EFFECT OF CHEMICAL PRESERVATIVES ON OVERALL QUALITY OF PULP PREPARED FROM WILD APRICOT GROWN IN AZAD KASHMIR

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ABSTRACT

The study was conducted to determine the effect of sodium benzoate andpotassium metabisulphite on the overall quality of wild apricot pulp stored inplastic jars at room temperature for three months. The data was analyzed afterfifteen days gap. The treatments applied during study were AP_0 (without preservative control), AP_1(0.05% sodium benzoate), AP_2 (0.05% potassium metabisulphite), AP_3 (0.1% sodium benzoate), AP_4 (0.1% potassium metabisulphite), and AP_5 (0.05%sodium benzoate + 0.05% potassium metabisulphite). The treated samples wereanalyzed for pH, total soluble solids (TSS), reducing sugar, non-reducing sugar,acidity and ascorbic acid and organoleptically for color, flavor and overall acceptability. The results revealed that with the passage of time gradual decrease was noted in pH (3.68-3.25), non-reducingsugar (4.16-3.34) and ascorbic acid contents (7.31-5.42 mg/100g), while an increase was observed in total soluble solids (15.0-16.64 ^oBrix), reducing sugar(5.59-6.28) and acidity (0.60-0.88) during storage. During the storage periods, organoleptic evaluation, flavor and overall acceptability were decreased.

Keywords:

Wild apricot, chemical characterization, sodium benzoate, potassium metabisulphate, Azad Kashmir.

Practical Application:

Wild apricots are a good source of carbohydrates, vitamins and minerals besideshaving attractive color and typical flavor. Wild apricots are incompatible for fresh consumption because of their high acid and low sugar content. However,the fruits are traditionally utilized for open sun drying pulping to preparedifferent products such as jams, chutney and naturally fermented and softdrinks.The apricot seed oil and press cake have been utilized to prepare various value-added products such as facial cream, lip balm, essential oil andprotein isolate with good quality attributes and consumer acceptability.

1 Introduction

Apricot fruit (*Prunus armeniaca*. L.)belongs to Rosaceae family. It isnative to China and is widely adapted to the Mediterranean climate. In the local language, it is also called khubani and is one of the most important fruits grown worldwide. It is consumed worldwide due to its pleasant and delightfularoma (Gutierrez *et al.* 2007). The major ecological zones in Pakistan forapricot production are the Northern Areas, Malakand division of KPK andupper parts of Baluchistan province. Favorable environmental conditions of this region enable the production of quality apricots with high dry matter andsugar contents apricot is the major fruit crop of the Northern Areas. Having 1.8 million fruit-bearing trees with an annual production of 0.11million Mt. It contributes to 62% share of total fruit production of the area (DOA, 2008).

Apricot is the 16th cultivated fruit in the world largely cultivated in mediterrianregion. During 2014-2015 1, 70,504 tons total production of apricots in Pakistanon total area of 24,112 hectares was reported (Agri. Stat. of Pak.2016), ministry ofnational food security and research). Owing to the perishable nature of this fruitand limited marketing opportunities, a large proportion is wasted during glutseason and the losses are as higher as 44% of the total fresh product (FAO, 2007).

Nutritionally, apricot is a rich source of sugars, fibers, minerals (K, Na, Ca, Zn,Co, Fe) and vitamins like A, C, E, thiamine, riboflavin, niacin and pantothenicacid (Leccese*et*

al., 2007; Sartaj *et al* 2011). In addition, apricot fruit is knownto contain appreciable amounts of carotenoids (mainly b-carotene) and bioactivephytochemicals such as chlorogenic, caffeic, p-coumaric and ferulic acids(Dragovic *et al* 2007). In a nutrition point of view, hundred grams of fresh apricothas about 48 Kcal energy, 11.0 g carbohydrates, 2.0 g fiber, 1.40g protein, 0.4gram fat, 10 mg ascorbic acid, 9.0 g sugar. (USDA,2011).However, high respiration and fast ripening rate of the apricot make the shelf lifeof this fruit very short (Jimenez *et al*., 2008). Apricot pulp is a perishableproduct and the pulp has a short shelf life (3-5 days) at ambient temperatureand hardly 2-4 weeks at cold storage. Hence, preserving the pulp for quality retention and extending the storage shelf life is an important consideration(Hussain *et al.*, 2014). Preservatives as a group of chemical compounds deliberately added to food or that appear in food as a result of pre-processing treatment, and processing storage. These include simple organic acids such as propionic, sorbic, and benzoic (Prescott *et al*., 2002).Therefore, the current study focused on the impact of different concentrations of chemical preservatives such as sodium benzoate and potassium metabisulphite on the overall quality of wild apricot pulp stored during the storage period.

