AJH
eISSN- 0976-724X

THE ASIAN JOURNAL OF HORTICULTURE
Volume **10** | Issue 2 | December, 2015 | 251-256
Visit us -*www.researchjournal.co.in*

**RESEARCH PAPER**

DOI : 10.15740/HAS/TAJH/10.2/251-256

*Article history* :
Received : 13.10.2015
Revised : 04.11.2015
Accepted : 18.11.2015

# Standardization of recipe for the preparation of ready-to-serve beverage from tamarind cv. LOCAL

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**ABSTRACT :** A study was conducted to develop a ready-to-serve (RTS) beverage using tamarind dried fruit at Department of Horticulture, Junagadh Agricultural University, Junagadh during 2011-2012. The results of physico-chemical analysis revealed that TSS, acidity and reducing sugar content increased while the ascorbic acid content decreased with the advancement of storage period. The findings of microbial studies showed no total plate counts in the formulated beverages except treatments $T_7$ and $T_{12}$. Sensory evaluation of the samples showed that there were significant differences between treatments with respect to overall acceptance. From the results of quality assessments, the formulated beverage with 12 per cent blended juice of tamarind and ginger (3:1), 21 per cent TSS and 0.3 per cent acidity was found superior in quality and could be stored at ambient conditions for a period of five months without any significant changes in quality.

**KEY WORDS :** *Tamarindus indica*, RTS, Ginger blending

**HOW TO CITE THIS ARTICLE :** Panjiar, Niketa, Delvadia, D.V., Hadwani, Mayuri, Babariya, V.J. and Malam, V.R. (2015). Standardization of recipe for the preparation of ready-to-serve beverage from tamarind cv. LOCAL. *Asian J. Hort.*, **10**(2) : 251-256.

Tamarind (*Tamarindus indica* L.) is also called Indian date, which belongs to the family Leguminaceae. India is the chief producer and consumer of this fruit in the world with an estimated area of 59.6 thousand hectares with a production of 2.06 lakh metric tonnes and productivity of 3.5 metric tonnes (Anonymous, 2012). Value addition is of immense benefit for traders and consumers. So, there is a need to concentrate on research efforts in diversification and popularization of tamarind products. Tamarind fruits can be processed into various value added products to make a convenient product with advantage of ease of handling, transportation, storage and use. Soft drinks occupy the first place among manufactured beverages. Due to prolonged tart taste on the tongue, the beverage is not so popular. Non-availability of suitable technology or lack of standard formulations is one of the reasons for tamarind beverage not popular in Indian market. Currently, efforts are going on to make health drinks or beverages from fruits like tamarind, which has several therapeutic properties. In this paper, an attempt has been made to describe the work done on the preparation of RTS beverage from tamarind pulp and tamarind-ginger blending and studies of physico-chemical changes and sensory rating of the beverage during storage period.

## RESEARCH METHODS

Good quality ripened, dried tamarind pulp having reddish brown colour was purchased from the local market, brought to the laboratory, sorted accordingly and used for the experiment. Similarly, in case of ginger, mother rhizomes, free from mechanical injury and disease were selected for the study.

For extraction of juice from tamarind pulp, the neatly

washed pulp were soaked in water for few minutes and boiled at $80^0$C for 10 minutes. Allowed to cool at room temperature and then the whole content were grinded with the help of an electronic driven mixer grinder. Then, juice was filtered through a fine strainer.

For blending of tamarind juice with ginger, the rhizomes were peeled with the help of knives. The peeled rhizomes were cut into slices and were crushed with the help of electric mixer grinder and juice was extracted. After extraction of tamarind juice, its total soluble solids (TSS) and acidity was measured. Then according to different recipe treatments, the quantity of sugar and water was calculated and added. In case of blending with ginger juice, first ginger was mixed with the pulp in different ratio according to the treatment combination. Then its TSS and acidity were measured. Thereafter, the quantity of sugar and water was calculated and added. For the preparation of RTS of different recipe, sugar syrup was prepared. For this purpose required quantity of sugar was added to measured quantity of water and boiled to dissolve the sugar. The prepared syrup was strained through strainer and then according to recipe required quantity of tamarind juice was blended with juice of ginger. For the preparation of different recipe of RTS beverage, the amount of juice required as per FPO specification was calculated (FPO specified, 1995). The TSS was measured using refractometer and adjusted with the table.

