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To study the effect of storage on chemical and sensory characteristics of ginger candy

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Abstract
The present entire investigation was carried out to study effect of storage period on chemical and sensory characteristics of ginger candy over different storage period like 0, 30, 60 and 90 days. The ginger was soaked with different seven treatments. Among the seven different treatments the blanched ginger candy was having good chemical and sensory characteristics. The ginger candy was prepared by using two different methods like cold and vacuum syruping methods. During the 0 to 90 days storage of ginger candy with two different methods it was observed that, there was decrease in moisture content, acidity, crude fiber, calcium, magnesium and phosphorus whereas, increase in T.S.S and total sugar. The acidity, moisture, crude fiber content was decreased from 11.29 to 7.00 percent, 1.98 to 1.05 percent, 1.89 to 0.95 per cent, 12.95 to 8.63 mg/100g, 25.92 to 29.06 mg/100g and 21.82 to 23.58 mg/100g. During 0 to 90 days storage period whereas, total soluble solids and total sugars were increased from 61.13 to 65.66 per cent and 68.27 to 72.04 ^{0}Brix over 0 to 90 days storage period. It was also found that the blanched sample of ginger with vacuum syruping was having highest sensory score over the cold syruping.

Keywords: T.S.S, storage, cold syruping and vacuum syruping

Introduction
Ginger (*Zingiber officinale*), belonging to Zingiberaceae family, is a perennial herb available in the form of rhizome and is consumed all over the world. Ginger is a native plant of Asia but cultivated in many tropical countries specifically in West Indies, Africa, India, and Nepal (Singletary, 2010) [31]. Because of the presence of polyphenols, terpenoids and isoterpenoids compounds, the ginger has many medicinal properties such as antioxidative, therapeutic and anti- bacterial properties (Famurewa *et al.*, 2011) [8]. Ginger contains volatile essential oil and non- volatile oleoresin which are potential to prevent diabetes, common cold, high cholesterol and cardiovascular diseases (Malu *et al.*, 2009) [13].

Ginger is found effective in stimulating digestion tract (Polasa and Nirmala, 2003) [23]. It is also found effective in treatment nausea caused by sea sickness, morning sickness (Sebiomo *et al.*, 2011) [27], diarrhea, asthama, respiratory disorders (Medouca *et al.*, 2009) [14] and treat migraine headache without side effects (Mustafa and Srivastava, 1990) [15]. In addition to their medicinal activities plants extracts also serve as a natural larvicidal agent (Kalaivani *et al*., 2012) [11].

Ginger is presently used in various forms like fresh, dried, ginger powder, pickles, ginger preserves or candies, ginger juice for making squashes and appetizers etc (Peter, 1996) [19]. The dried ginger is traded internationally and is used for the manufacture of essential oil, and oleoresins. Essential oil and oleoresin from ginger are utilized for the preparation of soft drinks, nonalcoholic beverages and vitaminized effervescent soft drinks (Peter, 1999) [20].

Ginger is mainly used as spice/curry powder and flavouring agent in different foods such as bread, tea, cookie and carbonated drinks etc. It is necessary to increase the direct consumption of gingers by developing ginger-based ready-to-eat products such as candy for the long-term health benefit to prevent many diseases and increase the economic value of gingers through proper processing and preservation (Gupta *et al*., 2012) [10].

Fresh ginger is perishable in nature and are spoiled due to improper handling, growth of spoilage microorganisms, susceptibility to rhizome rot, wilting and sprouting, action of naturally occurring enzyme, chemical reactions and structural changes during storage

(Baranowski, 1985) [6]. Processing ginger into dried product is an important method of reducing perishability and also to increase storage stability (Pezzutti and Crapiste, 1997) [21].

Material method

Preparation of Ginger Candy

Fresh uniform sized ginger rhizomes were collected from the local market of Rahuri and washed thoroughly with water to get rid of dirt or additionally to reduce the microbial load. After washing, rhizomes of ginger were air dried at room temperature (27 ± 2°C) for 1-2 hrs. For removal of surface moisture followed by peeled manually and slices were made with the help of stainless-steel knife (Nath *et al.*, 2013) [16]. The slices 1-2 mm thickness so prepared was used for preparation of ginger candy. These slices were weighed 200g and given seven soaking pretreatments. After each soaking treatment slices were further followed by two sugar syruping treatments *viz.*, cold soaking and vaccum syruping. The materials were taken out from the syrup and dried in shade. Dried materials were cooled at room temperature before being packed in air tight containers for further analyses. Flow chart for preparation of ginger candy is shown.

A. Soaking treatment

T_1 = Control
T_2 = Soaking in water (12 hrs)
T_3 = Soaking in 2% salt water (12 hrs)
T_4 = Soaking in 1% lime water (12 hrs)
T_5 = Blanching in hot water (1:3 w/v ratio) for 8 min.
T_6 = Partially dehydration at 50 ^{0}C for 5 hrs
T_7 = Autoclaving at 15 lbs for 5 min.

B. Sugar syruping

1. By cold method

Soaking in 50% sugar syrup for 24 hrs.
↓
Soaking in 60% sugar syrup for 24 hrs
↓
Soaking in 70% sugar syrup until TSS reaches to 70 ^{0}Brix.

2. Vaccum syruping method

Vaccum creation and soaking in 70 per cent sugar syrup until TSS reaches to 68-70 ^{0}Brix.

Chemical analysis

The ginger candy was crushed in pestle and mortar and was analyzed for the moisture (%), total sugars (%), TSS (^{0}Brix), crude fibre content, phosphorus (mg/100g) as reported by Ranganna (1986) [24], magnesium (mg/100g) and calcium (mg/100g),) was determined by A.O.A.C. method and acidity (%) was determined by using the method as recommended by (Ranganna, 1994) [25]. The observations were performed in triplicate and mean values are reported.

Sensory Evaluation of Ginger Candy

Sensory evaluation of ginger candy was carried out according to method of Amerine *et al*. (1965) on a 9-point hedonic scale (Appendix-I). The average scores of the ten semi-trained judges for different quality characteristics *viz,* colour and appearance, texture, taste and overall acceptability were recorded.

Result and Discussion

Changes in Chemical Composition of Ginger Candy during Storage

1. Moisture

The results regarding changes in moisture content of ginger candy during 90 days storage period are given in Table 1. The effect of treatments, syruping method, storage of ginger candy for 90 days was found to be significant and interaction between them was found to be non-significant. However, the moisture content tends to decrease during storage period. The decrease in moisture content may be due to evaporation during storage at ambient temperature. The treatment T_7 (autoclaving at 15 lbs for 5 min.) showed maximum moisture content and candy prepared by vaccum syruping method has maximum moisture content.

