Research Article

Effect of Different Food Preservatives on the Storage Stability of Peach Persimmon Blended Pulp

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Abstract | This study was designed to investigate the effect of food preservatives (potassium sorbate, potassium metabisulphite and sodium benzoate) on the storage stability at ambient temperature (25 ± 5˚C) of blended pulp of peach and persimmon. Effect of preservatives on physico-chemical parameters (total soluble solids, pH, titratable acidity, total phenolic compounds, ascorbic acid content and antioxidant activity) and sensory evaluation of blends was carried out. The treatments in this study included BP_0 [peach persimmon blend (6:4)], BP_1 [peach persimmon blend (6:4) + potassium sorbate (0.1%)], BP_2 [peach persimmon blend (6:4) + potassium metabisulphite (0.1%)], BP_3 [peach persimmon blend (6:4) + sodium benzoate (0.1%)], BP_4 [peach persimmon blend (6:4) + potassium sorbate (0.05%) + potassium metabisulphite (0.05%)], BP_5 [peach persimmon blend (6:4) + potassium sorbate (0.05%) + sodium benzoate (0.05%)], BP_6 [peach persimmon blend (6:4) + potassium metabisulphite (0.05%) + sodium benzoate (0.05%)], BP_7 [peach persimmon blend (6:4) + potassium sorbate (0.033%) + potassium metabisulphite (0.033%) + sodium benzoate (0.033%)]. The results revealed decline ($P < 0.05$) in pH, total phenolic content, antioxidant activity, ascorbic acid and sensory attributes whereas increase was observed in TSS and titratable acidity. The pH, total phenolic compounds, antioxidant activity and ascorbic acid content decreased from 3.84 to 3.16, 36.18 to 23.08 mg GAE/100g, 85.31 to 50.31 TE/100g and 28.31 to 13.47 mg/100 g respectively. Similarly, the values of titratable acidity and total soluble solids increased from 0.67 to 0.77 % and 9.12 to 10.59 ˚Brix respectively. On the basis of sensory evaluation BP_7 and BP_4 obtained maximum mean scores for color, flavor and overall acceptability. From the overall results, it was concluded that ($P < 0.05$) blended pulp treatment BP_7 (blended pulp + 0.033% potassium sorbate + 0.033% potassium metabisulphite + 0.033% was found best among all the treatments.

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Keywords | Peach-persimmon blended pulp, Food preservatives, Storage conditions, Sensory quality

Introduction

Persimmon (Diospyros) belongs to Ebenaceae family (Giordani, 2002) and peach is a member of Rossaceae family. The current persimmon (*Diospyros*) production of Pakistan is 25083 tonnes whereas the total peach (*Prunus persica*) production is 72536 tonnes during the year 2017-18 (MNFSR, 2019). These fruits are potential source of antioxidants. The major antioxidants present in both fruits are phenolic compounds which play a vital role in the prevention of various ailments such as inflammation, constipation, gastric ulcers and cancer (Maleeha et al., 2012).

Due to the high moisture content, nutrients availability and favorable pH fruits are more susceptible to

pathogenic fungi, resulting in making fruits unsound for human consumption. Furthermore, lack of storage and processing facilities, farmers are enforced to dispose their harvest of fruits at nominal prices leading to diminishing returns (Omolo et al., 2011).

In order to overcome the post harvest losses of fruits and vegetables during the glut season and uplift the socio-economic condition of the farmer community, there is dire need for carrying out the value addition of the produce. Value addition involves various techniques that enhance the commodities value. It may include the food processing by which various food products can be prepared from fruits e.g. fruit squashes, jams, pickles and juices etc. The main advantage of food processing and preservation is to increase the shelf life of produce and store it beyond its glut season (Parveen et al., 2014).

The main objective of this research was to investigate the effect of various food preservatives (potassium sorbate, potassium metabisulphite and sodium benzoate) on the storage stability of peach persimmon blended pulp.

Materials and Methods

Sample collection

Fresh persimmon and peach fruits were purchased from the local market. Peach fruit (A-8 variety) and persimmon fruit (Fuyu) was procured in the month of August and November respectively from local market of Peshawar city, Khyber Pakhtunkhwa Pakistan.

Sample preparation

Peach and persimmon fruits were thoroughly washed with potable water to remove any dirt and foreign materials. The pulp of peach and persimmon was extracted by using pulper machine and was mixed in the ratio of 6:4 respectively. Various chemical preservatives like potassium sorbate (KS), sodium benzoate (SB) and potassium metabisulphite (KMS) were added alone and in different combinations to blended pulp. The different treatments used in this research experiment are as follows.