## RESEARCH FINDINGS AND DISCUSSION

The observations were carried out on recovery of pulp, TSS, titrable acidity, reducing sugar and ascorbic acid content of the prepared RTS beverage during 6 months of storage at ambient conditions. The TSS content of pulp and RTS was directly measured by Hand Refractometer (0-32) and ascorbic acid content was

**Table 1 : Physical, sensory rating and chemical characteristics of tamarind dried pulp**

| Sr. No. | Characters | Results |
|---|---|---|
| 1. | Recovery of pulp (%) | 70 |
| 2. | Colour (score out of 10) | 8.25 |
| 3. | Taste (score out of 10) | 8.50 |
| 4. | Flavour (score out of 10) | 8.00 |
| 5. | Appearance (score out of 10) | 8.50 |
| 6. | TSS (%) | 10 |
| 7. | Acidity (%) | 1.25 |
| 8. | Ascorbic acid (mg/100 g) | 0.26 |
| 9. | Reducing sugar (%) | 4.35 |

**Table 2 : Effect of recipe on over all acceptance (10 point hedonic scale) of tamarind RTS beverage during storage**

| Treatments | Storage periods (Months) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Initial | 1st | 2nd | 3rd | 4th | 5th | 6th |
| $T_1$ | 8.70 | 8.40 | 7.83 | 7.27 | 6.83 | 5.93 | 4.80 |
| $T_2$ | 8.73 | 8.47 | 7.93 | 7.43 | 6.93 | 5.97 | 4.87 |
| $T_3$ | 8.77 | 8.43 | 8.03 | 7.40 | 7.03 | 6.00 | 4.93 |
| $T_4$ | 8.81 | 8.40 | 8.07 | 7.47 | 7.07 | 5.80 | 5.03 |
| $T_5$ | 8.80 | 8.53 | 8.00 | 7.30 | 7.03 | 5.77 | 4.90 |
| $T_6$ | 8.79 | 8.50 | 7.93 | 7.33 | 6.97 | 5.70 | 4.87 |
| $T_7$ | 8.87 | 8.63 | 8.10 | 7.63 | 7.17 | 6.07 | 5.07 |
| $T_8$ | 8.93 | 8.67 | 8.13 | 7.77 | 7.33 | 6.27 | 5.17 |
| $T_9$ | 9.10 | 8.77 | 8.27 | 7.83 | 7.47 | 6.37 | 5.23 |
| $T_{10}$ | 9.53 | 9.00 | 8.87 | 8.00 | 7.67 | 6.93 | 5.83 |
| $T_{11}$ | 9.33 | 8.90 | 8.73 | 7.93 | 7.57 | 6.73 | 5.70 |
| $T_{12}$ | 9.37 | 8.93 | 8.70 | 7.97 | 7.60 | 6.77 | 5.80 |
| S.E. ± | 0.03 | 0.03 | 0.04 | 0.04 | 0.05 | 0.05 | 0.05 |
| C.D. (P=0.05) | 0.09 | 0.10 | 0.12 | 0.13 | 0.15 | 0.14 | 0.14 |
| C.V. % | 0.59 | 0.70 | 0.86 | 1.00 | 1.18 | 1.32 | 1.54 |

determined as per AOAC method (AOAC, 1995). The reducing sugar and titrable acidity from RTS was determined as per AOAC method (AOAC, 1990).

**Sensory analysis:**

The prepared RTS beverage was evaluated before and after storage for sensory qualities with respect to overall acceptability by a panel of 6 trained judges using a 10 point Hedonic scale.

**Microbial analysis:**

Analysis of total bacterial and fungal counts was carried out on the RTS beverage using serial dilution technique.

The data were analyzed statistically according to Completely Randomized Block Design (CRBD). The observations on physical and sensory characteristics of the tamarind dried fruit with respect to recovery of pulp, colour, taste, flavour, appearance and chemical characteristics (TSS, acidity, ascorbic acid, reducing sugar) were recorded (Table 1).

The sensory quality score of the prepared RTS beverage decreased for overall acceptability with the advancement of storage period (Table 2). In general, the overall score was the highest in treatment with 12 per cent blended juice of tamarind and ginger (3:1), 21 per cent TSS and 0.3 per cent acidity ($T_{10}$).