Among the different treatments stored for 90 days, moisture content of treatment T_1 (control) decreased from 10.67 to 7.21 per cent by cold syruping method and from 10.75 to 7.24 per cent by vaccum syruping method. The treatment T_2 (soaking in water for 12 hrs.) showed decrease from 10.44 to 7.29 per cent by cold syruping method and from 10.55 to 7.40 per cent by vaccum syruping method. The treatment T_3 (soaking in 2% salt water for 12 hrs.) showed decrease in moisture content from 10.55 to 7.26 per cent by cold syruping and from 10.68 to 7.32 per cent by vaccum syruping method. The treatment T_4 (soaking in 1% lime water for 12 hrs.) showed decrease from 10.95 to 7.53 per cent by cold syruping method and 10.81 to 7.55 per cent by vaccum syruping method. The treatment T_5 [blanching in hot water (1:3 w/v ratio) for 8 min.] showed decrease from 10.76 to 7.38 per cent by cold syruping method and from 10.85 to 7.44 per cent by vaccum syruping method. The treatment T_6 (partially dehydration at 50 ^{0}C for 5 hrs.) showed decrease from 10.24 to 7.00 per cent by cold syruping method and from 10.35 to 7.02 per cent by vaccum syruping method. The treatment T_7 (autoclaving at 15 lbs for 5 min.) showed decrease from 11.18 to 7.80 per cent by cold syruping method and from 11.29 to 7.92 per cent by vaccum syruping method.

Similar results were reported by Navitha *et al*. (2018) [17] in moisture content of ber candy during 80 days of storage period, Dwivedi and Pandey (2017) [7] in aonla candy. The reduction of moisture content varied from 18.68 to 17.74 per cent. The moisture content of candies was significantly high in treatment vaccum syruping method (Pokharkar, 2014) [22]. After 270 days of storage, the moisture content decreased from an initial range 16.50 to 17.20 per cent to a final of 14.70 to 15.40 per cent in flavoured candy of four aonla cultivar (Nayak *et al.*, 2011) [18]. The moisture content was decreased during storage period in all treatments from 16.25 to 13.73 per cent (Yesmita, 2012) [34]. The results obtained in the present study on ginger candy are in the agreement with the literature values.

2. Acidity

The Table 1 revealed that the acidity of ginger candy during storage was tending to decrease as the storage period increases. The overall effect of treatments, syruping method and storage period of 90 days was found to be significant and interaction between them was found to be non-significant. In candy prepared with vaccum syruping acidity ranged between 1.95 to 1.13 per cent and was higher than cold syruping method which ranged between 1.98 to 1.05 per cent. The decrease in titratable acidity during storage might be due to utilization of acid for conversion of non-reducing sugars to

reducing sugars and in non-enzymatic reactions (Sharma *et al*., 2004) [29].

However, the treatment T_1 (control) showed decrease in acidity from 1.98 to 1.07 per cent by cold syruping and from 1.95 to 1.13 per cent by vaccum syruping method during 90 days of storage period. The treatment T_2 (soaking in water for 12 hrs.) showed decrease in acidity from 1.16 to 1.10 per cent by cold syruping and from 1.21 to 1.14 per cent by vaccum syruping method during 90 days of storage period. The treatment T_3 (soaking in 2% salt water for 12 hrs.) showed decrease in acidity from 1.18 to 1.11 per cent by cold syruping and from 1.19 to 1.14 per cent by vaccum syruping method during 90 days of storage period. The treatment T_4 (soaking in 1% for lime water for 12 hrs.) showed decrease in acidity from 1.15 to 1.08 per cent by cold syruping and from 1.21 to 1.16 per cent by vaccum syruping method during 90 days of storage period. The treatment T_5 [blanching in hot water (1:3 w/v ratio) for 8 min.] showed decrease in acidity from 1.11 to 1.05 per cent by cold syruping and from 1.20 to 1.15 per cent by vaccum syruping method during 90 days of storage period. The treatment T_6 (partially dehydration at 50 ^{0}C for 5 hrs.) showed decrease in acidity from 1.20 to 1.11 per cent by cold syruping and from 1.23 to 1.17 per cent by vaccum syruping method during 90 days of storage period. The treatment T_7 (autoclaving at 15 lbs for 5 min.) showed decrease in acidity from 1.10 to 1.06 per cent by cold syruping and from 1.21 to 1.16 per cent by vaccum syruping method during 90 days of storage period.

A gradual and significant decrease in titratable acidity was also observed in aonla candy during 120 days storage period by Ghanwat *et al.* (2019) [9]. The acidity of aonla candy decreased significantly in all treatment during storage period from 0.72 to 0.58 per cent (Pokharkar, 2014) [22]. Similar results were reported in nutmeg fruit rind candy (Yesmita, 2012) [34]; in aonla candy (Tripathi *et al*., 1988) [32] and in apple candy (Sharma *et al*., 1998) [28]. Present results are in agreement with the previous research findings.

3. Total Soluble Solids (TSS)

The results presented in Table 1 showed that the effect of different treatments, syruping method, storage period of 90 days and interaction between them was found to be significant. The TSS of ginger candy was found to increase as the storage period increase. This might be due to conversion of polysaccharides into sugars during hydrolysis process. Increase in TSS might also be attributed to the reduction in moisture content of the product with storage. However, the treatment T_5 [blanching in hot water (1:3 w/v ratio) for 8 min.] showed maximum TSS content in ginger candy and candy prepared by vaccum syruping showed maximum as compared to cold syruping method.

Among the treatments, TSS of ginger candy in treatment T_1 (control) prepared by cold syruping method increased from 68.52 to 69.42 ^{0}Brix and from 68.87 to 70.49 ^{0}Brix by vaccum syruping method during 90 days of storage period. The treatment T_2 (soaking in water for 12 hrs.) showed increase from 68.61 to 69.53 ^{0}Brix by cold syruping method and from 68.96 to 70.19 ^{0}Brix by vaccum syruping method during 90 days of storage period. The treatment T_3 (soaking in 2% salt water for 12 hrs.) showed increase in TSS from 69.35 to 70.77 ^{0}Brix by cold syruping and from 70.01 to 71.75 ^{0}Brix by vaccum syruping method 90 days storage period. The treatment T_4 (soaking in 1% lime water for 12 hrs.) showed increase from 69.64 to 70.70 ^{0}Brix by cold syruping method and 69.21 to 71.50 ^{0}Brix by vaccum syruping method during 90 days of storage period. The treatment T_5 [blanching in hot water (1:3 w/v ratio) for 8 min.] showed increase from 70.01 to 71.28 ^{0}Brix by cold syruping method and from 69.91 to 72.04 ^{0}Brix by vaccum syruping method during 90 days of storage period. The treatment T_6 (partially dehydration at 50 ^{0}C for 5 hrs.) showed increase from 68.27 to 69.11 ^{0}Brix by cold syruping method and from 68.33 to 69.21 ^{0}Brix by vaccum syruping method during 90 days of storage period. The treatment T_7 (autoclaving at 15 lbs for 5 min.) showed increase from 68.40 to 69.32 ^{0}Brix by cold syruping method and from 68.55 to 69.75 ^{0}Brix by vaccum syruping method during 90 days of storage period.

Pokharkar (2014) [22] also reported that TSS gradually increases in storage period. The maximum increase in TSS was found in the candy prepared by vacuum syruping method (69.9 to 74.15 ^{0}Brix) during 180 days of storage at ambient condition. Navitha *et al*. (2018) [17] reported that the TSS of ber candy was found to increase with increase in storage duration 66.03 to 72.62 ºBrix. Dwivedi and Pandey (2017) [7] reported that during 120 days of storage of aonla candy TSS increased (72-75.4 ^{0}Brix) till end of the experiment. The total soluble solids in per cent were gradually increased significantly from 70.00-75.70 ^{0}Brix up to 9 months of storage in ber candy (Singh and Pathak, 2016) [30]. Ghanwat *et al.* (2019) [9] also reported increase in TSS of aonla candy during 120 days storage period. The present results of ginger candy are in accordance with the literature values.

