

Development and Standardization of Ready to Serve Aloe vera-Lemon Functional Drink

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Abstract: In present study the efforts have been made to prepare functional ready-to-serve (RTS) drink made from blend of aloe vera gel and lemon juice extract. The blended juices were prepared by using different proportions of aloe vera and lemon juice i.e., 100:0, 98:2, 96:4, 94:6 and 92:8 and 90:10 respectively. The blended therapeutic RTS drink samples were analyzed for its different physicochemical as well as sensory parameters. Sensory quality evaluated by adopting 9 point hedonic scale after 15 days interval. It was observed that TSS mean values increased (13.67-14.04%) during storage. Increase in acidity (0.53-0.63%) and decrease in pH (2.74-2.62) was also noted. Reducing sugars increased from 3.75 to 4.32% while non-reducing sugars decreased (9.53-8.91%) during storage. Vitamin C content of functional drinks decreased (8.43-7.64mg/100ml) during storage of 90 days. Sensory attributes showed that the highest hedonic scores for overall acceptability (8.08) were observed in aloe vera and lemon blended ratio of 94:6 followed by ratio of 92:8 (7.77) respectively. The developed RTS could be recommended for the large scale production at industrial level.

Key Words: Aloe vera, Eurica Lemon, Functional drink

I. Introduction

Scientific investigations on medicinal and therapeutic properties of aloe-vera made it worldwide important valuable ingredient for food, cosmetic and pharmaceutical industry. In food industry, it has been used as an ingredient for preparation of functional foods and production of gel-containing health drinks, energy drinks and different type of beverages like tea, milk, ice-cream and confectionary [31]. *Aloe vera* commonly known as Gheegwar belongs to family lileacea. It is a desert plant traditionally being used as a very popular herbal treatment of skin and other disorders [4]. It has been used as base for creams, lotions, soaps, shampoos, facial cleansers and other products in the cosmetic and toiletry industry [9].

Aloe vera leaf contains 95% of water, 75 nutrients, 200 active compounds, 20 minerals, 18 amino acids, 12 vitamins and 92 enzymes. It can be used as the source of vitamins like A, B₁, B₂, B₆, B₁₂, C, E, Folic acid, Niacin etc. Due to its succulent properties, it is a rich source of nutrients and essential minerals [12].

Aloe vera gel has a bitter taste which can be unpleasant in raw state and its palatability could be enhanced by substituting with other fruit juices. Lemon (*Citrus limon*) is an important therapeutic plant belonging to the family of Rutaceae. Lemon juice is very rich in vitamin C, a vitamin responsible for a series of health benefits. It is a small tree and originated probably from Asia. The fruit of lemon tree is green to yellow in color and it is used in making various foods, due to its distinctive flavor and ability to enhance spicy flavor of certain foods. The lemon juice is a major product of lemon fruit obtained on commercial scale [29]. It is planted mainly for its alkaloids, which are having anticancer activities and the antibacterial potential in crude extracts of different parts (viz., leaves, stem, root and flower) of Lemon against clinically significant bacterial strains has been reported [24].

Beverages from fruits and vegetables have a vital role in human nutrition [15]. They are consumed by people of all the groups to quench the thirst and health food. Now a day ready-to-serve beverages have been increasingly attaining popularity among people of all ages. Beverages are considered to be an excellent medium for the supplementation of nutraceutical components for enrichment [2].

Blending could lead to the production of delightful and delicious beverages with improve organoleptic quality and high nutritive value. Blending increases taste and flavor of fruit juices. The blending of juice may also improve aroma, taste and nutrients of the beverages [22].

Keeping in view the nutritive and health benefits of Aloe vera and lemon, the present study was carried out to make RTS aloe vera-lemon, as it possess bland taste and Aloe vera gel can serve as the best functional food by blending with lemon as taste improver.

II. Materials And Methods

This study was conducted in Food Technology Section, Post Harvest Research Centre, Ayub Agricultural Research Institute, Faisalabad, Pakistan during the year 2013-14.

