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RESEARCH ARTICLE

Effect of pretreatment methods on the qualitative and organoleptic attributes of pineapple candy during storage

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ABSTRACT

On the basis of the investigation, it was concluded that better quality candy can be obtained by steeping of the fruit pieces in 2% lime solution and blaching with erythrosine colour followed by syruping so as to maintain 78^0 Brix TSS C:B ratio of 1:0.587 was obtained by pineapple candy. Pineapple candy can be stored for 60 days with good retention of organoleptic quality and market value.

Key words : Pineapple candy, Pre-treatments, Organoleptic attributes

INTRODUCTION

Pineapple is a member of Bromiliaceae family, *Anana* genus and *comosus* species (Py, 1969). The stem is a stick with a wider upper section and narrower and usually curved lower section. The top of the fruit is covered with phylotaxia leaves, below this level there is a zone of dry leaves and a curved section underground from which many roots protrude.

Pineapple (*Ananas comosus*) is the second harvest of importance after bananas, contributing to over 20% of the world production of tropical fruits. Nearly 70% of the pineapple is consumed as fresh fruit in producing countries.

Pineapple production regions are usually confined to altitudes below 800 m above sea level, although Kenya reports production fields located between 1400 and 1800 m, and Malaysia orchards as high as 2400 m (Purseglove, 1968). When pineapple is grown at altitude greater than 1000m smaller fruits are produced the pulp has less attractive colour and flavour and elevated tartness

Pineapple composition has been investigated mainly in the edible portion. Reported ranges of the main components from data collected from several commercial operations and include additional variables as environmental factors and degree of maturity of the fruit. Pineapples contain 81.2 to 86.2% moisture, and 13-19% total solids, of which sucrose, glucose and fructose are the main components. Carbohydrates represent up to 85% of total solids whereas fibre makes up for 2-3%. Of the organic acids, citric acid is the most abundant. The pulp has very low ash content, nitrogenous compounds and lipids (0.1%). From 25-30% of nitrogenous compounds are true protein. Out of this proportion, Ca, 80% has proteolytic activity due to a protease known as Bromelin (Dull, 1971).

There are many factories, which are engaged in the manufacturing of different kinds of candy for distribution and sale in the country as well as abroad being analysis Indian product, it has got analysis exotic appeal also and thus has crated good export market. Therefore, the present investigation was undertaken with the following specific objective: to study the effect of pretreatment methods on qualitative attributes of candy during storage and to study the effect of pretreatment methods on organoleptic attributes of candy during storage.

MATERIALS AND METHODS

Procurement of raw material:

Pineapple fruit is a rich source of vitamin C and is usually consumed fully ripened as juice, dessert or at breakfast.

Fresh and mature pineapple butt was purchased from

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the local market of Allahabad district. It was ensured that the fruit was free from any kind of damage and infestation.

Treatments:

Different pre-treatments used for preparation of candy are as follows:

Treatments - 8

Replications - 3

– T_1 – Steeping of the fruits pieces in 2% salt solution (24 hours) and blanching with water (3 minutes).

– T_2 – Steeping of the fruits pieces in 2% salt solution (24 hours) and blanching with lime orange (3 minutes).

– T_3 – Steeping of the fruits pieces in 2% salt solution (24 hours) and blanching with erythrosine colour (3 minutes).

– T_4 – Steeping of the fruits pieces in 2% salt solution (24 hours) and blanching with fast green colour (3 minutes).

– T_5 – Steeping of the fruits pieces in 2% lime solution (4 hours) and blanching with water (3 minutes).

– T_6 – Steeping of the fruits pieces in 2% lime solution (4 hours) and blanching with lime orange (3 minutes).

– T_7 – Steeping of the fruits pieces in 2% lime solution (4 hours) and blanching with erythrosine colour (3 minutes).

– T_8 – Steeping of the fruits pieces in 2% lime solution (4 hours) and blanching with fast green colour (3 minutes).

Procedure followed for candy preparation:

The various steps used for the preparation of candy were as follows.

Step I : For pineapple candy preparation, mature fruits were peeled and removal of eyes and washed and cut into pieces and then pricked. After pricking, the pieces were dipped in 2% of lime water and in 2% salt solution.

Step II : The candy was prepared by slow process of cooking in sugar syrup using 1-1/2 times the weight of sugar for fruit. Initially half quantity of sugar *i.e.* 750 g was evenly spread on the fruits and kept for 24 hours.

Step III : The next day, the water was drawn out from the fruits to form syrup and the syrup consistency became thinner. The fruits were then removed from the syrup and 375 g of sugar was again added to the syrup and it was again heated to dissolved the sugar. The sugar was filtered again through white muslin cloth to separate the dissolve impurities of sugar. The fruit were again dipped in the prepared concentrated syrup and left immersed in it for 24 hours.

