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INFLUENCE OF BLENDING OF NATURAL EXTRACTS ON PHYSICOCHEMICAL AND SENSORY QUALITIES OF ALOE VERA SQUASH

T. H. PUSHPA[1], S. L. JAGADEESH[2] AND G . J. SURESHA[3]*
[1]Department of Post harvest Technology,
Kittur Rani Channamma College of Horticulture, Arabhavi Gokak - 591 218, Belgaum, Karnataka, INDIA
[2]College of Horticulture, University of Horticultural Sciences, Bagalkot, Karnataka, INDIA
[3]College of Horticulture, Department of Post harvest Technology, UHS Campus, GKVK Post, Bengaluru - 560 065
e-mail: suresh.gj@uhsbagalkot.edu.in

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***Corresponding author**

ABSTRACT
Alove vera squash was flavored with 2.25% and 3% peppermint (PM) and lime juice (LJ), and 1.5 and 2.25 % ginger juice (GJ). Aloe juice at 30% and TSS at 45 ^{0}B was maintained commonly for all the treatments. The prepared squash was stored for six months under ambient conditions to study their acceptability. Various chemical, physical and sensory qualities were recorded to establish its acceptability. Maximum TSS (47.86ºB) was recorded in the treatment in the blend of 3% PM. The treatment with 3 % PM blend recorded maximum reducing and total sugars initially as well as during storage. Higher sugar:acid ratio (57.52) was observed in the blends of 2.25% PM. Significantly maximum retention of ascorbic acid of 225.67mg/100ml was observed in 3 % LJ. Significantly maximum *L** (lightness) values was observed in 3% PP blend (8.18, 7.27, 6.20 and 3.76, respectively) at 0, 2, 4 and 6 months after storage. Considerably minimum bacterial population was seen in 2.25% GJ blend (4.49 CFU/ml) in the fresh squash. Higher overall acceptability score of 4.38 (out of 5) was obtained in the blend of ginger at 1.50%. In conclusion, blending of ginger juice at 1.5 % produced an acceptably good beverage.

INTRODUCTION

Blended beverages offers an advantage of utilizing unpalatable but pharmacologically rich juices into more acceptable form by blending with natural flavors. Alove vera (*Aloe barbadensis* Mill) is an important medicinal plant for several thousand years. Aloe vera is highly nutritive because it contains a range of biologically active compounds *viz.,* acetylated mannans, polymannans, anthraquinone C- glycosidase, anthrones, anthraquinones and various lectins, vitamins, minerals, amino acids, sugars and sterols (King *et al.,* 1995; Eshun and He, 2004; and Boudreau and Beland, 2006). Aloe vera gel is also used as flavouring component and preservative in some foods (Christaki and Florou-Paneri 2010). The aloe vera juice is called 'nature's tonic' mainly because of its richness in biologically active compounds and their unique medicinal properties.

Juices are a good source of sugars, vitamins, and minerals; all valuable components to human health. The current food trend toward healthier diets makes juice consumption an important natural food alternative and improves the availability of its nutritive compounds. Fruit, vegetable or herbal juices could play an important role in enhancing human health. Juice from aloe vera may be one of the value added edible product. Fruit juices and ready to serve (RTS) beverages are increasingly gaining popularity (Chakraborthy *et al.,* 1993). However, fresh aloe vera leaves are having bitter taste and unsuitable or unfit for direct consumption. Hence, the leaf of the pulp (aloe vera juice) may be utilized for the processing of several value added products (like beverages) and for making the ayurvedic medicines. Aloe vera juice when diluted gives colorless, flavorless and slightly bitter taste that hinders its utilization in the preparation of RTS. Hence, blending with natural and/or synthetic flavors would enhance its acceptability as nutritional health drink. The technique of blending of juices has been used to improve the color, flavor, functionality and sensory quality. The blending improves the utilization of the nutritionally rich but sensorially weak crops.