2. Materials and methods

Wild apricot was collected from district Haveli AJ&K and brought to theLaboratory of Food Science and Product Development Institute of NationalAgriculture Research Centre, Islamabad.

2.1 Preparation of pulp sample

The pulp was extracted with an electric blender. The extracted pulp was thenpasteurized at 82^0C for 30 min in a water bath described by Ahmad *et al.*,2014, to inactivate pathogenic microorganisms. After pasteurization oncooling, chemical preservatives as per treatment combination were mixed withextracted pulp. Sterilized plastic jars were filled with treated pulp samples 250gand stored under ambient 25 - 30 conditions in the dark for 90 days of storage.

Applied Treatments

AP_0= *Apricot pulp without preservatives

AP_1 = Apricot pulp + 0.05% sodium benzoate

AP_2 = Apricot pulp + 0.05% potassium metabisulphate

AP_3 = Apricot pulp + 0.1% sodium benzoate

AP_4 = Apricot pulp + 0.1% potassium metabisulphate

AP_5 = Apricot pulp + 0.05% sodium benzoate + potassium metabisulphite

2.2 Chemical Characterization

The chemical analysis of the samples in terms of pH, total soluble solids, reducing sugar, non-reducing sugar, titratable acidity, and ascorbic acid content was determinedusing the standard method of AOAC(2012).

2.2.1 pH

The pH of the wild apricort sample were analyzed by following the standard method of AOAC (2012). For this purpose the pH meter was standardized with standard buffer solutions and then the sample (juice) poured in a beaker and the pH electrode dipped in this sample until to recorded a fix data, pH meter electrode was washed with distil water and paper dried each time before the analyze of each sample.

2.2.2 Ascorbic Acid

The ascorbic acid content of the sample was recorded by applying the titramitric method as described in AOAC (2012).

2.2.2.1 Preparation of sample

For this 10 ml of sample was taken in a volumetric flask and made up the volume up to 100 ml with the addition of0.4 %oxalic acids solution.

2.2.2.2 Titration of sample

Sample solution (10 ml) was taken in a conical flask and adds 15 ml 0.4% oxalic acid and was titrated with against the 0.4 % dye solution until pink color appeared for 15-20 seconds. Ascorbic acid content was calculated by the following formula:

mg ascorbic acid per 100 ml juice = dye equivenalent × titer x dilution

2.2.3 Total Soluble Solids

Total soluble solid of the wild apricort sample were determined by using the refractometer and the readings were noted accordingly the described standard method of AOAC (2012).The prism of refractometer was rinsed with distil water then dried with tissue paper after each data recording of the cherry samples.

2.2.4 Titratable Acidity (%)

Titratable acidity (%) of wild apricort sample was obtained by the prescribed method of AOAC (2012). About 10 ml of sample was taken in a volumetric flask and made up the volume with distil water. Then 10 ml of diluted sample was taken in a conical flask and put two or three drops of phenolphthalein as indicator then titration was carried out against 0.1N NaOH solution until pink color appeared and three readings were taken respectively. Acidity was calculated by using the formula:

$$\text{Acidity (\%)} = \frac{\text{C.F x N x ml of NaOH x 100 x 100}}{\text{A x B}}$$

2.2.5 Total Sugar

The standard method of AOAC (2012) by Lane and Eynon was used to determine reducing and non-reducing sugar of the sample.

2.2.5.1 Reducing sugar

Accurately 10 ml of the wild apricort sample was taken in a 250 ml volumetric flask and the volume was made by addition of distilled water and filtered through filter paper. The burette was filled with this solution. Then 5 ml of Fehling A and 5 ml of Fehling B solution along with 10 ml of distilled water were taken in a conical flask and then the flask was heated till boiling. Diluted sample solution was added from the burette drop wise while boiling till the color was become brick red in the flask. Methylene blue was added as indicator to noted the end point brick red color either brick red color change to blue or not. Reducing sugar was calculated by using the formula:

