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EFFECT OF PRETREATMENT ON ORGANOLEPTIC ATTRIBUTES OF APPLE CANDY DURING STORAGE

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ABSTRACT

Apple candy were prepared by steeping in 2% salt solution ((blanching with erythrosine colour (T1), green colour (T2), with water (T3), with lime orange (T4)) and 2% lime solution (T5-blanching with erythrosine colour, T6 green colour, T7 with water, T8-with lime orange) and candy was stored for 2 months. Various Organoleptic properties & shelf life were tested at 0, 20, 40 and 60 days after storage. Statistical analysis and sensory evaluation of the data was carried out and it was observed for organoleptic attributes of apple candy during storage. On the basis of investigation it was concluded that better quality candy obtained by steeping of the fruit pieces in 2% lime solution and blanching with erythrosine colour T₇ followed by T₆. The candy prepared with pretreatment of 2% lime solution and blanching with erythrosine colour T₇ was rated best (8.0) in colour and appearance which was significantly superior to other candies in T₆ (7.86), T₈ (7.76), T₅ (7.03), T₃ (6.63), T₂ (6.30), T₄ (6.53) and T₁ (6.16). T₇ was rated maximum score of (8.85) followed by the candy prepared by treatment T₆ (7.8). Texture in T₇ and T₆ might be due to the better lime treatment (hardens the tissue) in preparation of apple whey candy.

The maximum score of flavor was obtained in T₇ i.e. 8.0 followed by T₈ i.e., 7.86 at 40 days after storage slight decline was noted at 60 days after storage. Maximum score of taste was obtained in T₇ (8.0) followed by T₆ (7.66) at 40 days after storage. In general the overall acceptability improved gradually with the storage period of all the candies from the different treatments up to 40 days after storages. There was slight decline in score in 60 days after storage. The candies prepared by T₇ (8.08) were rated as best for overall acceptability. The maximum scores T₇ and T₆ were attributed to overall higher corresponding values of colour, taste, flavour and texture etc.

Key Words: *Apple, Candy, Pretreatments, Organoleptic Characteristics, Self life*

INTRODUCTION

Fruits are among the most important foods of mankind as they are both nutritive and indispensable for maintenance of health. Being rich source of carbohydrates, minerals, vitamins and dietary fibres, these constitute an important part of our daily diet. Moreover, they add flavour and diversity to diet.

Apple (*Malus domestica* Borkh) is the most favored fruit of millions of people and is a widely grown fruit in temperate regions of the globe. The world production of apple is about 58 million tons from an area of about 5.26 million ha (FAO, 2005). Presently, India is the 9th largest producer of apples in the world contributing about one-third of total apple production of the world with an annual production of 1.42 million tons from an area of 0.25 million ha (Anon, 2004).

Eighty four percent of the apple is water and the remaining 16 % is total solids. This 16% contains nitrogen, fatty materials, minerals, carbohydrates, astringents, color compounds, enzymes, volatiles, vitamin A, C and flavonoids (Smock and Neubert 1950). Maine apples usually contain less than 1% fat, have no cholesterol or sodium, are low in calories and have most of the essential vitamins and minerals (MDA, 2000). Apples are an excellent source of fiber. A medium sized apple has about 5 g of fiber - 25% of the recommended daily intake of fiber (20 g). They also contains about 40 calories; one Kilogram (2.2

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lb) of fresh apples provides approximately 2100kJ (500 kcal) of energy. Apples contain both soluble and insoluble fiber, the majority of fiber that apples contain is a soluble fiber called pectin, which is a form of fiber that has cholesterol reduction properties (Smock and Neubert, 1950).

The amount of sugars and acids in fresh apples can vary. Maturity, production regions and varieties of apples, as well as the weather conditions throughout the year create differences in apple composition. There are numerous flavor compounds in apples, they are complex and volatile. Many of these flavor compounds are lost in making a clarified, preserved juice from freshly squeezed apples.

Excluding the peel and core of apples from the diet halves the amount of vitamin C and dietary fibre consumed but makes very little difference to the sugar intake addressing the health effects of the fruit. Research suggests that apples may reduce the risk of colon cancer, prostate cancer and lung cancer. Compared to many other fruits and vegetables, apples contain relatively low amounts of vitamin C, but are a rich source of other antioxidant compounds.

