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Physicochemical and Sensory Evaluation of Mango Squash Utilizing Chemical Preservatives During Storage

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ABSTRACT

This study assessed the physiochemical, sensory characteristics, and storage stability of mango squash with preservatives. Total four squash samples were made which were named as T_0 (Control), T_1 (Sodium Benzoate), T_2 (Potassium metabisulphite) and T_3 (Potassium metabisulphite + Sodium Benzoate). They were packaged in plastic bottles. All samples were sealed properly and stored at room temperature. Samples were analyzed at seven days interval physiochemically (pH, total soluble solids, % titratable acidity and ascorbic acid), and for sensory characteristics (color, flavor and overall acceptability) for a total period of two months. Results clearly showed that storage interval and preservatives had significant effect on physiochemical and organoleptic characteristics. All the treatments indicated a decreasing trend for ascorbic acid, pH, color, flavor and overall acceptability while increasing trend for total soluble solids and titratable acidity (%) during storage period. Total soluble solids increased maximum in T_0 (24.6%) and minimum in T_2 (3.1%). Increase in total soluble solids may be due to hydrolysis of polysaccharides. pH decreased maximum in T_0 (18.8%) and minimum in T_2 (3%). Decrease in pH of mango squash may be due to break down of pectic substances into pectic acid. Ascorbic acid decreased maximum in T_0 (56%) and minimum in T_2 (11%). Decrease in ascorbic acid content is due to presence of oxygen product and other cause is head space in the product packaging. Acidity increased maximum in T_0 (47.5%) and minimum in T_2 (9%). Increase in acidity might be due to high storage temperature and formation of acidic compounds by degradation and oxidation of reducing sugars. Color, flavor, and overall acceptability scores declined most in T_0 and least in T_2 due to higher pulp, sugar, and acid concentrations in T_2, which slowed Maillard reaction and quality deterioration.

INTRODUCTION

Mango (Mangifera indicae L.) is the most eaten tropical fruit in most countries in the world. The mango (Mangifera indicae L.) is a member of the Anacardiaceae family. The mango, sometimes referred to as the "King of fruits," is indigenous to Southern Asia, particularly Eastern India and Burma. The mango holds a prominent position among the commercial fruits grown in Pakistan since it is regarded as a fruit of quality. It is well known for its delicious flavor, lovely scent, and nutritious content. With 64–86 calories of energy, mangos are a great way to balance a person's diet. Approximately 90 nations worldwide produce more than 25.1 million tons of mangos, a rising tropical export crop. With 76.9% of global production, Asia leads the pack, followed by America (13.38%), Africa (9%), and Europe and Oceania (less than 1% apiece). With an output of 938 thousand tons and a 7.6% market share, Pakistan is ranked fifth among the major mango-producing nations (Sauco, 2002).

One of the most significant and ancient tropical fruits is the mango. Originating in South Asia, the mango has spread around the world to become one of the most widely grown tropical fruits. The only mango tree that is typically grown in many tropical and subtropical regions is Mangifera indica, also known as the "common mango" (Jash et al., 2015). Nearly all tropical and subtropical nations cultivate it. Its birthplace was a tropical to subtropical monsoon region in the foothills of the Himalayas, particularly in eastern India and Burma. Africa, Brazil, the Caribbean, and Central America were later affected. Mangoes are produced in great quantities in Pakistan. In 2013, the world produced around 43 million tons of mangoes, of which 42% (18 million tons) were from India. The next top producers were China and Thailand (FAO 2017).

