STANDARDIZATION OF PROTOCOL FOR FLAVOURED RTS, SQUASH AND BLENDED BEVERAGES OF ALOE VERA

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STANDARDIZATION OF PROTOCOL FOR FLAVOURED RTS, SQUASH AND BLENDED BEVERAGES OF ALOE VERA

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By

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CERTIFICATE

This is to certify that the thesis entitled "**STANDARDIZATION OF PROTOCOL FOR FLAVOURED RTS, SQUASH AND BLENDED BEVERAGES OF ALOE VERA**" submitted by **PUSHPA HOSUR** for the degree of **MASTER OF SCIENCE (HORTICULTURE)** in **POST HARVEST TECHNOLOGY,** of the University of Horticultural Sciences, Bagalkot, is a record of research work carried out by her during the period of her study in this university, under my guidance and supervision, and the thesis has not previously formed the basis of the award of any degree, diploma, associateship, fellowship or other similar titles.

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Affectionately dedicated to
My beloved Parents
Sri. Tammanna and
Late Smt. Laxmi
And my guide

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1. INTRODUCTION

Aloe vera was originated in tropical Africa and it is now cultivated in warm climatic areas of Asia, Europe and America (Harding, 1979). Aloe vera (*Aloe barabadensis* Miller.) is a perennial succulent plant of the family *Liliaceae* cultivated or collected wild and utilized in medicinal as well as cosmetic preparations. *Aloe vera* leaf contains aloins, a little amount of volatile oil, resin, gum, emodin, anthraquinone derivatives, chrysophanic acid and coumarins (Bhandari and Mukerjii, 1959). Joshi (1997) reported that the polysaccharides of the gel are presumed to play in the clinical activity of the gel. The aloe juice is generally considered to be harmless and non-toxic even for internal consumption as health food.

Presently, the use of aloe vera has gained popularity because of herbal movement initiated by naturopaths, yog gurus, alternative medicine promoters and holistic healers. Aloe gel contains as many as 75 known potentially active ingredients. The leaf of aloe is a treasure house of vitamins, minerals, enzymes, amino acids, sterols and anthroquinones. Aloe juice consists of 99.5 per cent moisture, 0.026 per cent reducing sugars, 0.19 per cent total sugars, 0.013 per cent proteins, 0.2 per cent fibre, 26 mg /l magnesium, less than 0.001 per cent of heavy metals with a pH of 4 to 5. The cathartic proportions of the aloes are attributed to the presence of a mixture of glycosides called “Aloin” (Chandegara and Varshney, 2005). Aloe vera gel is used in preparation of ayurvedic medicines and cosmetics. In Ayurveda, it is described as *Bhedinee* (Purgative), *Pleeharogaghna* (Insplenomegaly), *Netrya* (beneficial to eyes), *grantighna* (Cures randular enlargement), *Shwaasaghna* (In anti-dyspnoic, anti-spasmodic) (Satyavati *et al.,* 1976). Besides, the extract of aloe is used in the preparation of skin creams, body lotions, bath soaps, talc and soft drinks.

Aloe vera is an industrial crop and in the food industry it has been utilized for the preparation of various health food drinks, its concentrate can be used to mix with water, tea, milk, its powder can be used in ice cream and confectionary (Seoshin *et al*., 1995). The gel of fresh aloe leaf is a remedy for intestinal worms in children and anti-dysenteric, regular use of pulp is useful in prevention of abdominal tumours, dropsy, piles, sciatica and can cure tuberculosis, cancer and also Acquired Immune Deficiency Syndrome (AIDS) in the initial stages (McGuffin *et al.,* 1997). The industry size for aloe raw material is estimated to be about $ 125 million dollars. The

volume of the industry for finished products containing aloe vera is supposed to be around $110 billion dollars (Anon., 2006).

Thus, aloe vera is one of the important medicinal crops of commercial significance. It is hardy and highly remunerative even without much care. It is grown in dry belts of India and more popular in Rajasthan and Uttar Pradesh, where it is largely cultivated. It is also grown in dry parts of Bihar, Gujarat, Kharagapur and few pockets of Karnataka. In view of its diverse uses, its cultivation is increasing fast and the crop is becoming popular among the growers.

The aloe vera contains a range of biologically active compounds, the best studied being 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). 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 food (drinks) product. Fruit juices are refreshing and retain characteristic taste and aroma even after a few months of their preparation into a beverage compared to several other fruit products. Fruit juices and ready to serve beverages are increasingly gaining popularity throughout the country (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 in to several value added products (like beverages) and for making the ayurvedic medicines.

Fruit juices prepared from oranges and grapes can be consumed directly, where as direct consumption of aloe vera juice in its pure form is not relished because of high bitterness, low acid and low sugar or no sugar content of juice. Hence, it is necessary to convert the aloe vera juice into acceptable beverages for consumption. It is quite possible by incorporating various ingredients (juice, sugar, acid, water) and

develop to acceptable aloe beverages to develop aloe based beverages such as RTS, squash, syrup etc certain flavours.

Oranges, mango, pineapple and grapes have strong flavour, other fruit juices are not generally added while preparing RTS, squash, syrup, nectar etc. from them. However, health beneficial but bitter tasting juice of aloe vera may profit from blending with other natural flavoured juices. It may help to improve the taste, aroma, palatability, nutritive value and reduce bitterness in addition to improvement in colour and appearance if appropriately blended with flavouring ingredients like peppermint, lime, ginger, *jaljeera* and *chat-masala.*

Peppers mint (*Mentha piperita*), is used as flavouring as well as key ingredient in preparation of foods and soft drinks. It is commercially used in liquors, toothpastes, soaps, mouthwashes and as flavoring agent in tea, ice cream, chocolates and other deserts. Lime (*Citrus limetoides*) is rich source of citric acid and contains flavoring agent it enhances the flavour of the juice. *Jaljeera* powder is cooler and makes a delicious spicy appetizer drink comprising black salt, mint leaves, black pepper and dry ginger. *Jaljeera* is a famous mint flavoured lemonade generally served as an appetizer and is very popularly used in summer drinks. *Chat-masala* is a also spice mixture powder added to foods and drinks.

The fruits of aonla (*Emblica officinalis* Garch. Syn. *Phyllanthus emblica* L.) are highly nutritive and rich source of vitamin C among the fruits next only to Barbados cherry (Asenjo, 1953). They are also rich source of pectins and tannins. Aonla fruit is valued as an antisorbutic, diuretic, laxative and antibiotic. One or other part of the plant could be used in treating chronic dysentery, bronchitis, diabetes, fever, diarrhea, jaundice, dyspepsia, and cough and in tanning and dyeing industries (Bose and Mitra, 1990). Kokum (*Garcinia indica* Choisy) reduces fat, cools body, purifies blood, and fights cholesterol. Value addition in kokum fruits through processing assumes importance because raw/ripe fruits need to be processed before their consumption. Ginger (*Zangiber officinale*) has a wide range of uses that include flavourant, in culinary, soft drinks, alcoholic and non alcoholic beverages, confectionary, pickles, and pharmaceutical preparations. Ginger juice also has anti-bacterial and anti-fungal properties (Bhardwaj and Mukherjee, 2011).

Hence to mask undesirable taste of natural aloe juice and produce acceptable beverage, it was thought necessary to develop recipes with appropriate quantity of aloe juice, sugar, acid and blends with different natural flavors (peppermint, lime, ginger, *jaljeera, chat-masala*) to produce acceptable RTS and squash beverage from aloe vera. Further, it was also envisaged to blend the aloe vera juice with other fruit juices like aonla juice, kokum juice and green ginger juice to improve the flavour of aloe beverages. Therefore, in the present investigation different recipes containing varying levels of aloe juice, aonla juice, kokum juice, ginger juice were planned to develop aloe squash blends in order to produce a good quality aloe based mixed squash which has ready acceptability by the consumer. An increased knowledge about changes in juice quality caused by biochemical and microbial activity and improved preservation technique has made it possible to produce and bottle high quality juices for consumer use. Besides developing highly acceptable recipe, it is also important to preserve flavour, vitamins and other valuable ingredients of the raw material in the finished product.

A very little work has been carried out on processing of aloe vera for health drinks because of certain constraints in processing and storage, namely difficulty in extraction of the juice and the presence of bitter tasting anthraquinones. Therefore, the present investigation was planned to develop aloe vera products, *viz.,* flavoured Ready-to-Serve, flavoured squash and mixed squash beverage and to preserve the developed products with the following objectives:

Objectives

1. To standardize the protocol for preparation of aloe RTS and Squash with different natural flavors
2. To standardize the protocol for blending aloe with amla, kokum and ginger to obtain mixed aloe squash
3. To evaluate the quality and storability of blended aloe beverages

2. REVIEW OF LITERATURE

In a hot country like India, the use of refreshing and thirst quenching beverages, mostly falling under the category of aerated waters, has become stagnant. For a long time, the use of flavoured thick sugar syrups has been very common. During the last few decades, the products like fruit juices, squashes, cordials, crushes, syrup and ready- to- serve beverage have been introduced in the country to a large extent on commercial scale. The rapid increase in the production of these items in different parts of our country is a proof of their rising popularity. The use of fruits, vegetables, medicinal plants and spices by industry for the preparation of such products will not only reduce wastage of all these produce during handling but also add nutrition and palatability to the drink. The present investigation was planned to develop value added beverage products from aloe vera, a medicinal plant. The products experimented are flavoured aloe ready-to-serve (RTS) beverage, aloe squash with different natural flavours and aloe based blended squash. However, there is not much systematic research work published on these aspects of aloe vera utilization. Hence, the review also includes other crops related to the above products.

2.1 Preparation of ready-to-serve (RTS) beverages

RTS is a type of fruit beverage which contains at least 10 per cent of fruit juice and 10 to 15 per cent of total soluble solids besides about 0.3 per cent acid. It is not diluted before serving hence it is known as ready to serve (RTS) (Srivastava and Sanjeev Kumar, 1998).

The concept and methodology followed for preparation of beverage is same for most of the fruits with certain minor manipulations depending upon the type of fruit that are either highly acidic or extremely low in acidity or those fruits, which exhibit interfering factors such as highly astringent and bitter taste (Giridharilal *et al.,* 1986). Fresh aloe vera leaves are having bitter taste and unsuitable or unfit for direct consumption. Hence, the leaf of the pulp (aloe vera juice) needs proper processing to develop several value added products (like beverages) and for making the ayurvedic medicines. The aloe vera is highly nutritive because it contains a range of biologically active compounds (King *et al.,* 1995; Eshun and He, 2004 and Boudreau and Blend,

2006). The aloe juice is generally considered to be harmless and non-toxic even for internal consumption as health food (Joshi, 1997).

The entire process of gel separation involves washing the freshly harvested aloe vera leaves in a suitable bactericide, followed by the processing of the leaves to mechanically separate the gel matrix from outer cortex. The separation of the gel from the leaf could be facilitated by the addition of cellulose dissolving compounds like cellulose (Kojo and Qian, 2004). Chandegara and Varshney (2005) reported that the extraction of gel from aloe vera leaves by centrifugation should be carried out at 5ºC temperature, 1000 rpm speed with 30 minutes duration of centrifuge, without addition of acetone to pulp so as to obtain higher gel recovery (51.17%) of good quality. In order to avoid the loss of biological activity filleting operation must be completed within 36 hours of harvesting the leaves (Robert, 1997).

Fruit commonly used by processing industries for making beverage are mango, mandarins, sweet orange and pineapple. A study has opined that the citrus fruits are the most ideal for making beverage due to the fact that they are juicy, refreshing and retain the characteristic taste and aroma even after few months of their preparation into a beverage (Giridharilal *et al.,* 1986). Ready to serve beverage from guava and papaya blend was prepared in different ratios and RTS beverage prepared from 15 per cent juice of 80:20 blend of guava-papaya was adjudged the best (Sharma *et al.,* 2008). The prepared guava RTS blended with aloe and roselle juice with 15 per cent juice, 10º Brix TSS and 0.3 per cent acidity was rated as the best recipe with highest scores for organoleptic quality (Sudhindra Kumar *et al.,* 2012).

Preparation of fruit beverage needs basic ingredients such as fruit juice, sugar, organic acids and permissible preservatives, flavours and colours. Best beverage must have a proper sugar acid ratio to impart a particular taste, flavour and colour and should be stable during storage (Mabessa *et al.*, 1982).

A good quality ready to serve guava beverage can be prepared with fruit pulp content equivalent of 5 to 10 per cent peeled fruit, 12.5 per cent TSS and 0.25 per cent acidity (as citric) as reported by Jain and Borker (1970). The RTS prepared from Saradar guava containing 10 per cent guava pulp and 11 per cent TSS with 0.25 per cent acidity was found to be most ideal and better over Allahabad safeda (Pandey and Singh, 1998).

The RTS (ready- to –serve) beverage was prepared by blending of mango pulp of mango cv. Rumani was blended either with Mallika or Dashehari pulp in the ratio of 9:1, 8:2 and 7:3. The best pulp blend for beverage preparation was observed to be 7:3 after 12 months storage. The pulp of Deshehari was better over mallika for blending with Rumani (Tandon *et al.,* 2010). The ready to serve blends containing grape: mango (3:1) and grape: pineapple (1:1) received higher sensory quality scores as reported by Saxena *et al.* (1996). The RTS- (Ready-to-serve) beverage prepared from 10 per cent aloe juice with 15ºB TSS was found to be the most ideal recipe (Vijayalakshmi, 2012).

Paneer whey beverage (PWB) prepared from 2.5 per cent kokum juice and 15 per cent sugar with 0.1 per cent jeera powder contained 16.4 per cent TSS, 19.75 per cent total sugar, 4.66 per cent reducing sugar, 15.08 per cent non reducing sugar, 0.47 per cent acidity and 4.68 pH. The TSS, total sugar, reducing sugar, non reducing sugar, acidity increased significantly with increase in the level of kokum juice while pH of PWB reduced significantly with increasing level of kokum juice (Rupnar *et al.,* 2008).

Passion fruit juice is more popular for mixture with other juices. Among a number of tropical fruit products investigated by Swamy *et al.* (1977) passion fruit was one of those most preferred in beverages and punches. Passion fruit juice has proved to be too acidic for the manufacture of ice cream, but this characteristic is an advantage in the preparation of sherbet. The addition of passion fruit juice at 10 to 15 per cent to the basic sherbet mix is considered to be the optimum for a flavoured product.

The ready to serve beverage with a recipe of 12 per cent aonla juice + 2 per cent lime juice + 1 per cent ginger + sugar adjusted to a TSS of 15^{o} brix was found to be acceptable with highest organoleptic scores (Gajanana, 2002).

The blended juice of lime- aonla at the ratio of 95: 05 was used for the development of spiced RTS beverage having 6 per cent juice, 10º Brix total solids, 0.3 per cent acid and fortification with 2 per cent ginger juice, 0.4 per cent mint juice, 0.25 per cent cardamom and 0.1 per cent black pepper extracts along with 1 per cent salt (Dekha *et al.,* 2004). The appearance, colour and flavour characteristic of sour grape beverage were improved by blending with purple grape juice and phalsa juice at

2:1 and 1:1, respectively. The highest score of 7.4 and 7.5 were recorded for blended grape beverage with purple grape and phalsa juice respectively even after a storage period of 6 months (Balaswamy *et al.,* 2011).

Jasimahmed (1996) reported that banana RTS prepared from 15 per cent juice, 12º Brix TSS and 0.15 per cent acidity was found ideal. Singh and Sanjeevkumar (1995) reported that the blended ready to serve beverage prepared from 10 per cent aonla pulp + 2 per cent lime juice +1 per cent ginger + 12 per cent TSS and 0.3 per cent acidity was found ideal.

2.2 Preparation of squash beverages with natural flavours

Squash is a fruit juice beverage, which is altered considerably in its composition before consumption. It may be diluted before serving, with plain or aerated water. Squash consists of essentially strained juice containing moderate quantities of fruit pulp and appropriate sugar/ acid ratio for good taste. It is a refreshing drink containing vitamins and minerals. According to FPO specification squash should possess minimum juice of 25 per cent and TSS of 40º brix, maximum acidity 1.5 per cent and maximum preservative SO_2 350 ppm or benzoic acid 600 ppm (Anon., 1984). Squash and nectar preparation involves the extraction of fruit juice mixing it with sugar of known strength, addition of citric acid and permitted preservatives, canning or bottling and finally proper sealing and processing to ensure storage stability without spoilage (Bhatia *et al*., 1956).

Pandey and Singh (1998) studied the preparation and preservation of guava squash. The recipe containing 25 per cent pulp and 45 per cent TSS with 1.0 per cent acidity was found most ideal. The product remained acceptable up to a period of six months under ambient temperature. Vijay Jain *et al.* (2006) reported that recipe of 40 per cent pulp, 60^{o} brix TSS and 0.75 per cent acidity was most ideal to prepare squash from aonla. This product remained acceptable up to a period of six months during storage at room temperature. The total soluble solid, acidity, reducing sugar and total sugar of the squash increased continuously during storage while the ascorbic acid in contrast decreased.

Vishal and Sharma (1998) had given an ideal recipe for squash and syrup which includes 25 per cent pulp, 45 per cent TSS, one per cent acidity for squash and 25 per cent pulp, 68 per cent TSS and 1.2 per cent acidity for syrup from different varieties. Squash and syrup prepared from Cv. Chakaiya scored highest for organoleptic quality.

Sanjeevkumar and Singh (1998) studied the recipe for preparation of papaya beverages like nectar, squash and jam and the products were evaluated. Nectar with composition 20 per cent pulp, 13 per cent TSS and 0.3 per cent acidity, squash of composition 25 per cent pulp, 50 per cent TSS and 1.1 per cent acidity and jam composition 45 per cent pulp, 68 per cent TSS and 0.5 per cent acidity were found ideal.

Squash and RTS beverages prepared from comminuted malta orange beverage base and malta orange juice concentrate were found acceptable for six months when stored at room temperature (25-30^{0}C) (Pruthi *et al.*, 1984). Gajanana (2002) revealed that acceptable quality aonla squash could be obtained with the recipe containing 30 per cent aonla with 5 per cent lime juice, 2 per cent ginger juice and TSS adjusted to 40º Brix.

Thakur and Barwal (1998) studied the preparation and evaluation of squash from unmarketable kiwi fruit. The squash of 45^o brix with 25 per cent and 30 per cent pulp of the Cv. Allison had highest taste, flavour and acceptable score during storage period.

2.3 Preparation of fruit based mixed beverages

Blending of fruit juices is practiced to overcome high cost of some exotic fruits, scarcity or seasonal availability, blanching of strong flavours, high acidity, astringency, or bitterness, improving total soluble solids, nutritional or phytochemical properties can be improved by blending which offers to adjust sugar: acid and compensate undesirable juice consistency (Saxena *et al.,* 1996). Fruits , which are rich in nutrients but not acceptable due to high acidty, poor taste, and flavours, could be

blended with other fruits to improve their acceptability make use of available nutrients (Khan *et al.,* 1998).

Blended squash from 25 per cent aonla pulp + 5 per cent lime juice + 2 per cent ginger juice + 50 per cent TSS and 0.3 per cent acidity was found ideal (Singh and Sanjeevkumar 1995). The squash prepared from 30 per cent fruit pulp with spice recipe 0.1 per cent cardamom, 0.25 per cent cumin, 0.4 per cent black pepper, 0.5 per cent common salt, 1.0 black salt, 1 per cent ginger extract and 1.0 per cent mint extract at 40º brix TSS was found best among all the combinations (Sharma *et al.,* 2002).

Sandhu and Sindhu (1992), Saxena *et al*. (1996), Attri *et al*. (1998), Langthasa (1999), Deka (2000), Deka and Sethi (2001) reported that two or more fruits juice /pulp may be blended in various proportions for the preparation of nectar, RTS beverage *etc*. The blending of juice may also improve aroma, taste and nutrients of the beverage.

Sangeetha *et al*. (2005) have standardized the preparation of aloe juice in combination with lime juice, pineapple, papaya, grape and tomato pulp. *Aloe vera* extract and fruit juice in 1:1 ratio was found to be most acceptable. Aloe-lime squash was most preferable followed by aloe-pineapple, aloe-grape, and aloe-tomato squash. The anti-oxidant activities of aloe-lime, aloe-pineapple, aloe-grape, and aloe-tomato were high when compared to aloe-papaya and aloe-grape squashes. According to Saxena *et al.* (1996) the ready to serve blends containing grape: mango (3:1) and grape: pineapple (1:1) received higher sensory quality scores. Vijayalakshmi (2012) standardized the preparation of aloe squash in combination with aonla juice, kokum, ginger in various concentrations. Among them, aloe juice 20 per cent blended with 10 per cent aonla, 5 per cent kokum and 0.5 per cent ginger was more acceptable than any other recipe experimented.

Highly palatable drinks result from blends with the less acid juices of fruits like pear, apple, pineapple, orange, mango, and papaya etc., rather passion fruit juice which is too acidic to be acceptable as a pleasant beverage. Formulations for beverage based on passion fruit concentrate or blends of passion fruit with guava or pineapple concentrate are given by Brekke (1973). Blending passion fruit juice with other fruit

juices (pineapple) for manufacture of jam or jelly is a logical step to overcome the problems of high acidity and heat sensitivity. Tropical fruit cocktail and tropical fruit salad, which are experimental variation of the popular canned fruit cocktail, represent a major potential outlet for passion fruit juice. The content of passion fruit juice is less (1 part) in cocktail formulation but it contributes an exotic flavour because of its intense flavour (Seale and Sherman, 1960).

Four different carrot based ready-to-serve drinks were prepared by blending 400 g boiled carrot (for 45 min.), 600 ml water, 150 g sugar, 15 g citric acid and 0.12g sodium benzoate as well as 0.5 ml fruit flavour (natural or commercial mango and orange flavours). The approximate general analysis of carrot, mango and orange drinks showed that non-reducing sugar content was 10.89 per cent, 8.0 per cent and 2.95 per cent, respectively, while orange drink exhibited the highest percentage of reducing sugars. Carrot drink had the highest levels of acidity, carotenes and fibres as well as the lowest level of vitamin C, pectin substances and protein. The study also indicated that carrot drink was considered to contain reliable amounts of minerals and micronutrients (K, Na, Ca, P, Mg, Fe, Cu, Zn and Mn) (Mohamed *et al.,* 1997).

Kinnow mandrian juice and ginger were blended in the ratio of 0: 30, 5: 25, 10: 20, 15: 15, and 20:10, 25: 5 and 30:0, respectively to prepare squash from these blends with TSS being fixed at 40 t0 45º Brix. Among the blended squashes, the ratio of 25:5 scored the highest in terms of sensory attributes. A gradual and consist decrease in acidity was observed in the stored squash and this could be due to chemical interaction between the organic constituents of the juice induced by temperature and action of enzymes (Nath *et al.,* 2005).

2.4 Physico-chemical changes in fruit beverage during storage

The extent of physico-chemical and sensory changes during the storage of beverage depends on the type of fruit, ingredients used, method of processing and storage conditions (Paull, 1979). The nutrients loss was common feature in processed products (Tripathi *et al.,* 1988). They also observed that most of the beverage showed an increase in total soluble solids and reduction in total titratable acidity and ascorbic acid, which was proportional to the storage period. Damame *et al.* (2002) observed

that vitamin C content in aonla products (juice and syrup) goes on decreasing with the advancement of storage period.

Madanlal Choudhary *et al.* (2006) have reported that RTS beverage of guava noted an increase in acidity during its 150 days of storage. This might be due to formation of organic acids by ascorbic acid degradation as well as progressive decrease in pectin content. The pH value decreased with increased periods of storage up to 150 days under room temperature. It could be due to simultaneous increase in acidity and total soluble solids. The increase in reducing and total sugar corresponded to the increase in total soluble solids and ultimate decrease in non-reducing sugars; this might be due to hydrolysis of polysaccharide sugar into reducing sugar; an increase in reducing sugar was correlated with decrease in non-reducing sugar. The increased levels of total sugar were probably due to conversion of starch and pectin into simple sugars. Vijayalakshmi (2012) reported that ready-to-serve beverage of aloe vera noted an increase in TSS, reducing sugars, total sugars, sugar: acid ratio and pH, whereas titratable acidity, ascorbic acid, non-reducing sugars and polysaccharides decreased during the during the storage period of six months.

In guava beverage, the loss of ascorbic acid was in the range of 40 to 56 per cent after one year of storage, whereas, total soluble solids and acidity increased slightly over the control during the storage period (Kalra *et al.*, 1988). Five products (juice, squash, ready to serve, cordial, syrup) prepared from four varieties of litchi were stored at room temperature for twelve months and their quality was evaluated at every three months interval. Vitamin C (ascorbic acid) significantly decreased, whereas reducing sugars increased slightly in all the products during the storage period (Kumari Karuna *et al.,* 2005).

An increase in reducing sugar and decrease in ascorbic acid with processing and storage of citrus juice was noticed by Ranote and Bains (1982). According to Raghuramaih and Ranganna (1970), darkening of citrus juices during storage is due to the oxidation of ascorbic acid to dehydro-ascorbic acid. Mango squash prepared from different varieties showed an increase in reducing sugars and loss of acidity during storage, whereas, the total soluble solids did not change much (Palaniswamy *et al.,* 1974). Increase in total soluble solids and reduction in acidity and ascorbic acid was observed in lime juice squash by Palaniswamy and Muthukrishna (1974).

The physico-chemical changes in jamun (*Syzygium. cumini*) fruit products like ready-to-serve beverage (RTS), squash, syrup and jam during the storage were studied. Total soluble solids and reducing sugars increased whereas, the total sugars and acidity decreased slightly. The total phenolics (tannins) decreased throughout the storage period. The maximum retention of anthocyanin was in jam followed by syrup, squash and RTS beverage (Kannan *et al.,* 2004). Ready-to-serve beverage was prepared from two varieties of jackfruits with 10 per cent pulp, 18º Brix TSS and 0.25 per cent acidity (citric acid). The storage study showed an increasing trend in the acidity and reducing sugar and decreasing trend in total sugar, ascorbic acid content .Retention of ascorbic acid and beta carotene contents were much better in the sample stored in green coloured bottles (Krishanaveni *et al.,* 2001). Relekar *et al*. (2013) reported an increase in the levels of TSS, reducing sugar, total sugar and pH as well as a decline in that of acidity of sapota squash during the storage period of six months.

Garande *et al*. (1995) reported that jamun RTS stored at room temperature showed an increase in TSS, total sugar, reducing sugar and pH. However, a reduction in non reducing sugar and acidity was observed during storage. Vijayalakshmi,(2012), reported that increasing storage period with increase in TSS, total sugars, reducing sugars, pH, whereas acidity, ascorbic acid, non-reducing sugars decreased during storage in aloe squash.

Surender Singh *et al.* (2005) studied the standardization of processing technology of bael or blended bael ready to serve beverages. The total soluble solids, total soluble solids-acid ratio and total sugar of ready-to-serve drink increased during storage up to three months. Acidity, non-reducing sugar and phenols decreased, whereas reducing sugars and browning increased during the storage of six months. There was a continuous increase in the values of total sugars (11.2 to 13.6%) and reducing sugars (4.8 to 11.5%) in the RTS beverage prepared from pineapple guava blends during three months of storage (Tripathi *et al.,* 1988).

Kinnow mandarin juice and ginger juice were blended in the ratio of 0:30, 5:25, 10:20, 15:15, and 20:10, 25:5 and 30:0, respectively to prepare squash from these blends. TSS was fixed at 40 to 40.5^{o}B. A gradual and consistent decrease in acidity was observed in the stored squash and this could be due to chemical interaction between the organic constituents of the juice induced by temperature and

action of enzymes (Nath *et al.,* 2005). Roy and Singh (1979) reported that squash and nectar prepared from bael fruit changed its original colour to light brown during storage. They further observed a decrease in acidity as well as ascorbic acid and increase in total and reducing sugar content of squash and nectar during six months of storage at room temperature.

Storage time and temperature had great influence on the quality of heat processed kinnow mandarin juice. The TSS, ascorbic acid, total carotenoids, acidity, free amino acids, total sugars and soluble proteins of the juice decreased in contrast to non-enzymatic browning and reducing sugars, which increased during four months of storage with the increase in temperature and storage period (Ghorai and Khurdiya, 1998). Ramajayam *et al.* (2002) studied the development of value added simarouba and kokum-simarouba squash blends. During 5 months of storage, TSS and pH recorded an increasing trend whereas acidity recorded a decreasing trend. However, there was no conspicuous change in total sugars, reducing sugars and ascorbic acid.

. During storage of the beverage all the biochemical qualities changed with storage period irrespective of the treatments. The total sugar, pH and ascorbic acid of the RTS got reduced with storage period, whereas an increasing trend was observed in acidity and TSS. Yet, the changes were maximum in control samples. The results suggested the use of ginger juice as a source of natural preservative (Kalpana *et al.,* 2008). A significant decrease in acidity level with increase in pH level in sapota squash was noticed during storage period of six months (Srinivas *et al.,* 2007). Sudha *et al.* (2007) noticed an increasing trend in total sugar content (40.84 per cent to 41.76 per cent) of sapota squash prepared from sapota fruits of CO-2 cultivar after 30 days of storage.

2.5 Sensory changes in fruit juice and juice based beverages during storage

Jasimahmad (1996) found that the banana RTS beverage prepared from 15 per cent juice, 12º Brix TSS and 0.15 per cent acidity recorded highest sensory score for colour, flavour, consistency and overall acceptability. Gajanana (2002) reported that the blended beverage prepared from 12 per cent aonla juice + 2 per cent lime juice + 1 per cent ginger juice + sugar adjusted to a TSS at 15º brix and blended

squash with recipe of 30 per cent anola juice + 15 per cent lime juice + 2 per cent ginger + sugar adjusted to a TSS of 40º brix were found to be highly acceptable with higher organoleptic score.

Carrot drinks fortified with natural or commercial flavours of mango and orange had high quality attributes, sensory parameters and consumer acceptability. The data also revealed that carrot drinks fortified with natural flavours (mango or orange) exhibited higher quality and acceptability than those fortified with commercial flavours (Mohamed *et al.,* 1997). Sensory evaluation score was higher in the treatments involving blending kinnow juice with pomegranate and ginger juice in the ratio of 87:10:3 due to better consistency and flavour up to the end of storage (Bhardwaj *et al*., 2011). The RTS and nectar beverage prepared from blended fruits of grape:mango (3:1) and grape:pineapple (1:1) received the better sensory quality score as compared to other combinations (Saxena *et al.,* 1996). The stone apple RTS beverage with ginger juice fetched higher sensory acceptability.

Bhosale *et al*. (2000) reported that RTS beverage prepared from 80:20 (aonla: mango) blend had better consumer appeal and nutritional value over other blends. Gajanana (2002) reported that aonla RTS beverage prepared with recipe of 12 per cent aonla juice, 2 per cent lime juice and 1 per cent ginger and TSS adjusted to 15º brix was found to be acceptable with higher organoleptic score. The palmyrah fruit ready-to-serve sample subjected to sensory evaluation showed significant differences between treatments with respect to colour, aroma, taste, consistency and overall acceptability. From the result of quality assessments, the formulated beverage with 12 per cent of pulp concentration was found to be superior in quality and could be stored at 30±2ºC for minimum period of six months without any significant changes in quality (Nilugin and Mahendran*,* 2010).

Upale (2005) reported that jamun RTS beverage prepared with recipe consisting of 14 per cent juice + 0.15 per cent citric acid and adjusted with sugar to TSS of 14º Brix was found to be acceptable with higher organoleptic score. Kirtiraja *et al.* (2013) reported that RTS beverage prepared by blending aonla and ginger juice with aspartame scored maximum for all most all sensory quality attributes such as colour, flavour, taste and overall acceptability. Sapota squash with 30 per cent juice

and 50º brix TSS recorded the highest sensory score for flavour and taste (Relekar *et al.,* 2013).

Waskar and Khurdiya (1987) observed decline in overall acceptability of phalsa squash from 8.10 to 4.40 after 180 days of storage. Similar declining trend in overall acceptability was noticed by Dwivedi *et al.* (2004) in seabackthron squash and Jadhav *et al.* (2004) in karonda squash.

Paneer whey beverage prepared from 2.5 per cent kokum juice and 15 per cent sugar with 0.1 per cent jeera powder was found most acceptable sensory quality (Rupnar *et al.,* 2009). Blending of pomegranate and kokum juices in 80:20 per cent gave good TSS, acidity and anthocyanins. Higher overall acceptability and enhanced vitamin C content was achieved by blending goose berry juice with grape juice at 20:80 ratios (Jain and Khurdiya 2004). The blending sand pear juice with apple juice in the proportion of 50:50 to 60:40 gave better quality with higher sensory score (Devaraj *et al.,* 2010).

Mandal (2003) observed that the blended RTS containing 75 per cent pineapple juice and 25 per cent phalsa juice secured the highest organoleptic score. According to Singh *et al.* (2007) 70 per cent mango + 30 per cent papaya pulp squash secured maximum acceptability. Singh and Kumar (1995) reported that the RTS beverage prepared from 10 per cent aonla pulp + 2 per cent lime juice + 1per cent ginger juice having 12 per cent TSS, 0.3 per cent acidity was found to be best with regard to organoleptic quality. Joshi *et al.* (1993) reported that the plum pulp beverage with spice extracts like mint 0.4 per cent, ginger juice 0.5 per cent, cumin 0.25 per cent, cardamom 0.25 per cent and black pepper 0.1 per cent having 45ºbrix obtained highest organoleptic score.

2.6 Storage of fruit juice and juice based beverages

Various methods are employed for preservation of juice. Among them pasteurization, refrigeration, carbonation and preservation by chemicals are commonly used.

