Preparation and quality evaluation of lime based herbal blended RTS beverage

C. Thamilselvi1, T. Krishnakumar2*, S. Amutha

Home Science College and Research Institute, Tamil Nadu Agricultural University, Madurai-625 001, India.
Received: 01-07-2014 Accepted: 10-02-2015

ABSTRACT
Lime based RTS beverages were prepared using Tulsi and Arugampul herbal extract. Lime RTS beverage prepared from the selected herbs were filled in glass bottles and stored at room temperature (27±3°C) for 150 days and evaluated physico-chemically, organoleptically and microbiologically at an interval of 30 days. A marginal increase in TSS, pH, and total sugars were observed in all beverages for 150 days of storage, whereas acidity and Vitamin C showed decreasing trend. The increase in microbial load for 150 days of storage was negligible and safe for consumption. Sensory evaluation indicated that all the beverages were highly acceptable throughout the storage period. Overall acceptability scores of 8.3, 8.2 and 8.0 were observed for control, Lime + Tulsi juice extract, and Lime + Arugampul juice extract respectively for 150 days of storage.

Key words: Herbal extract, Lime, RTS, Shelf life, Tulsi.

INTRODUCTION
Lime (Citrus aurantifolia) belongs to the family of Rutaceae and is grown almost in every home garden. Lime juice is rich in vitamin C, responsible for a series of health benefits. Lime juice reduces the body heat and increases the appetite. Drinking lime juice with salt reduces the stomach pain. It helps in digestion of foods. Fruit juices and fruit juice beverages are becoming popular due to their pleasant flavour and nutritional characteristics. Beverages are consumed by people of all age group to quench the thirst as a social drink and for good health and medicinal values. The medicinal value of the fruit beverages can be enhanced by the incorporation of herbal extracts. Fruits juice could be enriched by addition of herbal extract for preparation of beverages which improves taste, aroma, and nutrition and also contributes to medicinal values. There is always a demand from the consumers all over the world for new food products which are nutritious with delicate flavour. Productions of Ready-To-Serve (RTS) beverages have been increasingly gaining popularity throughout the country due to their health and nutritional benefits, apart from pleasant flavour and taste. Fruit based RTS beverages are not only rich in essential minerals, vitamins and other nutritive factors but also are delicious and have good appeal. Herbal beverages in the form of RTS, squashes, appetizers, health drinks are important from the nutritional point of view.

Tulsi (Ocimum sanctum) is believed to have health benefits due to their anthelmintic activity and polyphenols (Gangrade et al., 2000). Juice or infusion of the tulsi leaves used in the treatment of bronchitis, catarrh, digestive complaints, arthritis, ringworms, hypertension, heart attack, cancer, viral hepatitis and diabetes. The leaves and seeds of tulsi are reported to have diuretic and laxative properties. Arugampul (Cynodon dactylon) is one of the most commonly occurring weed in India. It is a bitter plant having antimutagenic, antihumorigenic and antigenotoxic activity and can be used as the best chemo preventive agent (Annapurani and Bhagavathy, 2000). Moreover, owing to high acidity, bitterness and astringency, utilization of these herbs for preparation of various products become limited, despite having high medicinal properties. Since the latest trend for consumer demand is nutritious, health food, the Lime-Herbs blended juice will be a good option for the consumer. By keeping these points in mind, the study was focused to prepare and study the storage stability of Lime RTS beverage blended with these herbal extracts.

MATERIALS AND METHODS
The present study was conducted at the department of Food Science and Nutrition, Home Science College and Research Institute (HSC&RI), TNAU, Coimbatore. Fresh

*Corresponding author’s e-mail: krishnakumar_meag@yahoo.co.in and address: Department of Food and Agricultural Process Engg, AEC&RI, TNAU, Coimbatore, India.
1Post Harvest Technology Centre, Tamil Nadu Agricultural University, Coimbatore, India.
2Department of Food and Agricultural Processing, Tamil Nadu Agricultural University, Coimbatore, India.
lime fruits and herbs were procured from the local market, Madurai. Raw materials such as sugar and citric acid were purchased from the local market. Glass bottle of 200 ml capacity was used for bottling juice.

**Extraction of lime, tulsi and arugampul Juice:** Fully matured fresh lime fruits were used for extraction of juice. The fruits were cleaned and cut into halves. Stainless steel squeezer was used to squeeze the lime juice. For extraction of tulsi juice, fresh tulsi leaves were washed properly, blended in a laboratory blender and boiled in distilled water (1:5) for two minutes. Then the extract was filtered through sterile muslin cloth to obtain the juice. Similarly the same procedure was followed for extracting the arugampul juice.

