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Effect of different chemical preservatives on preservation of pear nectar

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Abstract
The study was conducted to estimate the effect of antimicrobial agents for example sodium benzoate and potassium sorbate separately and in combination with different concentration for preservation of pear nectar. The samples were packed in 250 ml transparent plastic bottles at room temperature for storage period of 90 days. The treatments were P0 (pear nectar with no preservative), P1 (pear nectar + 0.1% sodium benzoate), P2 (pear nectar + 0.1% potassium sorbate), P3 (pear nectar + 0.05% sodium benzoate), P4 (pear nectar + 0.05% potassium benzoate) and P5 (pear nectar + 0.05% sodium benzoate and 0.05% potassium sorbate). Samples of pear nectar were evaluated for total soluble solids, ascorbic acid, %acidity, pH, reducing and non-reducing sugar and sensory evaluation (color, flavor, taste and overall acceptability). pH decrease from 4.03 to 3.60, total soluble solids increase 14.90 to 16.03, % acidity 0.93 to 1.02,ascorbic acid decrease 7.04 to 5.15, reducing sugar increase 18.03 to 18.28, non-reducing sugar decrease 3.88 to 3.40, color decrease 8.10 to 5.57, flavor 8.20 to 5.75, taste 8.10 to 5.60 and overall acceptability decreased 7.18 to 5.02 during period of storage. The results shows that storage period and treatments had significant effect ($p<0.05$) on phsico chemical and sensory evaluation of pear nectar. The nectar sample P5 was found best followed by P1, while P0 show the poor results.

Keywords: Nectar, preservation, sodium benzoate, sorbate

Introduction
The pear (*Pyrus pyrifolia*) is a tree and shrub specie of genus Pyrus in the family Rosaceae. The pear is cultivated all over the world and mostly produced in temperate zone (Shakir *et al.*, 2009) [34], pear has low caloric level and very delicious to eat, it is liked by the consumer. It has a low content of protein and lipids and is rich in sugar (Sensor *et al.*, 1999) [33]. The total area under cultivation of pear in Pakistan is 2.4 thousand hectares which include 0.1 Punjab, 1.8 KPK, 0.2 thousand hectares Baluchistan while the total production in Pakistan is 19.0 thousand tones which includes 0.1 Punjab, 18.4 KPK, 0.5 thousand tons Baluchistan (Agriculture Statistics of Pakistan, 2011-2012). Pear help in producing 242 KJ energy, 15.46g carbohydrates, 3.1g dietary fibers, 0.38g protein, 119mg potassium, 4.2mg vitamin C, 9mg calcium, 0.17mg iron, 7mg magnesium, 11mg phosphorus, 0.157mg niacin(vit B3), 0.028mg vitamin B6, 0.012mg thiamine and 0.025mg riboflavin (Vit.B2) per 100g to our body (USDA Nutrient database 2009) [38].
The shelf life of fruits is not prolong so fruit based products are processed to make sure the availability in off season. Chemical preservatives such as sodium benzoate and potassium sorbate have been used in food products to enhance their shelf life (Mishra *et al.*, 2011) [27]. Use of chemical additives in food preservation has low cost as well either to be used into the products. Due to greater solubility in water, the salts of sorbic acid are mostly used in food. Sorbate act as a primary inhibitor against yeast and molds while the activity against bacteria is not wide-ranging and appears to be selective, overall sorbates are the safest food preservatives for juice and nectar preservation (Shew *et al.*, 1995) [37].

Materials and Methods
Sound and healthy pear of proper size and optimum maturity were collected from Azad Jammu and Kashmir and brought to the laboratory of Food Science and Technology, The University of Agriculture Peshawar Pakistan.

Preparation of samples
After washing and cutting grinder were used to extract pulp from the fruit.

And the nectar was prepared by using this extracted pulp. Pear nectar samples were prepared by the addition of water and sugar.

Treatments

P_0 = Pear nectar without preservatives
P_1 = Pear nectar + 0.1% sodium benzoate
P_2 = Pear nectar + 0.1% potassium sorbate
P_3 = Pear nectar + 0.05% sodium benzoate
P_4 = Pear nectar + 0.05% potassium sorbate
P_5 = Pear nectar + 0.05% sodium benzoate + 0.05 potassium sorbate

Storage

To evaluate the physic-chemical properties and organoleptic evaluation the prepared nectar samples were packed in 250ml plastic bottles and stored at ambient temperature for 90 days and the samples were evaluated after each 15 day of interval during through the storage period.