Pruthi and Lal (1959) studied the preservation and storage of passion fruit juice. Of the three methods of preservation *viz*., sulphitation at 600 ppm, benzoate at 1000ppm and 50:50 combinations of SO_2 and sodium benzoate, sulphitation retained highest ascorbic acid content. Saini *et al.* (2001) reported that, thermally processed RTS mango beverage showed increases in reducing sugar, total sugar and reduction in non reducing sugar over a storage period of 24 weeks. Masoodi *et al.* (1992) reported that the perlette grape juice could be stored by addition of different quantity of potassium metabisuplphite (350,450, 550 and 600 ppm) and heating the juice at 88ºC for two minutes prior to storage.

An ideal squash should have acidity of 1.00 to 1.50 per cent, whereas in nectar, it should be in the order of 0.3 to 0.5 per cent. It has been reported that acidity helps in effective processing, retention of colour, taste and flavour. Acidity also prevents development of off-flavour or off-odour during storage of the products (Mabessa *et al.*, 1982, Jain *et al.*, 1984). Jack fruit squash preserved with potassium metabisuplhite showed very little changes in its colour, taste and flavour during storage. However, it exhibited an increase in reducing sugar content of the squash irrespective of preservatives used (Deverajaiah, 1987). The jamun products like RTS, squash, syrup and jam stored in colourless glass bottles were accepted even after 6 months storage at ambient conditions. The appearance, colour, flavour, texture, taste and overall acceptability were found to be good (Kannan *et al.,* 2004).

Aonla juice pasteurized at 85 to 90º C was filled in sterilized bottles, 200 guage polyethylene pouches and the pouches were blast frozen at -40º C. Both were shelf stable, where as pasteurized juice filled in high density polyethylene bags with class- II preservative was stable up to six months of storage at 10ºC (Vijayanand *et al.,* 2003). According to Sudhir and Kilara (1983) temperature plays an important role in storage stability of processed products. Temperature fluctuations, high temperature and unhygienic storage conditions have an adverse effect on the quality of stored processed products causing early deterioration. Chobe (1999) reported an increasing trend in TSS, pH, reducing sugar, non reducing sugar, total sugar during storage of pomegranate juice both at room and low temperature, while there was decrease in acidity and ascorbic acid. In one more study, the tamarind RTS beverages were stored at ambient (33.8± 7.4º C, RH 74.2± 23.8 per cent) and low (7±2º C, RH 90-95%) temperature for 180 days. The changes in chemical composition and overall

acceptability score of the products during storage showed that TSS, titratable acidity and total sugar content of the RTS beverage stored at both temperatures increased, whereas ascorbic acid content decreased. The overall acceptability score for the ready to serve (RTS) beverage decreased during storage (Kotecha and Kadam 2003).

Sorolia and Mukharjee (2002) studied the effect of different preservation methods on keeping quality of lime juice, *viz.,* heating at 85ºC, pasteurization, potassium metabisulphite, and sodium benzoate. Among the various treatments, the use of KMS 0.1 per cent was found to be effective in preserving the juice for two and half months. Storage studies showed an increase in sugars, pH, TSS and browning, whereas acidity and ascorbic acid of lime juice decreased. The enzymatic browning changes in fresh sugarcane juice stored at room temperature (25ºC) and at refrigerator (4ºC) were studied by determining juice colour and polyphenoloxidase (PPO) enzyme activity. Result showed that thermal and chemical pre-treatments of stems before squeezing effectively prevented degreening and/or browning and reduced activities of PPO of fresh sugarcane juice. Added citric acid and SO_2 prevented degreening and /or browning with reduced PPO enzyme activity in fresh sugarcane juice during storage at room temperature or at refrigeration.

2.7 Microbial analysis of fruit juices and juice based beverage

In recent years, the increasing consumer awareness has emphasized the need for microbiologically safe food. Since the human food supply consists basically of plants and animals or products derived from them, it is undesirable that our food supply can contain microorganisms in interaction with the food. When the microorganisms involved are pathogenic, their association with our food is critical from a public health point of view. Serious health hazards due to presence of pathogenic microbes in food can lead to food poisoning outbreaks.

In India the chances of transmission of disease through fruit juices are due to unsatisfactory hygiene and adulteration practices. Microorganisms are present both inside as well as outside of fruits and vegetables. At the time of consumption, the majority of bacteria found on the surface are usually gram negative and belong to the *Enterobacteriaceae*. Many of these organisms are usually non pathogenic to humans. The inner tissues of fruits are usually regarded as sterile. However, bacteria can be

present in low number as a result of the uptake of water through certain irrigation or washing procedures.

Assessment of microbial contamination indicates the sanitary quality of the food products. Microorganisms associated with the food products not only cause the spoilage, but also responsible for the food borne illness. Proper processing and storage conditions can control the growth of the micro organisms in the food products. Yeast, moulds and coliforms were not detected in unpasteurized, sweet orange juice stored in sterilized containers at refrigerated conditions (10±2°C) up to four days, there after juice exhibited presence of microbes except *Staphylococcus aureas*. Pasteurization and refrigeration inhibited the growth of microbes (Jain *et al*., 2003).

Addition of 350 ppm of potassium metabisulphite in whey based kinnow juice concentrate was found to be effective in retarding the growth of yeast and mould counts during storage at refrigerated temperature (4±1°C, 80% RH) for nine months and at ambient temperature (15-35°C, 66-85 % RH) for four months (Khamuraui *et al*., 2004). The juice blend ratio of kinnow juice: aonla juice: ginger juice (92:5:3) was best in view of non enzymatic browning (0.081 to 0.10 ^{4}) and minimum population of bacteria (4.0×10^3 CFU), mould (1.5×10^3 CFU) and yeast (2.1×10^3 CFU) at the end of storage (6 months). It contained fair amount of vitamin C (38.95 mg/100ml juice) at six months of storage. It was also observed that the addition of ginger juice in blends improves the quality and reduces microbial growth. Further, the juice was found acceptable after six months of storage at room temperature (Bhardwaj and Mukherjee 2011).

The microbial analysis of stored whey based papaya juice for 90 days at refrigerated condition was studied by Kumar *et al*. (2005). A slight increase in colonies of bacteria ($1- 2X10^{-6}$), yeast ($1X10^{-5}$) and fungi ($1-2X10^{-4}$) were observed, which are considered as safe for consumption. Nirmal *et al*. (2006) found that in the wood apple RTS beverage with addition of sodium benzoate was found to be effective in controlling the growth of micro organisms, as no microbial growth was observed at 90 days of storage. Standard plate count of bottle gourd juice treated with sodium benzoate (100 ppm) registered $4X10^{-3}$ and $3X10^{-3}$ counts during the storage of three months at room temperature (30±2°C) and at cold temperature (5±1°C), respectively (Madhukar, 2008).

Effect of thermal processing (92°C, 2min) and high pressure treatment (500Mpa, 25°C, 10min) on microbial inactivation of tomato juice during refrigerated storage at 4°C for 28 days was investigated by Hsu, *et al.* (2008). It was reported that thermal processing produced microbial stable juice with total viable counts less than 1.0 cfu/ml, without any detection of yeast, moulds and *E.coli.* High pressure treatment also resulted in efficient inactivation of all micro organisms with the minimum loss of other nutrients.

3. MATERIAL AND METHODS

Investigation on "Standardization of protocol for flavoured RTS, Squash and Blended Beverages of Aloe vera" was conducted during 2012-2013 in the Department of Post Harvest Technology, Kittur Rani Channamma College of Horticulture, Arabhavi (UHS, Bagalkot), Belgaum (District), Karnataka. The present study was carried out to standardize the protocol for preparation of flavoured aloe RTS beverage, aloe squash using different natural flavours and preparation of aloe based mixed squash and to study the storage behaviour of these products for biochemical and organoleptic quality as influenced by the treatments. The details of materials used and the technique adopted during the investigation are elucidated hereunder.

3.1 Geographical location and climate

Arabhavi is suited in northern dry zone (zone 3) of Karnataka. It lies at 16º 12'N latitude and 75º 45' E longitudes, at an altitude of 640m from mean sea level. The average annual rainfall at Arabhavi is about 530 mm and it is distributed over a period of seven months from May to November. The mean maximum temperature goes up to 29.75º C (April) and mean minimum temperature drops down to 20.90 (January). The relative humidity varies between 63.03% (February).

3.2 Material

Aloe vera (*Aloe barabadensis Miller)* leaves were procured from Mr. Chandrashekar R. Hosakoti's farm located at Musaguppi village of Gokak taluk, Belgaum district of Karnataka. Leaves of uniform size, shape and maturity were harvested, packed in polythene bags and brought to the laboratory immediately for further experimentation.

3.3 Preparation of aloe juice

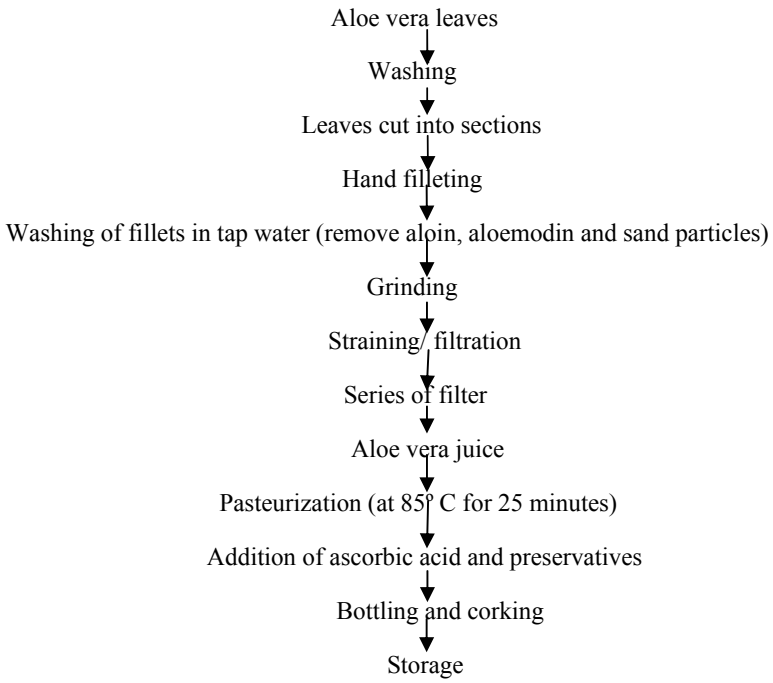
The harvested aloe vera leaves were washed thoroughly in continuous tap water. In order to avoid contamination of internal fillet with the yellow sap, the traditional hand- filleting method of processing was done. The lower one inch of the leaf base (the white part attached to the large rosette stem 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, then 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. This is of critical concern because the highest concentration of potentially beneficial aloe constituents are found in this mucilage, as this layer represents the constituents synthesized by the vascular bundle cells empowered by energy developed in the green rind cells through sun induced photosynthesis.

The fillet consists of more than 99% water. 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 85º 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.

3.4 Flow diagram illustrating juice preparation from aloe vera



Aloe vera leaves

Aloe vera cubes

Filleting

Aloe juice

Plate 1. Steps in extraction of aloe juice

3.5 Experimental details

3.5.1 Experiment –I: Preparation and storage of flavoured aloe RTS beverage

In this study, aloe vera juice was prepared as per the treatments. The experiment was conducted in a Completely Randomized Design with three replications. The details of the treatments are as follows.

Treatments details

T_1- Aloe juice 15% + Pepper mint juice 0.75%

T_2- Aloe juice 15% + Pepper mint juice 1.00%

T_3- Aloe juice 15% + Lime juice 0.75%

T_4- Aloe juice 15% + Lime juice 1.00%

T_5- Aloe juice 15% + Ginger juice 0.50%

T_6- Aloe juice 15% + Ginger juice 0.75%

T_7 - Aloe juice 15%+ Jaljeera powder 0.50 %

T_8- Aloe juice 15% + Jaljeera powder 0.75%

T_9- Aloe juice 15% + Chat-masala powder 0.50%

T_{10}- Aloe juice 15% + Chat-masala powder 0.75%

Acidity level of 0.4% and Total Soluble Solids (TSS) of 15º Brix was adjusted commonly for all the above treatments. After preparation and addition of preservatives, aloe RTS was bottled and kept for storage in ambient condition up to six months. The observations were recorded initially and at every two months interval.

3.5.2 Methodology for extraction of pepper mint, lime and ginger juice

The pepper mint leaves procured from the farm of Department of Medicinal and Aromatic Plants, KRCCH, Arabhavi 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 the RTS and squash beverage.

Lime fruits were brought from the orchard of Department of Fruit Science, KRCCH, Arabhavi. The fruits were washed thoroughly, then 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 making the RTS and squash beverage.

Ginger juice was obtained by soaking green ginger in water for 2-3 hours to facilitate to easy peeling. Then rhizomes were peeled using a hand peeler. Further, they 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. The juice was filtered again using a muslin cloth to acquire clear juice. This juice was used for experimentation.

Jaljeera (Brand: Kwality) and *chat-masala* (Brand: Suhana) powders were procured from Gokak market. The ingredients of *jaljeera* as per the label were iodised salt, cumin, fennel, black pepper, black salt, dry ginger, acidifier E330, mint leaves, fenugreek and asafoetida. Similarly, the ingredients of *chat-masala* were dry mango, common salt, rock salt, black salt, black pepper, coriander, chilli, cumin, dry ginger, fennel, ajwan seeds, musk melon seeds, clove, cassia bark, nutmeg and asafoetida. These two spice mixtures were used as source of flavour by blending with aloe juice for making the RTS (Ready-to- serve) and squash.

The juices blended as per the treatments were filled in to clean, sterilized crown bottles of 300 ml capacity, sealed with crown caps using crown corking machine and stored under ambient conditions

3.5.3 Experiment –II: Preparation and preservation of Aloe squash with different natural flavours.

The design adopted for this experiment was Completely Randomized Design with three replications. The details of the treatments are as given below.

Treatments

T_1- Aloe juice 30% + Pepper mint 2.25%

T_2- Aloe juice 30% + Pepper mint 3.00%

T_3- Aloe juice 30% + Lime juice 2.25%

T_4- Aloe juice 30% + Lime juice 3.00%

T_5- Aloe juice 30% + Ginger juice 1.50%

T_6- Aloe juice 30% + Ginger juice 2.25%

T_7 – Aloe juice 30%+ Jaljeera 1.50 %

T_8-Aloe juice 30% + Jaljeera 2.25%

T_9- Aloe juice 30% + Chat-masala 1.50%

T_{10}- Aloe juice 30% + Chat-masala 2.25%

In all the treatments, TSS and acidity level were commonly adjusted to 45º B with table sugar and 1 per cent acid by the addition of citric acid respectively. After pasteurization and addition of chemical preservatives, aloe vera squash beverages were bottled. The squash beverages were subjected to storage studies at room temperature for a period of 6 months. Samples were drawn initially and at bimonthly interval to evaluate changes in chemical, organoleptic parameters and total bacterial count. The products were evaluated for sensory qualities *viz.,* colour and appearance, taste and aroma, mouth-feel and overall acceptability by a panel of 5 judges using 5 point hedonic scale.

3.5.4 Experiment –III: Preparation and preservation of aloe based mixed squash beverage

In the experiment on aloe based mixed squash, there were twelve treatments in the experiment and their details are as given below. The design adopted was Completely Randomized Design with three replications.

Treatments details

T_1- Aloe juice 20% + Amla 10%

T_2- Aloe juice 25% + Amla 10%

T_3- Aloe juice 20% + Kokum 5%

T_4- Aloe juice 25% + Kokum 5%

T_5- Aloe juice 20% + Amla 5% + Kokum 10 %

T_6- Aloe juice 25% + Amla 5% + Kokum 10%

T_7- Aloe juice 20 %+ Amla 10% + Kokum 5%

T_8- Aloe juice 25 % + Amla 10% + Kokum 5%

T_9- Aloe juice 20% + Amla 10% + Kokum 5% + Ginger1.5 %

T_{10}- Aloe juice 25% + Amla 5% + Kokum 10% + Ginger1.5 %

T_{11}- Aloe juice 20% + Amla 5% + Kokum 10% + Ginger1.5 %

T_{12}- Aloe juice 25 % + Amla 10% + Kokum 5% + Ginger1.5 %

Similar to second experiment, TSS and acidity level were commonly adjusted to 45º B with table sugar and 1 per cent acid by the addition of citric acid respectively in all the treatments. After pasteurization and addition of chemical preservatives, bottled aloe vera based mixed squash beverage was subjected to storage studies at room temperature for a period of 6 months. Samples were drawn initially and at every two months interval to evaluate changes in chemical, organoleptic parameters and total bacterial count.

3.5.5 Methodology for extraction of kokum, aonla and ginger juice

The Kokum juice was obtained by soaking dried rind of fruits for overnight in known quantity of water. Next day, the juice was extracted and filtered through a double layered muslin cloth and this clear juice was used for blending to aloe juice for making the squash. The aloe juice was obtained by the method as described in 3.3.

The selected aonla fruits were washed with the tap water. The fruits were deseeded and cut simultaneously into 4 longitudinal pieces using aonla deseeding machine. Fruit slices were pulverized in an electric grinder into fine pulp. This fine pulp was squeezed through a double layer muslin cloth to obtain juice. The juice so obtained was filtered in double layer cloth again to get clear juice. The juice was pasteurized separately at 80ºC for 10 minutes, cooled immediately and used for blending to aloe juice for making the squash.

Ginger juice extraction method was same as in 3.5.2. This juice was used for making aole mixed the squash.

The juice blended as per the treatments was filled in to clean, sterilized crown bottles of 200 ml capacity, sealed with crown caps using crown corking machine and stored at ambient conditions.

3.6 Observations recorded

The following observations in three aloe vera products (ready- to- serve, squash, aloe based mixed squash) were recorded initially and subsequently at bimonthly interval during storage period of 6 months.

3.6.1 Total soluble solids (ºBrix)

The total soluble solids of aloe vera RTS, squash and aloe based mixed squash was measured by using an 'Erma' make hand refracto-meter and expressed as percentage after making necessary corrections.

3.6.2 Sugars (%)

The sugar content of juice of aloe products obtained from representative sample under each treatment were estimated and expressed as per cent.

3.6.2.1 Reducing sugar (%)

Reducing sugar in sample was estimated as per the Dinitrosalicylic acid method (Miller, 1972). The values obtained were expressed as per cent.

3.6.2.2 Non-reducing sugar (%)

The per cent non- reducing sugars were obtained by subtracting the value of reducing sugar from that of total sugar.

Non-reducing sugar (%) = [Total sugar (%) – reducing sugar (%)] × 0.95

3.6.2.3 Total sugars (%)

The total sugar content present in the products were estimated by the same method as in case of reducing sugar after inversion of the non–reducing sugar using dilute hydrochloric acid (Anon., 1984). The values obtained were expressed as per cent.

3.6.2.4 Sugar: acid ratio

Sugar: acid ratio was calculated by dividing of total sugars (%) by the respective value of titratable acidity (%) of the particular sample. This was expressed as absolute value.

3.6.3. Polysaccharides (mg/100 ml)

The polysaccharide content present in the products was estimated by the phenol sulphuric acid method. The absorbance of the sample was determined at 490 nm in spectrophotometer. Then the content of polysaccharide was estimated by comparison with a standard curve generated from the analysis of glucose. The values obtained were expressed in milligrams per 100 ml of juice (Hu *et al.,* 2003).

3.6.4 Ascorbic acid (mg/100g)

Ascorbic acid content was estimated by using 2, 6 - dichlorophenol indophenol dye titrimetrically as per the modified procedure of AOAC (Anon., 1984). Five ml of juice was taken and diluted to a known volume (100 ml) with 4 per cent oxalic acid. This was filtered through muslin cloth to get clear juice. Five ml of aliquot was titrated against 2,6- dichlorophenol indophenols dye till the pink end point which persisted for at least 15 seconds. The result was expressed as milligrams of ascorbic acid per 100 ml.

$$Ascorbic\ acid\ \left({}^{mg}/_{100\,ml}\right) = \frac{Dye\ factor\ X\ Titre\ value\ X\ Vol.made\ up}{Aliquot\ X\ Vol.of\ sample} \times 100$$

3.6.5 pH

The pH of aloe vera RTS, squash and aloe based mixed squash was determined using Toshniwal digital pH meter (model DI- 707).

3.6.6 Titratable acidity (%)

A known volume of juice sample (5 ml) was taken and titrated standard NaOH using phenolphthalein indicator. The appearance of light pink colour was marked as the end point. The value was expressed in terms of citric acid as per cent titratable acidity of juice (Anon., 1984).

3.6.7 Microbial analysis (CFU/ml)

The microbial analysis of processed aloe vera products *viz.,* RTS, squash and aloe based mixed squash beverage 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 ± 1º C and colonies were counted and CFU per ml was calculated.

3.6.8 Organoleptic evaluation (score out of 5.00)

Organoleptic evaluation of flavoured aloe vera RTS, squash and aloe based mixed squash was carried out by a panel of 5 semi-trained judges immediately after preparation and after two, four and six months of storage.

The organoleptic characters like colour and appearance, taste and aroma mouthfeel and overall acceptability were evaluated on a 5 point Hedonic scale using the score card mentioned below. The scores given by 5 semi-trained judges were used for statistical analysis. The data on changes in colour was measured by Lovibond colour meter in terms of *L**(brightness), *a** (red-green) and *b** (blue-yellow).

Score card for organoleptic evaluation

Colour and appearance	Mouth-feel	Taste and Flavour	Overall Acceptability	Scores
Highly attractive	Extremely pleasant	Excellent	Extremely acceptable	5
Very attractive	Very pleasant	Very good	Very acceptable	4
Moderately attractive	Moderately pleasant	Good	Moderately acceptable	3
Slightly attractive	Slightly pleasant	Fair	Slight acceptable	2
Not attractive	Not pleasant	Poor	Not acceptable	1

3.6.9 Statistical analysis

The data on the physico-chemical parameters, organoleptic characters and total bacterial count (TBC) recorded were subjected to completely randomized design analysis in experiments I, II and III. Interpretation of the data was carried out in accordance with Panse and Sukhatme (1985). The level of significance used in 'F' test was p= 0.01. Critical difference values were calculated wherever 'F' test was significant.

4. EXPERIMENTAL RESULTS

The experiment entitled "Standardization of protocol for flavoured RTS, squash and bended beverage of aloe vera (*Aloe barabadensis* Miller.)" was conducted during 2012-2013 at the Department of Post Harvest Technology, Kittur Rani Channamma College of Horticulture, Arabhavi. The results obtained in the present study in respect of changes in physico-chemical parameters and organoleptic evaluation in the fresh aloe vera ready- to- serve (RTS) beverage, squash and aloe based mixed squash beverages and also during their storage are presented hereunder.

4.1 Experiment –I: Preparation and storage of flavoured aloe RTS

4.1.1 Total soluble solids (ºBrix)

The data on total soluble solids (TSS) of ready to serve (RTS) of aloe as influenced by treatments and storage periods are presented in Table 1.

The TSS was adjusted to 15^{o}Brix commonly in all the treatments at the beginning. However, there was no significant difference among the treatments for this parameter during storage. The treatment T_2 (aloe juice 15 per cent + TSS 15ºBrix + 1.00 per cent pepper mint) recorded highest TSS of 15.77ºB, 16.03ºB and 16.23ºB, respectively at 2, 4, 6 months after storage, followed by treatment T_1 (15.60ºB) and T_{10} (15.57ºB) at 2 months after storage, and T_1 (15.87ºB) and T_9 (15.87º) at 4 months storage, and T_1 (16.13ºB) and T_{10} (16.13ºB) at 6 months of storage. The minimum TSS of 15.30ºB, 15.45ºB and 15.60ºB was recorded in the treatment T_4 (Aloe juice 15 per cent +TSS 15ºBrix + 1 per cent lime juice) at 2, 4 and 6 months after storage followed by treatment T_3 (15.35ºB, 15.50ºB and 15.65ºB, respectively) at 2, 4 and 6 months after storage.

4.1.2 Total sugars (%)

The data on total sugar content of aloe vera based RTS are presented in Table 1. The results on total sugars content revealed significant differences among the treatments.

Initially, the significantly highest total sugars content of 7.47 per cent in aloe RTS was recorded in T_2 (15% Aloe juice + 15º Brix TSS +1% pepper mint) and it was

Table1: Effect of treatments and storage period on total soluble solids and total sugars of aloe vera RTS

Treatments	Total soluble solids (ºBrix)				Total sugars (%)			
	Initial	**2MAS**	**4MAS**	**6MAS**	**Initial**	**2MAS**	**4MAS**	**6MAS**
T_1- Aloe juice 15% + TSS 15ºBrix + Peppermint 0.75%		15.60	15.87	16.13	7.30	7.40	7.63	7.80
T_2 - Aloe juice 15 % + TSS 15ºBrix + Pepper mint 1.00 %		15.77	16.03	16.23	7.47	7.50	7.73	7.83
T_3- Aloe juice 15 %+ TSS 15ºBrix + Lime juice 0.75 %		15.35	15.50	15.65	7.20	7.23	7.30	7.50
T_4- Aloe juice 15% + TSS 15ºBrix + Lime juice 1.00 %		15.30	15.45	15.60	7.17	7.20	7.25	7.40
T_5- Aloe juice 15 %+ TSS 15ºBrix + Ginger juice 0.50 %	15.00	15.45	15.55	15.85	7.20	7.30	7.40	7.61
T_6- Aloe juice 15 % + TSS 15ºBrix + Ginger juice 0.75 %		15.47	15.51	15.70	7.23	7.35	7.50	7.53
T_7- Aloe juice 15 %+ TSS 15ºBrix + Jaljeera 0.50 %		15.50	15.83	15.86	7.26	7.32	7.40	7.57
T_8- Aloe juice 15% + TSS 15ºBrix + Jaljeera 0.75 %		15.52	15.60	15.90	7.25	7.33	7.37	7.41
T_9- Aloe juice 15 % + TSS15ºBrix + Chat-masala 0.50 %		15.45	15.87	16.07	7.22	7.37	7.38	7.50
T_{10}-Aloe juice 15 % + TSS 15ºBrix + Chat-masala 0.75 %		15.57	15.70	16.13	7.20	7.30	7.27	7.43
Mean	**15.00**	**15.49**	**15.69**	**15.91**	**7.25**	**7.33**	**7.42**	**7.56**
S. Em±	---	0.389	0.430	0.439	0.045	0.068	0.155	0.083
C.D. at 1%		NS	NS	NS	0.182	0.273	0.624	0.334

MAS = Months after storage

at parity with treatment T_1 (7.30%). The minimum total sugars content of (7.17%) was observed in treatment T_4 (15% Aloe juice + 15º Brix TSS + 1% lime) and it was on par with all other treatments except T_2.

At 2, 4 and 6 months after storage, the maximum total sugar was observed in treatment T_2 (7.50, 7.73 and 7.83%, respectively) and it was on par with all the remaining treatments except treatment T_4 (7.20%) at 2 months and other with all treatments except T_4, T_8 and T_{10} at 6 months after storage.

At 2, 4 and 6 months after storage, the minimum total sugar was recorded in T_4 (7.20, 7.25 and 7.40%, respectively).

4.1.3 Reducing sugar (%)

The data with respect to reducing sugar content of aloe vera based RTS beverage in different treatments stored up to 6 months are presented in Table 2. Mean values for reducing sugars indicated an increasing trend their level with increase in storage time.

But, there were significant differences among the treatments only at 2 and 6 months after storage. At the beginning, the treatment T_2 (Aloe juice 15 per cent +TSS 15 ºBrix + 1 per cent pepper mint) recorded maximum reducing sugar content of 1.92 per cent and the minimum was associated with the treatment T_4 (1.70%). Minimum reducing sugar (1.70 %) was observed in fresh RTS in the treatment T_4 (Aloe juice 15 per cent + 15º+ 1 per cent lime) followed by T_{10} (1.77%).

After 2, 4 and 6 months after storage, maximum reducing sugar contents were noted in T_2 (1.96%, 2.26% and 2.40% respectively). The treatment T_2 was on par with all the treatments except T_4 at 2 months, and T_3 and T_4 at 6 months. The treatment T_4 (Aloe juice 15 per cent + TSS 15º Brix + 1 per cent lime juice) which recorded the minimum reducing sugars throughout the storage (at 2 months - 1.73 %; 4 months - 2.09 % and 6 months 2.13%) differed significantly only with T_2 both at 2 and 6 months after storage.

Table 2: Effect of treatments and storage period on reducing and non-reducing sugars of aloe vera RTS

Treatments	Reducing sugars (%)				Non-reducing sugars (%)			
	Initial	**2MAS**	**4MAS**	**6MAS**	**Initial**	**2MAS**	**4MAS**	**6MAS**
T_1- Aloe juice 15% + TSS 15ºBrix + Peppermint 0.75%	1.91	1.93	2.20	2.30	5.11	5.09	5.06	5.04
T_2 - Aloe juice 15 % + TSS 15ºBrix + Pepper mint 1.00 %	1.92	1.96	2.26	2.40	5.27	5.25	5.21	5.19
T_3- Aloe juice 15 %+ TSS 15ºBrix + Lime juice 0.75 %	1.80	1.83	2.10	2.14	5.15	5.14	5.13	5.12
T_4- Aloe juice 15% + TSS 15ºBrix + Lime juice 1.00 %	1.70	1.73	2.09	2.13	5.19	5.18	5.17	5.16
T_5- Aloe juice 15 %+ TSS 15ºBrix + Ginger juice 0.50 %	1.90	1.91	2.13	2.20	5.06	5.03	5.03	4.99
T_6- Aloe juice 15 % + TSS 15ºBrix + Ginger juice 0.75 %	1.87	1.88	2.12	2.21	5.09	5.08	5.08	5.07
T_7- Aloe juice 15 %+ TSS 15ºBrix + Jaljeera 0.50 %	1.83	1.86	2.16	2.22	5.16	5.15	5.13	5.09
T_8- Aloe juice 15% + TSS 15ºBrix + Jaljeera 0.75 %	1.81	1.83	2.19	2.21	5.16	5.15	5.13	5.09
T_9- Aloe juice 15 % + TSS15ºBrix + Chat-masala 0.50 %	1.80	1.82	2.13	2.23	5.15	5.14	5.13	5.13
T_{10}-Aloe juice 15 % + TSS 15ºBrix + Chat-masala 0.75 %	1.77	1.81	2.14	2.24	5.16	5.15	5.14	5.13
Mean	**1.83**	**1.85**	**2.15**	**2.23**	**5.15**	**5.14**	**5.12**	**5.10**
S. Em±	0.061	0.054	0.059	0.053	0.047	0.036	0.046	0.031
C.D. at 1%	NS	0.217	NS	0.214	0.191	0.144	0.183	0.125

MAS = Months after storage

4.1.4 Non-reducing sugar (%)

The data on changes in non-reducing sugars content of fresh and stored aloe based RTS beverage as influenced by treatments are presented in Table 2. The data indicated the existence of significant differences among the treatments.

The mean values for non-reducing sugars decreased with the progress in the storage period. The treatment T_2 (Aloe juice 15 per cent + TSS 15º Brix + 1per cent pepper mint) recorded maximum (5.27%) non-reducing sugars content and it was on par with all the treatments except T_5 initially. The minimum non-reducing sugars were observed in the treatment T_5 (5.06%) followed by the treatment T_6 (5.09%).

After 2, 4 and 6 months of storage, the highest non-reducing sugars content was noted in treatment T_2 (5.25%, 5.21%, 5.19% respectively). It was on par with all the treatment except treatment T_1, T_5 and T_6 at 2 months. However, no significant differences were observed at 4 months. But, again at 6 months after storage, the treatment T_2 showed significant difference for non-reducing sugar content with T_1, T_5, T_6, T_7 and T_8.

The lowest non- reducing sugars was observed in treatment T_5 (5.03, 5.03 and 4.99%, respectively) initially and also at 2, 4 and 6 months after storage.

4.1.5 pH

Changes in pH content of the aloe RTS as influenced by treatments and storage period as presented in Table 3 and depicted in Fig 1.