The TSS increased with gradual passage of storage

**Table 3 : Effect of recipe on the microbial growth in tamarind RTS beverage during $0^{th}$ and $6^{th}$ month of storage**

| Treatments | Bacterial colony | | Fungal colony | |
|---|---|---|---|---|
| | $0^{th}$ month | $6^{th}$ month | $0^{th}$ month | $6^{th}$ month |
| $T_1$ | - | - | - | - |
| $T_2$ | - | $2 \times 10^5$ | - | - |
| $T_3$ | - | - | - | - |
| $T_4$ | - | $16 \times 10^5$ | - | $2 \times 10^3$ |
| $T_5$ | - | $1 \times 10^5$ | - | $1 \times 10^3$ |
| $T_6$ | - | $2 \times 10^5$ | - | $1 \times 10^3$ |
| $T_7$ | - | $72 \times 10^5$ | - | $17 \times 10^3$ |
| $T_8$ | - | - | - | $4 \times 10^3$ |
| $T_9$ | - | $3 \times 10^5$ | - | - |
| $T_{10}$ | - | - | - | - |
| $T_{11}$ | - | $3 \times 10^5$ | - | - |
| $T_{12}$ | - | $90 \times 10^5$ | - | $11 \times 10^3$ |

**Table 4 : Changes in TSS ($^0$Brix) during storage in tamarind RTS at ambient condition**

| Treatments | Storage period (Months) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Initial | $1^{st}$ | $2^{nd}$ | $3^{rd}$ | $4^{th}$ | $5^{th}$ | $6^{th}$ |
| $T_1$ | 18.00 | 18.07 | 18.20 | 18.23 | 18.43 | 18.53 | 18.73 |
| $T_2$ | 18.00 | 18.10 | 18.27 | 18.27 | 18.53 | 18.60 | 18.77 |
| $T_3$ | 18.00 | 18.17 | 18.23 | 18.30 | 18.57 | 18.63 | 18.87 |
| $T_4$ | 21.00 | 21.03 | 21.23 | 21.27 | 21.47 | 21.43 | 21.57 |
| $T_5$ | 21.00 | 21.13 | 21.23 | 21.23 | 21.50 | 21.53 | 21.67 |
| $T_6$ | 21.00 | 21.10 | 21.20 | 21.30 | 21.43 | 21.50 | 21.63 |
| $T_7$ | 18.00 | 18.10 | 18.33 | 18.33 | 18.47 | 18.57 | 18.77 |
| $T_8$ | 18.00 | 18.17 | 18.30 | 18.33 | 18.53 | 18.57 | 18.87 |
| $T_9$ | 18.00 | 18.07 | 18.37 | 18.30 | 18.47 | 18.63 | 18.83 |
| $T_{10}$ | 21.00 | 21.23 | 21.33 | 21.37 | 21.57 | 21.67 | 21.77 |
| $T_{11}$ | 21.00 | 21.10 | 21.23 | 21.27 | 21.43 | 21.53 | 21.67 |
| $T_{12}$ | 21.00 | 21.13 | 21.20 | 21.27 | 21.43 | 21.53 | 21.63 |
| S.E. ± | - | 0.05 | 0.05 | 0.04 | 0.03 | 0.03 | 0.03 |
| C.D. (P=0.05) | - | 0.14 | 0.15 | 0.11 | 0.10 | 0.09 | 0.10 |
| CV(%) | - | 0.41 | 0.43 | 0.33 | 0.28 | 0.26 | 0.29 |

time (Table 4) which might be due to hydrolysis of polysaccharides into monosaccharide and oligosaccharides. Similar results were also reported in lime-aonla juice blends (Deka *et al.*, 2004).

There was a significant increase in acidity content during storage (Table 5) and maximum increase was recorded in $T_{10}$ (12 % blended juice of tamarind and ginger (3:1) with 21 % TSS and 0.3 % acidity) treatment, from 0.3 to 0.56 per cent this might be due to the blending of ginger juice. Similar findings were also reported in papaya juice blended with whey (Kumar and Manimegalai, 2005).

The ascorbic acid content decreased in all the recipe treatments and maximum decrease was recorded in $T_{10}$ treatment from 0.98 to 0.30 mg/100ml with the advancement of storage period (Table 6). This might be due to blending of ginger juice that has reduced the oxidation process. Similar results were also recorded in mango RTS (Rabbani, 1992). Reducing sugars increased from 2.29 to 4.13 per cent in $T_{10}$ treatment (Table 7).

