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Studies on the Development of Value Added Guava- Mint- Basil- Honey Blended Ready to Serve Refreshing Squash

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Development and evaluation of bael beverages.

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ABSTRACT

Squash beverages are drinks produced by blending concentrated fruit syrup with water to create pleasant refreshment. These drinks are appreciated for their refreshing taste and the ability to customize them by varying the amount of syrup added. They are a pleasant tasty thirst quenching option and are enjoyed by various different age groups. The focus of this investigation is the creation of an innovative beverage, a guava mint Basil squash sweetened with honey, a natural alternative to processed sugars. Guava is a powerhouse of nutrition, boasting high levels of antioxidants, vitamin C, potassium, and dietary fiber, all contribute to its numerous health benefits. The study examines the sensory attributes, physical and chemical constituents, and the shelf life of the product's freshness. A series of blends have been made and put through a rigorous assessment to gauge their flavor, scent, hue, pH level, acidity, sugar content, colour measurement and bacterial purity. Storage studies were carried out up to one week and the result showed that selected sample were in good condition after one month, though little bit of faded colour was found at the end of storage periods. Sample with40% sugar syrup, 50% guava pulp, 5% mint paste and 5% basil paste secured the highest score on sensory attributes. The research findings reveal that honey not only improves the taste experience but also preserves the healthful attributes of the squash. Moreover, the beverage shows commendable preservation of retention over time. The research enriches the range of health-oriented beverages and illuminates the use of natural sweeteners in beverage innovations.

INTRODUCTION

Squash is non - alcoholic concentrated syrup, typically fruit - flavoured, made from fruit juice, water and sugar substitute. It must be diluted with water or carbonated water before consumption. Fruit squashes are gaining popularity over synthetic beverages due to their taste, flavour, nutritional benefits and storage stability. As a nutritious soft drink, squash is widely enjoyed globally.

Guava (*Psidium guajava L.*), is one of the most well known edible fruits grown widely in more than sixty countries throughout the tropical and subtropical regions of the world. . Guava fruit is high in vitamin A, vitamin C, and antioxidants such as carotene and lycopene, which protect the skin from wrinkles. Because of its beneficial effects on dyslipidaemia, lycopene has been linked to the prevention of cardiovascular disease. Lycopene is a strong antioxidant that aids the body in eliminating damaging free radicals, which may lead to cancer if left unchecked. Guava's antioxidant properties have been linked to anticancer effects in both solid and hematological cancers. The sodium and potassium levels in the body are maintained by the guava fruit, which helps people with hypertension control their blood pressure. Manganese is found in its fruit, which aids in the absorption of other important minerals from food.

Mint (*Mentha viridis L.*) belongs to the family Lamiaceae and has common name 'Pudina'. Mint leaves contain a number of vitamins and minerals, which are vital to maintain a healthy body. It is also said to relieve symptoms of indigestion, heartburn and irritable bowel syndrome by relaxing the muscles in and around the intestine, act as a powerful antioxidant, protecting the body against the formation of cancerous cells, very good cleanser for the blood and help in clearing up skin disorders such as acne (Aflatuni et al., 2005).

Basil (*Ocimum sp.*), also known as Tulsi, it is an erect much branched softly pubescent undershrub 30 to 60 cm high plant to an aromatic plant in the family Lamiaceae. Basil's extracts are used in Ayurvedic remedies for common colds, headaches, stomach disorders, inflammation, heart disease Chatterjee G (2015), various forms of poisoning and malaria among the conditions listed.

Honey is a sweet viscous yellowish liquid with tempting flavours, which is elaborated by the honeybee from the nectar of plants. Beside antioxidants, acids (primarily gluconic acid), protein, minerals, flavonoids, vitamins and enzymes among are also found in honey (Wang et al., 2004). Blending of two or more fruit juices and their beverages with the addition of spice extracts/ drops as health drinks is thought to be convenient alternative for its utilization in order to have some value added fruit drinks, having high quality in respect of both sensory and nutritional aspects. (Joshi et al., 1993 and Gowda and Jalali, 1995). Keeping in mind the nutritional and medicinal properties of guava, mint and Tulsi and the flavour enhancing capacity of spices.

MATERIALS AND METHODS MATERIALS:

Sample Collection-

The mature guava pulp was collected from industry.

Chemicals, Solvents and Ingredients-

Chemicals and reagents used in the study were used from laboratory stock. Sugar, Preservatives and other ingredients were collected from local market. The study utilized reagent grade chemicals and solvents, and the water used was distilled. Plastic Bottle was used as the packaging materials.

