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ORIGINAL ARTICLE

# Effect of Different Level of Pectin and Starch on Quality and Storage Stability of Apple-Date Fruit Bar

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## Abstract

A study was undertaken to evaluate the effect of different level of apple pulp, date pulp, milk powder, pectin and starch on physicochemical quality, sensory quality and shelf life of developed fruit bar. The moisture content of fresh fruit bar was in between 27.92%-30.14%. The pH, ascorbic acid, and percent of acidity were found to be in between 5.29 to 5.40%, 31.04 (mg per 100g) to 32.32 (mg per 100g) and 0.42%- 0.57% in fresh fruit bar. No microbial detection in developed fresh fruit bar was found. The developed fresh fruit bar was well acceptable by panelists. During storage pH value and moisture content was significantly decreased, while total plate count was increased consistently. The developed fruit bar was well acceptable by panelist even after 90 days of storage.

**Keywords**: Fruit bar, Starch, Pectin, Physicochemical properties, Sensory quality, Shelf life.

## 1. Introduction

Fruits are generally liked by majority of the people from all age groups. But fruits are available only during specific season. There are many ways of preserving fruits and making fruit bars is one such method. Pulpy fruits like date banana, mango, guava, apple etc. are best suited for making fruit bars. Various products such as canned fruits, frozen slices, beverages, fruit leather, fruit bars are developed from fruits which are inherently perishable in nature and for value addition. Several types of fruit bars have been developed using different fruits, singly or in combination. Among different processed products, fruit bar is one of the processed products which are thick, pleasant and concentrated product made from fruit pulp having high calorie and rich source of the vitamins and minerals. Food can be fortified with nutrients either in powder or liquid form and the nutrients addition must impart desirable characteristics to the food *i.e.* change in colour, taste, smell, texture and increase shelf life (Parekh *et al.,* 2014). It can be classified as a confectionary product with longer shelf life. Fruit bars are considered to be hygienic as they are produced mechanically. They are attractively packed and consumed readily. The fruit bars or fruit-slabs or fruit-leather are the terms used for the products prepared by dehydration of fruit pulps (Chauhan *et al.,* 1993). Fruit bar prepared by dehydration of apricot pulp supplemented with soy slurry, had increased protein and fat, and decreased titratable acidity and ascorbic acid content (Chauhan *et al.,* 1993). Product having 70% apricot pulp and 30% soy slurry with 15.3% moisture, 7.8% protein and 16.5 mg/ 100 g ascorbic acid was found best in sensory qualities. The product had good flavour, texture and taste (Chauhan *et al.,* 1993). In view of above, present study was conducted to observe the changes in quality of developed fresh fruit bars during storage.

## 2. Material and Methods

### 2.1 Raw Materials and Preparation of Fruit Bar

Ripe date fruit and ripe apple fruit were used to carry out the this study. The date fruit and apple of uniform shape and size, and with proper maturity were procured from local market. Sugar was used as sweetener. Hydrocolloids namely pectin and starch were added to modify the texture. Pectin was added as a coagulant combined with starch soluble as a binding agent. Citric acid used as preservatives at permitted levels and milk powder used as protein source. Four samples were prepared (Table 1). A low density polyethylene bags were used for packaging and storage for a period of 3 months. All ingredients were mixed uniformly and then heated at 80-100$^{o}$C in a container till the concentration of 68 to70$^{o}$ Brix reached with -

Table 1: Preparation formulation for fruit bar Samples

| S. No. | Sample Code | Date pulp (g) | Apple pulp (g) | Milk power (g) | Sugar (g) | Citric Acid (g) | Starch (g) | Pectin (g) |
|---|---|---|---|---|---|---|---|---|
| 1 | S1 | 400 | 600 | 50 | 1050 | 10 | 22 | 18 |
| 2 | S2 | 500 | 500 | 50 | 1050 | 10 | 19 | 21 |
| 3 | S3 | 450 | 650 | 50 | 1000 | 10 | 17 | 15 |
| 4 | S4 | 600 | 400 | 50 | 950 | 10 | 20 | 23 |

stirring action. At this stage heating was stopped. The concentrated product was poured spread in a tray containing oil coated poly film. The top surface was leveled and another by smooth bottom of the tray and kept at room temperature (28-32 $^0$C) for proper setting. It was cut in form of suitable shape and size and stored at ambient temperature.