It has been observed that tamarind RTS beverage performed better in case of microbial count. On 6th month

**Table 5 : Changes in acidity (%) during storage in tamarind RTS at ambient condition**

| Treatments | Storage period (Months) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Initial | 1st | 2nd | 3rd | 4th | 5th | 6th |
| $T_1$ | 0.30 | 0.32 | 0.34 | 0.37 | 0.40 | 0.44 | 0.51 |
| $T_2$ | 0.30 | 0.32 | 0.34 | 0.36 | 0.39 | 0.45 | 0.52 |
| $T_3$ | 0.30 | 0.31 | 0.33 | 0.37 | 0.41 | 0.45 | 0.53 |
| $T_4$ | 0.30 | 0.32 | 0.34 | 0.37 | 0.40 | 0.45 | 0.52 |
| $T_5$ | 0.30 | 0.32 | 0.34 | 0.38 | 0.41 | 0.46 | 0.52 |
| $T_6$ | 0.30 | 0.33 | 0.35 | 0.37 | 0.40 | 0.47 | 0.53 |
| $T_7$ | 0.30 | 0.33 | 0.35 | 0.37 | 0.40 | 0.46 | 0.54 |
| $T_8$ | 0.30 | 0.32 | 0.34 | 0.37 | 0.41 | 0.47 | 0.54 |
| $T_9$ | 0.30 | 0.32 | 0.34 | 0.38 | 0.41 | 0.47 | 0.54 |
| $T_{10}$ | 0.30 | 0.34 | 0.35 | 0.36 | 0.42 | 0.48 | 0.56 |
| $T_{11}$ | 0.30 | 0.33 | 0.34 | 0.37 | 0.41 | 0.47 | 0.54 |
| $T_{12}$ | 0.30 | 0.33 | 0.34 | 0.38 | 0.42 | 0.47 | 0.53 |
| S.E. ± | - | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 |
| C.D. (P=0.05) | - | 0.02 | 0.02 | 0.02 | 0.06 | 0.02 | 0.02 |
| CV(%) | - | 3.1 | 1.38 | 2.38 | 2.93 | 0.97 | 2.01 |

**Table 6: Changes in ascorbic acid (mg/100ml) during storage in tamarind RTS at ambient condition**

| Treatments | Storage period (Months) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Initial | 1st | 2nd | 3rd | 4th | 5th | 6th |
| $T_1$ | 0.92 | 0.80 | 0.71 | 0.60 | 0.51 | 0.47 | 0.25 |
| $T_2$ | 0.93 | 0.81 | 0.72 | 0.61 | 0.52 | 0.48 | 0.26 |
| $T_3$ | 0.95 | 0.83 | 0.74 | 0.63 | 0.53 | 0.48 | 0.26 |
| $T_4$ | 0.94 | 0.83 | 0.75 | 0.64 | 0.55 | 0.49 | 0.27 |
| $T_5$ | 0.95 | 0.84 | 0.75 | 0.65 | 0.54 | 0.50 | 0.28 |
| $T_6$ | 0.96 | 0.82 | 0.76 | 0.66 | 0.55 | 0.51 | 0.28 |
| $T_7$ | 0.97 | 0.84 | 0.75 | 0.66 | 0.56 | 0.52 | 0.27 |
| $T_8$ | 0.97 | 0.83 | 0.75 | 0.67 | 0.54 | 0.51 | 0.27 |
| $T_9$ | 0.96 | 0.84 | 0.74 | 0.68 | 0.56 | 0.50 | 0.28 |
| $T_{10}$ | 0.98 | 0.86 | 0.78 | 0.69 | 0.58 | 0.55 | 0.30 |
| $T_{11}$ | 0.97 | 0.84 | 0.77 | 0.68 | 0.56 | 0.53 | 0.28 |
| $T_{12}$ | 0.97 | 0.85 | 0.76 | 0.68 | 0.56 | 0.54 | 0.29 |
| S.E. ± | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.01 |
| C.D. (P=0.05) | 0.02 | 0.02 | 0.06 | 0.03 | 0.06 | 0.02 | 0.02 |
| CV(%) | 0.87 | 1.17 | 1.34 | 1.02 | 1.53 | 1.35 | 2.29 |

