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Keywords: *olive fruit, apple fruit, jam evaluation.*

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Quality Evaluation and Preparation of Apple and Olive Fruit Blended Jam

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Abstract- The present research work was carried out to investigate the effect of storage and treatment on overall quality of the apple olive blended jam, and to develop a suitable combination of olive and apple fruits pulps for jam preparation. Jam prepared from various blends of apple and olive were studied for physico chemical properties such as, % acidity, pH, (TSS), % non-reducing and % reducing sugar and for sensory attributes namely, taste, texture, color and overall acceptability during three months of storage with an interval of fifteen days. Results indicated that titratable acidity was increased from 0.64 to 0.77%, with reduction in pH from 3.57 to 3.40. Non reducing sugar was decreased from 44.57 to 27.52%. On the other hand reducing sugar of all jam samples increased from 16.62 to 30.52%. TSS of jam samples was increased during storage from 69.37 to 70.43 °Brix. Results regarding sensory properties revealed that the color, texture and taste score rate were decreased during storage period which lowered the acceptability level of the product. It is concluded that storage has considerable ($p < 0.05$) effect on physicochemical and organoleptically properties of apple olive blended jam. It was also concluded that treatment AO₅ were found best suitable combination of apple olive blended jam regarding their physicochemical and organoleptic properties.

Keywords: olive fruit, apple fruit, jam evaluation.

I. INTRODUCTION

Jam is semi-solid mass, which attained from the cooking fruit pulp and sugar followed by acid, pectin, flavors and coloring substances. Jams contain about 68.5% total soluble substances and 45% at least fruit pulp, while the (7) revealed that jam should contain more than 65% total soluble solids in finished product (5). Jam, jellies and marmalade is one simple fruit product prepared from fruit individually or combination of different fruit (15). Olive (*Olea europaea* L.) is a small tree fruit mostly grown in temperate zones. Olive is an egg shaped fruit, with sizes varying from 2 to 3 cm and flesh to stone ratio of 3 to 6.5. Olive is famous for its nutritious edible oil with a lot of health benefits. Other constituents are water, sugar, protein, oleuropein and anthocyanins. Oleuropein cause bitterness must be removed (10). Composition of olive fruit, moisture 65 to 75%, lipids 10-15%, reducing sugar 3-6%, non reducing sugar < 0.3%, fiber 1- 4% and protein 1-2 %

(9).Olive fruit also contain 1-3% phenolic compounds, 1.5% inorganic matters and 5.8% cellulose organic acid, pectin and pigments in small amount (6). Jam Apple (*Malus Sylvestris*) is a member of rosaceae family and sub family pomoidae. Apple is the chief tree fruit of the globe. It was originated from the south western Asia. Nutrition facts include 84.7% water, 13.9 g carbohydrates, 0.3g lipids, 0.4g protein and vit.C 8mg per 100 from of edible fruit. Apples are rich source of antioxidants including flavonoids and polyphenols mainly occurs in its skin. Thus eating whole apple is recommended to obtained full health benefits (11). Nonetheless, the future of olives production and processing might be very much bright in our country in general and Khyber Pakhtunkhwa in particular because this fruit fetches maximum economic returns for the farmer. To promote the olive fruit production and processing, this research work was designed to prepare a value added product from olive fruit i.e jam, which will be available throughout the year in a market. The farmers will be benefitted while getting proper return for their produce.

II. MATERIALS AND METHODS

Good quality, fresh, mature and healthy olive & apple fruits was selected for the research work and was brought from the Sungbatti Olive Research Farm Swabi and apple was purchased from the local market. The selected fruit were washed with water in order to remove dust, and any other foreign material. Olive has a bitter taste, which is due to a natural glucoside called oleuropein Olive fruit were first dipped in 2% Sodium Hydroxide (Lye solution) for 36 hours in order to remove the bitterness. The removal of oleuropein is tested with 1% phenolphthalein indicator which gives red color. The lye is leached out from the olive fruit by washing in running water for 24 hours, The removal of lye is again test with 1% phenolphthalein giving no color indicating that lye is completely removed from the olive fruit. (13) After removal of bitterness from the olive fruit the pulp was obtained through pulper machine. Similarly apple fruit was washed, peeled, trimmed, cut and dipped in 1% citric acid solution to prevent oxidation. Then the fruit was blended in order to get the pulp. Treatments with different combination of olive and apple pulp were made. All the treatments were replicated three times.

