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Development of Orange Squash Blended with Herbal Infusion

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A B S T R A C T

The present study was conducted to develop a blended beverage using orange juice and herbal infusion such as basil, rosemary and oregano at different concentrations of 1.0, 2.0, and 3.0 per cent with sugar and water. From the organoleptic values of three levels of herbal infusion incorporated orange squashes, 2 per cent of herbal infusion found optimum as 3 percent showed bitter taste and 1 per cent showed no difference with control (orange squash). The standardized orange squash blended with herbal infusions were analyzed for its sensory and nutritional properties. The findings of microbial studies showed no total plate counts in the formulated beverages. The orange squash blended with herbal infusion of oregano at 2 per cent level found to be superior in quality and has good acceptability followed by rosemary and basil.

Introduction

Herbal and natural products of folk medicine have been used for centuries in every culture throughout the world (Acharya and Srivastava, 2008). "Let food be your medicine and let medicine be your food" is world famous advice of father of medicine "Hippocrates" (Katarzyna *et al.*, 2010**)**. Over the past few years as natural products have become increasingly popular, the field of natural herbal remedies has flourished. One of such application is blending herbal infusions into non-alcoholic fruit beverages. Squash is non-alcoholic concentrated syrup that is usually fruit flavored and made of fruit juice, water and sugar or a sugar substitute. Modern squash may also contain food coloring and additional flavoring. Some traditional squash contain herbal extracts.

Orange squash is thirst quenching, refreshing, and energizing drink. Squash is a non-fermented fruit beverage containing at least 25% fruit juice or pulp and 40 % TSS commercially. It also contains about 1% acid

350 ppm SO_2 or 600 ppm sodium benzoate. It is diluted and chilled before serving.

The sweet orange (*Citrus sinensis L.*) belongs to citrus fruits. Among all the citrus fruits produced either for export or local market. The sweet orange contributes 71% of the total citrus production in the world. Brazil is largest producer of sweet orange. India has taken 3rd place in production of sweet oranges with an annual production of 4266.9 million tons (Syed *et al.,* 2012).

The chemical composition of sweet orange shows that it contains water (86-92%), sugar (5-8%), pectin (1-2%), glycosides (0.1-1.5%), pentosans (0.8-1.2%), citric acid (0.4 to 1.5%), fibre (0.6-0.9%), proteins (0.6-0.8%), fat (0.2-0.5%), minerals (0.5-0.9%) and essential oils (0.2-0.5%).Nutritionally it is one of the most plentiful source of vitamin-c (provides 53.2 mg per 100 g, about 90% of DRI) amongst fruits and vegetables. It is also a good source of carotenoids, flavonoids, essential oils, sugar, fiber and minerals. Oranges have been found to contain many phytochemicals such as flavonones, flavones such as ferulic acid. Hesperdin the main flavonoids found in orange followed by narirutin and trace amounts of beta carotene was found in oranges.

Ocimum basilicam L. the plant named basil which grows throughout India. It is an erect, almost glabrous herb. The leaves are used for the extraction of oil. The oil of basil is used as flavoring agent in confectionary, baked goods, sauces, ketchups, tomato pastes, pickles, fancy vinegars, spiced meats, sausages and beverages.

The major portion of the essential oil of basil is either methyl cinnamate, linalool or methyl chavicol. Other major components include ocimene, linalylacetae, eugenol and transanethole (Bedi *et al.,* 2008). A number of studies shows various beneficial effects of basil including protection from radiation, chemo preventative activity, anti-inflammatory activity, a stimulatory effect upon the nervous system, bactericidal activity, modulation of glutathione and other antioxidant enzymes, anti-ulcer activity, anti-diarrhea and blood-sugar lowering effects (Dasgupta *et al.,* 2004).

Oregano is one of the most studied herbs, as it has shown consistently high levels of phenolics, antioxidant activity. Oregano extracts exhibited the antioxidant properties in processed foods by retarding lipid peroxidation in edible oils and better than the synthetic antioxidants BHA and BHT.

Rosemary belongs to the mint family *Lamiaceae*. The fresh and dried leaves are used frequently in traditional Mediterranean cuisine as an herb; they have a bitter astringent taste.