4. Total Sugars

Results given in Table 1 pertaining to total sugar content of ginger candy prepared by using cold syruping and vaccum syruping method indicated a slight increase during storage. The results from Table 1 showed that the effect of treatments, syruping method, storage period of 90 days and interaction between them was found to be significant. The increase might be due decrease in moisture content of ginger candy.

Among the treatments, total sugar content of ginger candy in treatment T_1 (control) prepared by cold syruping method increased from 61.73 to 64.13 per cent and from 61.85 to 64.51 per cent by vaccum syruping method during 90 days of storage period. The treatment T_2 (soaking in water for 12 hrs.) showed increase from 61.45 to 64.25 per cent by cold syruping method and from 61.55 to 64.40 per cent by vaccum syruping method 90 days storage period. The treatment T_3 (soaking in 2% salt water for 12 hrs.) showed increase in total sugar content from 62.60 to 65.04 per cent by cold syruping and from 62.50 to 65.15 per cent by vaccum syruping method during 90 days of storage period. The treatment T_4 (soaking in 1% lime water for 12 hrs.) showed increase from 61.86 to 64.88 per cent by cold syruping method and 62.04 to 65.66 per cent by vaccum syruping method during 90 days of storage period. The treatment T_5 [blanching in hot water (1:3 w/v ratio) for 8 min.] showed increase from 62.36 to 65.33 per cent by cold syruping method and from 62.48 to 65.61 per cent by vaccum syruping method during 90 days of storage period. The treatment T_6 (partially dehydration at 50 ^{0}C for 5 hrs.) showed increase from 61.24 to 63.85 per cent by cold syruping method and from 61.29 to 64.26 per cent by vaccum syruping method during 90 days of storage period. The treatment T_7 (autoclaving at 15 lbs for 5 min.) showed increase from 61.13 to 63.90 per cent by cold syruping method and from 61.39 to 64.43 per cent by vaccum syruping method 90 days storage period.

Increase in total sugars content with storage was also reported by Dwivedi and Pandey (2017) [7] in aonla candy; Singh and

Pathak (2016) [30] in ber candy; Nayak *et al.* (2011) [18] in aonla candy with cardamom and ginger flavour; Yesmita (2012) [34] in nutmeg rind candy. The mean value of total sugars was found to significantly increase from 54.37 to 58.47 per cent. The candies prepared by vacuum syruping method and 35 ºC temperature syruping exhibited higher increase in total sugars during storage. Increase in total sugars might due to decrease in moisture content during storage (Pokharkar, 2014) [22].

5. Crude Fibre

The results regarding the differentiation in crude fibre content of ginger candy during storage is presented in Table 1. The crude fibre content tends to decrease gradually in storage period. The results indicated that the effect of treatments, syruping method, storage period of 90 days was found to be significant and interaction between them was found to be non-significant. The mean score of crude fibre was found to significantly decrease from 1.86 to 0.95 per cent by cold syruping and from 1.89 to 0.96 per cent by vaccum syruping method. It was observed that treatment T_5 [blanching in hot water (1:3 w/v ratio) for 8 min.] contained maximum crude fibre and candies prepared with vaccum syruping contained slightly high crude fibre compared to cold syruping method.

However, the treatment T_1 (control) showed decrease in crude fibre content from 1.65 to 1.02 per cent by cold syruping and from 1.68 to 1.05 per cent by vaccum syruping method during 90 days of storage period. The treatment T_2 (soaking in water for 12 hrs.) showed decrease in crude fibre content from 1.70 to 1.04 per cent by cold syruping and from 1.74 to 1.09 per cent by vaccum syruping method during 90 days of storage period. The treatment T_3 (soaking in 2% salt water for 12 hrs.) showed decrease in crude fibre content from 1.75 to 1.09 per cent by cold syruping and from 1.76 to 1.12 per cent by vaccum syruping method during 90 days of storage period. The treatment T_4 (soaking in 1% for lime water for 12 hrs.) showed decrease in crude fibre content from 1.72 to 1.05 per cent by cold syruping and from 1.78 to 1.07 per cent by vaccum syruping method during 90 days of storage period. The treatment T_5 [blanching in hot water (1:3 w/v ratio) for 8 min.] showed decrease in crude fibre content from 1.86 to 1.18 per cent by cold syruping and from 1.89 to 1.21 per cent by vaccum syruping method during 90 days of storage period. The treatment T_6 (partially dehydration at 50 ^{0}C for 5 hrs.) showed decrease in crude fibre content from 1.59 to 0.95 per cent by cold syruping and from 1.65 to 0.96 per cent by vaccum syruping method during 90 days of storage period and the treatment T_7 (autoclaving at 15 lbs for 5 min.) showed decrease in crude fibre content from 1.62 to 0.97 per cent by cold syruping and from 1.66 to 1.01 per cent by vaccum syruping method during 90 days of storage period.

This finding was also observed in ghee residue candy incorporated with orange peel by Ananthakumar *et al.* (2018) [4] and in sugar coated candied products by Sandhu (1994) [26]. There was slight decrease in crude fibre content during storage of 4 months in ginger candy prepared with different sugar solution. The reduction in crude fibre content for 50% sugar solution was 2.06% to 1.75%, for 60% sugar solution 1.84% to 1.68% and for 70% sugar solution 1.70% to 1.46% (Alam *et al.*, 2018) [2]. The trend in decrease of crude fibre in ginger candy was similar to these previous findings.

6. Calcium

Changes in calcium content of ginger candy are presented in Table 1. The results revealed that the effect of treatments, syruping method, storage period of 90 day was found to be significant and interaction between them was found to be non-significant. The maximum calcium content was recorded from treatment T_5 [blanching in hot water (1:3 w/v ratio) for 8 min.] in candy prepared with both the syruping method. Among the syruping method, candies prepared by using vaccum syruping method contain higher calcium content as compared to cold syruping method.

Among that treatments, the treatment T_1 (control) showed decrease in calcium content from 11.76 to 9.02 mg/100g by cold syruping and from 11.97 to 9.09 mg/100g by vaccum syruping method during 90 days of storage period. The treatment T_2 (soaking in water for 12 hrs.) showed decrease in calcium content from 11.79 to 9.11 mg/100g by cold syruping and from 12.06 to 9.19 mg/100g by vaccum syruping method during 90 days of storage period. The treatment T_3 (soaking in 2% salt water for 12 hrs.) showed decrease in calcium content from 12.24 to 9.28 mg/100g by cold syruping and from 12.28 to 9.35 mg/100g by vaccum syruping method during 90 days of storage period. The treatment T_4 (soaking in 1% for lime water for 12 hrs.) showed decrease in calcium content from 12.16 to 9.22 mg/100g by cold syruping and from 12.22 to 9.25 mg/100g by vaccum syruping method during 90 days of storage period. The treatment T_5 [blanching in hot water (1:3 w/v ratio) for 8 min.] showed decrease in calcium content from 12.86 to 9.77 mg/100g by cold syruping and from 12.95 to 9.83 mg/100g by vaccum syruping method during 90 days of storage period. The treatment T_6 (partially dehydration at 50 ^{0}C for 5 hrs.) showed decrease in calcium content from 11.63 to 8.63 mg/100g by cold syruping and from 11.69 to 8.66 mg/100g by vaccum syruping method during 90 days of storage period. The treatment T_7 (autoclaving at 15 lbs for 5 min.) showed decrease in calcium content from 11.71 to 8.73 mg/100g by cold syruping and from 11.81 to 8.78 mg/100g by vaccum syruping method during 90 days of storage period.

