DEVELOPMENT AND STORAGE STABILITY OF MANGO AND MUSKMELON BLENDED PULP

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ABSTRACT

Mango and muskmelon are major fruits and their products (e.g. juices, concentrates, nectars, etc.) have high acceptance by consumers globally. The study was carried out with an objective of preparing excellent quality clarified blended mango and muskmelon pulp with high yield and consumer acceptance. Mango and muskmelon blended pulp treated with different concentrations of sodium benzoate and potassium sorbate showed a significant change during storage at ambient temperature. The blended pulp ratio was 50:50 while the concentrations of preservatives were as T_0 (with no preservatives), T_1 (0.1% sodium benzoate), T_2 (0.1% potassium sorbate), T_3 (0.05 % sodium benzoate + 0.05 % potassium sorbate), T_4 (0.075 % sodium benzoate + 0.025 % Potassium sorbate), T_5 (0.025 % sodium benzoate + 0.075 % potassium sorbate). Physio chemically the blended pulp was study for (percent acidity, pH, TSS, ascorbic acid, reducing and non-reducing sugars) and organoleptically i.e (color, flavor, taste and overall acceptability) after each 15 days intervals. During three month of storage an inclined was recorded in TSS from 14.55 to 18.87 ^{0}Brix, from 0.25 % to 0.30 % and reducing sugar from 6.19 % to 6.54 % while a reduction was taken place in ascorbic acid from 38.48 to 24.49 mg/100g, pH from 4.49 to 3.81 and non-reducing sugar from 8.92 % to 7.63 %. During sensory evaluation T_4 and T_5 obtained maximum means score of judges while T_1, T_2 and T_3 gained minimum means score. Sample T_4 was found

the most suitable treatment on the overall basis of study. The Statistical analysis showed that storage interval and treatments had a significant ($p<0.05$) effect on physio-chemical and sensory analysis of mango and muskmelon blended pulp.

Key words: Blended pulp, storage stability, sodium benzoate, potassium sorbate

INTRODUCTION

Mango (*Mangifera indica*) belonging to family *Anacardiaceae*, is native to Indian subcontinent and hundreds of its varieties have been introduced in various warm region of the world. Fruits and vegetables are main source of food for all the humans around the world in aspects of providing balance diet, job opportunities and keep the environment clean, natural and Pure (Moard, 2009). The nutritional value of mango fruit is also very high, it contain many essential vitamins and minerals such as Vitamin A, C, thiamin and niacin and mineral like iron and calcium in considerable amount and provide 75 kcal energy per 100g of serving (Griesbach, 2003). It is composed of 79.3 to 82% moisture, 12.9 to 20.8% total soluble solids, 10 to 17.4% total sugar, 7.28 to 12.35% non-reducing sugars, 0.49 to 0.58% ash content and 0.38 to 0.62% crude protein by weight of fresh product (Anonymous 1999).

Mango fruit is best known for its attractive color, best aroma and fascinating flavor (Giuseppe, 2010). According to CSA (2014/2015) report, annual worldwide mango production is 25 million tons. India is the largest producer of mangoes followed by China, Thailand, Pakistan, Brazil and Philippines. Major mango exporter countries include Mexico, Pakistan and Philippines. Matured mango pulp is used in production of frozen, canned and processed products while dehydrated juices serve as a drink (Ramteke and Eipeson, 1997). In Pakistan, the total space allocated to fruit farming is 854,400 hectares with the production of 7,178,800 tons, while the area devoted to growing mango is 167,500 hectare with production of 1,733 thousand tons. Mango is the second important fruit of Pakistan after citrus and ranked 4th worldwide in mango production.

