



Short communication

Studies on effect of chemical preservatives on physico-chemical changes of beverages in lime and ginger juice with their combinations

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ABSTRACT

The physico-chemical character of lime and ginger RTS and blended RTS were evaluated after addition of potassium meta-bi-sulphite (KMS) and sodium benzoate stored at ambient temperature up to 150 days. Lime and ginger RTS preserved with KMS (0.1%) retained more ascorbic acid and acidity as compared to other treatments. During storage, total soluble solids, reduction and total sugars showed an increasing trend with increasing period of storage under ambient condition in KMS (0.1%) as compared to other treatments. Among the various treatment RTS prepared from ginger juice with KMS 0.1% could be stored for extended period of time for sensory characteristics.

Key words: Lime, ginger, potassium, meta-bi-sulphite, sodium benzoate, RTS, storage

Lime (*Citrus aurantifolia* Swingle) is one of the important fruits of citrus group, acidic in nature and excellent source of vitamin C. India produces 15.42 thousand tonnes of lime per year, raw fruit is freshly consumed and also utilized in preparation of value added products like squash, cordial, syrup, marmalade, pickle, salted lime and dried peel. However, very less work has been done on preservation of lime juice for long duration. Since ancient times, ginger (*Zingiber officinale* Rosc.) has been used as a spice and medicine in India. The total production of ginger is 359 thousand tonnes during 2004-05 (Anonymous, 2005). Ginger can be used in ginger ale, ginger beer, dried pickle, paste and candied ginger.

As lime and ginger juices are health benefitting and refreshing, the ready-to-serve juice of lime, ginger and their blends are very important. Blending not only improves quality and nutrition of basic raw material, but also offers for development of newer product (Nath and Yadav, 2005). Very little work has been done on lime and ginger RTS as well as blended RTS of lime and ginger. Therefore, the present investigation was carried out at post-harvest laboratory of Department of Horticulture, I.G.K.V., Raipur, during the year 2007-08.

Lime and ginger juices were extracted from mature well-ripened lime and fresh ginger procured from local market. Healthy lime fruits and ginger rhizomes were

selected and washed thoroughly in running tap water to remove dirt and dust particles. Lime juice was extracted by lime squeezer and filtered with muslin cloth to obtain clear fruit juice free from juice vesicles. In case of ginger, after removal of the peel, rhizomes were cut into pieces with the help of knife and ground in mixer and filtered through muslin cloth to obtain fiber-less juice. After the juice extraction 10% of blended juice of lime and ginger were used for RTS preparation. TSS of 17% and acidity of 0.3 % were maintained by addition of calculated amount of sugar, citric acid and water for all treatments. Fifteen treatments were prepared by combination of different concentration of lime juice (0%, 25%, 50%, 75%, and 100%), ginger juice (0%, 25%, 50%, 75%, and 100%), and chemical preservatives (sodium benzoate 0.1%, potassium meta bisulphate 0.1% and sodium benzoate 0.05% + potassium meta bisulphate 0.05%). The bottles of RTS beverages were kept at ambient condition for further studies up to 150 days. Stored RTS were evaluated at 0, 30, 60, 90, 120 and 150 days of storage for various physico-chemical parameters analysed by using completely randomized design.

Stored RTS were evaluated for ascorbic acid, acidity, TSS, reducing sugar, non-reducing sugar, total sugar, sugar: acid ratio and sensory characteristics. TSS was recorded by using hand refractometer. The ascorbic acid was determined by using 2-6 Dichlorophenol-indophenol dye. The acidity per cent was analysed by titrating the fruit and

rhizome juice with N/10 NaOH using phenolphthalein as an indicator. The reducing sugar, non reducing sugar and total sugar were also determined as per Ranganna (1997). Sensory evaluation of the RTS beverages was done by the panel of ten judges at 30 days interval following the Hedonic rating test as described by Ranganna (1997).

The ascorbic acid and acidity were decreased in lime and ginger RTS but TSS and sugar: acid ratio showed an increasing trend with increase in storage period (Table 1). Maximum ascorbic acid and acidity retention was observed in case of RTS preserved with KMS (0.1%). The loss in ascorbic acid might be attributed to the oxidation of irreversible conversion of L-ascorbic acid into dehydro-ascorbic acid oxidase caused by trapped or residual oxygen in the glass bottles. The decrease in acidity in RTS during storage might be attributed to the chemical interaction between organic constituents of the juice induced by temperature and action of enzymes. Deka (2000) and Deka *et al* (2004) reported similar finding with lime-aonla blended RTS and Nath and Yadav (2005b) with ginger-kinnow squash. The increase in TSS in RTS/ blended RTS, during storage was probably due to conversion of polysaccharides, like pectin, cellulose, starch etc., into simple sugars. Sugar: acid ratio in RTS/ blended RTS showed an increasing trend with increasing period of storage (Table 2). The finding of Singh *et al* (2005) for bael/ blended bael RTS beverages are in close conformity with these results.