Similar decrease in calcium content with advancement of storage was in nutmeg fruit rind candy during storage at room temperature for period of 3 month from 0.33-0.26 mg/100g (Yesmita, 2012) [34]. The calcium content significantly decreased during storage at room temperature for period of 180 days. It was found that mean value of calcium content decreased from 33.17 to 27.98 mg/100g during storage. Minimum decrease in calcium was found in candy prepared by vacuum syruping method (Pokharkar, 2014) [22]. The calcium content was found to decrease in celeriac candy from 73.94 mg/100g to 56.77 mg/100g (Kersic *et al*., 2004) [12]. In wood apple fruit jam and fruit bar it was decreased from 15.20 to 13.20 mg/100g and 18.10 to 16.80 mg/100g (Vidhya and Narain, 2011) [33].

7. Phosphorus

The results on changes in phosphorus content of ginger candy during 90 days of storage period are presented in Table 1. Among that treatments, the treatment T_1 (control) showed decrease in phosphorus content from 23.40 to 22.89 mg/100g by cold syruping and from 23.41 to 22.92 mg/100g by vaccum syruping method during 90 days of storage period. The treatment T_2 (soaking in water for 12 hrs.) showed decrease in phosphorus content from 23.44 to 22.94 mg/100g by cold syruping and from 23.46 to 23.00 mg/100g by vaccum syruping method during 90 days of storage period. The treatment T_3 (soaking in 2% salt water for 12 hrs.) showed decrease in phosphorus content from 23.50 to 23.11 mg/100g by cold syruping and from 23.52 to 23.14 mg/100g by vaccum syruping method during 90 days of storage period.

The treatment T_4 (soaking in 1% for lime water for 12 hrs.) showed decrease in phosphorus content from 23.46 to 22.97 mg/100g by cold syruping and from 23.48 to 23.06 mg/100g by vaccum syruping method during 90 days of storage period. However, the treatment T_5 [blanching in hot water (1:3 w/v ratio) for 8 min.] also showed decrease in phosphorus content from 23.57 to 23.13 mg/100g by cold syruping and from 23.58 to 23.16 mg/100g by vaccum syruping method during 90 days of storage period. The treatment T_6 (partially dehydration at 50 ^{0}C for 5 hrs.) showed decrease in phosphorus content from 22.30 to 21.82 mg/100g by cold syruping and from 22.35 to 21.83 mg/100g by vaccum syruping method during 90 days of storage period. The treatment T_7 (autoclaving at 15 lbs for 5 min.) showed decrease in phosphorus content from 22.35 to 21.85 mg/100g by cold syruping and from 22.47 to 21.91 mg/100g by vaccum syruping method during 90 days of storage period.

The phosphorus content of ginger candy decreased throughout the storage from 23.57 to 21.82 mg/100g in candies prepared with cold syruping method and from 23.58 to 21.83 mg/100g by vaccum syruping method. Among the treatments, the treatment T_5 [blanching in hot water (1:3 w/v ratio) for 8 min.] tends to contain maximum phosphorus content. As compared between syruping method vaccum syruping method recorded high phosphorus than cold syruping method.

Decrease in phosphorous content from 52.01 mg/100g to 33.08 mg/100g was also reported in celeriac candy during three-month storage at ambient temperature (Kersic *et al*., 2004) [12]. The phosphorus content of nutmeg fruit rind candy decreased during storage at ambient temperature for period of 90 days. It was found that phosphorus content decreased from 8.07 to 7.61 mg/100g during storage (Yesmita, 2012) [34]. In wood apple fruit jam and fruit bar phosphorus content decreased from 34.1 to 32.1 mg and 31.6 to 29.2 mg/100g respectively during three-month storage period at ambient temperature (Vidhya and Narain, 2011) [33].

8. Magnesium

The results on magnesium content presented in Table 1 showed that the effect of treatments, syruping method, storage period of 90 days was found to be significant and interaction between them was found to be non-significant. The magnesium content was found to decrease during storage period. The candies prepared with vaccum syruping method showed higher magnesium content than cold syruping method. Among the treatments, the treatment T_5 [blanching in hot water (1:3 w/v ratio) for 8 min.] showed maximum magnesium content.

However, the treatment T_1 (control) showed decrease in magnesium content from 27.93 to 27.41 mg/100g by cold syruping and from 28.08 to 27.56 mg/100g by vaccum syruping method during 90 days of storage period. The treatment T_2 (soaking in water for 12 hrs.) showed decrease in magnesium content from 28.05 to 27.56 mg/100g by cold syruping and from 28.18 to 27.66 mg/100g by vaccum syruping method during 90 days of storage period. The treatment T_3 (soaking in 2% salt water for 12 hrs.) showed decrease in magnesium content from 28.55 to 27.97 mg/100g by cold syruping and from 28.76 to 28.22 mg/100g by vaccum syruping method during 90 days of storage period. The treatment T_4 (soaking in 1% for lime water for 12 hrs.) showed decrease in magnesium content from 28.36 to 27.82 mg/100g by cold syruping and from 28.57 to 28.05 mg/100g by vaccum syruping method during 90 days of storage period. The treatment T_5 [blanching in hot water (1:3 w/v ratio) for 8 min.] showed decrease in magnesium content from 28.82 to 28.32 mg/100g by cold syruping and from 29.06 to 28.55 mg/100g by vaccum syruping method during 90 days of storage period. The treatment T_6 (partially dehydration at 50 ^{0}C for 5 hrs.) showed decrease in magnesium content from 26.48 to 25.92 mg/100g by cold syruping and from 26.55 to 26.02 mg/100g by vaccum syruping method during 90 days of storage period. The treatment T_7 (autoclaving at 15 lbs for 5 min.) showed decrease in magnesium content from 27.22 to 26.69 mg/100g by cold syruping and from 27.42 to 26.88 mg/100g by vaccum syruping method during 90 days of storage period

Changes in organoleptic parameters of ginger candy during storage

1. Colour and Appearance

The results regarding changes in colour and appearance score of ginger candy influenced by storage are presented in Table 2. The mean score for colour and appearance was found to decrease significantly during storage a tambient temperature. The colour deterioration was found more in treatment T_6 (partially dehydration at 50 ^{0}C for 5 hrs.) and treatment T_7 (autoclaving at 15 lbs for 5 min.), this might be due to Millard reaction occurred in this treatment. The colour changed from light brown to dark brown or blackish brown. However, the treatments T_5 [blanching in hot water (1:3 w/v ratio) for 8 min.] and T_3 (soaking in 2% salt water for 12 hrs.) maintained better colour and appearance during storage of 90 days. Among the syruping method, candies prepared with vaccum syruping method maintained better colour and appearance as compared to cold syruping method. The statistical analysis showed that the effect of treatments and storage period on colour of candy was significant and effect of syruping method and interaction between them was not significant.