Step IV : On the third day, the fruits were again removed from the syrup and the remaining 375 g of sugar was added and heated till it was completely dissolved. The syrup was again filtered by means of a white muslin cloth. The prepared syrup was with 65-70° Brix. Fruits were again dipped in the syrup for another 24 hours.

Step V : On the fourth day, the fruits were again removed from the syrup and was boiled for about 3 minutes to raise its Brix by 10. Fruits were again dipped in syrup for 24 hours.

Step VI : On the fifth day, the concentration of syrup was brought between 70-75^0 Brix.

Step VII : On the sixth day the fruits were kept on a stainless steel sieve to drain out syrup and then fruits were coated with sugar and pectin. The fruits were then dried in the air at room temperature.

Storage period:

The pineapple candy was stored for 2 months and various physico-chemical properties, organoleptic rating and shelf-life were tested at 0, 20, 40 and 60 days after storage (Fig. 1)

Determination of total soluble solids (TSS):

The estimation of total soluble solids gave the

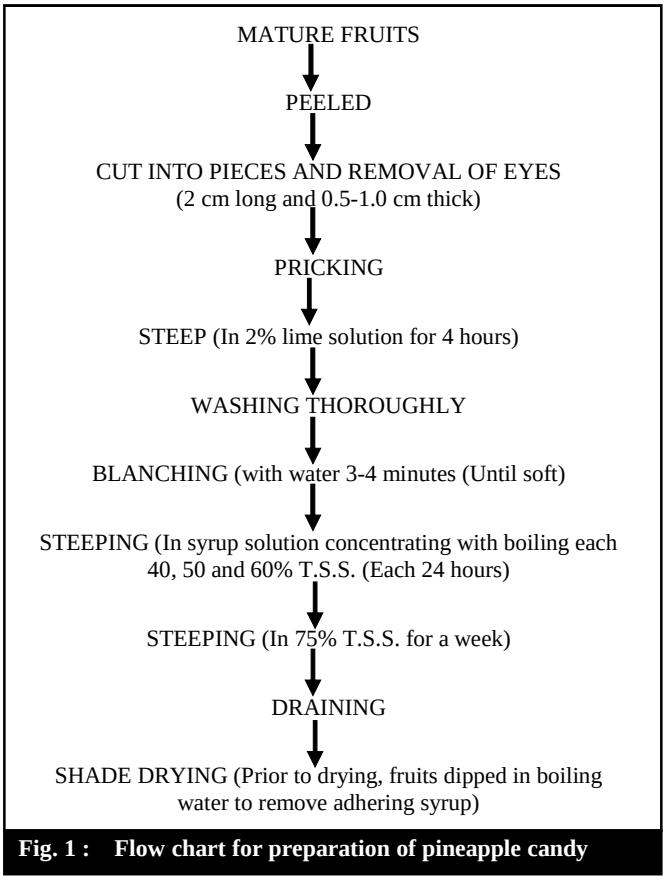

Fig. 1 : Flow chart for preparation of pineapple candy

approximate amount of water soluble substance present in the sample. Among the various soluble substances, the amount of sugar was 75-81 per cent. The total soluble content can be determined by hand refractometer. The refractometer reading was taken by placing the prepared parts of candy on the prism and the reading was recorded and total soluble solids was expressed in °Brix (Sethi, 1999).

Determination of total titrable acidity:

The juice was extracted with sufficient quantity that it gave at least 50 ml of juice, filtered the juice with the help of filter paper and funnel. 10 ml of juice was taken with the help of pipette and transfered it into 100 seed weight ml volumetric flask and added distil water to make up the volume. Shake well and draw 10 ml aliquot of diluted juice with a pipette and transfer it into 100 seed weight ml beaker and add 3 drops of phenolphthalein indicator to the solution.

The burette was filled with N/10 NaOH solution should and adjusted into 0 mark. The alkali solution was added drop by drop to the beaker with consistent stirring until the pink end is reached. Read the quantity of alkali content used not the percentage of acidity.

Acidity was determined by taking known quantity of prepared same parts homogenized interrelationship of distilled water and filtered. Known quantity of aliquot was transferred in a conical flask and titrated against 0.1 N standard NaOH solutions using few drops of 1% phenolphthalein solution as indicator. The total acidity was then calculated in terms of acidity percentage as citric acid (w/v). This formula was given by (Sethi, 1999).

Calculation:

$$\text{Total acidity as citric acid \% (w/v)} = \frac{T \times N \times V_1 \times E \times 100}{V_2 \times W \times 100} \quad (1)$$

T = Titrate value
V_1 = Volume made up
V_2 = Volume of aliquat taken for estimation
N = Normality of alkali
E = Equivalent weight of acid
W = Weight of sample taken
Determination of ascorbic acid

Preparation of 3 per cent metophasphoric acid solution:

Three per cent metaphorphoric acid solution was made by dissolving exactly 30 g of meta phosphoric acid in 80 ml of acetic acid and adding to it 500 ml distilled water and the volume made up to 1000 ml. The solution was filled and stored.