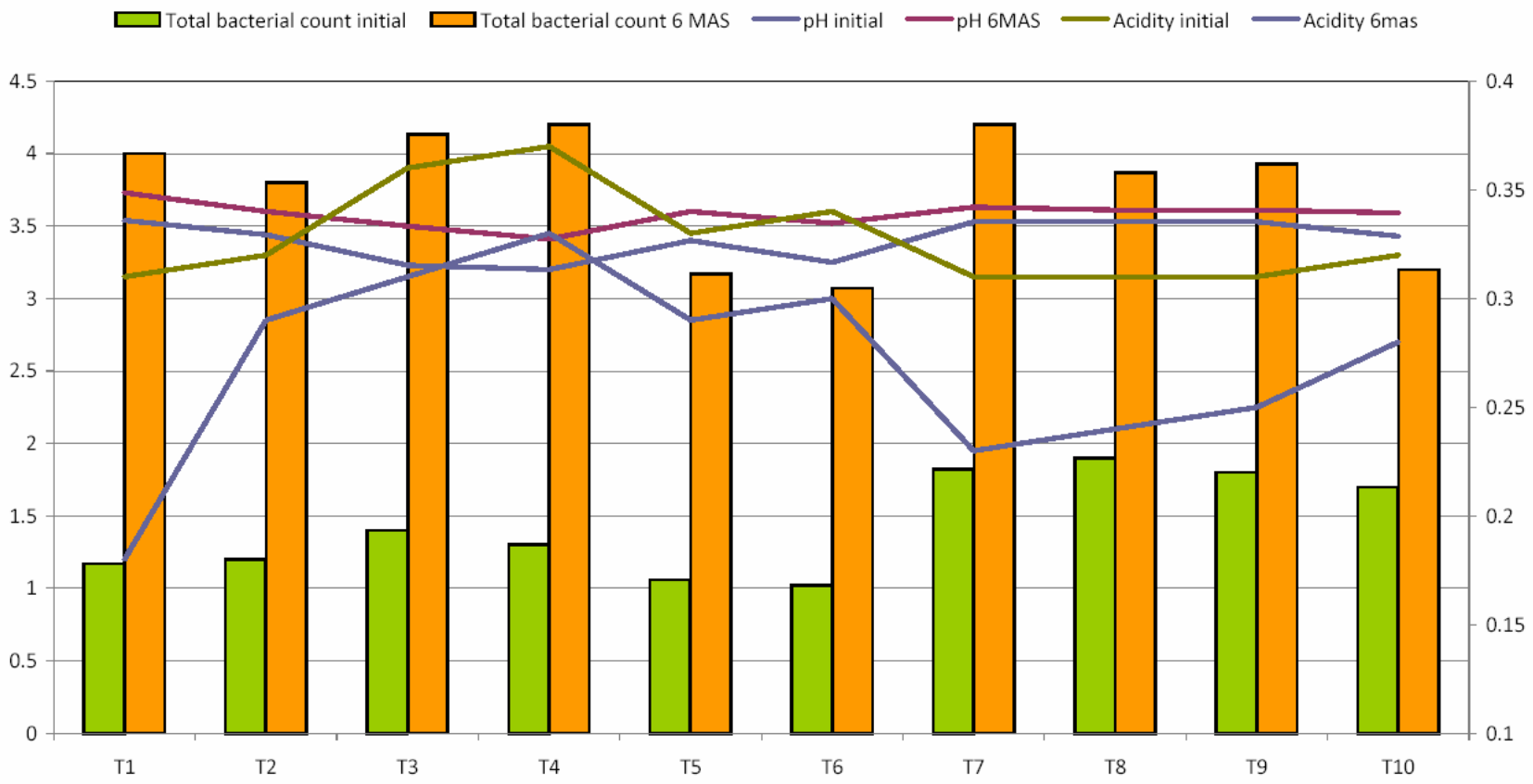
Mean values for pH indicate an increasing trend their level with increase storage period (Table 3). In the fresh aloe RTS, the treatment T_1 (15% Aole juice + 15ºBrix + 0.75%s pepper mint juice) showed the maximum pH value of 3.54 and it was on par with the treatments T_2 (3.44), T_5 (3.40), T_6 (3.25), T_7 (3.53), T_8 (3.53), T_9 (5.53) and T_{10} (3.43). However, the least pH (3.20) was found in treatment T_4 (Aloe juice 15 per cent +15ºB TSS+1 per cent lime) and it behaved on par with T_3 (3.23).

The treatment T_1 (Aloe juice 15 per cent + 1 per cent lime juice+15ºBrix TSS) recorded the maximum pH (3.70 and 3.73, respectively) at 4 and 6 months after storage. It showed non-significant differences with all the treatments except T_3, T_4

Table 3: Effect of treatments and storage period on pH and titratable acidity of aloe vera RTS

Treatments	pH				Titratable acidity (%)			
	Initial	**2MAS**	**4MAS**	**6MAS**	**Initial**	**2MAS**	**4MAS**	**6MAS**
T_1- Aloe juice 15% + TSS 15ºBrix + Peppermint 0.75%	3.54	3.58	3.70	3.73	0.31	0.29	0.25	0.18
T_2 - Aloe juice 15 % + TSS 15ºBrix + Pepper mint 1.00 %	3.44	3.46	3.50	3.60	0.32	0.31	0.30	0.29
T_3- Aloe juice 15 %+ TSS 15ºBrix + Lime juice 0.75 %	3.23	3.30	3.35	3.50	0.36	0.34	0.33	0.31
T_4- Aloe juice 15% + TSS 15ºBrix + Lime juice 1.00 %	3.20	3.27	3.30	3.41	0.37	0.36	0.34	0.33
T_5- Aloe juice 15 %+ TSS 15ºBrix + Ginger juice 0.50 %	3.40	3.44	3.47	3.60	0.33	0.32	0.31	0.29
T_6- Aloe juice 15 % + TSS 15ºBrix + Ginger juice 0.75 %	3.25	3.31	3.37	3.52	0.34	0.33	0.32	0.30
T_7- Aloe juice 15 %+ TSS 15ºBrix + Jaljeera 0.50 %	3.53	3.58	3.63	3.63	0.31	0.29	0.25	0.23
T_8- Aloe juice 15% + TSS 15ºBrix + Jaljeera 0.75 %	3.53	3.57	3.50	3.61	0.31	0.30	0.29	0.24
T_9- Aloe juice 15 % + TSS15ºBrix + Chat-masala 0.50 %	3.53	3.56	3.60	3.61	0.31	0.29	0.27	0.25
T_{10}-Aloe juice 15 % + TSS 15ºBrix + Chat-masala 0.75 %	3.43	3.53	3.47	3.59	0.32	0.31	0.31	0.28
Mean	**3.41**	**3.46**	**3.49**	**3.58**	**0.33**	**0.32**	**0.30**	**0.27**
S. Em±	0.073	0.104	0.070	0.056	0.006	0.007	0.006	0.006
C.D. at 1%	0.293	NS	0.281	0.225	0.027	0.029	0.025	0.024

MAS = Months after storage



T_1- 15 % Aloe juice + 15° Brix TSS + 0.75 % Peppermint
T_2- 15 % Aloe juice + 15° Brix TSS + 1.00% Peppermint
T_3- 15 % Aloe juice + 15° Brix TSS + 0.75 % Lime juice
T_4- 15 % Aloe juice + 15° Brix TSS + 1.00 % Lime juice
T_5- 15 % Aloe juice + 15° Brix TSS + 0.50 % Ginger juice
T_6- 15 % Aloe juice + 15° Brix TSS + 0.75 % Ginger
T_7- 15 % Aloe juice + 15° Brix TSS + 0.50 % Jaljeera
T_8- 15 % Aloe juice + 15° Brix TSS + 0.75 % Jaljeera
T_9- 15 % Aloe juice + 15° Brix TSS + 0.50 % Chat-masala
T_{10}- 15 % Aloe juice + 15° Brix TSS + 0.75 % Chat-masala

Fig. 1: Effect of different treatments on changes in pH, acidity and total bacterial count in fresh and six months stored aloe vera RTS

and T_6 at 4 months and with all the treatments except T_4. However, no significant differences were observed at 2 months after storage. The minimum pH was found in T_4 at 2 months (3.27), 4 months (3.30) and 6 (3.41) months after storage. The treatment T_4 was found to behave on par with only T_3 at 4 months and with all the treatments except T_1 at 6 months.

4.1.6 Titratable acidity (%)

The titratable acidity was expressed in terms of citric acid as percentage on fresh juice weight basis. The data on changes in titratable acidity as influenced by different treatments and storage periods are presented in Table 3 and depicted in Fig. 1.

The results on total titratable acidity showed significant differences between the treatments and storage periods. The titratable acidity content of the fresh aloe RTS was initially adjusted to 0.4 per cent in all the treatments. During storage, the mean titratable acidity content after 2, 4 and 6 months of storage was 0.32, 0.30 and 0.27 per cent, respectively.

The treatment T_4 recorded significantly maximum titratable acidity in aloe based RTS beverage after 2, 4 and 6 months of storage (0.36%, 0.34% and 0.33%, respectively) and it was found on par only with the treatments T_3 (0.34%) and T_6 (0.33%) at 2 months after storage, with T_3 (0.33%), T_5 (0.31%), T_6 (0.32%) and T_{10} (0.31%) at 4 months and with the treatments T_3 and T_6 at 6 months of storage.

The lowest titratable acidity was found in T_1 (0.29%) at 2 months after storage and it did not differ significantly with T_2 (0.31%), T_7 (0.29%), T_8 (0.30%), T_9 (0.29%) and T_{10} (0.31%). At 4 months after storage, the lowest and the same titratable acidity (0.25%) was associated with the treatments T_1 and T_7, and these treatments did not differ only with the treatment T_9. The least acidity containing treatment T_1 at $_6$ months (0.18%) after storage differed significantly with rest of the treatments.

4.1.7 Sugar: acid ratio

The data regarding sugar: acid ratio content of aloe vera RTS as influenced by treatments and storage period are presented in Table 4 and depicted in Fig. 2.

The data on sugar: acid ratio content was found to be significant among the treatments. At the beginning, maximum sugar: acid ratio content of 23.50 was

recorded in treatment T_1 (15 % aloe juice +15º TSS + 0.75 % pepper mint) and it behaved statistically on par with all the treatments, except the treatments T_3 and T_4. The minimum ratio noted in the treatment T_4 (19.33) was found to be on par with T_3 (20.00).

At two months after storage, the significantly maximum sugar: acid ratio of 25.50 was recorded in the treatment T_1 (15 % aloe juice + 15ºBrix TSS + 0.75 % pepper mint) and it was on par with T_2 (24.20), T_7 (25.23), T_8 (24.43) T_9 (25.43) and T_{10} (23.50). However, the minimum was observed in the treatment T_4 (20.00) was statistically similar with T_3 (21.27).

At the end of four and six months after storage, highest sugar:acid ratio (30.17 and 43.33) was observed again in the treatment T_1 (15 % aloe juice + 15º Brix TSS + .075 % pepper mint). It had no significant difference only with the treatment T_7 (30.20) at 4 months. Similarly, the lowest ratio was associated with the treatment T_4 both at 4 months (21.13) and 6 months (22.40) after storage which had statistical similarity with the treatments T_3 and T_6 at 4 months, and with the treatments T_3 and T_{10} at 6 months after storage.

4.1.8 Ascorbic acid (mg/100 ml)

The data pertaining to retention of ascorbic acid content of juice as influenced by treatments and storage period are presented in Table 4.

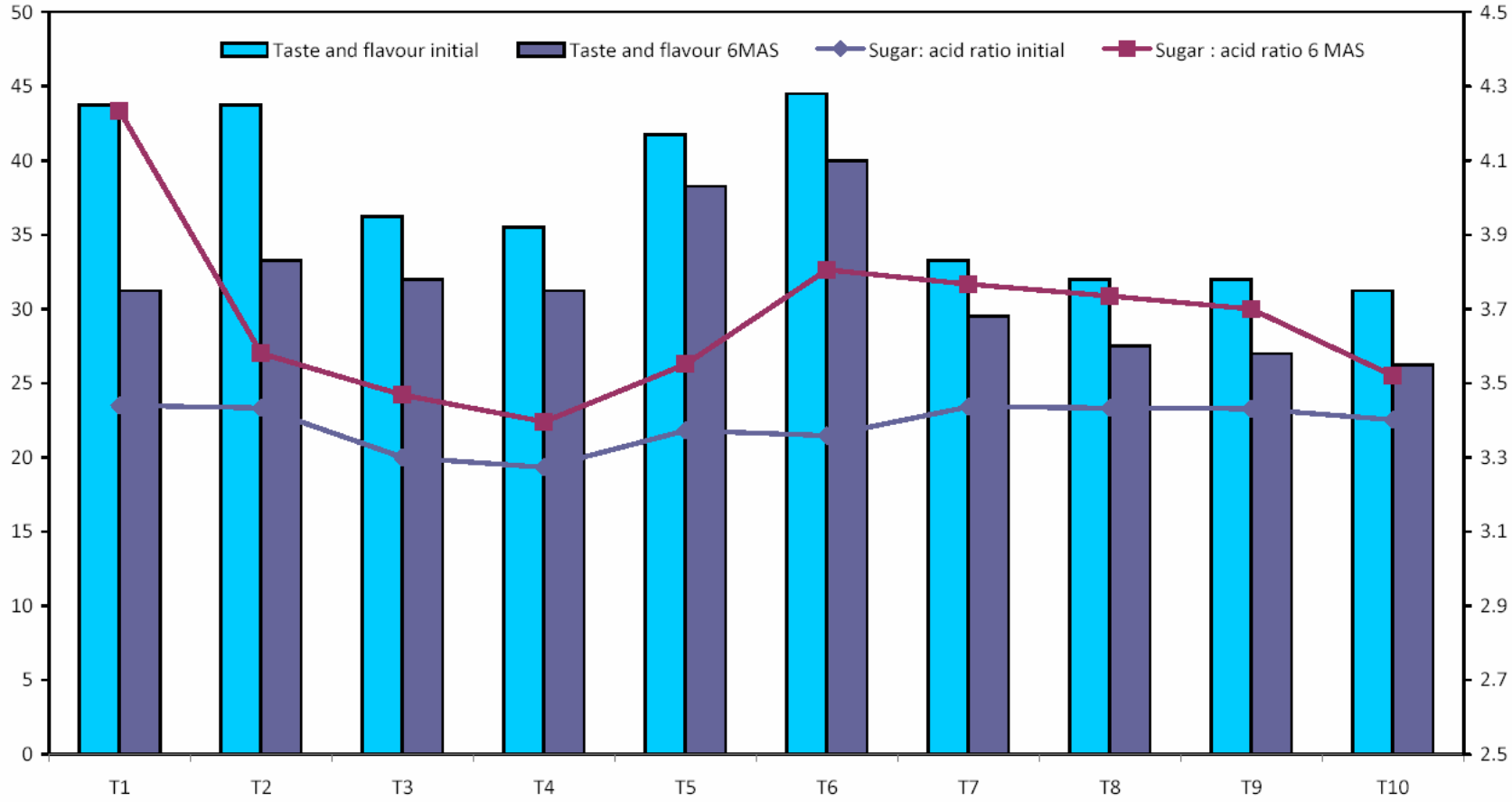
The data on retention of ascorbic acid content was found to have significant differences among the treatments during the storage period. As evident from the grand mean, ascorbic acid presented a decreasing trend with the increase in storage period in a storage period of 6 months.

Fresh RTS beverage of aloe showed significantly maximum value (85.66mg/100ml) for ascorbic acid in the treatment T_4 (15 % aloe juice + 15ºBrix TSS + 1 % lime juice) and it was on par with treatment T_3 (82.83) and T_5 (84.00). The ascorbic acid content was significantly least in the treatment with 15 per cent aloe juice + 15º Brix TSS + 0.75 per cent pepper mint (T_1) when fresh (71.40 mg/100 ml) and also after 2 (68.54 mg/100ml) months of storage. The treatment T1 behaved on par with T_2, T_6, T_7 and T_8 in the fresh aloe based RTS and with T_9 (69.99 mg/100ml) and T_{10} (69.98 mg/100ml) at 2 months after storage.

Table 4: Effect of treatments and storage period on sugar: acid ratio and ascorbic acid of aloe vera RTS

Treatments	Sugar :acid ratio				Ascorbic acid (mg/100ml)			
	Initial	**2MAS**	**4MAS**	**6MAS**	**Initial**	**2MAS**	**4MAS**	**6MAS**
T_1- Aloe juice 15% + TSS 15ºBrix + Peppermint 0.75%	23.50	25.50	30.17	43.33	71.40	68.54	65.67	54.54
T_2 - Aloe juice 15 % + TSS 15ºBrix + Pepper mint 1.00 %	23.33	24.20	25.25	27.00	79.60	74.25	68.54	61.36
T_3- Aloe juice 15 %+ TSS 15ºBrix + Lime juice 0.75 %	20.00	21.27	23.04	24.20	82.83	79.52	71.49	64.25
T_4- Aloe juice 15% + TSS 15ºBrix + Lime juice 1.00 %	19.33	20.00	21.13	22.40	85.66	82.81	78.54	67.15
T_5- Aloe juice 15 %+ TSS 15ºBrix + Ginger juice 0.50 %	21.80	22.80	24.29	26.27	84.00	78.54	74.23	65.68
T_6- Aloe juice 15 % + TSS 15ºBrix + Ginger juice 0.75 %	21.47	22.27	23.14	32.63	78.57	75.67	64.27	62.82
T_7- Aloe juice 15 %+ TSS 15ºBrix + Jaljeera 0.50 %	23.40	25.23	30.20	31.67	75.57	74.25	65.68	61.40
T_8- Aloe juice 15% + TSS 15ºBrix + Jaljeera 0.75 %	23.33	24.43	25.47	30.87	74.67	72.82	61.03	58.53
T_9- Aloe juice 15 % + TSS15ºBrix + Chat-masala 0.50 %	23.27	25.43	27.11	30.00	72.03	69.99	59.92	57.13
T_{10}-Aloe juice 15 % + TSS 15ºBrix + Chat-masala 0.75 %	22.53	23.50	24.13	25.50	74.26	69.98	58.00	58.54
Mean	**22.20**	**23.46**	**25.39**	**29.39**	**77.86**	**74.64**	**66.74**	**61.14**
S. Em±	0.758	0.522	0.521	0.777	0.931	0.826	0.767	0.743
C.D. at 1%	3.051	2.102	2.095	3.126	3.745	3.323	3.086	2.990

MAS = Months after storage



T_1- 15 % Aloe juice + 15° Brix TSS + 0.75 % Peppermint
T_2- 15 % Aloe juice + 15° Brix TSS + 1.00% Peppermint
T_3- 15 % Aloe juice + 15° Brix TSS + 0.75 % Lime juice
T_4- 15 % Aloe juice + 15° Brix TSS + 1.00 % Lime juice
T_5- 15 % Aloe juice + 15° Brix TSS + 0.50 % Ginger juice
T_6- 15 % Aloe juice + 15° Brix TSS + 0.75 % Ginger
T_7- 15 % Aloe juice + 15° Brix TSS + 0.50 % Jaljeera
T_8- 15 % Aloe juice + 15° Brix TSS + 0.75 % Jaljeera
T_9- 15 % Aloe juice + 15° Brix TSS + 0.50 % Chat-masala
T_{10}- 15 % Aloe juice + 15° Brix TSS + 0.75 % Chat-masala

Fig. 2: Effect of different treatments on changes in taste and flavour and sugar: acid ratio in fresh and six months stored aloe vera RTS

At two months after storage, the treatment with aloe juice 15 per cent + TSS 15ºBrix + 1 per cent lime juice (T_4) registered significantly maximum ascorbic acid content (82.81 mg/ 100ml) which was closely followed by T_3 (79.52 mg/100ml). Similar trend was noticed at 4 and 6 months after storage period with the same treatment T_4 recording the maximum ascorbic acid content (78.54 mg/100ml and 67.15 mg/100ml respectively). But at 6 months, the treatment T4 had no significant differences with T_3 (64.25 mg/100ml) and T_5 (65.68 mg/100ml). However, the minimum ascorbic acid content was observed in treatment T_{10} (58.00 mg/100ml) at 4 months and it was on par with T_8 (61.03 mg) and T_9 (59.92 mg/100ml). At 6 months after storage least ascorbic acid content was observed in treatment T_1 (54.54 mg/100ml), and it was on par with T_9 (57.13).

4.1.9 Colour analysis

The data on changes in colour of RTS beverage was measured by Lovibond colour meter in terms of *L**(brightness), *a** (red-green) and *b** (blue-yellow) and is presented in Table 5 and Table 6 and depicted in Fig 3.

The mean values of lightness (*L**) and blueness (*b**) decreased with increasing storage period and whereas redness (*a**) showed increasing trend. Significantly maximum *L** value over rest of the treatments was observed in the treatment T_1 (5.52) at initial, 2 MAS (4.82), 4 MAS (2.89) and 6 MAS (2.69). It was followed by T_2 at 0, 2 and 6 months after storage and T_3 (2.86) at 4 months after storage. The minimum *L** value of 3.04 observed in treatment T_9 in the fresh RTS beverage was on par with T_6 (3.23), T_7 (3.34), T_8 (3.30) and T_{10} (3.06). At 2 MAS (2.25) and 6 MAS (1.20), the least value for *L** associated with T_{10} differed significantly with the remaining treatments. But at 4 MAS, the minimum for lightness (L*) found with T_9 (1.46) differed non-significantly with T_{10} (1.51).

After 0, 2, 4 and 6 months after storage, the significantly maximum *a** value was observed in treatment T_{10} (15% aloe juice + 15ºTSS + 0.75% *chat-masala*) with values of (0.64, 0.65, 0.68 and 0.70, respectively) and it was followed by T_9 at initial (0.63) and at 2, 4 and 6 months after storage (0.62, 0.65 and 0.69 respectively). The treatments T_{10} did differ statistically with the treatment T_9, only at the beginning and after 6 months of storage. Minimum *a** value was observed in treatment T_6 (0.26) at initial and also at 2 MAS (0.28), 4 MAS (0.30) and 6 MAS (0.35). Differences for

Table 5: Effect of treatments and storage period on colour (*L* a) values of aloe vera RTS**

Treatments	*L** value				*a** value			
	Initial	**2MAS**	**4MAS**	**6MAS**	**Initial**	**2MAS**	**4MAS**	**6MAS**
T_1- Aloe juice 15% + TSS 15ºBrix + Peppermint 0.75%	5.52	4.82	2.89	2.69	0.61	0.58	0.62	0.65
T_2 - Aloe juice 15 % + TSS 15ºBrix + Pepper mint 1.00 %	4.97	4.18	2.30	2.48	0.55	0.59	0.64	0.68
T_3- Aloe juice 15 %+ TSS 15ºBrix + Lime juice 0.75 %	4.21	3.86	2.86	2.10	0.35	0.43	0.45	0.50
T_4- Aloe juice 15% + TSS 15ºBrix + Lime juice 1.00 %	4.34	4.08	2.27	2.10	0.28	0.29	0.31	0.36
T_5- Aloe juice 15 %+ TSS 15ºBrix + Ginger juice 0.50 %	4.10	3.38	2.03	1.90	0.42	0.44	0.48	0.49
T_6- Aloe juice 15 % + TSS 15ºBrix + Ginger juice 0.75 %	3.23	3.19	2.10	1.88	0.26	0.28	0.30	0.35
T_7- Aloe juice 15 %+ TSS 15ºBrix + Jaljeera 0.50 %	3.34	3.06	1.77	1.64	0.40	0.55	0.59	0.62
T_8- Aloe juice 15% + TSS 15ºBrix + Jaljeera 0.75 %	3.30	2.95	1.92	1.84	0.48	0.55	0.57	0.60
T_9- Aloe juice 15 % + TSS15ºBrix + Chat-masala 0.50 %	3.04	2.95	1.46	1.44	0.63	0.62	0.65	0.69
T_{10}-Aloe juice 15 % + TSS 15ºBrix + Chat-masala 0.75 %	3.06	2.25	1.51	1.20	0.64	0.65	0.68	0.70
Mean	**3.91**	**3.47**	**2.11**	**1.92**	**0.46**	**0.49**	**0.52**	**0.56**
S. Em±	0.091	0.046	0.011	0.007	0.015	0.003	0.003	0.003
C.D. at 1%	0.366	0.185	0.046	0.029	0.060	0.013	0.013	0.013

MAS = Months after storage ***L**** **= Dark - Light,** ***a**** **= Green - Red**

Table 6: Effect of treatments and storage period on colour (*b) value of aloe vera RTS**

Treatments	*b** value			
	Initial	**2MAS**	**4MAS**	**6MAS**
T_1- Aloe juice 15% + TSS 15ºBrix + Peppermint 0.75%	0.94	0.93	0.73	0.75
T_2 - Aloe juice 15% + TSS 15ºBrix + Pepper mint 1.00%	0.95	0.92	0.55	0.36
T_3- Aloe juice 15% + TSS 15ºBrix + Lime juice 0.75%	0.92	0.89	0.35	0.33
T_4- Aloe juice 15% + TSS 15ºBrix + Lime juice 1.00%	0.86	0.77	0.36	0.19
T_5- Aloe juice 15% + TSS 15ºBrix + Ginger juice 0.50%	0.91	0.64	0.36	0.13
T_6- Aloe juice 15% + TSS 15ºBrix + Ginger juice 0.75%	0.69	0.63	0.37	0.11
T_7- Aloe juice 15% + TSS 15ºBrix + Jaljeera 0.50%	0.67	0.57	0.53	0.04
T_8- Aloe juice 15% + TSS 15ºBrix + Jaljeera 0.75%	0.45	0.44	0.20	0.05
T_9- Aloe juice 15% + TSS 15ºBrix + Chat-masala 0.50%	0.18	0.15	0.14	0.02
T_{10}- Aloe juice 15% + TSS 15ºBrix + Chat-masala 0.75%	0.18	0.10	0.09	0.09
Mean	**0.67**	**0.60**	**0.20**	**0.36**
S.Em±	0.003	0.003	0.003	0.003
C.D.at 1%	0.013	0.012	0.013	0.013

MAS = Months after storage ***b**** **= Blue -yellow**

minimum *L** value were insignificant between the treatments T_6 and T_4 throughout the storage.

Significantly maximum *b** value of 0.95 observed in treatment T_2 (15% aloe juice +15º Brix TSS + 1% pepper mint) was on par with T_1 (0.94) at the beginning of storage. Significantly minimum *b** value for fresh RTS beverage was observed in treatment T_9 and T_{10} (0.18).

After 2, 4 and 6 months after storage, significantly maximum *b** value was noted in treatment T_1 (Aloe juice 15 per cent + 15ºBrix TSS+ 0.75per cent pepper mint) with its values being 0.93, 0.75 and 0.73 respectively. The minimum *b** value was observed in treatment T_{10} (0.10) at 2 MAS, T_{10} (0.09) at 4 MAS, and T_9 (0.02) at 6 months of storage.

4.1.10 Organoleptic evaluation

The aloe based RTS beverage prepared with different recipe was subjected to organoleptic evaluation to assess the sensory attributes like colour and appearance, mouthfeel, taste and flavour, and overall acceptability.

4.1.11 Colour and appearance (score out of 5.00)

The data on organoleptic evaluation pertaining to the colour and appearance as influenced by treatments and storage period are presented in Table 7 and depicted in Fig. 3.

The result on colour and appearance varied, there was no-significantly difference among the treatments and storage period. During storage, the mean score for fresh RTS colour and appearance irrespective of treatments decreased from an initial value of 3.98 to 3.64 at the end of 6 months of storage. In freshly prepared RTS, the highest score (4.28) for this parameter was observed in treatment T_6 (15% aloe juice + 15º Brix TSS + 0.75% ginger). The same treatment exhibited highest value for colour and appearance at 2 months (4.15) and also at 4 months (3.92) and 6 months after storage (3.78), followed by T_5 (4.13), T3(4.13), T_4 and T_1 (4.08) at 2 months after storage, and T_5 (4.03), T_3 (4.00) T_1 (3.96) at 2 months, and T_1(3.82), T_5 (3.83) and T_4 (3.82) at 4 months after storage and T_5 (3.75), T_3 (3.70) at 6 months after storage.

Table 7: Effect on treatments and storage period on colour and appearance and mouthfeel of aloe vera RTS

Treatments	Colour and appearance (scores out of 5.0)				Mouth feel (score out of 5.0)			
	Initial	**2MAS**	**4MAS**	**6MAS**	**Initial**	**2MAS**	**4MAS**	**6MAS**
T_1- Aloe juice 15% + TSS 15ºBrix + Peppermint 0.75%	4.08	3.96	3.82	3.60	4.23	4.07	3.75	3.58
T_2 - Aloe juice 15 % + TSS 15ºBrix + Pepper mint 1.00 %	4.13	4.00	3.77	3.67	4.25	4.17	3.82	3.75
T_3- Aloe juice 15 %+ TSS 15ºBrix + Lime juice 0.75 %	4.08	3.78	3.82	3.70	4.32	4.28	3.92	3.82
T_4- Aloe juice 15% + TSS 15ºBrix + Lime juice 1.00 %	3.88	3.78	3.77	3.53	4.22	4.18	3.83	3.75
T_5- Aloe juice 15 %+ TSS 15ºBrix + Ginger juice 0.50 %	4.13	4.03	3.83	3.75	4.33	4.32	4.17	3.83
T_6- Aloe juice 15 % + TSS 15ºBrix + Ginger juice 0.75 %	4.28	4.15	3.92	3.78	4.40	4.40	4.33	4.17
T_7- Aloe juice 15 %+ TSS 15ºBrix + Jaljeera 0.50 %	3.78	3.78	3.73	3.67	4.07	3.83	3.75	3.58
T_8- Aloe juice 15% + TSS 15ºBrix + Jaljeera 0.75 %	3.78	3.85	3.82	3.53	3.86	3.75	3.62	3.45
T_9- Aloe juice 15 % + TSS15ºBrix + Chat-masala 0.50 %	3.87	3.78	3.68	3.58	4.00	3.75	3.58	3.62
T_{10}-Aloe juice 15 % + TSS 15ºBrix + Chat-masala 0.75 %	3.72	3.70	3.58	3.53	3.83	3.67	3.55	3.52
Mean	**3.98**	**3.88**	**3.77**	**3.64**	**4.15**	**4.04**	**3.83**	**3.71**
S. Em±	0.341	0.289	0.336	0.302	0.252	0.299	0.223	0.175
C.D. at 1%	NS	NS	NS	NS	NS	NS	NS	NS

MAS= Months after storage

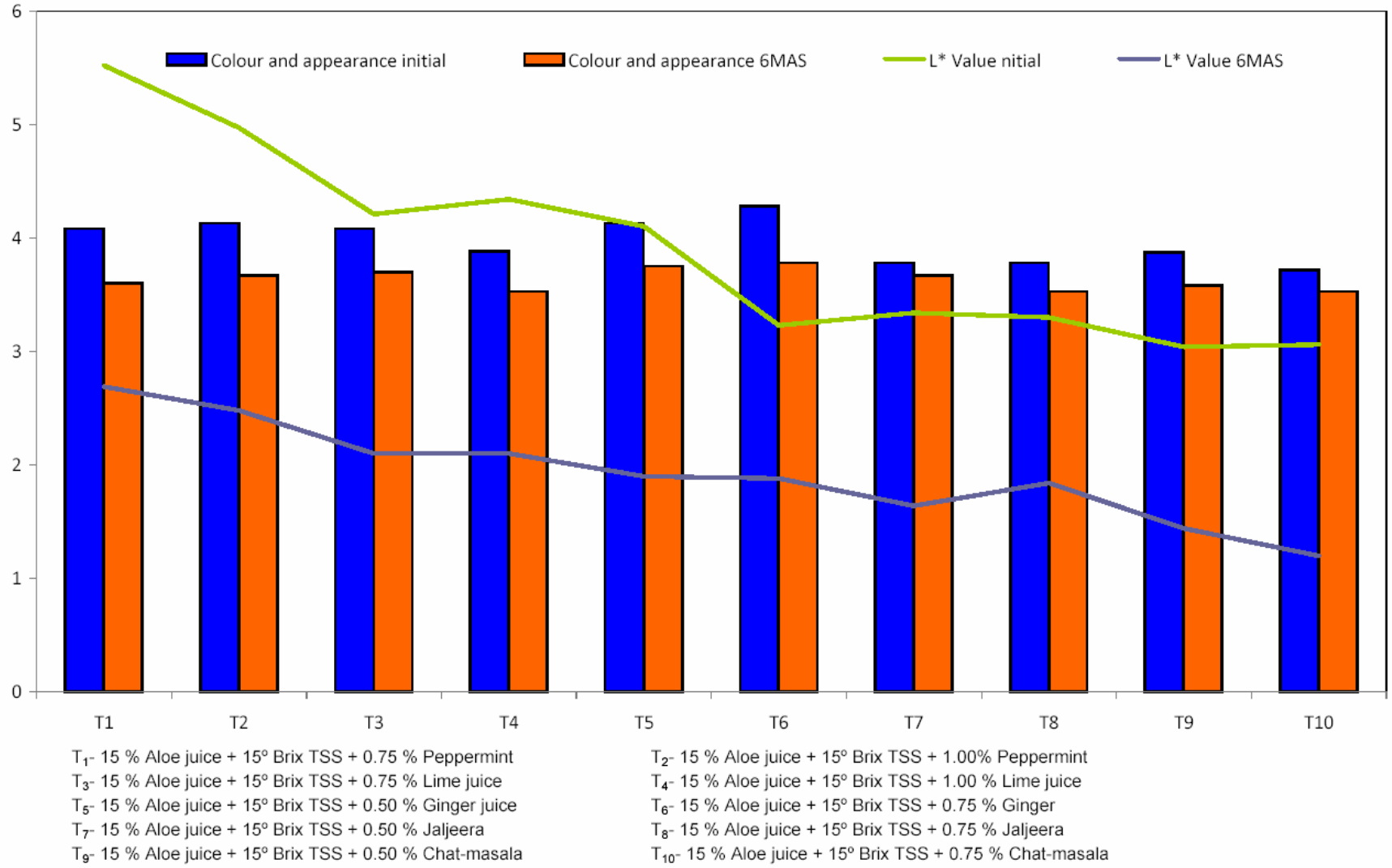


Fig. 3: Effect of different treatments on changes in colour value (L*) and sensory colour and appearance in fresh and six months stored aloe vera RTS

The least score was obtained in T_{10} in the fresh RTS (3.72) as well as at 2 MAS (3.70), 4 MAS (3.58) and 6 MAS (3.53). Throughout the study period, the treatment T_{10} showed lower score for colour and appearance over rest of the treatments.

4.1.11.1 Mouth feel (score out of 5.00)

The data on organpleptic evaluation pertaining to the mouth-feel as influenced by different treatments are presented in Table 7.

The results on mouth feel of RTS beverage indicated non-significant differences among the treatments except at 6 months of storage. In fresh RTS, highest score for mouth feel was observed in treatment T_6 (4.40). It was closely followed by T_3 and T_5. Similar trend of maximum score for mouth-feel was observed in the treatment T_6 throughout the storage (4.40 at 2 months, 4.33 at 4 months and 4.17 at 6 months) and it was followed by T_5. Minimum score for this parameter was noted in T_{10} at 0 MAS (3.83), 2 MAS (3.67) and 4 (3.55) MAS. But, mouth-feel witnessed significant difference at 6 MAS with the minimum scores being associated with treatments T_8 (3.42) and T_{10} (3.45). They both differed significantly with the treatment T_6 (4.17).

4.1.11.2 Taste and flavour (score out of 5.00)

The data on organoleptic evaluation pertaining to taste and flavour as influenced by treatments and storage period are presented in Table 8 and depicted in Fig. 2.

There were no significant differences among treatments throughout the storage period. At the beginning, the highest score was registered in treatment T_6 (4.28) containing 15 per cent aloe juice + 15º Brix TSS + 0.75 per cent ginger, followed by T_5 (4.17), T_1 (4.25) and T_2 (4.25). The lowest score was observed in treatment T_{10} (3.75).