2.1 Preparation of Aloe vera juice

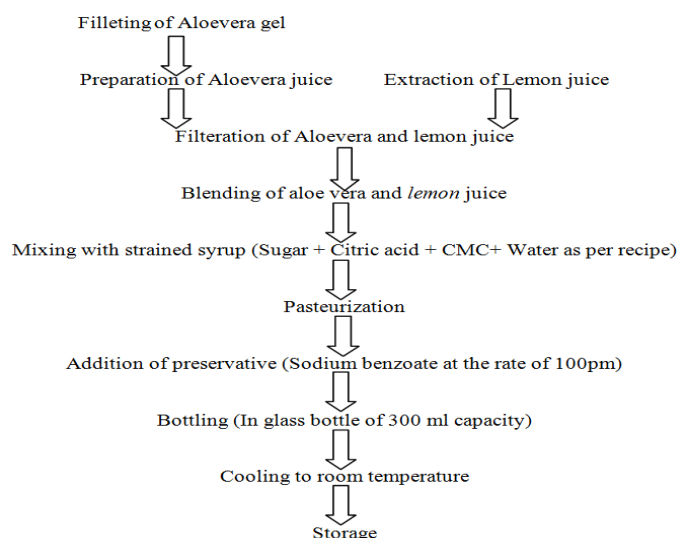
Good quality fresh aloe vera leaves were procured locally, the yellow fluid secretions from the leaves were completely removed for its processing and purity of drinks. The leaves were thoroughly washed with fresh water. The hand filleting method of processing of aloe vera leaves was adopted. Aloe vera gel was removed from leaves with the help of sharp knife. The gel was ground in a juicer and filtered through muslin cloth, pasteurized at 70°C for 30 min. and centrifuged at 2000 rpm for 30 min to obtain extract [25].

2.1.1 Preparation of lemon juice

Fresh lemons (Eurica lemon) were purchased from market. After washing lemons were cut into two halves squeezed with squeezer to obtain clear juice.

Blended RTS drinks were prepared by blending aloe vera and lemon juices at different ratios ($T_1 = 100:0$, $T_2 = 98:2$, $T_3 = 96:4$, $T_4 = 94:6$, $T_5 = 92:8$ and $T_6 = 90:10$) respectively.

2.1.2 Flow chart for preparation of Aloe vera-Lemon Functional RTS drink



The prepared drinks were analyzed for total soluble solids (TSS) by Refractometer (Abbe Refractometer Model 2WAJ) for three months storage at 15 days intervals. A few drops of well homogenized sample were taken on prism of refractometer and direct reading was taken by reading the scale in meter as described in AOAC. The pH of each sample was determined with digital pH meter (InoLab 720, Germany). A sufficient quantity (50mL) of aloe vera-lemon drink was taken in 100mL beaker and pH meter was used to record pH according to method explained in AOAC [3]. The acidity in each sample was determined according to standard procedure given in AOAC [3]. 10mL of Aloe vera-lemon drink along with 100mL water was taken and then titrated with 0.1 N NaOH using phenolphthalein as an indicator (1-2 drops) till light pink colour was achieved. Reducing and non-reducing sugars were determined as described in AOAC using Lane and Eynon method. Sensory evaluation was made through panel of 10 semi-trained judges. The panel evaluated the acceptance level of drinks for colour, flavour, taste and overall acceptability. A 9-point hedonic scale was used for this purpose [5]. The data obtained were subjected to statistical analysis using analysis of variance technique and comparison of means by LSD test [21].

III. Results And Discussion

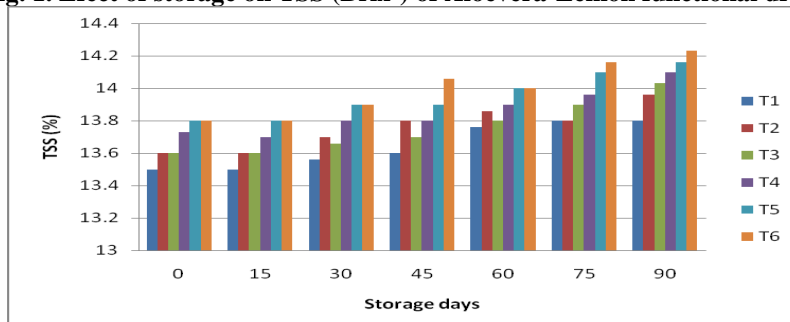
3.1 Total soluble Solids (%)

The mean values of TSS (fig 1) revealed significant difference (13.50-13.80%) among treatments and significant increase (13.64-14.01%) during storage period. The TSS increased gradually which might be due to hydrolysis of polysaccharides into monosaccharide and oligosaccharides. Maximum TSS was recorded in T_6 (14.01%) followed by T_5 (13.96%) against minimum in T_1 (13.64%) and T_2 (13.75%).

Results pertaining to chemical changes during storage revealed that total soluble solids increased gradually during storage that might be attributed to conversion of polysaccharides and other constituents of juice into sugar [18].

