blended fruit bars can be made by mixing or blending with more than two fruit pulps. The objective of choosing two or more fruits for blending is to boost the nutritional characteristics and sensory stability of fruit bars. Fruit bars can also be fortified with other functional ingredients such as protein, fibre, nutrients etc. to increase their nutritional value as a food and serve as an appropriate matrix for the introduction of prebiotics and probiotics. To address the growing demand for low-calorie snack foods, it is possible to prepare fruit bars with different sweeteners and sugar substitutes. In the health food sector, fruit bars are typically marketed as nutritious snacks. They are frequently eaten as an energy boost during exercises or outdoor activities, as a quick on-the-go snack, or as a supplement to a lunchbox.

Among the tropical fruits, jackfruit and papaya are categorized as important underutilized fruits with high nutritional value. Jackfruit is rich in carotenoids, minerals, dietary fibre etc. Papaya fruit has attractive colour and good source of minerals, carotenoids, vitamins C, E & flavonoids which acts as antioxidants. Papaya fruit hasn't garnered the attention it deserves from customers, primarily due to its disagreeable smell, which restricts its commercial exploitation at the processing level [2]. However, because of its blood crimson pulp, tasty flavour, and low acidity, papaya fruit can be used to make nutritionally enhanced food products as well as to blend with other fruits [5]. Nutritional and sensory qualities of fruit bars can be improved by blending with the pulps of jackfruit and papaya. Hence the present study was undertaken with the objective to standardize a jackfruit-papaya blended fruit bar and to evaluate its quality.

2. MATERIAL AND METHODS

Good quality, fresh and uniformly ripe fruits of jackfruit (varikka type) and papaya (Red lady) free from visual defects were collected from farmer's field, Thiruvanthapuram. The collected fruits were washed, surface sanitized using ozonation (100 ppm), inedible parts were removed and pulp was extracted. The extracted pulp of jackfruit (J) and papaya (P) were blended in 6 different ratios *viz*., 90J:10P (B_1), 80J:20P (B_2), 70J:30P (B_3), 60J:40P (B_4), 50J:50P (B_5) and 100J (B_6) (control) for the production of fruit bars as per the FSSAI specifications. The prepared pulp was dried at 55°C temperature till it attained a moisture content of 15-20%. The blended fruit bars were compared with pure jackfruit bar (100J) for chemical, nutritional and organoleptic quality parameters. Chemical parameters such as TSS, acidity [6], reducing sugar [6], total sugar [6] and nutritional parameters such as ascorbic acid [6], carotenoid, protein and crude fibre content were analyzed. Organoleptic quality parameters like colour, appearance, flavor, texture, taste and overall acceptability of blended fruit bars were evaluated by conducting sensory evaluation with a semi-trained panel of 30 members [7]. The present study was employed in Completely Randomized Design (CRD) with 6 treatments and 3 replications. Data recorded from the experiments were statistically analyzed using GRAPES [8]. Based on superior chemical, nutritional and organoleptic quality parameters, the best blending ratio of fruit bar was selected.

3. RESULTS AND DISCUSSION

3.1. CHEMICAL PARAMETERS

The data with respect to the chemical quality parameters of blended fruit bars are presented in Table 1. The result revealed that the TSS content of blended fruit bars was significantly increased with increased papaya pulp concentration. The blended fruit bar prepared with 50% Jackfruit pulp and 50% papaya pulp (B_5) recorded the highest TSS content (55.53^0 Brix), whereas the least TSS content was observed in pure jackfruit bar (control) (47.60^0 Brix) (Fig. 1). The result conformed with the findings of [9] who had reported a highest TSS of 58.53^0Brix in jack fruit based blended fruit bar and the least in pure jackfruit bar (47.87^0 Brix). The increased TSS content might be due to the addition of different concentrations of fruit pulps and a constant amount of sugar. Similar results were also found by [9] in mixed fruit bars, which was consistent with the findings of [10] in pineapple leather.