The treatment T_6 continued to record the highest score for taste and flavour at 2 months (4.25), 4 months (4.17) and 6 months (4.10) after storage. The lowest score for taste and flavour observed in treatment T_{10} (3.65. 3.60 and 3.55, respectively) during storage at 2, 4 and 6 months.

Table 8: Effect of treatments and storage period on taste and flavour and overall acceptability of aloe vera RTS

Treatments	Taste and flavour (score out of 5.00)				Overall acceptability (score out of 5.00)			
	Initial	**2MAS**	**4MAS**	**6MAS**	**Initial**	**2MAS**	**4MAS**	**6MAS**
T_1- Aloe juice 15% + TSS 15ºBrix + Peppermint 0.75%	4.25	4.06	3.92	3.75	4.03	3.96	3.92	3.67
T_2 - Aloe juice 15 % + TSS 15ºBrix + Pepper mint 1.00 %	4.25	4.17	4.00	3.83	4.10	3.99	3.85	3.75
T_3- Aloe juice 15 %+ TSS 15ºBrix + Lime juice 0.75 %	3.95	3.92	3.82	3.78	4.21	4.17	4.13	4.08
T_4- Aloe juice 15% + TSS 15ºBrix + Lime juice 1.00 %	3.92	3.83	3.78	3.75	4.17	4.12	4.10	4.03
T_5- Aloe juice 15 %+ TSS 15ºBrix + Ginger juice 0.50 %	4.17	4.17	4.13	4.03	4.28	4.20	4.17	3.73
T_6- Aloe juice 15 % + TSS 15ºBrix + Ginger juice 0.75 %	4.28	4.25	4.17	4.10	4.43	4.32	4.28	4.17
T_7- Aloe juice 15 %+ TSS 15ºBrix + Jaljeera 0.50 %	3.83	3.78	3.75	3.68	3.93	3.92	3.82	3.75
T_8- Aloe juice 15% + TSS 15ºBrix + Jaljeera 0.75 %	3.78	3.75	3.65	3.60	3.90	3.82	3.75	3.50
T_9- Aloe juice 15 % + TSS15ºBrix + Chat-masala 0.50 %	3.78	3.72	3.62	3.58	3.89	3.70	3.68	3.55
T_{10}-Aloe juice 15 % + TSS 15ºBrix + Chat-masala 0.75 %	3.75	3.65	3.60	3.55	3.88	3.50	3.47	3.40
Mean	**3.99**	**3.93**	**3.84**	**3.77**	**4.08**	**3.97**	**3.92**	**3.76**
S. Em±	0.229	0.199	0.214	0.152	0.185	0.276	0.212	0.171
C.D. at 1%	NS	NS	NS	NS	NS	NS	NS	NS

MAS= Months after storage

4.1.11.3 Overall acceptability (score out of 5.00)

The data on organoleptic evaluation of aloe RTS with respect to overall acceptability as influenced by different treatments and storage period are presented in Table 8

The highest score for overall acceptability of RTS beverage at the beginning was observed in treatment T_6 (15 % aloe juice +15º Brix TSS + 0.75% ginger juice) at the beginning (4.43) as well during when it was observed at 2 MAS (4.32), 4 MAS (4.28) and 6 MAS (4.17). The high scoring treatment (T_6) remained statistically at parity with all the treatments up to 4 months of storage. However, it differed significantly for overall acceptability at the end of 6 months with treatment T_{10} (3.88).

The lowest overall acceptability score was obtained by the treatment T_{10} (15 % aole juice + 15º Brix TSS + 0.75 % chat –masala) at 0, 2, 4 and 6 MAS (3.88, 3.50, 3.47 and 3.40, respectively).

4.1.11.4 Polysaccharides (mg/100ml)

The data on polysaccharide content (mg/100ml) of aloe RTS as influenced by different treatments are presented in Table 9.

In fresh RTS the treatment T_1 (aloe juice 15 per cent + TSS 15º Brix + 0.75 per cent pepper mint) registered significantly maximum polysaccharide content (17.44 mg/100ml) and it was on par with all treatments except T_4 and T_{10}. The least value of polysaccharide (15.10mg/100ml) was recorded in the treatment with 15 per cent aloe juice + 15ºB TSS+ 0.75 per cent chat- masala (T_{10}).

At the end of storage period, the treatment T_1 (15% aloe juice + 15º Brix TSS + 0.75% pepper mint) was significantly recorded maximum polysaccharide of 17.37 mg 100 ml of RTS, and it was on par with all treatments except T_4 and T_9. The lowest polysaccharide content (15.00 mg/100ml) was found in T_9 (Aloe juice 15 per cent + 15ºBrix TSS +0.50 per cent chat-masala).

4.1.11.5 Microbial analysis (CFU/ml)

The data presented in Table 9 indicate the microbial load of aloe vera RTS as influenced by treatments and storage period. and depicted in Fig. 1.

Table 9: Effect of treatments and storage period on polysaccharides and total bacterial count of aloe vera RTS

Treatments	Polysaccharides (mg/100ml)				Total bacterial count (CFU/ml)			
	Initial	**2MAS**	**4MAS**	**6MAS**	**Initial**	**2MAS**	**4MAS**	**6MAS**
T_1- Aloe juice 15% + TSS 15ºBrix + Peppermint 0.75%	17.34	17.37	1.17	2.13	3.00	4.00	3.92	3.67
T_2 - Aloe juice 15 % + TSS 15ºBrix + Pepper mint 1.00 %	17.44	17.23	1.20	2.20	3.27	3.80	3.85	3.75
T_3- Aloe juice 15 %+ TSS 15ºBrix + Lime juice 0.75 %	16.10	15.98	1.40	2.33	3.40	4.13	4.13	4.08
T_4- Aloe juice 15% + TSS 15ºBrix + Lime juice 1.00 %	15.43	15.34	1.30	2.30	3.10	4.20	4.10	4.03
T_5- Aloe juice 15 %+ TSS 15ºBrix + Ginger juice 0.50 %	16.16	16.15	1.06	2.00	2.80	3.17	4.17	3.73
T_6- Aloe juice 15 % + TSS 15ºBrix + Ginger juice 0.75 %	16.44	16.34	1.02	1.90	2.70	3.07	4.28	4.17
T_7- Aloe juice 15 %+ TSS 15ºBrix + Jaljeera 0.50 %	16.24	16.18	1.82	2.43	3.47	4.20	3.82	3.75
T_8- Aloe juice 15% + TSS 15ºBrix + Jaljeera 0.75 %	17.08	16.98	1.90	2.47	3.30	3.87	3.75	3.50
T_9- Aloe juice 15 % + TSS15ºBrix + Chat-masala 0.50 %	15.10	15.00	1.80	2.37	3.40	3.93	3.68	3.55
T_{10}-Aloe juice 15 % + TSS 15ºBrix + Chat-masala 0.75 %	16.00	16.03	1.70	2.40	3.20	3.20	3.47	3.40
Mean	**16.33**	**16.26**	**1.44**	**2.25**	**3.16**	**3.74**	**3.92**	**3.76**
S. Em±	0.445	0.478	0.049	0.073	0.201	0.079	0.212	0.171
C.D. at 1%	1.789	1.923	0.199	0.293	NS	0.320	NS	NS

MAS = Months after storage **CFU = Colony forming unit**

As evident from mean values, bacterial population exhibited an increasing trend in aloe based RTS from the beginning (1.44 CFU/ ml) to 6 months after storage (3.74 CFU/ml). Significantly minimum bacterial population was seen in T_6 (1.02 CFU/ml) in the fresh RTS and it did not differ significantly with treatments T_1 (1.71 CFU/ml), T_2 (1.20 CFU/ml) and T_5 (1.06 CFU/ml).

The maximum bacterial population in the fresh RTS was associated with T_8 (1.90 CFU/ml) and it was on par with bacterial load in T_7 (1.82 CFU/ml), T_8 (1.80 CFU/ml) and T_{10} (1.70CFU/ml). After 2 months of storage maximum bacterial population was observed in the same treatment T_8 (2.47 CFU/ml) followed by treatment T_9 (2.37) and T_{10} (2.40). The treatment T_8 showed statistical differences with T_1 (2.13) and T_5 (2.00). The maximum microbial load was observed in treatment T_7 (3.47 CFU/ml and 4.20 CFU/ml) at 4 and 6 months after storage. At 6 MAS, the treatment T_7 had significant differences with T_2, T_5, T_6, T_8 and T_{10}.

At 2, 4 and 6 months after storage, the minimum bacterial population was observed in treatment T_6 (1.90 CFU/ml, 2.70 CFU/ml and 3.07 CFU/ml, respectively) and it revealed no significant difference among the treatments at 4 months after storage.

4.2 Experiment II: Preparation and preservation of flavoured aloe squash

4.2.1 Total soluble solids (ºBrix)

The data on changes in total soluble solids with respect to different treatments and storage periods are presented in Table 10. Irrespective of treatments, the total soluble solids of squash was found to increase with the increase in storage period from the initially and commonly adjusted TSS of 45^{o}Brix.

The result on total soluble solids of aloe squash indicated no significant differences among the treatments during storage. The treatments T_2 (30 % aloe juice + TSS 15ºBrix + 3.00 % pepper mint) recorded highest TSS of 46.49ºB, 46.63ºB and 47.87ºB, respectively at 2, 4, 6 months after storage, followed by T_1 (46.36º B), T_5 (46.35ºB) and T_6 (46.32ºB) at 2 months after storage, and T_1 (46.53ºB), T_7 (46.41ºB)

Table 10: Effect of treatments and storage period on total soluble solids and total sugars of flavoured aloe vera squash

Treatments	Total soluble solids (ºBrix)				Total sugars (%)			
	Initial	2MAS	4MAS	6MAS	Initial	2MAS	4MAS	6MAS
T_1- Aloe juice 15% + TSS 15ºBrix + Peppermint 0.75%		46.36	46.53	47.80	38.44	38.50	38.54	38.57
T_2 - Aloe juice 15 % + TSS 15ºBrix + Pepper mint 1.00 %		46.49	46.63	47.87	38.59	38.65	38.69	38.70
T_3- Aloe juice 15 %+ TSS 15ºBrix + Lime juice 0.75 %		46.26	46.28	47.71	38.24	38.35	38.37	38.50
T_4- Aloe juice 15% + TSS 15ºBrix + Lime juice 1.00 %		46.22	46.27	47.67	38.10	38.15	38.21	38.47
T_5- Aloe juice 15 %+ TSS 15ºBrix + Ginger juice 0.50 %	45.00	46.35	46.39	47.74	38.42	38.46	38.52	38.55
T_6- Aloe juice 15 % + TSS 15ºBrix + Ginger juice 0.75 %		46.32	46.33	47.71	38.27	38.38	38.47	38.52
T_7- Aloe juice 15 %+ TSS 15ºBrix + Jaljeera 0.50 %		46.28	46.41	47.78	38.46	38.44	38.45	38.54
T_8- Aloe juice 15% + TSS 15ºBrix + Jaljeera 0.75 %		46.25	46.37	47.74	38.30	38.42	38.44	38.50
T_9- Aloe juice 15 % + TSS15ºBrix + Chat-masala 0.50 %		46.31	46.36	47.73	38.34	38.42	38.44	38.53
T_{10}-Aloe juice 15 % + TSS 15ºBrix + Chat-masala 0.75 %		46.28	46.29	47.70	38.33	38.37	38.39	38.54
Mean	**45.00**	**46.31**	**46.38**	**47.74**	**38.34**	**38.41**	**38.45**	**38.54**
S. Em±		0.425	0.358	0.333	0.489	0.524	0.486	0.399
C.D. at 1%		NS	NS	NS	NS	NS	NS	NS

MAS = Months after storage

and T_5 (46.39ºB) at 4 months after storage, and T_1(47.80), T_5 (47.74º B) and T_7 (47.78ºB) after 6 months of storage.

The minimum TSS of 46.22º B, 46.27º B and 47.67º B was recorded in the treatment T_4 (30% aloe juice +TSS 15ºBrix + 3 % lime juice) at 2, 4 and 6 months after storage, followed by treatment T_3 (46.26º B) and T8 (46.25ºB) at 2 months after storage, and T_3 (46.28º B) and T_{10} (46.29ºB) at 4 months after storage, and T_3 (47.71ºB) and T_6 (47.71ºB) at 6 months after storage.

4.2.2 Total sugars (%)

The mean values of total sugars increased with stages of storage periods of aloe vera squash (Table 10). There appeared no significant differences among the treatments at fresh as well as during storage. However, the maximum total sugars content was observed in treatment T_2 throughout the storage period and minimum in T_4.

The maximum total sugars content was observed in treatment T_2 (30% aloe juice + 45º Brix TSS + 3% pepper mint) at fresh stage as well as at 2, 4 and 6 months after storage (38.59, 38.65, 38.69 and 38.70% respectively) followed by T_1 (38.44%), T_5 (38.42%) and T_7 (38.46%) at initial stage and T_2 (38.50%), T_5 (38.46%) and T_7 (38.44%) at 2 months after storage, T_1 (38.54%), T_5 (38.52%) and T_7 (38.47%) at 4 months after storage and T_1 (38.57%), T_5 (38.55%) ,T_7 (38.54%) and T_{10} (38.54%) at 6 months after storage.

The minimum total sugars content at initial, 2, 4 and 6 months after storage was observed in treatment T_4 (30 % aloe juice + 45º Brix +3 % lime juice with values of 38.10%, 38.15%, 38.21% and 38.47% respectively) followed by T_3 (38.24%, 38.35%, 38.37% and 38.50% respectively) at 0, 2, 4 and 6 months after storage.

4.2.3 Reducing sugars (%)

The data regarding sugars content (%) of aloe vera squash as influenced by different treatments and storage periods are presented in Table 11.

The reducing sugars content of all the treatments was found to increase with the progress in storage period. Fresh squash had considerably maximum reducing sugars in treatment T_2 (8.80 %) followed by T_1 (8.77%) and T_7 (8.43%). The

Table 11: Effect of treatments and storage period on reducing and non-reducing sugars of flavoured aloe vera squash

Treatments	Reducing sugars (%)				Non –reducing sugars (%)			
	Initial	**2MAS**	**4MAS**	**6MAS**	**Initial**	**2MAS**	**4MAS**	**6MAS**
T_1- Aloe juice 15% + TSS 15ºBrix + Peppermint 0.75%	8.77	8.79	8.80	8.83	28.19	28.12	28.09	28.08
T_2 - Aloe juice 15 % + TSS 15ºBrix + Pepper mint 1.00 %	8.80	8.83	8.86	8.89	28.30	28.29	28.24	28.23
T_3- Aloe juice 15 %+ TSS 15ºBrix + Lime juice 0.75 %	8.22	8.27	8.37	8.44	28.50	28.49	28.47	28.40
T_4- Aloe juice 15% + TSS 15ºBrix + Lime juice 1.00 %	8.13	8.16	8.20	8.39	28.48	28.42	28.41	28.37
T_5- Aloe juice 15 %+ TSS 15ºBrix + Ginger juice 0.50 %	8.36	8.37	8.56	8.60	28.55	28.52	28.50	28.44
T_6- Aloe juice 15 % + TSS 15ºBrix + Ginger juice 0.75 %	8.35	8.38	8.42	8.57	28.45	28.35	28.36	28.33
T_7- Aloe juice 15 %+ TSS 15ºBrix + Jaljeera 0.50 %	8.43	8.45	8.40	8.53	28.50	28.51	28.47	28.44
T_8- Aloe juice 15% + TSS 15ºBrix + Jaljeera 0.75 %	8.36	8.38	8.39	8.47	28.44	28.43	28.40	28.39
T_9- Aloe juice 15 % + TSS15ºBrix + Chat-masala 0.50 %	8.36	8.38	8.39	8.48	28.46	28.47	28.36	28.32
T_{10}-Aloe juice 15 % + TSS 15ºBrix + Chat-masala 0.75 %	8.27	8.28	8.33	8.46	28.55	28.52	28.45	28.44
Mean	**8.40**	**8.42**	**8.47**	**8.56**	**28.44**	**28.41**	**28.37**	**28.34**
S. Em±	0.404	0.422	0.416	0.358	0.389	0.394	0.425	0.447
C.D. at 1%	NS	NS	NS	NS	NS	NS	NS	NS

MAS = Months after storage

minimum reducing sugar content was observed in treatment T_4 (8.13%) followed by T_3 and T_{10}.

After 2, 4 and 6 months of storage, the maximum reducing sugars content was observed in treatment T_2 (8.83%, 8.86% and 8.89% respectively) followed by T_1. The minimum reducing sugars content was observed in treatments T_4 (8.16%, 8.20% and 8.39% respectively) followed by remaining all treatments.

4.2.4 Non–reducing sugars (%)

The data with respect to non-reducing sugars (%) content in aloe vera squash as influenced by different treatments and storage period are presented in Table 11.

The result on non-reducing sugars content was found to decrease with storage period. Maximum and the same non-reducing sugars (28.55%) were recorded in the treatment T_5 and T_{10} in the fresh squash followed by T_3 (28.50%) and T_7 (28.50%). The minimum non- reducing sugar content was observed in treatment T_1 (28.19%) followed by T_2 (28.30%) and T_8 (28.44%).

At 2 months after storage, maximum and the same non-reducing sugars content was observed in treatments T_5 (28.52%) and T_{10} (28.52%) followed by T_7 (28.51) and T_2 (28.49%). The minimum non-reducing sugars of (28.12%) was observed in treatment T_1 (Aloe juice 30 per cent + 45ºBrix TSS + 2.25 per cent pepper mint) followed by T_2 (28.29%) and T_6 (28.35%).

The maximum non-reducing sugar was present in the treatment T_5 (28.50%) at 4 months and the similar value of 28.44 per cent was noted in T_5, T_7, and T_{10} at 6 months after storage. The minimum non- reducing content was recorded in treatment T_1 at 4 months (28.09%) and 6 months (28.08%) after storage followed by T_2 (28.24%) and T_6 (28.36%).

4.2.5 pH

The data on pH of aloe vera squash in different treatments and storage periods are presented in Table12

The overall mean pH of aloe vera squash showed variability ranging from 3.08 to 3.92 indicating an increase in pH with increase in storage period. In fresh aloe

based squash significantly higher pH of 3.20 was observed in treatment T_1 (Aloe juice 30 %+ 45º Brix TSS + 2.25 % pepper mint) and it was on par with all other treatments except T_3 and T_4. The minimum pH of (2.85) was observed in treatment T_4 (Aloe juice 30 % + 45º Brix TSS + 3 % lime juice).

After 2, 4 and 6 months of storage, significantly maximum pH was observed in the treatment T_1 (3.38, 3.72 and 4.10, respectively) followed by T_2 (3.32, 3.65 and 4.07) and both of them were at parity after 4 and 6 months of storage. The minimum pH was observed in treatment T_4 (3.18, 3.43 and 3.82, respectively) at 2, 4 and 6 months after storage. It was on par with T_3, T_7 and T_8 at months and with all other treatments except T_1 and T_2.

4.2.6 Titratable acidity (%)

The data on titratable acidity pertaining to this experiment was expressed in terms of citric acid as percentage (Table 12) The results showed significant differences among the treatments and storage periods. The titratable acidity content of the fresh aloe squash was initially adjusted to 1 per cent in all the treatments. During storage, the mean titratable acidity content decreased. After 2, 4 and 6 months of storage, it was found to be 0.95, 0.89 and 0.82 per cent, respectively.

The treatment T_4 recorded significantly maximum titratable acidity in aloe based squash after 2, 4 and 6 months of storage (0.99%, 0.94% and 0.91% respectively) and it was found to be on par with the treatments T_3 (0.98%) , T_5 (0.96%) ,T_6 (0.97%), T_7 (0.96%), T_8 (0.93%) and T_{10} (0.94%) at 2 months after storage, with T_3 (0.93%), T_5 (0.91%), T_6 (0.92%) T_9 (0.88%) and T_{10} (0.89%) at 4 months, and with T_3 (0.88%), T_5 (0.85%) and T_6 (0.84%) at 6 months of storage.

The lowest titratable acidity was found in T_1 (0.91%) at 2 months after storage and it non-significantly differed with T_2 (0.92%), T_5 (0.96%), T_7 (0.96%), T_8 (0.94%), T_9 (0.93%) and T_{10} (0.94%). At 4 months after storage, the lowest titratable acidity (0.84%) was associated with the treatments T_1 (30% aloe juice + 45º Brix TSS+ 2.25 % pepper mint) and it was on par with treatments T_2 (0.85%), T_7 (0.85%) and T_8 (0.86%). The least acidity containing treatment T_1 at 6 months (0.67%) after storage differed significantly with rest of the treatments.

Table 12: Effect of treatments and storage period on pH and titratable acidity of flavoured aloe vera squash

Treatments	pH				Titratable acidity (%)			
	Initial	**2MAS**	**4MAS**	**6MAS**	**Initial**	**2MAS**	**4MAS**	**6MAS**
T_1- Aloe juice 15% + TSS 15ºBrix + Peppermint 0.75%	3.20	3.38	3.72	4.10		0.91	0.84	0.67
T_2 - Aloe juice 15 % + TSS 15ºBrix + Pepper mint 1.00 %	3.17	3.32	3.65	4.07		0.92	0.85	0.75
T_3- Aloe juice 15 %+ TSS 15ºBrix + Lime juice 0.75 %	2.90	3.23	3.45	3.84		0.98	0.93	0.88
T_4- Aloe juice 15% + TSS 15ºBrix + Lime juice 1.00 %	2.85	3.18	3.43	3.82		0.99	0.94	0.91
T_5- Aloe juice 15 %+ TSS 15ºBrix + Ginger juice 0.50 %	3.10	3.20	3.58	3.89		0.96	0.91	0.85
T_6- Aloe juice 15 % + TSS 15ºBrix + Ginger juice 0.75 %	3.15	3.30	3.59	3.91	1.00	0.97	0.92	0.84
T_7- Aloe juice 15 %+ TSS 15ºBrix + Jaljeera 0.50 %	3.16	3.25	3.53	3.88		0.96	0.85	0.83
T_8- Aloe juice 15% + TSS 15ºBrix + Jaljeera 0.75 %	3.10	3.25	3.52	3.85		0.94	0.86	0.81
T_9- Aloe juice 15 % + TSS15ºBrix + Chat-masala 0.50 %	3.09	3.20	3.56	3.90		0.93	0.88	0.80
T_{10}-Aloe juice 15 % + TSS 15ºBrix + Chat-masala 0.75 %	3.10	3.31	3.60	3.92		0.94	0.89	0.81
Mean	**3.08**	**3.28**	**3.56**	**3.92**	**1.00**	**0.95**	**0.89**	**0.82**
S. Em±	0.063	0.064	0.025	0.028		0.014	0.013	0.016
C.D. at 1%	0.255	0.259	0.102	0.112		0.055	0.053	0.066

MAS = Months after storage

4.2.7 Sugar: acid ratio

The data on sugar: acid ratio of the aloe vera squash as influenced by treatments and storage periods are presented in Table 13 The data revealed that, there were no-significant differences among the treatments at initial stage. The maximum sugar: acid ratio was observed in treatment T_2 (38.59) at initial, followed by T_1 (38.47), T_7 (38.46) and T_5 (38.42). The minimum sugar: acid ratio was observed in treatments T_4 (38.10), followed by T_3 (38.24).

At two months after storage, the results showed significant differences among the treatments. The significantly maximum sugar acid ratio of (42.30) was recorded in treatments T_1 (30 % aloe juice + 45ºBrix TSS + 3 % pepper mint), and it was on par with T_2 (42.03), T_5 (40.07), T_8 (40.60), T_9 (41.30) and T_{10} (40.80). The minimum sugar: acid ratio was observed in treatment T_4 (37.15), and it was on par with T_3 (39.13).

At 4 and 6 months after storage, the maximum sugar: acid ratio was observed in treatment T_1 (45.86) at 4 months, and it was on par with T_2 (45.54) ,T_7 (45.54), T_8 (44.75) , At 6 months storage, highest sugar: acid ratio was recorded in T_1 (57.52), it significantly differ with other treatments. The minimum sugar: acid ratio was observed in treatments T_4 (40.55 and 42.29) at 4 and 6 months after storage, and it was on par with T_3 (41.28), T_5 (42.33) and T_6 (41.8) at 4 months after storage, and T_3 (43.72), at 6 months after storage.

4.2.8 Ascorbic acid (mg/100ml)

In general, ascorbic acid content of aloe based squash was found to decrease with the storage period in all the treatments (Table 13).

Ascorbic acid in fresh aloe squash was found maximum (225.67mg/100ml) in treatment T_4 (Aloe juice 30 per cent + 45º Brix+ 3 per cent lime juice) and it was on par with T_3 (222.45 mg/100ml). The minimum ascorbic acid content observed in treatment T_{10} (180.00 mg/100ml) was on par with T_8 (184.67).

At 2, 4 and 6 months after storage, the maximum ascorbic acid content was recorded in treatment T_4 (220.33 mg/100ml, 211.67 mg/100ml and 200.00 mg/100ml respectively), and it was at parity with T_3 (216.33 mg/100 ml) at 2 months. However,

Table 13: Effect of treatments and storage period on sugar: acid ratio and ascorbic acid of flavoured aloe vera squash

Treatments	Sugar : acid ratio				Ascorbic acid (mg/100ml)			
	Initial	2MAS	4MAS	6MAS	Initial	2MAS	4MAS	6MAS
T_1- Aloe juice 15% + TSS 15ºBrix + Peppermint 0.75%	38.44	42.30	45.86	57.52	209.07	203.67	193.33	161.00
T_2 - Aloe juice 15 % + TSS 15ºBrix + Pepper mint 1.00 %	38.59	42.03	45.54	51.63	211.14	209.67	195.00	167.33
T_3- Aloe juice 15 %+ TSS 15ºBrix + Lime juice 0.75 %	38.24	39.13	41.28	43.72	222.45	216.33	189.00	179.67
T_4- Aloe juice 15% + TSS 15ºBrix + Lime juice 1.00 %	38.10	37.15	40.55	42.29	225.67	220.33	211.67	200.00
T_5- Aloe juice 15 %+ TSS 15ºBrix + Ginger juice 0.50 %	38.42	40.07	42.33	45.32	197.67	193.00	187.33	139.00
T_6- Aloe juice 15 % + TSS 15ºBrix + Ginger juice 0.75 %	38.27	39.52	41.80	45.85	196.00	188.33	179.00	143.67
T_7- Aloe juice 15 %+ TSS 15ºBrix + Jaljeera 0.50 %	38.46	40.01	45.28	46.41	188.33	183.67	175.67	148.00
T_8- Aloe juice 15% + TSS 15ºBrix + Jaljeera 0.75 %	38.30	40.60	44.73	47.51	184.67	181.00	162.33	127.47
T_9- Aloe juice 15 % + TSS15ºBrix + Chat-masala 0.50 %	38.34	41.30	43.66	48.19	182.00	177.33	161.67	140.33
T_{10}-Aloe juice 15 % + TSS 15ºBrix + Chat-masala 0.75 %	38.33	40.80	43.18	47.56	180.00	176.33	165.33	132.67
Mean	**38.34**	**40.29**	**43.42**	**47.60**	**199.70**	**194.96**	**182.33**	**153.00**
S. Em±	0.489	0.485	0.506	0.434	0.919	0.978	0.989	0.974
C.D. at 1%	1.967	1.953	2.036	1.748	3.699	3.933	3.979	3.919

MAS = Months after storage

T_4 showed significantly maximum ascorbic acid content over rest of the treatments at 4 and 6 MAS.

The minimum ascorbic acid was observed in treatment T_{10} (176.33 mg/100ml) at 2 months which did not exhibit significant difference with the treatment T_9 (177.33 mg/100 ml). At 4 MAS, T_9 (161.67 mg/100ml) recorded minimum ascorbic acid and it was on par with T_8 (162.33 mg/100 ml) and T_{10} (165.33 mg/100 ml). The lowest ascorbic acid at 6 months was observed in T_8 (127.47 mg/100ml) which differed non-significantly with T_{10} (132.67 mg/100ml).

4.2.9 Colour analysis

The data on changes in *L**(brightness) and *a** (red-green) of aloe vera RTS as influenced by treatment and storage are presented in Table 5 and that of *b** (blue-yellow) values are presented in Table 14 and Table 15.

The mean values of lightness (*L*)* and greenness (*b*)* decreased with increasing storage period where as redness (*a**) showed an increasing in trend. Freshly prepared aloe based squash had significantly maximum brightness in treatment T_2 (8.18) over all other treatments. However, it was followed by T_1 (7.25) and T3 (6.91). The significantly minimum *L** value observed in treatment T_9 (3.74) was followed T_9 (4.34) and T_8 (4.75).

At 2, 4 and 6 months after storage, the significantly maximum *L** value was observed in treatment T_2 (7.27, 6.20 and 3.76 respectively) followed by T_1 (6.76) and T_3 (6.25). The significantly minimum *L** value was observed in treatment T_{10} (2.58, 2.92 and 1.99 respectively) and it was followed by T_9 (3.68, 3.13 and 2.16) at 6 months of storage.

The maximum *a** values was observed in treatment T_{10} (0.53, 0.64, 0.71 and 0.86 respectively) at 0, 2, 4 and 6 months after storage. It showed significantly more redness than any other treatments at 2 and 4 MAS. But at 6 MAS, T_{10} was on par with T_9 (0.77) and T_8 (0.75). The minimum *a** values was observed in treatment T_2 at 0, 2, 4 and 6 MAS (0.23, 0.24, 0.33 and 0.33 respectively). It (T_2) was found on par with T_1 (0.26), T3 (0.28), T_4 (0.27) and T_5 (0.27) in the fresh squash, with T_1 (0.27), T_3 (0.28) and T_4 (0.27) at 2 months, with T_1 (0.33) and T3 (0.43) at 4 months and with T_1 (0.37), T_4 (0.48), T_5 (0.47), T_6 (0.48) and T_7 (0.50).

Table 14: Effect of treatments and storage period on colour (*L* a) values of flavoured aloe vera squash**

Treatments	*L** Value				*a** Value			
	Initial	**2MAS**	**4MAS**	**6MAS**	**Initial**	**2MAS**	**4MAS**	**6MAS**
T_1- Aloe juice 15% + TSS 15ºBrix + Peppermint 0.75%	7.25	6.76	5.52	3.07	0.26	0.27	0.37	0.33
T_2 - Aloe juice 15 % + TSS 15ºBrix + Pepper mint 1.00 %	8.18	7.27	6.20	3.76	0.23	0.24	0.33	0.33
T_3- Aloe juice 15 %+ TSS 15ºBrix + Lime juice 0.75 %	6.91	6.25	5.19	2.82	0.28	0.28	0.62	0.43
T_4- Aloe juice 15% + TSS 15ºBrix + Lime juice 1.00 %	6.68	5.32	4.96	2.69	0.27	0.27	0.49	0.48
T_5- Aloe juice 15 %+ TSS 15ºBrix + Ginger juice 0.50 %	5.72	5.23	4.77	2.62	0.27	0.36	0.51	0.47
T_6- Aloe juice 15 % + TSS 15ºBrix + Ginger juice 0.75 %	5.10	4.75	4.74	2.42	0.29	0.35	0.57	0.48
T_7- Aloe juice 15 %+ TSS 15ºBrix + Jaljeera 0.50 %	4.99	4.18	3.70	2.28	0.29	0.42	0.57	0.50
T_8- Aloe juice 15% + TSS 15ºBrix + Jaljeera 0.75 %	4.75	4.16	3.19	2.19	0.32	0.46	0.75	0.58
T_9- Aloe juice 15 % + TSS15ºBrix + Chat-masala 0.50 %	4.34	3.68	3.13	2.16	0.35	0.46	0.77	0.59
T_{10}-Aloe juice 15 % + TSS 15ºBrix + Chat-masala 0.75 %	3.74	2.58	2.92	1.99	0.53	0.64	0.86	0.71
Mean	**5.76**	**4.96**	**4.43**	**2.66**	**0.30**	**0.37**	**0.51**	**0.56**
S. Em±	0.119	0.037	0.029	0.013	0.013	0.015	0.026	0.051
C.D. at 1%	0.479	0.157	0.092	0.054	0.053	0.063	0.107	0.206

MAS = Months after storage

Table 15: Effect of treatments and storage period on colour (*b) value of flavoured aloe vera squash**

Treatments	*b** Value			
	Initial	**2MAS**	**4MAS**	**6MAS**
T_1- Aloe juice 30% + TSS 45ºBrix + Peppermint 2.25%	1.04	1.01	0.64	0.63
T_2 - Aloe juice 30% + TSS 45ºBrix + Pepper mint 3.00%	1.98	1.35	1.07	0.87
T_3- Aloe juice 30% + TSS 45ºBrix + Lime juice 2.25%	0.75	0.72	0.59	0.57
T_4- Aloe juice 30% + TSS 45ºBrix + Lime juice 3.00%	1.05	0.81	0.38	0.38
T_5- Aloe juice 30% + TSS 45ºBrix + Ginger juice 1.50%	0.63	0.63	0.39	0.32
T_6- Aloe juice 30% + TSS 45ºBrix + Ginger juice 2.25%	0.31	0.30	0.28	0.24
T_7- Aloe juice 30% + TSS 45ºBrix + Jaljeera 1.50%	0.21	0.20	0.09	0.06
T_8- Aloe juice 30% + TSS 45ºBrix + Jaljeera 2.25%	0.29	0.27	0.07	0.05
T_9- Aloe juice 30% + TSS 45ºBrix + Chat-masala 1.50%	0.13	0.12	0.04	0.02
T_{10}-Aloe juice 30% + TSS 45ºBrix + Chat-masala 2.25%	0.11	0.07	0.03	0.01
Mean	**0.65**	**0.54**	**0.42**	**0.31**
S.Em±	0.026	0.032	0.023	0.008
C.D.at 1%	0.107	0.131	0.094	0.035

MAS = Months after storage

The significantly maximum *b** value was observed in treatment T_2 (1.98, 1.35, 1.07 and 0.87 respectively) at initial as well as 2, 4 and 6 months after storage. Nevertheless, it was closely followed by T_1. The minimum *b** value was observed in treatment T_{10} at all the periods of observation (0.11, 0.07, 0.03 and 0.01 respectively). Treatment T_{10} was on par with treatment T_7 (0.21 and 0.20) and T_9 (0.13 and 0.12) at 0 and 2 months after storage. Treatments T_7 (0.09), T_8 (0.07) and T_9 (0.04) at 4 MAS and T_8 (0.05) and T_9 (0.02) at 6 MAS were at parity with T_{10}.

