

Physicochemical Analysis of Apple and Pear Mixed Fruit Jam Prepared from Varieties Grown in Azad Jammu and Kashmir

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A comparative study was carried out on mixed fruit jam of (apple + pear) pulp, incorporated within the ratios 50:50 (T₁), 60:40 (T₂), 40:60 (T₃), 100% apple (T₄) and 100% pear (T₅). All the jam samples were stored in sterilized glass jars and evaluated physicochemically for ascorbic acid, acidity, pH, total soluble solids, reducing sugars and non-reducing sugars for an interval of 15 days during 3 months storage period. All the samples were significantly different at ($P < 0.05$) during storage. A decrease was observed in ascorbic acid from 17.40 mg/100g to 9.19 mg/100 g, pH 3.64 to 3.22 and non-reducing sugars 46.00% to 16.69%. While increase was noted in % acidity from 0.6 % to 0.78%, reducing sugars 16.55% to 47.30% and TSS 68.5 °brix to 71.2 °brix during evaluation.

Apple (*Malus Sylvestris*) belongs to the family rosaceae and subfamily pomoideae. Apple is one of the most important tree fruit of the world, which was originated in the Central and South/Western Asia. In Pakistan its cultivation is limited to the northern hilly areas of Punjab, NWFP and Balochistan. Some important varieties grown in various regions of Pakistan are: Kashmiri, Kashmir Amri, Kandhari, Kulu, Kalat Special, Red Beauty of Bath, Golden Delicious, Banki, and Sky Spur. In addition, some low chilling new varieties have been introduced like Tropical Beauty, Enna and Einsheimer. Enna is reported to perform well at lower altitudes (Chaudhry, 1994). The total area under apple cultivation in Pakistan is 110.8 thousand hectares which include 0.4 Punjab, 0.1 Sindh, 8.8 NWFP and 101.5 thousand hectare Balochistan while total production in Pakistan is 333.8 thousand tons which includes 3.6 Punjab 0.1 Sindh, 106.3 NWFP and 223.8 thousand tons Balochistan (Agric. Stat. Pakistan, 2003-2004). The pear, is also an important fruit which is grown in temperate zone throughout the world. Out of the several species the European pear (*Pyrus communis*) is most widely grown. The European pear is considered by many to be among the most delicious of all species. It contains a better juicy texture with a delicate flavor and aroma. The common varieties of pear are *pyrus pyrifolia*, *pyrus bretschneideri*, *pyrus pashia* and *pyrus communis* (Layne and Quamme, 1975). The total area under cultivation of pear in Pakistan is 2.4 thousand hectares which include 0.1 Punjab, 2.4 NWFP and 0.1 thousand hectares Balochistan while the total production of

pear in Pakistan is 30.7 thousand tons which includes 1.2 Punjab, 29.0 NWFP, 0.5 thousand ton in Balochistan (Agric. Stat. Pakistan, 2003-2004). In Azad Kashmir total pear production is 2546 tons (Azad Kashmir Statistical Year Book, 2004). In Azad Kashmir three varieties of pear are produced which locally called as Nashpati, Kotonal, and Nakh, among these varieties the Nashpati is most delicious and having fleshy and juicy texture. Among other two varieties Nakh are very delicious and owing to their perishability a huge production goes wasted and needs to be preserved. Commercial production of jam is subjected to standard formulations of fruit pulp, sugar content, adjusted acidity and pectin content. Jam is a semisolid food made from not less than 45% (by weight) fruit and 55% (by weight) sugar. This substrate is concentrated to about 65% or above soluble solids. Flavoring and coloring agents are added to overcome the deficiencies that occur in the fruit. Its self standard formulations are developed according to their end use, consumer preferences, market demand, food laws, buyers specifications and economic utilization of inputs required (Desrosier and Desrosier, 1978). The present research work was carried out by keeping in view the loss of apple and pear in Azad Jammu and Kashmir due to improper handling and preservation techniques. Mixed fruit jam of (apple and pear) with different pulp ratios was prepared to reduce this problem.

MATERIALS AND METHODS

Fresh, mature and healthy apple and pear fruit was purchased from the Rawalakot Azad Jammu & Kashmir fruit market and transported in wooden boxes to the laboratory of Food Science & Technology Department,

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Faculty of Nutrition Sciences N.W.F.P Agricultural University Peshawar. After washing, sorting, peeling and coring the fruit pieces were made with the help of stainless steel knife and dipped in 0.2% citric acid solution already prepared to avoid browning. Fruit pulp was extracted. Pulp was incorporated within the ratios given below.

Different ratios of apple and pear pulp

Treatments	Apple	Pear
T ₁	50	50
T ₂	60	40
T ₃	40	60
T ₄	100	0
T ₅	0	100

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RESULTS AND DISCUSSION

The results showed that the ascorbic acid of the jam decreased during storage.