Leaves are used in small quantities as a flavoring in soups and stews (Bedi *et al*., 2008).

The sweet orange fruit is processed commercially to various forms mainly juice, frozen concentrates, squash, RTS drinks, nectar, dry mixes, canned segments, juice blends, marmalades and other value added products like pectin and essential oil from peel, natural colours, candied peel, feed yeast etc. Fresh juice of sweet orange is an important nutritious product providing 45 kcal, moderate quantity of vitamin C, potassium, bioflavonoid and folic acid and essential items of breakfast. It is refreshing, thirst quenching and energizing drink that improves health and nutritional requirements (Syed *et al.,* 2012), therefore a beverage can be utilised as a health drink by incorporating the above said herbs i.e basil, rosemary and oregano.Addition of herb (basil, rosemary and

oregano leaves) will not only increase sensory quality but also enhance nutritional profile of the product with certain vitamins, minerals, antioxidants and antimicrobial agents that these herbs contain naturally (Saha *et al.*, 2007).

Materials and Methods

Recipe was standardized according to sensory scores of the product (Table - 1) prepared with different concentrations of herbs (basil, rosemary and oregano leaves). Different fruit juice blends were prepared as (Kinnow juice: *Aonla*juice: Ginger juice in 100: 0: 0, 95: 5:0, 92: 5: 3 ratio and Kinnow juice: Pomegranate juice: Ginger juice in 90: 10: 0, 87: 10: 3 ration) for improving flavour, palatability, nutritive and medicinal value. The juice blends were preserved by pasteurization (75°C for 15 min) and by addition potassium meta-bi-sulphite (750 ppm) (Bhardwaj and Mukherjee, 2011).

According to Chauhan *et al.*, 2012 in the development of functional herbal RTS beverage, orange juice was used as blending material in preparation of blended Noni RTS beverage. Before mixing the Noni and orange juice, the beverages were standardised in order to optimise the formulation, varying only the contents of orange juice for the sensory analysis. Corrections of total soluble solids (degree Brix) and pH values were done when needed.

The standardised pH value was 4.0 (corrected with citric acid). Total soluble solids (degree Brix) were kept constant to 10^0 Brix, in the same manner only orange juice was replaced by herbal infusions in different levels of concentrations but keeping other parameters constant such as TSS and fruit content of squash as 40 degree brix and 25 per cent fruit respectively. Different concentrations of Orange juice blended with herbal infusion is given below

Product formulation

It is carried out by mixing 250 ml orange juice, 480 g sugar, 750 ml water, 1% citric acid, 2% herbal infusion and 100 ppm sodium benzoate. Samples were tested for different parameters like color, flavor, taste, after taste, and overall acceptability. Consumer acceptance test was done by sensory panelist according to 9 point hedonic scale for sensory evaluation as described by Ranganna (1986).

On each occasion, panelists were provided with coded paper plates containing the sample under the investigation. Sensory evaluation was carried out under ambient conditions, a comfortable area without distractions (isolated booths) under fluorescent lighting and controlled temperature.

The formulated samples were evaluated for chemical parameters via Estimation of moisture content, pH, Total soluble solids (TSS), Titratable acidity, colour, Reducing sugars, total sugars, Ascorbic acid(vitamin-c). Moisture content of Squash was determined according to oven method (AOAC, 2000). The reducing sugars convert the copper in fehling's solution used as titrant, to red and insoluble Cu_2O in alkaline medium. Under controlled conditions this is quantitative. Ascorbic acid is determined colorimetrically. It is first dehydrogenated by bromination.

The dehydroascorbic acid is then reacted with 2,4dinitrophenyl hydrazine to form osazone and dissolved in sulphuric acid to give an orange-red color solution which is measured at 540nm. Microbial limit test (MLT) was done to analyze the sample for the microbial quality (both bacterial and fungal).

Results and Discussion

The data regarding the effect of different levels of herbal concentrations on organoleptic quality of orange squash with herbal infusion have been represented in Table 1. In the formulations basil, rosemary and oregano were used only in three concentrations such as 1.0, 2.0 and 3.0 per cent because they are rich in flavor with altering taste with slight bitter notes.