Pre-treatment as Sulphur dioxide, which possesses bactericidal properties and inhibits enzymatic and non-enzymatic darkening has been found to be applicable to air dehydration of fruits for control of browning of cut fruits during drying. Blanching of the vegetable tissue as a pre drying treatment is usually carried out to prevent off flavours and colour changes resulting from enzymatic reactions. It is also applied to decrease the initial microorganism load. Candy is a sweet food prepared from fruits or vegetables by impregnating them with sugar syrup followed by draining of excessive syrup and then drying the product to a shelf stable state. Fruits and vegetables like apples, ginger, mangoes, guava, carrots and citrus peels have been used to prepare candies (Mehta and Bajaj 1984; Sharma *et al.*, 1998).

Caronda, ber and Aonla candies have also been developed (Kaikadi *et al.*, 2006). Candied products available these days are descended from the simplest confections first made more than 4,000 years ago. Candy making is fairly simple process. In traditional candy production, a mixture of sugar, water, and possibly corn syrup are mixed together and boiled until sufficient water has been boiled out of the candy mass (Ribeiro and Sabaa-Srur, 1999; Chandu and Prasad, 2006)

Current candy preparation techniques are grouped as semi-solid or soft candy (e.g., chocolate-based, fruit-based, including tamarind, cherry etc.) with or without chili or other visible particulate ingredients (i.e., Chaca-Chaca, Pelon-Pelon Rico), hard candy with or without visible particulate ingredient (chili) either in the candy or on the surface of the candy, hard candy with supplemental but separate salt and chili and powdered sugar or flavored salt products with or without other particulate ingredients. With this view, the study was undertaken to develop consumer friendly candies from cherries, Candy apples, also known as toffee apples outside of North America, are whole apples covered in a hard sugar candy coating. While the topping varies from place to place, they are almost always served with a stick of sorts in the middle making them easier to eat.

MATERIALS AND METHODS

Fresh and mature apples were purchased from the local market in Chitrakoot on daily basis prior to each set of experiment. It should be ensured that the fruit should be free from any kind of damage and infestation. The fruits had good indication of physiological maturity.

Pre-Treatment of Apples

Pretreatments were applied to the apples before drying, and untreated sample was used as a control. The pretreated samples were pre-treated with chemical treatments. Each sample was weighed before and after pre-treatment. The candy samples were made from apples after pretreatments. Different pretreatments used for apples during candy preparation are follows:

1. T₁- Steeping of the fruits pieces in 2% salt solution (24 hours) and blanching with water (3 minutes).

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2. T₂-Steeping of the fruits pieces in 2% salt solution (24 hours) and blanching with lime orange (3 minutes).
3. T₃- Steeping of the fruits pieces in 2% salt solution (24 hours) and blanching with erythrosine colour (3 minutes).
4. T₄- Steeping of the fruits pieces in 2% salt solution (24 hours) and blanching with fast green colour (3 minutes).
5. T₅ – steeping of the fruits pieces in 2% lime solution (4 hours) and blanching with water (3 minutes).
6. T₆- steeping of the fruits pieces in 2% lime solution (4 hours) and blanching with lime orange (3 minutes).
7. T₇- steeping of the fruits pieces in 2% lime solution (4 hours) and blanching with erythrosine colour (3 minutes).
8. T₈- 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 follows.

Step 1: For apple 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 2: 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 3: 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 dissolve the sugar. The sugar was filtered again.

Step 4: On the third day the fruits were again removed from the syrup and the remaining 375g 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 65-70⁰ Brix. Fruits were again dipped in the syrup for another 24 hours.

Step 5: 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 the syrup for another 24 hours.

Step 6: On the fifth day the concentration of syrup was brought between 70-75⁰ Brix.

Step 7: On the sixth day the fruits were kept on a stainless steel seive to drain out syrup and then fruits are coated with sugar and pectin. The fruits were then dried in the air at room temperature.