## 2.2 Physicochemical Properties

### 2.2.1 pH Measurement

10g of developed fruit bar were taken along with 50ml distilled water homogenized in a mixer grinder. The ground sample was filtered and the pH was determined by dipping the combined glass electrode of a digital pH meter (Khera Model, Indian Make) into the filtrate.

### 2.2.2 Percentage Acidity

Acidity of fruit bar was determined by using the method as recommended by (Ranganna, 1994). To prepare the sample, 10 gm sample was pulped with the help of a pestle and mortar. Then boiled in 100 ml of distilled water for one hour, replacing the water lost by evaporation. It was then cooled, filtered and transferred to a volumetric flask and made up to 100 ml with distilled water. 10 ml of the aliquot was pipette out and titrated with 0.1N NaOH using few drops of phenolphthalein as indicator.

The titre value was noted and percent total acidity was calculated as citric acid using the following equation:

$$\%\text{Acidity} = \frac{\text{Titre x Normality of NaOH x Volume made up x Eq.wt. of Citric Acid (64.04) x 100}}{\text{Volume of Sample taken for Estimation x wt. or volume of sample taken x 1000}} \text{x } 100$$

### 2.2.3 Moisture Content (MC)

10g of sample were weighed in flat bottom dried tarred dish. The dish and its content were placed in hot air oven (Yorco Hot Air Sterilizer, India) which was thermo statistically controlled at 150±10$^0$C and heated until successive weighing showed no further weight loss. At the end, the dish was removed from the oven and placed in desiccators and allowed to cool and then again weighed. Following formula was used for estimation of moisture content of fruit bar samples.

$$\text{Moisture content \%} = \frac{\text{Loss in weight of sample}}{\text{Initial weight of sample}} \times 100$$

### 2.2.4 Ascorbic Acid Percentage

Take sample and dissolve and after that weighing the 10 g of powder blend with 3% $HPO_3$ and make up 100 ml with $HPO_3$ filter end point to pink color. The formula used is given below:

$$\text{Vitamin C \%} = \frac{\text{Titrate value x dye factor x volume made up}}{\text{Adequate of extract taken x weight of volume}} \text{X } 100$$

## 2.3 Microbiological Analysis

### 2.3.1 Total Plate Counts

Briefly, 10 g fruit bar sample was homogenized in 90ml of normal saline solution (NSS) and serial diluted up to $10^{-6}$ dilution and 0.1ml sample of each dilution was spread on selective media plates under aseptic conditions. Nutrient agar media was used to determine total plate count. After that inoculated plates were incubated at 37$^o$C for 24-48 h. The bacterial and fungal counts were determined and presented as described by APHA (1995) as cfu/gm.

## 2.4 Sensory Quality

Sensory attributes viz. colour, aroma, taste, texture, tooth packing and overall acceptability of the samples were evaluated. Hedonic rating test as recommended by (Ranganna,1994) was used for the purpose of evaluation. This test measures the consumer's acceptability. Detailed methodology is explained below:

A semi trained panel consisting of more than 10 members of different age groups having different eating habits was selected to evaluate the sensory quality. The judgments were quantified by appropriate analysis for determining the overall quality. Samples were served to the panelists and they were asked to rate the acceptability of the product through sense of organs. Different attributes viz. colour, aroma, taste,

texture, and overall acceptability were rated on the basis of 9-point hedonic scale ranging from 1 (dislike extremely/most undesirable) to 9 (like extremely/most desirable) as shown in Table 2. A test performa was also prepared and supplied to them at the time of evaluation.