Table 1. Effect of storage and treatments on ascorbic acid content (mg/100g) of Jam samples.

Treatments	Initial	15	30	45	60	75	90	Mean
T ₁	14.30	13.99	12.91	12.43	11.68	10.95	10.40	12.38c
T ₂	13.98	11.95	10.98	10.37	9.96	9.48	9.19	10.84d
T ₃	15.15	14.20	13.40	12.98	12.18	11.88	10.88	12.96b
T ₄	14.80	13.80	13.14	12.59	11.97	11.13	10.78	12.60c
T ₅	17.40	16.50	15.87	14.96	13.98	13.00	12.33	14.86a
Mean	15.14a	14.09b	13.26c	12.67d	11.95e	11.29f	10.72g	

Values are mean of three replications.

Values followed by different letters are significantly ($P < 0.05$) different from each other.

The mean values of all the treatments showed significant difference from 14.86 (T₅) to 12.96 (T₃), 12.60 (T₄), 12.38 (T₁) and 10.84 (T₂) respectively. The maximum mean value was recorded for T₅ and minimum for T₂. Results are shown in Table 1. Statistical analysis revealed that treatment and storage effect on all the samples were significant. These results are in agreement with Riaz *et al.* (1999) who observed decrease in ascorbic acid content of strawberry jam from 18mg/100g to 13mg/100g during 90 days of storage. Torezan (2002) reported that jam A presented twice the vitamin C content (14.5 mg/100g) of B (7.6 mg/100g) because of its faster processing, reducing, thermal and oxidative degradation.

The results pertaining to the titratable acidity revealed that acidity increased during storage. The mean values recorded were 0.6629 (T₅) to 0.6829 (T₃), 0.6843 (T₄), 0.7029 (T₂) and 0.7229 (T₁) respectively. The maximum mean value was recorded for (T₁) and minimum for (T₅) results are given in

table 2. Statistical analysis revealed that treatment and storage effect on all the samples were significant. The similar results were reported by Riaz *et al.* (1999) who observed decrease in ascorbic acid content of strawberry jam from 18 mg/100g to 13 mg/100g during 90 days of storage. Torezan (2002) reported that jam A presented twice the vitamin C content (14.5 mg/100g) of B (7.6 mg/100g) because of its faster processing, reducing, thermal and oxidative degradation.

Table 2. Effect of storage period and treatments on acidity (% age) of jam samples.

Treatments	Initial	15	30	45	60	75	90	Mean
T ₁	0.66	0.68	0.71	0.73	0.74	0.76	0.78	0.7229a
T ₂	0.64	0.66	0.69	0.71	0.72	0.74	0.76	0.7029b
T ₃	0.62	0.64	0.67	0.69	0.70	0.72	0.74	0.6829c
T ₄	0.62	0.64	0.66	0.68	0.71	0.73	0.75	0.6843c
T ₅	0.60	0.62	0.65	0.67	0.68	0.70	0.72	0.6629d
Mean	0.6280g	0.6480f	0.6760e	0.6960d	0.7100c	0.7300b	0.7500a	

Values are mean of three replications.

Values followed by different letters are significantly ($P < 0.05$) different from each other.

pH of all the jam samples was decreased during storage. The mean values of all the treatments showed significant difference from 3.586 (T₄) to 3.573 (T₂), 3.504 (T₃), 3.504 (T₁) and 3.276 (T₅) respectively. The minimum mean value was recorded for (T₅) and maximum for (T₄) results are presented in table 3. Statistical analysis revealed that treatment and storage effect on all the samples were significant. These results are in agreement with Ehsan *et al.* (2002) reported decreasing trend in pH of all treatments of mixed jam prepared from watermelon and lemon during storage. Maximum decrease was observed in T₅ (50 : 50). Ehsan *et al.* (2003) studied grape fruit apple marmalade and reported decreasing trend in pH maximum decrease in pH value (3.13) was observed in T₃(50:50).

Table 3. Effect of storage period and treatments on pH of jam samples.

Treatments	Initial	15	30	45	60	75	90	Mean
T ₁	3.56	3.55	3.53	3.51	3.48	3.46	3.44	3.504c
T ₂	3.63	3.61	3.60	3.58	3.55	3.53	3.51	3.573b
T ₃	3.56	3.54	3.53	3.51	3.48	3.44	3.45	3.504c
T ₄	3.64	3.63	3.61	3.58	3.56	3.55	3.53	3.586a
T ₅	3.33	3.32	3.3	3.27	3.25	3.24	3.22	3.276d
Mean	3.544a	3.530b	3.514c	3.490d	3.464e	3.448f	3.430g	

Values are mean of three replications.