According to sensory parameters tested by trained and semi trained panelists, above 2 per cent level of herbal infusion in orange squash gave bitter and sour taste and the flavor of the product covered by high level of bitterness after taste whereas below 2 % level showed dominant flavor of orange as similar as control and 2 per cent concentration of all used herbal infusions found to be optimum but keeping the taste of orange within the squash.

According to Bharadwaj and Mukherjee (2012), research on factors affecting physic-chemical, sensory and microbiological quality of kinnow juice blends revealed that the concentration of ginger used only up to 3 per cent level as optimum level.So the concentration levels of herbs or spices used in beverages observed to be 2-3 per cent.

The data regarding physico chemical composition of different formulations of orange squash blended with herbal infusions have been presented in the Table 2.

Moisture Content

The results of moisture analysis have been presented in Table 2. On observation of the data, it was indicated that the moisture content of the control, sample 111, sample 112 and sample 113 of squash were 64.2 %, 63.9 %, 64 % and 63.9 % respectively. From the above observation, we can conclude that the moisture content of the all samples shown almost similar values.

pH

The pH values of the various samples are presented in the Table 2. pH of the control, sample 111, sample 112 and sample 113 of squash were 4.21, 4.55, 4.38 and 4.52 respectively. From these observations we interpret that pH of control is least i.e., control tends to be more acidic than other samples

TSS

The total soluble solids (TSS) determined are presented in the Table 2. TSS (in °brix) of the control, sample 111, sample 112 and sample 113 of squash were 42, 42, 42 and 42 respectively. The total soluble solids of samples shown similarity with control as there maintained 40 degree brix.

Acidity

The acidity of squash is expressed in terms of percent of citric acid present in the sample. The acidity determined for the samples is listed in Table 2. Acidity of control, sample 111, sample 112 and sample 113 of squash were 0.67, 0.62, 0.62 and 0.62 respectively.

Brix/Acid Ratio

This value indicates the sweetness of the product with respect to acidity. Higher the ratio sweeter is the product. These values are represented in the Table 2. Brix/acid ratio for control, sample 111, sample 112 and sample 113 of squash were 62.5, 68.2, 68.2 and 68.2 respectively. We observed that all samples except control are having same brix/acid ratio hence we can say that they are sweeter than control; hence the organoleptic parameters like taste and overall acceptability of the control may affected.

Reducing sugars

The results of reducing sugars analysis are represented in Table 4.2. The amount of reducing sugars present in control, sample 111, sample 112 and sample 113 of squash were 17.6 %, 18 %, 17.8 % and 18 % respectively. From the above observation, we can conclude that the reducing sugar contents of sample 111 and sample 113 were highest among all the samples. Sharma *et al.,* (2012) reported after studying Guava-papaya blended ready-to-serve beverages that there was a slight increase in total sugars during storage that could be due to hydrolysis of insoluble polysaccharides like pectin, starch, etc. into simple sugars. Similar observations were also recorded by Patel *et al.,* (2011) in low calorie beverages based on Sapota fruits and Prasad *et al.,* 2003 in Ber squash.

Ascorbic acid

The results of ascorbic acid estimation are represented in Table 2. The amount of ascorbic acid present in control, sample 111, sample 112 and sample 113 of squash were 140.1, 146.6, 141.3 and 144.7 respectively. The sample 111 contains highest amount of ascorbic acid among all the samples.

Based on the studies of Jain and Khurdiya, 2004 in Indian gooseberry juice blends it is observed that ascorbic acid content of the juice decreased during storage with advancement of storage period. Similar results were obtained by Bharadwaj and Mukharjee (2012) in kinnow juice blends.

Organoleptic Evaluation

Sensory analysis was conducted on 9-point hedonic scale and results were discussed below. Sensory attributes like appearance, taste, texture, and overall acceptability are analyzed by 9-point hedonic scale. The average sensory score for each attributes of orange squash is represented in the Table 2.

The score for colour was found highest in the sample 113.The score for flavour was found highest in the sample 112. The score for taste was found highest in the sample 113. The score for after taste was found highest in both sample 112 and sample 113. The score for the overall acceptability was found highest in the sample 112.