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After the jam were preserved in 450gm of glass jars and3 stored at room temperature for 90 days.

a) *Research Plan*

Treatments	Apple pulp	Olive pulp	Sugar
Apple olive (AO ₀)	1000 g	-	1000g
Apple olive (AO ₁)	900 g	100 g	1000g
Apple olive (AO ₂)	800 g	200 g	1000g
Apple olive (AO ₃)	700 g	300 g	1000g
Apple olive (AO ₄)	600 g	400 g	1000g
Apple olive (AO ₅)	500 g	500 g	1000g

b) *Chemical Used*

Sodium Benzoate (Analytical grade-Merck Germany), Potassium sorbate (Analytical grade-Merck), Sodium hydroxide (Analytical Grade-Sigma), Copper sulphate (Analytical Grade-Merk Germany), Oxalic Acid (Analytical Grade- Sigma), Potassium hydroxide (Analytical Grade-Sigma), Methylene Blue (Sigma), Phenolphthalein (Analytical Grade-Merk). Sodium Potassium tartrate (ChemPol England).

c) *Physiochemical analysis*

Physiochemically all of the samples were analyzed for pH, titratable acidity, total soluble solids (TSS), reducing sugar and non-reducing sugar by (1).

d) *Organoleptic Evaluation*

The apple olive blended jam samples were sensory evaluated for color, texture, flavor and overall acceptability by 10 trained judge's panel. Organoleptic study was carried out at each 15 days interval for 3 month storage. The evaluation was conceded out by using 9 points hedonic scale of (14). The results are of scoring rate 1-9 awarded by judges of panel

e) *Statistical Analysis*

All the data concerning treatments and storage interval were statistically analyzed using factorial experiment in completely randomized design and the means were separated by applying least significant difference (LSD) Test at 5% possibility level as defined by (16). A statistical software STATISTIX 8.1 were used for the analysis of the data

III. RESULT AND DISCUSSION

a) *Chemical Analysis*

i. *pH*

pH of all the samples of apple olive blended jam were reduced during the total period of storage. The mean values of all the treatments showed considerable decreased from AO₀ to AO₅ 3.53, 3.56, 3.48, 3.55, 3.48 and 3.55 respectively. The least mean value was noted for AO₂ and AO₄ (3.48) followed by AO₀ (3.53) and highest mean value was noted for AO₁ (3.56) followed by AO₃ (3.55) as shown (Table 1). Statistical analysis shows that treatment and storage has considerable effect (P < 0.05) on all the samples. The largest percent decline was examined in AO₀ (5.33%) followed by AO₁ (4.93%), while smallest decline was examined in AO₅ (3.59%) followed by AO₂ (4.49%) (Table 1). Decreasing trend in pH might be due the hydrolysis of pectic bodies and formation of acidic compound during degradation of sugar contents. The gradual decrease in mean value of the pH may partly due to their varying composition, observed in mixed fruit jam prepared form water melon flesh part and lemon (8) who reported decrease in trend in pH of all treatments of mixed jam prepared from watermelon and during storagethe change in pH might be due to the change and formation acidic compound during storage of the jam

Table 1 : pH of Apple olive blended jam

Treatments	Storage intervals							% Decrease	Mean
	Initial	15	30	45	60	75	90		
AO ₀	3.38	3.34	3.3	3.27	3.24	3.22	3.2	5.33	3.53d
AO ₁	3.65	3.62	3.59	3.56	3.53	3.51	3.47	4.93	3.56a
AO ₂	3.56	3.53	3.51	3.48	3.46	3.43	3.4	4.49	3.48c
AO ₃	3.63	3.61	3.58	3.55	3.52	3.49	3.46	4.68	3.55b
AO ₄	3.57	3.53	3.51	3.48	3.45	3.42	3.4	4.76	3.48c
AO ₅	3.62	3.6	3.58	3.55	3.53	3.51	3.49	3.59	3.55ab
Mean	3.57a	3.54b	3.51c	3.48d	3.46e	3.43f	3.40g		