Values followed by different letters are significantly ($P < 0.05$) different from each other.

The results showed that reducing sugars increased during storage the mean values recorded were 23.36(T₁), to 28.87 (T₂), 30.13 (T₅), 32.28 (T₄) and 32.45 (T₃) respectively. The maximum mean value was recorded for (T₃) and minimum for (T₁) results are given in table 4. Statistical analysis revealed that treatment and storage effect on all the samples were significant. The similar results are reported by Riaz *et al.* (1999) who observed increasing trend in reducing sugars

of strawberry Jam during 3 months storage. Anjam *et al.* (2000) while working on apricot diet jam observed increase in reducing sugars. Ehsan *et al.* (2003) reported increasing trend in reducing sugars of grape fruit apple marmalade reducing sugars increased from 16.55 to 31.36 after 60 days of storage.

Table 4. Effect of storage period and treatments on reducing sugars (% age) of jam samples.

Treatments	Initial	15	30	45	60	75	90	Mean
T ₁	16.55	17.56	18.60	20.68	25.00	29.90	35.20	23.36d
T ₂	16.60	20.68	24.68	27.76	33.00	37.60	41.80	28.87c
T ₃	16.62	22.60	27.68	32.77	38.76	42.20	46.50	32.45a
T ₄	16.70	21.71	27.68	32.67	37.65	42.25	47.30	32.28ab
T ₅	16.64	20.60	25.62	29.75	34.55	39.58	44.15	30.13bc
Mean	16.62g	20.63f	24.85e	28.73d	33.79c	38.31b	42.99a	

Values are mean of three replications.

Values followed by different letters are significantly ($P < 0.05$) different from each other.

Results pertaining to the non reducing sugars showed a decreased in non reducing sugars. The mean values for all the treatments were 33.94 (T₁) to 31.23 (T₂), 30.64 (T₃) and 29.22 (T₄) and 26.88 (T₅) respectively. The minimum mean value was recorded for (T₃) and maximum mean value for (T₁) results is given in table 5. Statistical analysis revealed that treatment and storage effect on all the samples were significant. The results of decrease in non reducing sugars are in accordance with. Riaz *et al.* (1999) observed decrease in non reducing sugars from 44.64 to 32.35% in strawberry jam. Ehsan *et al.* (2003) observed decrease in non reducing sugars of grape fruit apple marmalade.

Table 5. Effect of storage period and treatments on non reducing sugars (% age) of jam samples.

Treatments	Initial	15	30	45	60	75	90	Mean
T ₁	45.50	42.40	38.20	34.30	28.20	25.40	23.60	33.94a
T ₂	46.00	40.80	36.50	32.30	25.65	20.66	16.69	31.23b
T ₃	43.20	37.00	31.69	26.78	20.52	17.50	11.46	26.88d
T ₄	44.10	38.89	33.92	28.59	23.76	19.64	15.67	29.22c
T ₅	42.40	39.28	34.78	30.63	26.28	23.09	18.01	30.64bc
Mean	44.24a	39.67b	35.02c	30.52d	24.88e	21.26f	17.08g	

Values are mean of three replications.

Values followed by different letters are significantly ($P < 0.05$) different from each other

Total soluble solids increased during storage. The mean values for all the treatments were 69.37 (T₁) to 70.04 (T₅), 70.14 (T₃), 70.31 (T₂) and 70.56 (T₄) respectively maximum mean value was recorded for (T₄) and minimum for (T₁) results are shown in table 6. Statistical analysis revealed that treatment and storage effect on all the samples were significant. These results are in accordance with Tremazi (1967) reported that total soluble solids increased in canned Pakistani peaches on storage. Riaz *et al.* (1999) observed increase in total soluble solids of strawberry jam during storage. Ehsan *et al.* (2002) and Ehsan *et al.* (2003) reported the increase in TSS of watermelon lemon Jam from 68.6 to

68.9 and grape fruit apple marmalade from 70.0 to 70.8 after 60 days.

Table 6. Effect of storage period and treatments on total soluble solids of jam samples.

Treatments	Initial	15	30	45	60	75	90	Mean
T ₁	68.5	68.6	68.8	68.9	70.1	70.3	70.4	69.37d
T ₂	69.8	69.9	70.2	70.3	70.5	70.7	70.8	70.31b
T ₃	69.6	69.8	69.9	70.1	70.3	70.6	70.7	70.14bc
T ₄	70.0	70.1	70.3	70.5	70.8	71.0	71.2	70.56a
T ₅	69.5	69.6	69.8	70.1	70.3	70.4	70.6	70.04c
Mean	69.48e	69.60de	69.80cd	69.98c	70.40b	70.60ab	70.74a	

Values are mean of three replications.

Values followed by different letters are significantly ($P < 0.05$) different from each other.

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