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Research Article

Effect of Different Chemical Preservatives on Preservation of Pear Nectar

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ABSTRACT

Benzoate and Potassium sorbate separately and in combination with different concentration is used for the preservation of pear nectar. The samples were packed in 250 ml transparent plastic bottles at room temperature for a 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 show that the storage period and treatments had a significant effect ($p<0.05$) on physicochemical and sensory evaluation of pear nectar. The nectar sample P5 was found best followed by P1, while P0 shows the poor results.

Keywords: Nectar; Preservation; Sodium benzoate; Sorbate

INTRODUCTION

The pear (*Pyrus pyrifolia*) is a tree and shrub species of genus Pyrus in the family Rosaceae. The pear is cultivated all over the world and mostly produced in temperate zone [1] 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 [2]. 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 include 0.1 Punjab, 18.4 KPK, 0.5 thousand tons Baluchistan [3]. Pear help in producing 242 KJ energy, 15.46 g Carbohydrates, 3.1 g dietary fibers, 0.38 g Protein, 119 mg Potassium, 4.2 mg Vitamin C, 9 mg Calcium, 0.17 mg iron, 7 mg Magnesium, 11 mg phosphorus, 0.157 mg Niacin (Vit. B3), 0.028 mg Vitamin B6, 0.012 mg Thiamine and 0.025 mg Riboflavin (Vit. B2) per 100 g to our body [4] availability in off season. Chemical preservatives such as Sodium benzoate and potassium to the transesterification process [5-8]. It is observed that the cost of biodiesel production using pure refined oil as feedstock is more expensive than petroleum-derived diesel and this is due to the high cost of the refined oil used as feedstocks [9-11]. The use of waste frying oil (vegetable and palm oil) as feedstock to replace refined vegetable oil in biodiesel production is an alternative way to reduce the feedstock cost and also using the waste oil will solve the problem of waste disposal in the environmental [12-14]. Waste frying oil (vegetable and palm oil) is defined as used frying oil (vegetable and palm oil) obtained from the frying process. During the frying process, the triglyceride in the refined vegetable and palm oil) break down to form diglycerides, monoglycerides and Free Fatty Acid (FFAs), the waste frying oil (vegetable and palm oil) compose of these compounds formed during the frying process [15]. The compounds formed during this frying process increase the molecular mass of the oil but reduce the volatility of the waste oil [16]. The properties of the waste frying oil are different from the refined oil, this is due to the chemical reactions during the frying process which include oxidation, hydrolysis, polymerization and material transfer that occurs between the food and oil (Vegetable and palm oil) [15]. Waste frying oil (Vegetable and palm oil) has a higher proportion of saturated fatty acids and renewability of better oxidation stability [17-19]. According to the ASTM standard, the density, viscosity, acid value, and free fatty acid of waste frying vegetable oil should range between (896-950) kg/m^3, (29-40) cst, (1.5-2) mg of KOH/g of oil and (0.1-0.25)% respectively [19,20].

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While for waste cooking palm oil, the density, viscosity, acid value, and free fatty acid of waste cooking vegetable oil range between (912-916) kg/m^3, (133.33-137.53) mm^2/s, (0.2-0.824) mg of KOH/g of oil and (0.1-0.412)% respectively [21,22]. Much research work has been done on how to reduce the high cost of production and increase the quantity and quality of biodiesel fuel from waste frying vegetable oil and waste frying palm oil using homogeneous catalyst [15,22-26]. However, they have not worked toward the determination of the possible optimum level of process variables for statistical optimization. The aim of this paper is to investigate the potential use of WFVO and WFPO as feedstock for biodiesel production. The effects of catalyst loading, methanol to oil ratio and reaction time on biodiesel yield were evaluated. Also, optimum levels of process conditions for optimum production of biodiesel were determined.

MATERIALS AND METHODS

Sound and a healthy pear of the 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. The chemical characterization of the waste frying oil (vegetable oil and palm oil) and biodiesel produced were analyzed chemically according to the ASTM standards. Properties analyzed were density, viscosity, acid index, iodine index, saponification value, waste content (%), free fatty acid (%), flash point and pour point.

Treatments

P0=Pear nectar without preservatives

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 sorbate

P5=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 250 ml 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 [27].

