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Effect of blend ratio and storage period on the quality of RTS beverage of mango *cv.* Totapuri

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Abstract
The present investigation was carried out in the Post-Harvest Laboratory, Department of Horticulture, College of Agriculture, JNKVV Jabalpur (M.P) during the year 2013-14. Among the fourteen treatments two pulp concentration of 10% & 12% pulp and 7 various levels of sugar i.e. (100, 110, 120, 130, 140, 150 and 160 g. per liter of RTS) were used for preparation of the RTS. The °Brix TSS values recorded for mango RTS increases with the increase in sugar content and storage period. The highest value of °Brix TSS was registered with recipe 14th (12% pulp + 160 gm. sugar per liter of RTS). The higher value of % acidity was recorded (0.111%) with the recipe 8th (12% pulp + 100 g. sugar per liter of RTS) at initial stage of observation. At initial stage the maximum (393.91) TSS/Acid ratio was recorded with the recipes 7th (10% pulp + 160 gm. sugar per liter of RTS). The value of pH at initial stage was recorded minimum in the recipe 8th (5.89) and maximum value was recorded recipe 7th (6.49). The recipe 8th showed maximum ascorbic acid content and the lowest by recipe 7th).

Keywords: Mango, RTS beverage, storage period, TSS, quality characters

1. Introduction
Mango (*Mangifera indica* L.) is the most important and commercially cultivated fruit crop belongs to the family Anacardiaceae. It is originated In south Asia mainly indo-Burma region. In India, It is commercially cultivated in different states, viz. Utter Pradesh, Andhra Pradesh, Kamataka, Bihar, Gujrat, Tamilnadu, Orrisa, west Bengal, Jharkhand, Maharashtra, kerala, M.P. and together contribute for about 93% of the total production in India. The cultivars grown in India are Totapuri, Amrapali, Sunderja Mallika. Langra, Deshehari, Chausa, Alphonso, Bombey Green etc. The total mango production in India is 18431.3 (‘000 MT) with an area of 2516.0 (‘000 ha) and average productivity of 7.3 (MT ha^{-1}) fruit per year in (2013-14), Whereas, in Madhya Pradesh it is grown in 18.3(‘000 ha) area with an annual production of 175.1 (‘000 MT) with productivity of 9.56 (MT ha $^{-1}$) (Anonymous, 2014) [1].
Mango fruit is an excellent source of Vitamin-A minirals and flavonoids like beta-carotene, alpha-carotene, and beta-cryptoxanthin. It is also a very good source of vitamin-B_6 (Pyridoxine), Vitamin-C and Vitamin-E. The fresh fruits of mango have limited shelf life. Therefore, it is necessary to utilize the fruit for making different products to increase its availability over an extended period and to stabilize the price during the glut season. Mango can be consumed fresh or can be processed into juice, nectar, pulp, jam, jelly and slices. In syrup, fruit bar or dehydrated products as well as being used as an additive to other fruit juices or pulps (Leite *et al.,* 2006) [6]. These products have good potential for internal as well as external trade. They influence the treatment received during the processing and good indicators of other properties as well as the qualities of food. These give benefit the producer, industry and the consumer (Ramos and Ibarz, 1998) [9]. Keeping the above points in view, the present investigation was undertaken.

2. Material and Methods
The fresh, uniform size mature fruits of mango *cv.* Totapuri were procured during the summer season (2013) from the whole sale fruit market and used for experimentation. The unripe, shorted diseased, damaged and off type fruits was discarded. The selected fruits were thoroughly washed with tap water to remove dirt and dust particles adhering to the surface of fruit and were allowed for surface drying. The good quality shorted fruits were picked up and used for the purpose of experimentation. The fruits were peeled with the help of stainless steel knife, then some quantity of water was added with trats and steamed for pulp preparation.

The steamed pulp was prepared with the help of mixer cum grinder and the stones were discarded manualy, fiber & other pulp waste were strained with stainless steel sieve.

2.1 Procedure for preparation of RTS

The extracted pulp was used for the preparation of mango RTS. The required quantity of pulp was added to measly quality of water and grinded sugar was also added to it. In all the fourteen treatments similar method was used (as per ratio of pulp & quantity of sugar in each treatments as given in the (table 1). The pulp and sugar was mixed throughly and heated up to 65°C to dissolve it properly. It was homogenized with juicer cum mixture and then strained with coorte muslin cloth to remove impurities if any. The Sodium benzoate @ 700 ppm was used as preservative for the prepared RTS. The RTS was than filled in sterilized glass bottles (200ml capacity) and sealed with crown cork.