Preparation of dye solution:

Weighed 50 ml of 2, 6 dichlorophenol indophenol dye and 42 mg of sodium bicarbonate accurately on a chemical balance. Dissolved both in 150 ml of distilled water. The solution was heated gently on water both to make it homogenous, and raised the volume to 200 ml after cooling at room temperature, transfered the solution in analysis air tight brown container and placed in refrigerator.

Preparation of standard ascorbic acid solution:

Weighed 100 seed weight mg of ascorbic acid on a chemical balance and dissolved in 3 per cent metaphosphoric acid, made the volume to 500 ml.

Standardization of dye solution:

5 ml of standard ascorbic acid solution was taken in a clean beaker to which 5 ml of 3 per cent metaphosphoric acid solution was added with the help of a pipette. This solution was titrated against the dye till a faint pink colour appeared which persisted for not more than 15 seconds.

Estimation of ascorbic acid:

Weighed 30 g of fruit and blended it with equal weight of 6%, metaphosphoric acid for 3-4 minutes. Took 15 g of this slurry in a 100 seed weight ml volumetric flask and made up volume by adding 3% metaphosphoric acid, filtered it through a fast filter paper.

Ascorbic acid was estimated by taking known quantity of prepared sample paste dilated with 3% metaphosphoric acid and filtered. Known quantity of aliquot was transferred into a conical flask and titrated against 2-6 dichlorophenol into phenol dye solution till pinkish colour persisted from 15 seconds. The results were expressed as mg of ascorbic acid per 100 g of candy paste the amount of ascorbic acid was calculated by the formula given by (Sethi, 1999).

$$\text{Ascorbic acid mg/100g} = \frac{T \times D.F. \times V_1 \times 10}{V_2 \times W} \quad (2)$$

where,
T = Titrate value
D.F. = Dye factor
V_1 = Volume made up
V_2 = Volume of aliquot taken for estimation
W = Weight of sample taken

Estimation of reducing sugar:

The reducing and total sugar were determined according to the method described by Lane and Dynon (1923). A known weight of sample, plus 100 seed weight ml distrilled water was boiled for analysis hour. The

samples were macerated and neutralized within NaOH. 0 ml of lead acetate was added and subsequently after waiting for 0 minute, it was freed from lead by the addition of 10 ml potassium oxalate. The volume was made up to 250 ml with distilled water and filtered. The filtrate was designated as (A). 5 ml each of Fehlings A and B plus 20-25 ml of distilled water was heated on burner and titrated against sugar solution (A) using methylene blue as analysis indicator and percentage of reducing sugar was calculated using the following equation.

$$\text{Reducing sugar (\%)} = \frac{\text{0.05 x volume made}}{\text{Titrate value x weight of sample}} \text{ x 100} \quad (3)$$

Source of variance	d.f.	S.S.	M.S.S.	F. Cal	F. tab. at 5%
Treatment	t-1	Tr. S.S.	Tr. M.S.S.	Tr. M.S.S/ E.M.S.S.	F(t-1), (n-1)
Error	n-t	E.S.S.	E.M.S.S.		
Total	n-1	T.S.S.			

Statistical analysis :

The data were statistically analyzed by using CRD (Complete randomized design) with 8 treatments. Calculations were done as suggested by Fisher (1955).

Standard error :

Standard error was calculated by the following formula:

$$SE = \sqrt{\frac{2EMSS}{r}}$$

Critical difference:

Critical difference was calculated by the following formula :

$$C.D. = SE \times t_{(5\%)}$$

Error d.f.

where,

t = Number of treatments
r = Number of replications
n = Total number of observations
S.S. = Sum of squares
M.S.S. = Mean sum of squares
Tr.M.S.S = Treatment mean sum of squares
E.M.S.S. = Error mean sum of squares

RESULTS AND DISCUSSION

The results obtained from the present investigation are presented below :

Qualitative analysis of candy

Total soluble solids :

Mean values of total soluble solids of candies prepared through various pre-treatment and stored for 60 days are presented in Table 1 Results are also depicted through bar diagram in Fig. 1.

Table 1 : Change in the total soluble solid (TSS) in ^{0}Brix of candies as affected by various treatments

Treatments	0 Day	20 Day	40 Day	60 Day
T_1	81	81.60	83.13	81.76
T_2	81	81.20	83.09	84.31
T_3	81	81.35	83.07	83.59
T_4	81	81.01	83.13	84.23
T_5	81	81.47	83.36	84.32
T_6	81	81.59	83.42	84.42
T_7	81	81.81	83.56	84.52
T_8	80.67	81.56	83.34	84.41
F. value	NS	S	S	S
S.E.M±	-	0.005	0.00235	0.0016
C.D. (P=0.05)	-	0.01345	0.00634	0.0044