Values having different alphabetical letters are significantly different (P < 0.05)

ii. *Titratable Acidity (%)*

Acidity of all the samples of apple olive blended jam was greater than that observed before storage. The mean values of all the treatments significantly decreased from AOO to AO5 0.68, 0.70, 0.69, 0.71, 0.72 and 0.73 successively. The least amount mean value was noted for AOO (0.68) followed by AO2 (0.69) and highest mean value was noted for AO5 (0.73) followed by AO4 (0.72). Maximum increased was obtained in AOO (20.00) followed by AO1 (20.51) least amount increased was observed in AO5 (15.19) followed by AO4 (15.38). Results are shown in table 2. The increased in

acidity of the apple olive blended jam might be due to the break down of pectic bodies to pectenic acid. The reason for increasing trend of acidity was due to the formation different organic acid during carbohydrates degradation and hydrolysis at storage. These results are in agreement with (4) who reported increasing trend in acidity of all treatments observed 0.65 to 0.70% after in 60 days storage interval of apricot jam (Table 2). Increase in acidity was due to the formation of acids by degradation of polysaccharides and oxidation of reducing sugar or by break down pectic substance and uronic acid reported by (12).

Table 2 : Titratable Acidity (%) of Apple olive blended Jam

Treatments	Storage intervals								Mean
	Initial	15	30	45	60	75	90	% inc	
AO ₀	0.6	0.62	0.65	0.68	0.7	0.73	0.75	20.00	0.68e
AO ₁	0.62	0.64	0.67	0.7	0.73	0.75	0.78	20.51	0.70d
AO ₂	0.62	0.65	0.67	0.69	0.72	0.74	0.76	18.42	0.69d
AO ₃	0.64	0.67	0.69	0.71	0.74	0.76	0.77	16.88	0.71c
AO ₄	0.66	0.68	0.7	0.72	0.74	0.76	0.78	15.38	0.72b
AO ₅	0.67	0.69	0.71	0.74	0.76	0.78	0.79	15.19	0.73a
Mean	0.64g	0.66f	0.68e	0.71d	0.73c	0.75b	0.77a		

Values having different alphabetical letters are significantly different ($P < 0.05$)

iii. *Reducing sugar*

Mean of Reducing sugar significantly difference from AO0 to AO5 27.08, 23.44, 24.10, 23.30, 23.20 and 22.80 respectively. The minimum mean value was noted for AO5 (22.80) followed by AO4 (23.20) and maximum mean value was noted for AO0 (27.08) followed by AO2 (24.10). Maximum increased was observed in AO0 (48.72 %) followed by AO1 (46.35%) minimum increased was observed in AO5 (42.59%) followed by AO4 (44.39%). The reason for increasing the reducing sugar might be due to the presence of invertase enzymes but invertase enzymes works properly at 4.6 pH and 50 °C

temperature And since the temperature was ambient in this condition, thus making it inadequate for activity of invertase enzyme. The increase in reducing sugar might be due to the inversion of non reducing sugar to during storage. The inversion of non reducing sugar was due to the presence of acid along with high temperature speed up the inversion process. Results are presented in table 3. These results are in agreement with (2) reported increased trend in reducing sugars of strawberry jam during 90 days storage. Similarly, increase in reducing sugar of apricot jam during storage was also observed by (4)

Table 3 : Reducing sugar (%) of Apple olive blended Jam

Treatments	Storage intervals								Mean
	Initial	15	30	45	60	75	90	% inc	
AO ₀	16.64	19.34	20.89	23.13	25.67	29.78	32.45	48.72	23.99ab
AO ₁	16.7	18.36	20.67	23.21	25.67	28.31	31.13	46.35	23.44bc
AO ₂	16.63	19.34	22.31	24.78	26.23	28.55	30.89	46.16	24.10a
AO ₃	16.6	18.76	20.56	23.48	25.89	27.88	29.95	44.57	23.30cd
AO ₄	16.55	18.99	20.79	22.98	25.34	27.97	29.76	44.39	23.20cd
AO ₅	16.61	18.52	20.47	22.78	25.43	26.86	28.93	42.59	22.80d
Mean	16.62a	18.89b	20.95c	23.39d	25.71e	28.23f	30.52g		