Apparatus Required-

Blender, Filter cloth, Measuring cylinder, Pipette, Oven, Weight balance, Beaker, Volumetric flux.

METHODS:

Extraction of pulp and paste making:

Guava pulp:

Guava fruits were washed thoroughly with clean running water and cooked with 70 per cent of water in pressure cooker for 15 minutes. It was then brought to room temperature. Peel were separated from the pulp with the help of a stainless steel knife. The extracted pulp was passed through fruit pulper to obtain fine pulp, packed in polyethylene bags and then stored under frozen condition (~ 20°C) to be used later.

Mint paste:

Fresh tender twigs of mint with green leaves were washed thoroughly under running tap water and then allowed to air dry. The paste was made by grinding the leaves in a grinder and by adding 40ml water to 500g pulp to facilitate paste making. The paste was packed in polyethylene bags and stored at frozen condition (~ 20°C).

Basil paste:

Basil's fresh leaves were washed under running tap water and then left to air dry. The paste was made by grinding the leaves in a grinder and by adding 50 ml water to 500g of pulp to facilitate paste making. The paste was packed in polyethylene bags and stored at frozen condition (~ 20°C).

Formulation and preparation of squash:

Table 1 shows the formulation of mixed squash with different combination of sugar, guava, mint, basil. The sample S1 contained 35% sugar syrup, 40% guava pulp, 15 % mint paste and 10 % basil paste. The sample S2 contained 40% sugar syrup, 50% guava pulp, 5% mint paste and 5% basil paste and the sample S3 contained 30% sugar syrup, 50% guava pulp, 10 % mint paste and 10% basil paste, Kaanane A, et.al (1988).. All the ingredients were mixed thoroughly and heated at 30 ◦ mixed juice was then cooled. After cooling the juice was filled into plastic bottles and capped properly.

3 times and then sensory analyzed to obtain best proportion of honey. The best combination of above prepared squash blends with or without honey were separately bottled in 500 ml bottles, capped and stored at room temperature (35±5°C) for further analysis.

Table: 1 Preparation *of squash from guava-mint-Basil proportions:*

S.NO	SUGAR : GVAVA: MINT : BASIL
1.	35 : 40 : 15 : 10
2.	40 : 50 : 05 : 05
3.	30 : 50 : 10 : 10

In brief, the total soluble solids (TSS) and acidity contents of blends were analyzed. Then requisite quantities of sugar syrup was prepared and calculated amount of critic acid was added to the blends to obtain final TSS and acidity as 50 per cent and 1 per cent, respectively. The squash prepared from various proportions was diluted 3 times and then sensory evaluated to obtain the best combination of the blend. The best combination of sensory evaluated squash blend, was reformulated by partially replacing sugar by 5, 10 and 15 per cent honey. The reformulated squash blend with various proportions of honey was diluted

Sensory Evaluation of squash:

The sensory evaluation of three samples of squash were evaluated for color, flavor, taste and overall acceptability parameters by 10 tasters. The panelists were selected from the employees of srini food park Ltd. For evaluation of squash were given to 10 panelist and randomly coded sample. The participants were requested to rate the provided sample using a 9- point hedonic scale, assigning ratings 9 =Like extremely, 8 = Like very much, 7 = Like moderately, 6 = Like slightly, 5 = Neither like or unlike, 4 =Dislike slightly, 3 =Dislike moderately, 2 = Dislike very much, 1 = Dislike extremely.

Physicochemical Analysis:

Total solids of formulated squash

Total solids of squash is determined according to the method reported in AOAC (2000), using conventional oven method, as was earlier determined by Tanwar et al. (2022), with required modifications. 10 g sample of squash is placed in an air oven at 105 °C in sample dish. The weight of the samples was monitored every 4 h until the consecutive weight difference was less than 1 mg/g solids. A total solid is determined in triplicate, and are calculated using the following formula:

$$\text{Total solids} = W2 / W1 \times 100$$

Where: W1= initial weight of the sample; W2= final weight of the sample.

Titratable acidity of formulated squash

Titratable acidity of squash was determined using the titration method as illustrated in the AOAC (2000) and was expressed as g of citric acid/100

ml of the sample. 0.1N NaOH solution was prepared using 2 g of NaOH dissolved in 500 ml of distilled water. Similarly, phenolphthalein indicator was prepared by dissolving 1g of phenolphthalein in 100ml ethanol. Then 10 ml of squash was taken as sample from each treatment and 2–3 drops of indicator was added into it. Sample was titrated against 0.1N NaOH solution until pink color was obtained. Acidity factor used for acidity determination was 0.064, and below given formula was used to determine titratable acidity.