Ginger (*Zangiber officinale*) has a wide range of uses also has anti-bacterial and anti-fungal properties (Bhardwaj and Mukherjee, 2011). Pepper mint and lime have refreshing, cooling and flavoring properties. Peppers mint (*Mentha piperita*) is used as flavoring as well as key ingredient in preparation of foods and soft drinks. Lime (*Citrus limetoides*) is rich source of citric acid and contains flavoring agent that enhances the flavor of the juice.

The aim of the present work is to study the effect of blending of natural flavours *viz*. peppermint, lime and ginger at different levels to the aloe squash on physico-chemical and sensory quality. These flavouring agents were blended with 30% aloe vera juice. The quality parameters *viz.,* TSS, sugars, sugar :acid ratio, ascorbic acid, color (*L*a*b**) values and sensory acceptability were assessed over storage period of 6 months at ambient condition.

MATERIALS AND METHODS

Aloe vera leaves of uniform size, shape and maturity were harvested, packed in polythene bags and brought to the laboratory immediately for further experimentation. Peppermint leaves were washed thoroughly and then ground to get juice. The juice was filtered through muslin cloth and this clear juice was used for blending with aloe juice for making squash beverage. Lime fruits were washed thoroughly, cut into halves and the juice was extracted through squeezer. Juice was then filtered through muslin cloth and the resultant clear juice was used for blending with aloe juice for making the RTS and squash beverage. Ginger juice was obtained by soaking green ginger in water for 2-3 hours to facilitate easy peeling. Peeled rhizomes were ground with the help of an electric mixer-grinder. The fine paste obtained was squeezed through a double layered muslin cloth to get juice.

Methodology of preparation

Aloe vera leaves were washed thoroughly in continuous tap water. In order to avoid contamination of internal fillet with the yellow sap, the traditional hand-filleting method of processing was done. The lower one inch of the leaf base (the white part attached to the large rosette stem of the plant), the tapering point (2-4 inch) of the leaf top and short, sharp spines located along the leaf margins were removed by a sharp knife. The top rind was removed by introducing sharp knife into the mucilage layer below the green rind avoiding the vascular bundles. The bottom rind was similarly removed and the rind parts to which a significant amount of mucilage remains attached, were discarded. At this point, another portion of the mucilage layer remains accumulated on the top of the fillet. After filleting operation the fillets were washed again to ensure that there was no possibility of bacterial contamination after which the fillet was inserted to the pulper/grinder. After grinding, the juice was filtered three times using muslin cloth until clear juice was obtained. Then the juice was pasteurized at 85° C for 25 minutes. Subsequently the juice was immediately cooled; ascorbic acid and preservatives were added on weight basis and bottled. The aloe juice so extracted and preserved was used for experimentation.

The TSS was adjusted to 45° B while acidity to 1% with citric acid. The mixture was pasteurized at 85° C for 20 minutes and filled in pre- sterilized glass bottles of 200 ml capacity. The bottles were sealed, pasteurized in boiling water for 20 minutes, cooled and stored at ambient temperature.

Analysis of physical and chemical parameters

The total soluble solid content was measured using a hand refractometer (Make: Erma). Reducing sugar was estimated as per the Dinitrosalicylic acid method (Miller, 1972). Total sugars, reducing and non-reducing sugars, titratable acidity and ascorbic acid were estimated as per the procedures outlined by AOAC (Anon., 1984). Sugar: acid ratio was calculated by dividing total sugars (%) by the respective value of titratable acidity (%) of the particular sample.

Instrumental color analysis

Color values ($L^*a^*b^*$): The color of the beverage was measured using a Lovibond color meter (Make: Lovibond RT300, Portable spectrophotometer, The Tintometer Limited, Salisbury, UK) fitted with 8mm diameter aperture. The instrument was calibrated using black and white tiles. Samples were directly placed under the aperture of the color meter. Three measurements were performed for each sample and results were averaged. Color was expressed in Lovibond units L^* (Lightness/darkness), a^* (redness/greenness) and b^* (yellowness/blueness).