The qualitative characters (i.e., TSS, Acidity, TSS/Acid, p^H and Ascorbic acid) were recorded for RTS beverage at 30 days interval. Total soluble solids in the RTS were measured with the help of hand Referectometer and p^H of RTS were measuring using elemer p^H meter after calibration of the instrument with standard buffer solution. The Titerable acidity and ascorbic acid content were determined by AOAC (1984) [2] methods. The data obtained in the study were subjected to statistical analysis.

Table 1: Detail of various treatment combinations.

Treatment Symbols	Treatment Combinations	Treatment details
T_1	P_1R_1	10% Pulp + 100 g Sugar/litre of RTS
T_2	P_1R_2	10% Pulp + 110 g Sugar/litre of RTS
T_3	P_1R_3	10% Pulp + 120 g Sugar/litre of RTS
T_4	P_1R_4	10% Pulp + 130 g Sugar/litre of RTS
T_5	P_1R_5	10% Pulp + 140 g Sugar/litre of RTS
T_6	P_1R_6	10% Pulp +150 g Sugar/litre of RTS
T_7	P_1R_7	10% Pulp + 160 g Sugar/litre of RTS
T_8	P_2R_1	12% Pulp + 100 g Sugar/litre of RTS
T_9	P_2R_2	12% Pulp + 110 g Sugar/litre of RTS
T_{10}	P_2R_3	12% Pulp + 120 g Sugar/litre of RTS
T_{11}	P_2R_4	12% Pulp + 130 g Sugar/litre of RTS
T_{12}	P_2R_5	12% Pulp + 140 g Sugar/litre of RTS
T_{13}	P_2R_6	12% Pulp + 150 g Sugar/litre of RTS
T_{14}	P_2R_7	12% Pulp + 160 g Sugar/litre of RTS

3. Results and Discussion

The qualitative parameters were significantly influenced by the various treatments of recipes and pulp concentration.

3.1 TSS (°Brix)

The result obtained from the present Lab investigation revealed that the higher concentration of mango pulp increased the TSS per cent of mango RTS and this effect was observed up to 120 days of storage. The °brix TSS values recorded for mango RTS increases with the increase in sugar content and storage period the highest value of °brix TSS was registered with recipe 14th (12% pulp + 160 g. sugar per liter of RTS) followed by recipe 7th (10% pulp + 160 g. sugar per liter of RTS). These findings are in confermation with the findings of (Kumari and Sandal, 2011) [5] who reported a decreasing trend in TSS of mango RTS during upto 100 days of storage. (Datey and Raut, 2009) [4] reported that TSS of mango pulp increases with the increasing storage period (90 days). The reason assigned for the increased TSS content in pulp during storage might be due to the conversion of left polysaccharide into soluble sugar. However, there increasing trend in TSS content was recorded in all the recipes up to 90 days of storage after which a gradual decrease in TSS value was noticed up to 120 days of storage. This decreas in TSS value might be due to the conversion of sugars. Similar findings were reported by (Ledeker *et al.,* 2012) [7].

3.2 Acidity (%)

As per the observation recorded for the % acidity value, revealed that the order of % acidity was increased in accordance with the increasing storage period gradually up to 120 days of storage. Similar trend of result was observed with the increasing pulp content with the RTS. The higher values were recorded for % acidity with 12% pulp content as compare to 10% pulp content RTS. The quantity of sugar added to RTS also affected the % acidity and the highest (%) acidity (0.111) was recorded with the recipe 8th. These findings are in conformation with the findings of (Kumari and Sandal, 2011) [5] who observe that there was gradual increase in acidity value with an increase in the storage period in mango RTS. The increase in acidity in RTS during 120 days of storage might be due to formation of organic acid by ascorbic acid degradation as well as progressive decrease in pectin content. (Datey and Raut, 2009) [4] indicated that there was an increase in titrable acidity and reducing sugar and a decrease in pH and ascorbic acid with the advancement of storage period. Similar result were also reported by (Zambare *et al.,* 2009) [14] with wood apple RTS beverage.