The acidity of blended fruit bars was significantly decreased from 1.24% to 0.93% with increased papaya pulp concentration from 10% to 50%. The highest acidity of 1.34% was recorded in pure jackfruit bar (100%J), whereas the lowest acidity of 0.93% was found in blended fruit bar prepared with 50% jackfruit pulp and 50% papaya pulp (B_5) (Fig. 2). The result was in accordance with the findings of [11] and [12] who had reported an acidity in the range of 1.48% to 1.63% in fruit bars after drying. They also discovered that pure papaya fruit bar had a lower acidity level than other blended fruit bars. The addition of citric acid to the fruit pulp during the preparation of fruit bars made them acidic. Drying process concentrated the natural acidity of fruit pulp, which significantly increased the acidity of the fruit bar. The strong acidity levels in fruit bars can inhibit bacterial growth and maintain the fruit's flavour and colour.

The total and reducing sugar contents were increased with increase in papaya pulp concentration. The highest reducing sugar content of 42.86% was observed in the blended fruit bar prepared with 50% jackfruit pulp and 50% papaya pulp (B_5) (Fig. 3). The lowest reducing sugar content of 27.28% was recorded in pure jackfruit bar. Similar findings had been reported by [13] in guava-papaya blended fruit bar with a reducing sugar content of 45.95%. Fruit bar prepared with 60% guava pulp and 40% papaya pulp had a reducing sugar content of 41.40% and fruit bar prepared with 50% guava pulp and 50% papaya pulp recorded a reducing sugar content of 44.50%. The increase in reducing sugars might be due to the inversion of non-reducing sugars into reducing sugars and hydrolysis of polysaccharides [13].

The total sugar content was highest (67.58%) for blended fruit bar prepared with 50% jackfruit pulp and 50% papaya pulp (B_5) and pure jackfruit bar observed with the lowest total sugar content of 40.21% followed by fruit bar prepared with 90% jackfruit pulp and 10% papaya pulp (B_1) (41.09%) (Fig. 4). These findings were confirmed by [14] in guava-papaya blended fruit bars. The total sugar content of guava-papaya blended fruit bar increased from 66.43% to 68.13% when the papaya pulp concentration increased from 20 to 40%. The highest total sugar content of 69.31% was reported by [2] in fruit bar prepared with 100% papaya pulp which was comparable to other treatments.

3.2. NUTRITIONAL PARAMETERS

The data with respect to the nutritional parameters of blended fruit bars are presented in Table 2. The ascorbic acid content was significantly increased with increased papaya pulp concentration. The highest ascorbic acid content of 29.76 mg $100g^{-1}$ was recorded in blended fruit bar prepared with 50% jackfruit pulp and 50% papaya pulp. The lowest ascorbic acid content of 23.40 mg $100g^{-1}$ was noticed in pure jackfruit bar (100%J) (Fig. 5). According to [15] the highest ascorbic acid content of 28.76 mg$100g^{-1}$ was found in jackfruit-guava-pineapple blended fruit bar (60:20:20), whereas the lowest ascorbic acid content of 23.29 mg$100g^{-1}$ was observed in pure jackfruit bar. These results were align with the findings of [16], who had reported that the increased ascorbic acid levels of fruit bars might be due to the utilization of fruit pulp with increased ascorbic acid content for blending. Similar conclusions were drawn by [17] in apple-peach fruit bars and [18] in guava-orange fruit bars. Papaya and guava blended fruit leather had improved ascorbic acid and carotenoids content due to contribution from both fruits [16].

The carotenoid content of jackfruit-papaya blended fruit bars increased with an increased concentration of papaya pulp (Fig. 6). The fruit bar prepared by blending with 50% jackfruit pulp and 50% papaya pulp (B5) had the highest carotenoid content of 1.41 mg $100g^{-1}$. The lowest carotenoid content of 0.30mg $100g^{-1}$ was noticed in pure jackfruit bar (control). Similar results were reported by [2] who had observed a significant increase in carotenoid content in papaya-guava blended fruit bars when the concentration of papaya pulp increased from 50% to 100%. According to [18], blended fruit bar prepared with 50% guava pulp and 50% papaya pulp recorded the highest carotenoid content compared to other blends. There was an increase in carotenoid content as increased papaya pulp in blending ratio of fruit bar might be due to the high amount of carotenoids in papaya [19].