Sensory evaluation: Organoleptic evaluation (color, taste, texture and overall acceptability) were evaluated by a panel of the selected panel using 9 points of hedonic scale of Larmond.

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.

RESULTS AND DISCUSSION

Pear nectar was packed in 250 ml plastic bottles and analyzed for TSS in the storage period of 90 days. The highest TSS mean value for treatment was noted in sample P_0 (15.87°brix) followed by P4 (15.78°brix), while lowest mean value was noted in sample P_5 (15.24°brix) followed by P_1 (15.33°brix). During the storage period the highest increase was noted in sample P_0 (11.74%) followed by P_4 (10.40%) and the lowest increase was observed in sample P_5 (4.90%) followed by P_2 (5.37%). TSS may be increased during storage due to the conversion of sucrose into (glucose+fructose). The results of TSS closely related to the findings of Cecilia E et al. [28]. They found an increase in TSS value from (16.5 to 17.4)°brix (Table 1).

Pear nectar was packed in 250 ml plastic bottles and analyzed for acidity in the storage period of 90 days. Table 2 shows the statistical data of the mean value of % acidity which was significantly ($p<0.05$) increased from 0.93-1.02 during the storage period. Pear nectar sample P_4 showed the highest mean value of % acidity (1.04) which was followed by P_2 (0.99), whereas, pear nectar sample P_5 (0.93) observed lowest mean value followed by P_1 (0.95). The maximum increase was noted in P_0 (17.78%) followed by P_4 (11.22%) and minimum acidity value recorded in P_5 (6.67%) followed by P_1 (7.69%). The results of current research work similar to the findings of Iqbal SA et al. [29] they found an increase in % acidity caused by the acidic compound formation and oxidation of reducing sugar in apple juice during storage temperature, increase in acidity may be caused due to oxidation of reducing sugar into pectinic acid.

Pear nectar was packed in 250 ml plastic bottles and analyzed for ascorbic acid in a storage period of 90 days. Table 3 showed that

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

Treatment	Storage Intervals							% Increase	Mean
	0	15	30	45	60	75	90	11.74	15.87
P_0	14.9	15.33	15 .58	15.92	16.26	16.48	16.65		1
						15.6			15.33
P_1	14.9	15.1	15.22	15.32	15.45	0	15.7	5.373	3
						15.6			15.39
P_2	14.88	15.15	15.3	15.42	15.54	6	15.78	6.055	0
						15.8			15.5
P_3	14.9	15.22	15.35	15.55	15.68	2	15.95	7.052	1
						16.3			15.78
P_4	14.9	15.32	15.57	15.82	16.08	2	16.45	10.402	3
						15.5			15.24
P_5	14.9	15	15.1	15.2	15.35	0	15.63	4.903	0
						15.9			18.62
Mean	14.9	15.19	15.35	15.54	15.73	0	16.03		1

ascorbic acid mean value significantly ($p<0.05$) minimized from (7.04 to 5.15) mg/100 g, whereas maximum value of ascorbic acid for treatments was obtained in P_5 (6.48) which was followed by P_1 (6.41) mg/100 g, however minimum value of mean was calculated in P_0 (5.44) mg/100 g followed by P_4 (5.55) mg/100 g P_0 (38.83%) showed the highest decrease followed by P_4 (34.56%) and lowest decline was observed in P_5 (16.90%) followed by P_1 (19.68%). Cecilia E et al. [28]. 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 250 ml plastic bottles and analyzed for pH in the 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 P_5 (3.89) followed by P_2 (3.87) found as the highest mean value of pH and sample P_0 (3.64) followed by P_4 (3.75) observed as lowest mean. Results revealed that the highest decrease was recorded in nectar sample P_0 (18.85%) followed by P_4 (12.0%) while the lowest decrease was recorded in sample P_5 (6.93%) followed by P_1 (7.46%).

The pH of the sample might be decreased due to the conversion of pectin into organic acid or also due to the minimum increment in acidity during the storage period. Previously Imran et al. [30] stated that a declined in pH value may be due to the conversion of pectin into organic acid.