4.2.10 Organoleptic evaluation

Organoleptic evaluation of aloe based squash involving various treatments was done to assess its consumer acceptability by a panel of semi trained judges.

4.2.10.1 Colour and appearance (score out of 5.00)

The data pertaining to the colour and appearance of aloe squash as influenced by treatments and storage period are presented in Table 16.

In fresh aloe based squash, the highest score (4.36) for colour and appearance was observed in treatment T_5 (30 % aloe juice + 45º Brix TSS + 1.50 % ginger) and it was on par with the treatments T_1 (4.22) and T_6 (4.35). The lowest score of 3.56 was observed in treatment T_{10} (30 % aloe juice + 45º Brix TSS + 0.75% chat-masala) and it differed significantly over all other treatments except T_9 (3.63).

The treatment T_5 (30 % aloe juice + 45 º Brix TSS + 1.50 % ginger) continued to score maximum at 2, 4 and 6 months of storage (4.22, 4.19, 4.11, respectively) and it behaved statistically similar to all the treatments except T_9 (3.54, 3.51) and T_{10} (3.56, 3.43) at 2 and 4 MAS respectively. However, at the end of 6 months of storage, there were no significant differences among the treatments. The treatment T_{10} progressed with minimum score for colour and appearance at 2, 4 and 6 months (3.52, 3.43 and 3.37, respectively) followed by T_8.

4.2.10.2 Mouth feel (score out of 5.00)

The data pertaining to the mouth feel of aloe squash as influenced by treatments and storage period are presented in Table 16.

Table 16: Effect of treatments and storage period on colour and appearance and mouth feel of flavoured aloe vera squash

Treatments	Colour and appearances (score out of 5.00)				Mouth feel (out of 5.00)			
	Initial	**2MAS**	**4MAS**	**6MAS**	**Initial**	**2MAS**	**4MAS**	**6MAS**
T_1- Aloe juice 15% + TSS 15ºBrix + Peppermint 0.75%	4.22	4.21	4.15	4.01	3.95	3.94	3.90	3.88
T_2 - Aloe juice 15 % + TSS 15ºBrix + Pepper mint 1.00 %	4.15	4.10	4.05	4.02	4.21	4.19	4.11	4.06
T_3- Aloe juice 15 %+ TSS 15ºBrix + Lime juice 0.75 %	3.98	3.92	3.89	3.87	4.15	4.12	4.07	3.97
T_4- Aloe juice 15% + TSS 15ºBrix + Lime juice 1.00 %	3.87	3.81	3.76	3.74	4.03	3.98	3.77	3.77
T_5- Aloe juice 15 %+ TSS 15ºBrix + Ginger juice 0.50 %	4.36	4.22	4.19	4.11	4.46	4.39	4.31	4.26
T_6- Aloe juice 15 % + TSS 15ºBrix + Ginger juice 0.75 %	4.35	4.15	4.14	4.07	3.98	3.94	3.91	3.96
T_7- Aloe juice 15 %+ TSS 15ºBrix + Jaljeera 0.50 %	3.95	3.90	3.87	3.64	3.82	3.82	3.79	3.78
T_8- Aloe juice 15% + TSS 15ºBrix + Jaljeera 0.75 %	3.80	3.70	3.60	3.51	3.83	3.81	3.82	3.80
T_9- Aloe juice 15 % + TSS15ºBrix + Chat-masala 0.50 %	3.63	3.54	3.51	3.40	3.83	3.76	3.75	3.71
T_{10}-Aloe juice 15 % + TSS 15ºBrix + Chat-masala 0.75 %	3.56	3.52	3.43	3.37	3.44	3.42	3.42	3.40
Mean	**3.98**	**3.90**	**3.85**	**3.77**	**4.35**	**3.93**	**3.88**	**3.85**
S. Em±	0.047	0.157	0.173	0.185	0.160	0.160	0.236	0.144
C.D. at 1%	NS	NS	NS	NS	NS	NS	NS	NS

MAS = Months after storage

Significantly highest score (4.46) at the beginning was observed in treatment T_5 (30 % aloe juice + 45º Brix TSS + 1.50 % ginger) and it was at parity with all the treatments except T_{10}. The treatment T_5 was closely followed by T_2 (4.21) and T_3 (4.15). The lowest score of 3.44 was observed in treatment T_{10} (30 % aloe juice + 45º Brix TSS + 1.5 % chat- masala) followed by T_9 (3.83) and T_7 (3.82).

Even at 2, 4 and 6 months after storage, the squash of treatment T_5 (30 % aloe juice + 45 º Brix TSS + 1.50 % ginger) continued to score the highest (4.39, 4.31, 4.26 respectively) and it was non-significantly differed with remaining treatments except T_{10} at 2 and 6 MAS. There were no statistical differences observed among the treatments during their evaluation at 4 MAS. The treatment T_{10} scored minimum for mouth feel at 2, 4 and 6 months (3.44, 3.42 and 3.40 respectively) throughout the storage duration closely followed by T_8.

4.2.10.3 Taste and flavour (score out of 5.00)

The sensory scores for taste and aroma of aloe vera squash as presented in Table 17 indicate a linear decrease from 3.96 at initial stage to 3.83 at the end of 6 months of storage. The maximum taste and flavour was observed in the treatment T_5 at initial, 2, 4 and 6 months after storage (4.30, 4.26, 4.21 and 4.19, respectively) and it was on par with all treatments except T_9 and T_{10} at the beginning, and except T_{10} at 2 MAS. However T_5 differed significantly with T_4, T_8, T_9 and T_{10} at 4 MAS, and with T_9 and T_{10} at 6 MAS.

The minimum taste and flavour was observed in treatment T_{10} (3.50, 3.48, 3.46 and 3.45) respectively followed by the treatment T_9 and T_8 throughout the study.

4.2.10.4 Overall acceptability (score out of 5.00)

The data pertaining to the overall acceptability of aloe squash as influenced by treatments and storage period are presented in Table 17. The mean score for overall acceptability varied from 4.02 in the fresh aloe based squash to 3.90 at the end of its storage for 6 months.

The maximum score for overall acceptability was observed in treatment T_5 (aloe juice + 45 ºBrix TSS + 1.50 per cent ginger) with score of 4.38, 4.36, 4.33 and 4.31 respectively at initial, 2 4 and 6 months storage. The treatment T_5 showed

Table 17: Effect of treatments and storage period on taste and flavour and overall acceptability of flavoured aloe vera squash

Treatments	Taste and flavour (score out of 5.00)				Overall acceptability (score out of 5.00)			
	Initial	**2MAS**	**4MAS**	**6MAS**	**Initial**	**2MAS**	**4MAS**	**6MAS**
T_1- Aloe juice 15% + TSS 15ºBrix + Peppermint 0.75%	3.98	3.94	3.92	3.89	3.97	3.95	3.94	3.91
T_2 - Aloe juice 15 % + TSS 15ºBrix + Pepper mint 1.00 %	3.98	3.95	3.91	3.88	3.98	3.94	3.90	3.83
T_3- Aloe juice 15 %+ TSS 15ºBrix + Lime juice 0.75 %	4.17	4.11	4.19	4.11	4.28	4.22	4.15	4.10
T_4- Aloe juice 15% + TSS 15ºBrix + Lime juice 1.00 %	3.81	3.78	3.72	3.70	4.25	4.21	4.17	4.15
T_5- Aloe juice 15 %+ TSS 15ºBrix + Ginger juice 0.50 %	4.30	4.26	4.21	4.19	4.38	4.36	4.33	4.31
T_6- Aloe juice 15 % + TSS 15ºBrix + Ginger juice 0.75 %	4.23	4.22	4.07	4.00	3.96	3.94	3.90	3.89
T_7- Aloe juice 15 %+ TSS 15ºBrix + Jaljeera 0.50 %	4.02	3.96	3.95	3.94	3.86	3.85	3.84	3.83
T_8- Aloe juice 15% + TSS 15ºBrix + Jaljeera 0.75 %	3.87	3.76	3.72	3.68	3.90	3.88	3.70	3.69
T_9- Aloe juice 15 % + TSS15ºBrix + Chat-masala 0.50 %	3.77	3.65	3.64	3.52	3.86	3.81	3.79	3.73
T_{10}-Aloe juice 15 % + TSS 15ºBrix + Chat-masala 0.75 %	3.50	3.48	3.46	3.45	3.82	3.80	3.72	3.63
Mean	**3.96**	**3.91**	**3.87**	**3.83**	**4.02**	**3.99**	**3.94**	**3.90**
S. Em±	0.128	0.178	0.141	0.154	0.129	0.113	0.132	0.151
C.D. at 1%	0.515	0.715	0.566	0.620	0.520	0.454	0.530	0.608

MAS = Months after storage

significant difference only with the treatment T_{10} in the fresh squash, with T_7, T_8, T_9 and T_{10} at 2 MAS, with T_8, T_9 and T_{10} at 4 MAS, and with T_8 and T_{10} at 6 MAS

The minimum overall acceptability was observed in treatment T_{10} (3.82, 3.80, 3.72 and 3.63 respectively) at initial, 2, 4 and 6 months after storage followed by T_9 and T_8 throughout the period of investigation.

4.2.10.5 Polysaccharide (mg/100ml)

The data pertaining to retention of polysaccharide content of aloe vera squash as influenced by treatments and storage period are presented in Table 18. The statistical differences among the treatments were non-significant both in the fresh squash as well as after its storage for 6 months.

Polysaccharide content in fresh aloe vera squash showed maximum level (26.53 mg/100 ml) in the treatment with aloe juice 30 per cent + 45ºBrix TSS + 3 per cent pepper mint (T_2) followed by T_8 (26.52 mg/100 ml) and T_7 (26.48 mg/100 ml). The minimum level of polysaccharide was observed in treatment T_4 (Aloe juice 30 per cent + 45º Brix TSS+ 3 lime juice with level of (26.18 mg/100 ml) followed by T_3 and T_{10} with the same level of 26.22 mg/100 ml.

At 6 months after storage, there was a slight decrease was noticed in the level of polysaccharide. The maximum polysaccharide content was observed in treatment T_2 (26.40mg/100 ml) followed by treatment T_8 (26.36 mg/100 ml) and T_7 (26.35 mg). The minimum polysaccharide content of (26.17 mg/100 ml) was associated with treatment T_4 (30 % aloe juice + 45º Brix TSS+ 3 % lime juice followed by the treatments T_3 (26.19 mg/100 ml), T_9 (26.21 mg/100 ml) and T_{10} (26.21 mg/100 ml).

4.2.10. 6 Microbial analysis (CFU/ml)

The perusal of data presented in Table 18 indicate that microbial load of aloe vera squash varied significantly in the treatments as influenced by treatments and storage period.

As evident of the mean values, microbial population showed an increasing trend in aloe squash from fresh (5.23 CFU/ml) to 6 months after storage (5.37 CFU/ml).

Table 18: Effect of treatments and storage period on polysaccharides and total bacterial count of flavoured aloe vera squash

Treatments	Polysaccharides (mg/100ml)				Total bacterial count (CFU/ml)			
	Initial	2MAS	4MAS	6MAS	Initial	2MAS	4MAS	6MAS
T_1- Aloe juice 15% + TSS 15ºBrix + Peppermint 0.75%	26.34	26.29	5.34	5.25	5.39	5.33	3.90	3.88
T_2 - Aloe juice 15 % + TSS 15ºBrix + Pepper mint 1.00 %	26.53	26.40	5.37	5.28	5.31	5.38	4.11	4.06
T_3- Aloe juice 15 %+ TSS 15ºBrix + Lime juice 0.75 %	26.22	26.19	5.25	5.31	5.35	5.36	4.07	3.97
T_4- Aloe juice 15% + TSS 15ºBrix + Lime juice 1.00 %	26.18	26.17	5.30	5.31	5.37	5.39	3.77	3.77
T_5- Aloe juice 15 %+ TSS 15ºBrix + Ginger juice 0.50 %	26.40	26.32	5.03	5.11	5.22	5.27	4.31	4.26
T_6- Aloe juice 15 % + TSS 15ºBrix + Ginger juice 0.75 %	26.47	26.34	4.99	5.03	5.15	5.23	3.91	3.96
T_7- Aloe juice 15 %+ TSS 15ºBrix + Jaljeera 0.50 %	26.48	26.35	5.24	5.31	5.39	5.40	3.79	3.78
T_8- Aloe juice 15% + TSS 15ºBrix + Jaljeera 0.75 %	26.52	26.36	5.36	5.43	5.40	5.46	3.82	3.80
T_9- Aloe juice 15 % + TSS15ºBrix + Chat-masala 0.50 %	26.24	26.21	5.34	5.37	5.43	5.45	3.75	3.71
T_{10}-Aloe juice 15 % + TSS 15ºBrix + Chat-masala 0.75 %	26.22	26.21	5.37	5.38	5.46	5.48	3.42	3.40
Mean	**26.36**	**26.28**	**5.23**	**5.27**	**5.34**	**5.37**	**3.88**	**3.85**
S. Em±	0.496	0.458	0.508	0.479	0.421	0.417	0.236	0.144
C.D. at 1%	NS	NS	2.045	1.927	1.694	1.677	NS	NS

MAS = Months after storage **CFU = Colony forming units**

Significantly minimum microbial load of (4.99 CFU/ml) was observed in treatment T_6 (30 % aloe juice with 45º Brix TSS + 2.25 % ginger juice) in the beginning as well as after 2 months (5.03 cfu/ml), 4 months (5.15 CFU/ml) and 6 months after storage (5.23 CFU/ml), followed by treatment T_5 (5.03 CFU/ml, 5.11CFU/ml, 5.22 CFU/ml and 5.27 CFU/ml respectively) at initial, 2, 4 and 6 months after storage.

The maximum microbial population was observed in treatment T_{10} and T_2 (5.37 CFU/ml) and T_9 and T_1 (5.34 CFU/ml) at initial. At 2, 4 and 6 months storage maximum microbial population was observed in treatment T_{10} (5.38, 5.46 and 5.48, respectively), followed by treatment T_9 (5.37CFU/ml, 5.43CFU/ml and 5.45 CFU/ml respectively).

4.3 Experiment III: Preparation and preservation of aloe based mixed squash

In the present study, different recipes containing various levels of aloe juice, aonla juice, kokum juice and ginger juice were used to develop aloe vera based mixed squash. The results of the study are presented hereunder.

4.3.1 Total soluble solids (ºBrix)

The data on total soluble solids (TSS) of aloe based mixed squash as influenced by treatments and storage periods are presented in Table 19. There were no significant differences found among the treatments with respect to TSS content throughout the study. Irrespective of the treatments, there was a general increase in the TSS content in all the treatments as the storage period prolonged.

The squash was adjusted to TSS of 45º Brix in the beginning for all the treatments. The treatments T_{10} (25% aloe juice + 5% Amla + 10% Kokum + 1.5% Ginger) recorded the highest TSS of 46.53ºB, 47.40ºB and 48.13ºB respectively at 2, 4 and 6 months after storage and it was on par with all the treatments at 2, 4 and 6 months after storage followed by T_9 and T_{11}. The minimum TSS was recorded in treatment T_1 (46.20º B, 46.30º B and 47.37º B, respectively) at 2, 4 and 6 months after storage followed by T_2 and T_3.

Table 19: Effect of treatments and storage period on total soluble solids and total sugars of aloe vera based mixed squash

Treatments	Polysaccharides (mg/100ml)				Total bacterial count (CFU/ml)			
	Initial	2MAS	4MAS	6MAS	Initial	2MAS	4MAS	6MAS
T_1- Aloe juice 20% + Amla 10%		46.20	46.30	47.37	31.43	31.85	32.22	32.77
T_2- Aloe juice 25% + Amla 10%		46.27	46.40	47.40	31.55	31.92	32.33	32.80
T_3- Aloe juice 20% + Kokum 5%		46.30	46.50	47.43	32.20	32.47	32.83	33.17
T_4- Aloe juice 25% + Kokum 5%		46.33	46.53	47.47	32.21	32.48	32.85	33.23
T_5- Aloe juice 20% + Amla 5% + Kokum10%		46.37	46.50	47.57	33.70	33.90	34.03	34.17
T_6- Aloe juice 25% + Amla 5% + Kokum10%	45.00	46.43	46.56	47.60	33.73	33.89	34.00	34.10
T_7- Aloe juice 20% + Amla 10% + Kokum5%		46.30	46.47	47.50	32.91	33.10	33.29	33.43
T_8- Aloe juice 25% + Amla 10% + Kokum5%		46.33	46.53	47.57	33.07	33.17	33.40	33.80
T_9- Aloe juice 20% + Amla 10% + Kokum 5% + Ginger1.5%		46.43	47.33	48.07	35.20	35.63	35.90	36.13
T_{10}-Aloe juice 25% + Amla 5% + Kokum 10% + Ginger1.5%		46.53	47.40	48.13	35.43	35.83	36.07	36.17
T_{11}-Aloe juice 20% + Amla 5% + Kokum 10%+ Ginger1.5%		46.50	47.37	48.12	35.36	35.63	36.05	36.16
T_{12}-Aloe juice 25% +Amla 10% + Kokum 5% + Ginger1.5%		46.40	47.33	48.10	35.30	35.56	35.95	36.03
Mean	**45.00**	**46.37**	**46.77**	**47.69**	**33.51**	**33.79**	**34.08**	**34.33**
S. Em±		0.274	0.274	0.284	0.425	0.238	0.156	0.145
C.D. at 1%		NS	NS	NS	1.682	0.941	0.617	0.576

MAS = Months after storage

4.3.2 Total sugars (%)

The data on total sugar content of aloe based mixed squash as influenced by treatments at different storage periods are presented in Table 19.

The data revealed significant differences among the treatments and also at different months of storage. Maximum total sugars were recorded in treatment T_{10} (25% aloe juice + 5% Amla + 10% Kokum + 1.5% Ginger) in fresh squash and also when it was observed at 2, 4 and 6 months of storage period (35.43%, 35.83%, 36.07% and 36.17% respectively) and it was on par with most of the treatments except $T_{9,}$ T_{11} and T_{12} at 0, 2, 4 and 6 months after storage.

The minimum total sugar content was observed in treatment T_1 (31.43%, 31.85%, 32.22% and 32.77% respectively) at 0, 2, 4 and 6 months after storage and it was on par with treatments T_2 (31.55%), T_3 (32.20%), T_4 (32.21%), T_7 (32.91%) and T_8 (33.07%) at initial; with T_2 (31.92%), T_3 (32.47%) and T_4 (32.48%) at 2 months after storage; with T_2 (32.33%) and T_3 (32.83%) at 4 months after storage; and with T_2 (32.80%), T_3 (33.17%) and T_4 (33.23%) at 6 months after storage.

4.3.3 Reducing sugars (%)

The mean values for reducing sugars increased (8.45 to 8.80%) with storage periods (Table 20). The parameter was found to significantly vary among the treatments.

In aloe vera squash, the significantly maximum reducing sugars level was existent in treatment T_{10} (25% aloe juice + 5% Amla + 10% Kokum + 1.5% Ginger) at 0, 2, 4 and 6 months after storage with values being 9.26%, 9.32%, 9.40% and 9.56% respectively. It (T_{10}) was on par with T_{11} (9.20%, 9.29%, 9.36% and 9.50%) at 0, 2, 4 and 6 months after storage.

The minimum reducing sugar content was observed in treatment T_1 (20% aloe juice + 10% amla) at initial, 2, 4 and 6 months after storage (7.64, 7.72, 7.81 and 7.94% respectively). The treatment differed significantly from rest of the treatments at all the periods of observation except with T_2 (7.85%) and T_3 (7.93%) only in the fresh blended squash.

Table 20: Effect of treatments and storage period on reducing and non-reducing sugars of aloe vera based mixed squash

Treatments	Reducing sugars (%)				Non- reducing sugars (%)			
	Initial	2MAS	4MAS	6MAS	Initial	2MAS	4MAS	6MAS
T_1- Aloe juice 20% + Amla 10%	7.64	7.72	7.81	7.94	22.60	22.53	22.42	22.38
T_2- Aloe juice 25% + Amla 10%	7.85	7.90	8.02	8.20	24.09	23.83	23.72	23.64
T_3- Aloe juice 20% + Kokum 5%	7.93	8.10	8.22	8.46	23.05	23.03	22.98	22.96
T_4- Aloe juice 25% + Kokum 5%	8.00	8.16	8.26	8.49	22.99	22.93	22.86	22.82
T_5- Aloe juice 20% + Amla 5% + Kokum10%	8.52	8.64	8.72	8.82	23.91	23.80	23.76	23.72
T_6- Aloe juice 25% + Amla 5% + Kokum10%	8.60	8.68	8.76	8.89	23.88	23.80	23.75	23.70
T_7- Aloe juice 20% + Amla 10% + Kokum5%	8.37	8.42	8.50	8.69	23.33	23.26	23.20	23.10
T_8- Aloe juice 25% + Amla 10% + Kokum5%	8.46	8.53	8.61	8.71	23.36	23.30	23.26	23.22
T_9- Aloe juice 20% + Amla 10% + Kokum 5% + Ginger1.5%	8.79	8.85	8.92	9.10	24.86	24.73	24.68	24.60
T_{10}-Aloe juice 25% + Amla 5% + Kokum 10% + Ginger1.5%	9.26	9.32	9.40	9.56	25.15	24.95	24.90	24.87
T_{11}-Aloe juice 20% + Amla 5% + Kokum 10%+ Ginger1.5%	9.20	9.29	9.36	9.50	24.85	24.77	24.70	24.67
T_{12}-Aloe juice 25% +Amla 10% + Kokum 5% + Ginger1.5%	8.82	8.96	9.12	9.20	25.08	24.72	24.60	24.56
Mean	**8.45**	**8.55**	**8.64**	**8.80**	**23.93**	**23.80**	**23.74**	**23.69**
S. Em±	0.087	0.031	0.025	0.012	0.340	0.225	0.025	0.025
C.D. at 1%	0.346	0.125	0.102	0.051	1.346	0.892	0.099	0.102

MAS = Months after storage

4.3.4 Non-reducing sugars (%)

Changes in non-reducing sugars (%) content in aloe based mixed beverage squash as influenced by treatments and storage period are presented in Table 20. The perusal of data on non-reducing sugars content indicated significant differences among the treatments and this biochemical parameter decreased linearly as the storage period increased.

The significantly maximum non-reducing sugar content was observed in treatment T_{10} (25% aloe juice + 5% Amla +10% Kokum + 1.5% Ginger) at initial, 2, 4 and 6 months after storage (25.15%, 24.95%, 24.90% and 24.87% respectively), and it was on par with T_2 (24.09%), T_5 (23.91%), T_6 (23.88%), T_9 (24.86%) and T_{11} (24.85%) at initial; with T_9 (24.73%), T_{11} (24.77%) and T_{12} (24.72%) at 2 months after storage. However, T_{10} was noted to contain significantly higher non-reducing sugar over rest of the treatments at 4 and 6 MAS.

The significantly minimum non-reducing content was registered in treatment T_1 (22.60, 22.53, 22.42 and 22.38% respectively) at 0, 2, 4 and 6 months after storage. The treatment T_1 behaved statistically on par with T_3 (23.05%), T_4 (22.99%), T_5 (23.91%), T_6 (23.85%), T_7 (23.33%) and T_8 (23.36%) at initial; and with T_3 (23.03%), T_4 (22.93%), T_7 (23.26%) and T_8 (23.30%) at 2 months after storage. Nevertheless, T_{10} at 4 and 6 MAS contained significantly minimum non-reducing sugar over the remaining treatments.

4.3.5 pH

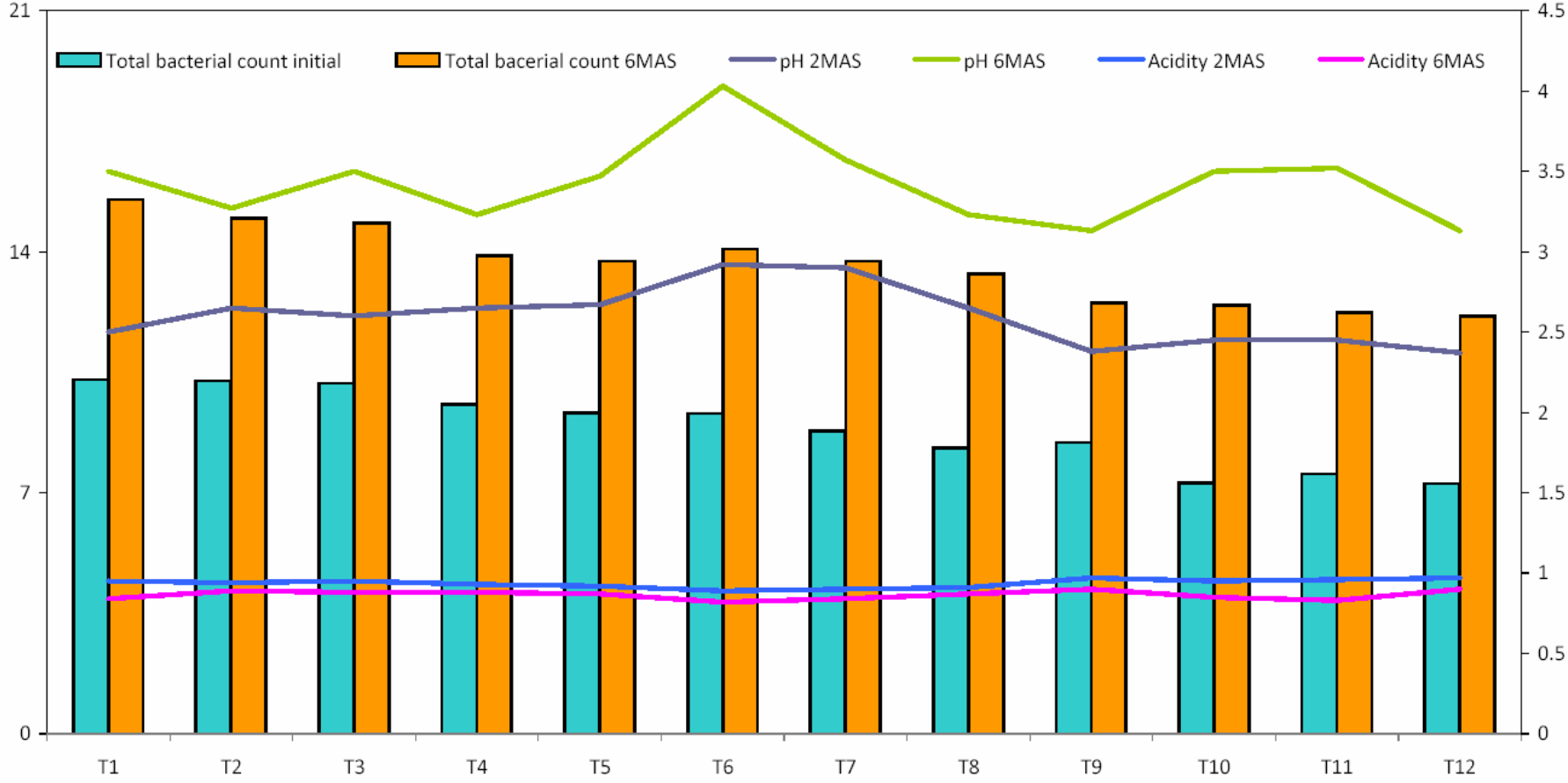
Mean values for pH indicate an increasing trend their level with increase storage period (Table 21) and depicted in Fig.4. The maximum pH was observed in treatment T_6 (2.92, 3.47, 4.03 respectively) at 2, 4 and 6 months after storage. It differed significantly over all the remaining treatments except T_7 at 2 MAS, but 4 and 6 MAS the pH of T_6 was significantly more than any other treatment in the study.

Minimum pH was associated with the treatment T_{12} (2.37, 2.30 and 3.13, respectively) followed by T_9. The treatment T_{12} did not show significant differences with T_9 at 2 and 6 months after storage, but it differed statistically with all the treatments at 4 MAS.

Table 21: Effect of treatments and storage period on pH and titratable acidity of aloe vera based mixed squash

Treatments	pH				Titratable acidity (%)			
	Initial	**2MAS**	**4MAS**	**6MAS**	**Initial**	**2MAS**	**4MAS**	**6MAS**
T_1- Aloe juice 20% + Amla 10%	2.37	2.50	2.70	3.50		0.95	0.91	0.84
T_2- Aloe juice 25% + Amla 10%	2.40	2.65	2.94	3.27		0.94	0.91	0.89
T_3- Aloe juice 20% + Kokum 5%	2.43	2.60	2.60	3.50		0.95	0.90	0.88
T_4- Aloe juice 25% + Kokum 5%	2.50	2.65	2.85	3.23		0.93	0.90	0.88
T_5- Aloe juice 20% + Amla 5% + Kokum10%	2.53	2.67	2.91	3.47		0.92	0.89	0.87
T_6- Aloe juice 25% + Amla 5% + Kokum10%	2.43	2.92	3.47	4.03	1.00	0.89	0.86	0.82
T_7- Aloe juice 20% + Amla 10% + Kokum5%	2.34	2.90	3.13	3.57		0.90	0.88	0.84
T_8- Aloe juice 25% + Amla 10% + Kokum5%	2.40	2.65	2.65	3.23		0.91	0.90	0.87
T_9- Aloe juice 20% + Amla 10% + Kokum 5% + Ginger1.5%	2.57	2.38	2.56	3.13		0.97	0.92	0.90
T_{10}-Aloe juice 25% + Amla 5% + Kokum 10% + Ginger1.5%	2.57	2.45	2.85	3.50		0.95	0.91	0.85
T_{11}-Aloe juice 20% + Amla 5% + Kokum 10%+ Ginger1.5%	2.40	2.45	2.65	3.52		0.96	0.90	0.83
T_{12}-Aloe juice 25% +Amla 10% + Kokum 5% + Ginger1.5%	2.45	2.37	2.38	3.13		0.97	0.92	0.90
Mean	**2.45**	**2.60**	**2.85**	**3.42**	**1.00**	**0.94**	**0.90**	**0.86**
S. Em±	0.053	0.002	0.015	0.027		0.011	0.007	0.012
C.D. at 1%	0.209	0.010	0.061	0.110		0.046	0.030	0.047

MAS = Months after storage



T_1- 20 % Aloe juice + 10 % Amla,
T_2- 25 % Aloe juice + 10 % Amla,
T_3- 20% Aloe juice + 5 % Kokum
T_4- 25% Aloe juice+ 5 % Kokum,
T_5- 20% Aloe juice + 5 % Amla+ 10% Kokum,
T_6- 25% Aloe juice + 5 % Amla+ 10 % Kokum

T_7- 20 % Aloe juice + 10% Amla + 5 % Kokum
T_8- 25 % Aloe juice + 10 % Amla + 5 % Kokum
T_9- 20 % Aloe juice + 10% Amla + 5 % Kokum + 1.5 % Ginger
T_{10}- 25 % Aloe juice + 5% Amla + 10% Kokum + 1.5 % Ginger
T_{11}- 20 % Aloe juice + 5% Amla + 10 % Kokum + 1.5 % Ginger
T_{12}- 25 % Aloe juice + 10% Amla + 5 % Kokum + 1.5 % Ginger

Fig. 4: Effect of different treatments on changes in pH, acidity and total bacterial count in fresh and six months stored aloe based mixed squash

4.3.6 Titratable acidity (%)

The titratable acidity content (expressed in terms of citric acid) of the fresh aloe based mixed squash was initially adjusted to 1 per cent in all the treatments. The titratable acidity of aloe based mixed squash decreased as the storage period increased (Table 21) and depicted in Fig. 4.

At 2, 4 and 6 months after storage, significantly maximum and similar titratable acidity content (0.97%, 0.97% and 0.90%) was observed in the treatment T_9 and T_{12} at 2, 4 and 6 months after storage. These two high acidity containing treatments (T_9 and T_{12}) were on par with all other treatments except T_6 (0.89%), T_7 (0.90%) and T_8 (0.91%) at 2 MAS; except T_6 (0.86%) and T_7 (0.88%) at 4 MAS; and except T_6 (0.82%), T_7 (0.84%) and T_{11} (0.83%) at 6 MAS.

The least titratable acidity value observed in the treatment T_6 (0.89%, 0.86% and 0.82% respectively) at 2, 4 and 6 months after storage was found to have significant differences with other treatments except T_4 (0.93%), T_5 (0.92%), T_7 (0.90%) and T8 (0.91%) at 2 months; except T_6 (0.89%) and T_8 (0.88%) at 4 months; and except T_8 (0.84%) at 6 months after storage.

4.3.7 Sugar : acid ratio

The data on sugar: acid ratio of the aloe based mixed squash as influenced by treatments and storage periods are presented in Table 22 and depicted in Fig. 6.