NS= Non-significant

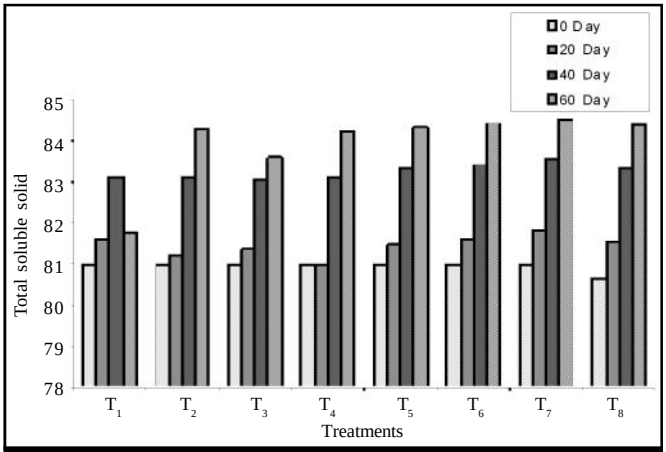

Fig. 1 : Change in the total soluble solid (TSS) in ^{0}Brix of candies as affected by various treatments.

The candies prepared by pre-treatment T_7 and T_6 could retain maximum amount of total soluble solids (TSS) 84.52 ^{0}Brix and 84.42 ^{0}Brix, minimum leaching to TSS, was found in T_3 83.59 °Brix after 60 days storage of candy.

On storage, maximum TSS, (84.52 ^{0}Brix) was found in 60 days followed by 40 days 83.56 (^{0}Brix). The storage could induce a significant increase in TSS content of all

the candies irrespective of their pre-treatments.

The total soluble solids (TSS) content was found to be 10.8 ^{0}Brix in fresh fruit. However, the average TSS content of the processed candies during storage varied from 81.00 ^{0}Brix to 84.52 ^{0}Brix. It is clear that the processing employed for preparation of candy has forced out the water content to give place to the soluble solids in terms of sugar, salt, lime and other soluble ingredients present in the various pre-treatments. The reports made by Bhat *et al.* (1982) with the aonla candy also showed increasing TSS content of the fruit.

In all the 8 treatments of the present investigation, TSS content of pineapple candies followed a consistently increasing trend as the storage period increased (Table 1 and Fig. 1).

Similar results were also reported by Baramanray *et al.* (1995) and Singh and Kumar (1997), respectively for guava nectar and in raw aonla fruit

Total titrable acidity:

Mean values of titrable acidity of different candies stored for 2 months are given in Table 2 and Fig. 2, for more fruitful discussion of the results for comparing the titrable acidity of different candies. It was found that there was general loss in acidity because of processing of fruit through various pre-treatments and preparation of candies. The titrable acidity of different candies on 1st day varied from 0.085 to 0.098%. Statistical analysis also indicated a significant variation in the titrable acidity of the candies from various treatments. The maximum titrable acidity of the fresh candy was recorded in T_3 as 0.098% and minimum 0.085% in T_6 and T_7. The maximum acidity of 0.098% further increased and was recorded to 0.13 after 60 days of storage. Similarly, the minimum acidity of 0.085% was further increased to 0.106 after 60 days of storage.

Table 2 : Change in the titrable acidity (%) of candies as affected by various treatments

Treatments	0 Day	20 Day	40 Day	60 Day
T_1	0.095	0.098	0.101	0.12
T_2	0.096	0.098	0.105	0.136
T_3	0.098	0.097	0.106	0.139
T_4	0.097	0.098	0.106	0.142
T_5	0.088	0.091	0.095	0.109
T_6	0.085	0.087	0.094	0.109
T_7	0.085	0.083	0.092	0.106
T_8	0.086	0.087	0.095	0.108
F. value	NS	NS	S	S
S.E.M±	-	-	0.0008	0.0011
C.D. (P=0.05)	-	-	0.001	0.0023

NS= Non-significant

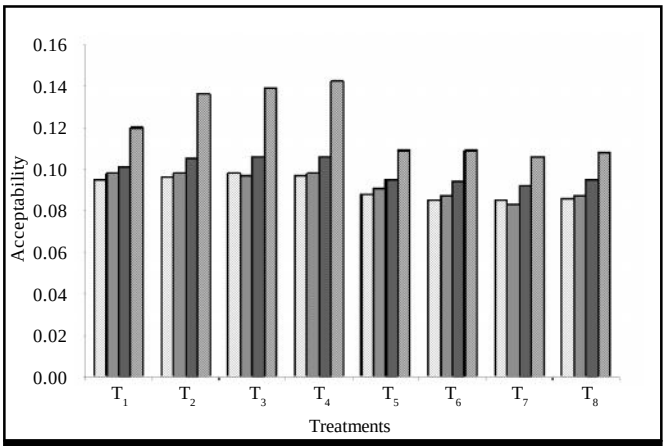

Fig. 2 : Extimation of overall acceptability

The acidity of fresh pineapple fruit was found to be 0.6% whereas the acidity of the different candies prepared by different pre-treatments varied from 0.14% to 0.106%. This clearly showed a reduction in acidity because of the various types of treatments employed during processing for candy.