Pakistan's second-largest fruit, mangos, are produced on 93.42 thousand hectares and yield 915.7 thousand tons (GOP, 2014). Although more land is being used for mango production, the rate of increase in output has been rather slow. In the province of Sindh, Sanghar, Mirpur Khas, Hyderabad, and Thatta are the primary mango-growing districts. It is grown in Peshawar and Mardan in the province of KPK, and in the Punjab province, in Multan, Bahawalpur, Muzaffar Garh, and Rahim yar Khan (GOP, 2014). Due to Sindh's warmer climate and one month earlier arrival than Punjab, the province has been able to cultivate early mango types. A new practice of cultivating late varieties in Punjab has since gained widespread popularity, extending the market season and increasing the amount of excess that can be exported (GOP, 2014). Pakistan's mango season begins in late May with the harvest from Sindh region and ends in late August in Punjab. The two most common mango varieties in Pakistan are Sindhri and Chounsa, while some areas of the provinces of Sindh and Punjab also grow Dosehri, Malda, Swarnarika, Langra, Siroli, Alphonso, Gulab Khas, Fajri, Golden, Anwar Ratol, and Begun Phali. In contrast to Punjab, where Chounsa is the predominant crop, Sindhri is primarily cultivated in Sindh. The industry views Chounsa and Sindhri as good cultivars with good taste that are in high demand in both domestic and foreign markets (PHDEB, 2005).

According to estimates from the World Health Organization (WHO), 80% of people in underdeveloped nations get their primary medical care from traditional medicine, primarily plant-based medications (Malhotra et al., 2010). The most delicious fruit is the mango. It is favored for its nutritious value to our diet in addition to its pleasing flavor and aroma. Along with vitamins A and C and minerals like iron and phosphorus, it is an essential source of energy. Mangos that are juicy are preferred while making squash. Juices that have been sweetened and have some pulp are called squash. Squash and "cordial" are frequently used interchangeably. Fruit squashes contain at least 25% by volume of a robust iron-rich diet that includes juicy mangoes (Govt. of Pak (2004). Agricultural statistics of Pakistan). Vitamins A, C, B6, E, phenolic components, and carotenoids are all abundant in mango fruit, which is also a great source of fiber. It aids in the production of iron, protects against some types of cancer, and boosts the immune system's ability to fight off illnesses. A popular fruit, mangos are rich in minerals including phosphorus and iron. Additionally, mango fruit can help with kidney issues (Kader et al., 2008).

Fresh and processed mangos are among the commodities exported to the United Kingdom, the United States of America, France, Malaysia, Qatar, and Singapore. Strong anti-oxidant, anti-lipid peroxidation, immunomodulatory, cardiotonic, hypotensive, wound-healing, antidegenerative, and antiluetic properties are also found in mangos. Mango fruits that are ripe are used to make preserves, jams, preserves, juice, syrup, and squash. Because of its short shelf life and high perishability, mango pulp is preserved by adding certain food additives. This is something that both consumers and marketers would like to see extended.

According to the levels outlined in the food additives regulation (No 95/2 EC, 1995), food preservatives are frequently added to a wide variety of foods in the amounts necessary to regulate biochemical changes, such as the growth of microbes and the oxidation of vitamins, colorants, tastes, etc. Benzoic, acetic, sorbic, and propionic acids are the main weak organic acid food preservatives. These substances, along with sulphite, make up the most common acid preservatives used in commercial food and beverage manufacturing. As allowed by law, sulfur dioxide, benzoic acid, and sulfuric acid can be added to food alone or in combination, at amounts up to 0.1% (by food weight) (Dong and Wang, 2006; Ping et al., 2009).

MATERIALS AND METHODS

Selection of Fruits

Best quality fresh, mature and juicy fruits of mango were selected and bought from local fruit market of Peshawar and brought to Food processing lab of Nuclear Institute for Food and Agriculture Peshawar, KPK Pakistan.

Washing of Fruits

All the fruits were washed with water and kept at room temperature (20~25^{O}C) till further processing.

Peeling & Coring

After washing of fruits these fruits were peeled off and the seeds were been removed.

Extraction of Mango Pulp

The pulp from ripe mango pulp was extracted with the help pulper.