Titratable acidity = amount of NaOH used × 0.064.

pH analyses of formulated squash

The pH value is determined by using digital pH meter as described by AOAC method no. 981.12 (2000). The electrode of pH meter was directly dipped into the sample and the value on the meter, which illustrates the pH of the sample, was noted after performing analysis for three times.

Brix of formulated squash

Total soluble solids are measured using a hand refractometer (RHB-32ATC) of 0–32°B. Brix is obtained by adding few drops of sample solution on the prism of refractometer and closing the lid, under method 932.12 of AOAC (2000). To see the internal scale, refractometer is held perpendicularly to a source of light. The Brix reading are clearly seen, where the light area meets the dark areas on the scale.

Viscosity of formulated squash

Prior to the measurement of viscosity, the squash sample is conditioned at 4 °C. A rotator type viscometer is used to determine the viscosity of squash samples as earlier reported by Aggarwal et al. (2020), with some modifications. Viscosity is determined in triplicate to find out the mean value, by using spindle number 5 and the speed is set at 50 rpm. The results of the viscosity are expressed in centipoises (cP).

Determination by colour

The colour parameters were measured using a benchtop colorimeter Chroma meter CR-5 (Konica Minolta; Chiyoda City, Tokyo, Japan). The top measurement port was adjusted to 8 mm. The evaluated color parameters were L* (lightness), a* (±red–green) and b* (±yellow–blue). Preliminary measurements under dark chamber cover and daylight illumination revealed no discrepancy in the obtained color parameters, thus all measurements were conducted in natural day light. Triplicate measurements were executed, and the results are presented as means with standard deviations

Proximate Analysis for selected sample:

Different chemical properties of samples were analysed for moisture content, ash, fat, protein and total carbohydrate. All the determinations were done in triplicate and the results were expressed as the average value.

- Ash-

Drying the sample at 100 0C and charned over an electric heater. It was then ash in muffle furnace at 550 0C for 5 hrs.By AOAC (2005). It was calculated using the following formula:

$$\%\ Ash\ Content = \frac{\mathrm{AW}}{IW}\ x\ 100$$

Where, AW = Weight of Ash and IW= Initial weight of dry matter.

- Moisture content-

Moisture content was determined adopting AOAC (2005) method as following:

$$\%\ \mathrm{Moisture\ Content} = \frac{\mathrm{Loss\ in\ Weight}}{\mathrm{Weight\ of\ Sample}}\ x\ 100$$

- Fat-

AOAC (2005) method using Soxhlet apparatus was used to determined crude fat content of the sample. The percent of crude fat was expressed as follows:

$$\%\ Crude\ Fat\ = \frac{\mathrm{Weight\ of\ dried\ ether\ \ Soluble\ material}}{\mathrm{Weight\ of\ sample}}\ x\ 100$$

- Protein-

Protein content was determined using AOAC (2005) method. Percentage of nitrogen and protein calculated by the following equation:

$$\%\ Nitrogen\ = \frac{\mathrm{TS - TB\ x\ Normality\ of\ acid\ x\ 0.0014}}{\mathrm{Weight\ of\ the\ sample}}\ x\ 100$$

Where, Ts = Titre volume of the sample (ml), TB = Titre volume of Blank (ml), 0.014= M eq. wt. of N2. % Protein = Nitrogen × 6.25

- Total carbohydrates-

Total carbohydrate content of the samples was determined as total carbohydrate by difference that is by subtracting the measured protein, fat, ash and moisture from 100 phenol sulphuric acid method as given by AOAC (2005).

Microbiological Count:

Determination of Total Viable Bacteria-

The standard pour plate method is employed to assess the total viable count of microorganisms found in selected sample was followed according to the method described in "Recommended method for the microbiological examination of food" (Ali et al., 2008).

Preparation of Media-

Nutrient agar was used for total viable count. All necessary ingredients were measured and mixed in a conical flask. The conical flask was heated for proper mixing. In the time of heating, the mixture was rotted with the glass rod. When the mixture was properly mixed, the mouth of the conical flask was blocked with cotton plug and covered with aluminium foil. Then the conical flask with media was placed in autoclave for sterilization (Temperature: 1210C, Pressure: 14.5 psi and time: 15mins.).