Pear nectar was packed in 250 ml plastic bottles and analyzed for reducing sugar in a 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 5 and the highest mean value observed in sample P_0 (18.25) followed by P_4 (18.19) while least mean value was noticed in sample P_1 (18.10) followed by P_5 (18.11). Results showed that the highest increase was found in P_0 (2.05%) followed by P_4 (1.50%) while the least increased in pear nectar sample P_5 (1.05%) followed by P_1 (1.11%). Kinh et al. [31] stated in their research work that the breakdown of sucrose (glucose+fructose) may have caused an increment in reducing sugar in the presence of acidity (Table 6).

Pear nectar was packed in 250 ml plastic bottles and analyzed for non-reducing sugar in a storage period of 90 days. Results show that non-reducing sugar was calculated highest mean value in nectar sample P_1 (3.74) followed by P_0 (3.72) whereas the least value found in P_3 (3.51) followed by P_4 (3.53). The highest decrease noticed in sample P_0 (14.07%) followed by P_4 (13.16%) while the lowest in-sample P_5 (9.87%) followed by P_1 (10.89%) (Table 7). The results of non-reducing sugar value related to the findings of Hassan et al. [32] 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 into glucose and fructose Sandi et al. [33] similarly Ali [34] reported that during the storage period increase in reducing sugar may be responsible due to the conversion of non-reducing sugar into reducing sugar.

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

Treatment	Storage Intervals							% Increase	Mean
	0	15	30	45	60	75	90		
P_o	0.9	0.93	0.96	0.98	1.01	1.04	1.06	17.782	0.98
P_1	0.91	0.93	0.94	0.95	0.96	0.97	0.98	7.691	0.952
P_2	0.94	0.96	0.98	1	1.01	1.02	1.03	9.575	0.991
P_3	0.93	0.95	0.97	0.98	0.99	1	1.01	8.603	0.98

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

Treatment	Storage Interval							% Decrease	Mean
	0	15	30	45	60	75	90		
P_o	7.03	6.35	5.7	5.3	4.9	4.5	4.3	38.832	5.443
P_1	7.06	6.95	6.65	6.45	6.2	5.9	5.67	19.681	6.412
P_2	7.06	6.75	6.4	6.05	5.9	5.65	5.3	24.92	6.16
P_3	7.04	6.7	6.4	5.9	5.65	5.3	5.2	26.135	6.033
P_4	7.03	6.35	5.8	5.3	5	4.8	4.6	34.56	5.558
						6.2			
P_5	7.04	6.8	6.65	6.51	6.32	S	5.85	16.901	6.48
Mean	7.04	6.65	6.27	5.92	5.66	5.39	5.15		7.21

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

Treatment	Storage Intervals							% Decrease	Mean
	0	15	30	45	60	75	90		
P_o	4.03	3.91	3.75	3.62	3.5	3.38	3.27	18.85	3.64
P_1	4.02	3.95	3.91	3.86	3.82	3.77	3.72	7.462	3.861
P_2	4.04	3.97	3.93	3.87	3.83	3.76	3.69	8.665	3.871
P_3	4.02	3.95	3.89	3.84	3.79	3.71	3.65	9.203	3.84
P_4	4	3.91	3.82	3.74	3.66	3.58	3.52	12.002	3.75
P_5	4.04	3.99	3.95	3.88	3.84	3.8	3.76	6.934	3.89
Mean	4.03	3.95	3.88	3.8	3.74	3.67	3.6		4.576

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.

The results of panel judge represented that the maximum mean value was observed P_1 (7.27) followed by P_5 (7.09), while minimum mean value noted in sample P_0 (5.93) followed by P_4 (6.07) whereas the highest decline in color score was found in nectar sample P_0 (44.44%) followed by P_4 (40%) awhile least score noticed P_5 (22.22%) followed by P_1 (24.39%) (Table 8). Previous work revealed that due to the presence of oxygen and non-enzymatic browning responsible in color degradation Brendor et al. [35].

