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Standardization of blended RTS beverages from sweet orange (*Citrus sinensis*), Guava (*Psidium guajava*) and Ginger (*Zingiber officinale*)

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Abstract
The present experiment was carried out during 2020-21 in Post Harvest Lab of Department of Horticulture, SHUATS, Prayagraj. The experiment was conducted in Completely Randomized Design with 11 treatments replicated thrice. The treatments were T_1 (Sweet orange 100% + ginger 2%),T_2 (Sweet orange 90% + Guava 10% + ginger 2%),T_3 (Sweet orange 80% + Guava 20% + ginger 2%),T_4 (Sweet orange 70% + Guava 30% + ginger 2%),T_5 (Sweet orange 60% + Guava 40% + ginger 2%),T_6 (Sweet orange 50% + Guava 50% + ginger 2%),T_7 (Sweet orange 40% + Guava 60% + ginger 2%),T_8 (Sweet orange 30% + Guava 70% + ginger 2%),T_9 (Sweet orange 20% + Guava 80% + ginger 2%),T_{10} (Sweet orange 10% + Guava 90% + ginger %),T_{11} (Guava 100% + ginger 2%). From the present study, it is concluded that the treatment T_7 (Sweet orange 40% + Guava 60% + Sugar 10% + ginger 2%) could be gainfully utilized for enhancing the value of sweet orange and guava RTS preparation in the terms of TSS, Acidity, pH, Reducing sugar, color and appearance, flavor, taste, texture and overall acceptability. The treatment T_7 was also good in terms of economic return with benefit cost ratio (1:1.80).

Keywords: RTS, Sweet Orange, Guava, Ginger, etc.

Introduction
Ready to Serve (RTS) beverage is a non-fermented beverage prepared from mixing edible portion of fruit, sugar, water, and additives for direct consumption. RTS beverages are valued for their nutritional content, refreshing quality, pleasant flavor and medicinal properties.

Citrus consists of a group of fruits belonging to the family Rutaceae. The citrus fruits represent the third largest fruit industry of India next to the mango and banana. Besides having nutritional importance, citrus consists of a number of species and varieties, which are made available throughout the year, making their cultivation remunerative.

The Citrus fruits such as oranges, lemons and limes have been cultivated in South China, Malaysia and the sub-Himalayan parts of Assam from time immemorial and they spread to other tropical and sub-tropical parts of the world possessing a suitable climate. The most important is the mandarin orange, santra or kamla orange (*Citrus reticulata*). This is a loose-skinned orange and is often erroneously called orange. Sweet orange which in the English language denotes the tight skinned orange (*Citrus sinensis*).

The sweet orange (*Citrus sinensis*) is indigenous to China. It is believed to have been introduced into South India. The area under citrus fruits cultivation was 846.0 thousand hectares which is about 13.3% of total area under fruits and the total production was about 7,464.0 thousand MT which accounts to 10% of total fruit production with productivity of 8.8MT/ha. With the reorganization of states Andhra Pradesh now leads in citrus production (24.2%) followed by Maharashtra, Punjab, Madhya Pradesh and Gujarat.

Guava (*Psidium guajava* L.) is quite hardy, prolific bearer with sweet aroma and pleasant sour sweet taste, This is a member of dicotyledonous, belong to large member of Myrtaceae or Myrtle family believed to be originated in Central America and Southern part of Mexico (Somogyi *et al*., 1996) [12]. It is a small tree or shrub of 2 to 8 m in height with wide spreading branches (Singh, 1988) [13]. It is claimed to be the fourth most important cultivated fruit in area and production after mango, banana and citrus. India leads the world in guava production (Singhal, 1996) [14]. Crop in India occupies an area of 2.20 lack ha with annual production 25.72 lack MT having productivity 11.70 MT/ha (2010). Majorguava producing states are Uttar Pradesh, Maharashtra, Bihar, Andhra Pradesh, Gujarat, Madhya Pradesh, and Karnataka. In Maharashtra Guava is an important commercial horticultural crop and stands 2nd place in

production with an area of 33,469 ha, produce of 2.58 lack MT and productivity 7.80 MT/ha (Bijay Kumar 2011) [15]. The quality and nutritional value of guava fruits are influenced by physical and biochemical changes during maturation by photosynthesis and accumulation. Fully mature guava fruits have very strong flavour therefore it is unsuitable to use as a table purpose.