Storage Period: The apple candy was stored for 2 months various physio-chemical properties and shelf life were tested at 0, 20, 40 and 60 days after storage.

Sensory Analysis: The prepared candy samples were analyzed for colour, taste, texture, flavour and overall acceptability by nine point hedonic scale.

Statistical Analysis: The experiments were conducted with 3 replicates \pm standard deviation (SD). The data recorded during the course of investigation were statistically analyzed using analysis of variance (ANOVA) and quantified in terms of the correlation factor, r^2 . Two-way ANOVA was used to determine whether the differences between measurements are significant. This technique was developed by Dr. R. A. Fisher in 1923 gives an appropriate method capable of analyzing the variation of population variance. The significant affect of treatment was judged with the help of 'F' (variance ratio). Calculated F value was

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compared with the table value of F at 5% level of significance. If calculated value exceeded the table value the affect was considered to the significant.

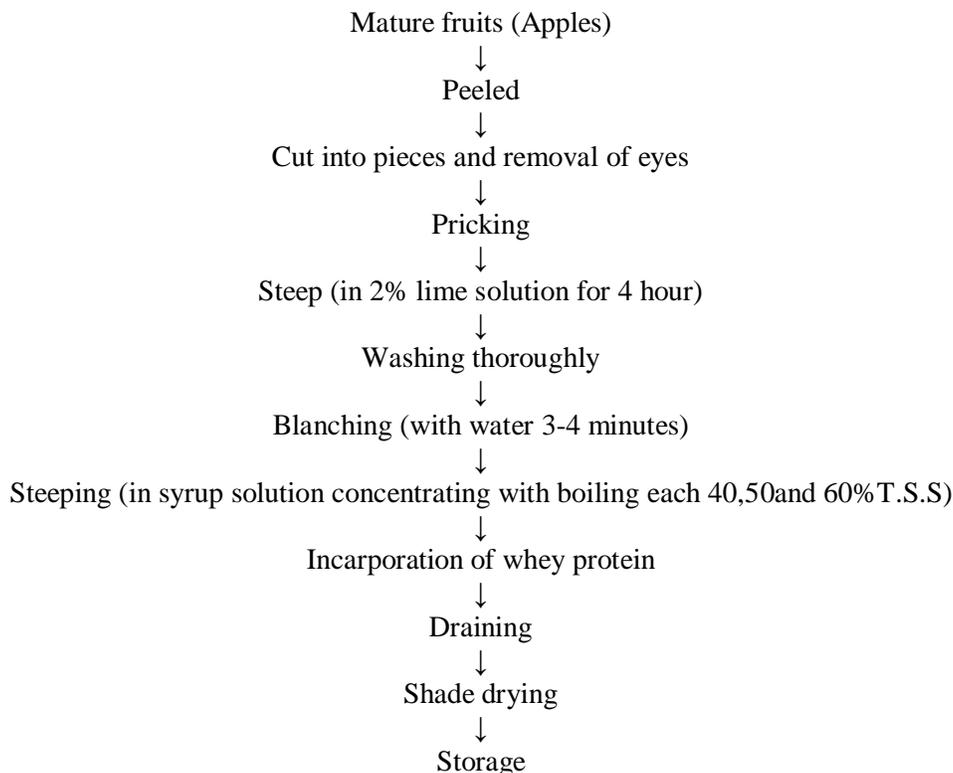


Figure 1: Process flow sheet for the preparation of apple candy

RESULTS AND DISCUSSION

Organoleptic scoring was done to workout the overall acceptability of the product consumer. The sensory evaluation of the product was under taken by a pannel of the judges considering the sensory attributes like colour, appearance, taste, texture, flavor and overall acceptability on a 9 points hedonic scale ranging from like extremely to dislike extremely as narrated in the material and methods. The mean score of the different attributes and overall acceptability are reported in the tables (1, 2, 3, 4&5).

It is clear from the data given in tables that organoleptic rating increased at for all the characters upto 40 days after storage there after decline.