The protein content of blended fruit bars decreased from 0.24 mg$100g^{-1}$ to 0.20 mg$100g^{-1}$ with increased papaya pulp concentration from 10% to 50% (Fig. 7). The highest protein content of 0.25 mg$100g^{-1}$ was recorded in the pure jackfruit bar (control) which did not differ significantly with blended fruit bar prepared with 90% jackfruit pulp and 10% papaya pulp (B_1) (0.24mg $100g^{-1}$). Fruit bar prepared with B_5 recorded the lowest protein content (0.20 mg $100g^{-1}$) followed by Fruit bars prepared with B_2 (80J:20P), B_3 (70J:30P) and B_4 (60J:40P) (0.21 mg $100g^{-1}$). The significant variation in protein content, ranging from 0.87% to 1.85% was recorded by [20] in sapota-papaya blended fruit bars. The change in protein content of fruit bars might be due to the addition of varying concentrations of papaya pulp.

The crude fibre content of jackfruit-papaya fruit bars significantly increased with increased papaya pulp concentration (Fig. 8. The highest crude fibre content of 9.30% was recorded in the blended fruit bar prepared with 50% jackfruit pulp and 50% papaya pulp (B_5), whereas the lowest crude fibre content of 9.07% was noticed in pure jackfruit bar which was on par with fruit bar prepared with B_1 (9.11%). Similar results were reported by [19] in sapota-papaya fruit bar. The increased crude fibre content in fruit bars might be due to the addition of increased papaya pulp concentration, as papaya is rich in protein compared to jackfruit.

3.3. ORGANOLEPTIC EVALUATION OF FRUIT BARS

When the prepared blended fruit bars were subjected to organoleptic evaluation (Table 3), fruit bar prepared with 50% jackfruit pulp and 50% papaya pulp (B5) had maximum sensory scores for appearance (8.02), colour (7.82), taste (8.02) and overall acceptability (7.60). Blended fruit bar prepared with 70% jackfruit pulp and 30% papaya pulp had maximum sensory score for flavour (7.82) and maximum sensory score for texture (8.15) was recorded in fruit bar prepared with 80% jackfruit pulp and 20% papaya pulp (B5). Blending of fruit pulps could improve the acceptability of products as reported by [23]. Hence, it would be concluded that the blending of fruit pulps provides better compatibility for the preparation of quality mixed fruit bar. Several studies suggested that, blending of papaya pulp for preparation of fruit bar/ leather had great potential and it could be successfully explored for sustainable use of highly perishable

commodities in processing and value addition. Fruit bar made with 50% guava pulp and 50% papaya pulp recorded maximum sensory scores for colour (8.86), taste (8.96), flavour (8.46), texture (8.03) and overall acceptability (8.90) [13]. A study conducted by [21] reported that blending of two or more fruit pulps in different ratios had positively influenced sensory properties.

Table 1. Chemical parameters of jackfruit-papaya blended fruit bars

Blending ratios	TSS (° Brix)	Acidity (%)	Reducing sugar (%)	Total sugar (%)
B_1 (90 J:10 P)	48.93^{e}	1.24^{b}	30.02^{e}	41.09^{e}
B_2 (80 J:20 P)	50.10^{d}	1.18^{bc}	33.25^{d}	43.60^{d}
B_3 (70 J:30 P)	52.80^{c}	1.13^{c}	35.62^{c}	55.14^{c}
B_4 (60 J:40 P)	54.26^{b}	1.02^{d}	41.66^{b}	57.26^{b}
B_5 (50 J:50 P)	55.53^{a}	0.93^{e}	42.86^{a}	67.58^{a}
B_6 (Control) (100% J)	47.60^{f}	1.34^{a}	27.28^{f}	40.21^{e}
SE(±m)	0.17	0.02	0.03	0.51
CD(0.05)	0.52	0.08	1.13	1.60