Product Analysis

Physico-chemical Analysis

Total soluble solids, Titratable acidity, pH, Ascorbic acid, Reducing sugar and Non-reducing sugar was determined by the standard method of AOAC (2012) [2].

Sensory Evaluation

Organoleptic evaluation (color, taste, texture and overall acceptability) were evaluated by a panel of selected panel using 9-point hedonic scale of Larmond (1977).

Statistical Analysis

All the analyses were performed in triplicate and the results were calculated statistically by simple CRD two way analyses as recommended by (Steel and Torrie. 1998).

Results and Discussions

Pear nectar was packed in 250ml plastic bottles and analyzed for TSS in storage period of 90 days. The highest TSS mean value for treatment was noted in sample P0 (15.87°brix) followed by P4 (15.78°brix), while lowest mean value was noted in sample P5 (15.24°brix) followed by P1 (15.33°brix). During the storage period the highest increase was noted in sample P0 (11.74%) followed by P4 (10.40%) and lowest increase was observed in sample P5 (4.90%) followed by P2 (5.37%). TSS may be increase during storage due to the conversion of sucrose into (glucose + fructose). The results of TSS closely related to the findings of Ayub *et al*. (2010) they founded increase in TSS value from (16.5 to 17.4obrix.

Pear nectar was packed in 250ml plastic bottles and analyzed for acidity in storage period of 90 days. Table.2 shows the statistical data of mean value of % acidity which was significantly (p<0.05) increased from 0.93 – 1.02 during storage period. Pear nectar sample P4 showed the highest mean value of %acidity (1.04) which was followed by P2 (0.99), whereas, pear nectar sample P5 (0.93) observed lowest mean value followed by P1 (0.95). Maximum increase was noted in P0 (17.78%) followed by P4 (11.22%) and minimum acidity value recorded in P5 (6.67%) followed by P1 (7.69%). The results of current research work similar to the findings of Cecilia and Maia (2002) [7] they found increase in % acidity caused by acidic compound formation and oxidation of reducing sugar in apple juice during storage temperature, increased in acidity may be caused due to oxidation of reducing sugar into pectinic acid (Iqbal *et al.* 2001) [19].

Pear nectar was packed in 250ml plastic bottles and analyzed for ascorbic acid in storage period of 90 days. Table.3 showed that ascorbic acid mean value significantly (p<0.05) minimized from 7.04 to 5.15 mg/100g, whereas maximum value of ascorbic acid for treatments was obtained in P5 (6.48) which was followed by P1 (6.41) mg/100g, however minimum value of mean was calculated in P0 (5.44) mg/100g followed by P4 (5.55) mg/100g. P0 (38.83%) showed the highest decrease followed by P4 (34.56%) and lowest decline was observed in P5 (16.90%) followed by P1 (19.68%). Ayub *et al.* (2010) deliberated that during storage period minimum loss of ascorbic acid had occurred by the addition of sodium benzoate and potassium sorbate.

Pear nectar was packed in 250ml plastic bottles and analyzed for pH in storage period of 90 days. The decreasing mean of pH presented in Table-4 which showed decline significantly (p<0.05) from 4.03 to 3.60 during storage where P5 (3.89) followed by P2 (3.87) found as highest mean value of pH and sample P0 (3.64) followed by P4 (3.75) observed as lowest mean. Results revealed that highest decrease was recorded in nectar sample P0 (18.85%) followed by P4 (12.0%) while lowest decrease was recorded in sample P5 (6.93%) followed by P1 (7.46%).

pH of the sample might be decreased due to the conversion of pectin into organic acid or also due to minimum increment in acidity during the storage period. Previously Imran *et al.* (2000) [20] stated that declined in pH value may be due to the conversion of pectin into organic acid.

Pear nectar was packed in 250ml plastic bottles and analyzed for reducing sugar in storage period of 90 days. The results of current research work revealed that the reducing sugar value increased from 18.03 to 18.28 during the storage period Table-V and the highest mean value observed in sample P0 (18.25) followed by P4 (18.19) while least mean value was noticed in sample P1 (18.10) followed by P5 (18.11). Results shows that highest increase was found in P0 (2.05%) followed by P4 (1.50%) while least increased in pear nectar sample P5 (1.05%) followed by P1 (1.11%). Kinh *et al*. (2001) [21] stated in their research work that breakdown of sucrose into (glucose + fructose) may be caused increment in reducing sugar in the presence of acidity.