$$\text{Reducing sugar (\%)} = \frac{F}{T} \times D \times \frac{100}{1000}$$

2.2.5.2 Non reducing sugar

For this 5 ml of wild apricort sample was taken and adds 5 g citric acid in it than volume was made up to 100 ml with distilled water. After then boiled the solution for 10 minutes then cooled the solution and filtered. Add 2 to 3 drops of phenolphthalein indicator then treated with 20 % NaOH until the solution trends to pink color after than 1 N HCL was added in the flask drop wise until pink color disappeared. The volume was made up to 250 ml with addition of distilled water and burette was filled with the solution. Then 5 ml of Fehling A and 5 ml of Fehling B solutions were taken in a conical flask and add 10 ml distilled water and boiled. On boiling the solution was titrated with the sample solution from the burette till color of solution transform to brick red. It was tested with ethylene blue as indicator till red brick color persists. Non-reducing sugar was calculated by using the formula:.

$$\text{Total sugar (\%)} = \frac{F}{T} \times D \times \frac{100}{1000}$$

2.3 Sensory evaluation

All the samples were examined organoleptically for color, flavor, Taste, texture and overall acceptability by a panel of 9 expert judges at every 4 days intervals. Nine point hedonic scales were used for sensory evaluation as reported by Larmond (1977).

2.4 Statistical analysis

All the data were performed triplicate and results were analyzed statistically using CRD two-way ANOVA as Steel and Torrie (1997) recommended.

3 Results and discussions

Wild apricot pulp sample was analyzed at 15 days interval for parameter such as pH, total soluble solids, reducing sugar, non reducing sugar, acidity, ascorbic acid and

sensory properties including color, flavor and overall acceptability during 90 days of storage period.

3.1 pH

The results indicated that pH of the sample was decreased during storage. The mean value for pH of apricot pulp decreased from 3.69 to 3.25 during storage as presented in Table1. Significantly highest decrease was found in AP_5 (3.56) followed by AP_3 (3.52) as wellas lowest reduction of mean value was found AP_0 (3.29) followed by AP_1(3.42).The highest decrease was found in AP_0 (20.65) than AP_1 (13.15), whereas the lowest decrease was observed in AP_5 (7.55),followed by AP_4 (8.47).

Treatment and storage interval statistically have a significant ($p<0.05$) effect on the pH of all samples of wild apricot pulp. Decrease in pH was associated with the breakdown of pectin into pectenoic acid as well as production of free acids Imran et al. (2000). Same results were shown by Durrani et al., (2010) who investigated a decrease in pH (3.62 to 3.28) of chemically preserved pulp prepared from apple. Hussain et al., (2011) also investigated that when pH fall down acidity increases. Cecilia and Maia (2002) also confirmed above mention results. Shahnawaz et al., (2012) also reported that pH of blended pulp was decreased from 3.62 to 3.28 in the presence of preservatives during storage.

3.2 Total soluble solids

The results regarding the effect of storage and chemical preservatives on TSS contenthave been shown in Table 1. The mean value of total soluble solids was significantlyincreased from 15.00 to 16.64 during storage. For treatment,the maximum meanvalue was recorded in AP_0 (16.44) followed by AP_1 (15.96), whereas the minimum mean value was found in AP_4 (15.38) followed by AP_5 (15.41). Similarly, a maximum increase in total soluble solids was observed in AP_0(19.87) followed by AP_1 (12.53) while the minimum increase was found in AP_5 (5.40)followed by AP_4 (5.73).

Shah et al., (1975) reported that rise in solids of produce is because of solubilization of fruit constituents during storage. The increase in TSS may be due to

inversion of sucrose contents in fructose and glucose due hydrolysis. Muhammad et al., (2011) also reported increment in total soluble solids (9.75 to 11.390Brix) in apple pulp during storage. These results are also in accordance with Akhtar et al., (2009) who had investigated an increase in TSS of mango pulp which was preserved by preservatives. Agar and Polate (1995) reported an increase in TSS from 10.6 to 140 Brix during storage and that was due to break down of carbohydrates into sugars such as glucose and fructose, organic acid and some other soluble material by metabolic process.

