

PJN

ISSN 1680-5194

PAKISTAN JOURNAL OF
NUTRITION

ANSI*net*

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Studies on Microbial and Sensory Quality of Mango Pulp Storage with Chemical Preservatives

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Abstract: The effect of chemical preservatives of sodium benzoate, potassium metabisulphite and potassium sorbet used individually and in combination, was studied on the microbial and sensory quality of the mango pulp (packed in 1kg glass and plastic containers) stored at ambient temperature (30-36°C) for 90 days with an interval of fifteen days. Mean score of taste panel for color, flavor and overall acceptability significantly ($p < 0.01$) decreased, while microbial growth significantly ($p < 0.01$) increased during storage. Results showed that samples with 0.2% potassium metabisulphite packed in plastic containers had negligible microbial growth, maintained maximum nutrients stability and best quality characteristics during storage.

Key words: Mango pulp, chemical preservatives, sensory quality

Introduction

Mango (*Mangifera indica* L.) is one of the oldest and most important tropical fruit. It is cultivated in almost every tropical and sub tropical country. It has originated in a tropical to sub tropical monsoon area in the Himalayan foot hills especially Burma and eastern India. Later on it spread to Africa, Brazil, Caribbean and Central America (Iagtiani *et al.*, 1988).

Pakistan produces mangoes in large quantities. The main varieties grown in Pakistan are Dusehri, Katha, Chonsa, Anwar Ratual, Malda, Fajri, Saroli, Sindheri, Langra, Desi, Almas, Totapari, and Ting etc (Iagtiani *et al.*, 1988). Total area under mango cultivation in Pak. was 102.7 thousand hectares and total production was 1.04 million tonnes during the year 2002-2003, while the total area and production of mango in N.W.F.P was 306 hectares and 3224 tonnes respectively. (Agri. Stat. of Pak., 2002-2003).

Mango is one of the cherished fruit not only for taste but also for nutritional values. It serves as a good source of energy and vitamin A & C, Iron & phosphorus etc. (Watt and Merrill, 1963). Mango fruit is also beneficial in the treatment of nephritis as well as other kidney troubles (Islam, 1986). Due to such qualities, perhaps mango is considered as the king of fruits.

Mango is mostly consumed as fresh fruit, but due to its perishable nature it cannot be stored for long time. In order to make the mango fruit available during the off season it is processed to make juices, jams, squashes, nectars, chutney, pickles, toffees, canned mango slices etc. (Hussain *et al.*, 2003).

During peak harvest season large quantities (30-50%) of this valuable fruit is wasted due to limited storage life

(Wills and Scott, 1972). It is important to prepare such products, which can be preserved for longer time. Keeping in view this fact, this study was undertaken to know the effect of different chemical preservatives on the microbial and sensory quality of mango pulp stored in bulk at ambient temperature (30-36°C). In this way the producers will get their proper return at peak harvest season and the consumer will enjoy a variety of products in off season.

Materials and Methods

Preparation of mango pulp: Fresh mature mangoes were purchased from Peshawar fruit market and were brought to Department of Food Sci. and Tec. NWFP Agricultural University Peshawar, where the research was carried out. After washing, peeling and coring, the flesh was cut into small pieces with stainless steel knives and pulp was made by using an electric blender.

Pasteurization: Pulp was then pasteurized in a water bath at a temperature of $82 \pm 2^\circ\text{C}$ for 30 minutes to reduce the microbial load.

Addition of acid: Acidity was increased by addition of 1% commercial grade citric acid.

Treatments: The product was divided in to different treatments and was stored in 1 kg glass and plastic containers. Following are the treatments combinations.

T₁ = Control + glass container

T₂ = Control + plastic container

T₃ = 0.2% sodium benzoate + glass container

T₄ = 0.2% sodium benzoate + plastic container

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Table 1: Total Bacterial Count (cfu/g) of mango pulp

Trts	Storage interval (Days)								
	Fresh	15	30	45	60	75	90	% Inc	Means
T ₁	7	23	72	135	216	309	384	5385.71	163.71 ^a
T ₂	7	18	66	127	203	295	356	4985.71	153.14 ^a
T ₃	5	12	27	44	53	64	83	1560	41.14 ^b
T ₄	5	10	25	40	50	61	78	1460	38.42 ^b
T ₅	5	10	22	37	45	58	74	1380	35.85 ^b
T ₆	5	9	23	34	43	56	70	1300	34.28 ^b
T ₇	5	10	28	47	53	66	83	1560	41.71 ^b
T ₈	5	10	27	42	52	61	78	1460	39.28 ^b
T ₉	5	11	25	40	50	62	77	1400	38.57 ^b
T ₁₀	5	9	24	37	48	60	75	1400	36.85 ^b
Means	5.4 ^d	12.2 ^d	33.9 ^{cd}	58.3 ^{bc}	81.3 ^{ab}	109.2 ^{ab}	135.9 ^a		

Mean followed by different letters are statistically different (P<0.01) using LSD test.