During the storage period, the flavor of samples decreased from 8.2 to 5.75 significantly ($p<0.05$) which represented in Table 8. The highest mean value for the pear nectar sample was noted in P_5 (7.57) followed by P_2 (7.37), and the lowest was found in P_0 (6.13) followed by P_4 (6.56). The highest decrease was noticed in sample P0 (43.75%) followed by P_4 (33.75%) while the lowest decrease was found in sample P_5 (22.35%) followed by P_1 (25.61%). Previously Navarro et al. studied in their research work Valencia orange concentrates (60°Brix) stored at (0-9)°C and 18°C to find out the adequate conditions for bulk storage at 0°C and revealed that flavor of the product loses during the storage. Similarly decline in flavor (5.04 to 3.14) during the storage of guava slice was stated.

The mean score for taste was significantly ($p<0.05$) decreased from 8.10 to 5.60 with the passage of time (Table 9). The highest mean value was noted in sample P_1 (7.50) followed by P_3 (7.21) and the lowest was found in sample P_0 (6.11) followed by P_2 (6.21). The highest decline in score was noticed in sample P_0 (43.75%) followed by P_4 (35.37%) while the lowest decrease was recorded in sample P_5 (22.50%) followed by P_1 (24.71%). The results of this research work closely related to the findings of Marcy et al. [36] they reported that effect of storage temperature and time on the quality of orange juice stored at (12.2, 6.6, 1.1 and 4.4)°C and also increased in acidity responsible for the degradation of taste.

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

C	Storage Intervals							% Decrease	Mean
P_o	0	15	30	45	60	75	90	14.071	3.72
	3.98	3.9	3.82	3.74	3.63	3.54	3.42		
P_1	3.95	3.9	3.83	3.74	3.66	3.58	3.52	10.89	3.741
P_2	3.9	3.83	3.75	3.66	3.57	3.5	3.46	11.285	3.671

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

Treatment	Storage Intervals							% Decrease	Mean
P_o	0	15	30	45	60	75	90	14.071	3.72
	3.98	3.9	3.82	3.74	3.63	3.54	3.42		
P_1	3.95	3.9	3.83	3.74	3.66	3.58	3.52	10.89	3.741
P_2	3.9	3.83	3.75	3.66	3.57	3.5	3.46	11.285	3.671

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

Treatment	Storage Intervals							% Decrease	Mean
P_o	0	15	30	45	60	75	90		
	8.1	7.1	6.2	5.6	5.2	4.8	4.5	44.44	5.93
P_1	8.2	7.9	7.6	7.3	7	6.7	6.2	24.39	7.27
P_2	8.1	7.6	7.3	7	6.7	6.3	6	25.93	7
P_3	8.1	7.4	6.8	6.4	6.2	5.9	5.6	30.86	6.63
P_4	8	7	6.4	5.9	5.4	5	4.8	40	6.07
P_5	8.1	7.7	7.4	6.9	6.6	6.6	6.3	22.22	7.09
Mean	8.1	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.

Treatment	Storage Intervals							% Decrease	Mean
P_o	0	15	30	45	60	75	90		
	8	7.3	6.6	6	5.5	5	4.5	43.75	6.13
P_1	8.2	8	7.7	7.3	6.9	6.5	6.1	25.61	7.24
P_2	8.4	8.1	7.8	7.4	7	6.7	6.2	26.19	7.37
P_3	8.1	7.6	7	6.5	6.3	6.1	5.8	28.4	6.77
P_4	8	7.5	7	6.5	6	5.6	5.3	33.75	6.56
P_5	8.5	8.2	7.9	7.6	7.3	6.9	6.6	22.35	7.57
Mean	8.2	7.78	7.33	6.88	6.5	6.13	5.75		8.32

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

Treatment	Storage Intervals							% Increase	Mean
	0	15	30	45	60	75	90		
P_o	8	7.2	6.6	6	5.5	5	4.5	43.75	6.11
P_1	8.5	8.2	7.9	7.5	7.2	6.8	6.4	24.71	7.5
P_2	7.5	7	6.5	6	5.8	5.5	5.2	30.67	6.21
P_3	8.4	7.9	7.5	7.3	6.9	6.5	6	28.57	7.21
P_4	8.2	7.5	7	6.4	5.7	5.5	5.3	35.37	6.51
P_5	8	7.6	7.4	6.8	6.6	6.4	6.2	22.5	7
Mean	8.1	7.57	7.15	6.67	6.28	5.95	5.6		8.11