It was evident from the same table that all treatments showed the decreasing trend in acidity during storage period. This type of trend in the acid content of the candies prepared by all 8 treatments of the candies could be mainly due to formation of sulphurous acid during storage. Similar findings have been reported by Gupta and Dhawan (1996) in guava jelly, Singh and Kumar (1997) in aonla fruits. Maciel *et al.* (1999) reported change in acidity in acerola jelly.

Ascorbic acid content:

Table 3 comprises of the mean value of ascorbic acid content of various candies prepared through different pre-treatments and stored for 2 months. The results have also been depicted through bar diagram for more lucid comparison of the results (Fig. 3). In general, the processing of the fruits through various pre-treatments employed for preparation of candies resulted in remarkable loss of vitamin-C for a value of 30.21mg/100 g fresh fruits. The ascorbic acid content of candies varied from 5.70 mg/100 g to 4.17 mg/100 g during storage.

There was a significant variation in ascorbic acid content of the candies prepared through various treatments. The candy obtained from treatment T_7 was found to retain maximum ascorbic acid content 5.70 mg/100 g.

Further, the perusal of Table 3 indicated a general,

Table 3 : Change in ascorbic acid content (mg/100) of candies as affected by various treatments

Treatments	0 Day	20 Day	40 Day	60 Day
T_1	5.44	4.89	4.54	4.38
T_2	5.44	4.84	4.45	4.20
T_3	5.49	4.84	4.45	4.17
T_4	5.52	4.87	4.59	4.41
T_5	5.62	4.99	4.65	4.45
T_6	5.65	4.98	4.69	4.48
T_7	5.70	5.04	4.80	4.51
T_8	5.62	4.98	4.78	4.67
F. value	S	S	S	S
S.E.M±	0.00235	0.003726	0.005	0.04769
C.D. (P=0.05)	0.006340	0.010025	0.01345	0.12830

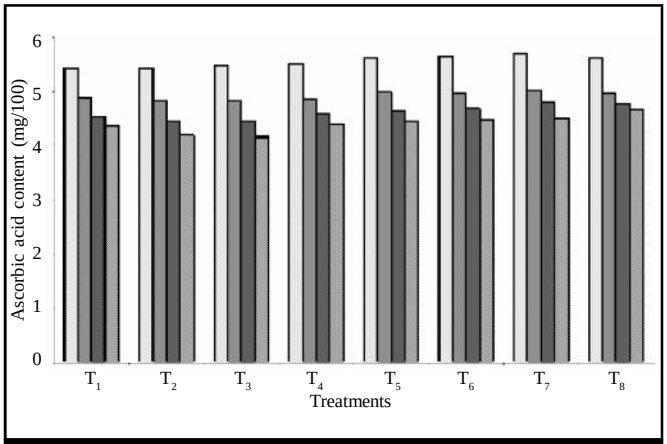

Fig. 3 : Change in ascorbic acid content (mg/100) of candies as affected by various treatments

gradual and significant reduction in ascorbic acid content during the whole span of storage. The final products obtained after 60 days contained ascorbic acid ranging from 4.17 mg/100 g to 4.67 mg/100 g.

The ascorbic acid content in the original fruits was found to be 30.21 mg/100g. While the ascorbic acid content of the candies prepared through various pre-treatments was quite variable. The candies showed heavy losses of vitamin-C during processing. In the fresh candy maximum amount of ascorbic acid of 5.70 mg/100g was estimated in treatment T_7 and segmented steeping with 2% lime solution and blanching with erythrosine colour.

This reduction in ascorbic acid content might be due to oxidation. Present findings are simlar to those of Barvathi and Anby (1997) in aonla candy, Macial *et al.* (1999) in aonla jelly and Chauhan (1981) in guava jelly.

Reducing sugar:

Table 4 comprised the mean value of reducing sugar content of various candies prepared through different treatment and stored for 2 months. The results are further depicted through bar diagram for more lucid comparison of the results (Fig. 4).

The reducing sugar continued varity from 42.91 to 41.19 in the fresh candies. There was a significant variation in reducing sugar content of the candies prepared through various pre-treatments. The candy obtained from treatment T_7 was found to retain significantly maximum reducing sugar (42.93%), followed by T_6 (42.54) whereas candy processed through pre-treatment T_7 was found to retain minimum amount of reducing sugar *i.e.* 41.09% (T_2).

It is also evident from Table 4 that there was gradual and significant increase in reducing sugar content throughout the storage period. At 60 days after storage, the reducing sugar ranged from 55.41% to 51.18%. The maximum (55.41%) was recorded in T_7 followed by T_5 both being at par to each other. While minimum sugar content was found in T_2 (51.18%).