Table 2: Show Scale for hedonic rating

| Rating | Scale |
|---|---|
| Like Extremely | 9 |
| Like very much | 8 |
| Like moderately | 7 |
| Like slightly | 6 |
| Neither like nor dislike | 5 |
| Dislike slightly | 4 |
| Dislike moderately | 3 |
| Dislike very much | 2 |
| Dislike extremely | 1 |

### 2.5 Statistical Analysis

The best and most commonly used statistical evaluation of the precision of analytical data is the standard deviation. The standard deviation measures the spread of the experimental values and gives a good indication of how close the values are to each other. Samples were prepared in three replication and data obtained for selected quality parameters were analyzed for mean and standard deviations using following formula:

$$SD = \pm \sqrt{\sum (X_i - X)^2 / n}$$

Where,

$X_i$= individual sample values

X = mean of individual samples

n = total population of sample

## 3. Results and Discussion

### 3.1 Physicochemical Properties

#### 3.1.1 Moisture Content of Fruit Bar

The details of moisture content of developed fruit bars were presented in Table 3. This study showed unveiled variation on the quality parameters of all developed samples. All products were semi solid, but there may have seen variation in moisture of fruit bar. Due to the atmospheric packaging and leakage of packaging material the fruit bar lost moisture during storage at ambient temperature. It was observed that the moisture content of developed fruit bar significantly decreased with increasing storage periods. The moisture content of fruit bar to a specific low level provides good conditions for the shelf life stability. In addition, the less moisture content make the fruit bar shelf-stable during storage and transportation.

#### 3.1.2 Percentage of Acidity of Fruit Bar

The details of acidity of developed fruit bars were presented in Table 4. The acidity of sample S1 was found 0.50 percent on day one and it was increased significantly from 0.50 to 1.63% with increasing period of storage, where the acidity of samples S2, S3 and S4 were found 0.41, 0.40 and 0.52 on day one respectively. After 90 days of storage the acidity of all fruit bar samples S1, S2, S3 and S4 were found 1.63, 1.67, 1.50 and 1.70 respectively. Acidity of all four type samples of fruit bar were significantly increased with increasing period of storage at room temperature.

#### 3.1.3 Ascorbic Acid (mg per 100g) of Fruit Bar

The details of ascorbic acid of developed fruit bars were presented in Table 5. The ascorbic acid of fruit bar sample S1 was initially found 35.31 which on further storage continuously increased with increased storage period. Ascorbic acids were significantly changed during storage at ambient temperature in all fruits bar samples. Vitamin C is one of the most important of all vitamins and plays a significant role as an antioxidant, thereby protecting body tissue from the damage due to oxidation. They must be supplied in our diet or in man-made dietary supplements. The developed fruit bars were one of good natural source of ascorbic acids and storage stability have no adverse effect on vitamin C content.

#### 3.1.4 pH of Fruit Bar

The pH values of all four types of apple pulp, date pulp incorporated fruit bar were showed that the pH values of apple, date pulp incorporated fruit bar were in the neutral range from 5.28 to 4.30 (Table 6). The sample S1 which was developed by incorporation of apple pulp, date pulp along with milk powder and hydrocolloids showed the pH value 5.29 after preparation. The effects were noticed on pH values under ambient storage and it was observed that the pH of samples S2, S3 and S4 were 5.40, 5.35 and 5.28 respectively on day 1 of storage. As a function of time the pH values were significantly changed during storage at ambient temperature. The pH of sample S1 reached to 4.33 whereas the pH of sample S2, S3 and S4 after 90 days of storage reached to 5.56, 5.89 and 5.30. During storage at ambient temperature the pH was declined significantly. Thus this decreasing trend in pH was related to spoilage of the product. The fall in pH values in all samples is due to denaturation or oxidation of protein during storage at ambient temperature. These entire factors may be responsible to