Reducing sugar and total sugar increased with the increase in storage period in lime and ginger RTS/ blended

Table 1. Effect of different preservatives on ascorbic acid (mg/100ml) of stored lime and ginger RTS/ blended RTS beverages

Treatments	Storage period (in days)					
	0	30	60	90	120	150
T ₁	27.63	27.53	25.30	20.30	10.50	9.50
T ₂	27.50	25.16	22.41	18.23	8.43	6.43
T ₃	27.60	25.85	24.46	19.23	9.43	7.96
T ₄	3.25	3.21	2.30	1.46	1.15	1.03
T ₅	3.13	2.58	2.20	1.16	0.95	0.89
T ₆	3.16	2.86	2.23	1.36	1.00	0.93
T ₇	26.50	26.33	24.30	18.36	9.43	8.86
T ₈	26.13	25.43	22.35	15.36	7.56	6.46
T ₉	26.36	26.06	24.25	17.36	9.10	8.43
T ₁₀	25.36	25.30	23.21	17.36	9.30	8.76
T ₁₁	25.33	25.10	22.26	15.46	8.03	7.06
T ₁₂	25.40	25.26	23.16	16.70	9.16	8.50
T ₁₃	27.36	27.10	25.05	17.36	10.36	9.50
T ₁₄	27.20	25.06	22.10	14.60	7.50	6.43
T ₁₅	27.30	25.76	24.36	17.26	9.36	8.60
SEm ±	0.07	0.12	0.16	0.13	0.12	0.14
CD(P=0.05)	0.19	0.32	0.46	0.36	0.31	0.39

Notation details-

- T₁ - Lime juice + KMS 0.1%
- T₂ - Lime juice + SB 0.1%
- T₃ - Lime juice + KMS 0.05% + SB 0.05%
- T₄ - Ginger juice + KMS 0.1%
- T₅ - Ginger juice + SB 0.1
- T₆ - Ginger juice + KMS 0.05% +SB 0.05%
- T₇ - Lime juice 50% + ginger juice 50% + KMS 0.1%
- T₈ - Lime juice 50% + ginger juice 50% SB 0.1%
- T₉ - Lime juice 50% + ginger juice 50% + KMS 0.05% + SB 0.05%
- T₁₀ - Lime juice 75% + ginger juice 25% + KMS 0.1%
- T₁₁ - Lime juice 75% + ginger juice 25% + KMS 0.1%
- T₁₂ - Lime juice 75% + ginger juice 25% + KMS 0.05% + SB 0.05%
- T₁₃ - Lime juice 25% + ginger juice 75% + KMS 0.1%
- T₁₄ - Lime juice 25% + ginger juice 75% + KMS 0.1%
- T₁₅ - Lime juice 25% + ginger juice 75% + KMS 0.05% + SB 0.05%

Table 2. Effect of different preservatives on TSS (%), acidity (%) and sugar: acid ratio of stored lime and ginger RTS/ blended RTS