J:Jackfruit, P:Papya

Fig 1. TSS content of jackfruit- papaya blended fruit bars

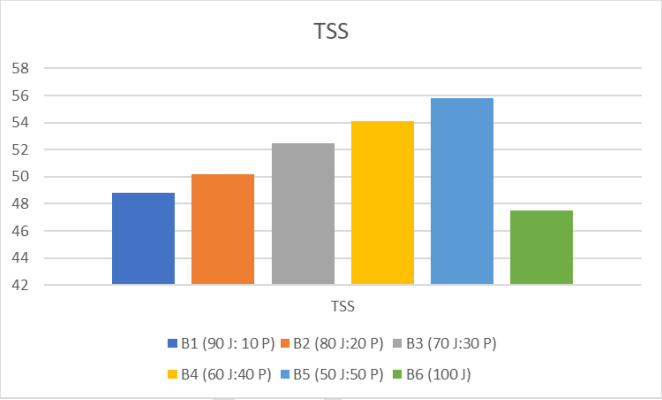


Fig. 2. Acidity content of jackfruit-papaya blended fruit bars

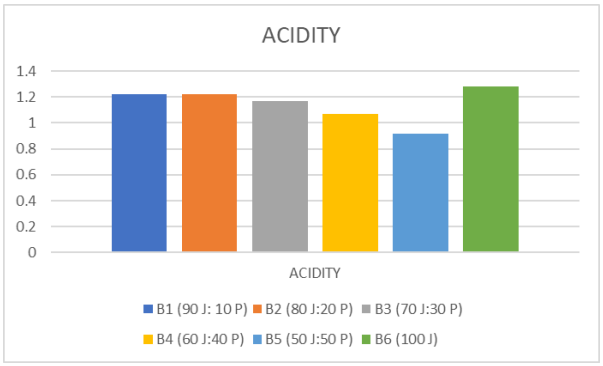


Fig. 3. Reducing sugar content of jackfruit-papaya blended fruit bars

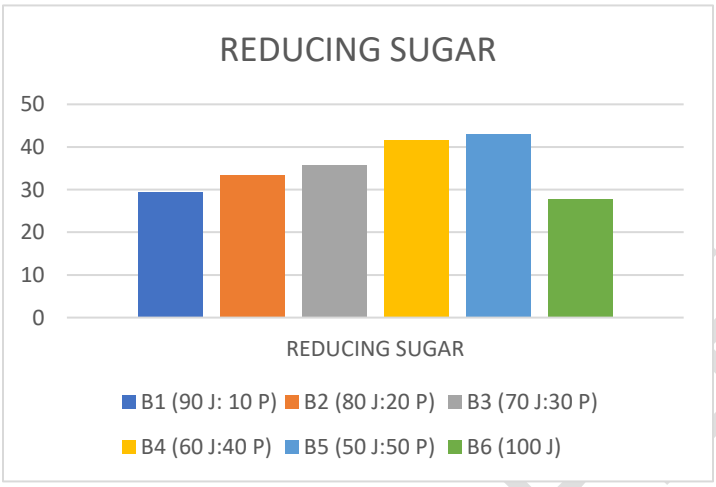
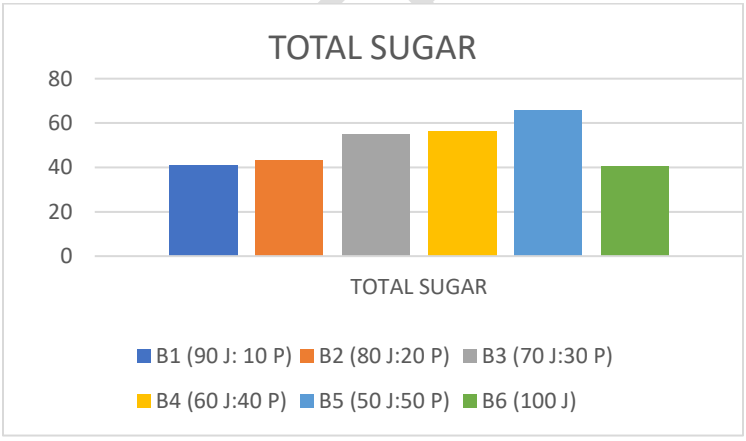