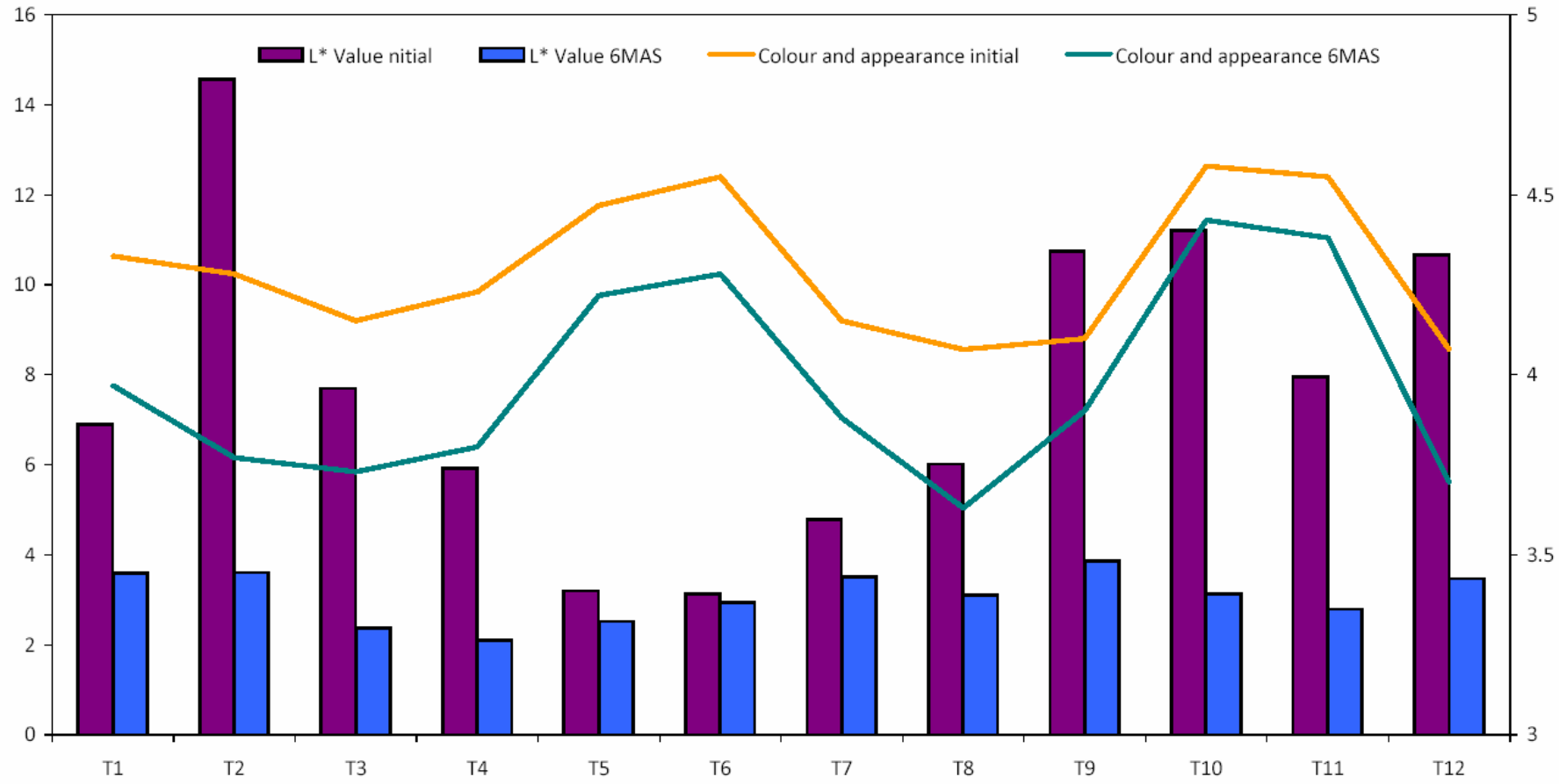
The result of this parameter revealed that, there was highly significant difference among the treatments and between the different stages of storage period. In fresh aloe vera squash the significantly maximum sugar: acid ratio (35.48) was observed in T_{10} (25% Aloe juice + 5% Amla + 10% Kokum + 1.5% Ginger) and it was on par with T_5 (33.70), T_6 (33.73), T_9 (35.52) T_{11} (34.36) and T_{12} (34.37). The minimum was recorded in T_1 (31.43), and it was on parity with T_2 (31.55), T_3 (32.20) and T_4 (32.21).

At 2, 4 and 6 months after storage, the significantly maximum sugar: acid ratio was observed in T_{10} (37.93, 40.05 and 43.56, respectively) , and it was on par with T_5 (35.84), T_6 (37.07), T_9 (37.71) and T_{12} (37.04) at 2 months after storage and

Table 22: Effect of treatments and storage period on sugar: acid ratio and ascorbic acid of aloe vera based mixed squash

Treatments	Sugar : acid ratio				Ascorbic acid (mg/100ml)			
	Initial	2MAS	4MAS	6MAS	Initial	2MAS	4MAS	6MAS
T_1- Aloe juice 20% + Amla 10%	31.43	33.17	35.02	35.41	574.05	561.00	556.73	546.00
T_2- Aloe juice 25% + Amla 10%	31.55	33.95	35.52	36.85	576.00	564.00	560.10	552.00
T_3- Aloe juice 20% + Kokum 5%	32.20	33.52	35.68	36.85	540.22	528.00	524.00	518.00
T_4- Aloe juice 25% + Kokum 5%	32.21	33.92	35.57	37.76	542.13	533.07	526.10	520.00
T_5- Aloe juice 20% + Amla 5% + Kokum10%	33.70	35.84	37.23	39.31	624.23	608.00	589.03	576.00
T_6- Aloe juice 25% + Amla 5% + Kokum10%	33.73	37.07	39.53	41.58	626.75	604.00	586.07	568.00
T_7- Aloe juice 20% + Amla 10% + Kokum5%	32.94	36.10	37.82	39.79	621.55	593.00	576.13	572.00
T_8- Aloe juice 25% + Amla 10% + Kokum5%	32.07	36.45	35.30	38.85	632.63	615.00	611.13	608.00
T_9- Aloe juice 20% + Amla 10% + Kokum 5% + Ginger1.5%	35.20	37.71	39.02	41.05	656.23	642.20	635.13	628.00
T_{10}-Aloe juice 25% + Amla 5% + Kokum 10% + Ginger1.5%	35.48	37.93	40.05	43.56	636.13	619.07	615.67	589.07
T_{11}-Aloe juice 20% + Amla 5% + Kokum 10%+ Ginger1.5%	34.36	35.73	39.63	43.05	638.29	621.00	617.67	610.48
T_{12}-Aloe juice 25% +Amla 10% + Kokum 5% + Ginger1.5%	34.37	37.04	39.50	41.38	664.36	656.00	646.00	632.00
Mean	**33.27**	**35.70**	**37.49**	**39.62**	**611.05**	**595.36**	**586.98**	**576.63**
S. Em±	0.548	0.559	0.575	0.574	0.853	0.694	0.857	0.975
C.D. at 1%	2.169	2.212	2.274	2.272	3.371	2.747	3.399	3.850

MAS = Months after storage



T_1- 20 % Aloe juice + 10 % Amla,
T_2- 25 % Aloe juice + 10 % Amla,
T_3- 20% Aloe juice + 5 % Kokum
T_4- 25% Aloe juice+ 5 % Kokum,
T_5- 20% Aloe juice + 5 % Amla+ 10% Kokum,
T_6- 25% Aloe juice + 5 % Amla+ 10 % Kokum

T_7- 20 % Aloe juice + 10% Amla + 5 % Kokum
T_8- 25 % Aloe juice + 10 % Amla + 5 % Kokum
T_9- 20 % Aloe juice + 10% Amla + 5 % Kokum + 1.5 % Ginger
T_{10}- 25 % Aloe juice + 5% Amla + 10% Kokum + 1.5 % Ginger
T_{11}- 20 % Aloe juice + 5% Amla + 10 % Kokum + 1.5 % Ginger
T_{12}- 25 % Aloe juice + 10% Amla + 5 % Kokum + 1.5 % Ginger

Fig. 5: Effect of different treatments on changes in colour value (L*) and sensory colour and appearance in fresh and six months stored aloe based mixed sqash

T_7 (37.82), T_9 (39.02) and T_{11} (39.63) and T_{12} (39.50) at 4 months after storage, and T_6 (41.58) and T_{12} (41.38) at 6 months after storage.

The minimum sugar: acid ratio was observed in T_1 (33.17, 35.02 and 35.41 respectively) which containing 20% Aloe juice + 10% Amla, and it was on par with T_2 (33.95), T_3 (33.52) and T_4 (33.52) at 2 months, and T_2 (35.52), T_3 (35.68) and T_4 (35.57) at 4 months, and T_2 (36.85) and T_3 (36.85) at 6 months after storage.

4.3.8 Ascorbic acid (mg/100ml)

The data pertaining to the ascorbic acid of aloe based mixed squash as influenced by treatments and storage period are presented in Table 22. The mean ascorbic acid content over the different periods of observation indicates that the constituent gradually decreased with the increase in storage period. The treatments differed significantly among themselves at different periods of storage.

In fresh aloe based mixed squash, significantly maximum ascorbic acid content (664.36 mg/100ml) was noticed in treatment T_{12} (25% Aloe juice + 10% Amla + 5% Kokum + 1.5% Ginger). The treatment T_{12} was followed by T_9 (656.23 mg/100ml), T_{11} 638.29 mg/100ml) and T_{10} (636.13 mg/100ml). A significantly minimum ascorbic acid content (540.22 mg/100ml) was observed in T_3 (20% Aloe juice + 5% Kokum) followed by T_4 (542.13 mg/100ml) which were on par with each other.

At 2, 4 and 6 months after storage, the significantly maximum ascorbic acid content was observed in T_{12} (656.00 mg, 646.00mg and 632 mg respectively). The treatment T_{12} was found to be non-significant with the treatment T_9 (628.00 mg/100ml) only at the end of storage. However, significantly minimum ascorbic acid content was present in T_3 (528mg, 524mg and 518mg respectively) at different intervals of observation (2, 4 and 6 months after storage). However, it was on par with T_4 (526.10 mg and 520 mg) at 4 and 6 months after storage.

4.3.9 Colour analysis

Colour of aloe vera based mixed squash was measured by colour meter in terms of L^*(luminosity), a^* (red-green) and b^* (blue- yellow) and the data is presented in Table 23 and Table 24 and depicted in Fig. 5.

Table 23: Effect of treatments and storage period on colour (*L *a) values of aloe vera based mixed squash**

Treatments	*L** Value				*a** Value			
	Initial	**2MAS**	**4MAS**	**6MAS**	**Initial**	**2MAS**	**4MAS**	**6MAS**
T_1- Aloe juice 20% + Amla 10%	6.89	4.32	3.62	3.59	-0.74	-0.95	-0.59	-0.57
T_2- Aloe juice 25% + Amla 10%	14.57	7.05	3.67	3.61	-0.85	-0.67	-0.48	-0.47
T_3- Aloe juice 20% + Kokum 5%	7.70	2.77	2.40	2.37	1.09	1.20	0.31	0.29
T_4- Aloe juice 25% + Kokum 5%	5.92	2.63	2.10	2.10	1.20	0.42	0.35	0.34
T_5- Aloe juice 20% + Amla 5% + Kokum10%	3.19	2.87	2.69	2.52	2.26	1.93	0.67	0.66
T_6- Aloe juice 25% + Amla 5% + Kokum10%	3.13	3.67	2.98	2.94	1.88	1.40	0.40	0.39
T_7- Aloe juice 20% + Amla 10% + Kokum5%	4.79	4.26	3.51	3.50	1.91	1.07	0.32	0.31
T_8- Aloe juice 25% + Amla 10% + Kokum5%	6.02	5.54	3.19	3.10	1.97	1.24	0.39	0.38
T_9- Aloe juice 20% + Amla 10% + Kokum 5% + Ginger1.5%	10.74	6.08	3.87	3.86	2.78	1.40	0.23	0.22
T_{10}-Aloe juice 25% + Amla 5% + Kokum 10% + Ginger1.5%	11.21	5.20	3.14	3.13	3.20	1.62	0.65	0.64
T_{11}-Aloe juice 20% + Amla 5% + Kokum 10%+ Ginger1.5%	7.96	5.16	2.80	2.79	3.41	2.23	0.89	0.88
T_{12}-Aloe juice 25% +Amla 10% + Kokum 5% + Ginger1.5%	10.66	5.05	3.58	3.47	2.50	1.02	0.31	0.30
Mean	**7.73**	**4.45**	**3.13**	**3.08**	**1.72**	**0.99**	**0.29**	**0.28**
S. Em±	0.186	0.065	0.269	0.229	0.0183	0.027	0.025	0.013
C.D. at 1%	0.739	0.257	1.067	0.906	0.0723	0.107	0.099	0.051

MAS = Months after storage ***L** = Light-Dark, *a** = Green- Red**

Table 24: Effect of treatments and storage period on colour (*b) values of aloe vera based mixed squash**

Treatments	*b** Value			
	Initial	**2MAS**	**4MAS**	**6MAS**
T_1- Aloe juice 20% + Amla 10%	1.39	1.40	1.41	1.42
T_2- Aloe juice 25% + Amla 10%	1.16	1.19	1.20	1.21
T_3- Aloe juice 20% + Kokum 5%	0.15	0.15	0.16	0.17
T_4- Aloe juice 25% + Kokum 5%	0.14	0.15	0.16	0.17
T_5- Aloe juice 20% + Amla 5% + Kokum10%	0.62	0.77	0.78	0.79
T_6- Aloe juice 25% + Amla 5% + Kokum10%	0.63	0.65	0.66	0.67
T_7- Aloe juice 20% + Amla 10% + Kokum5%	1.31	1.31	1.32	1.33
T_8- Aloe juice 25% + Amla 10% + Kokum5%	1.37	1.43	1.44	1.46
T_9- Aloe juice 20% + Amla 10% + Kokum 5% + Ginger1.5%	1.42	1.47	1.48	1.49
T_{10}-Aloe juice 25% + Amla 5% + Kokum 10%+Ginger1.5%	1.01	1.03	1.04	1.05
T_{11}-Aloe juice 20% + Amla 5% + Kokum 10%+Ginger1.5%	0.82	0.87	0.88	0.89
T_{12}-Aloe juice 25% +Amla 10% + Kokum 5% + Ginger1.5%	1.45	1.48	1.49	1.50
Mean	**0.91**	**0.99**	**1.00**	**1.01**
S.Em±	0.030	0.012	0.014	0.019
C.D.at 1%	0.121	0.050	0.055	0.078

MAS = Months after storage ***b** = Blue- Yellow**

In fresh aloe based mixed squash, the significantly maximum *L** was observed in treatment T_2 (14.57) followed by T_9 (10.74), T_{10} (11.21) and T_{12} (10.66). The minimum *L** value was observed in T_6 (3.13) and it was on par with T5 (3.19).

After 2 months of storage, the maximum *L** value was observed in T_2 (7.05); at 4 and 6 months after storage, the maximum *L** value was observed in T_9 (3.87 and 3.86, respectively). After 4 month storage, T_9 was on par with all most all the treatments except T_3, T_4 and T_5. Treatment T_9 was at parity with T_1 (3.59), T_2 (3.61), T_7 (3.50), T_8 (3.10), T_{10} (3.13) and T_{12} (3.47) at 6 MAS. The minimum *L** value was observed in T_4 (2.63, 2.10 and 2.10, respectively) at 2, 4 and 6 months after storage. Treatments T_3 (2.77, 2.40 and 2.37) and T_5 (2.87, 2.69 and 2.52) were statistically similar to T_4 at 2, 4 and 6 MAS.

In fresh aloe based mixed squash, the significantly maximum *a** value was observed in treatment T_{11} (3.41), followed by T_{10} (3.20) and T_9 (2.78) indicating more redness of the sample. The minimum *a** value was observed in treatment T_2 (-0.85), followed by T_1 (-0.74) signifying greenness (less red) in the samples.

The significantly maximum *a** value was observed in treatment T_{11} (2.23, 0.89 and 0.88 respectively), followed by T_{10} (1.62, 0.65 and 0.64, respectively) after 2, 4 and 6 MAS. However, significantly minimum *a** value was observed in treatment T_1 (-0.95, -0.59 and -0.57, respectively), followed by T_2.

Significantly higher *b** value was observed in treatment T_{12} (25 per cent aloe juice + 10 per cent amla + 5 per cent kokum + 1.5 per cent ginger) (1.45, 1.48, 1.49 and 1.50, respectively) at 0, 2, 4 and 6 MAS. It was on parity with T_1 (1.39), T_8 (1.37) and T_9 (1.42) at initial, and T_8 (1.43) and T_9 (1.47) at 2 months, and T_8 (1.44) and T_9 (1.48) at 4 MAS, and T_1 (1.42), T_8 (1.46) and T_9 (1.49) at 6 months after storage. However, the minimum *b** value was observed in treatment T_4 (0.14, 0.15, 0.16 and 0.17, respectively) at 0, 2, 4 and 6 months after storage, and it was on par with T_3 (0.15, 0.15, 0.16 and 0.17, respectively).

4.3.10 Organoleptic evaluation

Organoleptic evaluation of aloe based mixed squash was carried out by a penal of judges at the all stages of storage periods. Each treatment was evaluated for

colour and appearance, taste and flavour, mouthfeel and overall acceptability on a 5 point scale.

4.3.10.1 Colour and appearance (score out of 5.00)

Colour and appearance of aloe based mixed squash as influenced by treatments and storage period are presented in Table 25 and depicted in Fig. 5.

In fresh aloe vera based blended squash, there were no-significant differences observed among the treatments. The score with respect to colour and appearance was recorded to be the highest (4.58) in treatment T_{10} (25% Aloe juice + 5% Amla + 10% Kokum + 1.5% Ginger). The minimum and same score (4.07) for colour and appearance was observed in T_8 and T_{12}.

The treatment T_{10} scored significantly maximum (4.55, 4.52 and 4.43 respectively) throughout the stored period when observed at the end of 2, 4 and 6 months of storage. The score of treatment T_{10} remained significantly higher over all other treatments where it was statistically on par with all the treatments except T_8, T_9 and T_{11} only at 4 MAS.

The minimum and same score (4.03) was observed in T_8 and T_{12} at 2 months. The same treatment (T_8) obtained minimum score (3.95 and 3.63 respectively) at 4 and 6 months after storage followed by T_{12} (3.99 and 3.70 respectively) and it differed non-significantly with T_1, T_2, T_3, T_4, T_7, T_9 and T_{12} only at 4 months after storage.

4.3.10.2 Mouthfeel (score out of 5.00)

The perusal of data indicated the presence of significant differences only initially and 2 months after storage. The score for mouth feel of aloe vera based mixed squash indicate their decease linearly from 4.11 at initial stage to 3.90 at 6 months after storage (Table 25).

The significantly maximum score (4.50) was recorded in treatment T_9 (20% Aloe juice + 10%Amla + 5% Kokum + 1.5% Ginger), and it was on par with T_2 (4.33), T_7 (4.10), T_8 (4.15), T_{10} (4.30), T_{11} (4.30) and T_{12} (4.27). The least score observed in treatment T_1 (3.75) was of statistical similarity with T_3 (3.92), T_4 (3.90), T_5 (3.92), T_6 (3.92), T_7 (4.10) and T_8 (4.15).

Table 25: Effect of treatments and storage period on colour and appearance and mouthfeel of aloe vera based mixed squash

Treatments	Colour and appearances (score out of 5.00)				Mouth feel (out of 5.00)			
	Initial	**2MAS**	**4MAS**	**6MAS**	**Initial**	**2MAS**	**4MAS**	**6MAS**
T_1- Aloe juice 20% + Amla 10%	4.33	4.30	4.28	3.97	3.75	3.73	3.72	3.65
T_2- Aloe juice 25% + Amla 10%	4.28	4.22	4.18	3.77	4.33	4.30	4.17	3.98
T_3- Aloe juice 20% + Kokum 5%	4.15	4.13	4.12	3.73	3.92	3.83	3.72	3.65
T_4- Aloe juice 25% + Kokum 5%	4.23	4.22	4.20	3.80	3.90	3.92	3.88	3.48
T_5- Aloe juice 20% + Amla 5% + Kokum10%	4.47	4.42	4.38	4.22	3.92	3.90	3.85	3.80
T_6- Aloe juice 25% + Amla 5% + Kokum10%	4.55	4.52	4.50	4.28	3.92	3.90	3.82	3.75
T_7- Aloe juice 20% + Amla 10% + Kokum5%	4.15	4.13	4.12	3.88	4.10	4.00	4.07	4.00
T_8- Aloe juice 25% + Amla 10% + Kokum5%	4.07	4.03	3.95	3.63	4.15	4.10	3.83	3.73
T_9- Aloe juice 20% + Amla 10% + Kokum 5% + Ginger1.5%	4.10	4.08	4.05	3.90	4.50	4.48	4.42	4.25
T_{10}-Aloe juice 25% + Amla 5% + Kokum 10% + Ginger1.5%	4.58	4.55	4.52	4.43	4.30	4.27	4.25	4.22
T_{11}-Aloe juice 20% + Amla 5% + Kokum 10%+ Ginger1.5%	4.55	4.52	4.50	4.38	4.30	4.25	4.20	4.15
T_{12}-Aloe juice 25% +Amla 10% + Kokum 5% + Ginger1.5%	4.07	4.03	3.99	3.70	4.27	4.25	4.23	4.17
Mean	**4.29**	**4.26**	**4.23**	**3.98**	**4.11**	**4.08**	**4.01**	**3.90**
S. Em±	0.180	0.150	0.103	0.207	0.127	0.121	0.178	0.234
C.D. at 1%	NS	NS	NS	NS	NS	NS	NS	NS

MAS = Months after storage

At 2, 4 and 6 months after storage, the maximum score for mouthfeel was observed in T_9 (4.48, 4.42 and 4.25, respectively) and it was on par with T_2 (4.30), T_7 (4.00), T_8 (4.10), T_{10} (4.27), T_{11} (4.25) and T_{12} (4.25) at 2 months after storage. However, there were no significant differences noticed at 4 and 6 months after storage. The minimum score was recorded in T_1 (3.73, 3.72 and 3.65, respectively) throughout the storage period (2, 4 and 6 MAS).

4.3.10.3 Taste and flavour (score out of 5.00)

The score for taste and flavour of aloe based mixed squash indicates their decrease linearly from 4.07 at initial stage to 3.89 at 6 months after storage (Table 26) and depicted in Fig. 6. There appeared no significant differences among the treatments at different storage periods.

In fresh squash as well at 2, 4 and 6 months after storage, the treatment T_{10} (25% Aloe juice + 5% Amla + 10% Kokum + 1.5% Ginger) recorded maximum score (4.33, 4.30, 4.28 and 4.25 respectively) followed by T_{11} (4.27, 4.25, 4.22 and 4.17, respectively) and T_9 (4.25, 4.20, 4.17 and 4.15, respectively). The lowest score was observed in T_1 (3.87, 3.75, 3.67 and 3.63 respectively) at 0, 2, 4 and 6 months after storage of aloe based mixed squash.

4.3.10.4 Overall acceptability (score out of 5.00)

The result for overall acceptability of aloe vera blended squash exhibited non-significant differences among the treatments initially and during different intervals of observation (Table26).

The mean for overall acceptability showed decrease in score (4.12 to 3.96) with advancement in storage period. In fresh squash as well as in squash after storing for 2, 4 and 6 months, the maximum overall acceptability was recorded in T_{10} (4.42, 4.32, 4.28 and 4.23 respectively) followed by T_{11} (4.23, 4.22, 4.20 and 4.18 respectively) and T_9 (4.18, 4.12, 4.08 and 4.02 respectively). The lowest score was adjudged in the treatment T_1 (3.90, 3.72, 3.70 and 3.68 respectively) throughout the investigation.

Table 26: Effect of treatments and storage period on taste and flavour and overall acceptability of aloe vera based mixed squash

Treatments	Taste and flavour (score out of 5.00)				Overall acceptability (score out of 5.00)			
	Initial	**2MAS**	**4MAS**	**6MAS**	**Initial**	**2MAS**	**4MAS**	**6MAS**
T_1- Aloe juice 20% + Amla 10%	3.87	3.75	3.67	3.63	3.90	3.72	3.70	3.68
T_2- Aloe juice 25% + Amla 10%	4.13	4.10	4.08	3.98	4.15	4.08	3.93	3.82
T_3- Aloe juice 20% + Kokum 5%	3.92	3.83	3.75	3.72	4.02	3.90	3.85	3.83
T_4- Aloe juice 25% + Kokum 5%	3.93	3.85	3.75	3.70	4.00	3.98	3.95	3.95
T_5- Aloe juice 20% + Amla 5% + Kokum10%	3.88	3.80	3.75	3.65	4.09	4.00	3.98	3.97
T_6- Aloe juice 25% + Amla 5% + Kokum10%	4.00	3.88	3.85	3.83	4.21	4.18	4.12	4.10
T_7- Aloe juice 20% + Amla 10% + Kokum5%	4.03	3.92	3.88	3.85	4.03	4.00	3.95	3.88
T_8- Aloe juice 25% + Amla 10% + Kokum5%	4.08	3.97	3.92	3.87	4.02	3.98	3.93	3.92
T_9- Aloe juice 20% + Amla 10% + Kokum 5% + Ginger1.5%	4.25	4.20	4.17	4.15	4.18	4.12	4.08	4.02
T_{10}-Aloe juice 25% + Amla 5% + Kokum 10% + Ginger1.5%	4.33	4.30	4.28	4.25	4.42	4.32	4.28	4.23
T_{11}-Aloe juice 20% + Amla 5% + Kokum 10%+ Ginger1.5%	4.27	4.25	4.22	4.17	4.23	4.22	4.20	4.18
T_{12}-Aloe juice 25% +Amla 10% + Kokum 5% + Ginger1.5%	4.10	4.08	3.92	3.87	4.17	4.15	3.92	3.90
Mean	**4.07**	**3.99**	**3.94**	**3.89**	**4.12**	**4.05**	**3.99**	**3.96**
S. Em±	0.128	0.143	0.129	0.186	0.123	0.161	0.137	0.171
C.D. at 1%	NS	NS	NS	NS	NS	NS	NS	NS

MAS = Months after storage

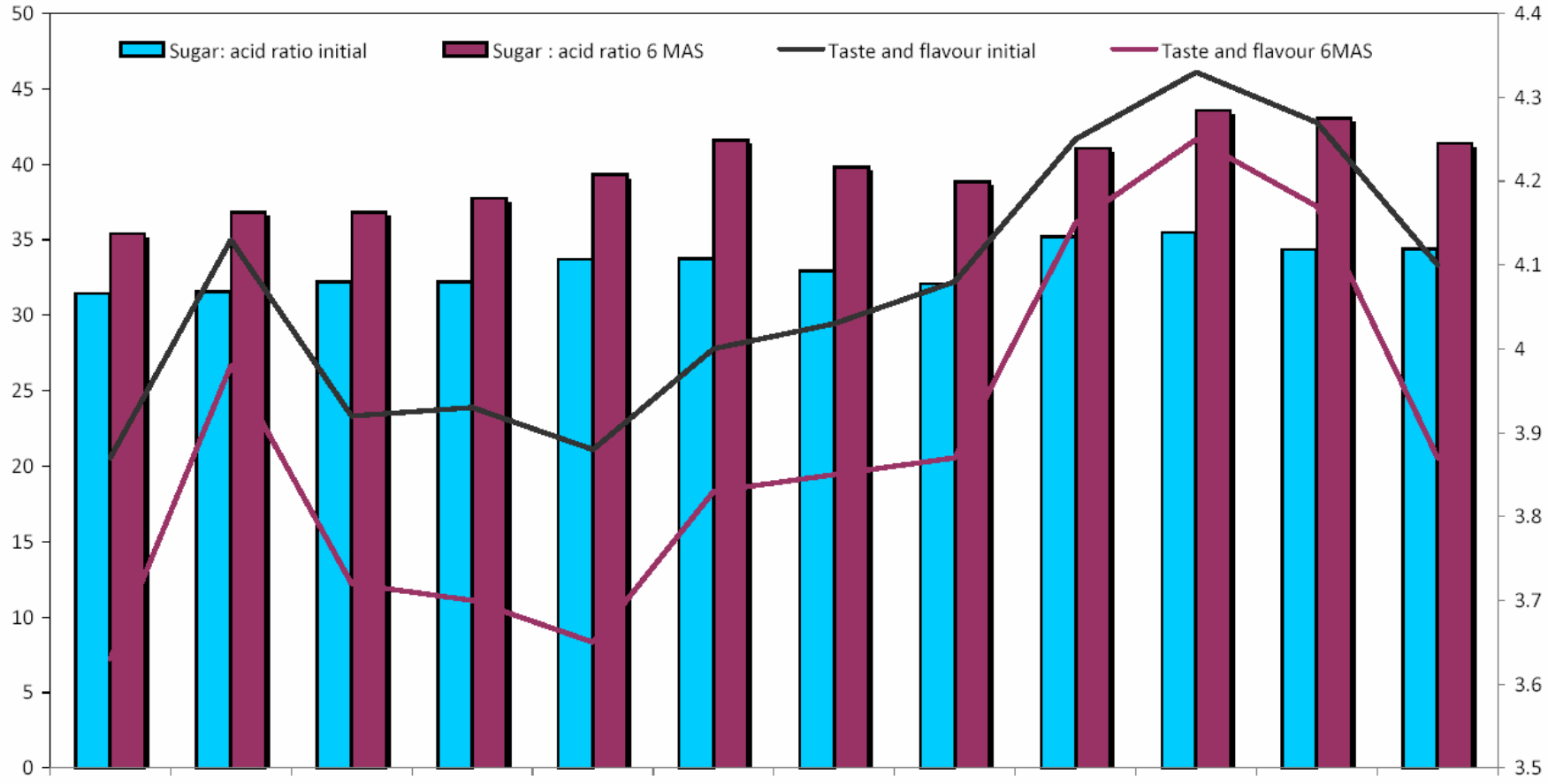


Fig. 6: Effect of different treatments on changes in sugar: acid ratio and taste and flavour in fresh and six months stored aloe based mixed squash

4.3.11 Polysaccharides (mg/100ml)

Polysaccharide content of aloe based mixed squash showed the significant variations (Table 27).

Significantly maximum polysaccharide content (28.75 mg/100ml) was noted in treatment T_{12} (25% Aloe juice + 10% Amla + 5% Kokum + 1.5% Ginger) and it was on par with T_9 (28.63 mg)/100 ml), T_{10} (28.21 mg/100 ml) and T_{11} (28.10 mg/100 ml) in squash blend when it was afresh. However, significantly minimum polysaccharide level was found to exist in T_1 (24.16 mg/100ml).

At the end of six months of storage, the highest polysaccharide was observed in T_{12} (28.65 mg/100ml) followed by T_9 (28.58 mg) and T_{10} (21.16 mg/100ml). The treatments T_9, T_{10} and T_{12} were found to be statistically at parity among each other. However, the minimum polysaccharide content observed inT_1 (24.14 mg /100ml) was significantly different from rest of the treatments.

4.3.12 Microbial analysis (CFU/ml)

The perusal of data presented in Table 27 and depicted in Fig. 1.indicates that microbial load of aloe vera squash varied significantly among the treatments as influenced by treatments and storage period. As evident from the mean values, microbial population showed an increasing trend in aloe squash from fresh (7.59 CFU /ml) to (13.62 CFU/ml) at 6 months after storage.

Significantly minimum microbial load was noticed in T_{12} (25% Aloe juice + 10% Amla + 5% Kokum + 1.5% Ginger) with colonies of 6.18 CFU/ml, 7.27 CFU/ml, 9.32 CFU/ml and 12.13 CFU/ml respectively at initial, 2, 4 and 6 months after storage, followed by T_{10} and T_{11}. However, it was on par with T_{10} (6.31 CFU/ml) in the fresh squash; with T_{10} (7.28 CFU/ml) and T_{11} (7.54 CFU/ml) at2 months; with T_{10} (9.57 CFU/ml) and T_{11} (9.36 CFU/ml) at 4 months; and only with T_{11} (12.24 CFU/ml) at 6 months after storage. However, the maximum microbial population was observed in T_1 (9.20 CFU/ml, 10.29 CFU/ml, 12.40 CFU/ml and 15.51 CFU/ml respectively) at all the periods of observation. However, T_1 was found to be at parity with T_2 (10.25 CFU/ml) and T_3 (10.18 CFU/ml) at 2 months; with T_2 (12.38 CFU/ml), T_3 (12.15 CFU/ml) and T_6 (12.17 CFU/ml) at 4 months after storage.

Table 27: Effect of treatments and storage period on polysaccharides and total bacterial count of aloe vera based mixed squash

Treatments	Polysaccharides (mg/100ml)		Total bacterial count (CFU/ml)			
	Initial	6MAS	Initial	2MAS	4MAS	6MAS
T_1- Aloe juice 20% + Amla 10%	24.16	24.14	9.20	10.29	12.40	15.52
T_2- Aloe juice 25% + Amla 10%	26.20	26.18	8.87	10.25	12.38	14.96
T_3- Aloe juice 20% + Kokum 5%	25.19	25.12	8.25	10.18	12.15	14.84
T_4- Aloe juice 25% + Kokum 5%	26.12	26.08	8.24	9.56	11.48	13.88
T_5- Aloe juice 20% + Amla 5% + Kokum10%	26.15	26.11	7.30	9.32	11.34	13.73
T_6- Aloe juice 25% + Amla 5% + Kokum10%	27.00	26.93	7.49	9.30	12.17	14.08
T_7- Aloe juice 20% + Amla 10% + Kokum5%	26.15	26.13	7.56	8.78	10.92	13.73
T_8- Aloe juice 25% + Amla 10% + Kokum5%	27.10	27.07	7.61	8.30	10.34	13.35
T_9- Aloe juice 20% + Amla 10% + Kokum 5% + Ginger1.5%	28.63	28.58	7.23	8.46	10.40	12.52
T_{10}-Aloe juice 25% + Amla 5% + Kokum 10%+Ginger1.5%	28.21	28.16	6.31	7.28	9.57	12.45
T_{11}-Aloe juice 20% + Amla 5% + Kokum 10%+Ginger1.5%	28.10	28.06	6.84	7.54	9.36	12.24
T_{12}-Aloe juice 25% +Amla 10% + Kokum 5% + Ginger1.5%	28.75	28.65	6.18	7.27	9.32	12.13
Mean	**26.81**	**26.77**	**7.59**	**8.88**	**10.99**	**13.62**
S .Em±	0.158	0.141	0.099	0.119	0.098	0.089
C. D. At 1%	0.626	0.558	0.227	0.273	0.225	0.203

MAS = Months after storage

5. DISCUSSION

Aloe vera is highly nutritive and has unique medicinal properties because it contains a range of biologically active compounds viz., acetylated mannans, polymannans, anthraquinone, and various vitamins, minerals, amino acids, sugars and sterols. The aloe vera juice is called 'nature's tonic because of its biologically active compounds and their unique medicinal properties. Hence, the leaf of the pulp (aloe vera juice) may be utilized for processing in to several value added products and for making ayurvedic medicines. However, fresh aloe vera leaves are bitter in taste and unsuitable or unfit for direct consumption.