Treatment	TSS (%)						Acidity (%)						Sugar: acid ratio					
	Storage period (in days)						Storage period (in days)						Storage period (in days)					
	0	30	60	90	120	150	0	30	60	90	120	150	0	30	60	90	120	150
T ₁	17.00	17.33	17.33	17.47	17.54	17.60	0.30	0.29	0.28	0.26	0.24	0.22	56.60	59.31	61.89	67.19	73.08	80.00
T ₂	17.00	17.20	17.30	17.38	17.47	17.56	0.30	0.29	0.26	0.22	0.20	0.16	56.60	59.31	66.53	79.00	87.35	109.75
T ₃	17.00	17.20	17.31	17.40	17.48	17.58	0.30	0.28	0.27	0.24	0.22	0.17	56.60	61.42	64.11	72.50	79.45	103.41
T ₄	17.00	17.10	17.14	17.21	17.30	17.34	0.30	0.29	0.29	0.28	0.26	0.24	56.60	58.96	59.00	61.46	66.53	75.25
T ₅	17.00	17.10	17.12	17.21	17.25	17.30	0.30	0.29	0.28	0.28	0.26	0.22	56.60	58.96	61.14	61.46	66.34	78.36
T ₆	17.00	17.10	17.12	17.20	17.29	17.33	0.30	0.29	0.29	0.28	0.26	0.23	56.60	58.96	59.03	61.42	66.50	75.34
T ₇	17.00	17.20	17.34	17.38	17.45	17.52	0.30	0.29	0.28	0.27	0.25	0.22	56.60	59.31	61.92	64.37	69.80	79.63
T ₈	17.00	17.20	17.30	17.38	17.38	17.45	0.30	0.29	0.27	0.25	0.23	0.18	56.60	59.31	64.07	69.52	75.56	96.94
T ₉	17.00	17.20	17.31	17.32	17.43	17.48	0.30	0.28	0.27	0.26	0.24	0.19	56.60	61.42	64.11	66.61	72.02	92.00
T ₁₀	17.00	17.20	17.34	17.46	17.54	17.56	0.30	0.28	0.27	0.26	0.24	0.20	56.60	61.42	64.22	67.15	73.08	87.80
T ₁₁	17.00	17.20	17.30	17.39	17.47	17.54	0.30	0.27	0.25	0.23	0.21	0.17	56.60	63.70	69.20	75.60	83.19	103.17
T ₁₂	17.00	17.20	17.31	17.42	17.50	17.55	0.30	0.29	0.27	0.26	0.24	0.22	56.60	59.31	64.11	66.96	72.19	87.75
T ₁₃	17.00	17.20	17.34	17.42	17.50	17.56	0.30	0.29	0.28	0.27	0.25	0.22	56.60	59.31	61.92	64.51	70.00	79.81
T ₁₄	17.00	17.20	17.31	17.33	17.40	17.50	0.30	0.27	0.25	0.23	0.21	0.17	56.60	63.70	61.92	75.34	82.85	102.94
T ₁₅	17.00	17.20	17.30	17.42	17.47	17.52	0.30	0.28	0.27	0.25	0.23	0.21	56.60	61.42	69.24	69.68	75.95	83.42
SEm ±	-	-	0.05	0.05	0.05	0.05	-	-	0.01	0.01	0.01	0.01	-	-	0.15	0.09	0.15	0.26
CD	-	-	0.16	0.16	0.15	0.15	-	-	0.03	0.03	0.03	0.04	-	-	0.43	0.26	0.44	0.77

(P=0.05)

Table 3. Effect of different preservatives on reducing sugar (%), non reducing sugar (%) and total sugar (%) of stored lime and ginger RTS/ blended RTS

Treatment	Reducing sugar (%)						Non-reducing sugar (%)						Total sugar (%)					
	Storage period (in days)						Storage period (in days)						Storage period (in days)					
	0	30	60	90	120	150	0	30	60	90	120	150	0	30	60	90	120	150
T ₁	6.62	6.79	6.96	7.13	7.28	7.45	1.36	1.30	1.20	1.14	1.08	1.02	7.98	8.09	8.16	8.27	8.36	8.47
T ₂	6.62	6.74	6.84	6.95	7.13	7.25	1.36	1.25	1.16	1.07	0.90	0.80	7.98	7.99	8.00	8.01	8.03	8.05
T ₃	6.62	6.77	6.92	7.07	7.22	7.37	1.36	1.27	1.18	1.10	0.93	0.86	7.98	8.03	8.05	8.10	8.15	8.20
T ₄	6.11	6.28	6.45	6.62	6.79	6.96	1.12	1.06	1.00	0.94	0.88	0.82	7.23	7.34	7.45	7.56	7.67	7.78
T ₅	6.11	6.24	6.36	6.49	6.61	6.73	1.12	1.00	0.90	0.79	0.69	0.59	7.23	7.24	7.26	7.28	7.30	7.32
T ₆	6.11	6.26	6.41	6.56	6.70	6.85	1.12	1.02	0.92	0.82	0.72	0.62	7.23	7.28	7.33	7.38	7.42	7.47
T ₇	6.50	6.67	6.84	7.01	7.18	7.35	1.24	1.18	1.12	1.06	1.00	0.94	7.74	7.85	7.96	8.07	8.18	8.29
T ₈	6.50	6.60	6.75	6.88	7.02	7.14	1.24	1.15	1.02	0.91	0.79	0.68	7.74	7.75	7.77	7.79	7.81	7.83
T ₉	6.50	6.65	6.80	6.95	7.07	7.20	1.24	1.14	1.04	0.94	0.84	0.73	7.74	7.79	7.84	7.89	7.91	7.93
T ₁₀	6.37	6.54	6.71	6.88	7.05	7.21	1.30	1.24	1.18	1.12	1.05	0.98	7.67	7.78	7.89	8.00	8.10	8.19
T ₁₁	6.37	6.50	6.64	6.75	6.90	6.97	1.30	1.18	1.07	0.97	0.85	0.77	7.67	7.68	7.70	7.72	7.74	7.75
T ₁₂	6.37	6.52	6.67	6.82	6.97	7.12	1.30	1.20	1.10	1.00	0.90	0.81	7.67	7.72	7.77	7.82	7.87	7.93
T ₁₃	6.23	6.40	6.57	6.74	6.92	7.09	1.18	1.12	1.06	1.00	0.93	0.86	7.41	7.52	7.63	7.74	7.85	7.95
T ₁₄	6.23	6.33	6.48	6.63	6.80	6.94	1.18	1.10	0.98	0.84	0.70	0.58	7.41	7.43	7.46	7.48	7.50	7.52
T ₁₅	6.23	6.38	6.53	6.68	6.84	6.98	1.18	1.08	0.98	0.88	0.78	0.67	7.41	7.46	7.51	7.56	7.62	7.65
SEm±	0.07	0.01	0.01	0.02	0.09	0.09	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03
CD	0.19	0.04	0.04	0.06	0.27	0.26	0.03	0.04	0.05	0.06	0.04	0.04	0.04	0.06	0.06	0.06	0.05	0.09