Another possible reason for the rapid increment in soluble solid contents may be due to hydrolysis of sucrose to invert Sugars, as previously reported for increased TSS value with storage time in the case of bitter gourd RTS beverage [27].

Fig. 1. Effect of storage on TSS (Brix⁰) of Aloe vera-Lemon functional drink

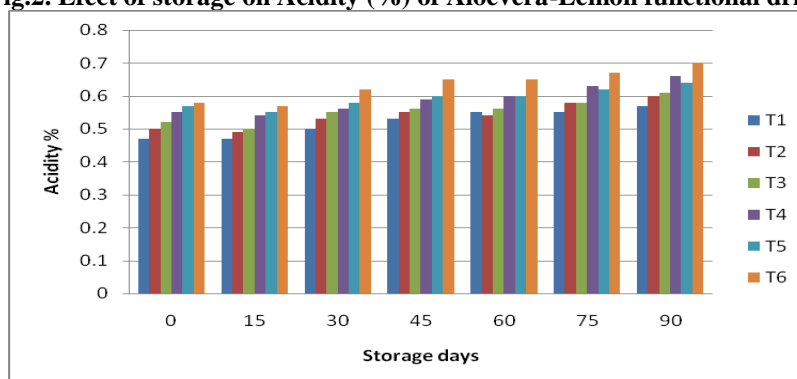


3.2 Titratable acidity (%)

Acidity of the prepared drink varied significantly due to substitution of lemon in aloe vera juice as described in fig.2. There was significant increase in acidity (0.52%-0.63%) among treatments and also significant increase (0.53%-0.63%) during storage period. At zero day, the acidity of blended therapeutic RTS was in the range of 0.47-0.58% and almost non significant change was observed in these drinks till 15 days of storage. After 15 days a significant (0.55%- 0.63%) increase in acidity was observed in all the treatments during storage. The maximum acidity was found in T₆ (0.58 %) while minimum was observed in T₁(0.47%). This can be attributed partially to the contribution of inherent acid, naturally present in the beverage and partially to the citric acid purposely added to the beverage at the time of preparation.

Minor changes in acidity were also observed in carrot-spinach and carrot-pineapple juices i.e. from 0.39 to 0.42 % [27].

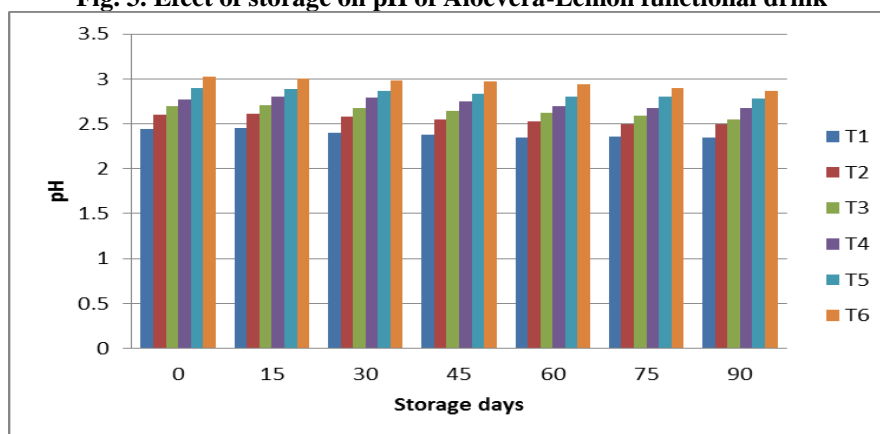
Fig.2. Effect of storage on Acidity (%) of Aloe vera-Lemon functional drink



3.3 pH

The pH of blended therapeutic RTS could be correlated inversely with the acidity of RTS and found to decrease with increase in storage periods as reported by AOAC [3]. The results of present study also showed significant effect of storage period and treatments on pH of all drink samples with the increase in acidity and decrease in pH. Mean values (fig 3) ranged from 2.44-3.02. It revealed significant increase in pH among treatments and significant decrease (2.74-2.62) during storage period of three months. Maximum mean values were recorded in T₆ (2.95), and minimum in T₁ (2.39). These findings are almost similar to earlier study [14] where pH of fruit juices decreases (from 3.9 to 3.6) with corresponding increase in acidity during storage. Similar trends were reported by other researchers in case of banana and sapota beverage stored at different temperatures for 180 days [16]. This gradual decrease in pH has a significant effect as lower pH does not allow pathogenic microorganisms to grow and hence acts as a preservative.