Microbial analysis

The deterioration of fruit products is caused by physical, chemical and biological factors. Most significant changes in fruit products are due to biological factors especially micro-organisms. The results of microbial test revealed that quality of formulated samples of orange squash blended with herbal infusion not deteriorated with microbial contamination.

No bacterial growth was observed in the formulated samples. Therefore, there was no total plate count found in these samples. The oils of clove, oregano, rosemary, thyme, sage and vanillin have been found to be most consistently effective against microorganisms.

They are generally more inhibitory against gram positive than gram negative bacteria. Rosemary contains borneol, cineol, camphor, thymol, whereas oregano, thyme and savory contain volatile terpenescarvacol, p-cymene and thymol, which acts as anti-microbial agents and have medium inhibitory effect (Saha *et al.,* 2007)

The heat treatment was sufficient to destroy initial microbial load and the fruit beverages. Many products that could safely be maintained sterile by pasteurization process alone could be doubly preserved by addition of sodium benzoate. The benzoates inhibit yeasts, moulds and bacteria (Doughari *et al.,* 2007).

Table.1 Standardization of Formulation of Orange Squash Blended with Herbal Infusion

Level (%)	Sensory parameter			
Parameter	**Appearance**	**Flavor**	**Taste**	Overall acceptability
Basil (%)				
1.0	6.5	6.5	6.5	6.5
2.0	7.5	8.0	7.5	7.7
3.0	5.5	5.5	6.0	5.6
Rosemary (%)				
1.0	5.0	5.0	5.0	5.0
2.0	8.0	8.0	7.0	7.7
3.0	6.0	6.0	6.0	6.0
Oregano (%)				
1.0	5.5	6.0	5.0	5.5
2.0	8.0	8.5	8.5	8.2
3.0	7.0	7.0	7.5	7.1
Control (orange squash)	7.0	7.0	7.0	7.0

Table.2 Physico Chemical Composition of Different Formulations

	Control	2% Basil (Sample 111)	2% Rosemary (Sample 112)	2% Oregano (Sample 113)
Moisture content(%)	64.2	63.9	64.0	63.9
pH	4.21	4.55	4.38	4.52
TSS(in ^{0}brix)	42.0	42.0	42.0	42.0
Acidity (%)	0.67	0.62	0.62	0.62
Brix/Acid Ratio	62.5	68.2	68.2	68.2
Reducing sugars (%)	17.6	18.0	17.8	18.0
Ascorbic acid (mg/100g)	140.1	146.6	141.3	144.7

Table.3 Sensory Analysis Data of Orange Squash Blended with Herbal Infusion

Attributes	Control	S-111	S-112	S-113
Colour	6.75	6.28	7.14	7.28
Flavour	6.0	7.14	7.8	7.14
Taste	7.0	7.4	7.28	7.7
After Taste	6.35	6.8	7.0	7.0
Overall Acceptability	6.5	6.84	7.3	7.28

Table.4 Microbial Count (Cfu/G) of Orange Squashof Orange Squash Blended with Herbal Infusion

Group	Control	Sample 111	Sample 112	Sample 113
Bacterial count	nil	nil	nil	nil
Fungal count	nil	nil	nil	nil

Chart.1 Flow chart for herbal infusion

Extraction of Orange Juice

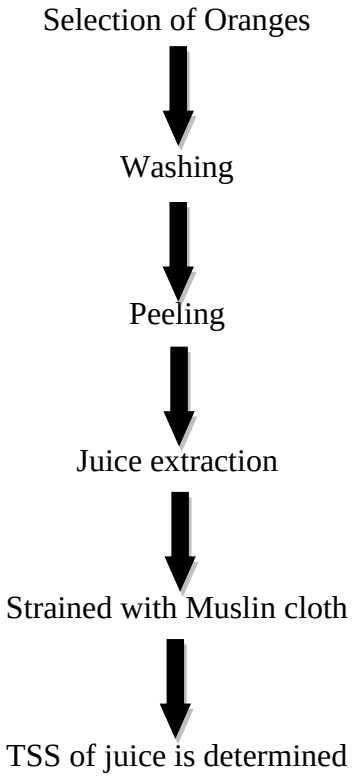


Chart.2 Flow chart for Juice extraction

Syrup Preparation

Weigh the sugar

↓

Dissolve in known volume of water

↓

Heat the syrup

↓

Strain with a Muslin cloth

↓

TSS of syrup is determined

Chart.3 Flow chart for syrup preparation

Preparation of Herbal Infusion

Herbs

↓

Heat the water (60-70°C)