Pear nectar was packed in 250ml plastic bottles and analyzed for non-reducing sugar in storage period of 90 days. Results shows that non-reducing sugar was calculated highest mean value in nectar sample P1 (3.74) followed by P0 (3.72) whereas least value found in P3 (3.51) followed by P4 (3.53). The highest decrease noticed in sample P0 (14.07%) followed by P4 (13.16%) while lowest in sample P5 (9.87%) followed by P1 (10.89%). The results of non-reducing sugar value related to the findings of Hussain *et al.* (2010) they revealed that non-reducing sugar value from (6.99 to 6.57). The decline in non-reducing sugar value may be due to the conversion of non-reducing sugar in to glucose and fructose Sandi *et al.* (2004) [31] similarly Ali (1965) [3] reported that during the storage period increase in reducing sugar may be responsible due to the conversion of non-reducing sugar into reducing sugar.

Sensory Evaluation

The pear nectar samples were evaluated for sensory evaluation (color, flavor, taste and overall acceptability) in the presence of panel judges they scored 9-1 extremely like and dislike by pre described method of Larmond (1977).

The results of panel judge represented that the maximum mean value was observed P1 (7.27) followed by P5 (7.09), while minimum mean value noted in sample P0 (5.93) followed by P4 (6.07) whereas the highest decline in color score was found in nectar sample P0 (44.44%) followed by P4 (40%) awhile least score noticed P5 (22.22%) followed by P1 (24.39%). Previous work revealed that due to the presence of oxygen and non-enzymatic browning responsible in color degradation Brendor *et al*. (1985) [4].

During the storage period the flavor of samples decreased from 8.2 to 5.75 significantly ($p<0.05$) which represented in Table-VIII. The highest mean value for the pear nectar sample was noted in P5 (7.57) followed by P2 (7.37), and lowest was found in P0 (6.13) followed by P4 (6.56). The highest decrease was noticed in sample P0 (43.75%) followed by P4 (33.75%) while lowest decrease was found in sample P5 (22.35%) followed by P1 (25.61%). Previously Navarro *et al.* (1981) studied in their research work Valencia orange concentrates (60 0Brix) stored at 0-9.0 and 18 0C to find out the adequate conditions for bulk storage at 0oC and revealed that flavor of the product lose during the storage. Similarly Ayub *et al.* (2005) also stated that decline in flavor (5.04 to 3.14) during storage of guava slice.

The mean score for taste was significantly ($p<0.05$) decreased from 8.10 to 5.60 with the passage of time (Table-IX). The highest mean value was noted in sample P1 (7.50) followed by P3 (7.21) and lowest was found in sample P0 (6.11) followed by P 2 (6.21). The highest decline in score was noticed in sample P0 (43.75%) followed by P4 (35.37%) while lowest decrease was recorded in sample P5 (22.50%) followed by P1 (24.71%). The results of this research work closely related to the findings of Marcy *et al.* (1984) [25] they reported that effect of storage temperature and time on quality of orange juice stored at 12.2, 6.6, 1.1 and 4.4 0C and also increased in acidity responsible for the degradation of taste.

During storage period the maximum mean value was calculated in sample P5 (7.93) followed by P1 (6.54) and minimum mean value was recorded in sample P0 (5.51) followed by P4 (5.61). The highest decrease was noted in sample P0 (45.71%) followed by P4 (4.84%) while lowest decrease was noticed in sample P5 (15.06%) followed by P1 (20.83%). Rosario (1996) [30] studied in his research work with the passage of time and the presence of temperature responsible in breakdown of quality of any fruit which results in decline in overall acceptability similar study was found by Kinh *et al.* (2001) [21] they preserved apple pulp with the addition of potassium metabisulphite.

Table 1: Effect of sodium benzoate and potassium sorbate on TSS of pear nectar during storage.

Treatments	Storage Intervals							% Increase	Means
	0	15	30	45	60	75	90		
Po	14.90	15.33	15.58	15.92	16.26	16.48	16.65	11.740	15.871
P1	14.90	15.10	15.22	15.32	15.45	15.60	15.70	5.373	15.333
P2	14.88	15.15	15.30	15.42	15.54	15.66	15.78	6.055	15.390
P3	14.90	15.22	15.35	15.55	15.68	15.82	15.95	7.052	15.501
P4	14.90	15.32	15.57	15.82	16.08	16.32	16.45	10.402	15.783
P5	14.90	15.0	15.10	15.20	15.35	15.50	15.63	4.903	15.240
Means	14.90	15.19	15.35	15.54	15.73	15.90	16.03		18.621

Table 2: Effect of sodium benzoate and potassium sorbate on percent acidity of pear nectar during storage.