It is evident from reviewed literature that little attention has been given to develop the processing technologies for aloe vera leaves for edible products. Based on the available technology for other fruits, few products such as fruit juice, ready-to-serve beverage, squashe, nectar and other soft drinks can be tried for the domestic as well as international markets. Further, sincere efforts are needed to standardize the processing techniques and aloe vera has bitter taste which can be unpleasant in raw state and its palatability could be enhanced with addition of some other fruit juices and to evaluate the consumer acceptance and economic viability for commercialization of aloe vera based products. Out of the several products that can be prepared from a fruit, juice based beverages are more popular in India as well as in the world (Chakraborthy *et al.,* 1993). Therefore, the present investigation was carried out to study the preparation and preservation of flavoured aloe ready-to-serve (RTS) beverage, aloe based flavoured squash and aloe based mixed squash. The results obtained in the study are discussed hereunder.

5.1 Preparation and preservation of flavoured aloe RTS beverage

In case of processed products, yield is not the one and only criteria for evaluating the efficiency of a treatment. Quality of a product is of prime importance as it is directly related to the consumer acceptability in the commerce. The chemical composition determines the quality of a product. Therefore, the RTS beverage developed from aloe vera blend with natural flavours in the present investigation was analysed for physico-chemical composition.

In the present study, various physico- chemical parameters of the aloe vera RTS were found to be influenced by different treatments involved. It has been reported that the compositional and nutritional quality is influenced by the different procedures adopted in processing (Jain and Broker, 1970 in guava juice; Pruthi, 1971 in grape juice). Several changes in the biochemical constituents of the preserved products during storage have been reported by several workers (Jain *et al.,* 1984; Tripathi, *et al.,* 1988; Paull, 1979; Surendra singh, 2005; Mubeen, *et al.,* 2008; Kalpana, *et al*., 2008; Imtiaz *et al,* 2011).

5.1.1 TSS, sugars, polysaccharides

Retention or minimum increase in total soluble solids content of juice during storage is desirable for the preservation of good quality juice. The total soluble solids content in the juice increased apparently during storage, which might be due to hydrolysis of polysaccharides in to simple sugars and also inversion of added sucrose into simpler soluble substances in the preparation time.

In the fresh aloe RTS beverage, initially TSS was adjusted to 15º Brix in all the treatments. As the storage period advanced, the level of TSS increased. This may be attributed to the conversion of acids and polysaccharides in to sugars. Increase in the concentration of juice due to dehydration may also answer an increase in the TSS of RTS beverage. 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, 2008). The treatment T_2 (aloe juice 15 per cent + TSS 15ºBrix + 1.00 per cent pepper mint) recorded highest TSS of 15.77ºB, 16.03ºB and 16.23ºB respectively, at 2, 4, 6 months after storage. The minimum TSS of 15.30ºB, 15.45ºB and 15.60ºB was recorded in the treatment T_4 (Aloe juice 15 per cent +TSS 15ºBrix + 1 per cent lime juice) at 2, 4 and 6 months after storage. There were no significant differences among the treatments at each interval of observation in the current study. Nevertheless, an increase in TSS was noticed in all the treatments with the progress in storage period. Similar result of increase in the level of sugars during storage have been reported by Ahmed *et al.*(1986), Tripathi *et al*. (1988), Ramajayam and Jaganath (2001), Sarolia and Mukharjee (2002), Kanna *et al.* (2004), in jamun fruit products, Saravanan *et al*. (2004) in papaya beverage, Bharadwaj and Mukherjee (2011) in kinnow RTS blend, Vijayalakshmi (2012) in aloe blended RTS beverage.

Concomitant with the change in TSS, sugar content of RTS beverages increased during the storage period. Both total sugars and reducing increased significantly, whereas non-reducing decreased. Total and reducing varied in the same way as TSS in the RTS treatments for the similar reason. The findings of the present study are well supported by Roy *et al*. (1972), Attri *et al*. (1998), Tiwari (2000), Deka (2000), Agrahari and Khurdiya (2003), Vijayalakshmi (2012) who also noticed an increase in sugar content of beverages during storage. Significantly highest total sugars content of 7.47 per cent in the fresh aloe based RTS was recorded in T_2 (15% Aloe juice + 15º Brix TSS +1% pepper mint) and it was at parity with treatment T_1 (7.30%). The minimum total sugars content of (7.17%) was observed in treatment T_4 (15% Aloe juice + 15º Brix TSS + 1% lime) and it was on par with all other treatments except T_2. At the beginning, the treatment T_2 (Aloe juice 15 per cent +TSS 15 ºBrix + 1 per cent pepper mint) recorded maximum reducing sugar content of 1.92 per cent and the minimum was associated with the treatmentT_4 (1.70%). Retention of high titratable acidity in the treatment T_4 (with 1% lime juice) might answer for lower level of total sugars in this treatment. Conversion of acids and polysaccharides in to sugars might have not occurred easily in the treatments containing lime juice (1%) and spice extracts (*jaljeera* and *chat-masala*) in comparison to other treatments. Similar type of behaviour in sugar level in blended RTS beverages has been reported by Bharadwaj and Pandey (2011), Bhardwaj and Khurdiya (2003), Tiwari (2000), Deka (2000) and Sandhu and Sindhu (1992).

On the contrary to total and reducing sugars, the level of non-reducing sugars in all the treatments decreased as function of storage time. The non-reducing were found to occur in significantly highest amount (5.15%) in fresh aloe RTS which were later reduced to 5.14, 5.12 and 5.10 per cent after storing for two, four and six months respectively. This significant decrease in non-reducing sugars might be due to break down of non-reducing sugars (sucrose) in to reducing sugars due to reaction with acids (Sandi *et al.,* 2004; Singh, *et al.* 1997). The findings of the present study are well supported by Surender Singh *et al.,*2005); Mubeen *et al.* (2008), Madanlal *et al.* (2006); Saravanan *et al.* (2005); Saini *et al*. (2001) and Ruiz-Nieto *et al*. (1997), Vijayalakshmi (2012) who found that with increase in storage time non-reducing sugars decreased. The non-reducing sugars were found to be significantly highest in T_2 in fresh aloe RTS (5.27%) which reduced to 5.19 per cent after six months.

Significantly minimum non-reducing sugars of 5.06 per cent noted in treatment T5 in the fresh aloe RTS were reduced to 4.99% per cent at 6 months. These variations among the treatments owe to difference in the conversion of acids and polysaccharides to sugars caused various components of blends.

Non-reducing sugar was found occur in major proportion among the total sugars. The mean values for total and non-reducing sugars had a range from 7.25 per cent (initial) to 7.56 per cent (6 MAS) and 5.14 (initial) to 5.10 (6 MAS), respectively. It is attributed to the addition of sucrose which is a non-reducing sugar as a source of sweetness in the beverage. The amount of sugars present naturally in aloe vera juice is negligible.

5.1.2 Titratable acidity, pH and ascorbic acid

In the present investigation, the level of titratable acidity decreased from the initial value of 0.33 to 0.27 per cent at 6 MAS. Overall mean titratable acidity after 2, 4 and 6 months of storage was 0.32, 0.30 and 0.27 per cent, respectively. The decrease in the titratable acidity of the RTS in the present investigation was governed by both increase in total soluble solids as well as reducing sugars and total sugars. Inturn, it may be accounted for conversation of organic acids in to sugars. Similar results of decrease in titratable acidity have been reported by Ahmed *et al.* (1986); Ramajayam and Jaganath (2002); Sarolia and Mukharjee (2002); Kannan *et al.,* and Saravanan *et al.* (2004).

The significantly highest titratable acidity was seen in the treatment T_4 (15% aloe juice + TSS 15º Brix + 1 % lime juice) throughout the storage (Initial-0.37%, 2 MAS-0.36%, 4 MAS-0.34% and 6 MAS-0.33%). The lowest titratable acidity with significant difference was recorded with treatment T_1 at all the observation intervals (Initial-0.31%, 2 MAS-0.29%, 4 MAS-0.25% and 6 MAS-0.18%). The variation in acidity observed among the treatments could be attributed to the chemical interaction between the organic constituents of the juice induced by composition of juice blends. The decrease and variation in acidity during storage of various juice blends was also observed Nagi and Manjreker (1976) in apple cidar, Mehta and Rathore (1976); Jain *et al* (2003) in aonla juice, Tiwari (2000) also observed a slight decrease in the acidity of guava and papaya blended RTS during storage at room temperature. Nidhi *et al.* (2008), Kantharaja *et al*. (2011) in tamarind blended rose apple squash.

The pH of all the treatments increased with the increase in storage period. The increase in pH of aloe RTS varied from 3.41(fresh) to 3.58 (6 MAS). As it has already been discussed, titratable acidity decreased with the increase in storage period. The decrease in titratable acidity mirrored the increase in pH. This rise in pH and decrease in titratable acidity indicates that acid concentration in the juice declined with increase in storage period. In this study, treatment T_1 (15% Aole juice + 15ºBrix + 0.75per cent pepper mint juice) showed significantly maximum pH value throughout the storage period with 3.54 at the beginning to 3.73 at the end of 6 months of storage. On the other hand, treatment T_4 was observed to contain minimum pH value during the course of investigation (Initial-3.20, 2 MAS-3.27, 4 MAS-3.30 and 6 MAS-3.41). The increase in pH of RTS of these treatments could be attributed to decrease in acidity during their storage. The difference in pH of the treatments in the present study might be due to chemical reaction between organic constituents that affected the titratable acidity in RTS blends. Variation in pH of RTS beverage blends due to variation in composition and also increase in pH during storage has been reported by many workers Teotia *et al.* (1997), Deka (2000) in lime-aonla blended RTS, Ramajayam and Jaganath (2002); Sarolia and Mukharjee (2002); Kenghe *et al.* (2009) and Kantharaja *et al*. (2011) in tamarind blended rose apple squash. Vijayalaxmi (2012) in blended aloe squash.

Ascorbic acid is one of the major nutritional components; aloe vera juice ascorbic acid content is very negligible in quality. At the time of processing, ascorbic acid was added in the present study for the purpose of preventing browning in aloe juice, and to improve nutritional and antioxidant property of aloe based juice blends. In this experiment mean ascorbic acid content of aloe based RTS beverages was found to decrease from 77.86 mg/100 ml in the fresh RTS to 61.14 mg/100 ml at 6 MAS. 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. Most researchers agree that the ascorbic acid can be easily destroyed by heat and oxidation (Gowda and Ramanjaneya 1995; Pandey *et al.,* 1995; Jain *et al.,* 1996; Adsule and Roy 1975; Hemakar *et al.,* 2000; Dobhal, 2000 and Mandal, 2003).

Significantly maximum retention of ascorbic acid throughout the study period was observed in T_4 (15 % aloe juice + 15ºBrix TSS + 1 % lime juice) and it ranged

from 85.66 to 67.15 mg/100 ml. Conversely, the treatment T_1 (15 per cent aloe juice + 15º Brix TSS + 0.75 per cent pepper mint) showed significantly less ascorbic acid level with an initial value of 71.40 mg/100 ml to 54.54 mg/100 ml at the end of storage for 6 months. Catalytic activity of fructose in the catabolization of ascorbic acid has been emphasised by Mapson (1970) and hence a variation in the reducing sugar level among the treatments might have contributed to the difference in ascorbic acid retention by various treatments in the current study. Variation in ascorbic acid content in fresh and stored RTS beverage blends has been reported by by Kalra *et al.* (1991) in mango- papaya blended RTS, Tripathi *et al*. (1992) in pineapple-guava blended RTS, Deka (2000) in mango- pineapple blended RTS and Bhardwaj and Mukherjee (2005) in kinnow: aonla juice blended.

5.1.3 Colour analysis

Colour in food is usually due to the presence of natural pigments like anthocyanins, carotenoids or chlorophyll. The variation in the colour of a system varies with changes in concentration of some of the components that from the basis of coorimetric analysis. (Ludneava and Yankov, 1994) determined changes in furfural colour (*L*, a*, b** values) during storage of mixed nectars prepared from apple and citrus fruits.

The mean values of lightness (*L**) and yellowness (*b**) decreased with increasing storage period and whereas redness (*a*)* showed increasing trend in flavoured aole RTS. Significantly maximum *L** (lightness) value was observed in treatment T_1 (5.52, 4.82 , 2.89 and 2.69 respectively) at 0, 2, 4 and 6 months after storage, which containing 15 per cent aloe juice + 15ºBrix TSS + 0.75 per cent peppermint .Juice extracts of ginger, pepper mint and lime being natural, imparted attractive light colour to the product. However, minimum *L** value was observed in T_9 (3.04) at initial, T_{10} (2.25) at 2 MAS, T_9 (1.46) at 4 MAS, and T_{10} (1.20) at 6 months after storage. lower *L** value indicate the darkness.

Significantly maximum *a** value was observed in treatment T_{10} (0.64, 0.65, 0.68 and 0.70 respectively) at 0, 2, 4 and 6 months after storage, which containing 15 per cent aloe juice +15ºBrix TSS + 0.75 per cent *chat-masala*. Reason for maximum *a** vale observed in this treatments is its containing spice mixture like chilli powder, balck salt which impart the redness. In present study *a** values is increased with

Plate 2: Variation in colour of freshly prepared aloe vera ready to-serve beverage as influenced by treatments

T_1- 15 % Aloe juice + 0.75 % Pepper mint , T_2- 15 % Aloe juice + 1.00 % Peppermint, T_3- 15 % Aloe juice + 0.75 % Lime juice T_4- 15 % Aloe juice + 1.00 % Lime juice, T_5- 15 % Aloe juice + 0.50 % Ginger juice + T_6- 15 % Aloe juice + 0.75 % Ginger juice , T_7- 15 % Aloe juice + 0.50 % Jaljeera , T_8- 15 % Aloe juice + 0.75 % Jaljeera + T_9- 15 % Aloe juice + 0.50 % Chat-masala, T_{10}- 15 % Aloe juice + 0.75 % Chat-masala

Plate 3: Variation in colour of freshly prepared flavoured aloe vera squash as influenced by treatments

T_1- 30 % Aloe juice + 2.25 % Pepper mint , T_2- 30% Aloe juice + 3.00 % Peppermint, T_3- 30 % Aloe juice + 2.25 % Lime juice T_4- 30 % Aloe juice + 3.00 % Lime juice, T_5- 30% Aloe juice + 1.50 % Ginger juice + T_6- 30 % Aloe juice + 2.25 % Ginger juice , T_7- 30 % Aloe juice + 1.50% Jaljeera , T_8- 30 % Aloe juice + 2.25 % Jaljeera + T_9- 30% Aloe juice + 1.50 % Chat-masala, T_{10}- 30 % Aloe juice + 2.25 % Chat-masala

increasing storage period it might be a due to millard reaction was observed during storage.

Significantly maximum *b** value was observed in treatment T_1 (0.95) in freshly prepared RTS. However, minimum *b** value was observed in T_{10} (0.18). Highest value of *b** indicate that yellowness, contrary lowest means towards blue.

5.1.4 Organoleptic evaluation

Evaluation of sensory qualities of products is an important tool for deciding the consumer acceptability. A human element plays an important role in evaluation of orgaoleptic characters of a product. For any new product, the consumer acceptability needs be evaluated first at the laboratory level. Hence, in the present investigation, 5 semi–trained panellists comprising teachers and post graduate students of Kittur Rani Channamma College of Horticulture, Arabhavi were involved in the evaluation process.

Quality aspects of food products such as colour, flavour and nutritive value generally reduce with the increase in storage period. In the present study also, organoleptic score for colour and appearance, mouth-feel, taste and flavour, and overall acceptability of aloe based RTS beverages decreased in all the treatments as the storage time progressed. Similar decrease in sensory quality during storage of beverages has been reported by Rao *et al*. (1979), Harnanan *et al*. (1980), Barmanray *et al*. (1995) , Jain and Asati (2004),

In general, aloe juice blended with ginger, pepper mint and lime obtained higher score as compared that blended with *jajeera* and *chat-masala*. Juice extracts of ginger, pepper mint and lime being natural, imparted attractive light colour to the product, whereas *jajeera* and *chat-masala* with various spices powder, black salt, etc in their mixture imparted slightly brown colouration which might have decreased the acceptability score. However, there were no statistical differences among the treatments.

The treatment with 15 per cent aloe juice + 15º Brix TSS + 0.75 per cent (T6) scored better for all the four sensory parameters than the remaining treatments. On the other hand, the least score for all the organoleptic properties was received by T_{10} (Aloe juice 15 per cent + 15º Brix TSS + 0.75 per cent *chat-masala*) throughout

the period of investigation. The natural and familiar pleasing flavour induced by ginger at the proportion used in the beverage was more appreciated by the panellists than not so familiar mixture of chat-masala imparting a different taste and flavour. Reports of blending ginger with various juices resulting in higher orgnoleptic score was reported by Natha and Yadav (2002); Bhardwaj and Mukharjee (2005); Joshi *et al*. (1993); Gowda and Jalali (1995).

5.1.4 Changes is microbial (bacterial) population

The quality of the products may deteriorate during storage. It might be influenced by various treatments employed in the preparation of products and conditions of storage environment. The microbial population showed a slight increase in their number during the storage period of six months (Table 9). However, such marginal increase did not affect the wholesomeness of the products. Potassium sorbate, ascorbic acid and sodium benzoate were used for preservation of aloe based RTS beverage in the present study. Pasteurization of aloe RTS prior to filling in to bottles combined with addition of these chemical preservatives might have helped in controlling and limiting the bacterial population to a safe level (Giridharilal *et al.,* 1986), Majid *et al*. (2007). As evident from mean values, bacterial population exhibited an increasing trend in aloe based RTS from the beginning (1.44 CFU/ ml) to 6 months after storage (3.74 CFU/ml). Significantly minimum bacterial population was seen in T_6 (1.02 CFU/ml) in the fresh RTS and it did not differ significantly with treatments T_1 (1.71 CFU/ml), T_2 (1.20 CFU/ml) and T_5 (1.06 CFU/ml). Minimum microbial population was recorded when aloe juice was blended with juice extracts of ginger and mint. This might be due to the inhibitory effect these ingredients towards microorganisms. Similar beneficial effects of ginger and other spices on microbial inhibition has been reported by Ejechi *et al.* (1998); Attri *et al.* (1998); Deka (2000).

5.2 Preparation and preservation of aloe based flavoured squash

5.2.1 TSS, sugars and polysaccharides

The TSS of aloe vera squash recorded a slight increase in total soluble solids (Initial – 45^oB, at 6 MAS – 47.74^oB) with the advancement of storage period. This might be due to increase in total sugars caused by inversion of polysaccharides like starch and cellulose substances in the presence of organic acids into simpler soluble

molecules (Baramanray *et al.,* 1995) and also inversion of added sucrose into simpler soluble substance in the course of time. This indicates that during storage there was change in the pulp, juice extracts or other ingredients used in the product causing change in TSS. Similar results were observed by Palaniswamy and Muthukrishna (1974) in mango squash, Kannan and Thirumaran (2004) in jamun syrup, Surendra singh *et al.,*2005) in bael or blended bael ready to serve beverage, Madanlal Choudhary *et al*. (2006) in guava ready to serve beverage and Vijay Jain *et al.* (2006) in aonla squash.

The treatment T_2 (30% aloe juice + TSS 45º Brix + 3 % pepper mint) was found to have high total soluble solids, reducing sugars, total sugars and polysaccharides content initially as well as during storage (Table 10, 11 and 18). On the contrary, the treatment T_4 (30 % aloe juice + 45º Brix TSS+ 3 % lime juice) exhibited minimum value for all these parameters throughout the study period. However, the treatments had no significant differences for all these parameters. 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 varying rate of breakdown of polysaccharides like starch and cellulose substances into simpler soluble molecules in the presence of organic acids and also inversion of added sucrose into simpler soluble substances during the course of investigation.

Total soluble solids are a measure of total sugar content of products, thus the treatment with maximum sugar content was associated with maximum TSS. The increased levels of total sugars were probably due to conversion of starch and other polysaccharides into simple sugars. It is supported by Roy and Singh (1979) in squash and nectar prepared from bael fruits. Madanlal Choudhary *et al*. (2006) also reported the increase in reducing and total sugars corresponding to the increase in total soluble solids and ultimate decrease in non-reducing sugars, which might be due to hydrolysis of polysaccharides into reducing sugars, as increase in reducing sugars was correlated with decrease in non-reducing sugars.

In aloe based flavoured squash beverage there was considerable raise in reducing sugars and corresponding decline in non-reducing sugars. This could be due to inversion of non-reducing sugars to reducing sugars caused by acids present in

products. This view is corroborated by Jain *et al*. (1984) in orange, lemon and bael squash, Vijay Jain *et al*. (2006) in amla squash and Gajanana (2002) in amla juice. Increase in reducing and total sugars and decrease in non-reducing sugars during storage of aloe based squash in the present study is a general phenomenon as witnessed by many workers in blended beverages (Ray *et al*., 1972; Agrahari and Khurdiya, 2003; Saini and Dharmpal 1997; Madanlal *et al.*, 2006; Kalpana *et al.,* 2008; Shrivastava *et al*., 2009), Jain *et al*. (2011).

5.2.2 Titratable acidity, pH and ascorbic acid

Mean values of titratable acidity at different months of storing aloe squash (1.00, 0.95%, 0.89% and 0.82% respectively) at 0, 2, 4 and 6 months after storage indicate that titratable acidity decreased with the progress in storage period. The decrease in acidity might be due to hydrolysis of polysaccharide in to simple sugars and non-reducing in to reducing sugars where acid is utilized for converting them in to reducing sugars. Similar results were reported by Gajanana (2002) in aonla juice; Ramajayam and Jaganath (2002); and Surender Singh *et al.,* 2005).

The treatment T_4 recorded significantly maximum titratable acidity in aloe based squash after 2, 4 and 6 months of storage (0.99, 0.94 and 0.91%, respectively) and The significantly lowest titratable acidity was found in T_1 throughout the storage period (2 MAS – 0.95%, 4 MAS – 0.89% and 6 MAS – 0.82%). Reduction in acidity level in fruit beverages owes to chemical interaction between the organic constituents of the juice induced by temperature and actions of enzymes as reported by Palaniswamy and Muthukrishnan (1974) and Nath *et al.* (2005). The decrease in acidity during storage was also observed in kinnow mandarin juice by Sarmah *et al*. (1981); Similar result was reported by Mehta and Bajaj (1983); Nagi and Manjrekar (1976).

The average pH values of aloe based flavoured squash in this study at 0.2, 4 and 6 months of storage were 3.08, 3.28, 3.56 and 3.92. The mean pH assessments signify that the pH augmented with increase in storage period. It is imperative to note that, titratable acidity decreased with the increase in storage period. It is well founded law that acidity and pH are inversely proportional. In the present investigation, increase in the values of pH of aloe vera squash with advancement in the storage time reflected the decrease titratable acidity. In fresh as well as stored aloe vera squash, the

treatment T_1 (30% aloe juice + 45º Brix TSS + 2.25 % pepper mint) recorded significantly higher pH (3.20), and it was on par with all other treatments except T_3 and T_4. The treatment T_1 continued to register higher pH throughout the storage period with its value being 4.10 at end of 6 months. The treatment T_4 (30% aloe juice + TSS45ºBrix + 3.00% Lime juice) recorded minimum pH throughout the study. However, all the treatments in aloe vera flavoured squash registered continuous increase in pH. The ascent in pH and decline in titratable acidity indicate that acidity concentration in the beverage diminished with increase in storage period. Similar decrease in acidity and increase in pH was reported by Tripathi *et al.* (1992); Deka (2000); Bhardwaj and Mukherjee (2005), Boghani *et al*. (2012).

Ascorbic acid (vitamin C) is an important nutrient, which is not only an antioxidant but has a medicinal value as well. In the present study, ascorbic acid content in the aloe squash beverage in all the treatments reduced considerably during storage as the time advanced. This fact is evident from the mean ascorbic acid level (199.70 mg/100ml, 194.96 mg/100ml, 182.33 mg/100ml and 153.00 mg/100ml respectively) observed at 0, 2, 4 and 6 months after storage. The decline in ascorbic acid concentration could be due to thermal degradation during processing and subsequent oxidation in storage as it is very sensitive to heat and pressure treatment, oxidation and light (Mapson, 1970). The decrease in ascorbic acid content might owe to conversion of ascorbic acid to dehydroxy ascorbic acid. Both ascorbic acid and dehydro-ascorbic acid are highly volatile and unstable forms of vitamin C. Trends of declines in ascorbic content of stored products was noticed by Vijay and sethi (1993) in litchi squash, Roy and Singh (1979) in bael fruit squash and nectar, Ranote and Bains (1982) in kinnow mandarin juice, Urmila and Satinder (1983) in citrus juice, Vijay (1985) in litchi juice, Kalra and Tandon (1987) in mango and guava nectar, Tripathi *et. al.* (1988), Teotia *et. al.* (1997) in muskmelon nectar from enzyme clarified juice, Ghorai and Kurdiya (1998) in kinnow mandrin juice, Sanjeev kumar and Singh (2001) in aonla ready to serve, squash and syrup and Gajanana (2002) in amla juice.

Ascorbic acid in fresh aloe squash was found maximum (225.67mg/100ml) in treatment T_4 (Aloe juice 30 per cent + 45º Brix+ 3 per cent lime juice) and it was on par with T_3 (222.45 mg/100ml). The treatment (T_4) continued to record maximum ascorbic acid during 6 months of storage period. High titratable acidity in treatment T_4

seem to have played a protective role for ascorbic acid retention. The minimum ascorbic acid content observed initially and at 2 MAS in treatment T_{10} (180.00 mg/100ml), at 4 MAS in T9 (161.67 mg/100ml) and at 6 MAS in T_8 (127.47 mg/100ml). A continuous decrease in ascorbic acid during storage as well as due to treatment effect has been reported by Tripathi *et al.* (1992) in he blends of pineapple: guava RTS beverage during three months of storage; Attri *et al.* (1998) in blended juice of pear with apple, apricot, plum;

5.2.3 Colour analysis

The maximum *L** value was observed in T_2 throughout the storage period which containing 15 per cent aloe juice + 15º Brix TSS + 3 per cent pepper mint. In this study natural extract of peppermint, lime, ginger show more lightness compared to powders, in the blends.

The maximum *a** value was observed in the treatment T_{10} (0.53, 0.64, 0.71 and 0.86 respectively), at o, 2, 4 and 6 months after storage. It might be due to composition of the blending and also possible millard reaction during storage. On other hand minimum *a** vale was observed in treatment T_2 (0.23, 0.24, 0.33 and 0.33, respectively) lower *a** value indicates that towards greenness of the sample it mght be due to natural plant extract peppermint juice is light in colour or gree.

The maximu *b** value was observed in treatment T2 (1.98, 1.35, 1.07 and 0.87, respectively) at 0. 2, 4 and 6 months after storage, it mght be due to natural plant extract peppermint juice is greenness. However, minimum was observed in T10 (0.11, 0.07. 0.03 and 0.01, respectively) at 0, 2, 4 and 6 months after storage.

5.2.4 Organoleptic evaluation

In fresh aloe squash, the highest score for colour and appearance (4.36) was observed in treatment T_5 (Aloe juice 30 per cent + 45º Brix TSS + 1.50 per cent ginger), and it was on par with T_6 (4.35), T_1 (4.22), T_2 (4.15). The lowest score of (3.56) was observed in treatment T_{10} (Aloe juice 30 per cent + 45º Brix TSS + 0.75 per cent chat-masala) followed by T_9 (3.63) and T_8 (3.80). The treatment T_5 (Aloe juice 30 per cent + 45 º Brix TSS + 1.50 per cent ginger) continued to score the highest at 2, 4 and 6 months (4.22, 4.19, 4.11 respectively). However, considering the

performance with respect to colour and appearance, mouthfeel, taste and flavour as well as overall acceptability, the treatment T_5 stands superior. In contrast, the treatment T_{10} with chat-masala as flavouring agent scored minimum continuously during storage period of 6 months. Nevertheless, treatments did not differ significantly among themselves for various sensory attributes tested. The use of ginger in many culinary dishes and fruit beverages at certain proportion imparts enjoyable taste and odour. Hence, superior performance of treatment with ginger (1.5%) in flavoured aloe squash blend (T_5) might be due to pleasing sensory qualities imparted to the beverage. Joshi *et al.* (1993) reported considerable improvement with respect to taste and aroma in the products with added spice extract; Kaur *et al.* (1995) and Chauhan *et al.* (1997) in isolated studies observed an improvement in the flavour and organoleptic quality of sugarcane juice added with lemon juice and ginger juice at different proportion.

5.2.5 Changes in microbial (bacterial) population

The data on total bacterial count of flavoured aloe vera squash indicates that microbial population showed an increase in their number during the storage period of six months. But it did not affect the integrity of the product. Use of potassium sorbate and sodium benzoate has been reported to be very effective in preventing the spoilage of the products during storage (Giridharilal *et al.,* 1986). In the current experimentation on aloe based squash, these two preservatives were employed for safeguarding aloe squash beverages from microbial spoilage. Pasteurization of flavoured aloe squash prior to filling in to bottles and addition of these chemical preservatives might have played noteworthy task in controlling and limiting the bacterial population to a safe level. However, minimum microbial population was recorded in treatments containing ginger juice as a blend (T_5 and T_6). The inhibitory effect of ginger towards microorganisms is very well known and it has been documented in some studies (Bharadwaj and Pandey, 2011; Bharadwaj and Mukherjee, 2005; Deka, 2000; Ejechi *et al*., 1998 and Attri *et al.,* 1998).

5.3 Preparation and preservation of aloe based mixed squash

In case of fruits like orange, mango, pineapple and grapes, the ingredients used in the preparation of RTS, squash and syrup *etc.* are principally sugar, acid and

Plate 4: Treatments differences in colour of flavoured aloe vera squash beverage at 6 months of storage

T_1- 30 % Aloe juice + 2.25 % Pepper mint , T_2- 30% Aloe juice + 3.00 % Peppermint, T_3- 30 % Aloe juice + 2.25 % Lime juice T_4- 30 % Aloe juice + 3.00 % Lime juice, T_5- 30% Aloe juice + 1.50 % Ginger juice + T_6- 30 % Aloe juice + 2.25 % Ginger juice , T_7- 30 % Aloe juice + 1.50% Jaljeera , T_8- 30 % Aloe juice + 2.25 % Jaljeera + T_9- 30% Aloe juice + 1.50 % Chat-masala, T_{10}- 30 % Aloe juice + 2.25 % Chat-masala

Plate 5: Variation in colour of freshly prepared aloe vera based mixed squash as influenced by treatments

T_1- 20 % Aloe juice + 10 % Amla T_2- 25 % Aloe juice + 10 % Amla T_3- 20 % Aloe juice + 5 % Kokum T_4- 25 % Aloe juice + 5 % Kokum T_5- 20 % Aloe juice + 5 % Amla + 10 % Kokum T_6- 25 % Aloe juice + 5 % Amla + 10 % Kokum T_6- 25 % Aloe juice + 5 % Amla + 10 % Kokum T_7- 20 % Aloe juice + 10 % Amla + 5 % Kokum T_8- 25 % Aloe juice + 10 % Amla + 5% Kokum T_9- 20 % Aloe juice + 10 % Amla + 5 % Kokum + 1.5 % Ginger T_{10}- 25 % Aloe juice + 5 % Amla + 10 % Kokum + 1.5 % Ginger T_{11}- 20 % Aloe juice + 5% Amla + 10 % Kokum + 1.5 % Ginger T_{12}- 25 % Aloe juice + 10 % Amla + 5 % Kokum + 1.5 % Ginger

water. As the fruits have strong flavour, other fruit juices are not generally added while preparing RTS, squash, syrup, nectar etc. from them. On the contrary, aloe vera juice in its pure from is not relished because of high bitterness, low acid and low sugar or no sugar content of juice. Hence, it is necessary to convert the aloe juice into acceptable beverage before it can be consumed. However, very little work has been done on working out protocol for preparation of aloe based blended beverage. Therefore, in the present investigation an attempt was made to standardize the recipe for preparation of aloe juice based blended squash beverage using aonla, kokum and green ginger juices in various combinations. Aonla juice is not only nutritious and medicinal but has satisfactory taste. Similarly, kokum with medicinal properties imparts attractive colour. Ginger adds medicinal value and pleasing flavour. Results obtained in the present investigation aimed at masking the undesirable taste of natural aloe juice and developing aloe based mixed squash has been discussed below.

5.3.1 TSS, sugars and polysaccharides

The TSS content of all the treatments was initially adjusted to 45ºB. The mean TSS at increased through the storage recording 46.37ºB at 2 months, 46.77º B at 4 months and 47.69ºB at 6 months. The data on effect of storage period on TSS of aloe based mixed squash showed a slight increase in all the treatments. The increase in total soluble solids throughout storage might be due to conversion of polysaccharides into sugars by hydrolysis. Corroborative findings to the present study are reported by Roy and Singh (1979) in bael beverage; Garande *et al.* (1995) in jamun products; Deka (2000) in lime- aonla and mango-pineapple spiced beverage; and Sanjeevkumar and Singh (2001) in aonla products.