↓

Add herbs and keep for few minutes

↓

Strain the solution

↓

Infusion is ready

Chart.4 Flow chart for preparations of orange juice with four herbal infusions

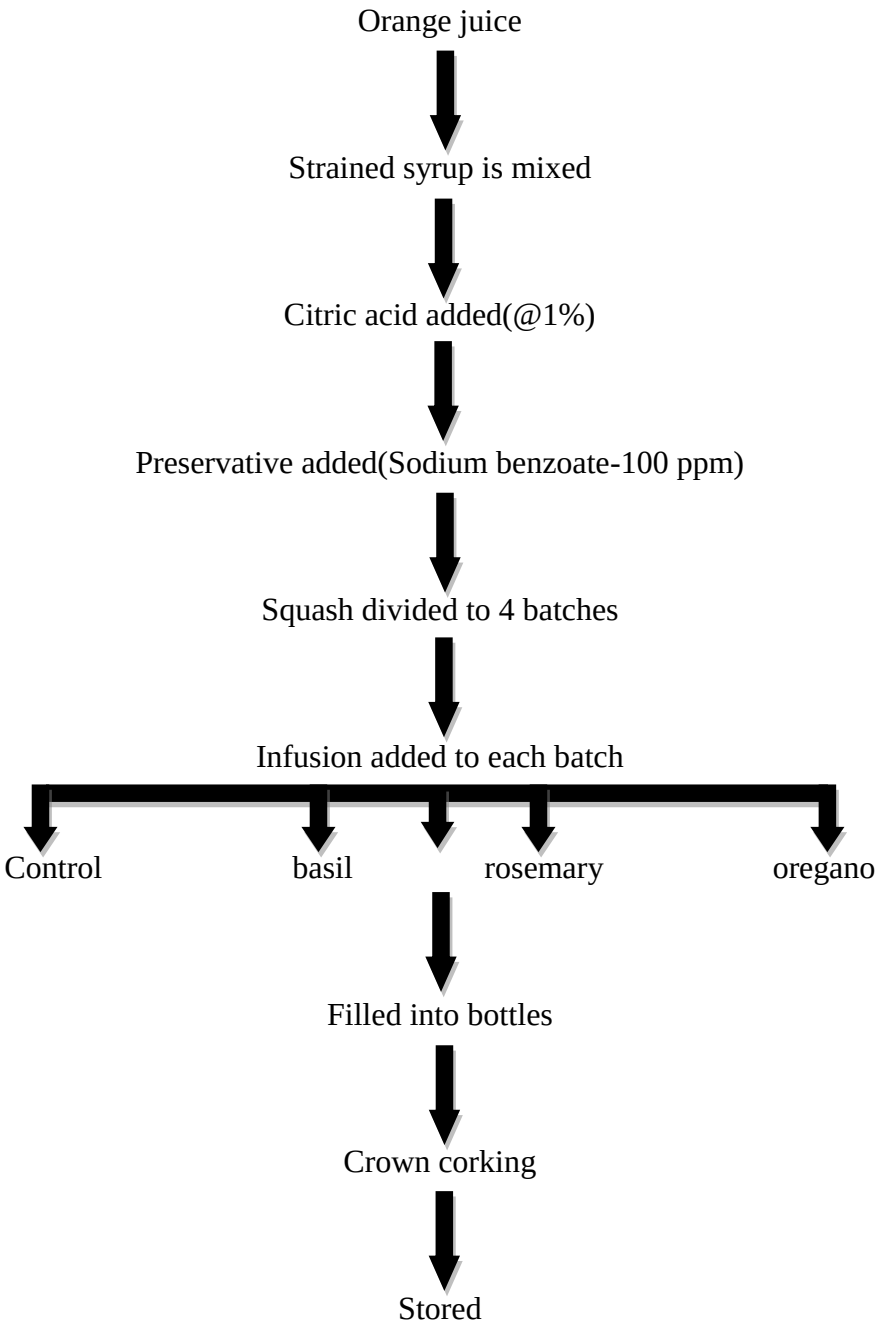


Fig.1 The Variation in Moisture Content in Orange Squash Blended with Herbal Infusion