Values having different alphabetical letters are significantly different ($P < 0.05$)

iv. *Non Reducing sugar*

Non-Reducing sugar of all the apple olive blended jam samples was decreased during storage. The mean values of all the treatments showed significant difference from AO0 to AO5 34.58, 35.40, 34.73, 37.53, 38.22 and 38.23 respectively. The minimum mean value was noted for AO0 (34.58) followed by AO2 (34.73) and maximum mean value was noted for AO5 (38.23) followed by AO4 (38.22). Maximum decreased was observed in AO0 (44.43%) followed by AO1 (40.02%) minimum increased was

observed in AO4 (34.31%) followed by AO5 (35.12%). Results are presented in table 4. The decreased in non reducing sugar of apple olive blended jam might be due the inversion of acid. These results are in agreement with (2) reported decreasing trend in non-reducing sugars from 44.64 to 32.35% of strawberry jam during 90 days storage. (8) observed decreased in non-reducing sugar of grape fruit apple marmalade. The maximum decreased recorded 49.41to 34.85% and minimum decreased was recorded from 49.50 to 34.60%.

Table 4 : Non Reducing Sugar (%) of Apple olive Blended Jam

Treatments	Storage intervals								Mean
	Initial	15	30	45	60	75	90	% Dec	
AO ₀	42.4	39.28	36.2	33.3	30.12	27.34	23.56	44.43	33.17e
AO ₁	44.1	41.45	38.67	35.56	32.12	29.45	26.45	40.02	35.40c
AO ₂	43.2	40.43	37.89	34.78	31.67	28.9	26.23	39.28	34.73d
AO ₃	46	43.45	40.49	37.69	34.77	31.33	28.98	37.00	37.53b
AO ₄	45.5	43.78	40.99	38.9	35.67	32.78	29.89	34.31	38.22a
AO ₅	46.21	43.21	41.12	38.89	35.41	32.79	29.98	35.12	38.23a
Mean	44.57a	41.93b	39.23c	36.52d	33.29e	30.43f	27.52g		

Values having different alphabetical letters are significantly different (P<0.05)

v. *Total Soluble Solid (TSS)*

Total soluble solid of all the apple olive blended jam samples was increased during 90 days storage interval. The mean values of all the treatments show significant difference from AO0 to AO5 70.06, 70.63, 70.13, 70.31, 69.04 and 69.29 respectively. The minimum mean value was noted for AO4 (69.04) followed by AO5 (69.29) and maximum mean value was noted for AO1 (70.63.) followed by AO3 (70.31).

Maximum increased was observed in AO 1 (1.82%) followed by AO4 (1.58%) minimum increased was observed in AO3 (1.41%) followed by AO5 (1.43%). The increasing in total soluble solid of the apple olive jam might be due to the degradation of polysaccharides in the presence of acid. Results are presented in table 5. Increased in TSS of watermelon lemon jam from 68.62 up to 68.90 and during 60 days of storage in grapes fruit marmalade from 70 to 70.8 °brix by (8)



Figure 1: Showing Apple olive Blended jam stored at ambient temperature

Table 5 : Total soluble solid (°Brix) of Apple olive Blended Jam

Treatments	Storage intervals								Mean
	Initial	15	30	45	60	75	90	% inc	
T0	69.5	69.7	69.9	70.1	70.3	70.5	70.4	1.28	70.06c
T1	70	70.2	70.4	70.6	70.8	71.1	71.3	1.82	70.63a
T2	69.6	69.8	69.9	70.1	70.3	70.5	70.7	1.56	70.13c
T3	69.8	69.9	70.2	70.3	70.5	70.7	70.8	1.41	70.31b
T4	68.5	68.7	68.8	69	69.2	69.5	69.6	1.58	69.04e
T5	68.8	68.9	69.1	69.3	69.5	69.6	69.8	1.43	69.29d
Mean	69.37g	69.53f	69.72e	69.90d	70.10c	70.32b	70.43a		