The maximum TSS content in aloe based mixed squash was noted in treatment T_{10} (25% aloe juice + 5% Amla + 10% Kokum + 1.5% Ginger). The same treatment recorded higher total sugar content (35.43%, 35.83%, 36.07% and 36.17%) at 0, 2, 4 and 6 months respectively. The treatment T_{10} was closely followed by T_{11} (20% aloe juice + 5% Amla +10%Kokum +1.5% Ginger). These two treatments were designed to have same proportion of aonla, kokum and ginger juice with variation in aloe juice concentration. A slight difference obsevervd in these two treatments regarding total sugar content might relate to the variation in aloe juice proportion. Singnificant

differences among all the treamtens regarding total sugar content might relate to the composition of different types of juices in different proportion.

Following the same trend as TSS, total sugars content in all the treatments increased with increasing storage period. The increase in sugar content with the passage of time might be due to conversion of starch and other carbohydrates into sugars. Similar results were observed by Palaniswamy *et al*. (1974) in mango squash, Roy and Singh (1979) in bael nectar and squash, Garande *et al*. (1995) in jamun RTS, Saini *et al*. (2001) in thermally processed mango RTS and Krishnaveni *et al*. (2001) in jackfruit RTS during storage. Anjum *et al*.(2000) while observed increase in reducing sugars in apricot diet jam. Ehsan *et al*. (2003) reported increasing trend in reducing sugars of grape fruit apple marmalade during 60 days of storage.

Non–reducing sugars of aloe squash stored for a period of six months were affected significantly by the treatments (Table 20). The result in Table 20 revealed that non-reducing sugars decreased as a function of storage period. The mean values for non-reducing sugars in the aloe based mixed squash at the beginning were 23.93 per cent and it was reduced to 23.69 per cent at the end of 6 months. The findings of the present study are well supported by Singh *et al.* (2007) who also observed decrease in non-reducing sugars with increase in storage time. This significant decrease in non-reducing sugars might be due to the breakdown of non-reducing sugars (sucrose) to reducing monosaccharide sugars by the action of acids present in the beverage. Riaz *et al.* (1999) observed decrease in non-reducing sugars from 44.64 to 32.35 per cent in strawberry jam and Ehsan *et al.* (2003) observed decrease in non-reducing sugars of grape fruit apple marmalade during storage.

5.3.2 Titratable acidity, pH and ascorbic acid

Similar to aloe RTS and squash, the titratable acidity of aloe based mixed squash beverage also showed decline from the initial level through the storage. This is evident from mean values observed for titratable acidity at different months of storing aloe based mixed squash (1% - initial, 0.94% - 2 MAS, 0.90% - 4 MAS and 0.86% - 6 MAS). The decrease in acidity might also be due to hydrolysis of polysaccharide and non-reducing sugars where acid is utilized for converting them into reducing sugars. Similar results were reported by Dhaliwal and Hira (2001) in carrot juice blends, Gajanana (2002) in aonla juice, Deka (2002) in RTS beverage prepared from lime-

aonla, mango- pineapple, guava- mango blends, Tiwari (2002) in guava and papaya blended RTS and Bhardwaj and Mukherjee (2011) in kinnow mandarin juice. The reduction in acidity is a general phenomenon during storage of beverages in the presence of sugars (Bhatia *et al.,* 1956). This fact may be further justified by increase in the Sugar : acid ratio of aloe vera based mixed squash from the initial (33.27) to further at 2 months (35.70), 4 months (37.49) and 6 months (39.62) of storage. Reduction in acidity during storage was also noticed by Tripathi *et al.* (1988) in many fruit beverages and Thakur and Barwal (1998) in kiwi fruit squash and Sanjeevkumar and Singh (2001) in aonla fruit products.

At 2, 4 and 6 months after storage, significantly maximum and similar titratable acidity content (0.97%, 0.92% and 0.90%) was observed in the treatment T_9 and T_{12} at 2, 4 and 6 months after storage. These two high acidity containing treatments (T_9 and T_{12}) were on par with all other treatments except T_6 (0.89%), T_7 (0.90%) and T_8 (0.91%) at 2 MAS; except T_6 (0.86%) and T_7 (0.88%) at 4 MAS; and except T_6 (0.82%), T_7 (0.84%) and T_{11} (0.83%) at 6 months after storage. This variation might relate to the inclusion of different types of juices of varying physico-chemical properties at different proportion in the treatments. Further, the treatments (T_9, T_{10}, T_{11} and T_{12}) containing green ginger as one of the juices in blends had retained higher titratable acidity in comparison to other treatments. Nath *et al.* (2005) states that higher acidity level observed in squashes with ginger might be due to inhibitory effect of ginger juice on enzymes responsible for decreasing acidity.

There was increase in the pH of all the treatments with advancement in storage period as it has been observed in the experiments of aloe RTS and aloe squash. This is indicated by mean of pH of aloe based mixed squash which exhibited a variation from 2.45 (initial) to 3.42 (at 6 months). This rise in pH and decrease in titratable acidity indicate the opposite relation existing between pH and acidity. Similar behaviour of beverages with respect to pH has been reported by Tripathi *et al*. (1992); Teotia *et al.* (1997); Tiwari (2000); Bharadwaj and Mukherjee (2005); Kantharaj *et al.* (2011); and Boghani *et al.* (2012).

Ascorbic acid content in the aloe based mixed squash reduced considerably during storage in all the treatments with storage time. Mean values for ascorbic acid level observed at 0, 2, 4 and 6 months after storage obviously focus the decline (611.05 mg/100ml, 591.36 mg/100ml, 586.98 mg/100ml and 576.63mg/100ml,

respectively). The decline in ascorbic acid concentration could be due to thermal degradation during processing and subsequent oxidation in storage as it is very sensitive to heat and pressure treatment, oxidation and light (Pandey *et al.,* 1995; Jain *et al.,* 1996; Adsule and Roy 1975; Hemarkar *et al*., 2000; Davey *et al*., 2000 and Yeom *et al.*(2000). Trends in decline in ascorbic acid content of stored products was noticed by Vijay and Sethi (1993) in litchi squash, Roy and Singh (1979) in bael fruit squash and nectar, Ranote and Bains (1982) in kinnow mandrian juice, Urmil and Satinder (1983) in citrus juice, Tripathi *et al.* (1988), Teotia *et al.* (1997) in muskmelon nectar from enzyme clarified juice.

Maximum ascorbic acid was noticed in treatment T_{12} (25% Aloe juice + 10% Amla + 5% Kokum + 1.5% Ginger) (664.36 mg/100ml) followed by T_9 (656.23 mg/100ml), T_{11} 638.29 mg/100ml) and T_{10} (636.13 mg/100ml) and its retention also followed the same trend throughout the storage. The maximum ascorbic acid content in these aloe based mixed squash treatments throughout the study period may be due variation in the blending ratio of different juices and also due to higher proportion of total juice than the remaining treatments.

5.3.3 Colour analysis

The initial significantly higher L^* value was observed in T_2 (14.57, 7.05, 3.67 and 3.61 respectively) which containing only aloe juice (25%) blended with (10%) amla which are light in colour which impart the light colour. However, the least L^* value was observed in T_6 (3.13) at initial and T_4 (2.63) at 2 MAS, and T_3 (2.10 and 2.10) at 6 months after storage, lowest L^* value indicating darkness or redness it due to blending of kokum its impart redness.

The redness (a^*) in the sample was maximum in the treatment T_{11} (3.41, 2.23, 0.89 and 0.88 respectively) at initial, 2, 4 and 6 months after storage. This is due to blending composition of the treatments which containing 10 per cent of kokum with 20 per cent aloe juice, 5 per cent aonla and 1.5 per cent ginger. On contrary, the lower value for a^* was recorded in the treatment T_2 (-0.85) in initial, T_1 (-0.95, -0.59 and -0.57 respectively) at 2, 4 and 6 months after storage. This trend clearly indicate the absence of kokum and ginger might be have contribute for less redness. In this study, during the storage of squash the a^* values were decreasing trend. Similar result was reported by Deka (2000) in lime- aonla and mango- pineapple spiced RTS beverage.

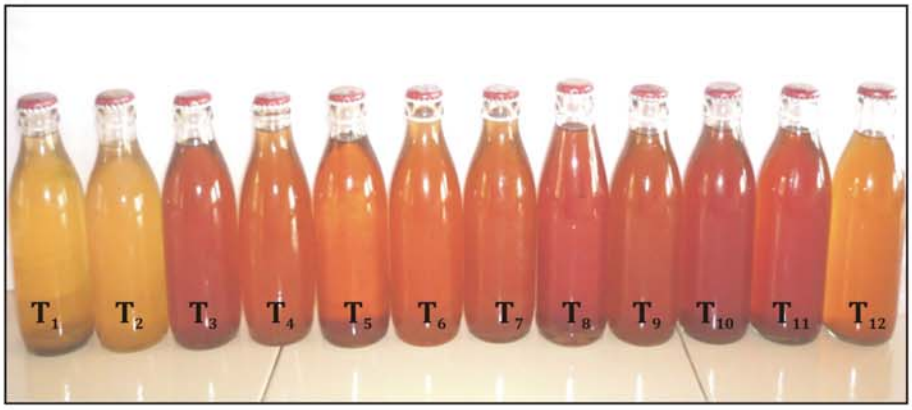


Plate 6: Treatments difference in colour of aloe vera based mixed squash at 6 months storage

T_1- 20 % Aloe juice + 10 % Amla T_2- 25 % Aloe juice + 10 % Amla T_3- 20 % Aloe juice + 5 % Kokum T_4- 25 % Aloe juice + 5 % Kokum T_5- 20 % Aloe juice + 5 % Amla + 10 % Kokum T_6- 25 % Aloe juice + 5 % Amla + 10 % Kokum T_7- 25 % Aloe juice + 5 % Amla + 10 % Kokum T_7- 20 % Aloe juice + 10 % Amla + 5 % Kokum T_8- 25 % Aloe juice + 10 % Amla + 5% Kokum T_9- 20 % Aloe juice + 10 % Amla + 5 % Kokum + 1.5 % Ginger T_{10}- 25 % Aloe juice + 5 % Amla + 10 Kokum + 1.5 % Ginger T_{11}- 20 % Aloe juice + 5% Amla + 10 % Kokum + 1.5 % Ginger T_{12}- 25 % Aloe juice + 10 % Amla + 5 % Kokum + 1.5 % Ginger

Plate 7: four best performing treatments of aloe vraa based mixed squash beverage as they appeared when fresh

T_9- 20 % Aloe juice + 10 % Amla + 5 % Kokum + 1.5 % Ginger , T_{10}- 25 % Aloe juice + 5 % Amla + 10 % Kokum + 1.5 % Ginger, T_{11}- 20 % Aloe juice + 5% Amla + 10 % Kokum + 1.5 % Ginger, T_{12}- 25 % Aloe juice + 10 % Amla + 5 % Kokum + 1.5 % Ginger

The maximum *b** value was observed in T_{12} (1.45, 1.48, 1.49 and 1.50, respectively) at 0, 2, 4 and 6 months after storage. Which containing 25 per cent aloe juice, 10 per cent aonla , 5 per cent kokum and 1.5 per cent ginger . The higher level of blending of amla and ginger mght be due to contributed for yellowness in the squash. On the other hand the lower level of *b** values were recorded in T_4 (0.14, 0.15, 0.16 and 0.17 respectively) at initial, 2 , 4 and 6 months after storage. This trend is justifiable because the squash in the T_4 contains only aloe and kokum.

5.3.4 Organoleptic evaluation

The organoleptic evaluation of aloe based mixed squash was carried out by diluting the squash to 15º Brix by addition of water. The aloe based mixed squash in the treatments T_{10} (25% Aloe juice + 5% Amla + 10% Kokum + 1.5% Ginger) and T_9 (20% Aloe juice + 10%Amla + 5% Kokum + 1.5% Ginger) were found to have maximum acceptability based on organoleptic scores with respect to colour, appearance, taste and flavour, mouthfeel and overall acceptability. In these treatments maximum organoleptic score was observed throughout the storage period of investigation. The treatments T_{10} and T_9 were closely followed the treatment T_{11} and $T_{12.}$ These 4 treatments with high score for overall acceptability were composed of 1.5 per cent ginger juice in common. Although the treatments T_5, T_6, T_7 and T_8 consisted of all the juice as in treatments T_9 to T_{12} except ginger, they failed perform superior to treatments T_9 to T_{12}. This may be related to the highly acceptable flavour principle induced by ginger to aloe based mixed squash satisfying olfactory and taste senses of consumers.

Gajanana (2002) reported that lime blended aonla squash prepared with 30 per cent aonla juice + 5 per cent lime juice + 2 per cent ginger and 40º B TSS had given highest score for over all acceptability. Singh and Sanjeev Kumar (1995) reported that lime blended aonla squash prepared with 25 per cent aonla juice + 5 per cent lime juice + 2 per cent ginger + 50º B TSS with 1 per cent acidity received the highest organoleptic score. Nath *et al.* (2005) report that out of different blending ratios of kinnow mandarin and ginger juice *viz* 0:30, 5:25, 10:20, 15:15 and 20:10, 25:5 and 30:0, respectively, the ratio of 25:5 scored the highest in terms of sensory attributes with TSS concentration of 40º to 40.5º B. Blending of grape juice with

purple grape juice and phalsa juice improved appearance, colour and flavour characteristics and hence scored good (Balaswamy *et al.,*2011).

5.3.5 Changes in microbial (bacterial) population

The data on microbial load of aloe vera based squash indicates that microbial population showed an increase in their number during the storage period of six months (Table 27). But, it did not affect characteristic feature of the product. Use of potassium sorbate and sodium benzoate has been reported to be very effective in preventing the spoilage of the producs during storage (Giridharilal *et al.,* 1986). In the present study on aloe vera based mixed squash, potassium sorbate and sodium benzoate were used for preservation of aloe squash beverage. Pasteurization of aloe squash blends before filling in to bottles and addition of chemical preservatives might have aided in checking the bacterial population during storage. Significantly minimum microbial load was noticed in T_{12} (25% Aloe juice + 10% Amla + 5% Kokum + 1.5% Ginger) with colonies of 6.18 CFU/ml, 7.27 CFU/ml, 9.32 CFU/ml and 12.13 CFU/ml respectively at initial, 2, 4 and 6 months after storage followed by T_{10} and T_{11}. This again proves the efficacy of ginger as an antimicrobial agent.

6. SUMMARY AND CONCLUSIONS

Investigation on "Standardization of protocol for flavoured RTS, squash and blended beverage of aloe vera (*Aloe barabadensis* Miller.)" was conducted during 2012-13 in the Department of Post Harvest Technology, Kittur Rani Channamma College of Horticulture, Arabhavi (UHS, Bagalkot), Karnataka. The present study was carried out to standardize the protocol for preparation of flavoured aloe RTS beverage, squash and aloe based mixed squash and to study the quality and storage behavior of these products as influenced by the treatments. The salient findings of the present investigation are summarized hereunder.

6.1 Preparation and preservation of flavoured aloe rts beverage

The chemical constituents of the beverage *viz*., total soluble solids, total sugars, reducing sugars, sugar: acid ratio, *a** value and pH were found to increase marginally from 15 to 15.91ºB, 7.25 to 7.56 per cent, 1.83 to 2.23 per cent, 22.20 to 29.39, 0.46 to 0.56 and 3.41 to 3.58, respectively, whereas titrable acidity, ascorbic acid, non-reducing sugars, *L** value and polysaccharides content decreased from 0.33 to 0.27 per cent, 77.86 to 61.14 mg per 100 ml, 5.15 to 5.10 per cent, 3.91to1.91 and 16.33 to 16.26 mg per 100 ml respectively, during the storage period of six months. However, significant differences were observed among the treatments except with respect to TSS.

During storage period of six months, the mean organoleptic scores decreased significantly from an initial value of 3.98 to 3.64 for colour and appearance, 3.99 to 3.77 for taste and aroma, 4.15 to 3.71 for mouth feel and 4.08 to 3.76 for overall acceptability. The results of organoleptic evaluation particularly indicated that the treatment with aloe juice 15 per cent + TSS 15˚B +0.75 per cent ginger juice blend was found superior in their acceptability than other treatments for all the four organoleptic parameters throughout the course of investigation. It appears that highly acceptable flavour might have been achieved in the treatment T_6 due to ginger resulting in higher scores for organoleptic quality. Very low scores in the aloe RTS treatments were associated with 15 per cent aloe juice + 15º Brix TSS + 0.75 per cent chat-masala. The natural and familiar pleasing flavour induced by ginger at the proportion used in the beverage was more appreciated by the panellists than not so

familiar mixture of chat-masala imparting a different taste and flavour. There was marginal increase in microbial load (TBC) of aloe RTS beverage during storage, but it did not cause any spoilage even up to six months of storage.

6.2 Preparation and preservation of flavoured aloe squash beverage

Aloe squash was prepared by keeping aloe juice (30%), TSS (45ºBrix) and titratable acidity (1%) common to all the treatments and varying flavour components (peppermint, lime, ginger, *jaljeera* and *chat-masala*).

Analyzing the flavoured aloe vera squash for specific chemical parameters indicated significant differences among the treatments. The chemical constituents, viz., total soluble solids, total sugars, reducing sugars, sugar: acid ratio, *a** value and pH were found to increase from 45.26 to 47.74^{o}B, 38.34 to 38.54 per cent, 8.40 to 8.56 per cent, 38.34 to 47.60, 0.30 to 0.56 and 3.08 to 3.92 respectively, whereas titratable acidity, ascorbic acid, non-reducing sugars, *L** value, *b** value and polysaccharides content decreased from 1.00 to 0.82 per cent, 199.7 to 150.30 mg per 100 ml, 28.44 to 28.34 per cent, 5.76 to 2.66 lightness, 0.65 to 0.31 yellowness and 26.36 to 26.28 mg per 100 ml respectively in a storage period of 6 months.

During six months of storage, the mean scores decreased significantly from an initial value of 3.98 to 3.77 for colour and appearance, 3.96 to 3.83 for taste and aroma, 4.35to 3.86 for mouth feel and 4.02 to 3.90 for overall acceptability. It indicates eventual decrease in preference due to changes in the chemical constituents of juice during storage. Considering the performance with respect to all the sensory parameters, the treatment T_5 (30% aloe juice + 45 ^{0}B TSS+ 1.50% ginger juice) stands superior in comparison to all other treatments. It may be attributed to the highly acceptable flavour that might have been accomplished in the treatment T_5 followed by T_6 (30% aloe juice + 45 ^{0}B TSS+ 2.25 % ginger) when scores for most of the parameters of organoleptic quality are examined together. There was marginal increase in microbial load of aloe squash beverage during storage period but did not affect the wholesomeness of the product during six months of storage.

6.3 Preparation and preservation of aloe based mixed squash beverage

The aloe based mixed squash was experimented using aloe juice in combination with amla, kokum and ginger juice in different proportions. However, initial TSS (45^{o}B) and titratable acidity (1%) were kept constant in all the treatments.

The highest total soluble solids, reducing sugars, total sugars, sugar: acid ratio, and non-reducing sugars was observed in treatment with 25 per cent aloe juice + 5 per cent amla juice + 10 per cent kokum juice + 1.5 per cent ginger (T_{10}) followed by 20 per cent aloe juice + 5 per cent amla juice + 10 per cent kokum juice + 1.5 per cent ginger (T_{11}) and highest *b** value (1.50) was observed in treatment with 25 per cent aloe juice + 10 per cent amla + 5 per cent kokum + 1.5 ginger (T_{12}). In contrast, lowest total soluble solids, reducing sugars, total sugars, sugar: acid ratio and non-reducing were recorded in treatment with 20 per cent aloe juice + 10 per cent amla juice (T_1). However, the means of titrable acidity, ascorbic acid, *L**, a*values and polysaccharides content decreased in general from 1.00 to 0.86 per cent, 606.45 to 555.41 mg per 100 ml, 26.02 to 25.54 per cent, 7.73 to 3.08 *L** value, 1.72 to 0.28 *a** value and 26.81 to 26.65 mg per 100 ml respectively during the storage of squash blends up to 6 months.

The organoleptic evaluation of aloe based mixed squash revealed that the treatments T_{10} (Aloe juice 15%+Amla 5%+Kokum 10%+Ginger 0.5%) and T_{11} (Aloe juice 20%+Amla 5%+Kokum 10%+Ginger 0.5%) were observed to have maximum acceptability based on organoleptic scores for all the parameters. The treatments T_{10} and T_{11} were closely followed by T_9 and T_{12}. These 4 treatments highly acceptable treatments had composed of 1.5 per cent ginger juice in common. It appears that addition of ginger juice in these blends might have brought in the highly acceptable flavour principle to aloe based mixed squash leading superior performance in organoleptic evaluation.

The total bacterial count was found to increase in aloe vera blended squash beverage during storage period. However, it did not affect the quality of the product during six months of storage.

Future line of work

1. Efforts may be made to accomplish supplementary increase in nutritional and functional quality of highly acceptable recipes of aloe RTS, squash and mixed squash beverages of the present investigation through medicinal herbs

2. Other edible products such as jelly and jam may be tried to add more food value to aloe vera

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Appendix I: Proximate composition of *Aloe vera* gel

Sl. No.	Parameters	Observations
1.	Total Soluble Solids (^{0} brix)	0.80-0.86^0 B
2.	Acidity as citric acid (%)	0.23-0.26 %
3.	pH	4.50-4.52
4.	Ascorbic acid (mg per 100g)	3.76-3.86 mg per 100g
5.	Moisture (%)	97.8-99.0%
6.	Total sugars (%)	1.92%
7.	Reducing sugar (%)	0.026%
8.	Non reducing sugar (%)	1.894%
9.	Calcium (mg per 100g)	8.86-9.0 mg per 100g
10.	Iron (mg per 100g)	0.92-0.94 mg per 100g

Appendix – II : Meteorological data recorded for the experimental period (2012-13) at Agricultural Research Station, Arabhavi

Months	Temperature (°C)		Mean Relative Humidity (%)	Rainfall (mm)
	Minimum	Maximum		
January 2012	9.3	29.64	67.94	0.0
February -2012	14.87	32.45	55.39	0.00
March -2012	18.27	36.33	88.89	0.00
April -2012	20.87	36.94	56.32	76.90
May -2012	21.24	36.85	59.85	15.90
June -2012	21.87	33.50	65.73	14.00
July -2012	21.95	29.92	78.15	79.40
August -2012	21.77	29.73	78.61	27.10
September- 2012	27.54	29.11	75.42	23.00
October -2012	18.19	30.29	71.44	100.40
November-2012	16.77	29.71	88.57	56.13
December-2012	11.63	30.48	88.59	39.26
January -2013	12.92	31.21	88.00	32.00
February -2013	14.05	32.53	92.07	32.93
March -2013	15.48	35.56	81.00	23.00
April - 2013	19.28	38.24	72.67	30.83
May - 2013	22.33	38.11	85.00	47.00

STANDARDIZATION OF PROTOCOL FOR FLAVOURED RTS, SQUASH AND BLENDED BEVERAGES OF ALOE VERA

PUSHPA HOSUR **2013** **Dr. S. L. JAGADEESH**
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ABSTRACT

Investigation on "Standardization of protocol for flavoured RTS, squash and blended beverages of aloe vera (*Aloe barabadensis* Miller.)" was conducted during 2012-13 in the Department of Post Harvest Technology, Kittur Rani Channamma College of Horticulture, Arabhavi (UHS, Bagalkot), Karnataka.

RTS, squash and blended beverages were prepared from colourless, flavourless aloe vera juice by blending with various flavours *viz.,* pepper mint, lime, ginger, *jaljeera* and *chat-masala* to impart colour, flavour and other proprieties. The prepared products were stored for six months and they were analysed at fresh, and at 2, 4, 6 months intervals. Initially, TSS was maintained at 15º B and 45ºB and acidity at 0.3% and 1% for RTS and squash, respectively. Total, reducing and non-reducing sugars were maximum, while titratable acidity was minimum in RTS blended with 1% peppermint. Sugar : acid ratio, colour values (L^* and b^*) were maximum in RTS blended with 0.75% peppermint. The overall acceptability score was maximum in the treatment with 0.75% ginger blend.

In flavoured squash, the maximum total and reducing sugars, sugar: acid ratio and b^* values were recorded in squash blended with 3 % pepper mint. The maximum ascorbic acid and acidity was observed in squash blended with 3% lime. The overall acceptability score was maximum in the squash with 1.5% ginger.

In the blended squash, significantly maximum total, reducing, non-reducing sugars and sugar: acid ratio was recorded in squash blended with 25% aloe juice + 5% amla + 10% kokum + 1.5% ginger. The maximum ascorbic acid and b^* value was observed in aloe juice blended with 10% amla + 5% kokum + 1.5% ginger. The overall acceptability score was maximum in the blended squash with 25% aloe juice + 5% amla + 10% kokum + 1.5% ginger.

ಲೋಳೆರಸ ಉಪಯೋಗಿಸಿ ಸುವಾಸನೆ ಭರಿತ ಸಿದ್ಧ ಪಾನೀಯ, ಸ್ಕ್ವಾಷ್ ಮತ್ತು ಮಿಶ್ರಿತ ಪಾನೀಯ ತಯಾರಿಸುವ ವಿಧಾನದ ಬಗ್ಗೆ ಸಂಶೋಧನೆ

ಪುಷ್ಪಾ ಹೊಸುರ 2013 ಡಾ. ಎಸ್. ಎಲ್. ಜಗದೀಶ್
ಮುಖ್ಯ ಸಲಹೆಗಾರರು

ಸಾರಾಂಶ

ಲೋಳೆಸರದ ರಸದಿಂದ ಸಿದ್ಧ ಪಾನೀಯ, ಸ್ಕ್ವಾಷ್ ಮತ್ತು ಲೋಳೆರಸ ಮಿಶ್ರಿತ ಪಾನೀಯವನ್ನು ತಯಾರಿಸುವ ವಿಧಾನದ ಬಗ್ಗೆ ತೋಟಗಾರಿಕಾ ವಿಜ್ಞಾನಗಳ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ ಬಾಗಲಕೋಟೆ ಅಡಿಯಲ್ಲಿ ಬರುವ ಕಿತ್ತೂರು ರಾಣಿ ಚನ್ನಮ್ಮಾ ತೋಟಗಾರಿಕಾ ಮಹಾವಿದ್ಯಾಲಯ, ಅರಭಾವಿಯ ಕೊಯ್ಲೋತ್ತರ ತಂತ್ರಜ್ಞಾನ ವಿಭಾಗದಲ್ಲಿ ೨೦೧೨–೨೦೧೩ ರಲ್ಲಿ ಕೈಗೊಳ್ಳಲಾಯಿತು.

ಲೋಳೆರಸವು ಸುವಾಸನೆ ಮತ್ತು ಬಣ್ಣವಿಲ್ಲದ ರಸವಾಗಿದೆ. ಆದ್ದರಿಂದ ಇದಕ್ಕೆ ಬಣ್ಣ ಮತ್ತು ಸುವಾಸನೆ ನೀಡಿ ಅದರಿಂದ ವಿವಿಧ ಪದಾರ್ಥಗಳಾದ ಸಿದ್ಧ ಪಾನೀಯ, ಸ್ಕ್ಯಾಷ್ ಮತ್ತು ಮಿಶ್ರಿತ ಸ್ಕ್ವಾಷ್ ತಯಾರಿಸುವ ವಿಧಾನದ ಸಂಶೋಧನೆ ಮಾಡಲಾಯಿತು. ಸುವಾಸನೆ ಭರಿತ ಪುದಿನಾ, ಲಂಬೆ ಹಣ್ಣು, ಶುಂಠಿ ಮತ್ತು ಮಸಾಲೆ ಮಿಶ್ರಿತ ಪುಡಿಯಾದ ಜಲ್‌ಜೀರಾ, ಚಾಟ್ ಮಸಾಲ ಬೆರೆಸುವುದರ ಮೂಲಕ ವರ್ಣ ರಹಿತ, ರುಚಿಯಾದ ಸಿದ್ಧ ಪಾನೀಯವಾಗಿ ಸಂಸ್ಕರಿಸಿ ಅದನ್ನು ೬ ತಿಂಗಳಗಳ ಕಾಲ ಶೇಖರಣೆ ಮಾಡಿ, ಪ್ರತಿ ೨ ತಿಂಗಳಿಗೊಮ್ಮೆ ಅದರ ವೈಜ್ಞಾನಿಕ ರಾಸಾಯನಿಕ ಲವಣಗಳ ಬಗ್ಗೆ ವಿಶ್ಲೇಷಣೆ ಮಾಡಲಾಗಿದೆ.

ಆರಂಭದಲ್ಲಿ ಸಿದ್ಧ ಪಾನೀಯ ಮತ್ತು ಸ್ಕ್ವಾಷ್‌ನಲ್ಲಿ ಸಕ್ಕರೆ ಅಳತೆಯನ್ನು ಕ್ರಮವಾಗಿ ೧೫ ಬ್ರಿಕ್ಸ್ ಮತ್ತು ೪೫ ಬ್ರಿಕ್ಸ್ ಹಾಗೂ ಆಮ್ಲೀಯತೆ ಶೇಖಡಾ ೦.೩ ಮತ್ತು ಶೇಕಡಾ ೧ನ್ನು ನಿರ್ವಹಿಸಲಾಗಿತ್ತು. ತಯಾರಿಸಿದ ಸಿದ್ಧಪಾನೀಯದಲ್ಲಿ ಗರಿಷ್ಠ ಸಕ್ಕರೆಯ ಅಂಶ ಮತ್ತು ಕಡಿಮೆ ಆಮ್ಲೀಯತೆಯು ಶೇಕಡಾ ೧ ಪುದಿನಾ ಸಂಯೋಜಿತ ಸಿದ್ಧ ಪಾನೀಯದಲ್ಲಿ ಕಂಡು ಬಂದಿದೆ. ಗರಿಷ್ಠ ಸಕ್ಕರೆ:ಆಮ್ಲದ ಅನುಪಾತ, ಹೊಳಪು, ಮತ್ತು ಹಳದಿ ಬಣ್ಣವು ಶೇಕಡಾ ೦.೭೫ ಪುದಿನಾ ಸಂಯೋಜಿತ ಸಿದ್ಧ ಪಾನೀಯದಲ್ಲಿ ಕಂಡು ಬಂದಿದೆ ಮತ್ತು ಸಂವೇದನಾ ಮಾಲ್ಯ ಮಾಪನದ ಪ್ರಕಾರ ಶೇಕಡಾ ೦.೭೫ ಶುಂಠಿ ಸಂಯೋಜಿತ ಸಿದ್ಧ ಪಾನೀಯವು ಅತ್ಯುತ್ತಮವಾಗಿದೆ.

ಸಂಯೋಜಿತ ಸ್ಕ್ವಾಷ್‌ನಲ್ಲಿ ಅತ್ಯಧಿಕ ಸಕ್ಕರೆ ಪ್ರಮಾಣ, ಸಕ್ಕರೆ:ಆಮ್ಲದ ಅನುಪಾತ ಮತ್ತು ಹಳದಿ ಬಣ್ಣವು ಶೇಕಡಾ ೩ ಪುದಿನಾ ಸಂಯೋಜಿತ ಸ್ಕ್ವಾಷ್‌ನಲ್ಲಿ ಕಂಡು ಬಂದಿದೆ. ಅತ್ಯಧಿಕ ಅಸ್ಕೋರ್ಬಿಕ್ ಆಮ್ಲ ಮತ್ತು ಆಮ್ಲೀಯತೆಯು ಶೇಕಡಾ ೩ ಲಂಬೆ ರಸ ಸಂಯೋಜೀತ ಸ್ಕ್ವಾಷ್‌ನಲ್ಲಿ ಕಂಡು ಬಂದಿದೆ ಮತ್ತು ಶೇಕಡಾ ೧ ಶುಂಠಿ ಸಂಯೋಜೀತ ಸ್ಕ್ವಾಷ್ ಅತ್ಯುತ್ತಮವಾಗಿದೆ. ಲೋಳೆರಸದಿಂದ ತಯಾರಿಸಿದ ಮಿಶ್ರ ಪಾನೀಯದಲ್ಲಿ ಅತ್ಯಧಿಕ ಸಕ್ಕರೆ ಪ್ರಮಾಣ ಮತ್ತು ಸಕ್ಕರೆ:ಆಮ್ಲ ಅನುಪಾತವು ೨೫% ಲೋಳೆರಸ + ೫% ನೆಲ್ಲಿಕಾಯಿ + ೧೦% ಕೋಕಂ + ೧.೫% ಶುಂಠಿರಸ ಸಂಯೋಜಿತ ಸ್ಕ್ವಾಷ್‌ನಲ್ಲಿ ಕಂಡು ಬಂದಿದೆ ಮತ್ತು ಅತ್ಯಧಿಕ ಅಸ್ಕೋರ್ಬಿಕ್ ಆಮ್ಲ ಮತ್ತು ಹಳದಿ ಬಣ್ಣವು ೧೦% ನೆಲ್ಲಿಕಾಯಿ ರಸ + ೫% ಕೋಕಂ + ೧.೫% ಶುಂಠಿ ರಸ ಸಂಯೋಜಿತ ಸ್ಕ್ವಾಷ್‌ನಲ್ಲಿ ಕಂಡು ಬಂದಿದೆ. ಸಂವೇದನಾ ಮಾಲ್ಯ ಮಾಪನದ ಪ್ರಕಾರ ೨೫% ಲೋಳೆರಸ + ೫% ನೆಲ್ಲಿರಸ + ೧೦% ಕೋಕಂ + ೧.೫% ಶುಂಠಿ ರಸ ಸಂಯೋಜಿತ ಸ್ಕ್ವಾಷ್ ಅತ್ಯುತ್ತಮವಾಗಿದೆ.