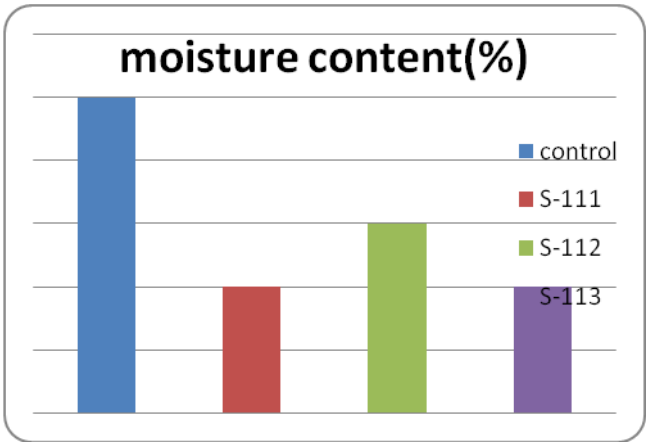


Fig.2 The Variation in pH of Orange Squash Blended with Herbal Infusion

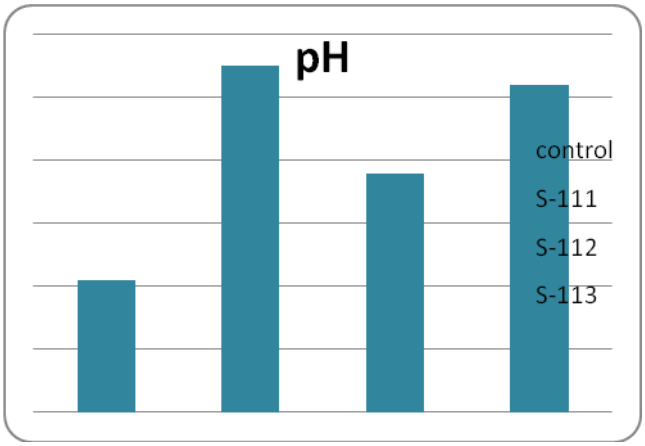


Fig.3 The Variation in TSS of Orange Squash Blended with Herbal Infusion

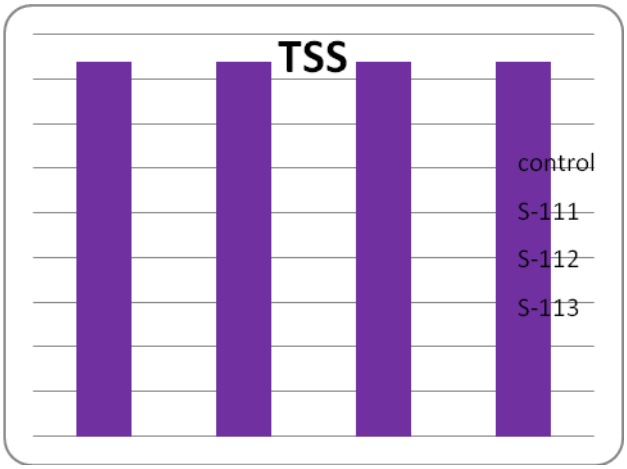


Fig.4 The Variation in Acidity in Orange Squash blended with Herbal Infusion