Muskmelon (Cucumis melon) belonging to family Cucurbitaceae, is native to Levant and Egypt by some scientist, while other link its origin to Persia, India and Central Asia (Kittiphoom et, al). Muskmelon is a juicy, tasty and delicious fruit popular for its nutritional and medicinal properties. The Cucurbitaceae family includes pumpkin, squash, cucumbers, melons, watermelons and pumpkins (Susan S. et, al). Cucumis melon is a rich source of ascorbic acid, carotenoids, folic

acids and potassium as well as other bio active compounds beneficial to health (Lester and Hodges, 2008). Muskmelon is important from health point of view in terms of supplying energy, nutrients and fulfilling water need. Muskmelon provides 34 calories of energy by consuming 100 grams. In addition it also provide good amount of vitamins A and vitamins C, with some other nutrients at a negligible level. Muskmelon also contains 9% carbohydrates, less than 1 % protein and fats immersed and 90 % moisture content (Susan, Percival, 2006 confirm this reference). There are almost 100 countries worldwide producing Muskmelons in an area of 1.94 million acre out of which China is leading producer followed by Egypt, Iran and Turkey (Nwachukwu, 2014).

The pulp of both mango and Muskmelon fruits can be blended to obtain a mixture that is rich in fiber, vitamins, minerals and antioxidant. This mixture has a number of health benefits which include maintaining blood sugar level, maintain pH balance in body, provide feeling of satiety and also fulfil energy requirement of body (Aiiza, P.R. and I.M.B. Cabornida. 2008). Melon and mango mixture can even be used as substitutes for meals if protein rich substances are also blended with mixture. Due to high fiber it also promotes bowl movement (Rani, S and A. Zeb. 2010). Muskmelons and Mango fruits are abundantly produced in Pakistan especially in region of Khyber Pakhtunkhwa and Sindh respectively. But a large proportion of it goes waste due to lack of preservation skills and techniques. If pulp of these fruits are blended and preserved, then they can be worthed and its losses can also be reduced to a great extent and can be provided as raw material for various product preparation.

MATERIALS AND METHODS

This research work was carried out to develop and to study the storage stability of blended pulp of mango and musk melon and the changes occur during the storage at ambient temperature in the laboratory of Food Science and Technology Department Khyber Pakhtunkhwa, The University of Agriculture Peshawar, Pakistan. Mature muskmelon and mango of good quality were collected from the fruit market of Peshawar. The pulp of both fruits was extracted by pulping machine. Initially an experiment was performed to select suitable mango muskmelon ratio for further study on basis of sensory attributes. It was observed that 50:50 mango and muskmelon blended pulp was ranked higher on sensory basis among all blended samples. Two chemicl preservatives (sodium benzoate and potassium sorbate) were added to blended pulp at various

concentration and six treatments were made, given in the following table. The treatments were studied with a break of fifteen days during the storage of three month.

T_1	0.1% sodium benzoate
T_2	0.1% potassium sorbate
T_3	0.05% sodium benzoate + 0.05 potassium sorbate
T_4	0.075% sodium benzoate + 0.025 Potassium sorbate
T_5	0.025% sodium benzoate + 0.075 potassium sorbate
T_6	Control (with no preservatives)

Physico-chemical Analysis

Parameters

Parameters regarding pH, Total Soluble solids, Titratable acidity, Ascorbic acid, Total sugar and sensory evaluation was studied during the research period. pH of grape juice samples was determined by pH meter as described in the standard method of AOAC (2000). TSS of the selected juice samples was analyzed by Atago digital refractometer as described by method of AOAC (2000). Standard alkali solution was used for titration of juice and TA was measured by usin following formula (AOAC-2000)

$$\text{Acidity (\%)} = \frac{\text{C.F} \times \text{N} \times \text{T} \times \text{D}}{\text{V} \times \text{S}} \times 100$$

The titrimetric method as explained by AOAC (2000) was used to analyze the content of ascorbic acid in sample. Content of ascorbic acid of juice samples was calculated by following formula:

Ascorbic acid (mg/100g) = L×F× 100/D×P

Sugars (reducing and non-reducing) was measured by Lane Eynon method as reported in AOAC (2000).

Sensory Analysis

Larmond (1977) method was used to analyze the samples of the whole grape juice for color, flavor and overall acceptability. Panels of 10 judges were called to taste the samples (whole grape juice) for color, flavor and overall acceptability to compare them and allocate the score between 1-9, where digit 1 show extremely disliked and digit 9 represents extremely liked.