3.3 TSS/Acid ratio

The result presented in (Table 3) are evidence that TSS/Acid ratio was influenced by various treatments and it was noticed that reduction in TSS/Acid ratio was continuous at every stage of observation up to 120 days storage and this reduction was highly significant. Further, it was observe that the TSS/Acid ratio was also influence by the various recipes used for preparation of the RTS. The maximum value (393.91) was registered with the recipe 7th (10% pulp + 160g sugar per liter of RTS). This might be due to increased quantity of sugar which directly correlated with the TSS/Acid ratio of mango RTS as influenced by quantity of sugar added. These findings are in conformation with those as reported by (Singh *et al.,* 2005) [12] who reported that there was decrease in quality character of mango + bale beverage with the advance storage period but it remained above the acceptable rating even after 6 months of storage. Similar findings have been reported by other workers (Sharma *et al.,* 2008) [11].

Table 2: Effect of storage period and blend ratio on the TSS (%) of mango RTS

Treatments	0 Days	30 Days	60 Days	90 Days	120 Days
T_1	10.80	13.03	16.07	16.13	16.00
T_2	12.53	14.27	16.73	17.00	16.93
T_3	15.87	16.03	18.00	18.13	18.00
T_4	16.20	16.53	18.47	18.60	18.40
T_5	17.20	17.87	18.73	19.40	19.40
T_6	18.20	19.47	19.67	19.80	19.60
T_7	19.20	20.00	20.20	20.40	20.20
T_8	15.40	16.40	16.73	16.80	16.60
T_9	16.00	16.93	17.00	17.13	17.13
T_{10}	17.20	17.87	17.93	18.00	17.53
T_{11}	17.30	18.00	18.27	18.40	18.27
T_{12}	18.00	19.40	19.60	19.80	18.40
T_{13}	19.03	20.00	20.20	20.40	19.40
T_{14}	19.60	20.40	20.60	21.00	20.47
MEAN	16.61	17.59	18.44	18.64	18.31
$SE_m \pm$	0.074	0.084	0.050	0.044	0.080
CD at 5% level	0.214	0.243	0.146	0.126	0.231

Table 3: Effect of storage period and blend ratio on the acidity (%) of mango RTS

Treatments	0 Days	30 Days	60 Days	90 Days	120 Days
T_1	0.098	0.119	0.128	0.149	0.175
T_2	0.085	0.106	0.119	0.136	0.157
T_3	0.081	0.093	0.111	0.128	0.149
T_4	0.076	0.085	0.106	0.119	0.136
T_5	0.068	0.08	0.098	0.111	0.128
T_6	0.064	0.072	0.085	0.106	0.119
T_7	0.051	0.064	0.076	0.098	0.111
T_8	0.111	0.124	0.14	0.162	0.188
T_9	0.096	0.111	0.128	0.149	0.175
T_{10}	0.093	0.106	0.119	0.136	0.157
T_{11}	0.085	0.098	0.111	0.128	0.149
T_{12}	0.08	0.093	0.106	0.119	0.136
T_{13}	0.076	0.085	0.098	0.111	0.128
T_{14}	0.072	0.076	0.085	0.106	0.119
MEAN	0.081	0.094	0.108	0.126	0.145
$SE_m \pm$	0.005	0.004	0.005	0.004	0.005
CD at 5% level	0.016	0.013	0.013	0.011	0.011

3.4 pH

The pH value of a product plays an important role in preservation of pulp. Lowering of pH value is the result of increased acidity. The low pH inhibits the activity of microorganism specially the Bacteria. The data presented in (Table 4) revealed that an overall pH value was observed during the study period less than 7.0 i.e., acidic. However, the pH value recorded at initial period of storage (0 days) was higher in all the recipes and the maximum (6.49) was recorded with RTS of 7th recipe. it was also revealed that pH values were increased with the increase in ratio of pulp and also with the higher concentration of sugar. Moreover, the pH value also reduced as the storage period increased in all the recipes. These results supported by the results obtained by (Datey and Raut, 2009) [4] who reported slightly decreased in pH values during 90 days storage of mango pulp. (Zambare *et al.,* 2009) [14] reported that the acidity of the samples increased while the pH of the samples decreased as the storage period increase. This might be due to the formation of organic acid by ascorbic acid degradation. (Nilugin SE, 2010) [8] and (Rustagi and Kumar, 2013) [10] also noticed that the pH decreased significantly during storage.