Treatments	Storage Intervals							% Increase	Means
	0	15	30	45	60	75	90		
Po	0.90	0.93	0.96	0.98	1.01	1.04	1.06	17.782	0.980
P1	0.91	0.93	0.94	0.95	0.96	0.97	0.98	7.691	0.952
P2	0.94	0.96	0.98	1.0	1.01	1.02	1.03	9.575	0.991
P3	0.93	0.95	0.97	0.98	0.99	1.0	1.01	8.603	0.980
P4	0.98	1.0	1.02	1.04	1.06	1.08	1.09	11.220	1.045
P5	0.90	0.91	0.92	0.93	0.94	0.95	0.96	6.675	0.936
Means	0.93	0.95	0.97	0.98	1.00	1.01	1.02		1.170

Table 3: Effect of sodium benzoate and potassium sorbate on ascorbic acid contents of pear nectar during storage.

Treatments	Storage Interval							% Decrease	Means
	0	15	30	45	60	75	90		
Po	7.03	6.35	5.70	5.30	4.90	4.50	4.30	38.832	5.443
P1	7.06	6.95	6.65	6.45	6.20	5.90	5.67	19.681	6.412
P2	7.06	6.75	6.40	6.05	5.90	5.65	5.30	24.920	6.160
P3	7.04	6.70	6.40	5.90	5.65	5.30	5.20	26.135	6.033
P4	7.03	6.35	5.80	5.30	5.0	4.80	4.60	34.560	5.558
P5	7.04	6.80	6.65	6.51	6.32	6.20 S	5.85	16.901	6.480
Means	7.04	6.65	6.27	5.92	5.66	5.39	5.15		7.210

Table 4: Effect of sodium benzoate and potassium sorbate on pH of pear nectar during storage.

Treatments	Storage Intervals							% Decrease	Mean
	0	15	30	45	60	75	90		
Po	4.03	3.91	3.75	3.62	3.5	3.38	3.27	18.850	3.640
P1	4.02	3.95	3.91	3.86	3.82	3.77	3.72	7.462	3.861
P2	4.04	3.97	3.93	3.87	3.83	3.76	3.69	8.665	3.871
P3	4.02	3.95	3.89	3.84	3.79	3.71	3.65	9.203	3.840
P4	4.0	3.91	3.82	3.74	3.66	3.58	3.52	12.002	3.75
P5	4.04	3.99	3.95	3.88	3.84	3.80	3.76	6.934	3.890
Mean	4.03	3.95	3.88	3.80	3.74	3.67	3.60		4.576

Table 5: Effect of sodium benzoate and potassium sorbate on reducing sugar of pear nectar during storage

	Storage Intervals								
Treatments	0	15	30	45	60	75	90	% Increase	Means
Po	18.06	18.13	18.20	18.25	18.31	18.36	18.43	2.051	18.251
P1	18.0	18.04	18.07	18.11	18.14	18.17	18.20	1.113	18.102
P2	18.02	18.06	18.10	18.14	18.17	18.20	18.25	1.280	18.130
P3	18.03	18.06	18.08	18.12	18.18	18.22	18.27	1.334	18.143
P4	18.05	18.10	18.16	18.20	18.24	18.29	18.32	1.503	18.190
P5	18.01	18.05	18.08	18.12	18.15	18.18	18.20	1.050	18.110
Means	18.03	18.07	18.12	18.16	18.20	18.24	18.28		21.790

Table 6: Effect of sodium benzoate and potassium sorbate on non-reducing sugar of pear nectar during storage.

Treatments	Storage Intervals							% Decrease	Means
	0	15	30	45	60	75	90		
Po	3.98	3.90	3.82	3.74	3.63	3.54	3.42	14.071	3.720
P1	3.95	3.90	3.83	3.74	3.66	3.58	3.52	10.890	3.741
P2	3.90	3.83	3.75	3.66	3.57	3.50	3.46	11.285	3.671
P3	3.76	3.67	3.57	3.49	3.42	3.36	3.29	12.503	3.510
P4	3.80	3.67	3.60	3.53	3.46`	3.38	3.30	13.160	3.530
P5	3.75	3.68	3.61	3.54	3.48	3.43	3.38	9.873	3.550
Means	3.88	3.79	3.71	3.63	3.55	3.47	3.40		3.632

Table 7: Effect of sodium benzoate and potassium sorbate on color of pear nectar during storage.