Fig. 4. Total sugar content of jackfruit-papaya blended fruit bars



Blending ratios	Ascorbic acid (mg $100g^{-1}$)	Carotenoid (mg $100g^{-1}$)	Protein (mg $100g^{-1}$)	Crude fibre (%)

B_1 (90 J:10 P)	24.18^{d}	0.37^{d}	0.24^{a}	9.11^{d}
B_2 (80 J:20 P)	26.98^{c}	0.39^{d}	0.21^{b}	9.12^{cd}
B_3 (70 J:30 P)	27.44^{c}	0.45^{c}	0.21^{b}	9.15^{c}
B_4 (60 J:40 P)	28.38^{b}	0.61^{b}	0.21^{b}	9.19^{b}
B_5 (50 J:50 P)	29.76^{a}	1.41^{a}	0.20^{c}	9.30^{a}
B_6 (Control) (100% J)	23.40^{e}	0.30^{e}	0.25^{a}	9.07^{d}
SE(±m)	0.20	0.01	0.03	0.01
CD(0.05)	0.62	0.03	0.01	0.04

Table 2. Nutritional parameters of jackfruit-papaya blended fruit bars

J:Jackfruit, P:Papya

Fig. 5. Ascorbic acid content of jackfruit-papaya blended fruit bars

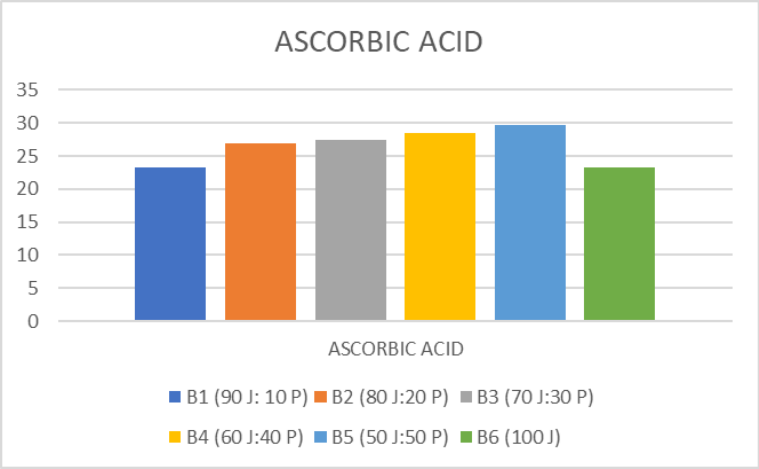


Fig. 6. Carotenoid content of jackfruit-papaya blended fruit bars

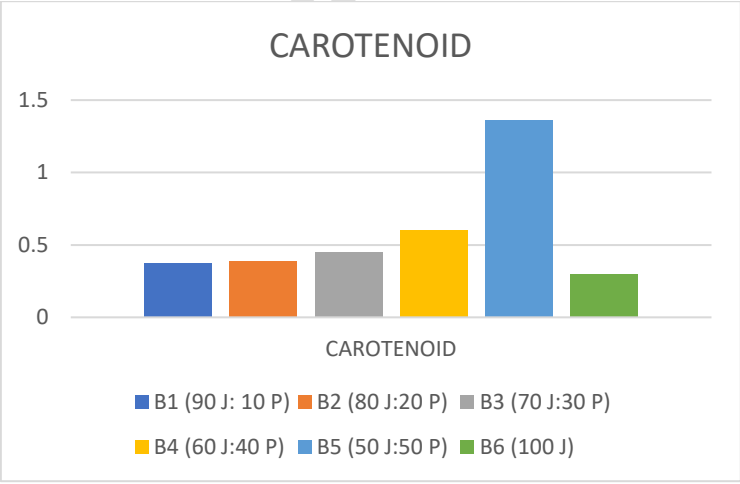


Fig. 7. Protein content of jackfruit-papaya blended fruit bars

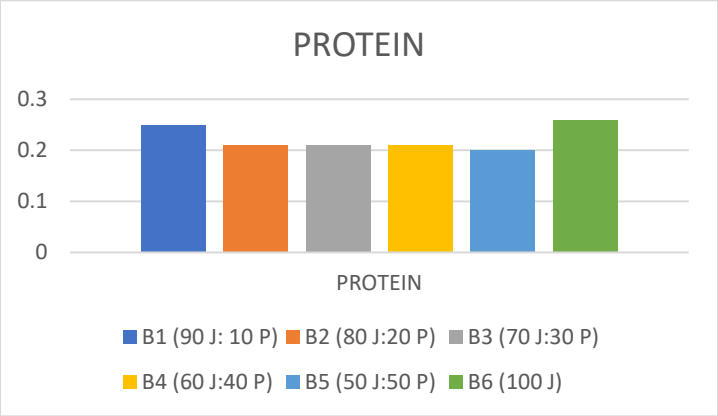


Fig. 8. Crude fibre content of jackfruit-papaya blended fruit bars

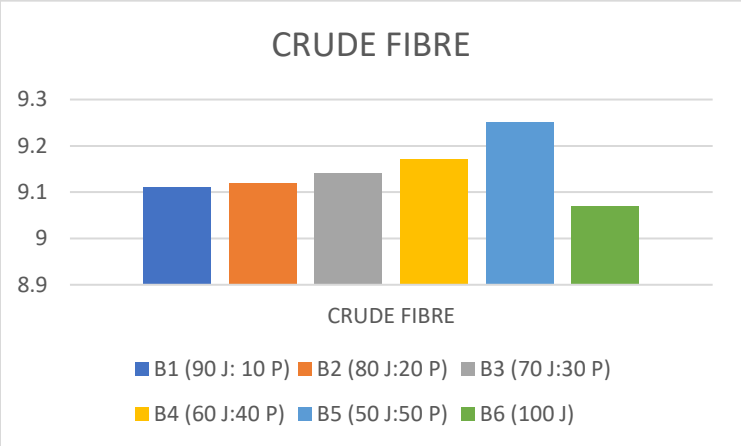


Table 3. Organoleptic evaluation of jackfruit-papaya blended fruit bars

Blending ratios	Appearance	Colour	Flavour	Texture	Taste	Overall Acceptibility
B_1 (90 J:10 P)	7.11^{ab}	6.14^{a}	7.00^{a}	7.12^{ab}	6.29^{ab}	6.73^{a}
B_2 (80 J:20 P)	7.20^{ab}	7.15^{bc}	7.20^{bc}	8.15^{a}	7.25^{cd}	7.39^{bc}