BP_0 = *Peach persimmon blend*

BP_1 = *Peach persimmon blend+potassium sorbate at 0.1%*

BP_2 = *Peach persimmon blend+potassium metabisulphite at 0.1%*

BP_3 = *Peach persimmon blend + sodium benzoate at 0.1%*

BP_4 = *Peach persimmon blend + potassium sorbate at 0.05% + KMS at 0.05%*

BP_5 = *Peach persimmon blend + potassium sorbate at 0.05% + sodium benzoate at 0.05%*

BP_6 = *Peach persimmon blend + potassium metabisulphite at 0.05% + sodium benzoate at 0.05%*

BP_7 = *Peach persimmon blend + KS at 0.033% + KMS at 0.033% + sodium benzoate at 0.033%*

Analytical work

The pH was determined using digital pH meter, TSS were measured by the digital refractometer, acidity and ascorbic acid content were analyzed in blended pulp of peach and persimmon according to standard method of AOAC (2012). Total phenolic compounds were determined according to the procedure reported by Mazumdar and Majumder (2003). Radical scavenging activity (DPPH) was determined according to procedure described by Brand Williams et al. (1995) in blended pulp samples.

Sensory evaluation

Sensory characteristics for the blended pulp samples were evaluated by using 9-point Hedonic Scale as described by Rios-Corripio et al. (2018).

Statistical analysis

All the data were analyzed by using MSTATC software. A two factorial complete randomized design (CRD), with three replications for each treatment, was applied. Means were separated using Least Significant Difference (LSD) test at 5% level of significance.

Results and Discussion

Physico-chemical analysis

Total soluble solids (TSS): The influence of preservatives on blended peach persimmon pulp showed increase during six months storage period on total soluble solids. The TSS mean value was increased (9.12 to 10.59° Brix) significantly ($p< 0.05$). The highest value of TSS (9.79°Brix) among all treatments was found in BP_3 followed by BP_6. The lowest value of TSS (9.55°Brix) was recorded in BP_7 followed by BP_1. The maximum increase of TSS (13.40%) was recorded in BP_1 followed by BP_4 (Figure 1). TSS content of blended pulp was inclined by storage and treatments significantly. Kumhar et al. (2014) also reported similar findings during storage studies of custard apple pulp. This change in total

soluble solids may be the inversion of sucrose into glucose and fructose at low pH and temperature. It may also be due to the hydrolysis of cell wall components (Hossain et al., 2014).

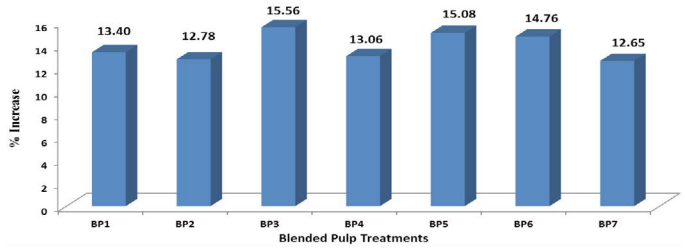

Figure 1: *Percent increase in TSS of blended pulp stored at ambient conditions.*

pH

The change in pH of blended pulp of peach and persimmon showed decrease during the storage period. The mean pH value decreased significantly ($p < 0.005$) from 3.84 to 3.16. BP_4 (3.66) had maximum mean pH value followed by BP_2 (3.65) within all treatments whereas minimum mean pH value was found in BP_o (3.44) followed by BP_3 (3.53) and BP_7 (3.53). Maximum decrease was observed in sample BP_o (26.16 %) followed by BP_3 (25.78%) as compared to all treatments whereas lowest decline was in BP_7 (11.13%) followed by BP_1 (12.76%) as shown in Figure 2. The effect of storage period and treatments was significant ($p < 0.05$) on the pH of blended pulp. Hussain et al. (2008) reported decrease in pH during storage of apple jam and described the reason of pH decline as the breakdown of pectin in organic acid.