Values having different alphabetical letters are significantly different (P<0.05)

b) *Organoleptic Evaluation*

i. *Color*

Color of all the apple olive blended jam samples was decreased during 90 days storage interval. The mean values of all the treatments showed significant difference from AO0 to AO5 9.77, 7.64, 7.87, 8.00, 7.93 and 8.23 respectively. The minimum mean value was noted for AO1 (7.64) followed by AO2 (7.87) and maximum mean value was noted for AO0 (9.77) followed by AO5 (8.23). Maximum decreased was observed in AO0 (27.38%) followed by AO1 (21.84%) minimum increased was observed in AO5 (15.73%)

followed by AO3 (16.09%). Changes in color might be attributed to Millard reaction, enzymatic browning ascorbic acid degradation and polymerization of color pigments (carotenoids and anthocyanin's) with other phenolic compound. Results are presented in table 6. The effect of low storage temperature and freezing techniques on ascorbic acid content and additional qualitative characteristics of Iranian strawberries and affirmed that the storage temperature of 18 and 24 0c were mostly excellent for preserving the qualitative individually (flavor, texture color and entirety) of the strawberries (3).

Table 6 : Color Score of Apple olive Blended jam

Treatments	Storage intervals								Mean
	Initial	15	30	45	60	75	90	% Decrease	
AO ₀	8.4	8.1	7.7	7.3	6.8	6.4	6.1	27.38	7.26d
AO ₁	8.7	8.2	7.9	7.6	7.3	7	6.8	21.84	7.64c
AO ₂	8.6	8.4	8.2	7.9	7.6	7.3	7.1	17.44	7.87b
AO ₃	8.7	8.5	8.3	8	7.7	7.5	7.3	16.09	8.00b
AO ₄	8.8	8.6	8.3	7.9	7.6	7.3	7	20.45	7.93b
AO ₅	8.9	8.7	8.5	8.2	8	7.8	7.5	15.73	8.23a
Mean	8.68a	8.42b	8.15c	7.82d	7.50e	7.22f	6.97g		

Values having different alphabetical letters are significantly different (P<0.05)

ii. *Taste*

Taste of all the apple olive blended jam samples was decreased during 90 days storage interval. The mean values of all the treatments showed significant difference from AO0 to AO5 10.54, 7.77, 8.21, 8.29, 8.29 and 8.37 respectively. The minimum mean value was noted for AO1 (7.77) followed by AO2 (8.21) and maximum mean value was noted for AO0 (10.54) followed by AO5 (8.37). Maximum decreased was observed in AO0 (34.12%) followed by AO1 (20.69%)

minimum increased was observed in AO5 (14.44%) followed by AO2 (15.73%). Results are presented in table 7. Organic acid and sugar ratio primarily creates a sense of taste which is perceived by specialized taste buds on the tongue. Decrease in taste score might be due to the fluctuation in acids, pH and sugar/acid ratio. These results are in accordance with (8) reported decreasing trend from 6.2 to 4 during initial and 150 days during storage of watermelon and lemon jam.

Table 7 : Taste Score of Apple olive Blended Jam

Treatments	Storage intervals								Mean
	Initial	15	30	45	60	75	90	% Dec	
AO ₀	8.5	8.1	7.7	7.2	6.8	6.3	5.6	34.12	7.17c
AO ₁	8.7	8.3	8	7.8	7.5	7.2	6.9	20.69	7.77b
AO ₂	8.9	8.7	8.5	8.2	8	7.7	7.5	15.73	8.21a
AO ₃	9	8.8	8.6	8.3	8.1	7.8	7.4	17.78	8.29a
AO ₄	9	8.7	8.5	8.3	8.1	7.9	7.5	16.67	8.29a
AO ₅	9	8.8	8.6	8.4	8.2	7.9	7.7	14.44	8.37a
Mean	8.85a	8.57b	8.32c	8.03d	7.78e	7.47f	7.10g		