Colour and Appearance

Mean score of colour and appearance of the candies prepared by various methods given in table 1 and depicted in figure 2. The mean of data exhibited that the various methods have significantly influence the colour and appearances of the candies. The candy prepared with pretreatment of 2% lime solution and blanching with erythrosine colour T₇ was rated best (8.0) in colour and appearance which was significantly superior to other candies in T₆(7.86), T₈(7.76), T₅(7.03), T₃(6.63), T₂(6.30), T₄(6.53) and T₁(6.16).

It was evident from the table 1 and in the fig.1 the colour and appearance in apple whey candy improved up to 40 days thereafter decline with the advancement of the storage period. Similar finding were reported by Hughes and Bannion (1970) in goose berry preserved, Gupta (1983) in ber candy.

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Table 1: 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	5.80	6.06	6.16	5.80
T ₂	6.10	6.30	6.96	6.36
T ₃	6.23	6.63	6.30	6.36
T ₄	5.80	6.13	6.53	6.20
T ₅	6.26	6.86	7.03	6.76
T ₆	7.06	7.50	7.86	7.63
T ₇	7.30	7.85	8.00	7.93
T ₈	6.83	7.40	7.76	7.50
F- test	S	S	S	S
S. Ed. (±)	0.197	0.190	0.268	0.271
C. D. (P = 0.05)	0.406	0.393	0.552	0.560

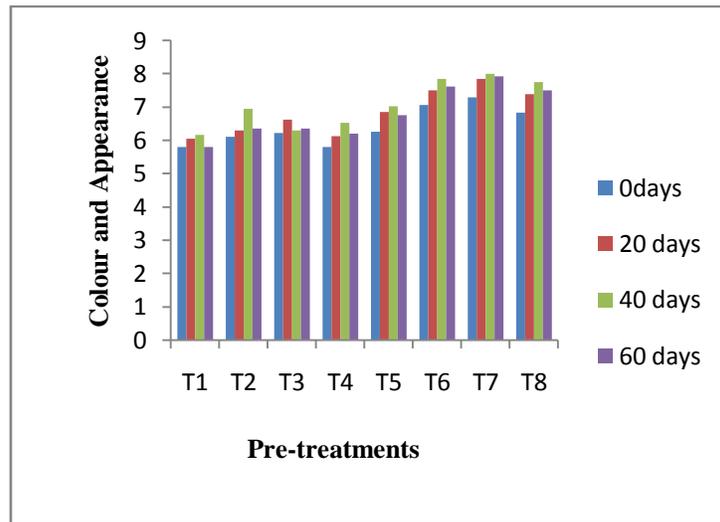


Figure 2: Change in sensory score for colour and appearance of candies as affected by various treatments

Texture

Mean scores for texture of the candies prepared by various methods given in tables 2 and depicted in fig. 3. The mean of data exhibited that the various methods have significantly influence the texture of the candies. The candy prepared with pretreatment T₇ was rated maximum score of (8.85) followed by the candy prepared by treatment T₆ (7.8). Texture in T₇ and T₆ might be due to the better lime treatment (hardens the tissue) in preparation of apple candy. Similar finding were reported by Totia *et al.*, (1973) in carrot preserved.

Flavour

The organoleptic score for aroma and flavor are given in table 3 and graphically shown in fig.4. The maximum score was obtained in T₇ i.e. 8.0 followed by T₈ i.e., 7.86 at 40 days after storage slight decline was noted at 60 days after storage. However, maximum score was still associated with T₇(8.0). Better retention of aroma and flavor in T₇ and T₆ might be due to corresponding higher values of TSS, Ascorbic acid and Total acidity present in the candy.

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Table 2: Change in sensory score for texture of candies as affected by various treatments

Treatments	0 day	20 day	40 day	60 day
T ₁	6.56	6.80	6.90	6.76
T ₂	6.33	6.83	6.73	6.73
T ₃	6.23	6.86	6.73	6.63
T ₄	5.90	6.50	6.43	6.33
T ₅	6.26	7.06	6.93	6.90
T ₆	6.80	7.43	7.46	7.23
T ₇	7.83	8.00	8.85	7.96
T ₈	6.73	7.26	7.36	6.93
F- test	S	S	S	S
S. Ed. (±)	0.330	0.297	0.278	0.093
C. D. (P = 0.05)	0.682	0.612	0.574	0.192