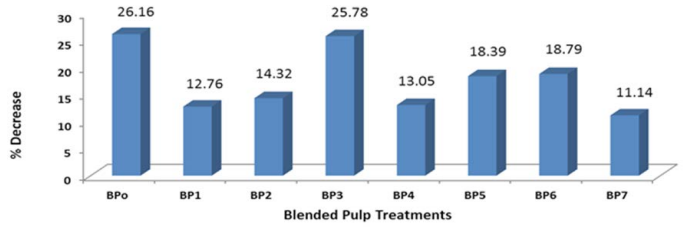

Figure 2: *Percent decrease in pH of blended pulp stored at ambient conditions.*

Titratable acidity

Variation in acidity of blended pulp showed decrease during storage period. Mean value of acidity of blended pulp increased significantly ($p<0.05$) from 0.67% to 0.77%. BP_0 (0.75%) had maximum mean non-reducing sugars value followed by BP_1 (0.72%) and BP_6 (0.72%) within all treatments whereas minimum mean acidity was observed in BP_2 (0.70%), BP_4 (0.70%) and BP_7 (0.70%) followed by BP_3 (0.71%) and BP_5 (0.71%). Maximum increase in acidity was observed in sample BP_0 (20.93%) followed by BP_6 (16.25%) as compared to all treatments whereas lowest decline was in BP_4 (8.33%) followed by BP_7 (9.33%) as shown in Figure 3. Treatments and storage intervals affected acidity of blended pulp significantly ($p<0.05$). Iqbal et al. (2001) reported the same trend in acidity and revealed that it may be due to the increase in formation of acids which are due to increase in concentration of weakly ionizing acids and respective salts. Ayub et al. (2010) also found that acidity of strawberry juice also significantly increased with storage period. The increase in acidity is due to degradation of pectin substances into organic compounds as reported by Durrani et al. (2010) and Zeeshan et al. (2018).

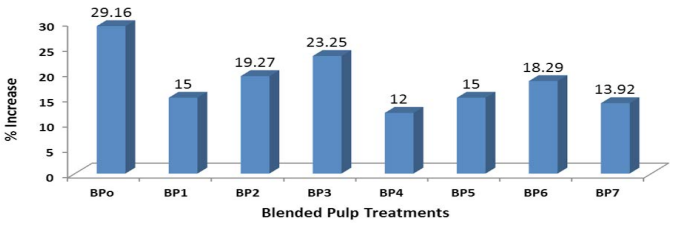

Figure 3: *Percent increase in acidity of blended pulp stored at ambient conditions.*

Total phenolic compounds

Impact of preservatives on total phenolic compounds of blended pulp showed decrease during storage period. Total phenolic compounds of blended pulp were significantly affected ($p<0.05$) by the storage period and treatments. Total phenolic compounds decreased in blended pulp samples during storage period of 180 days at ambient temperature. Mean value of total phenolic compounds of blended pulp decreased from 36.18 to 23.08 mg GAE/100g. BP_7 (32.41 mg GAE/100g) had maximum mean total phenolic compounds value followed by BP_2 (32.40 mg GAE/100g) within all treatments whereas minimum mean total phenolic compounds was observed in BP_1 (27.29 mg GAE/100g), followed by BP_3 (30.93 mg GAE/100g). Maximum decrease in total phenolic compounds was observed in sample BP_0 (65.01%) followed by BP_3 (40.52%) as compared to all treatments whereas lowest decline was in BP_7 (29.42%) followed by BP_1 (29.67%) as shown in Figure 4.

Ascorbic acid

The effect of chemical preservatives on the ascorbic acid showed decrease during storage period of 180 days in blended pulp at ambient conditions. The storage period and temperature significantly effected

($p<0.05$) the ascorbic acid of blended pulp samples. Ascorbic acid content (mg/100g) decreased in blended pulp samples during storage period. Mean value of ascorbic acid of blended pulp decreased from 6.72 to 2.82. BP_7 (5.62) had maximum mean ascorbic acid value followed by BP_4 (5.47) within all treatments whereas minimum mean ascorbic acid was observed in BP_1 (1.96), followed by BP_6 (4.22). Maximum decrease in ascorbic acid was observed in sample BP_0 (99.38%) followed by BP_3 (73.94%) as compared to all treatments whereas lowest decline was in BP_7 (38.35%) followed by BP_4 (39.85%) as shown in Figure 5. Hashmi et al. (2007) also found the same trend in mango pulp with the storage period. The loss of ascorbic acid in the blended pulp might be due to degradation with heat and temperature.