Table 3: Effect on moisture content (MC) of fruit bar samples during storage of 90 days at ambient temperature

| Samples | Function of time (Number of days) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0 | 15 | 30 | 45 | 60 | 75 | 90 |
| S1 | 30.14±0.34 | 28.76±0.21 | 27.29±0.18 | 26.86±0.12 | 26.06±0.13 | 25.16±0.08 | 24.53 ± 0.07 |
| S2 | 28.53±0.42 | 26.80±0.36 | 25.56±0.28 | 24.80±0.22 | 24.28±0.14 | 23.53±0.42 | 22.56 ± 0.05 |
| S3 | 27.90±0.19 | 26.42±0.13 | 25.72±0.28 | 24.56±0.16 | 23.78±0.12 | 22.71±0.29 | 20.45±0.13 |
| S4 | 29.34±0.14 | 28.57±0.15 | 27.43±0.12 | 26.93±0.10 | 25.09±0.04 | 24.16±0.18 | 23.57±0.15 |

Table 4: Effect on acidity of fruit bar samples during storage of 90 days at ambient temperature

| Samples | Function of time (Number of days) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0 | 15 | 30 | 45 | 60 | 75 | 90 |
| S1 | 0.50±0.10 | 0.65±0.15 | 0.86±0.10 | 1.09±0.03 | 1.30±0.02 | 1.46±0.08 | 1.63 ± 0.07 |
| S2 | 0.43±0.11 | 0.51±0.28 | 0.69±0.13 | 0.88±0.08 | 1.03±0.05 | 1.21±0.21 | 1.67±0.38 |
| S3 | 0.42±0.07 | 0.49±0.13 | 0.62±0.11 | 0.70±0.13 | 0.91±0.09 | 1.19±0.07 | 1.50±0.13 |
| S4 | 0.54±0.12 | 0.68±0.17 | 0.90±0.24 | 1.05±0.18 | 1.21±0.14 | 1.55±0.22 | 1.70±0.19 |

Table 5: Effect on vitamin C (mg per 100g) of fruit bar samples during storage of 90 days at ambient temperature

| Samples | Function of time (Number of days) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0 | 15 | 30 | 45 | 60 | 75 | 90 |
| S1 | 35.31±0.03 | 33.20±0.15 | 35.42±0.10 | 36.45±0.03 | 37.34±0.02 | 38.85±0.08 | 39.11 ± 0.07 |
| S2 | 30.94±0.03 | 31.12±0.08 | 32.09±0.06 | 33.93±0.04 | 35.56±0.09 | 36.14±0.03 | 37.42±0.06 |
| S3 | 32.32±0.07 | 33.86±0.08 | 35.10±0.01 | 36.50±0.07 | 37.98±0.06 | 38.27±0.07 | 39.99±0.03 |
| S4 | 30.34±0.05 | 31.34±0.07 | 32.98±0.06 | 33.88±0.08 | 34.53±0.02 | 35.55±0.05 | 36.66±0.07 |

Table 6: Effect on pH of fruit bar samples during storage of 90 days at ambient temperature

| Samples | Function of time (Number of days) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0 | 15 | 30 | 45 | 60 | 75 | 90 |
| S1 | 5.37 ± 0.021 | 5.09 ± 0.026 | 4.81 ± 0.035 | 4.64 ± 0.012 | 4.51 ± 0.025 | 4.46 ± 0.013 | 4.33 ± 0.072 |
| S2 | 5.40 ± 0.015 | 5.20 ± 0.038 | 5.07 ± 0.010 | 4.85 ± 0.015 | 4.63 ± 0.031 | 4.59 ± 0.01 | 4.56 ± 0.056 |
| S3 | 5.31 ± 0.015 | 5.23 ± 0.036 | 5.20 ± 0.015 | 5.18 ± 0.035 | 5.09 ± 0.046 | 4.93 ± 0.015 | 4.89 ± 0.021 |
| S4 | 5.29 ± 0.015 | 5.16 ± 0.061 | 5.07 ± 0.022 | 5.01 ± 0.016 | 4.90 ± 0.055 | 4.72 ± 0.021 | 4.30 ± 0.051 |

Table 7: Effect on total plate count ($x10^3$CFU/g)of fruit bar samples during storage of 90 days at ambient temperature

| Samples | Function of time (Number of days) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0 | 15 | 30 | 45 | 60 | 75 | 90 |
| S1 | ND | ND | 0.70±0.07 | 1.12±0.07 | 1.23±0.2 | 2.47±0.07 | 3.20±0.014 |
| S2 | ND | 0.50±0.02 | 0.98±0.12 | 1.45±0.23 | 2.43±0.06 | 2.87±0.011 | 3.21±0.014 |
| S3 | ND | 0.40±0.17 | 0.89±0.26 | 1.29±0.23 | 2.11±0.09 | 2.45±0.03 | 3.10±0.034 |
| S4 | ND | ND | 0.66±0.26 | 1.15±0.26 | 1.98±0.01 | 2.24±0.03 | 2.90±0.015 |

alter the acidity as a result pH decreased with increasing storage period.