Values having different alphabetical letters are significantly different (P<0.05)

iii. *Texture*

Texture of all the apple olive blended jam samples was decreased during 90 days storage interval. The mean values of all the treatments showed

significant difference from AO0 to AO5 5.9, 6.5, 6.7, 6.5, 6.7 and 7.1 respectively. The minimum mean value was noted for AO0 (5.9) followed by AO1 and AO3 respectively (6.5) and maximum mean value was noted



for AO5 (7.1) followed by AO2 and AO4 (6.7). Maximum decreased was observed in AO0 (34.7%) followed by AO1 (28.9%) minimum decreased was observed in AO5 (16.9%) followed by AO2 (23.7%). The textural properties of the jam are usually attributed pectic bodies composition. The pecticbodies in olive fruit are very low as compared to apple fruit. The decrease in

pecticsubstance with storage significantly affect the texture score of the apple olive blended jam; Results are presented in table 8. These results are in accordance with (17) studied the structural changes in strawberry tissue during glacial and stated that the textural attributes in particular were statistically significantly different among the strawberry jams.

Table 8 : Texture Score of Apple olive blended Jam

Treatments	Storage intervals								Mean
	Initial	15	30	45	60	75	90	% Dec	
AO ₀	7.2	6.9	6.3	5.8	5.3	5	4.8	34.7	5.9d
AO ₁	7.6	7.2	6.8	6.5	6.2	5.8	5.4	28.9	6.5c
AO ₂	7.6	7.2	6.9	6.7	6.4	6.1	5.8	23.7	6.7bc
AO ₃	7.4	7.1	6.8	6.5	6.2	5.9	5.6	24.3	6.5c
AO ₄	7.6	7.4	7.1	6.7	6.3	6	5.7	25.0	6.7b
AO ₅	7.7	7.5	7.3	7.1	6.8	6.6	6.4	16.9	7.1a
Mean	7.52a	7.22b	6.87c	6.55d	6.20e	5.90f	5.6g2		

Values having different alphabetical letters are significantly different (P<0.05)

iv. Overall Acceptability

Over all acceptability of all the apple olive blended jam samples was decreased during 90 days storage interval. The mean values of all the treatments showed significant difference from AO0 to AO5 6.91, 7.42, 7.68, 7.70, 7.73 and 7.72 respectively. The minimum mean value was noted for AO0 (6.91) followed by AO1 (7.42) and maximum mean value was noted for AO4 (7.73) followed by AO5 (7.72). Maximum decreased was observed in AO0 (31.84%) followed by

AO1 (22.92%) minimum decreased was observed in AO5 (17.43%) followed by AO2 (18.18%). The apple olive blended jam remains acceptable after 90 days of storage period. Sensory traits are non-generally inter related and contributes independently towards the overall sensory perception. Results are presented in table 8. These results are in accordance with (8) reported decreasing trend from 8.80 to 7.96 in apple marmalade.

Table 9 : Overall acceptability of Apple olive blended Jam

Treatments	Storage intervals								Mean
	Initial	15	30	45	60	75	90	% Decrease	
AO ₀	8.2	7.8	7.4	6.9	6.5	6.0	5.6	31.84	6.91c
AO ₁	8.4	8.0	7.7	7.4	7.1	6.8	6.5	22.92	7.42b
AO ₂	8.4	8.2	8.0	7.7	7.4	7.1	6.9	18.18	7.68a
AO ₃	8.5	8.2	8.0	7.7	7.4	7.2	6.9	18.90	7.70a
AO ₄	8.5	8.3	8.1	7.8	7.5	7.2	6.8	19.92	7.73a
AO ₅	8.5	8.3	8.0	7.7	7.4	7.2	7.0	17.43	7.72a
Mean	8.42a	8.14b	7.86c	7.53d	7.22e	6.90f	6.61g		

Values having different alphabetical letters are significantly different (P<0.05)



Figure 2: Showing treatment AO₅ and its replication of the Apple Olive blended jam stored at ambient temperature

IV. CONCLUSION

Apple olive blended jam was prepared from apple and olive pulp and was examined during time interval of 90 days. Statistically it is concluded that storage and treatment has significant effect on the quality and stability of the apple olive blended jam. Results investigated that good quality jam with equal amount of apple and olive pulp could be prepared and storage with minimum damages among the other treatment both physiochemically and organoleptically even after 90 days of storage interval.

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