However, the treatment T_1 (control) showed decrease in score of colour and appearance from 7.33 to 6.33 by cold syruping and from 7.33 to 5.67 by vaccum syruping method during 90 days of storage period. The treatment T_2 (soaking in water for 12 hrs.) showed decrease in score of colour and appearance from 7.67 to 6.33 mg/100g by cold syruping and from 7.67 to 6.33 by vaccum syruping method during 90 days of storage period. The treatment T_3 (soaking in 2% salt water for 12 hrs.) showed decrease in score of colour and appearance from 8.33 to 7.00 by cold syruping and from 8.67 to 6.83 by vaccum syruping method during 90 days of storage period. The treatment T_4 (soaking in 1% for lime water for 12 hrs.) showed decrease in score of colourand appearance from 8.17 to 6.33 by cold syruping and from 8.33 to 6.67 by vaccum syruping method during 90 days of storage period. The treatment T_5 [blanching in hot water (1:3 w/v ratio) for 8 min.] showed decrease in score of colourand appearance from 8.83 to 7.33 by cold syruping and from 9.00 to 7.50 by vaccum syruping method during 90 days of storage period. The treatment T_6 (partially dehydration at 50 ^{0}C for 5 hrs.) showed decrease in score of colourand appearance from 6.33

Table 1: Effect of storage on chemical content of ginger candy at ambient temperature

Parameters	Moisture (%)	TSS (^{0}Brix)	Acidity (%)	Total sugars (%)	Crude fibre (%)	Calcium (mg/100g)	Magnesium (mg/100g)	Phosphorus (mg/100g)
Treatments								
T_1	8.95	69.20	1.36	63.01	1.39	10.75	27.78	23.17
T_2	8.98	69.24	1.15	62.68	1.44	10.78	27.90	23.21
T_3	8.96	70.40	1.15	63.62	1.49	11.05	28.39	23.32
T_4	9.25	70.27	1.15	63.32	1.46	10.96	28.22	23.25
T_5	9.12	70.79	1.12	63.66	1.57	11.63	28.72	23.37
T_6	8.68	68.69	1.18	62.39	1.35	10.35	26.26	22.06
T_7	9.61	68.93	1.13	62.43	1.38	10.48	27.07	22.16
S.Em(±)	0.02	0.01	0.01	0.02	0.01	0.02	0.02	0.02
CD at 5%	0.05	0.04	0.03	0.04	0.03	0.05	0.05	0.05
Syruping method								
M_1	9.32	69.36	1.16	62.69	1.49	11.10	27.74	22.96
M_2	9.41	69.80	1.22	62.86	1.52	11.20	27.92	23.00
S.Em(±)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
CD at 5%	0.03	0.02	0.02	0.02	0.02	0.03	0.03	0.03
Storage period								
S_1	10.72	69.05	1.29	61.82	1.72	12.08	28.00	23.16
S_2	9.27	69.57	1.15	62.76	1.52	11.20	27.83	22.96
S_3	8.11	70.13	1.13	63.74	1.27	10.17	27.64	22.81
S_4	7.38	70.36	1.12	64.67	1.06	9.14	27.47	22.70
S.Em(±)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
CD at 5%	0.04	0.03	0.03	0.03	0.03	0.04	0.04	0.04
Interaction								
$T_1 M_1 S_1$	10.67	68.52	1.98	61.73	1.65	11.76	27.93	23.40
$T_1 M_1 S_2$	9.05	68.73	1.11	62.83	1.44	11.13	27.76	23.20
$T_1 M_1 S_3$	7.81	69.15	1.09	63.73	1.20	10.05	27.58	23.02
$T_1 M_1 S_4$	7.21	69.42	1.07	64.13	1.02	9.02	27.41	22.89
$T_1 M_2 S_1$	10.75	68.87	1.95	61.85	1.68	11.97	28.08	23.41
$T_1 M_2 S_2$	9.23	69.45	1.16	62.99	1.48	11.26	27.94	23.23
$T_1 M_2 S_3$	7.95	70.24	1.14	63.84	1.23	10.07	27.75	23.06
$T_1 M_2 S_4$	7.24	70.49	1.13	64.51	1.05	9.09	27.56	22.92
$T_2 M_1 S_1$	10.44	68.61	1.16	61.45	1.70	11.79	28.05	23.44
$T_2 M_1 S_2$	9.22	68.95	1.13	62.35	1.52	11.02	27.93	23.22
$T_2 M_1 S_3$	8.04	69.33	1.12	63.16	1.26	10.08	27.72	23.03
$T_2 M_1 S_4$	7.29	69.53	1.10	64.25	1.04	9.11	27.56	22.94
$T_2 M_2 S_1$	10.55	68.96	1.21	61.55	1.74	12.06	28.18	23.46
$T_2 M_2 S_2$	9.25	69.38	1.18	62.48	1.52	11.30	28.03	23.25
$T_2 M_2 S_3$	8.10	69.93	1.16	63.53	1.27	10.13	27.82	23.11
$T_2 M_2 S_4$	7.40	70.19	1.14	64.40	1.09	9.19	27.66	23.00
$T_3 M_1 S_1$	10.55	69.35	1.18	62.60	1.75	12.24	28.55	23.50
$T_3 M_1 S_2$	9.10	69.81	1.15	63.49	1.56	11.28	28.31	23.32
$T_3 M_1 S_3$	7.92	70.55	1.13	64.25	1.32	10.35	28.15	23.22
$T_3 M_1 S_4$	7.26	70.77	1.11	65.04	1.09	9.28	27.97	23.11
$T_3 M_2 S_1$	10.68	70.01	1.19	62.50	1.76	12.28	28.76	23.52
$T_3 M_2 S_2$	9.15	70.85	1.17	63.41	1.58	11.48	28.60	23.35
$T_3 M_2 S_3$	8.03	71.45	1.15	64.04	1.35	10.45	28.40	23.25
$T_3 M_2 S_4$	7.32	71.75	1.14	65.15	1.12	9.35	28.22	23.14
$T_4 M_1 S_1$	10.95	69.64	1.15	61.86	1.72	12.16	28.36	23.46
$T_4 M_1 S_2$	9.40	70.16	1.13	62.93	1.53	11.22	28.18	23.27
$T_4 M_1 S_3$	8.22	70.43	1.10	63.96	1.28	10.26	27.95	23.07

Table 1: Contd...