Statistical Analysis

Different means were separated by applying least significant difference test (LSD) as illustrated by Steel and Torrie (1997).

RESULTS AND DISCUSSION

pH

Initially the pH of blended pulp were noted as T_0 (5.21), T_1 (5.25), T_2 (5.17), T_3 (5.02), T_4 (5.11), and T_5 (5.19) that were gradually decreased to T_0 (3.44), T_1 (4.41), T_2 (3.48), T_3 (4.16), T_4 (3.68), and T_5 (3.71). The highest mean value for pH was observed in T_1 while the least mean value observed in T_2. (Table 4.1). Statistically analyzed data shows that a gradual decline in pH during storage (Appendix-I). These results are in line with the result of Iman *et al*. (2006), Hussain *et al*. (2003) and Riaz *et al*. (1988) detected also a similar reduction in the value of pH during storage of 4 month.

Total soluble solid (TSS)

Initially the Total soluble solid of blended pulp were noted as T_0 (15.6), T_1 (13.8), T_2 (13.6), T_3 (14.4), T_4 (15.3), and T_5 (14.6) that were gradually increased to T_0 (27.3), T_1 (16.65), T_2 (13.48), T_3 (15.93), T_4 (18.12), and T_5 (17.03). The maximum mean value were recorded in T_0 (21.90), while least mean value was detected in T_2 (Table 4.1). Statistically analyzed data reveals a gradual increase in TSS during storage (Appendix-II). Hussain *et al.* (2003) and Islam (1986) also showed the similar result, who noticed increase in TSS during storage. Rodriqo (2003) who reported that TSS of mixed mango juice increase in storage interval.

Acidity (%)

Primarily the Titrable acidity of blended pulp were noted as control (0.2), T_1 (0.2), T_2 (0.3), T_3 (0.3), T_4 (0.2), and T_5 (0.3) that were gradually increased to T_0 (0.27), T_1 (0.24) T_2 (0.38), T_3 (0.35), T_4 (0.23), and T_5 (0.35). The highest mean value was observed in T_2 (0.35) and the lowest mean value was recorded in T_4 (0.19) (Table 4.1). The statistical analysis data provides increase of titrateable acidity.(Appendix-III). The outcomes were in agreement with the result of Sandhu *et al*. (2001) and Mehmood *et al*. (2008) for different fruits juices.

Ascorbic acid

Initially the Ascorbic acid of blended pulp were noted as T_0 (38.35), T_1 (138.29), T_2 (39.01), T_3 (37.94), T_4 (38.25), and T_5 (39.03) that were gradually decreased to T_0 (15.73), T_1 (25.67) T_2 (27.83), T_3 (27.45), T_4 (27.93), and T_5 (22.34). Among treatments maximum ascorbic acid mean value was observed in T_2 (33.61) and the lowest mean value was recorded in T_0 (25.86). (Table 4.1). Statistical analysis data show a significant decrease of vitamin C content. (Appendix-IV). The outcomes were in line with the result of Negi, Roy (2000) and Mehmood *et al* (2008) too examined the similar dropping fashion of Vitamin C in apple fruit beverages. In similar study Saini *et al*. (2000) examined degradation in ascorbic acid content of fruit pulp preserved with different preservation.

Reducing Sugar

Primarily the Reducing sugar of blended pulp were noted as T_0 (7.11), T_1 (7.09), T_2 (7.04), T_3 (6.99), T_4 (6.88), and T_5 (6.91) that were gradually increased to T_0 (7.79), T_1 (5.21), T_2 (5.72), T_3 (7.02), T_4 (7.02), and T_5 (6.46). The highest mean value for treatment were recorded in T_0 (7.56) and the lowest mean value was recorded in T_1 (5.07). (Table 4.1). The statistical analysis of calculated data disclosed that significant ($p<0.05$) difference exists which is probably because of influence of storage duration and treatments on the reducing sugar of blended pulp storage duration. (Appendix-V). These outcomes are in correspondence with the result obtained by Saini, Pal (1996) and Babsky *et al*. (1986).