Preparation of Mango Squash

Pulp was taken in a kettle then water and sugar were added according to proposed plan.
Four bottles were taken and labelled as T_0, T_1, T_2 and T_3 according to proposed plan and all the samples were preserved with preservatives according to proposed plan. All the samples were stored at ambient temperature (25-30 c) and were analyzed physiochemically (Titratable acidity, Ascorbic acid, pH, TSS) and organoleptically

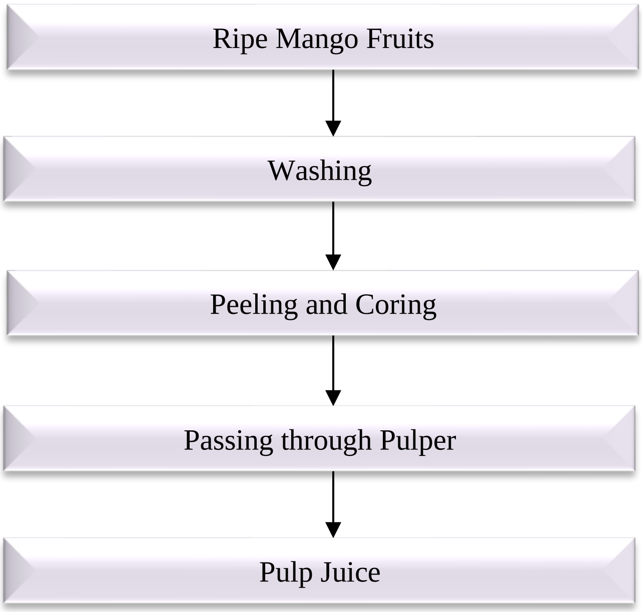
(Color, Flavor and Overall acceptability). The research was conducted in the laboratory of the section of Food Technology, Nuclear institute for food and agriculture (NIFA), Peshawar.

Table 1

Treatments	Pulp	Water	Preservative	Preservative amount
T_0	3.5 kg	3.5 L	Control	0
T_1	3.5 kg	3.5 L	S.B	3.5g
T_2	3.5 kg	3.5 L	P.M.B.S	2.1g
T_3	3.5 kg	3.5 L	S.B+P.M.B.S	1.75g+1.05g

Figure 1

Process Flow Chart for Extraction of Mango Juice



Physiochemical Analysis

All the samples were analyzed physiochemically for pH, TSS, AA and Acidity according to the standard methods of AOAC (2012). pH was determined by digital pH meter according to standard method of AOAC (2012) method no920.183. The total soluble solids (TSS) were determined at room temperature by standard method of AOAC (2012) method no 920.183 using ATAGO Japan, hand refractometer (Range 0 – 90 B). Titratable acidity was determined by standard method of AOAC (2012) method no 920.183. Ascorbic acid determination was done by the standard method as detailed in the AOAC (2012) method no 967.21.

Preparation and Standardization of Pigment Solutions

About 50 mgs 2, 6 dichlorophenol indophenols pigment was weighed and sodium bicarbonate of 42 mgs was weighed and scattered in cleaned water, inside the space filled up to 250 milliliters. 50 mgs quality ascorbic acid was taken in a volumetric flask of 50 milliliters, and the volume was made to the mark with acid of 0.4 %. 3ml ascorbic acid solution was titrated against the color solution up to lime light pink color become available, which persisted for ¼ minute.

Sensory Evaluation

Selected samples of mango squash were evaluated organoleptically for color, odor, taste, texture by the method as described by Lamond (1977). Samples were presented to panel of trained judge to compare them and assign them score between 1-9, where 1 represent extremely disliked and 9 represent extremely liked.

Statistical Analyses

All the data concerning storage interval and treatments were statistically investigated by CRD 1 factorial as recommended by Gomez and Gomez (1984) and the means were separated by applying Least Significant Difference (LSD) test at 5% possibility level as defined by Steel and Torrie (1997).