Table.1 Effect of treatment and storage interval on pH and TSS content of wild apricot pulp

Treatments	Storage intervals (Days)							
	Initial	15	30	45	60	75	90	Mean
AP_0	3.68±0.04	3.56±0.21	3.40±0.07	3.27±0.04	3.15±0.33	3.03±0.04	2.92±0.9	3.29c
AP_1	3.65±0.06	3.59±0.3	3.50±0.02	3.42±0.06	3.34±0.12	3.26±0.03	3.17±0.04	3.42b
AP_2	3.68±0.021	3.61±0.23	3.57±0.09	3.51±0.0.4	3.47±0.02	3.4±0.04	3.32±0.01	3.51a
AP_3	3.70±0.07	3.63±0.07	3.57±0.04	3.52±0.05	3.47±0.04	3.39±0.23	3.30±0.04	3.52a
AP_4	3.66±0.04	3.59±0.02	3.55±0.02	3.50±0.08	3.46±0.06	3.41±0.14	3.35±0.08	3.50a
AP_5	3.71±0.1	3.66±0.08	3.62±0.11	3.55±0.03	3.51±0.09	3.47±0.05	3.43±0.03	3.56a
Mean	3.69a	3.61ab	3.54bc	3.46cd	3.40de	3.33ef	3.25f	

Effect of treatment and storage interval on TSS content of wild apricot pulp

Treatments	Storage intervals (Days)							
	Initial	15	30	45	60	75	90	Mean
AP_0	15.00±0.03	15.53±0.23	15.94±0.09	16.41±0.21	16.87±0.03	17.36±0.03	17.98±0.03	16.44a
AP_1	15.00±0.05	15.31±0.06	15.73±0.02	15.97±0.03	16.23±0.42	16.59±0.05	16.88±0.04	15.96b
AP_2	15.00±0.06	15.27±0.04	15.59±0.05	15.81±0.08	16.09±0.05	16.43±0.07	16.59±0.08	15.83b
AP_3	15.00±0.02	15.29±0.07	15.7±0.01	15.88±0.04	16.04±0.06	16.36±0.02	16.7±0.021	15.85b
AP_4	15.00±0.12	15.19±0.03	15.27±0.04	15.34±0.09	15.43±0.02	15.56±0.04	15.86±0.06	15.38c
AP_5	15.00±0.03	15.13±0.05	15.21±0.03	15.39±0.02	15.58±0.03	15.73±0.05	15.81±0.04	15.41c
Mean	15.00f	1529ef	15.57de	15.80cd	16.04bc	16.34ab	16.64a	

3.3 Reducing sugar

In the same way, reducing sugar contentwas increased during the storage period. The highest mean value for treatment was found in AP_0 (7.03), followed by AP_1 (6.36), AP_3 (6.29) , AP_2 (6.16) and the lowest mean value was found in AP_5 (5.85), followed by AP_4 (5.98) illustrated in Figure 1-A.

Treatment and storage interval statistically have a significant ($p<0.05$) effect on the reducing sugar of wild apricot pulp. Majid et al., (2006) stated that rise up in reducing sugar is occurs when sucrose inverts into fructose and glucose, the main cause of this inversion is production of different acid and high temperature during storage. Kinh et al., (2001) reported that sucrose inverts into reducing sugar quickly due to the addition of chemicals and increasing temperature. Increment in reducing sugar from 15.70 – 17.80 was noticed by Ayub et al., (2010). These results are also agreed with the finding of Reddy and Peddy (2006) and Habib et al., (2007).

3.4 Non reducing sugar

The findings inducated that the non-reducing sugar content of the wild apricort sample were decreased durinf storage. The highest mean value for treatment was found in AP_5 (3.75), followed by AP_4 (3.73), AP_2 (3.44) , AP_3 (3.31) and the lowest mean value was found in AP_0 (2.73), followed by AP_1 (3.07) illustrated in Figure 1-B.

Non-reducingsugar might be reduced due to the conversion of non-reducing sugarconverts into reducing sugar due to a chemical reaction in theproduct. Treatment and storage interval statistically have a significant ($p<0.05$) effect on the non reducing sugar of wild apricot pulp samples. Non reducing sugar is reduced due to conversion in which non reducing sugar converts into reducing sugar due to chemical reaction taking place in product. Majid et al. (2006). The investigation of Hussain et al., (2008) and Tefera et al., (2008) are in accord with our research that identified decrease in non reducing sugars. Islam, (1986) and Iqbal, (1993), revealed that non reducing sugar of fruit pulp decreased during storage when sucrose breaks into reducing sugars (glucose and fructose) it caused due to preservatives and temperature.