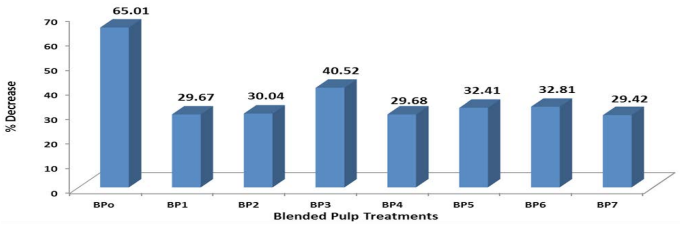

Figure 4: *Percent decrease in total phenolic content of blended pulp stored at ambient conditions.*

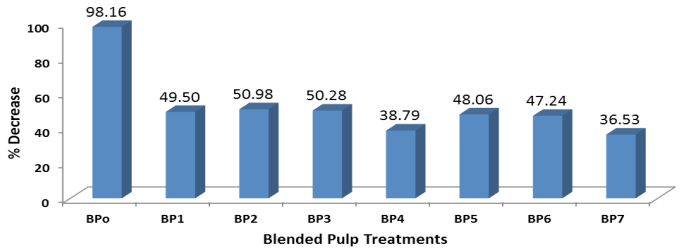

Figure 5: *Percent decrease in ascorbic acid of blended pulp stored at ambient conditions.*

Antioxidant activity

Impact of preservatives on antioxidant activity of blended pulp showed decrease during the storage duration of 180 days at ambient conditions. The antioxidant activity of blended pulp was significantly affected ($p < 0.05$) by storage duration and temperature. Antioxidant activity decreased in blended pulp samples during storage duration. Mean value of antioxidant activity of blended pulp decreased from 85.31 to 50.31. BP_7 (77.59) had maximum mean antioxidant activity value followed by BP_4 (77.38) within all treatments whereas minimum mean antioxidant activity was observed in BP_1 (29.7), followed by BP_3 (71.37). Maximum decline in antioxidant activity was observed in sample BP_0 (97.24%) followed by BP_3 (51.42%) as compared to all treatments whereas lowest decrease was in BP_4 (24.54%) followed by BP_7 (24.55%) as shown in Figure 6. Mariana-Atena et al. (2011) observed decrease in antioxidant activity of strawberry, sweet and sour cherry low sugar jam during storage studies. Deng et al. (2018) also reported decline in antioxidant activity of litchi pericarp during storage studies. The decrease in antioxidant activity is related to oxygen and free radicals which protect the juice from oxidation and these compounds get oxidized by reacting themselves with oxygen (Ismail et al., 2004).

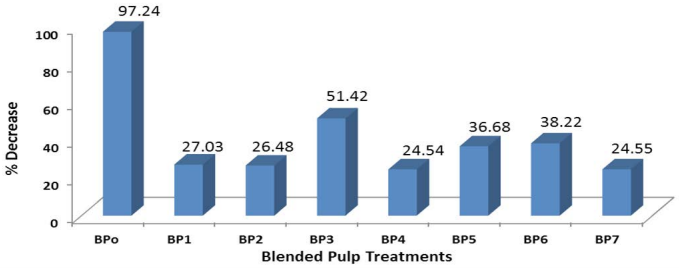

Figure 6: *Percent decrease in antioxidant activity of blended pulp stored at ambient conditions.*

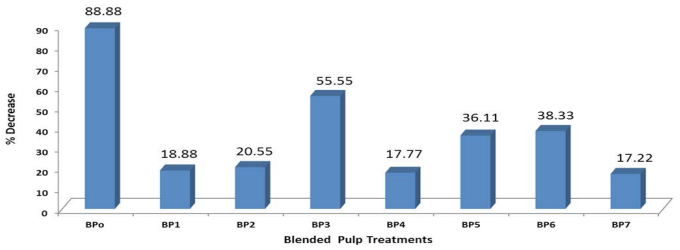

Figure 7: *Percent decrease in color of blended pulp stored at ambient conditions.*

Sensory evaluation

Nine point hedonic scale was used by the judge's panel for the organoleptic evaluation of blended peach and persimmon pulp during storage.

Color

Score for color decreased in blended peach and persimmon pulp during storage period of six months at ambient temperature conditions. Decrease in mean values for color was observed from 9.00 to 5.70 during the storage of blended pulp. BP_7 (8.29) had maximum mean score for color followed by BP_1 (8.23) and BP_2 (8.23) within all treatments whereas minimum mean score for color was observed in BP_0 (2.95), followed by BP_3 (7.16). Maximum decrease in score for color was observed in sample BP_0 (88.88%) followed by BP_3 (55.55%) as compared to all treatments whereas lowest decline was in BP_7 (17.22%) followed by BP_4 (17.77%) as shown in Figure 7. Blended pulp color was significantly affected ($p< 0.05$) by storage period

and treatments. Shahnawaz et al. (2012) reported decrease in color with storage duration in the refrigerated storage studies of mango seabuckthorn blended pulp with selected preservative and ginger extract. Akhter et al. (2009) also observed that deterioration of color of mango pulp with addition of potassium metabisulphite and sodium benzoate in synergistic concentration.