Non Reducing sugar

Initially the non-Reducing sugar of blended pulp were noted as T_0 (9.17), T_1 (9.17), T_2 (8.91), T_3 (8.79), T_4 (8.81), and T_5 (9.06) that were slowly reduced to T_0 (7.49), T_1 (8.32), T_2 (6.95),

T_3 (6.95), T_4 (7.35), and T_5 (8.69). Among treatments the highest mean value was recorded in T_1 (8.78) and lowest was shown by T_2 (7.55). (Table 4.1). The statistically analyzed data disclosed a sharp decrease of non-reducing sugar. (Appendix-VI). The outcome obtained for non-reducing sugars are in agreement with the result of Iqbal (1993), Ghorai and Khurdiya (1998) also said that sudden decline in sucrose is due to the transformation of non-reducing sugar to reducing sugar, primarily due to acid.

Table 1. Effect of chemical preservatives on the pH, TSS, acidity, ascorbic acid and reducing sugar value of mango and muskmelon blended pulp stored at ambient Temperature.

Treatment	pH	TSS	Acidity	Ascorbic Acid Value	Reducing S. Value	Non-reducing s. value
T0	3.76a	21.90a	0.25a	25.86a	7.56a	8.30a
T1	4.82b	15.12b	0.24b	30.98a	5.07b	8.78a
T2	3.67c	14.68b	0.35b	33.61a	5.58b	7.55b
T3	4.55cd	16.72c	0.32c	32.50ab	6.92c	7.68c
T4	3.92de	16.99d	0.19c	33.17b	6.94d	7.95d
T5	3.88e	15.90d	0.31d	33.42c	6.29e	8.68d
LSD	0.1	0.77	0.01	1.56	0.04	0.14
Storage time						
0	4.49a	14.55a	0.25a	38.48a	6.19a	8.92a
15	4.35b	15.38b	0.28b	36.30b	6.29a	8.59b
30	4.13c	16.99b	0.28bc	30.18c	6.38b	8.03c
45	3.97cd	17.74b	0.29bc	30.55d	6.42b	7.92c
60	4.02de	17.39b	0.27bc	32.52de	6.42b	8.01c
75	3.93ef	17.29c	0.27c	28.62e	6.54c	8.02c

90	3.81f	18.87c	0.30d	24.49f	6.54d	7.63d
LSD	0.11	0.84	0.01	1.69	0.04	0.15

Organoleptic evaluation

The trials of pulp were calculated for sensual evaluation i.e. color, Flavor, taste and whole acceptability by 10 judges. After 15 days we studied the sample organolaptically for 90 days. We used 9 points hedonic scale of Lormond (1977) for evaluation.

Color

Initially the color of blended pulp were T_0 (8.8), T_1 (8.3), T_2 (8.5), T_3 (8.3), T_4 (8.4), T_5 (8.5) that were slowly decreased to T_0 (3.4), T_1 (4.5), T_2 (4.9), T_3 (5.1), T_4 (5.4), T_5 (5.2) in storage interval. The highest mean value for color were observed in T_4 (7.13) and the lowest mean was observed in T_0 (5.07). (Table 4.2). The statistically analyzed data show a sharp decrease of color during storage.(Appendix-VII). The outcomes obtained for color are in agreement with the result of Jennifer (1993), Jain and Khurdiya (2004) were also agreeing with this result.

Flavor

Initially flavor value of blended pulp were T_0 (7.3), T_1 (8.3), T_2 (8.3), T_3 (8.2), T_4 (8.3), T_5 (8.1) that were slowly decreased to T_0 (1), T_1 (3.7), T_2 (3.39), T_3 (3.5), T_4 (3.87), T_5 (3.69) in storage interval. The highest mean value for flavor were observed in T_4 (7.79) and the lowest mean value for flavor were observed in T_0 (5.71) (Table 4.2). The statistically analyzed data show a share decrease in flavour during storage. (Appendix-VIII). The results obtained for flavor are in agreement with the result of Saini *et al*. (2000), Jain *et al* (2003), Bezman (2001) and Marcy *et al*. (1984) observe also the slowly loss in flavor score due to the variation in volatile mixtures of the juice during storing.