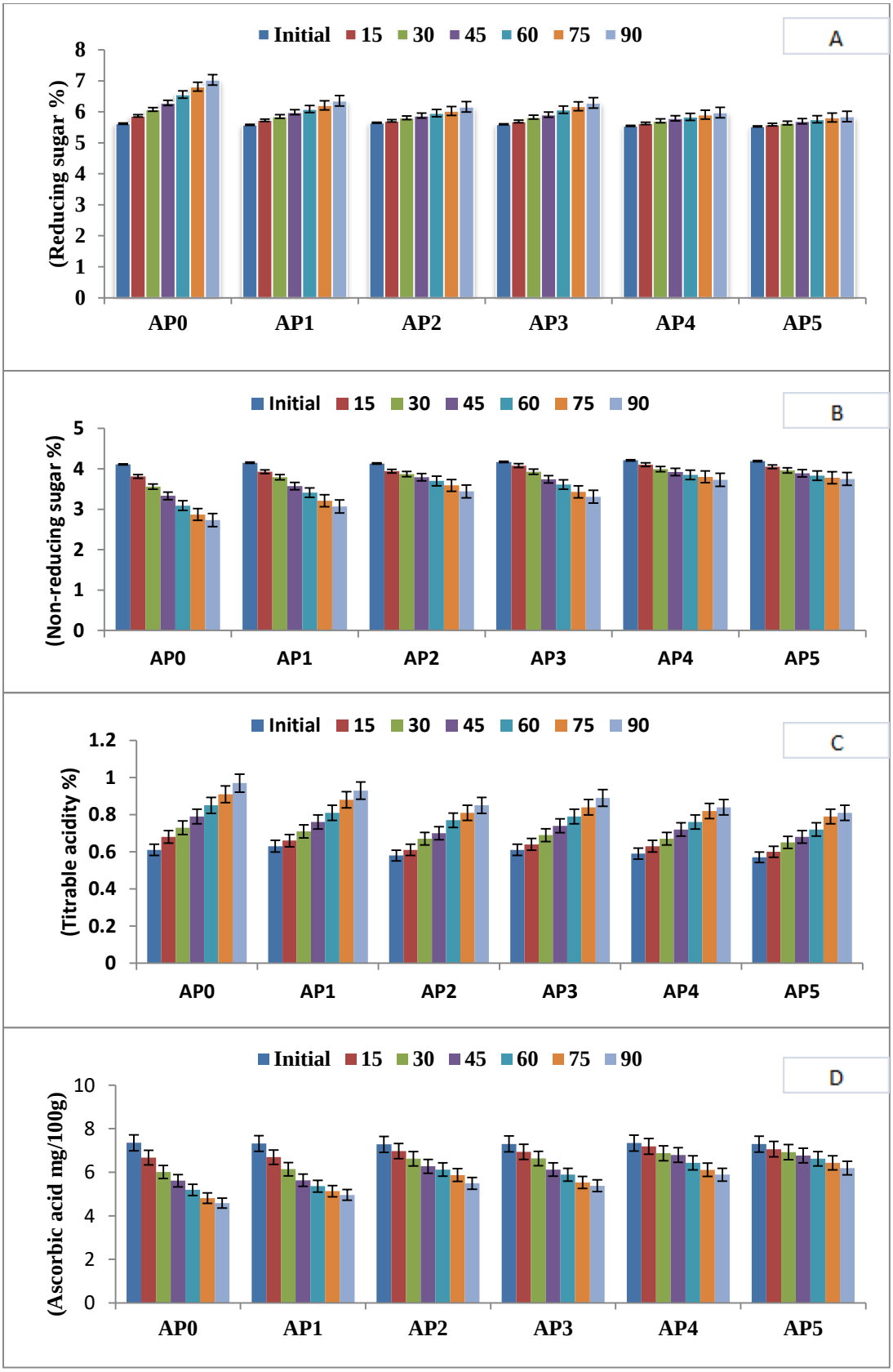

Figure. 1 Effect of treatment and storage interval on reducing sugar, non-reducing sugar, titrable acidity, and ascorbic acid of wild apricot pulp

3.5 Titrable acidity

The data related to the effect of storage and chemical preservatives on acidity has been illustrated in Figure-1-C. The mean value for treatments was significantly increased from during three month of storage. The highest mean value for treatment was found in AP_0 (0.97), followed by AP_1 (0.93), AP_3 (0.89) , AP_2 (0.85) and the lowest mean value was found in AP_5 (0.81), followed by AP_4 (0.84).