Parameters	Moisture (%)	TSS (^{0}Brix)	Acidity (%)	Total sugars (%)	Crude fibre (%)	Calcium (mg/100g)	Magnesium (mg/100g)	Phosphorus (mg/100g)
$T_4 M_1 S_4$	7.53	70.70	1.08	64.88	1.05	9.22	27.82	22.97
$T_4 M_2 S_1$	10.81	69.21	1.21	62.04	1.78	12.22	28.57	23.48
$T_4 M_2 S_2$	9.56	70.47	1.20	63.12	1.55	11.36	28.43	23.32
$T_4 M_2 S_3$	8.30	71.31	1.17	64.45	1.30	10.30	28.25	23.16
$T_4 M_2 S_4$	7.55	71.50	1.16	65.66	1.07	9.25	28.05	23.06
$T_5 M_1 S_1$	10.76	70.01	1.11	62.36	1.86	12.86	28.82	23.57
$T_5 M_1 S_2$	9.23	70.43	1.08	63.25	1.62	11.95	28.70	23.38
$T_5 M_1 S_3$	8.15	71.08	1.06	64.53	1.36	10.88	28.52	23.25
$T_5 M_1 S_4$	7.38	71.28	1.05	65.33	1.18	9.77	28.32	23.13
$T_5 M_2 S_1$	10.85	69.91	1.20	62.48	1.89	12.95	29.06	23.58
$T_5 M_2 S_2$	9.30	71.05	1.19	63.35	1.67	12.03	28.89	23.40

T_5 M_2 S_3	8.17	71.77	1.16	64.53	1.38	10.96	28.72	23.27
T_5 M_2 S_4	7.44	72.04	1.15	65.61	1.21	9.83	28.55	23.16
T_6 M_1 S_1	10.24	68.27	1.20	61.24	1.59	11.63	26.48	22.30
T_6 M_1 S_2	8.85	68.45	1.18	62.09	1.42	10.60	26.28	22.02
T_6 M_1 S_3	7.67	68.95	1.14	62.98	1.16	9.58	26.06	21.92
T_6 M_1 S_4	7.00	69.11	1.11	63.85	0.95	8.63	25.92	21.82
T_6 M_2 S_1	10.35	68.33	1.23	61.29	1.65	11.69	26.55	22.35
T_6 M_2 S_2	8.88	68.66	1.21	62.17	1.45	10.64	26.36	22.04
T_6 M_2 S_3	7.76	69.05	1.19	63.09	1.20	9.65	26.14	21.94
T_6 M_2 S_4	7.02	69.21	1.17	64.26	0.96	8.66	26.02	21.83
T_7 M_1 S_1	11.18	68.40	1.10	61.13	1.62	11.71	27.22	22.35
T_7 M_1 S_2	9.75	68.67	1.08	61.79	1.45	10.75	27.02	22.18
T_7 M_1 S_3	8.60	69.12	1.07	62.90	1.19	9.77	26.87	21.96
T_7 M_1 S_4	7.80	69.32	1.06	63.90	0.97	8.73	26.69	21.85
T_7 M_2 S_1	11.29	68.55	1.21	61.39	1.66	11.81	27.42	22.47
T_7 M_2 S_2	9.83	68.90	1.19	62.34	1.56	10.77	27.25	22.23
T_7 M_2 S_3	8.80	69.52	1.17	63.55	1.22	9.82	27.05	22.05
T_7 M_2 S_4	7.92	69.75	1.16	64.43	1.01	8.78	26.88	21.91
GM	8.89	69.78	1.17	63.23	1.40	10.68	27.75	22.92
S.Em(±) T x M x S	0.06	0.04	0.04	0.04	0.03	0.05	0.05	0.05
CD at 5%	NS	0.12	NS	0.12	NS	NS	NS	NS

Note: All results are mean of three replications.

Whereas,

T_1 = Control
T_2 = Soaking in water (12 hrs)
T_3 = Soaking in 2% salt water (12 hrs)
T_4 = Soaking in 1% lime water (12 hrs)
T_5 = Blanching in hot water (1:3 w/v ratio) for 8 min.
T_6 = Partially dehydration at 50 ^{0}C for 5 hrs.
T_7= Autoclaving at 15 lbs for 5 min.
M_1 = Cold syruping method
M_2 = Vaccum syruping method
S_1 = 0 days storage period
S_2 = 30 days storage period
S_3 = 60 days storage period
S_4 = 90 days storage period

To 4.33 by cold syruping and from 6.50 to 4.50 by vaccum syruping method during 90 days of storage period. The treatment T_7 (autoclaving at 15 lbs for 5 min.) showed decrease in score vof colourand appearance from 6.67 to 5.33 by cold syruping and from 6.83 to 5.50 by vaccum syruping method during 90 days of storage period.

The decrease in score of colour and appearance was also reported in aonla candy from 7.49 to 5.98 by Pokharkar (2014) [22], in nutmeg rind candy (Yesmita, 2012) [34], in aonla candy (Dwivedi and Pandey, 2017) [7] and citron peel candy (Baber *et al.*, 2013) [5].

2. Taste

The results on taste score of ginger candy as influenced by storage are presented in Table 2. However, the results indicated that gradual decrease in taste score of ginger candy during storage at ambient temperature. The treatment T_5 [blanching in hot water (1:3 w/v ratio) for 8 min.] and T_3 (soaking in 2% salt water for 12 hrs.) exhibit good taste throughout the storage but the taste of treatments T_6 (partially dehydration at 50 ^{0}C for 5 hrs.) and treatment T_7 (autoclaving at 15 lbs for 5 min.) deteriorate as storage period increases. Among the syruping methods candies prepared by vaccum syruping tastes good as compared to cold syruping. The statistical analysis showed that the effect of treatments, syruping method and storage period on taste of candy was significant and interaction between them was not significant.

However, the treatment T_1 (control) showed decrease in score of taste from 7.17 to 6.00 by cold syruping and from 7.17 to 5.83 by vaccum syruping method during 90 days of storage period. The treatment T_2 (soaking in water for 12 hrs.) showed decrease in score of taste from 7.33 to 6.17 by cold syruping and from 7.50 to 6.17 by vaccum syruping method during 90 days of storage period. The treatment T_3 (soaking in 2% salt water for 12 hrs.) showed decrease in score of taste from 7.67 to 6.33 by cold syruping and from 8.17 to 6.67 by vaccum syruping method during 90 days of storage period. The treatment T_4 (soaking in 1% for lime water for 12 hrs.) showed decrease in score of taste from 7.67 to 5.67 by cold syruping and from 7.83 to 6.33 by vaccum syruping method during 90 days of storage period. The treatment T_5 [blanching in hot water (1:3 w/v ratio) for 8 min.] showed decrease in score of taste from 8.33 to 6.33 by cold syruping and from 8.50 to 6.67 by vaccum syruping method during 90 days of storage period. The treatment T_6 (partially dehydration at 50 ^{0}C for 5 hrs.) showed decrease in score of taste from 6.67 to 4.17 by cold syruping and from 6.83 to 4.67 by vaccum syruping method during 90 days of storage period. The treatment T_7 (autoclaving at 15 lbs for 5 min.) showed decrease in score of taste from 6.67 to 4.67 by cold syruping and from 7.00 to 5.17 by vaccum syruping method during 90 days of storage period.

It is reported that score of taste decrease gradually as the storage period advances in aonla candy from 7.49 to 5.98 by Pokharkar (2014) [22], in nutmeg rind candy (Yesmita, 2012) [34], Dwivedi and Pandey (2017) [7] in aonla candy and in citron peel candy (Baber *et al.*, 2013) [5].

3. Flavour

Results on changes in flavour score of ginger candy influenced by storage period are presented in Table 2. The results indicated that the mean score of flavour decrease

during storage of 90 days atambient temperature. The treatment T_5[blanching in hot water (1:3 w/v ratio) for 8 min.] and T_3 (soaking in 2% salt water for 12 hrs.) exhibited highest score of flavour and candies prepared with vaccum syruping method have high score than candies prepared with cold syruping method. The statistical analysis showed that the effect of treatments, syruping method and storage period on flavour of candy was significant and interaction between them was not significant.