RESULTS AND DISCUSSION

Total Soluble Solids (^{O} Brix)

Table 3.1 shows the values calculated for total soluble solids (TSS) of mango squash samples during storage. The results indicated that there was a gradual increase in total soluble solids content of samples. Initially the TSS of samples was recorded as, T_0 (48), T_1 (47), T_2 (47.3) and T_3 (47.3) ^{O} Brix which was then increased to T_0 (59.8), T_1 (49.5), T_2 (48.8) and T_3 (49.9) ^{O}Brix respectively. The average was increased from 47.4 to 51.5 ^{O} brix. For treatments maximum average value was observed in T_0 (55) followed by T_3 (48.52), while minimum average value was observed in T_2 (47.91) followed by T_1 (48.25) ^{O} brix respectively. Highest % increase was observed in T_0 (24.6%) and minimum in T_2 (3.1%) as shown in (Table 01). This increase in TSS content mango squash during storage was probably due to the conversion of sucrose into glucose and fructose (Tefera et al., 2008). The results are in agreements with the findings of Germain et al., (2003) in mango pulp samples. The same slow increase in total soluble solids content was also shown by Hussain et al., (2008) in their spinach orange carrot juice samples. The results showed that treatments showed significant effect on TSS during storage time of mango-mandarin squash. Shahid et al., (2015) observed that treatments showed an increasing trend during storage time.

Table 3.1

Effect of preservatives and storage intervals on total soluble solids of mango squash

Treatments	Storage intervals (weeks)								%Increase	Average
	1st	2nd	3rd	4rth	5th	6th	7th	8th		

T_0	48	51.3	53.4	54.9	56.7	57.4	58.6	59.8	24.6	55
T_1	47	47.4	47.6	47.9	48.4	48.9	49.3	49.5	5.3	48.25
T_2	47.3	47.6	47.4	47.6	47.8	48.2	48.6	48.8	3.1	47.91
T_3	47.3	47.6	48.0	48.2	48.6	49.1	49.5	49.9	5.5	48.52
Average	47.4	48.47	49.1	49.65	50.38	50.9	51.5	51.9		

pH

Table (3.2) indicates the pH values of mango squash samples during storage. A gradual decrease was observed in pH content of samples. Initially the pH of samples was recorded as, T_0 (3.45), T_1 (3.39), T_2 (3.30) and T_3 (3.33), which was then decreased to T_0 (2.80), T_1 (3.24), T_2 (3.20) and T_3 (3.16) respectively. The average pH value was decreased for 3.36 to 3.10. Maximum average value was observed in T_1 (3.31) and minimum average value was observed in T_0 (3.10). Highest % decrease in pH content was observed in T_0 (18.8%) followed by T_3 (5%) and minimum in T_2 (3%) followed by T_1 (4.4%) as shown in (Table 3.2). increase in percent acidity and decrease in pH of mango squash showed opposite trend during entire period of study. this may be due to break down of pectic substances into pectic acid (chaurasiya et al., 2014). Decrease in pH during storage was also reported by (Iman et al., 2000) in guava pulp samples , by (Ayub et al., 2009) in strawberry juice samples. The results regarding the decrease in pH during storage time are in accordance with the earlier reports (Germain et al., 2003 and Bajwa et al., 2003). Also Treatments showed a decreasing trend in pH during storage (Punam et al., 2009).

Table 3.2

Effect preservatives and storage intervals on the pH of mango squash

Treatments	Storage intervals (weeks)								%Decrease	Average
	1st	2nd	3rd	4rth	5th	6th	7th	8th		
T_0	3.45	3.41	3.39	3.22	2.91	2.85	2.83	2.80	18.8	3.10
T_1	3.39	3.37	3.36	3.32	3.30	3.29	3.27	3.24	4.4	3.31
T_2	3.30	3.29	3.27	3.25	3.24	3.22	3.22	3.20	3	3.25
T_3	3.33	3.31	3.29	3.26	3.22	3.20	3.19	3.16	5	3.24
Average	3.36	3.34	3.32	3.26	3.16	3.14	3.12	3.10		

Titratable acidity (%)