Table 4: Effect of storage period and blend ratio on the TSS/Acid ratio of mango RTS

Treatments	0 Days	30 Days	60 Days	90 Days	120 Days
T_1	111.13	109.48	125.52	108.76	91.72
T_2	149.02	134.59	140.56	125.22	107.77
T_3	201.68	172.46	163.17	141.67	121.29
T_4	213.16	196.27	174.25	156.26	135.54
T_5	263.29	223.56	192.63	175.86	151.56
T_6	293.57	272.09	233.53	186.80	164.72
T_7	393.91	312.50	269.46	209.74	183.04
T_8	139.60	132.95	119.92	104.07	88.55
T_9	166.59	153.45	132.81	115.42	98.20
T_{10}	185.05	168.59	150.64	132.59	111.59
T_{11}	205.46	185.06	165.64	143.75	123.11
T_{12}	225.31	208.72	184.92	166.35	135.58
T_{13}	253.89	237.53	207.68	184.93	151.56
T_{14}	274.34	271.67	244.66	198.12	169.65
MEAN	219.71	198.49	178.96	153.54	130.99
$SE_m \pm$	24.180	10.422	10.191	5.646	3.922
CD at 5% level	70.046	30.193	29.522	16.355	11.361

3.5 Ascorbic acid content (mg/100 ml RTS)

The data presented in (table 5) revealed that the ascorbic acid content of RTS prepared from the mango cultivar had decreasing trend with an increase in the sugar content and acidity levels. The ascorbic acid content more (26.67mg/100ml of RTS) was recorded with RTS of recipe 8th. This might be due to less sugar content, acidity and more pulp. An increase in sugar content (TSS) decreased the ascorbic acid value in different recipe of RTS. These findings are in conformation as reported by (Singh *et al.,* 2007) [13] who reported that there was decrease in ascorbic acid of guava and pineapple beverage with the 120 days storage period. (Ali *et al.,* 2011) [3] reported that there was gradual increase in total soluble solids, titrable acidity, reducing sugar and total sugar while ascorbic acid content decrease during 120 days of storage.

Table 5: Effect of storage period and blend ratio on the p^H of mango RTS

Treatments	0 Days	30 Days	60 Days	90 Days	120 Days
T_1	6.02	5.81	5.72	5.51	5.25
T_2	6.15	5.94	5.81	5.64	5.43
T_3	6.19	6.07	5.89	5.72	5.51
T_4	6.24	6.15	5.94	5.81	5.64
T_5	6.32	6.2	6.02	5.89	5.72
T_6	6.36	6.28	6.15	5.94	5.81
T_7	6.49	6.36	6.24	6.02	5.89
T_8	5.89	5.76	5.6	5.38	5.12
T_9	6.04	5.89	5.72	5.51	5.25
T_{10}	6.07	5.94	5.81	5.64	5.43
T_{11}	6.15	6.02	5.89	5.72	5.51
T_{12}	6.2	6.07	5.94	5.81	5.64
T_{13}	6.24	6.15	6.02	5.89	5.72
T_{14}	6.28	6.24	6.15	5.94	5.81
MEAN	6.19	6.06	5.92	5.74	5.55
$SE_m \pm$	0.056	0.044	0.046	0.040	0.040
CD at 5% level	0.163	0.128	0.132	0.115	0.115

Table 6: Effect of storage period and blend ratio on the Ascorbic acid of mango RTS

Treatments	0 Days	30 Days	60 Days	90 Days	120 Days
T_1	23.33	21.67	20.00	18.33	16.67
T_2	21.67	20.00	18.33	16.67	15.00
T_3	20.00	18.33	16.67	15.00	13.33
T_4	18.33	16.67	15.00	13.33	13.33
T_5	16.67	15.00	13.33	13.33	11.67
T_6	15.00	13.33	13.33	11.67	10.00
T_7	13.33	11.67	11.67	10.00	8.33
T_8	26.67	23.33	21.67	20.00	18.33
T_9	23.33	21.67	20.00	18.33	16.67
T_{10}	21.67	20.00	18.33	16.67	13.33
T_{11}	20.00	18.33	16.67	13.33	11.67
T_{12}	18.33	16.67	13.33	11.67	10.00
T_{13}	16.67	13.33	11.67	10.00	8.33
T_{14}	13.33	11.67	10.00	8.33	6.67
MEAN	19.17	17.26	15.71	14.05	12.38
$SE_m \pm$	2.271	2.271	2.227	2.089	1.992
CD at 5% level	6.580	6.580	6.452	6.052	5.771

4. Conclusion

It is concluded from the present studies that the mango RTS prepared from 12% mango pulp and 150g of sugar per litre of RTS can be stored for longer period at room temperature with better acceptability, good quality, and marketability without any microbial growth.

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