Microbial analysis (CFU/ml)

Microbial analysis of the flavored squash was carried out as per the method of Harrigan and McCance (1966). Ten ml of juice was taken for analysis. The samples were plated on nutrient agar media for bacterial isolation following serial dilution technique. Plates were incubated for two days at 28 ± 1°C and colonies were counted and CFU per ml was calculated.

Overall acceptability

Overall acceptability of flavored aloe squash was carried out by a panel of 5 semi-trained judges immediately after preparation and after two, four and six months of storage.

RESULTS AND DISCUSSION

TSS

The TSS was adjusted to 45°Brix commonly for all the treatments. Maximum TSS (47.86°B) was recorded in the treatment in the blend of 3% PM. However, minimum TSS (47.67) was observed in 3% LJ blend. There was a gradual increase in the TSS over a storage period of blended squash (Fig. 1). This might be due to the hydrolysis of polysaccharides in to simple sugars and also inversion of added sucrose into simpler soluble substances. The similar trend of increasing TSS was recorded by Tiwari and Deen (2015) in blended bael and aloe blended ready-to-serve beverage; Nidhi *et al.* (2007) in bael and guava RTS; and Singh *et al.* (2007) in guava and pineapple blended beverage.

Increase in the concentration of juice due to dehydration may also answer for increase in the TSS of squash. Similar results of increase in TSS of stored RTS of different raw material have also been reported by several workers (Dobhal, 2000; Mandal, 2003; Tandon *et al.*, 2007 and Irfan *et al.* 2008).

Sugars

The treatment T_2 (30% aloe juice + TSS 45° Brix + 3 % pepper mint) was found to have high reducing sugars and total sugars initially as well as during storage (Fig. 2, 3 & 4). On the contrary, the treatment T_4 (30 % aloe juice + 45° Brix TSS + 3 % lime juice) exhibited minimum value for all these parameters throughout the study period. A slight variation observed with respect to these parameters among the treatments may be pointed to intended variation in the ingredient composition caused while designing the treatments and also to varying rate of breakdown of polysaccharides like starch and cellulose substances into simpler soluble molecules in the presence of organic acids. Inversion of added sucrose into simpler soluble substances may also substantiate this change.

Sugar: acid ratio

Sugar: acid ratio significantly increased with increase in storage

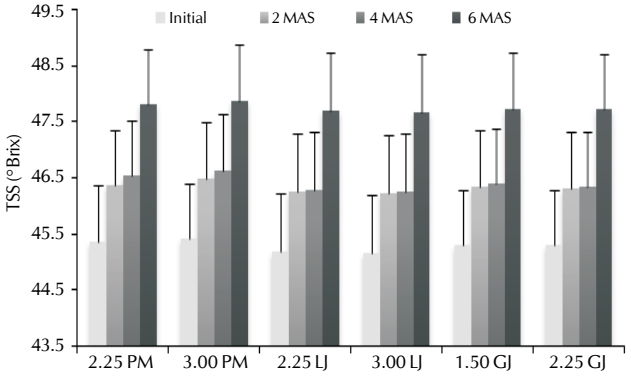

Figure1: Changes in TSS (°B) of flavored aloe squash during storage

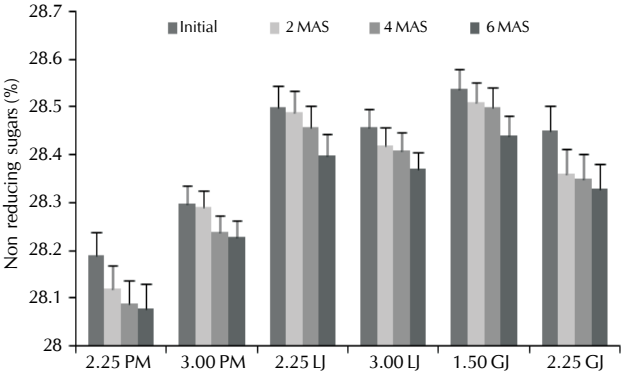

Figure 2: Changes in non-reducing sugars (%) of flavored aloe squash during storage