**Preparation of RTS beverage:** Schematic representation of the preparation of herbal blended lime RTS beverages is presented in Figure 1.

Lime based RTS beverage was prepared as per Fruit Product Order (FPO) specifications of India. Sugar syrup was prepared by adding the sugar (53 g), water (190 ml) and citric acid (0.2 g) in a vessel and heated till the sugar was dissolved completely. The main role of adding citric acid in juice is to clarify and avoid crystallization of sugar syrup. Lime juice and herbal extracts were added to the filtered sugar syrup and heated at 80°C for 15 minutes. The prepared RTS was poured immediately into the sterilized RTS bottles of 200 ml capacity leaving a head space of 2.0 cm and the bottles were corked with the sterilized crown corks. The bottled RTS was pasteurized at 90°C for 25 minutes and cooled to room temperature. RTS bottles were labelled and stored at room temperature (27±3°C) for storage studies of 5 months. Treatments selected for the study were

a. Lime RTS (control) - L1
b. Lime RTS with tulsi extract at different levels (5, 10, 15 and 20 %) - L2

c. Lime RTS with arugampul extract at different levels (5, 10, 15 and 20 %) - L3

Based on the organoleptic evaluation for colour, flavour, taste and overall acceptability, Lime RTS + 15 per cent of tulsi and arugampul extract were found to be better. Hence the combination of lime RTS + 15 per cent of tulsi and arugampul were selected for the present study and the storage stability was evaluated.

**Storage studies:** Lime based RTS beverages were subjected to storage studies at room temperature for a period of five months by drawing samples at one month interval to evaluate changes in biochemical, microbiological and organoleptic parameters.

**Biochemical analysis:** Physico-chemical test carried out were total soluble solids (TSS), titrable acidity (as citric acid), Vitamin C, pH and total sugars (Ranganna, 1995). The total soluble solids were measured using an ERMA hand refractometer.

**Microbiological analysis:** The bacterial count was estimated using nutrient glucose agar medium. Similarly the fungi and yeast count was determined using potato dextrose agar medium and yeast extract agar medium respectively.

The bacterial count was estimated using nutrient glucose agar medium. Similarly the fungi and yeast count were determined using potato dextrose agar medium and yeast extract agar medium respectively.

**Sensory evaluation:** Sensory evaluation of the Lime based RTS was carried out by 20 panelists using a triangle test. The panelists rated the sample for colour, flavour, taste and acceptability using 9 point hedonic rating test method (1=dislike very much, 9=like very much) as recommended by (Ranganna, 1995).
Statistical analysis: Data were analyzed statistically by ANOVA using SAS package to evaluate the significance at p<0.05.

RESULTS AND DISCUSSION

Lime based RTS beverage was prepared by blending the lime juice with the selected herbal extract. The physico-chemical constituents of the fresh lime juice and the lime RTS beverage are given in Table 1.

TABLE 1: Physico-chemical constituents of the fresh Lime and Lime based RTS beverage

<table>
<thead>
<tr>
<th>Chemical Constituents</th>
<th>Lime juice</th>
<th>Lime based RTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSS (°Brix)</td>
<td>6.00</td>
<td>15.00</td>
</tr>
<tr>
<td>Acidity (%)</td>
<td>4.50</td>
<td>0.30</td>
</tr>
<tr>
<td>pH</td>
<td>2.12</td>
<td>3.45</td>
</tr>
<tr>
<td>Vitamin C (mg per 100ml)</td>
<td>27.60</td>
<td>2.88</td>
</tr>
<tr>
<td>Total sugars (%)</td>
<td>4.50</td>
<td>8.36</td>
</tr>
</tbody>
</table>

TSS: TSS of lime based RTS beverage had gradual increase throughout the storage period of 150 days (Figure 2). The initial value of TSS of the juice was 15°Brix. At the end of storage, TSS value increased into 15.90, 15.70 and 15.90°Brix for L1, L2 and L3 treatment respectively. The increase in TSS could be due to the degradation of complex carbohydrate into simple sugars during storage (Mehta and Bajaj, 1983). Similar TSS trend was observed by Deka et al., (2004); Chaurasiya et al., (2007). TSS of Lime based RTS showed significant difference in all treatments by statistical analysis.