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

Treatment	Storage Intervals							%	Mean
	0	15	30	45	60	75	90		
P_o	7	6.5	6	5.6	5.1	4.6	3.8	45.71	5.51
P_1	7.2	7	6.8	6.6	6.5	6	5.7	20.83	6.54
P_2	7.3	6.8	6.4	6.15	5.9	5.6	5.2	28.76	6.19
P_3	7.2	6.6	6.4	5.7	5.5	5.2	5	30.55	5.94
P_4	7.1	6.5	6.2	5.7	5.1	4.5	4.2	40.84	5.61
P_5	7.3	7.1	6.9	6.7	6.5	6.3	6.2	15.06	6.71
Mean	7.18	6.75	6.45	6.08	5.77	5.37	5.02		7.3

During storage period the maximum mean value was calculated in sample P_5 (7.93) followed by P_1 (6.54) and a minimum mean value was recorded in sample P_0 (5.51) followed by P_4 (5.61) (Table 10). The highest decrease was noted in sample P_0 (45.71%) followed by P4 (4.84%) while the lowest decrease was noticed in sample P_5 (15.06%) followed by P_1 (20.83%). Rosario [37] studied in his research work with the passage of time and the presence of temperature responsible in the breakdown of the quality of any fruit which results in a decline in overall acceptability similar study was found by Kinh et al. [31] they preserved apple pulp with the addition of potassium metabisulphite.

CONCLUSION

In this research work pear nectar was preserved with chemical preservatives such as Sodium benzoate, and Potassium sorbate, stored in 250 ml 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 P_5 (0.05% Potassium sorbate+0.05% Sodium benzoate) and P_1 (0.1% Sodium benzoate) were found the best, while P_0 (peach nectar without preservative) showed poor results below the scale of sensory acceptability.

REFERENCES

1. Shakir I, Hussain I, Zeb A, Durrani Y. Sensory evaluation and microbial analysis of apple and pear mixed fruit jam prepared from varieties grown in Azad Jammu Kashmir. World J Dairy Food Sci. 2009:201-204.
2. Senser F, Sherz H, Munchen G. Tablas de composition de Alimentos. 1999:2.
3. Agricultural Statistic of Pakistan. Agriculture, Food security and research, Economic Wing, Islamabad. 2012:96.
4. USDA. National nutrient database for standard reference, Release. 2009
5. Carneiro. Rheological behavior of functional sugar-free guava preserves and effect of the addition of salts. J Food Sci Tech. 2013;31:404-412.
6. Hudina M, Tampar F. Sugar and organic acids contents of European pears (*Pyrus communis*) and Asian pear (Pyrusserotinarehd) cultivars. J Acta Alimentaria Akademiaikiado. 2000;29:217-230.
7. Hudina M, Stamper F. The correlation of the pear (*Pyrus communis*) yield, quality to the foliar nutrition and water regime. J Acta Agri Slovenica. 2005:85-200.
8. Hashmi A, Safiullah A. Agri and Food Security, Northern areas strategy for sustainable development. IUCN Pak Programme. 2003:92-93.
9. Khan NR. Photochemical changes in packed orange juice during storage. M.Sc. Thesis. Department of Food Science and Technology. NWFP. Agri Univ Pesh. 1987.
10. Lyne RE, Quamme HA. Study of different varieties of pear. J Adv Fruit Breed. 1975:38-70.
11. Mahammad MU, Kamba AS, Abubakar L, Bagna EA. Nutritional composition of pear fruits (pyruscommunis). Afr J Food Sci Tech. 2010;3:76-81.
12. Menezes CC, Borges SV, Ferrua FQ, Vilela CP, Carneiro JDS. Influence of packaging and potassium sorbate on the physical, physicochemical and microbiological alterations of guava preserves. J Food Sci. 2011;12:156-168.
13. Mishra B, Gautam S, Sharma A. Shelf life extension of sugarcane juice using preservatives and gamma radiation processing. J Food Sci. 2011;8:573-578.
14. Park KJ, Bin A, Brod FPR. Drying of pear with and without osmotic dehydration. J Food Eng. 2003:97-103.
15. Pereira PAP, Souza VR, Teixeira TR, Queiroz F, Borges SV, Carneiro JD. Rheological behavior of functional sugar-free guava preserves: Effect of the addition of salts. Food Hydrocolloids. 2013;31:404-412.
16. Salvador H, Maldonado G, wAna L, Montelongo M, Jacobo CM, Hernandez GH, et al. Physicochemical, nutritional, and functional characterization of fruits Xoconostle (*Opuntia matudae*) pears from central-Mexico region. J Food Sci. 2010;6:485-492.