Table 4 : Change in reducing sugar of candies as affected by various treatments

Treatments	0 Day	20 Day	40 Day	60 Day
T_1	41.65	44.90	48.50	52.46
T_2	41.09	44.87	48.21	51.18
T_3	41.2	45.43	49.19	52.51
T_4	41.46	45.39	49.1	52.29
T_5	42.16	45.78	49.56	55.16
T_6	42.54	45.9	50.09	53.51
T_7	42.93	46.57	50.89	55.41
T_8	42.14	45.79	49.87	54.89
F. value	S	S	S	S
S.E.M±	0.187	0.132	0.136	0.160
C.D. (P=0.05)	0.389	0.275	0.283	0.334

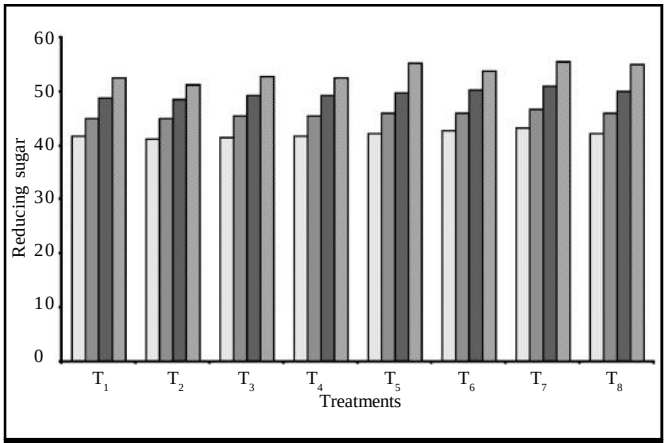

Fig. 4 : Change in reducing sugar of candies as affected by various treatments

The increase in reducing sugar might be due to breakdown of polysaccharides into oligosaccharides and monosaccharides.

Organoleptic evalution of candy:

Organoleptic scoring was done to work out the overall acceptability of the product consumer. The sensory evaluation of the product was undertaken by a panel of the judges considering the sensory attributes like colour, appearance, taste, texture, flavour and overall acceptability on a 9 point hedonic scale ranging from like extremely to dislike extremely as narrated in the Materials and Methods. The mean score of the different attributes and overall acceptability are presented in Tables (5, 6, 7 and 9).

It is clear from the data given in Tables that organoleptic rating increased at all the characters upto 40 days after storage and thereafter declined.

Colour and appearance:

Mean score of colour and appearance of the candies prepared by various methods are in given in Table 5 and depicted with Fig. 5. the mean of data exhibited that the various methods have significantly influenced the colour and appearance of the candies. The candy prepared with pre-treatment of 2% lime solution and blanching with erythrosine colour T_7 was rated best (8.3) in colour and appearance which was significantly superior to other candies in T_6 (8.06) , T_8 (7.83), T_5 (7.26), T_3 (7.23), T_2 (7.1), T_4 (6.8) and T_1 (6.8).

It is also evident from Table 5 and Fig. 5 that colour and appearance in pineapple candy improved upto 40 days thereafter declined with the advancement of the storage period. Similar findings were reported by Hughes and Bannion (1970) in gooseberry preserve and Gupta (1983) in *Ber* candy.

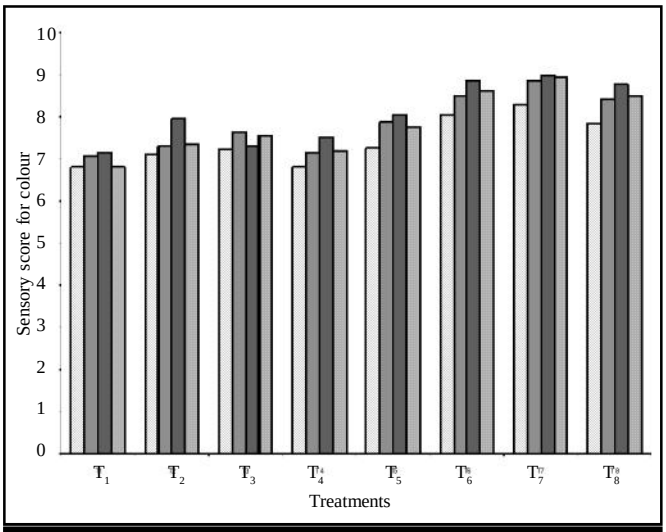

Fig. 5 : Change in sensory score for colour and apperance of candies as affected by various treatments

Texture:

Mean scores for texture of the candies are given in Table 6 and depicted in Fig. 6.

The data showed that candies prepared by treatment T_7 rated the best texture with the maximum score of 8.83 followed by the candies prepared by treatment T_6 (7.8). Texture in T_7 and T_6 might be due to the better lime treatment (hardens the tissues) in preparation of pineapple candy. Similar finding was reported by Toatia *et al.*, (1973) in carrot preserve.