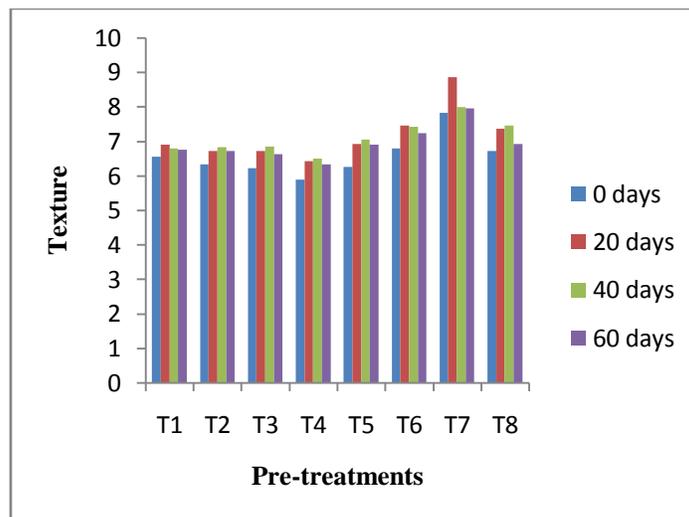


Figure 3: Change in sensory score for texture of candies as affected by various treatments

Table 3: Change in sensory score for flavoure of candies as affected by various treatments

Treatments	0 day	20 day	40 day	60 day
T ₁	6.56	8.16	6.50	6.16
T ₂	6.33	8.30	6.23	6.30
T ₃	6.30	6.73	6.96	6.56
T ₄	5.90	6.56	7.03	6.50
T ₅	6.26	6.73	7.26	6.70
T ₆	6.80	6.76	7.86	7.03
T ₇	7.83	7.96	8.00	7.50
T ₈	6.73	6.96	7.16	6.96
F- test	S	S	S	S
S. Ed. (±)	0.289	0.250	0.221	0.042
C. D. (P = 0.05)	0.596	0.515	0.457	0.087

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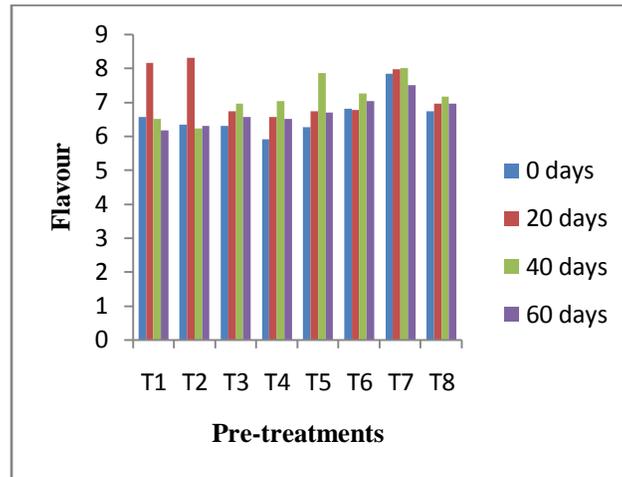


Figure 4: Change in sensory score for flavoure of candies as affected by various treatments

Taste

The mean organoleptic scores for taste are given in table 4 and graphically showed in fig. 5 Maximum score of taste was obtained in T₇(8.0) followed by T₆ (7.66) at 40 days after storage. However maximum score was still associated with T₇ (7.96) at 60 days after storage. Better retention of taste in T₇ and T₆ might be due to corresponding higher value of TSS, Ascorbic acid and reducing sugar.

Table 4: Change in sensory score for taste of candies as affected by various treatments

Treatments	0 day	20 day	40 day	60 day
T ₁	6.30	6.66	6.86	6.60
T ₂	6.26	6.90	7.13	6.90
T ₃	6.06	6.26	6.73	6.53
T ₄	6.10	6.40	6.63	6.46
T ₅	6.80	7.26	7.62	7.43
T ₆	6.90	7.43	7.66	7.40
T ₇	7.46	7.80	8.00	7.96
T ₈	6.76	7.26	7.63	7.26
F- test	S	S	S	S
S. Ed. (±)	0.325	0.324	0.314	0.105
C. D. (P = 0.05)	0.671	0.669	0.648	0.216

Overall Acceptability

Mean score of overall acceptability of the candies prepared by various methods given in tables 4 and depicted in fig. 4.1. It is obvious from the table that the various pretreatments have significantly influence the overall acceptability given by the panel of judges. In general the overall acceptability improved gradually with the storage period of all the candies from the different treatments up to 40 days after storages. There was slight decline in score in 60 days after storage.