However, the treatment T_1 (control) showed decrease in score of flavour from 6.83 to 5.33 by cold syruping and from 7.00 to 6.17 by vaccum syruping method during 90 days of storage period. The treatment T_2 (soaking in water for 12 hrs.) showed decrease in score of flavour from 7.33 to 5.67 by cold syruping and from 7.50 to 6.17 by vaccum syruping method during 90 days of storage period. The treatment T_3 (soaking in 2% salt water for 12 hrs.) showed decrease in score of flavour from 8.17 to 6.33 by cold syruping and from 8.33 to 6.83 by vaccum syruping method during 90 days of storage period. The treatment T_4 (soaking in 1% for lime water for 12 hrs.) showed decrease in score of flavour from 7.67 to 5.67 by cold syruping and from 7.83 to 6.00 by vaccum syruping method during 90 days of storage period. The treatment T_5 [blanching in hot water (1:3 w/v ratio) for 8 min.] showed decrease in score of flavour from 8.67 to 6.67 by cold syruping and from 8.83 to 6.83 by vaccum syruping method during 90 days of storage period. The treatment T_6 (partially dehydration at 50 ^{0}C for 5 hrs.) showed decrease in score of flavour from 6.50 to 4.17 by cold syruping and from 7.17 to 5.00 by vaccum syruping method during 90 days of storage period. The treatment T_7 (autoclaving at 15 lbs for 5 min.) showed decrease in score of flavour from 7.00 to 5.67 by cold syruping and from 7.17 to 6.17 by vaccum syruping method during 90 days of storage period. The statistical analysis showed that the effect of treatments, syruping method and storage period on flavour of candy was significant and interaction between them was not significant.

The decrease in flavour as the storage period advances is also reported in aonla candy (Dwivedi and Pandey, 2017) [7], nutmeg rind candy (Yesmita, 2012) [34], Aonla candy (Pokharkar, 2014) [22] and citron peel candy (Baber *et al.*, 2013) [5].

4. Texture

The results on changes in texture score of ginger candy influenced by storage are presented in Table 2. The results indicated that the treatment T_1 (control) showed decrease in score of texture from 7.17 to 5.83 by cold syruping and from 7.33 to 6.17 by vaccum syruping method during 90 days of storage period. The treatment T_2 (soaking in water for 12 hrs.) showed decrease in score of texture from 7.33 to 5.83 by cold syruping and from 7.50 to 5.67 by vaccum syruping method during 90 days of storage period. The treatment T_3 (soaking in 2% salt water for 12 hrs.) showed decrease in score of texture from 8.33 to 6.67 by cold syruping and from 8.50 to 7.00 by vaccum syruping method during 90 days of storage period. The treatment T_4 (soaking in 1% for lime water for 12 hrs.) showed decrease in score of texture from 7.67 to 6.33 by cold syruping and from 7.83 to 6.33 by vaccum syruping method during 90 days of storage period. The treatment T_5 [blanching in hot water (1:3 w/v ratio) for 8 min.] showed decrease in score of texture from 8.67 to 7.33 by cold syruping and from 8.83 to 7.67 by vaccum syruping method during 90 days of storage period. The treatment T_6 (partially dehydration at 50 ^{0}C for 5 hrs.) showed decrease in score of texture from 6.67 to 4.33 by cold syruping and from 6.83 to 5.17 by vaccum syruping method during 90 days of storage period. The treatment T_7 (autoclaving at 15 lbs for 5 min.) showed decrease in score of texture from 7.00 to 5.67 by cold syruping and from 7.17 to 5.83 by vaccum syruping method during 90 days of storage period.

The mean score of texture was found to decrease significantly in ginger candy during storage at ambient temperature. The treatments T_5 [blanching in hot water (1:3 w/v ratio) for 8 min.] and T_3 (soaking in 2% salt water for 12 hrs.) exhibited to have superior texture during storage up to 90 days. The treatment T_6 (partially dehydration at 50 ^{0}C for 5 hrs.) showed extensive deterioration in texture which might be due dehydrating effect and hardening of candy due to lose of moisture during storage. The statistical analysis showed that the effect of treatments, syruping method and storage period on texture of candy was significant and interaction between them was not significant.

The texture score was reported to decrease with the advancement of storage in aonla candy (Dwivedi and Pandey, 2017) [7], nutmeg rind candy (Yesmita, 2012) [34], aonla candy (Pokharkar, 2014) [22] and citron peel candy (Baber *et al.*, 2013) [5].

5. Overall Acceptability

The results regarding to sensory scores of overall acceptability of ginger candy prepared with different treatments are presented in Table 2. The results showed that overall acceptability of ginger candy decrease as the storage period advances. However, candies prepared with vaccum syruping and the treatments T_5 [blanching in hot water (1:3 w/v ratio) for 8 min.] and T_3 (soaking in 2% salt water for 12 hrs.] were more acceptable. The statistical analysis showed that the effect of treatments, syruping method and storage period on score of overall acceptability of candy was significant and interaction between them was not significant.

However, the treatment T_1 (control) showed decrease in score of overall acceptability from 7.17 to 5.67 by cold syruping and from 7.33 to 6.17 by vaccum syruping method during 90 days of storage period. The treatment T_2 (soaking in water for 12 hrs.) showed decrease in

Table 2: Effect of storage on organoleptic qualities of ginger candy at ambient temperature

Parameters	Colour and appearance	Taste	Flavour	Texture	Overall acceptability
Treatments					
T_1	6.81	6.55	6.45	6.52	6.67
T_2	7.14	6.90	6.69	6.74	6.81
T_3	7.90	7.40	7.55	7.69	7.83
T_4	7.55	6.93	6.98	7.14	7.24
T_5	8.19	7.70	7.79	8.12	8.05
T_6	5.74	5.83	5.88	6.07	6.19
T_7	6.21	6.24	6.64	6.55	6.57
S.Em(±)	0.10	0.09	0.09	0.08	0.07