Treatments	Storage Intervals							% Decrease	Means
	0	15	30	45	60	75	90		
Po	8.1	7.1	6.2	5.6	5.2	4.8	4.5	44.44	5.93
P1	8.2	7.9	7.6	7.3	7.0	6.7	6.2	24.39	7.27
P2	8.1	7.6	7.3	7.0	6.7	6.3	6.0	25.93	7.00
P3	8.1	7.4	6.8	6.4	6.2	5.9	5.6	30.86	6.63
P4	8.0	7.0	6.4	5.9	5.4	5.0	4.8	40.00	6.07
P5	8.1	7.7	7.4	6.9	6.6	6.6	6.3	22.22	7.09
Means	8.10	7.45	6.95	6.52	6.18	5.88	5.57		7.99

Table 8: Effect of sodium benzoate and potassium sorbate on flavor of pear nectar during storage

Treatments	Storage Intervals							% Decrease	Means
	0	15	30	45	60	75	90		
Po	8.0	7.3	6.6	6.0	5.5	5.0	4.5	43.75	6.13
P1	8.2	8.0	7.7	7.3	6.9	6.5	6.1	25.61	7.24
P2	8.4	8.1	7.8	7.4	7.0	6.7	6.2	26.19	7.37
P3	8.1	7.6	7.0	6.5	6.3	6.1	5.8	28.40	6.77
P4	8.0	7.5	7.0	6.5	6.0	5.6	5.3	33.75	6.56
P5	8.5	8.2	7.9	7.6	7.3	6.9	6.6	22.35	7.57
Means	8.20	7.78	7.33	6.88	6.50	6.13	5.75		8.32

Table 9: Effect of sodium benzoate and potassium sorbate on taste of pear nectar during storage.

	Storage Intervals								
Treatment s	0	15	30	45	60	75	90	% Decrease	Mean s
Po	8.0	7.2	6.6	6	5.5	5.0	4.5	43.75	6.11
P1	8.5	8.2	7.9	7.5	7.2	6.8	6.4	24.71	7.50
P2	7.5	7.0	6.5	6.0	5.8	5.5	5.2	30.67	6.21
P3	8.4	7.9	7.5	7.3	6.9	6.5	6.0	28.57	7.21
P4	8.2	7.5	7.0	6.4	5.7	5.5	5.3	35.37	6.51
P5	8.0	7.6	7.4	6.8	6.6	6.4	6.2	22.50	7.00
Means	8.10	7.57	7.15	6.67	6.28	5.95	5.60		8.11

Table 10: Effect of sodium benzoate and potassium sorbate on overall acceptability of pear nectar during storage.

Treatments	Storage Intervals							% Decrease	Mean s
	0	15	30	45	60	75	90		
Po	7.0	6.5	6.0	5.6	5.1	4.6	3.8	45.71	5.51
P1	7.2	7.0	6.8	6.6	6.5	6.0	5.7	20.83	6.54
P2	7.3	6.8	6.4	6.15	5.9	5.6	5.2	28.76	6.19
P3	7.2	6.6	6.4	5.7	5.5	5.2	5.0	30.55	5.94
P4	7.1	6.5	6.2	5.7	5.1	4.5	4.2	40.84	5.61
P5	7.3	7.1	6.9	6.7	6.5	6.3	6.2	15.06	6.71
Means	7.18	6.75	6.45	6.08	5.77	5.37	5.02		7.30

Conclusion

In this research work pear nectar was preserved with chemical preservatives as sodium benzoate, and potassium sorbate, stored in 250ml plastic bottles at ambient temperature for three months of storage time. The parameters studied were ascorbic acid, pH, TSS, %acidity, reducing sugar, non-reducing sugar and organoleptic evaluation (color, flavor, taste and overall acceptability). Sample P5 (0.05% potassium sorbate + 0.05% sodium benzoate) and P1 (0.1% sodium benzoate) were found the best, while P0 (peach nectar without preservative) showed poor results below the scale of sensory acceptability.

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