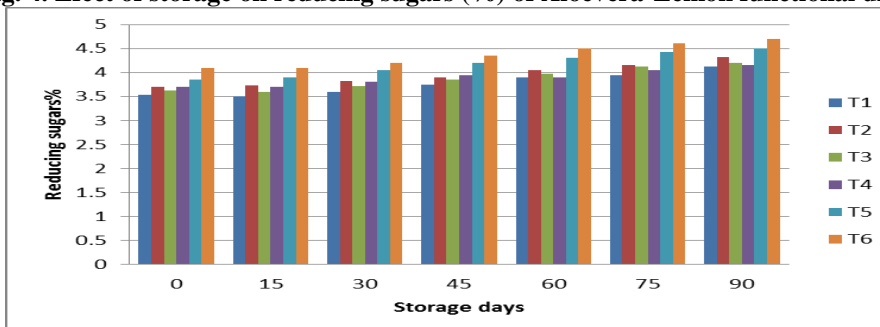
Fig. 3. Effect of storage on pH of Aloe vera-Lemon functional drink



3.4 Sugars

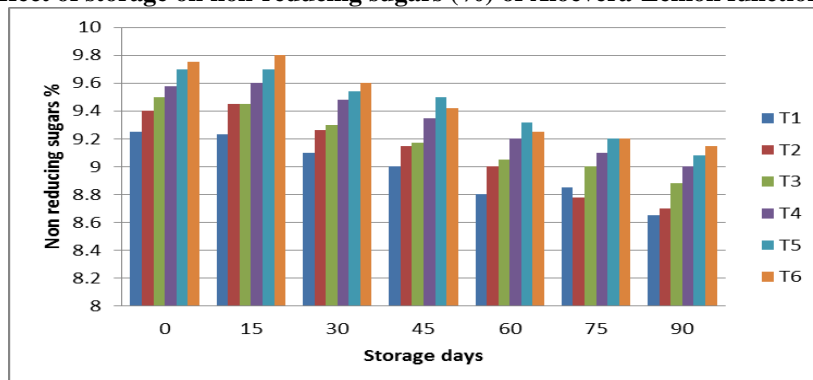
The results showed that different treatments and storage period had significant effect on reducing sugars of aloe vera-lemon RTS drinks. Fig 4 revealed significant decrease (3.76%-4.36%) among treatments and significant increase (3.75% to 4.32%) during storage of 90 days. Maximum mean score was recorded in T₆ (4.36%) followed by T₅ (4.17%) while minimum score was recorded in T₁ (3.76%). These changes may be attributed to the inversion of sucrose under acidic environment. The reducing sugars of blended RTS, increased continuously during entire period of storage and it was increased from 2.30 per cent to 5.29 percent. Similar trend in the case of lime ginger cocktail and jack fruit beverage was also reported. The increase in reducing sugars can be attributed to the hydrolysis of non-reducing sugars during processing and storage [7, 28].

Fig. 4. Effect of storage on reducing sugars (%) of Aloe vera-Lemon functional drink



The storage period had a significant effect on non reducing sugars of *Aloe vera* RTS. From fig. 5, it can be deduced that the non reducing sugars decreased significantly during the storage period of 90 days. Maximum mean value was observed in samples T₆ (9.45%) and T₅ (9.43%) respectively. Minimum mean value was observed in sample T₁ (8.98%). This minimum decrease in non reducing sugars during storage may be attributed to accelerated hydrolysis of insoluble polysaccharides and other carbohydrate polymers same trend was also reported in the case of aloe vera-mint-ginger RTS beverage [6, 30]

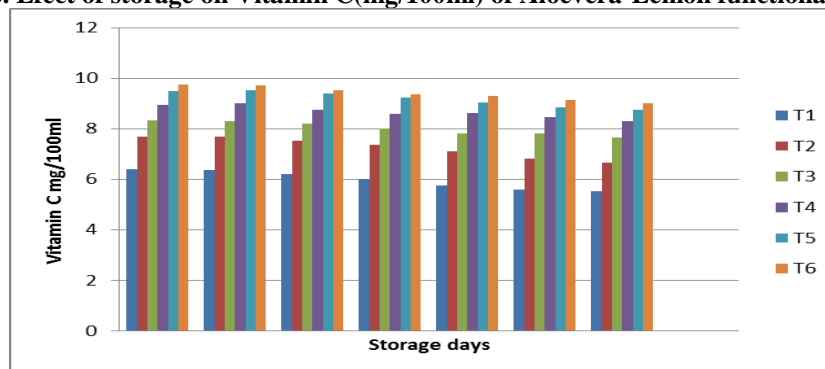
Fig.5. Effect of storage on non-reducing sugars (%) of Aloe vera-Lemon functional drink