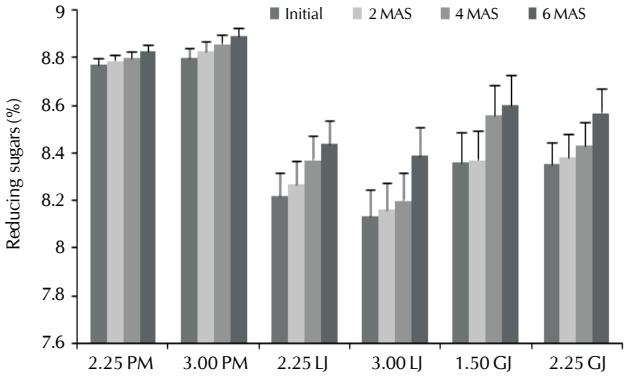

Figure 3: Changes in reducing sugars (%) of flavored aloe squash during storage

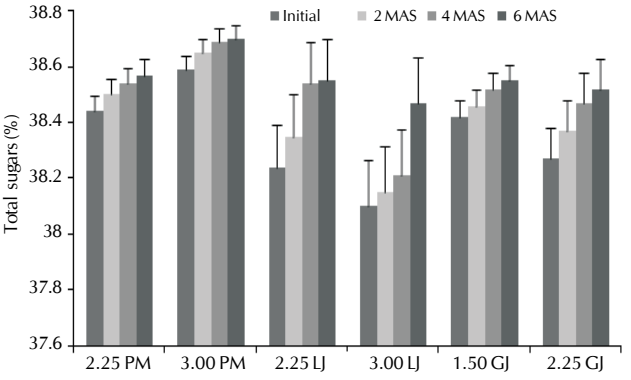

Figure 4: Changes in total sugars (%) of flavored aloe squash during storage

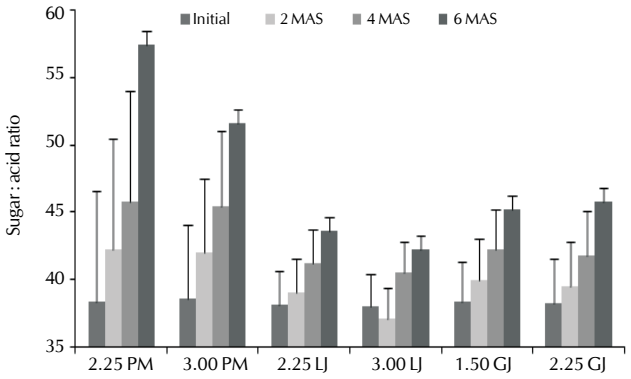

Figure 5: Changes in sugar:acid ratio of flavored aloe squash during storage

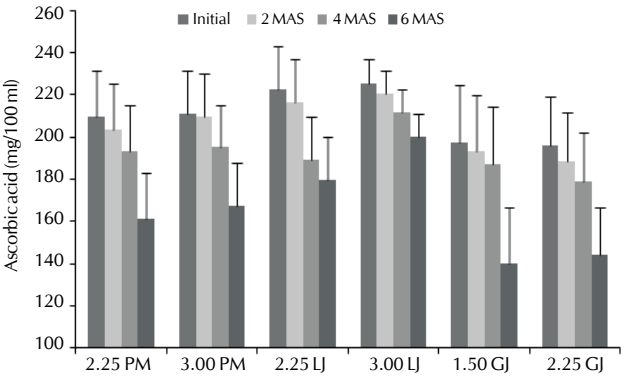

Figure 6: Changes in Ascorbic acid (mg/100ml) of flavored aloe squash

period (Fig. 5). Significant differences were observed in treatments, storage period and interaction. Maximum sugar:acid ratio (57.52) was observed in the blends of 2.25% peppermint. However, minimum sugar:acid was observed in 3% LJ blend.