Flavour:

The organoleptic scores for aroma and flavour are given in Table 7 and shown in bar diagram (Fig. 7). The maximum score was obtained in T_7 *i.e.* 9.0 followed by

Table 5 : Change in sensory score for colour and appearance of candies as affected by various treatments

Treatments	0 Day	20 Day	40 Day	60 Day
T_1	6.8	7.06	7.16	6.8
T_2	7.1	7.30	7.96	7.36
T_3	7.23	7.63	7.3	7.56
T_4	6.8	7.13	7.53	7.2
T_5	7.26	7.86	8.033	7.76
T_6	8.06	8.50	8.86	8.63
T_7	8.3	8.85	9.0	8.93
T_8	7.83	8.40	8.76	8.5
F. value	S	S	S	S
S.E.M±	0.147	0.122	0.114	0.108
C.D. (P=0.05)	0.307	0.25	0.236	0.225

Table 6 : Change in sensory score for texture of candies as affected by various treatments

Treatments	0 Day	20 Day	40 Day	60 Day
T_1	7.56	7.16	7.50	7.16
T_2	7.33	6.3	7.23	7.3
T_3	7.3	7.73	7.96	7.56
T_4	6.9	7.56	8.03	7.5
T_5	7.26	7.73	8.26	7.7
T_6	7.8	7.76	8.26	8.03
T_7	8.83	8.96	9.0	8.5
T_8	7.73	7.96	8.16	7.96
F. value	S	S	S	S
S.E.M±	0.151	0.11	0.10	0.13
C.D. (P=0.05)	0.31	0.24	0.20	0.27

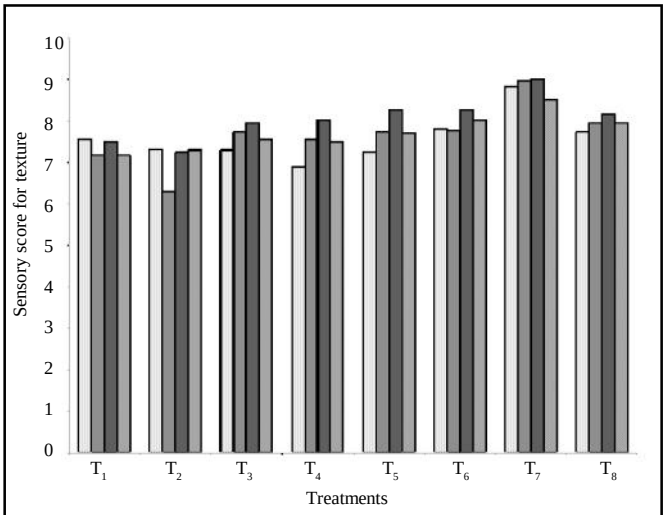

Fig. 6 : Change in sensory score for texture of candies as affected by various treatments

Table 7 : Change in sensory score for texture of candies as affected by various treatments

Treatments	0 Day	20 Day	40 Day	60 Day
T_1	7.56	7.9	7.8	7.76
T_2	7.33	7.73	7.83	7.73
T_3	7.23	7.73	7.86	7.63
T_4	6.9	7.43	7.5	7.33
T_5	7.26	7.93	8.06	7.9
T_6	7.8	8.46	8.43	8.23
T_7	8.83	9.85	9.0	8.96
T_8	7.73	8.36	8.46	7.93
F. value	S	S	S	S
S.E.M±	0.15	0.13	0.13	0.31
C.D. (P=0.05)	0.31	0.27	0.28	0.27

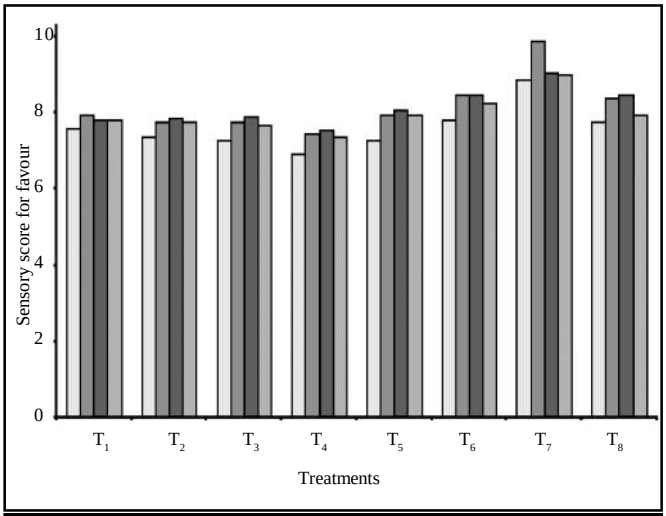

Fig. 7 : Change in sensory score for favour of candies as affected by various treatments

T_8 *i.e.* 8.46 at 40 days after storage. Slight decline was noted at 60 days after storage. However, maximum score was still associated with T_7 (8.96). Better retention of aroma and flavour in T_7 and T6 might be due to corresponding higher values of T.S.S., ascorbic acid and total acidity present in the candy.