B_3 (70 J:30 P)	7.06^{a}	6.82^{bcd}	7.82^{b}	7.05^{bcd}	6.52^{abc}	7.06^{bcd}
B_4 (60 J:40 P)	7.26^{bc}	6.42^{abd}	7.00^{a}	7.10^{abc}	6.92^{acd}	6.95^{abd}
B_5 (50 J:50 P)	8.02^{c}	7.82^{c}	7.10^{abc}	7.00^{d}	8.02^{d}	7.60^{c}
B_6(control) (100% J)	7.25^{bc}	6.22^{ad}	7.02^{ac}	7.02^{cd}	6.22^{b}	6.76^{ad}
X^2	16.59	16.68	16.35	16.68	16.68	16.73
P Value	0.005					

J: Jackfruit, P: Papya

4. CONCLUSION

Blending of two or more fruit pulps in appropriate proportion could improve the nutritional and sensory qualities of fruit bars. In this study, the fruit bar prepared with 50% jackfruit pulp and 50% papaya pulp (B_5) was selected as the best blending ratio due to its superior chemical, nutritional and organoleptic quality parameters. The blended fruit bar prepared with B_5 recorded the highest TSS (55.53 ^{0}Brix),reducing sugar (42.86%), total sugar (67.58%), ascorbic acid (29.76mg $100g^{-1}$), carotenoid content (1.41mg $100g^{-1}$), crude fibre (9.30%) and lowest acidity (0.93%). Blended fruit bar prepared with 50% jackfruit pulp and 50% papaya pulp (B5) had maximum sensory scores for appearance (8.02), colour (7.82), taste (8.02) and overall acceptability (7.60). Jackfruit-papaya blended fruit bars can be an excellent healthy snack alternative to high-sugar sweets.

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