Table 2: Mean score of judges for color of mango pulp

Trts.	Storage interval (Days)								
	Fresh	15	30	45	60	75	90	%Dec	Means
T ₁	9	7.6	6.2	4.3	4.3	3.0	1.8	83.33	5.13 ^b
T ₂	9	7.6	6.4	5.1	4.8	3.1	1.8	80.00	5.40 ^b
T ₃	9	8.1	7.3	5.5	4.5	3.6	3.3	63.33	5.90 ^b
T ₄	9	8.3	7.4	5.7	4.7	3.8	3.5	61.11	6.05 ^b
T ₅	9	8.5	8.1	7.5	7.3	6.8	6.2	31.11	7.63 ^a
T ₆	9	8.6	8.3	8.1	7.8	7.5	6.9	23.33	8.03 ^a
T ₇	9	7.9	6.5	5.7	4.8	3.7	2.8	68.88	5.77 ^b
T ₈	9	7.9	6.6	5.6	4.8	3.8	3.1	65.55	5.83 ^b
T ₉	9	8.4	7.8	7.3	7.0	6.5	5.5	38.88	7.36 ^a
T ₁₀	9	8.4	7.9	7.8	6.8	6.6	5.8	35.55	7.47 ^a
Means	9 ^a	8.1 ^{ab}	7.2 ^b	6.3 ^c	5.7 ^{cd}	4.8 ^{de}	4.0 ^e		

Table 3: Mean score of judges for flavor of mango pulp

Trts.	Storage interval (Days)								
	Fresh	15	30	45	60	75	90	%Dec	Means
T ₁	8.8	6.6	4.5	3.3	1.8	1.5	1.3	85.23	3.97 ^d
T ₂	8.8	6.6	5.5	3.8	2.4	1.6	1.5	82.95	4.31 ^{cd}
T ₃	8.6	6.1	7.3	5.6	3.5	3.4	3.0	65.11	5.35 ^{bc}
T ₄	8.9	6.3	7.5	5.8	4.3	3.9	3.1	65.16	5.68 ^b
T ₅	8.9	8.6	7.9	7.5	7.3	6.6	5.8	34.83	7.51 ^a
T ₆	8.8	8.8	8.5	7.8	7.5	6.8	6.2	29.54	7.77 ^a
T ₇	8.6	6.9	6.3	5.5	4.7	3.5	2.5	70.93	5.42 ^{bc}
T ₈	8.7	6.9	6.1	5.7	4.8	3.7	3.2	62.79	5.58 ^b
T ₉	8.8	8.3	7.7	6.6	6.3	5.7	5.3	39.33	6.95 ^a
T ₁₀	8.8	8.3	7.7	6.9	6.5	6.3	5.5	37.50	7.14 ^a
Mean	8.8 ^a	7.3 ^b	6.9 ^b	5.8 ^c	4.9 ^d	4.3 ^d	3.7 ^e		

Mean followed by different letters are statistically different (P<0.01) using LSD test.

T₅ = 0.2% potassium metabisulphite + glass container

T₆ = 0.2% potassium metabisulphite + plastic container

T₇ = 0.2% potassium sorbet + glass container

T₈ = 0.2% potassium sorbet + plastic container

T₉ = Mix (0.066% each) + glass container

T₁₀ = Mix (0.066% each) + plastic container

Storage: Preserved mango pulp was stored for a period of 3 months at ambient temperature (30-36°C). The product was studied for microbial and sensory

evaluation at 15 days interval for a total storage period of 90 days.

Total bacterial count (TBC): The samples were analyzed for microbiological evaluation by the total plate count method as described by Diliello (1982).

Sensory evaluation: Ready to serve mango drinks were prepared with selected treatments and were evaluated by a panel of 10 judges for sensory characteristics like color, flavor and over all acceptability as described by Larmond (1977).