**Table 7 : Changes in reducing sugars (%) during storage in tamarind RTS at ambient condition**

| Treatments | Storage period (Months) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Initial | 1st | 2nd | 3rd | 4th | 5th | 6th |
| $T_1$ | 2.23 | 2.39 | 2.46 | 2.87 | 3.23 | 3.50 | 3.67 |
| $T_2$ | 2.24 | 2.40 | 2.48 | 2.97 | 3.27 | 3.57 | 3.70 |
| $T_3$ | 2.26 | 2.41 | 2.47 | 3.03 | 3.37 | 3.63 | 3.77 |
| $T_4$ | 2.26 | 2.41 | 2.48 | 3.07 | 3.40 | 3.53 | 4.10 |
| $T_5$ | 2.26 | 2.38 | 2.47 | 3.10 | 3.40 | 3.53 | 4.00 |
| $T_6$ | 2.28 | 2.42 | 2.49 | 3.10 | 3.33 | 3.43 | 4.10 |
| $T_7$ | 2.27 | 2.39 | 2.48 | 3.13 | 3.43 | 3.60 | 3.70 |
| $T_8$ | 2.26 | 2.41 | 2.48 | 3.13 | 3.43 | 3.60 | 3.70 |
| $T_9$ | 2.27 | 2.41 | 2.47 | 3.13 | 3.43 | 3.53 | 3.69 |
| $T_{10}$ | 2.29 | 2.43 | 3.00 | 3.27 | 3.57 | 3.67 | 4.13 |
| $T_{11}$ | 2.27 | 2.40 | 2.47 | 3.07 | 3.47 | 3.47 | 4.10 |
| $T_{12}$ | 2.27 | 2.42 | 2.48 | 3.13 | 3.57 | 3.57 | 4.03 |
| S.E. ± | 0.02 | 0.01 | 0.02 | 0.05 | 0.03 | 0.03 | 0.04 |
| C.D. (P=0.05) | 0.06 | 0.02 | 0.05 | 0.14 | 0.10 | 0.10 | 0.11 |
| CV(%) | 0.37 | 0.37 | 1.20 | 2.54 | 1.77 | 1.69 | 1.60 |

**Table 8 : Economics of the standardized treatment**

| Materials | Weight (g) | Cost/kg | Total cost |
|---|---|---|---|
| Tamarind dried fruit | 900g | Rs. 90 /kg | Rs. 81 |
| Ginger rhizome | 300g | Rs. 80 /kg | Rs. 24 |
| Sugar | 1800g | Rs. 32 /kg | Rs. 57.6 |
| Bottle cost of 50 bottles | | | Rs. 50 |
| Crown cork cost | | | Rs. 25 |
| Total input cost | | | Rs. 237.6 |
| Processing cost @20% of input cost | | | Rs. 47.52 |
| Total cost of production per 10 litre | | | Rs. 285.12 |
| Profit @ 20% of total cost of production | | | Rs. 57.024 |
| Sale price per 10 litre | | | Rs. 342.144 |
| No. of bottles | | | 50 |
| Total cost of product per bottle (B/9) | | | Rs. 6.84 |
| Sale price of the product per bottle | | | Rs. 12 |
| Net income per bottle (11-10) | | | Rs. 5.15 |
| Net B:C ratio (12/10) | | | 0.75 |

The cost of production for preparation of 10 litre of the RTS from standardized recipe $T_{10}$ (12 % blended juice of tamarind and ginger (3:1) with 21 % TSS and 0.3 % acidity)

of storage, all recipe treatments were recorded with negligible microbial growth except $T_7$ and $T_{12}$ treatments (Table 3). $T_{10}$ treatment was reported with minimum microbial load on 6th month of storage, this might be due to increase in acidity content that inhibits the microbial growth.

In terms of net income and benefit cost ratio (B:C) $T_{10}$ treatment was recorded with the highest B:C ratio (0.75) along with maximum acceptability(Table 8). Thus recipe treatment $T_{10}$ has been considered economically feasible and also the best for consumption. Similar work related to the present investigation was also carried out by Arunkuamar *et al.* (2013); Parle and Dhamija (2012) and Parameswari and Srimathi (2009).

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