Ascorbic acid

Ascorbic acid is one of the major nutritional components. Aloe vera juice has very negligible ascorbic acid content. At the time of processing, ascorbic acid was added in the present study for the purpose of preventing browning in aloe juice, to improve nutritional and antioxidant property of aloe based juice blends. In this experiment mean ascorbic acid content of aloe based squash beverages was found to decrease from 225.67 mg/100 ml in the fresh squash to 200mg/100 ml at 6 MAS (Fig. 6). This could be attributed to light and heat labile nature of the vitamin getting affected by temperature during pasteurization and storage and by ambient light conditions during storage. Significantly maximum retention of ascorbic acid throughout the study period was observed in 3 % LJ addition and it ranged from 225.67 to 200mg/100 ml. Conversely, 2.25 per cent pepper mint showed significantly

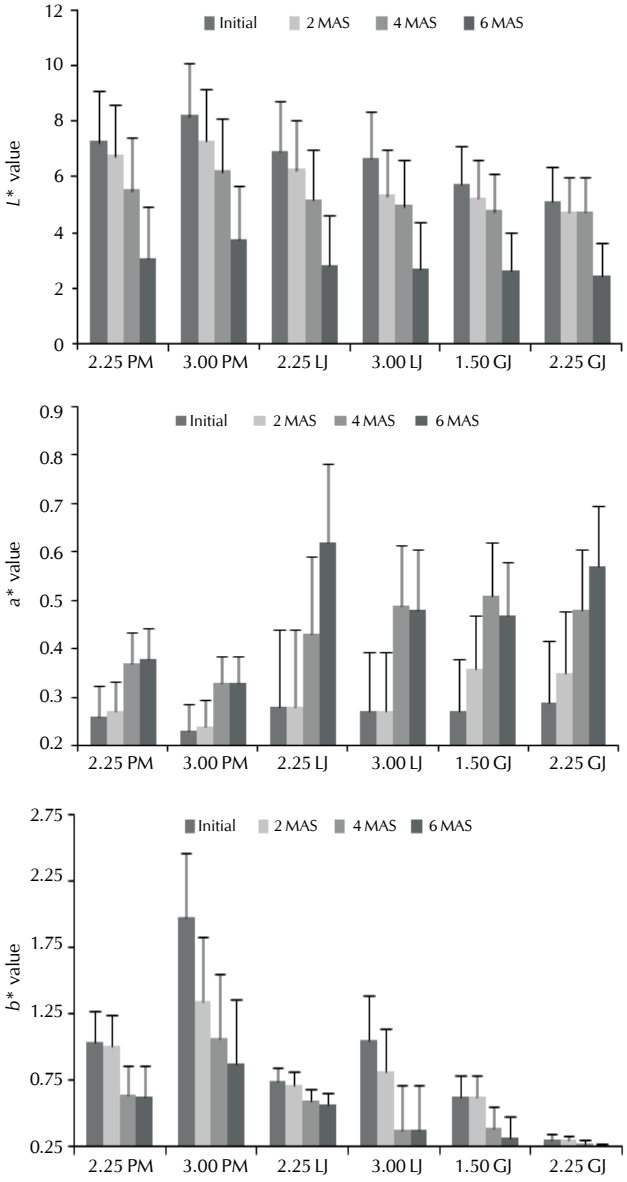

Figure 7: Changes in *L* a*b values of flavored aloe squash during storage**

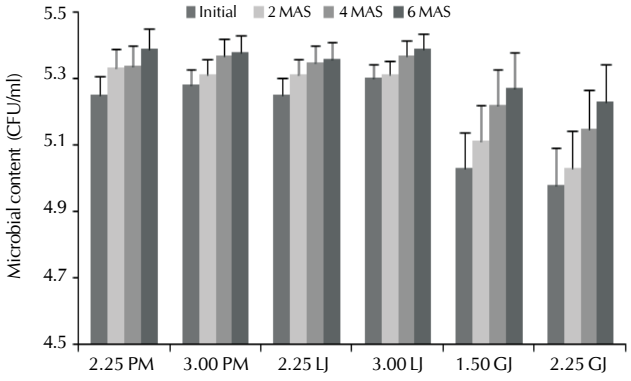

Figure 8: Changes in microbial load (CFU/ml) of flavored aloe squash during storage

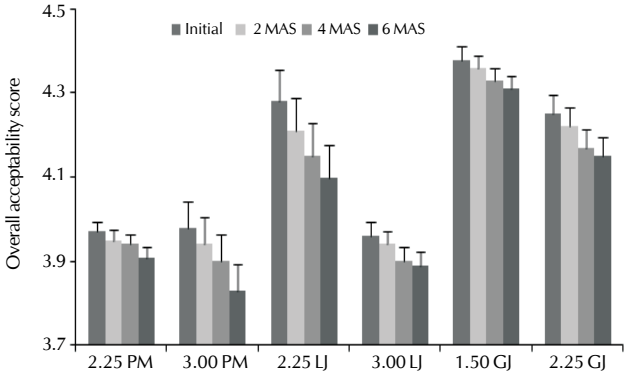

Figure 9: Changes in overall acceptability scores of flavored aloe squash during storage

less ascorbic acid level at end of storage for 6 months.

Color

The mean values of lightness (*L**) and yellowness (*b**) decreased with increasing storage period and whereas redness (*a**) showed increasing trend in flavored aole squash. Significantly maximum *L** (lightness) value was observed in 3% PP blend (8.18, 7.27, 6.20 and 3.76 respectively) at 0, 2, 4 and 6 months after storage. Juice extracts of ginger, pepper mint and lime being natural, imparted attractive light color to the product (Fig. 7). Significantly maximum *a** value was observed in treatment T_6 (0.29, 0.35, 