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Table 4: Overall acceptability of mango pulp

Trts.	Storage interval (Days)								Means
	Fresh	15	30	45	60	75	90	%Dec	
T ₁	8.8	6.8	4.9	3.5	1.8	1.6	1.5	82.95	4.12 ^d
T ₂	8.8	6.6	5.5	3.8	2.4	1.6	1.6	81.81	4.32 ^{c,d}
T ₃	8.6	6.1	7.3	5.6	3.5	3.4	3.3	61.62	5.40 ^{b,c}
T ₄	8.9	6.3	7.5	5.8	4.3	3.9	3.5	60.67	5.74 ^b
T ₅	8.9	8.6	7.9	7.5	7.3	6.6	6.2	30.33	7.57 ^a
T ₆	8.8	8.8	8.5	7.8	7.5	6.8	6.5	26.13	7.81 ^a
T ₇	8.6	6.9	6.3	5.5	4.7	3.5	2.8	67.44	5.47 ^b
T ₈	8.7	6.9	6.1	5.7	4.8	3.7	3.5	59.30	5.62 ^b
T ₉	8.8	8.3	7.7	6.6	6.3	5.7	5.5	37.50	6.98 ^a
T ₁₀	8.8	8.3	7.7	6.9	6.5	6.3	5.9	32.95	7.20 ^a
Means	8.8 ^a	7.4 ^b	6.9 ^b	5.9 ^c	4.9 ^d	4.3 ^d	4.0 ^d		

Mean followed by different letters are statistically different ($P < 0.01$) using LSD test. Each figure is the mean of observation of 10 judges

Statistical analysis: The results were analyzed statistically by using Randomized Complete Block Design as recommended by Steel and Torrie (1980) and means were separated by applying LSD test.

Results and Discussion

Total bacterial count: The mean total bacterial count (TBC) of mango pulp was significantly ($p < 0.01$) increased from 5.4 cfu/g to 135.9 cfu/g during storage. For treatments maximum mean value was recorded in sample T₁ (163.71 cfu/g), while minimum mean value was observed in sample T₆ (34.28 cfu/g). During storage maximum increase in TBC was observed in sample T₁ (5385.71%), while minimum increase of microorganisms was recorded in sample T₆ (1300%) (Table 1). Our results showed that samples with added 0.2% potassium metabisulphite had overall best results in controlling the microbial growth due to its more effectiveness in controlling microorganisms (Brenndor *et al.*, 1985). In another study Hussain *et al.* (2003) reported that application of potassium metabisulphite reduces the growth of microorganisms in mango pulp.

Organoleptic evaluation: The samples were sensory evaluated for color, flavor and overall acceptability at the storage interval of 15 days for a total period of 90 days.

Color: The mean score of judges for color were significantly ($p < 0.01$) decreased from 9 to 4.04 during storage. For treatments maximum mean score was observed in sample T₆ (8.03), while minimum mean score was recorded in sample T₁ (5.13). Maximum decrease was observed in sample T₁ (83.33%), while minimum decrease was recorded in sample T₅ (23.33%) (Table 2). Saini *et al.* (2000) observed that application of potassium metabisulphite control browning in fruit pulp. The reduction in color scores might be due to maillard reaction accelerated during storage. In another study Heikal and El-Sidawi (1972) observed that reducing sugars and amino acids help in browning of fruit pulp during storage.

Flavor: The mean score of judges for flavor were significantly ($p < 0.01$) decreased from 8.76 to 3.74 during storage. For treatments maximum mean score was observed in sample T₆ (7.77), while minimum mean score was recorded for sample T₁ (3.97). Maximum decrease in score was observed in sample T₁ (87.5%) while minimum decrease was recorded in sample T₆ (33.33%) (Table 3). Hussain *et al.* (2003) observed similar results in mango pulp.

Overall acceptability: The mean score of judges for overall acceptability were significantly ($p < 0.01$) decreased from 8.76 to 4.03 during storage. For treatments maximum mean score was observed in sample T₆ (7.81), while minimum mean score was recorded in sample T₁ (4.13). Minimum decrease was observed in sample T₆ (26.13%), while maximum decrease was recorded in sample T₁ (82.95%) (Table 4). In a similar study Saini *et al.* (2000) observed that pulp preserved with potassium metabisulphite either individually or in combination with other preservatives retains maximum overall acceptability, maintains maximum nutrients stability and negligible microbes. Statistical analysis showed that storage intervals and treatments had a significant ($p < 0.01$) effect on TBC and overall mean score of judges for color, flavor and overall acceptability of all mango squash samples during storage.

Conclusion: It could be concluded that addition of 0.2% potassium metabisulphite helps in controlling microbial growth and maintaining sensory characteristics of mango pulp, packed in bulk plastic containers.

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