## 3.2 Microbiological Analysis of Fruit bar

### 3.2.1 Total Plate Counts of Fruit Bar

The details of microbial quality of developed fruit bars were presented in Table 7. It was observed that microbial growth was appeared on 15 days and increase thereafter from initial count of 0.50 x $10^3$ to 3.21x $10^3$ CFU/g, 0.40x $10^3$ to 3.10x $10^3$ CFU/g, respectively as the storage period was increasing for S2 and S3. Whereas the total plate count of S1 and S4 did not shows any bacterial count until the day 15,however these fruit bar shows microbial activity after 15 days and as increased (from an initial count of 0.70 x $10^3$ to 3.20x $10^3$ CFU/g, 0.66x $10^3$ to 2.90x $10^3$ CFU/g respectively.) as increasing storage period. The growth

of microorganism could cause spoiled of fruits bar, however if less numbers of microorganisms present initially results in more shelf life in the developed fruits bar.

### 3.3 Sensory Quality of Fruit Bar

Sensory attributes viz. colour, aroma, taste, texture, tooth packing and over all acceptability of the samples were evaluated. Hedonic rating test was used for the purpose of evaluation. This test measures the consumer's acceptability. The sensory attribute's score and overall acceptability of all four types of apple pulp, date pulp incorporated fruit bar are shown in Fig 1, 2, 3 and 4. The texture and taste of all samples were not affected during the storage at room temperature. In samples S1 and S3 the colour has been change but not changed the taste and texture. Whereas in samples S2 and S4 was not affected the texture and colour. All the samples of fruits bar were under the acceptable condition by the panelists during period of 90 days. However, slight changes in aroma of all the fruit bars samples at room temperature were noticed during storage period.

## Conclusions

Finally it can be concluded that developed fruit bars is highly acceptable shelf stable energy food for benefits of consumers. Low level of milk powder and relatively high level of date pulp, apple pulp gave the product with higher overall acceptability. The samples were shelf stable during the storage period of 90 days.

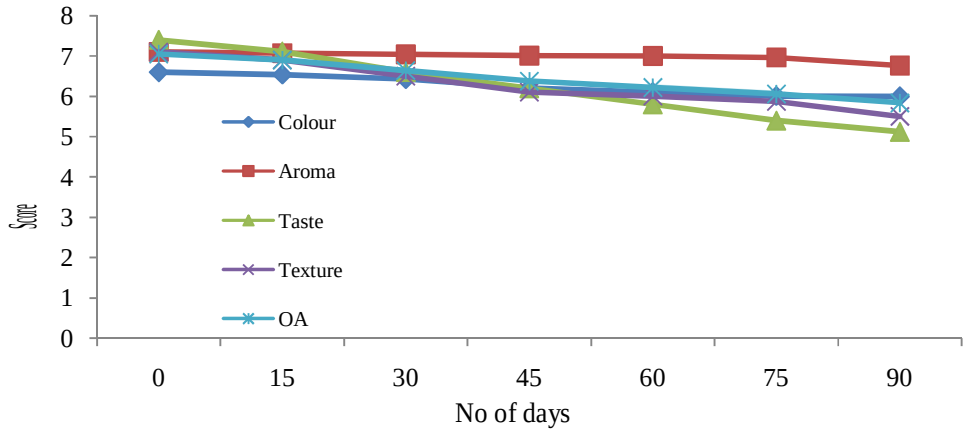


Fig 1: Effect on sensory characteristics of fruit bar sample S1 during storage of 90 days at ambient temperature