Table (3.3) describes the pH values of mango squash samples during storage. There was a gradual increase in acidity of samples. Initially the titratable acidity of the samples was recorded as, T_0 (0.82), T_1 (1.14), T_2 (1.19) and T_3 (1.21) which was then increased to T_0 (2.80), T_1 (3.24), T_2 (3.20) and T_3 (3.16) respectively. The average acidity value was increased from 1.09 to 1.31. For treatments maximum average value was observed in T_3 (1.29) and minimum in T_0 (1.06). Maximum % increase was observed in T_0 (47.5%) followed by T_1 (16.6%) and minimum in T_2 (9%) followed by T_3 (16.5%) as shown in (Table 3.3). Cecilia and Maia (2002) reported that increase in acidity might be due to high storage temperature and formation of acidic compounds by degradation and oxidation of reducing sugars. Another reason for the rise in acidity might be due to the acid formation, reducing sugars oxidation and polysaccharide degradation or by the breakdown of uronic acid and pectin substances. The same increasing trend in acidity was also reported by (Zeb et al., 2009) in grape juice samples and by (Ayub et al., 2001) in pomegranate syrup samples. The results regarding the increase in acidity during storage time are in accordance with the earlier findings (Hussain et al., 2008 and Ahmad et al., 1986). The increase in acidity might be attributed due to the increase in the concentration of powerless ionized acid and their salts during storage. Another reason for the rise in acidity might be due to the acid formation, reducing sugars oxidation and polysaccharide degradation or by the breakdown of uronic acid and pectin substances (Hussain et al., 2008 and Iqbal et al., 2001). The acidity of the fruit samples also tends to increase due to the addition of chemical preservatives (Germain et al., 2003).

Table 3.3

Effect of preservatives and storage intervals on the titratable acidity (%) of mango squash

Treatments	Storage intervals (weeks)								%Increase	Average
	1st	2nd	3rd	4rth	5th	6th	7th	8th		
T_0	0.82	0.89	0.96	1.08	1.14	1.16	1.19	1.21	47.5	1.06
T_1	1.14	1.17	1.19	1.20	1.23	1.25	1.29	1.33	16.6	1.22
T_2	1.19	1.23	1.24	1.24	1.26	1.28	1.29	1.30	9	1.25
T_3	1.21	1.24	1.25	1.26	1.29	1.34	1.37	1.41	16.5	1.29
Average	1.09	1.13	1.16	1.20	1.23	1.25	1.28	1.31		

Ascorbic acid (mg/100g)

Table (3.4) shows the ascorbic acid content of samples during storage. There was a gradual decrease in ascorbic acid content of mango squash samples during storage. Initially the ascorbic acid content of samples was recorded as T_0 (5.19), T_1 (5.36), T_2 (5.12) and T_3 (5.14) which was then decreased to T_0 (2.27), T_1 (4.21), T_2 (4.55) and T_3 (4.31) respectively. The average ascorbic acid content of samples was decreased from 5.20 to 3.83. For treatments the maximum average value was recorded in T_3 (4.83) followed by T_2 (4.80) and minimum in T_0 (3.57) followed by T_1 (4.76) respectively. Highest % decrease was observed in T_0 (56%) followed by T_1 (21%) and lowest in T_2 (11%) followed by T_3 (16%) as shown in (Table 3.4). Decrease in ascorbic acid content is due to the presence of oxygen product and other cause is head space in the product packaging (Wisal et al., 2008). Decrease in ascorbic acid content was also reported by (Mehmood et al., 2008) in apple juice samples, by (Zeb et al., 2008) in grape juice samples and by (Azerdo et al., 2000) in mango leather samples. (Hussain et al., 2005) recorded 26-50% losses in vitamin C content of mango squash during three months storage. The results are in agreement with reports of Deka et al. (Rodriguez et al., 1995) in mango pineapple based spiced beverages throughout six months storage period. (Punam et al., 2009) in bael-mango RTS drink and squash during 90 days storage. (Ismail et al., 2011) in whey based mango beverages, (Kumar et al., 2014) in bael-mango nectar and crush during three months storage at room temperature. Lakhanpal and Vaidya (2015) in mango nectar during six months storage.