Materials and Methods

The Experimental work of "Standardization of RTS beverages from Sweet orange (*Citrus sinensis Osbeck*) and Guava (*Psidium guajava* L.)" was conducted in the Post Harvest Laboratory, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during the year 2020. The treatments were T_1 (Sweet orange 100% + ginger 2%),T_2 (Sweet orange 90% + Guava 10% + ginger 2%),T_3 (Sweet orange 80% + Guava 20% + ginger 2%),T_4 (Sweet orange 70% + Guava 30% + ginger 2%),T_5 (Sweet orange 60% + Guava 40% + ginger 2%),T_6 (Sweet orange 50% + Guava 50% + ginger 2%),T_7 (Sweet orange 40% + Guava 60% + ginger 2%),T_8 (Sweet orange 30% + Guava 70% + ginger 2%),T_9 (Sweet orange 20% + Guava 80% + ginger 2%),T_{10} (Sweet orange 10% + Guava 90% + ginger %),T_{11} (Guava 100%+ ginger 2%),).

Climatic condition in the experimental site

The area of Prayagraj district comes under subtropical belt in the south east of Utter Pradesh, which experience extremely hot summer and fairly cold winter. The maximum temperature of the location reaches up to 46° C- 48° C and seldom falls as low as 4°C- 5°C. The relative humidity ranges between 20 to 94%. The average rainfall in this area is around 1013.4 mm annually. However, occasional precipitation is also not uncommon during winter months.

Experimental Findings

- The maximum Total soluble solid content in fruit jam was recorded in T_7 (Sweet orange 40% + Guava 60% + ginger 2%)) with 13.73 ^{0}B followed by T_6 (Sweet orange 50% + Guava 50% + ginger 2%) with 13.59 ^{0}B and the minimum was recorded in T_1 (Sweet orange 100% + ginger 2%),) with 10.42^{0}B.
- The maximum Reducing sugar content in RTS was recorded in T_7 (Sweet orange 40% + Guava 60% + ginger 2%)) with 10.36 followed by T_6 (Sweet orange 50% + Guava 50% + ginger 2%) with 10.25 and the minimum was recorded in T_1 (Sweet orange 100% + ginger 2%),) with 7.31.
- The maximum total sugar content in RTS was recorded in T_7 (Sweet orange 40% + Guava 60% + ginger 2%)) with 15.72 followed by T_6 (Sweet orange 50% + Guava 50% + ginger 2%) with 15.26 and the minimum was recorded in T_1 (Sweet orange 100% + ginger 2%),) with 9.70.
- The minimum titrable acidity content in RTS was recorded in T_7 (Sweet orange 40% + Guava 60% + ginger 2%)) with 0.30 followed by T_6 (Sweet orange 50% + Guava 50% + ginger 2%) with 0.39 and the maximum was recorded in T_1 (Sweet orange 100% + ginger 2%),) with 0.60.
- The maximum pH content in RTS was recorded in T_7 (Sweet orange 40% + Guava 60% + ginger 2%)) with 3.850 followed by T_6 (Sweet orange 50% + Guava 50% + ginger 2%) with 3.703 and the maximum was recorded in T_1 (Sweet orange 100% + ginger 2%),) with 3.337.
- The maximum ascorbic acid content in RTS was recorded in T_7 (Sweet orange 40% + Guava 60% + ginger 2%)) with 20.35 followed by T_6 (Sweet orange 50% + Guava 50% + ginger 2%) with 19.30 and the minimum was recorded in T_1 (Sweet orange 100% + ginger 2%) with 12.55.
- The maximum color and appearance content in RTS was recorded in T_7 (Sweet orange 40% + Guava 60% + ginger 2%)) with the score of 8.452 followed by T_6 (Sweet orange 50% + Guava 50% + ginger 2%) with 7.351 and the minimum was recorded in T_1 (Sweet orange 100% + ginger 2%) with 5.50.
- The maximum flavor and taste content in RTS was recorded in T_7 (Sweet orange 40% + Guava 60% + ginger 2%)) with the score of 8.86 followed by T_6 (Sweet orange 50% + Guava 50% + ginger 2%) with 8.46 and the minimum was recorded in T_1 (Sweet orange 100% + ginger 2%) with 6.03.
- The maximum consistency in RTS was recorded in T_7 (Sweet orange 40% + Guava 60% + ginger 2%)) with the score of 8.712 followed by T_6 (Sweet orange 50% + Guava 50% + ginger 2%) with 8.587 and the minimum was recorded in T_1 (Sweet orange 100% + ginger 2%) with 6.283.
- The maximum overall acceptability in RTS was recorded in T_7 (Sweet orange 40% + Guava 60% + ginger 2%)) with the score of 8.712 followed by T_6 (Sweet orange 50% + Guava 50% + ginger 2%) with 8.587 and the minimum was recorded in T_1 (Sweet orange 100% + ginger 2%) with 6.283.
- The maximum B:C ratio in RTS was calculated in T_7 (Sweet orange 40% + Guava 60% + ginger 2%)) with the 1.84 followed by T_6 (Sweet orange 50% + Guava 50% + ginger 2%) with 1.74 and the minimum was recorded in T_1 (Sweet orange 100% + ginger 2%) with 1.50.