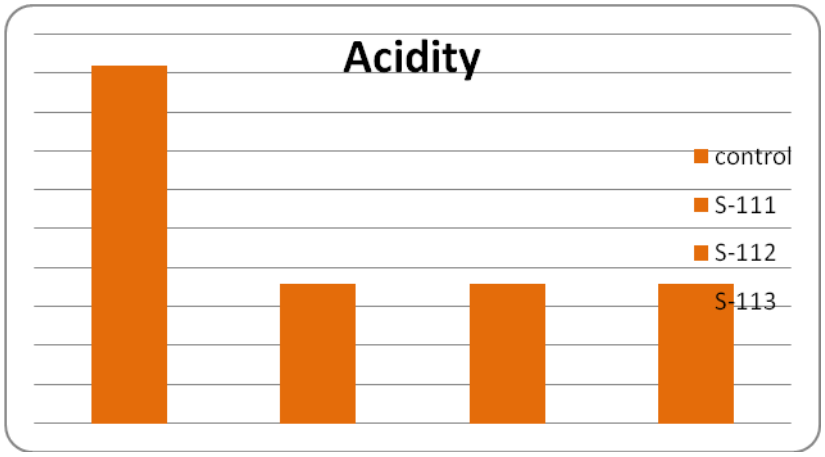


Fig.5 The Variation in Brix/Acid Ratio in Orange Squash Blended with Herbal Infusion

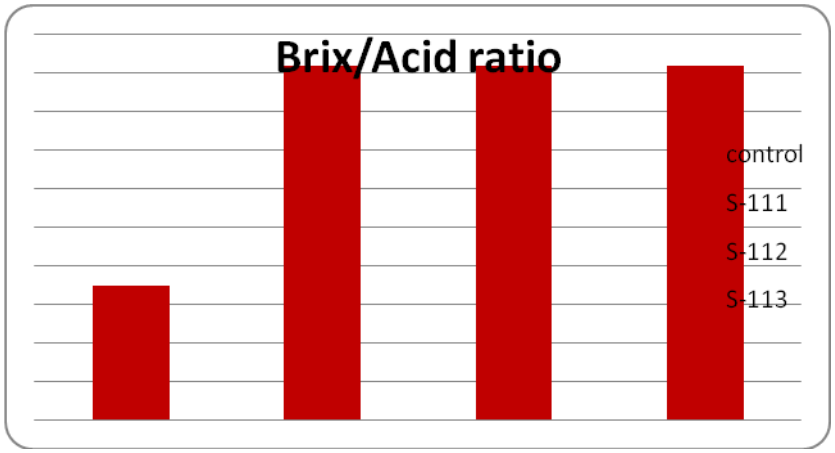


Fig.6 The Variation in Reducing Sugars in Orange Squash Blended with Herbal Infusion

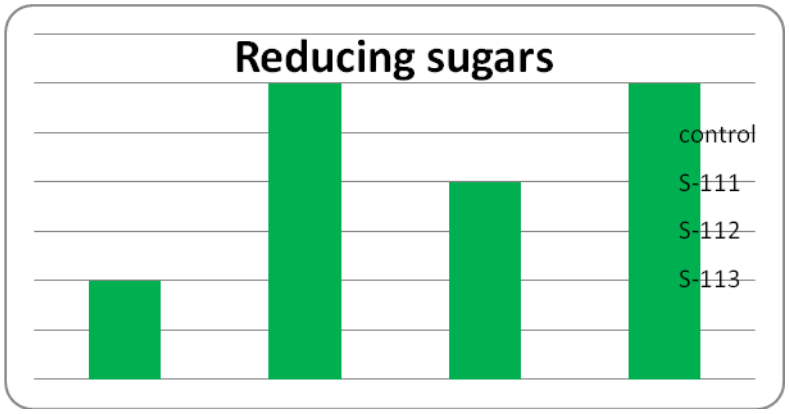


Fig.7 The Variation in Ascorbic Acid in Orange Squash Blended with Herbal Infusion