Table 3.4

Effect preservatives and storage intervals on the ascorbic acid content of mango squash

Treatments	Storage intervals (weeks)								%Decrease	Average
	1st	2nd	3rd	4rth	5th	6th	7th	8th		
T_0	5.19	4.89	4.23	3.71	3.16	2.73	2.39	2.27	56	3.57
T_1	5.36	5.22	5.09	4.88	4.63	4.42	4.29	4.21	21	4.76
T_2	5.12	5.06	4.91	4.84	4.73	4.65	4.59	4.55	11	4.80
T_3	5.14	5.04	5.89	4.73	4.64	4.51	4.40	4.31	16	4.83
Average	5.20	5.05	5.03	4.54	4.29	4.07	3.91	3.83		

Organoleptic Evaluation

Color

Table (3.5) shows the color score of mango squash samples. There was a gradual decrease in color score of mango squash samples during storage. Initially the color score of samples was recorded as, T_0 (8.3), T_1 (8.0), T_2 (8.5) and T_3 (8.1) which was then decreased to T_0 (4.1), T_1 (5.3), T_2 (6.9), T_3 (6.0) respectively. The average score was decreased from 8.22 to 5.57. For treatments maximum average score was observed in T_2 (7.76) followed by T_3 (6.75) and minimum in T_0 (5.77) followed by T_1 (6.63). Highest % decrease in color was observed in T_0 (50.6%) followed by T_1 (33.7%) and lowest % decrease was observed in T_2 (18.8%) followed by T_3 (25.9%) as shown in (Table 3.5). .The reduction in color might be due to maillard reaction accelerated during storage. The same decrease in color score was shown by (Brenndor et al., 1985) in post-harvest dried samples and by Haikal and sidawi (1985), in lime and orange juice samples. The color of fruit pulp tends to decrease periodically (Saini et al.,2003;Sofos and Busta, 1981). Gliemmo et al., (2009) stated that oxygen promotes carotenoid degradation by oxidation, and cause the development of off-flavors and off-color, due to the reduction of the oxygen in the headspace. The interaction between sugars and amino acid in acidic condition led to maillard reaction. Maillard reaction darkened the colour of squashes during storage (Kumari and Sandal, 2011). (Ahmed et al., 1993) reported that squashes were acceptable even after 4 months of storage at 22-36°C. (Kalra et al., 1994) also showed decreasing trend in sensory parameters of mango RTS drink throughout the storage period.

Table 3.5

Effect of preservatives and storage intervals on the color of mango squash

Treatments	Storage intervals (weeks)								%Decrease	Average
	1st	2nd	3rd	4rth	5th	6th	7th	8th		
T_0	8.3	7.2	6.1	5.6	5.3	4.9	4.7	4.1	50.6	5.77
T_1	8.0	7.7	7.3	6.9	6.2	5.9	5.8	5.3	33.7	6.63
T_2	8.5	8.3	8.1	7.8	7.6	7.6	7.3	6.9	18.8	7.76
T_3	8.1	7.4	7.1	6.4	6.6	6.3	6.1	6.0	25.9	6.75
Average	8.22	7.65	7.15	6.67	6.42	6.17	5.9	5.57		

Flavor

Table 3.6 shows the flavor score of mango squash samples during storage. The results showed that There was a gradual decrease in flavor score of mango squash samples during storage. Initially the flavor score of samples was recorded as, T_0 (8.0), T_1 (8.1), T_2 (8.2) and T_3 (8.0) which was then decreased to T_0 (3.1), T_1 (5.2), T_2 (6.8), T_3 (5.7) respectively. The average score was decreased from 8.1 to 5.2. For treatments maximum average score was observed in T_2 (7.68) followed by T_1 (6.8) and minimum in T_0 (5.93) followed by T_3 (6.78). Highest % decrease in flavor of samples was observed in