17. Spiller GA. Dietary Fiber in prevention and treatment of disease. CRC Handbook Diet Fiber Human Nutr. 2001:363-431.

18. Shew CW, Salomon D, Simon JL, Sreeualson T, Freese E. Inhibitory compounds on bacteria and mammalian ceff. Antimicrob Agents Chemoth. 1975;7:349-350.

19. Vadivel V, Janardhanam K. Plant foods for human nutrition. J Pears Free Diet. 2005;60:69-75.

20. Vanderslice JK, Higgs DJ, Hayes JM, Block G. Ascorbic acid and dehydroascorbic acid content of food. J Food Composit Analys. 1990;3:105-118.

21. Gouws PA, Keyser M , Műller IA, Cilliers FP, Nel W. Ultraviolet radiation as a non-thermal treatment for the inactivation of microorganisms in fruit juice. Innovative Food Sci Eng Tech. 2008;9:348-354.

22. Gabas AL, Cabral RAF, Telis-Romero J, Telis VRN, Finzer JRD. Effect of apparent viscosity on fluidized bed drying process parameters of guava pulp. J Food Eng. 2007;80:1096-1106.

23. Gillani SN. Development of mango squash from four different cultivars of mango. M.Sc. Thesis. Department of Food Science and Technology. NWFP. Agri Univ Pesh. 2002:511-516.

24. FOA/U. Food and Agriculture Organization of UN. Ecological and social department. The Statistical Division. 2008:157.

25. Fang CQ, Lin SH. Present situation and development counter-measure of pear production in China. J China Fruit Tree. 2003;1:47-50.

26. Dock L, Floros JD, Linton RH. Heat inactivation of *Escherichia coli* in apple cider containing malic acid, sodium benzoate, and potassium sorbate. J Food Prot. 2000;63:1026-1031.

27. AOAC. Official methods of analysis association of official and analytical chemists 13th Edison. Washington, DC. 2013.

28. Cecilia E, Maia GA. Storage stability of cashew apple juice preserved by hot fill and aseptic process. Department of Food Tech. University of Ceara, Brazil CEP. 2002;60:110-111.

29. Iqbal SA, Yasmin S, Waduad, Shah WH. Production, storage, packaging and quality evaluation of guava nectar. Pak J Food Sci. 2001;1:33-36.

30. Imran A, Rafiullah K, Muhammad A. Effect of added sugar at various concentration on the storage stability of guava pulp. Department of Food Science and Technology. NWFP Agricuture University Peshawar. Pak Sarhad J Agri. 2001;1:89-93.

31. Kinh Shearer AE, Dunne CP, Hoover DG. Preparation and preservation of guava pulp with chemical preservatives, and mild heat. J Food Prot. 2001;6:111-114.

32. Hassan LG, Usman BB, Kamba BB, Hassan SW. Protein and amino acid composition of hastala pasta squasch. J Food Nigeria. 2009;10:295-299.

33. Sandi D, Jose BP, Antonio CG, June FM, Marco TC, Patricia BL. Hunter color dimensions, sugar contents and volatile compounds in pasteurized yellow passion fruit juice during storage. 2004;2:233-245.

34. Ali M. Canning of fruits and vegetables and their juices. Effect of canning quality of juices from different varieties of oranges. M.Sc Agriculture Thesis. Agriculture University, Faislabad. 1965.

35. Brenndor K, Oswin CO, Trin DS, Mrema GC, Werek C. Bobby solar driers and their role in post-harvest processing. Commonwealth Sci Council. 1985:78-83.

36. Marcy JE, Graunlich TR, Crandall PG, Marshall MR. Factors affecting storage of orange concentrates. J Food Sci. 1984;6:551-555.

37. Rosario MJG. Formulation of ready to drink blends from fruits and vegetable juices. Asian J Sci Res. 1996:99.