0.57and 0.48 respectively) at 0, 2, 4 and 6 months after storage. In the present study *a** value increased with increasing storage period and it might be due to Millard reaction observed during storage. Significantly maximum *b** value was observed in treatment T_2 (1.98) in freshly prepared squash. However, minimum *b** value was observed in T_6 (0.31). Highest value of *b** indicate that yellowness, contrary lowest means towards blue.

Microbial populations

Significantly minimum bacterial population was seen in 2.25 % GJ blend (4.49 CFU/ml) in the fresh squash. The maximum bacterial population in the fresh squash was associated with 3 % PM blend (5.37 CFU/ml) at 2, 4 and 6 months after storage. The minimum bacterial population was observed in 2.25% GJ (5.03 CFU/ml, 5.15 CFU/ml and 5.23 CFU/ml, respectively). Microbial load has increased over the storage period. Significantly, minimum population was observed in the treatment ginger juice blends probably due to ginger acting as an antimicrobial agent.

Overall acceptability

Significantly maximum overall acceptability (4.38, 4.36, 4.33 and 4.31 respectively) at 0, 2, 4 and 6 months of storage was found in the treatment containing aloe juice 30% + TSS 45º Brix + ginger 1.50% (Fig. 9). The treatments involving ginger blends have maximum acceptability. The use of ginger in many culinary dishes and fruit beverages at certain proportion imparts enjoyable taste and odor. Hence, superior performance of the treatment with ginger (1.50%) in flavored aloe squash blend is quite possible. The similar findings of increased acceptability in blending of ginger were reported by Gupta *et al.*

(2015). Joshi *et al*. (1993) reported considerable improvement with respect to taste and aroma in the products with added spice extract (Boghani *et al*., 2012.

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