Table 1: Effect of different treatments on Total Soluble Solids (°Brix), Reducing Sugar (%) Acidity (%), Total Sugar (%) during storage of RTS.

Treatment	TSS				Reducing sugar				Total sugar %				Titrable acidity %			
	Initial	10 DAS	20 DAS	30 DAS	Initial	10 DAS	20 DAS	30 DAS	Initial	10 DAS	20 DAS	30 DAS	Initial	10 DAS	20 DAS	30 DAS
T_1	10.09	10.12	10.28	10.42	7.01	7.12	7.23	7.31	9.25	9.56	9.65	9.7	0.67	0.65	0.63	0.6
T_2	10.25	10.43	10.56	10.8	7.25	7.3	7.39	7.46	9.68	9.76	9.82	9.95	0.65	0.64	0.62	0.6
T_3	11.0	11.24	11.43	11.67	7.32	7.42	7.51	7.62	10.23	10.56	10.79	10.95	0.57	0.56	0.55	0.5
T_4	12.10	12.34	12.52	12.69	7.56	7.68	7.86	8	11.01	11.28	11.68	11.89	0.56	0.55	0.53	0.5
T_5	12.23	12.35	12.42	12.53	8.26	8.38	8.49	8.59	11.98	12.56	12.78	12.95	0.47	0.46	0.45	0.4
T_6	13.21	13.35	13.46	13.59	9.81	9.5	10.12	10.25	14.56	14.78	14.89	15.26	0.45	0.43	0.4	0.39
T_7	13.34	13.56	13.64	13.73	9.86	10.01	10.22	10.36	15.27	15.38	15.56	15.72	0.36	0.35	0.32	0.30
T_8	13.25	13.32	13.46	13.53	9.01	9.26	9.35	9.54	14.26	14.35	14.46	14.59	0.63	0.62	0.61	0.58
T_9	13.28	13.34	13.56	13.64	9.06	9.28	9.39	9.46	14.35	14.46	14.59	14.71	0.56	0.54	0.51	0.48
T_{10}	13.29	13.36	13.59	13.68	9.12	9.25	9.56	9.68	14.41	14.56	14.71	14.89	0.54	0.52	0.47	0.50
T_{11}	12.21	12.35	12.42	12.56	9.19	9.3	9.46	9.56	9.19	9.3	9.46	9.56	0.63	0.61	0.6	0.57
CD	1.278	1.397	1.457	1.754	1.278	1.397	1.457	1.754	1.278	1.397	1.457	1.754	1.754	1.457	1.397	1.278
SE.D	0.603	0.66	0.688	0.829	0.603	0.66	0.688	0.829	0.603	0.66	0.688	0.829	0.829	0.688	0.66	0.603
F Test	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S

Table 2: Effect of different treatments on pH, Ascorbic acid (mg/100g), Color and appearance and Flavor and taste during storage of RTS.