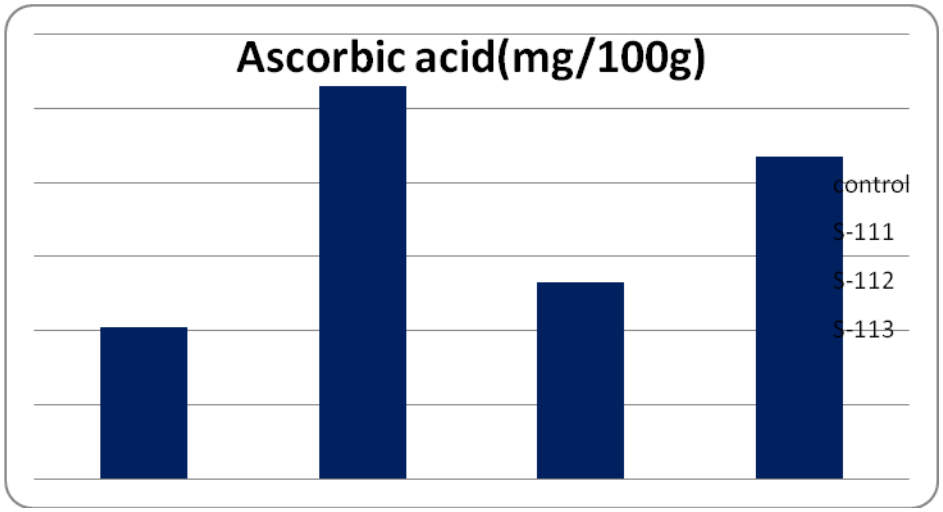
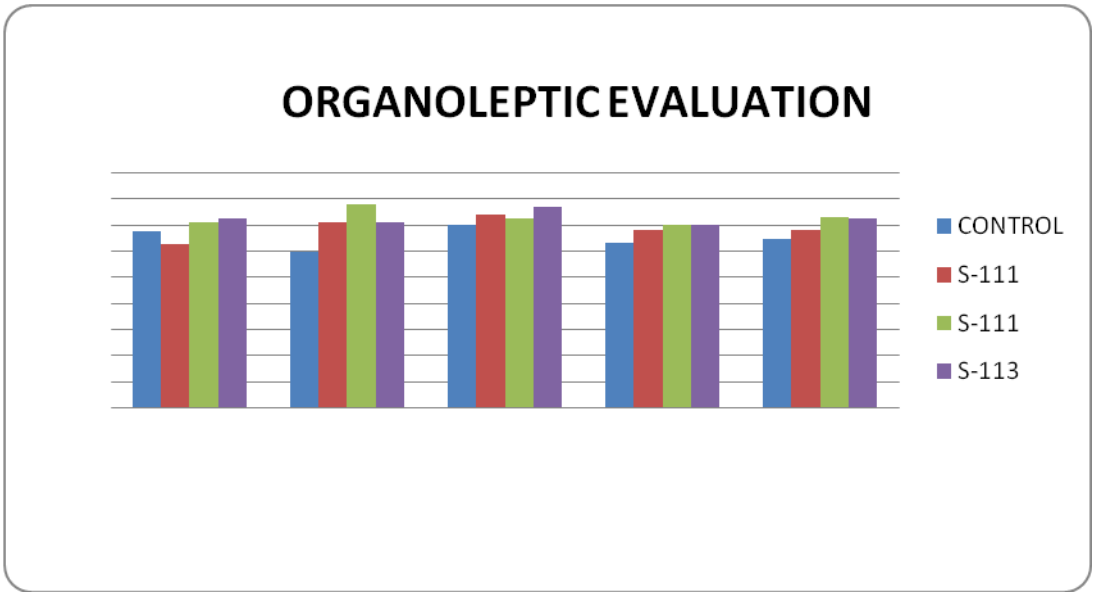


Fig.8 Organoleptic Evaluation of Orange Squash Blended with Herbal Infusion



The formulated product is evaluated for the presence of microbial count. The results obtained are given in Tabl.4. The data has shown that the colony count for both bacterial and fungal is nil and below the permissible count. Ground oregano (at 2% concentration) was found to posses a strong antifungal potential against several food-contaminating moulds, such as *Alternaria alternate Keissler, Fusarium oxysporum Schlecht, Penicillium citrinum, Penicillium roqueforti, Penicillium bpatulum, Aspergillus flavus and Aspergillus parasiticus* (Peter 2004).

From the results of the present study it can be concluded that sample 112 scored highest for flavor and after taste. Sample 113 was found to be superior in color and taste. Sample 113 showed significant acceptability than compared to control. This product is not only

beneficial as a thirst quenching and refreshing but is found to have therapeutic effects, anti ageing, anti-carcinogenic properties, protective effects as it is rich in polyphenolic compounds. Also the samples blended with herbal infusion are found to prevent loss of ascorbic acid during storage significantly. This product has showed an excellent sensory properties and a good shelf-life of more than 45 days when stored at room temperature.

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