T_0 (61.2%) followed by T_1 (35.8%) and lowest % decrease was observed in T_2 (17%) followed by T_3 (28.7%) as shown in (Table 3.6). . The work of (Bezman et al., 2001) in different juice samples are also in accordance with our results. Similar results obtained by Chauhan et al. (1993), who observed that apricot preserved with chemical preservatives maintained good flavor during storage. The results are in accordance with the Hussain et al. (2005) who studied the influence of storage and cultivars on overall acceptability and quality of mango squash and also observed that the quality parameters like color and flavor decreased during storage. Flavor decreased as the time proceeded. Gliemmo et al. (2009) stated that oxygen promotes carotenoid degradation by oxidation, and cause the development of off-flavors and off-color, due to the reduction of the oxygen in the headspace.

Table 3.6

Effect of preservatives and storage intervals on the flavor of mango squash

Treatments	Storage intervals (weeks)								%Decrease	Average
	1st	2nd	3rd	4rth	5th	6th	7th	8th		
T_0	8.0	7.5	7.0	6.6	6.1	5.2	4.0	3.1	61.2	5.93
T_1	8.1	7.8	7.4	7.1	6.9	6.1	5.8	5.2	35.8	6.80
T_2	8.2	8.5	8.1	7.9	7.7	7.3	7.0	6.8	17	7.68
T_3	8.0	7.6	7.4	7.1	6.5	6.1	5.9	5.7	28.7	6.78
Average	8.10	7.85	7.47	7.17	6.80	6.17	5.7	5.20		

Overall Acceptability

Table 3.7 shows the score for overall acceptability of mango squash samples during storage. The results showed that There was a gradual decrease in overall acceptability of mango squash samples during storage. Initially the score of samples was recorded as, T_0 (7.6), T_1 (7.8), T_2 (8.0) and T_3 (7.8) which was then decreased to T_0 (3.2), T_1 (5.5), T_2 (6.7), T_3 (7.1) respectively. The average score was decreased from 7.80 to 5.37. For treatments maximum average score was observed in T_2 (7.26) followed by T_3 (7.02) and minimum in T_0 (5.81) followed by T_1 (6.63). Highest % decrease in overall acceptability of samples was observed in T_0 (58%) followed by T_1 (29.4%) and lowest % decrease was observed in T_2 (16.2%) followed by T_3 (21.7%) as shown in (Table 3.7). Punam et al. (2009) reported a decline in overall acceptability of bael-mango RTS drink and squash during three months storage.]. Bhagwan and Awadhesh. (2014), reported similar results in mango-ginger RTS beverage during four months storage. According to Picouet et al. (2009) and Larmond (1977) , the overall acceptability of chemically preserved fruit beverages depended on what sort of chemical treatment were applied to them.

Table 3.7

Effect of preservatives and storage intervals on the overall acceptability of mango squash

Treatments	Storage intervals (weeks)								%Decrease	Average
	1st	2nd	3rd	4rth	5th	6th	7th	8th		
T_0	7.6	7.4	6.9	6.0	5.6	5.2	4.6	3.2	58	5.81
T_1	7.8	7.4	7.1	6.8	6.5	6.1	5.9	5.5	29.4	6.63
T_2	8.0	7.9	7.6	7.3	7.1	6.8	6.7	6.7	16.2	7.26
T_3	7.8	7.6	7.5	7.3	6.9	6.6	6.4	6.1	21.7	7.02
Average	7.80	7.57	7.27	6.85	6.25	6.17	5.90	5.37		

CONCLUSIONS AND RECOMMENDATIONS

From this study it was concluded that the addition of preservatives strongly affect the products shelf life and consumer acceptability. On the basis of different parameters and analysis it was observed that T_2 (mango pulp 3.5 kg, water 3.5 L, potassium meta bi sulphite 2.1 g) was found very acceptable both physiochemically and organoleptically during storage period of 2 months while T_0 (mango pulp 3.5 kg, water 3.5 L, no preservative) was found very bad both physiochemically and organoleptically during storage due to the absence of chemical preservatives and spoilage causing agents spoiled the product samples.

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