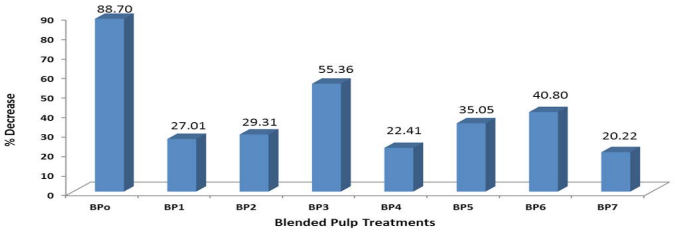

Figure 8: *Percent decrease in flavor of blended pulp stored at ambient conditions.*

Flavour

Score for flavor decreased in blended peach and persimmon pulp during storage period of 180 days at ambient temperature conditions. Decrease in mean values for flavor was observed from 8.73 to 5.24 during the storage of blended pulp. BP_7 (8.03) had maximum mean score for color followed by BP_4 (7.89) within all treatments whereas minimum mean score for flavor was observed in BP_0 (2.60). Maximum decrease in score for flavor was observed in sample BP_0 (88.70%) followed by BP_3 (55.36%) as compared to all treatments whereas lowest decline was in BP_7 (20.22%) followed by BP_4 (22.41%) as shown in Figure 8. Blended pulp flavor was significantly affected ($p< 0.05$) by storage period and treatments. Shahnawaz et al. (2012) reported decrease in flavor in the refrigerated storage studies of mango seabuckthorn blended pulp with selected preservative and ginger extract. Akhter et al. (2009) also observed that deterioration of flavor of mango pulp with addition of potassium metabisulphite and sodium benzoate either individually or in combination.

Overall acceptability

Overall acceptability of any food product plays vital role in product development. Score for overall acceptability decreased in blended peach and persimmon pulp during storage period of six months at ambient temperature conditions. Decrease in mean values for overall acceptability was observed from 8.87 to 5.47 during the storage of blended pulp. BP_7 (8.16) had maximum mean score for overall acceptability followed by BP_4 (8.05) within all treatments whereas minimum mean score for overall acceptability was observed in BP_0 (2.64). Maximum decrease in score for overall acceptability was observed in sample BP_0 (88.81%) followed by BP_3 (55.59%) as compared to all treatments whereas lowest decline was in BP_7 (18.41%) followed by BP_4 (20.11%) as shown in Figure 9. Blended pulp overall acceptability was significantly affected ($p< 0.05$) by storage period and treatments. Shahnawaz et al. (2012) reported decrease in overall acceptability in the refrigerated storage studies of mango seabuckthorn blended pulp with selected preservative and ginger extract. Akhter et al. (2009) also observed significant decrease in overall acceptability of mango pulp with addition of chemical preservatives.

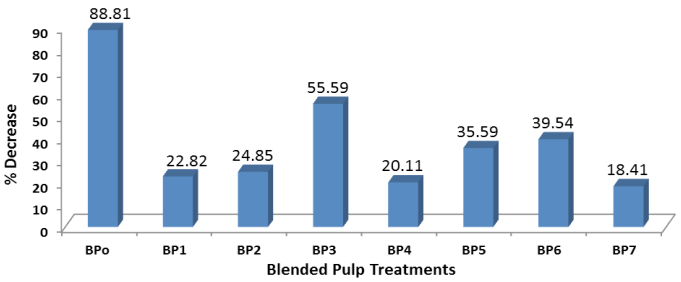

Figure 9: *Percent decrease in overall acceptability of blended pulp stored at ambient conditions.*

Conclusions and Recommendations

In present research work, it was found that the addition of food preservatives positively affected the physico-chemical and sensory characteristics of peach and persimmon blended pulp. The overall results showed that blended pulp treatment BP_7 (blended pulp + 0.033% potassium sorbate + 0.033% potassium metabisulphite + 0.033% sodium benzoate) was found best among all the treatments. Furthermore, it was also observed that treatments in which preservatives were used in combinations showed better physico-chemical and sensory attributes than the individual ones. It is recommended that food preservatives in combinations may be added in small quantities to get better end products as compared to high doses of single preservatives.

Novelty Statement

This is the first study to carryout value addition of peach pulp with persimmon pulp to overcome the postharvest losses of fruits. This will provide an opportunity to food industry as persimmon fruit has no

commercial utilization.

Author's Contribution

Ghulam Mohi Uddin Paracha: Conceived the basic idea, performed experiments, data entry, statistical analysis and wrote the manuscript.
Yasser Durrani: Supervised the research and improved the manuscript.

Conflict of interest

Authors have declared no conflict of interest.

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