(P=0.05)

RTS but, non-reducing sugar decreased with increase in storage period (Table 3). Maximum change in sugar content in lime and ginger RTS/ blended RTS, was observed in RTS preserved with (KMS 0.1%) whereas, minimum change was recorded with RTS preserved with (SB 0.1%). The increase in reducing sugar as well as total sugar were related to the increase in total soluble solids and ultimate decrease in non-reducing sugar in the beverage during storage period. The variation in different fraction of sugar might be due to hydrolysis of polysaccharides like starch, pectin and inversion of non-reducing sugar into reducing. The increase level of total sugar was probably also due to conversion of starch and pectin into simple sugar. The similar findings reported by Deka (2000) and Deka *et al* (2004) for lime-aonla blended RTS and Tiwari (2000) for RTS beverages prepared from guava-papaya.

The organoleptic score reflects the acceptability of the produce to the consumer. The RTS/blended RTS showed decrease in overall acceptability score with increasing storage period up to 150 days under ambient condition (Table 4). The treatment T₄ (ginger juice 100% + KMS 0.1%) had a highest overall acceptability score followed by the T₆ (ginger juice 100% + KMS 0.05% + SB 0.05%) and T₅ (ginger juice 100% + SB 0.1%). However, the RTS of treatment T₉ (lime juice 50% + ginger juice 50% + SB 0.05%) and T₈ (lime juice 50% + ginger juice 50% + SB 0.1%) were least acceptable by the evaluators.

Table 4. Effect of different preservatives on overall acceptability scores of stored lime and ginger RTS/ blended RTS

Treatments	Overall acceptability					
	Storage period (in days)					
	0	30	60	90	120	150
T ₁	8.0	7.7	7.5	7.4	7.2	6.6
T ₂	8.0	7.6	7.4	7.3	7.0	5.2
T ₃	8.0	7.8	7.6	7.5	7.2	6.2
T ₄	8.6	8.4	8.3	8.2	7.4	6.8
T ₅	8.6	8.4	8.2	8.1	6.2	5.4
T ₆	8.4	8.2	7.9	7.7	7.0	6.4
T ₇	7.8	7.5	7.3	7.2	6.8	6.4
T ₈	7.8	7.5	7.3	7.1	5.4	5.0
T ₉	7.7	7.4	7.2	6.9	6.6	6.0
T ₁₀	8.4	8.0	7.6	7.3	7.0	6.4
T ₁₁	8.3	8.0	7.4	7.1	5.8	5.2
T ₁₂	8.1	7.7	7.5	7.2	6.8	6.4
T ₁₃	8.2	7.8	7.4	7.1	6.8	6.4
T ₁₄	8.1	7.7	7.3	6.9	5.6	5.2
T ₁₅	8.2	7.7	7.4	7.0	6.4	6.0

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