Taste

The score of panelist for taste of blended pulp were T_0 (7.4), T_1 (6.6), T_2 (6.7), T_3 (8.5), T_4 (7.4), and T_5 (7.3) that were gradually decreased to T_0 (1), T_1 (3.5), T_2 (3.7), T_3 (3.69), T_4 (3.91), and T_5 (3.55) correspondingly in storage. The highest mean value were observed in T_4 (7.79) and

lowest mean value were recorded in T_0 (3.36) (Table 4.2). The statistically analyzed data show the sharp decrease in mean value of paste during storage (Appendix-IX). The outcomes obtained for taste are in agreement with the result of Martin (1993) and Jain (2003) who also observed the same results.

Overall Acceptability

The score of panelist for overall acceptability of blended pulp were T_0 (7.83), T_1 (7.73), T_2 (7.80), T_3 (8.30), T_4 (8.05), and T_5 (7.79) that were slowly reduced to T_0 (4.3), T_1 (4.2), T_2 (3.5), T_3 (3.9), T_4 (4.1), and T_5 (4.3) correspondingly in storage. The highest mean value of overall acceptability were recorded in T_4 (7.60) and the lowest mean value for overall acceptability was recorded in T_0 (4.23) (Table 4.2). The statistically analyzed data show that a sharp decrease in mean value during storage of blended pulp. (Appendix-X). The results obtained for overall acceptability are in agreement with the result of Saini (2000) who detected that the potassium sorbate alone or in combined, hold maximum overall acceptability due to high nutrients stability, minor microbes and maximum sensory value during storing at ambient temperature. The overall results showed that sample T_4 (0.075% sodium benzoate + 0.025 Potassium sorbate) and T_5 (0.025% sodium benzoate + 0.075 potassium sorbate) retain maximum overall acceptability during storage.

Table 4.2. Effect of chemical preservatives on the color, flavor, taste and overall acceptability value (OAV) of mango and muskmelon blended pulp stored at ambient Temperature.

Treatment	Color score rate	Flavor score rate	Taste score rate	OAV
T0	5.07a	5.71a	3.36a	4.23a
T1	6.53b	7.29ab	3.83ab	4.43a
T2	6.51bc	7.37b	6.27b	5.50b
T3	6.87c	7.4b	6.43c	5.84b
T4	7.13c	7.79c	7.29d	7.60c
T5	6.69d	7.44d	4.87d	7.37c
LSD	0.25	0.29	0.95	0.59
Storage time				
0	8.47a	8.08a	7.32a	8.85a
15	7.30b	7.18b	6.42a	6.63b
30	6.80c	7.10b	5.12b	7.03b
45	6.38d	7.00b	4.32b	5.77c
60	6.03e	6.50c	4.55b	4.57d
75	5.43f	6.22c	5.33b	4.08de
90	5.08g	5.87d	4.33b	3.87e
LSD	0.27	0.32	1.03	0.64

CONCLUSION

In this research work, 50 : 50 mango and muskmelon blended pulp treated with different concentration of two preservatives (sodium benzoate and potassium sorbate) is studied at ambient temperature in plastic jars. It was found that T_4 (0.075 % sodium benzoate + 0.025 % Potassium sorbate) is best quality followed by T_5.

DATA AVAILABILITY

The data that support the findings of this study are listed in the article and are available from the corresponding authors upon reasonable request.

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DECLARATION OF INTEREST

We declare that this manuscript is original, has not been published before and is not currently being considered for publication elsewhere. The authors certified that there is no conflicts of interest associated with this publication, and there has been no significant financial support for publishing this work that could have influenced its outcome. As corresponding Author, I conform that the manuscript has been read and approved for submission by all the named authors.

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