Taste:

The mean organoleptic scores for taste are given in Table 8 and shown in histogram (Fig. 8). Maximum score was obtained in T_7 (9.0) followed by T_6 and T_5 *i.e.* 8.66 at 40 days after storage. However maximum score was still associated with T_7 (8.96) at 60 days after storage. Better retention of taste in T_7 and T_6 might be due to corresponding higher values of T.S.S., ascorbic acid and reducing sugar.

Table 8 : Change in sensory score for taste of candies as affected by various treatments

Treatments	0 Day	20 Day	40 Day	60 Day
T_1	7.3	7.66	7.86	7.6
T_2	7.26	7.9	8.13	7.9
T_3	7.06	7.26	7.73	7.53
T_4	7.1	7.43	7.63	7.46
T_5	7.8	8.26	8.66	8.43
T_6	7.9	8.43	8.66	8.4
T_7	8.46	8.8	9.0	8.96
T_8	7.76	8.26	8.63	8.26
F. value	S	S	S	S
S.E.M±	0.13	0.12	0.07	0.12
C.D. (P=0.05)	0.28	0.26	0.16	0.26

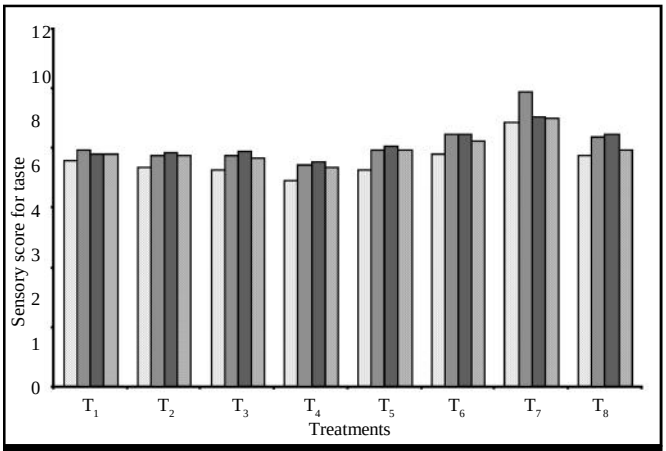

Fig. 8 : Change in sensory score for taste of candies by various treatments

Overall acceptability:

Mean score of overall acceptability of the candies

prepared by various pre-treatments are presented in table 9 and Fig. 9. It is obvious from the table that the various pre-treatment have significantly influenced the overall acceptability given by the panel of judges. In general, the overall acceptability improved gradually with the storage period in all the candies from the different treatments upto 40 days after storage. There was slight decline in score in 40 days after storage. The candies prepared by T_7 were rated as best for overall acceptability (8.00). T_6 was rated best next to T_7 giving scores as 8.63 at 40 days after storage. There was slight decline in score at 60 days after storage. The maximum scores, T_7 and T_6 were attributed to overall higher corresponding values of taste, flavour, texture etc.

Table 9 : Estimation of overall acceptability

Treatments	0 Day	20 Day	40 Day	60 Day
T_1	7.22	7.48	7.56	7.35
T_2	7.2	7.33	7.8	7.55
T_3	7.23	7.38	7.74	7.75
T_4	6.76	7.38	7.64	7.42
T_5	7.48	8.02	8.22	8.09
T_6	7.81	8.32	8.63	8.48
T_7	8.73	8.85	9.00	8.86
T_8	7.84	7.10	8.52	8.33
F. value	S	S	S	S
S.E.M±	0.09	0.10	0.10	0.10
C.D. (P=0.05)	0.18	0.21	0.22	0.21

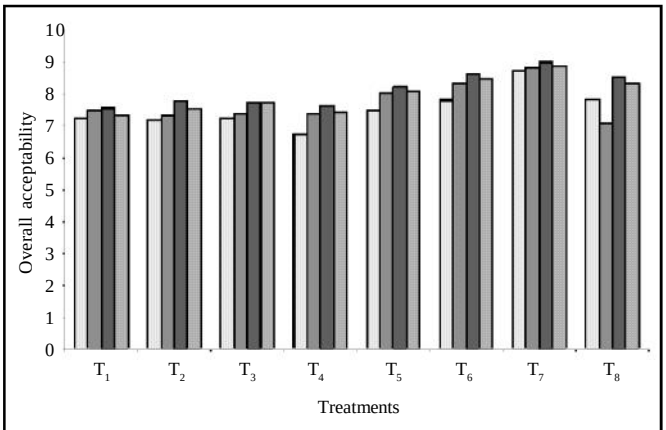

Fig. 9 : Estimation of overall acceptability

However, the organoleptic characters showed a gradual increase during the storage period upto 60 days. This finding was in conformity with Singh (1985) in guava cheese upto 60 days of storage and decrease thereafter. Singh (1984) also reported similar trend in *Jamun* jelly and beverages and Dube (1984) in *Bael*.

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