CD at 5%	0.29	0.24	0.25	0.23	0.21
Syruping method					
M_1	7.17	6.90	6.90	7.00	7.07
M_2	7.30	7.08	7.21	7.28	7.36
S.Em(±)	0.06	0.05	0.05	0.04	0.04
CD at 5%	NS	0.13	0.13	0.13	0.11
Storage period					
S_1	7.69	7.46	7.57	7.63	7.62
S_2	7.27	7.05	7.07	7.13	7.26
S_3	6.74	6.45	6.52	6.65	6.76
S_4	6.14	5.77	5.90	6.13	6.24
S.Em(±)	0.08	0.07	0.07	0.06	0.06
CD at 5%	0.22	0.18	0.19	0.18	0.16
Interaction					
$T_1 M_1 S_1$	7.33	7.17	6.83	7.17	7.17
$T_1 M_1 S_2$	7.00	6.50	6.50	6.33	6.83
$T_1 M_1 S_3$	6.67	6.33	6.33	6.00	6.17
$T_1 M_1 S_4$	6.33	6.00	5.33	5.83	5.67
$T_1 M_2 S_1$	7.33	7.17	7.00	7.33	7.33
$T_1 M_2 S_2$	6.67	6.50	6.67	6.67	7.00
$T_1 M_2 S_3$	6.33	6.17	6.50	6.33	6.50
$T_1 M_2 S_4$	5.67	5.83	6.17	6.17	6.17
$T_2 M_1 S_1$	7.67	7.33	7.33	7.33	7.17
$T_2 M_1 S_2$	7.33	7.00	6.67	6.83	7.00
$T_2 M_1 S_3$	7.00	6.50	6.00	6.17	6.33
$T_2 M_1 S_4$	6.33	6.17	5.67	5.83	6.17
$T_2 M_2 S_1$	7.67	7.50	7.50	7.50	7.33
$T_2 M_2 S_2$	7.33	7.17	7.33	7.17	7.17
$T_2 M_2 S_3$	6.67	6.67	6.33	6.33	6.50
$T_2 M_2 S_4$	6.33	6.17	6.17	5.67	6.33
$T_3 M_1 S_1$	8.33	7.67	8.17	8.33	8.17
$T_3 M_1 S_2$	8.00	7.50	7.67	7.33	7.83
$T_3 M_1 S_3$	7.33	7.17	7.17	7.17	7.17
$T_3 M_1 S_4$	7.00	6.33	6.33	6.67	7.00
$T_3 M_2 S_1$	8.67	8.17	8.33	8.50	8.67
$T_3 M_2 S_2$	8.33	7.67	7.67	8.17	8.17
$T_3 M_2 S_3$	7.67	7.33	7.50	7.67	7.83
$T_3 M_2 S_4$	6.83	6.67	6.83	7.00	7.50
$T_4 M_1 S_1$	8.17	7.67	7.67	7.67	7.67
$T_4 M_1 S_2$	7.50	7.17	7.17	7.33	7.17

Table 2: contd...

Parameters	Colour and appearance	Taste	Flavour	Texture	Overall acceptability
$T_4 M_1 S_3$	7.33	6.33	6.33	6.67	7.00
$T_4 M_1 S_4$	6.33	5.67	5.67	6.33	6.50
$T_4 M_2 S_1$	8.33	7.83	7.83	7.83	7.83
$T_4 M_2 S_2$	7.67	7.33	7.50	7.50	7.33
$T_4 M_2 S_3$	7.50	6.50	6.67	6.67	7.17
$T_4 M_2 S_4$	6.67	6.33	6.00	6.33	6.67
$T_5 M_1 S_1$	8.83	8.33	8.67	8.67	8.50
$T_5 M_1 S_2$	8.17	7.83	7.83	8.17	8.17
$T_5 M_1 S_3$	7.67	7.33	7.17	7.67	7.33
$T_5 M_1 S_4$	7.33	6.33	6.67	7.33	7.17
$T_5 M_2 S_1$	9.00	8.50	8.83	8.83	8.83
$T_5 M_2 S_2$	8.67	8.27	8.00	8.33	8.67
$T_5 M_2 S_3$	7.67	7.33	7.33	7.83	7.67
$T_5 M_2 S_4$	7.50	6.67	6.83	7.67	7.50
$T_6 M_1 S_1$	6.33	6.67	6.50	6.67	6.83
$T_6 M_1 S_2$	5.67	6.17	5.67	6.17	6.17
$T_6 M_1 S_3$	5.33	5.33	5.33	5.67	5.83
$T_6 M_1 S_4$	4.33	4.17	4.17	4.33	4.67
$T_6 M_2 S_1$	6.50	6.83	7.17	6.83	7.00
$T_6 M_2 S_2$	6.33	6.33	6.67	6.50	6.50
$T_6 M_2 S_3$	5.67	5.33	5.67	6.33	6.33
$T_6 M_2 S_4$	4.50	4.67	5.00	5.17	4.83
$T_7 M_1 S_1$	6.67	6.67	7.00	7.00	7.00
$T_7 M_1 S_2$	6.50	6.50	6.67	6.50	6.83
$T_7 M_1 S_3$	5.67	5.83	6.33	6.17	6.17

T_7 M_1 S_4	5.33	4.67	5.67	5.67	5.33
T_7 M_2 S_1	6.83	7.00	7.17	7.17	7.17
T_7 M_2 S_2	6.67	6.83	7.00	6.83	6.83
T_7 M_2 S_3	5.83	6.17	6.67	6.50	6.67
T_7 M_2 S_4	5.50	5.17	6.17	5.83	5.83
GM	6.99	6.71	6.78	6.91	6.99
S.Em (±) T x M x S	0.29	0.25	0.25	0.24	0.21
CD at 5%	NS	NS	NS	NS	NS

Note: All results are mean of ten replications. Organoleptic qualities judged by using 9-point hedonic scale.
Whereas,
T_1 = Control
T_2 = Soaking in water (12 hrs)
T_3 = Soaking in 2% salt water (12 hrs)
T_4 = Soaking in 1% lime water (12 hrs)
T_5 = Blanching in hot water (1:3 w/v ratio) for 8 min.
T_6 = Partially dehydration at 50 ^{0}C for 5 hrs.
T_7= Autoclaving at 15 lbs for 5 min.
M_1 = Cold syruping method
M_2 = Vaccum syruping method
S_1 = 0 days storage period
S_2 = 30 days storage period
S_3 = 60 days storage period
S_4 = 90 days storage period

Of overall acceptability from 7.17 to 6.17 by cold syruping and from 7.33 to 6.33 by vaccum syruping method during 90 days of storage period. The treatment T_3 (soaking in 2% salt water for 12 hrs.) showed decrease in score of overall acceptability from 8.17 to 7.00 by cold syruping and from 8.67 to 7.50 by vaccum syruping method during 90 days of storage period. The treatment T_4 (soaking in 1% for lime water for 12 hrs.) showed decrease in score of overall acceptability from 7.67 to 6.50 by cold syruping and from 7.83 to 6.67 by vaccum syruping method during 90 days of storage period. The treatment T_5 [blanching in hot water (1:3 w/v ratio) for 8 min.] showed decrease in score of overall acceptability from 8.50 to 7.17 by cold syruping and from 8.83 to 7.50 by vaccum syruping method during 90 days of storage period. The treatment T_6 (partially dehydration at 50 ^{0}C for 5 hrs.) showed decrease in score of overall acceptability from 6.83 to 4.67 by cold syruping and from 7.00 to 4.83 by vaccum syruping method during 90 days of storage period. The treatment T_7 (autoclaving at 15 lbs for 5 min.) showed decrease in score of overall acceptability from 7.00 to 5.33 by cold syruping and from 7.17 to 5.83 by vaccum syruping method during 90 days of storage period.

The overall acceptability was reported to decrease with advancement of storage in aonla candy (Dwivedi and Pandey, 2017) [7], nutmeg rind candy (Yesmita, 2012) [34], aonla candy (Pokharkar, 2014) [22] and citron peel candy (Baber *et al.*, 2013) [5]. The results obtained in the present experimental study on ginger candy preparation and their organoleptic properties are in accordance with the results already reported by various researchers for various types of candies.

Conclusion

In this present investigation it is concluded that during the 0 to 90 days storage of ginger candy with two different methods it was observed that, there was decrease in moisture content, acidity, crude fiber, calcium, magnesium and phosphorus whereas, increase in T.S.S and total sugar. It was also found that the blanched sample of ginger with vacuum syruping was having better chemical properties and sensory score over the cold syruping.

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