Nunes et al., (1995) described a significant increase in strawberry acidity due to additives. Our results were also parallel with the conclusion of Cecilia and Maia (2002). Kinh et al., (2001) stated that acidity of pulp increased during storage. The reason behind rise in acidity is break down of pectin into pectinoic acid. Preservative itself increases acidity, resulting in a decrease in product pH at which micro organism cannot grow and spread. Kays (1991) acknowledged that acidity directly associated with organic acid which are present in free form in fruits. Echeverria and Valich (1989), as pulp samples were airtight packed so there might be no chance of use of organic acid in respiration which increases acidity.

3.6 Ascorbic acid

In the same context, the ascorbic content of the sample decreased during storage. Treatment and storage interval statistically have a significant ($p<0.05$) effect on the contents of ascorbic acid of wild apricot pulp. The highest mean value for treatment was found in AP_5 (6.19), followed by AP_4 (5.89), AP_2 (5.49) , AP_3 (5.38) and the lowest mean value was found in AP_0 (4.58), followed by AP_1 (4.96) illustrated in Figure 1-D. Ascorbic acid content lost due to heat treatment, oxidation, light and moisture during storage. Majid et al., (2007) and Kansci et al., (2008) presented the loss of ascorbic acid during preservation of mango pulp. Negi and Roy (2000) reported that minimum loses of ascorbic acid were occurred by the use of potassium meta bisulphite during storage. When storage time increases, dehydroascorbic acid is converted into diketogulonic acid by oxidation that reduces ascorbic acid contents in product. Rai and Saxena, (1988). Our results also agree with Sabina et al., (2011) who reported the decrease in ascorbic acid from 48.1 to 35.9 and with Lee and Kader (2000) who observed that storage duration increased ascorbic acid decreased slowly but surely.

Sensory evaluation

The color, flavor and overall acceptability of samples were evaluated at each 15 days interval during three month storageperiod. Thepanel judged the samples using 9 pointshedonic scale inwhich 1 disliked extremely and 9 liked extremely.

The results regardingthe color of the apricot pulp showed that color scores decreased with the passage of time . The highest mean value for treatment was found in AP_5 (6.90), followed by AP_4 (6.80), AP_2 (6.30) , AP_3 (6.10) and the lowest mean value was found in AP_0 (3.80), followed by AP_1 (4.90) illustrated in Figure 2-A.

Fruit product color might be reduced due to enzymatic browning and degradation of color pigments during heat treatment. Sass et al., (2005) deliberated that change in color during storage was due to browning reaction between amino acid and reducing sugars. Color of apricot is due to beta carotnoids. Ayub et al., (2005) reported a decline in color in guava. Our results are also in agreement with the investigation of Habib et al., (2007) and Majid et al., (2007). During storage Millard reaction was speedup which might be reduced color of product fruitproduct color might be reduced due to enzymatic browning anddegradation of color pigments during heat treatment. Borges*et al*.,(2007) deliberate that change in color during storage was due to browning reaction between amino acid and reducing sugars

The results related to the effects of storage and chemical preservatives on the flavor of pulp illustrated in figure 2. During storage mean scorefor flavor decreased significantly . The highest mean value for treatment was found in AP_5 (7.10), followed by AP_4 (6.80), AP_3 (6.20) , AP_2 (6.10) and the lowest mean value was found in AP_0 (3.40), followed by AP_1 (5.60) illustrated in Figure 2-B.

Arthey and Philip (2005) reported that theproduct's flavor is affecteddue to organic acids, sugar and bitter andvolatile constituents. The organic acids are usually citric, malic and these provide tartness inflavour. The sugar contributes sweetness andbitterness is related tophenolic compounds.