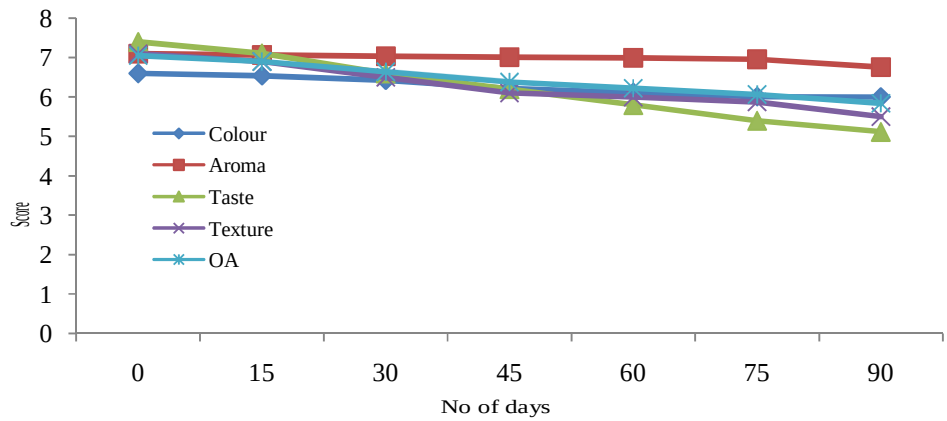


Fig 2: Effect on sensory characteristics of fruit bar sample S2 during storage of 90 days at ambient temperature

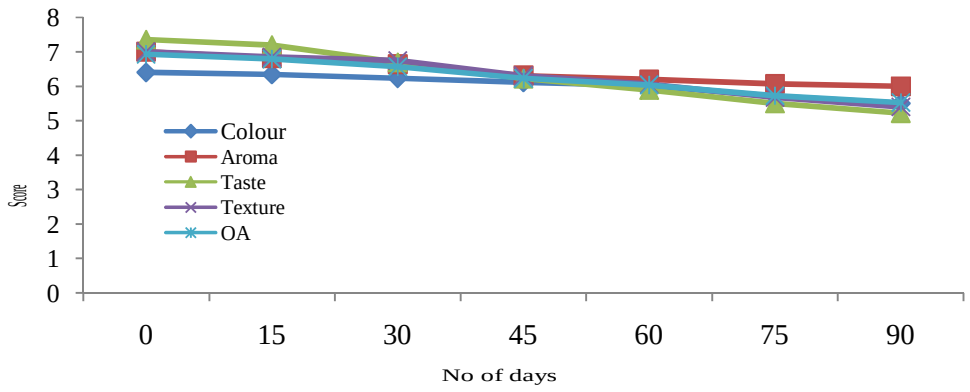


Fig 3: Effect on sensory characteristics of fruit bar sample S3 during storage of 90 days at ambient temperature

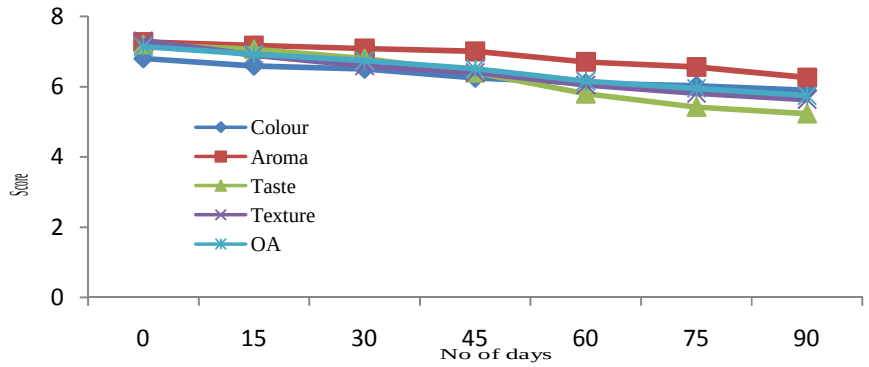


Fig 4: Effect on sensory characteristics of fruit bar sample S4 during storage of 90 days at ambient temperature

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