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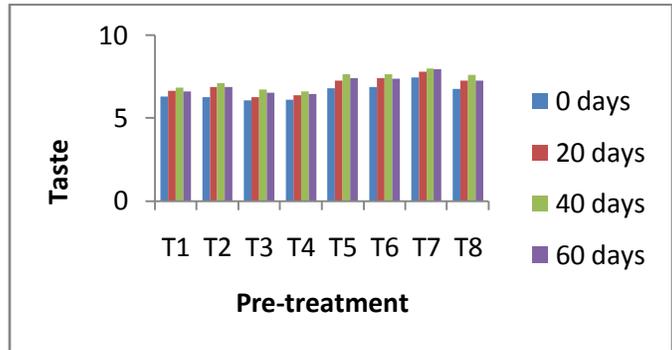


Figure 5: Change in sensory score for taste of candies as affected by various treatments

The candies prepared by T₇(8.08) were rated as best for overall acceptability. T₆ was rated best next to T₇ giving score as 7.63 at 40 days after storage. There was slight decline in score at 60 days after storage. The maximum scores T₇ and T₆ were attributed to overall higher corresponding values of taste, flavour and texture etc. However, the organoleptic characters showed a gradual increase during the storage period upto 60 days. This finding was in conformity within guava cheese upto 60 days of storage and decrease there after, also reported the similar trend in jamun jelly and beverages in bael.

Table 5: Change in sensory score for overall acceptability of candies as affected by various treatments

Treatments	0 day	20 day	40 day	60 day
T ₁	6.22	6.48	6.56	6.35
T ₂	6.20	6.33	6.80	6.55
T ₃	6.23	6.38	6.74	6.75
T ₄	5.76	6.38	6.64	6.42
T ₅	6.48	7.02	7.22	7.09
T ₆	6.81	7.32	7.63	7.48
T ₇	7.73	7.85	8.08	7.86
T ₈	6.84	7.10	7.52	7.33
F- test	S	S	S	S
S. Ed. (±)	0.325	0.359	0.281	0.258
C. D. (P = 0.05)	0.671	0.741	0.579	0.533

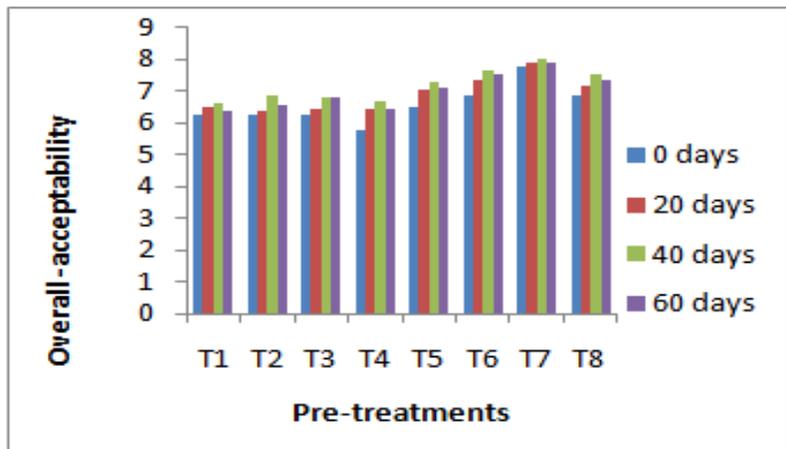


Figure 6: Change in sensory score for overall acceptability of candies as affected by various treatments

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Conclusion

The maximum organoleptic scores for colour and appearance 8.93, texture 9.0, flavour 9.0 and overall acceptability 9.0 at 40 days of storage was recorded in.

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