Acidity: Lime based RTS beverage had an initial acidity of 0.307, 0.328 and 0.320 per cent in control (L1), tulsi extract incorporated (L2) and arugampul extract incorporated (L3) samples respectively. During the storage, acidity of the beverage was found to be decreased into 0.268 % for L1, 0.275 % for L2 and 0.275 % for L3 respectively (Figure 3). The loss of acidity might be attributed to the chemical interaction between the organic constituents of juice induced by temperature and the action of enzymes. Similar results were observed in kinnow RTS beverage by Ranote et al., (1992).

pH: Lime based RTS beverages had an initial pH of 3.45 in control (L1), 3.52 in tulsi extract incorporated (L2) and 3.50 in arugampul incorporated (L3) beverages (Figure 4). During storage, pH of the RTS beverage was increased. The change in pH showed significant beneficial effect in all the three samples. The reason for increase in pH was due to the decrease of the RTS acidity. The highest pH value of 3.57 was observed for treatment L2. In general, increase in pH leads to decrease in shelf life, whereas in the present study, high antimicrobial properties of tulsi added with Lime Juice showed to improve the shelf life of RTS. Statistical analysis of the data indicated the pH of the Lime based nutraceutical RTS added with aulsi extract and Arugampul extract had high significant difference when compared to control sample. Similarly Saradhadevi et al. (2004) have studied about the changes in pH of whey based fruit beverage.
Vitamin C: Freshly prepared RTS contained vitamin C content of 2.88 mg per 100 ml for control (L₁), 3.12 mg per 100 ml for lime RTS added with tulsi extract (L₂) and 3.12 mg per 100 ml for lime RTS added with Arugampul extract (L₃) beverages respectively. At the end of 150 days of storage period it was found to be decreased to 0.72 (L₁), 1.01 (L₂) and 0.88 (L₃) mg per 100 ml respectively (Figure 5). This result was in accordance with the findings of Tripathi et al., (1992), Inyang and Abah (1997), Krishnaveni et al., (2001), Singh et al., (2005).

Total sugars: Total sugars increased with increase in storage periods (p<0.01). This might be due to the action of microorganism present in the juice. Total sugars increase was high in control (18.7°Brix) followed by treatment L₂ for 150 days of storage (Figure 6). Interaction between the different treatments was found to be significant. A similar trend was observed by Kotecha and Kadam (2003), Kannan and Banumathi (2005).

Microbiological population: Bacterial, yeast and fungi populations of the lime RTS beverage increased during storage. The increase of microbial population was comparatively less in treatment L₂ followed by L₃ and L₁. This might be due to the anti-microbial properties of tulsi and arugampul. The increase in microbial load for 150 days of storage was negligible and safe for consumption. Similar results were reported by Krishnaveni et al., (2001), Saravanakumar and Manimegalai (2002), Deka et al., (2004).

Sensory evaluation: All the lime based RTS beverages were found to be highly acceptable in taste throughout the storage period. At the 0th day of storage, the overall acceptability of

### TABLE 2: Microbial population of Lime based RTS beverage during storage

<table>
<thead>
<tr>
<th>Storage life (Days)</th>
<th>Lime based RTS</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bacteria</td>
<td>Yeast</td>
<td>Fungi</td>
</tr>
<tr>
<td></td>
<td>(10^5 \text{ CFU per ml})</td>
<td>(10^4 \text{ CFU per ml})</td>
<td>(10^3 \text{ CFU per ml})</td>
</tr>
<tr>
<td>0</td>
<td>BDL</td>
<td>BDL</td>
<td>BDL</td>
</tr>
<tr>
<td>30</td>
<td>1.00</td>
<td>1.33</td>
<td>1.00</td>
</tr>
<tr>
<td>60</td>
<td>1.66</td>
<td>2.33</td>
<td>1.00</td>
</tr>
<tr>
<td>90</td>
<td>2.33</td>
<td>3.00</td>
<td>1.33</td>
</tr>
<tr>
<td>120</td>
<td>2.66</td>
<td>3.33</td>
<td>1.66</td>
</tr>
<tr>
<td>150</td>
<td>3.00</td>
<td>3.66</td>
<td>2.00</td>
</tr>
</tbody>
</table>

*BDL – Below Detectable Level
L-1, L-2, and L-3 treatments were 9.0, 8.9 and 8.8. At the end of storage period (150 days), the sensory qualities of different treatments of lime RTS beverage are presented in Figure 7. There were no significant differences observed in nutritional and sensory qualities of the RTS stored till 120th of storage. After 120 days of storage period a remarkable reduction was noted in all the three samples.

CONCLUSIONS

The present study revealed that palatable and nutritive beverages can be prepared by blending the selected herbal extracts. Lime beverage blended with tulsi and arugampul extract yielded eye appealing products and received good scores throughout the storage period. The lime RTS beverage prepared with tulsi and arugampul extract had a good shelf life without the addition of artificial preservatives and acid. Blending of lime juice with herbal extract could be a better option to improve the medicinal and nutritive properties of RTS beverage. The study demonstrated that lime based ready-to-serve beverages are having high potential for commercialization and marketability due to rich in medicinal values and nominal cost.

REFERENCES