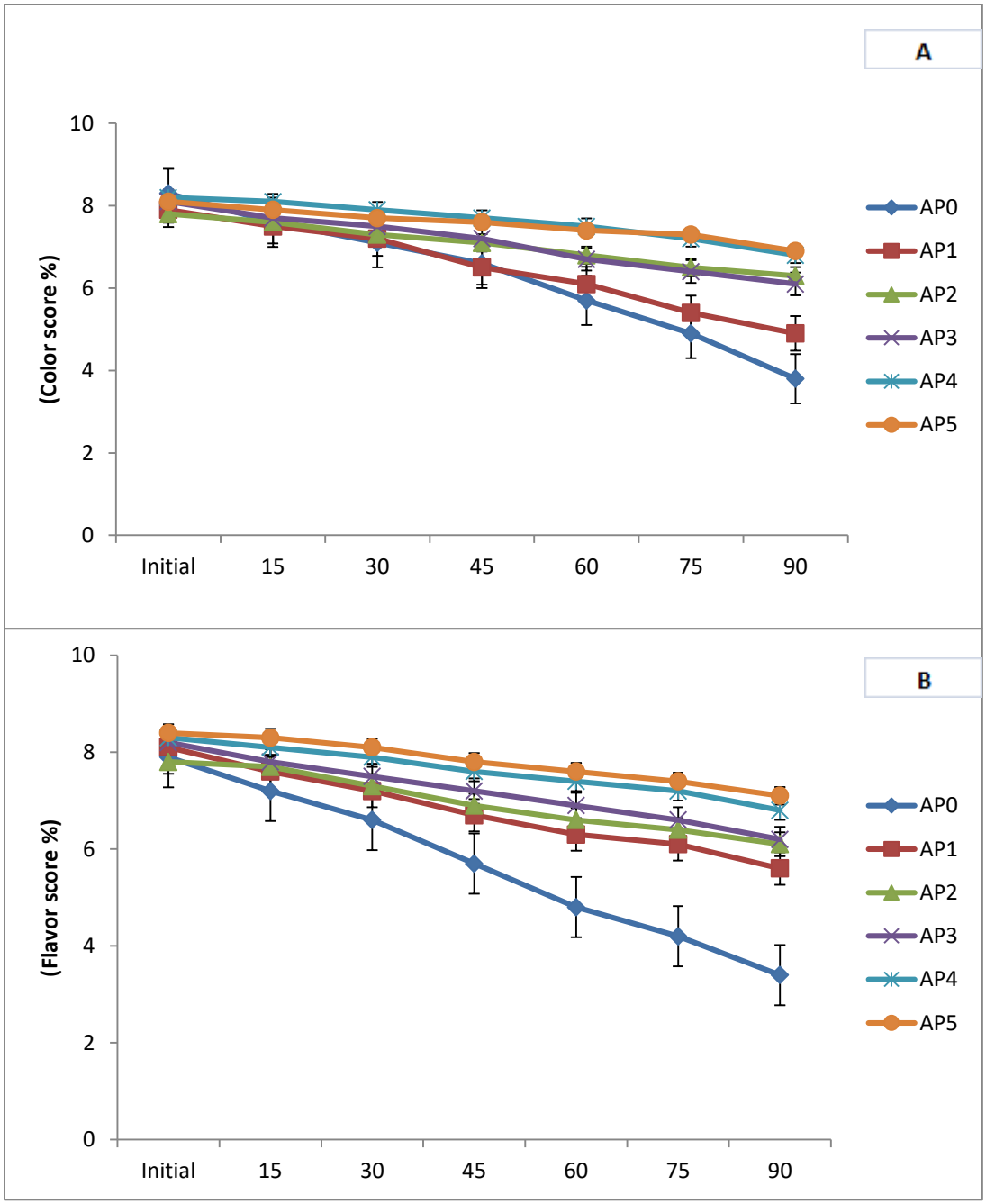

Figure. 2 Effect of treatment and storage interval on color and flavor of wild apricot pulp

In the same perspective, the taste of the sample decreased during storage. The highest mean value for treatment was found in AP_5 (7.40), followed by AP_4 (7.10), AP_3 (6.50) , AP_2 (6.40) and the lowest mean value was found in AP_0 (3.50), followed by AP_1 (5.50) illustrated in Figure 3-B.

In the same context, the overall acceptability of the sample decreased during storage. The highest mean value for treatment was found in AP_5 (6.70), followed by

AP_4 (6.30), AP_2 (6.30) , AP_3 (5.40) and the lowest mean value was found in AP_0 (3.10), followed by AP_1 (5.50) illustrated in Figure 3-A. Overall acceptability depends upon sensory attributes, including color, flavor, and physic-chemical characteristics. Overallacceptability depends upon sensory attributes, including color, flavor, and physic-chemical characteristics. The results also agree with Majid et al., (2007) and Akhtar et al., (2009) that pulp preserved with chemical preservatives retained the highest overall acceptability due tothe lowest nutrient loss, minor microbial assault and highest organolapticvalue during storage at room temperature.