3.5 Vitamin C

Losses in vitamin c content in fresh and processed fruits and vegetables and their products are well known .The results showed that different treatments and storage period had significant effect on vitamin C of RTS blended drinks. The data (fig 6) indicated significant increase (5.97 to 9.39%) among treatments and significant decrease (8.43 to 7.64%) during storage of 90 days. Maximum mean score was recorded in T₆ (9.39%) while minimum score was recorded in T₁ (5.97%). Losses of ascorbic acid during storage were attributed to oxidation of ascorbic acid to dehydro ascorbic acid which is directly affected by temperature and light exposure. The results coincide with the findings as described by M. Ahmed in mandarin RTS beverage and S. K. Kalra and D. K.,Tondon in guava nectar [13, 26].

Fig.6. Effect of storage on Vitamin C(mg/100ml) of Aloe vera-Lemon functional drink

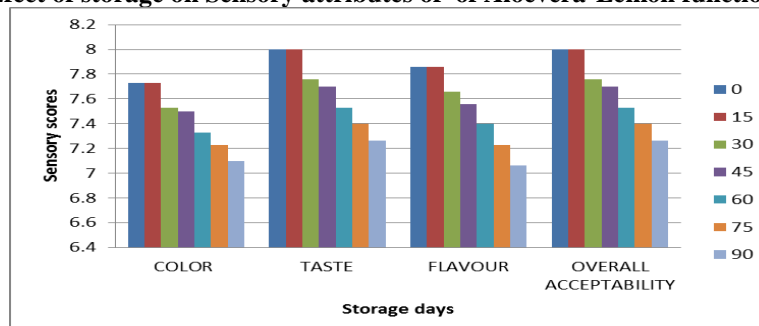


IV. Sensory Characteristics

The sensory quality profile of beverage is a prime factor to consider the marketability of product [1].

- 4.1 **Color:** The data (fig. 7) showed that color score decreased with an addition of lemon in aloe vera RTS drink .The storage period significantly decreased the color ratings of the drink and the mean value of color during a storage period of 90 days. The treatment T₄ (94:6) gained maximum score (7.94) followed by T₅ (92.8) (7.74) while minimum score was recorded for T₁ (100:0) (7.05) and T₆ (90:10) (7.11).the results are in agreement with findings of Yaduv who had worked on Aloe vera ready to serve beverage [23].
- 4.2 **Flavor:** The results indicated that during storage there was gradual decrease in flavour of drinks. A decrease in flavor score may be attributed to the increase in acidity of drinks. The mean values of flavour decreased from 7.68 to 6.68 (fig. 7). Maximum mean score was recorded for T₂ (7.68) followed by T₁ (7.48) while minimum score was recorded in T₅ (6.68) followed by T₄ (6.84). The results indicated that during storage there was gradual decrease in flavour of drinks. A decrease in flavor score may be attributed to the increase in acidity of drinks. A gradual decrease in flavour during storage may also be due to heat treatment applied during processing as reported by J. S. Pruthi [10].
- 4.3 **Taste:** During storage a gradual decrease in taste of drinks was observed. Among the treatments T₄ (90:10) ranked first (7:51) on the basis of taste while T₁ (60:40) while T₆ gained the lowest score (6.31). The results showed a loss of flavour and taste which may be due to the degradation of ascorbic acid and fural production.
- 4.4 **Overall acceptability:** The score for overall acceptability also decreased significantly during the storage period of 90 days. Sensory evaluation of RTS drink revealed that the highest score for overall acceptability i.e., 8.4 was exhibited in sample T₄ and the lowest in sample T₆ and T₁. Decrease in sensory profile of RTS drink during storage is also reported in other investigators [11,18,19,20].

Fig.8. Effect of storage on Sensory attributes of of Aloe vera-Lemon functional drink



V. Conclusion

In present study, attempts were made to develop functional RTS using *aloe vera* and *lemon* juices. It can be concluded that the drink prepared at 94:6 was most acceptable for minimum changes in TSS, acidity, pH, reducing and non-reducing sugar and vitamin C. Sensory quality parameters showed that *aloe vera* gel could be successfully incorporated with lemon juices in development of blended functional RTS drinks with improved taste, color, flavor and overall acceptability. The storage studies revealed that blended therapeutic RTS made from aloe vera gel and lemon juice could be successfully stored for the period of 3 months without significant change in chemical and sensory qualities. Moreover the introduction of new types of value added and nutrient enriched therapeutic plant based beverages might improve socio economic status of the country by enhancing the export trades.

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