Treatment	pH				Ascorbic acid				Color and appearance				Flavor and Taste			
	Initial	10 DAS	20 DAS	30 DAS	Initial	10 DAS	20 DAS	30 DAS	Initial	10 DAS	20 DAS	30 DAS	Initial	10 DAS	20 DAS	30 DAS
T_1	3.33	3.41	3.51	3.61	13.45	13.05	12.75	12.55	5.853	5.75	5.617	5.5	6.333	6.233	6.133	6.03
T_2	3.48	3.56	3.66	3.74	14.25	13.75	13.45	13.25	6.857	6.74	6.637	6.513	6.617	6.52	6.427	6.32
T_3	3.51	3.59	3.69	3.78	14.76	14.36	14.07	13.83	6.657	6.55	6.423	6.327	6.893	6.77	6.67	6.563
T_4	3.61	3.69	3.79	3.87	15.35	15.00	14.7	14.5	7.553	7.123	7.01	6.917	7.207	6.737	6.63	6.513
T_5	3.52	3.60	3.70	3.78	15.95	15.45	15.15	14.95	7.82	7.383	7.27	7.163	7.493	6.927	6.82	6.707
T_6	3.70	3.78	3.87	3.90	20.10	19.75	19.48	19.30	8.053	7.856	7.651	7.351	8.787	8.68	8.577	8.46
T_7	3.8	3.8	3.91	3.91	21.20	20.83	20.57	20.35	9	8.782	8.651	8.452	9.00	8.99	8.89	8.86
T_8	3.66	3.73	3.84	3.92	18.15	17.78	17.43	17.23	8.231	7.851	7.567	6.713	8.423	8.312	8.121	8.012
T_9	3.59	3.69	3.79	3.88	19.05	18.58	18.30	18.10	7.373	7.243	7.11	7.017	7.41	7.287	7.17	7.043
T_{10}	3.56	3.68	3.75	3.77	16.20	15.83	15.53	15.32	7.561	7.461	7.356	7.124	7.987	7.88	7.74	7.58
T_{11}	3.45	3.54	3.65	3.72	17.10	16.7	16.33	16.1	6.92	6.76	6.58	6.42	8.102	7.856	7.685	7.513
CD	1.754	1.457	1.397	1.278	1.278	1.397	1.457	1.754	1.278	1.397	1.457	1.754	1.278	1.397	1.457	1.754
SE.D	0.829	0.688	0.66	0.603	0.603	0.66	0.688	0.829	0.603	0.66	0.688	0.829	0.603	0.66	0.688	0.829
F Test	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S

Table 3: Effect of different treatments on Consistency, Overall acceptability and Benefit cost ratio during storage of RTS.

Treatment	Consistency				Overall acceptability				B:C Ratio
	Initial	10 DAS	20 DAS	30 DAS	Initial	10 DAS	20 DAS	30 DAS	
T_1	6.637	6.537	6.417	6.283	6.517	6.417	6.317	6.207	1.62
T_2	6.91	6.467	6.327	6.227	6.717	6.61	6.51	6.407	1.73
T_3	7.00	6.900	6.750	6.640	6.947	6.833	6.723	6.933	1.72
T_4	7.203	7.093	6.95	6.807	7.267	6.837	6.723	6.59	1.70
T_5	7.233	7.117	6.98	7.183	7.523	7.087	6.983	6.803	1.77
T_6	8.917	8.82	8.70	8.587	8.877	8.77	8.667	8.553	1.87
T_7	9.00	8.900	8.812	8.712	9.00	8.994	8.887	8.785	1.94
T_8	8.321	8.210	8.012	7.856	8.231	7.951	7.821	7.712	1.65
T_9	8.256	8.102	7.925	7.825	8.123	7.783	7.651	7.512	1.71
T_{10}	7.903	7.81	7.68	7.557	7.427	7.323	7.173	7.06	1.78
T_{11}	7.793	7.66	7.523	7.42	7.89	7.79	7.683	7.57	1.69
CD	1.278	1.397	1.457	1.754	1.278	1.397	1.457	1.754	
SE.D	0.603	0.66	0.688	0.829	0.603	0.66	0.688	0.829	
F Test	S	S	S	S	S	S	S	S	

Conclusion

From the present study, it is concluded that the treatment T_7 (Sweet orange 40% + Guava 60% + Sugar 10% + ginger 2%) could be gainfully utilized for enhancing the value of sweet orange and guava RTS preparation in the terms of TSS, Acidity, pH, Reducing sugar, color and appearance, flavor, taste, texture and overall acceptability. The treatment T_7 was also good in terms of economic return with benefit cost ratio (1:1.80)

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