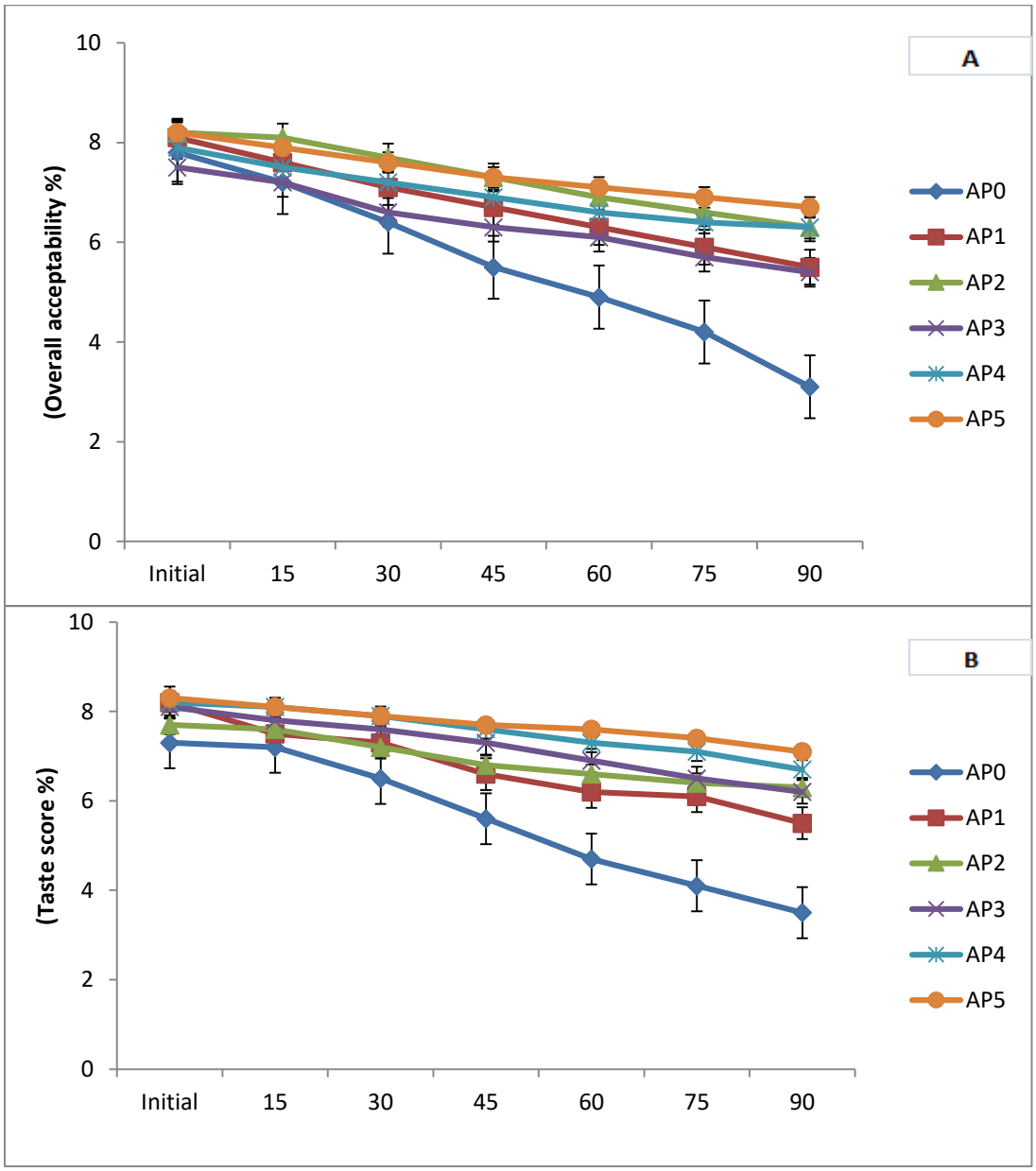

Figure. 3 Effect of treatment and storage interval on taste and flavor and overall acceptability of wild apricot pulp

4. Conclusion

The finding of the study revealed that sodium benzoate and potassium metabisulphite application greatly maintained the quality of wild apricot pulp during the three monthsof storage. On the basisof physico-chemical and sensory score, it is concluded that the apricot pulpthat treated withAP5 (0.05% sodium benzoate + 0.05% potassium metabisulphite) was found mosteffective than other treatments. Additionally, the results also indicated that the combination of sodium benzoate andpotassiummetabisulphitemaintained the overall quality of apricot pulp as compared to control. The results suggested that sodium benzoate and potassium metabisulphite can maintained the quality of fresh food products during storage.

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