Incubation and Colony Count-

After autoclaved the media was allow to cool in 40ºC. Approximately 20ml of media were poured into the petri dish, then adequately homogenized by alternating clockwise and counter clock wise motions before being left to solidify. After solidification the plate was incubate at 37ºc in inverted position for 24-48 hours. After incubation colony was counted by colony counter. Laminar air flow was used to maintain aseptic condition.

Colonies were counted with the aid of a magnifying glass and finally the total number of bacteria per gram of sample was calculated by the following equation:

Colony count (per ml) = Number of colonies (per plate) × Reciprocal of the dilution.

CFU/ml= (no. of colony × dilution factor)/ sample taken (ml)

Determination of Total Yeast and Mold-

The total yeast and mold count was determined using potato dextrose agar (PDA) with colonies counted using a colony counter and calculated using an equation after incubation.

Determination of Total Coli form Count-

Pour Plate Method was used to determine the coli form bacteria. Macconkey agar was used for total coliform count. After incubation colony was counted by colony counter and calculated by equation (same as section 2.3.6.1)

Studies on Storage Stability of Selected squash:

Selected sample, stored in bottle at room temperature, underwent shelf life assessment through objective and subjective tests at various time intervals. The pH, acidity, TSS, spectrometer, flavor, texture, microbial count and fungal growth were observed up to 30 days.

RESULTS AND DISCUSSION:

The findings from the ongoing investigation, along with pertinent discussions have been condensed into the following categories:

Sensory Attributes:

The value added squash prepared by blending sugar: guava: mint: basil in proportion of 40: 50: 5: 5 (on weight basis) was found more acceptable (8.34) over other proportions. In case of various proportions (5-20%) of honey used to partially substitute sugars, substitution resulted in improvement in organoleptic sensory score for 5, 10, 15 and 20 per cent was 7.13, 7.33, 7.57 and 8.63, respectively (Table 3). From sensory evaluation the best treatment were selected for storage studies without honey the proportion of sugar :guava: mint: basil was 40: 50: 5: 5 and for this ratio the partial substitution of honey for sugar was 15 per cent these two were further taken for storage studies.

Table 2: Mean sensory attributes scores of Guava-Mint-Basil squash (during standardization).

S.NO	SUGAR : GUAVA : MINT : BASIL Proportions	Mean sensory scores
1.	35 : 40 : 15 : 10	7.15
2.	40 : 50 : 05 : 05	8.50
3.	30 : 50 : 10 : 10	7.37

Table 3: Mean sensory attributes scores of partially honey substituted Green mango-Mint-Basil squash (during standardization)

S.No	Partial substitution of honey level (%)	Mean sensory scores
1.	5%	7.33
2.	10%	7.57
3.	15%	8.61

Parameters	Storage Days		
	0	15	30
Colour & Appearance	8.5	8.5	8.5
Flavour	8.5	8.5	8.4
Mouth-Feel	8.5	8.5	8.5
Overall Acceptability	8.5	8.4	8.4

Table 4. Sensory characteristics of fresh and stored Guava-Mint-Basil.

The sensory evaluations of prepared squash are performed by a panel of 5 judges using 9-point hedonic scale to know the overall acceptability of the product. The overall acceptability of the squash is found to be good at the end of 30 days of storage period. The score of prepared beverage in fresh condition is 8.5 and at the end of 30 days of storage period the scores of corresponding samples were found to be 8.4. Gradual decrease was observed in overall acceptability for Guava-Mint-Basil squash, (Table:4). This was due to increase in viscosity and darkening of the colour and pungency in taste, as reported by Shekilango et al. (1997)

Physical and Chemical constituents of squash:

The squash were analyzed for TSS, Acidity, PH, spectrometer properties Bandyopadhyay *et al*. (2008); Deka *et al*. (2005). The approximate composition showed in the table 4.

Table 4: Chemical constituents of fresh and stored Guava-Mint-Basil squash.

Parameters	Storage Days		
	0	15	30
TSS	14.4	14.1	13.8
Acidity	0.31	0.36	0.39
pH	3.80	3.82	4.10
Brix	0.53	0.71	0.83
viscosity	12.7	13.9	14.6
color	7.82	6.31	5.45

The physical and chemical constituent's changes in squash were analysed and results revealed that TSS was 31.77, Acidity was 0.31, pH was 3.83 and spectrometer was 35.131 mg/100g respectively.

Table 5.Proximate analysis of squash

Analysis	Amount
Ash	0.56
Moisture	97.02
Fat	0.81
Protein	2.3
Carbohydrates	8.88
Ascorbic acid	6.58
Energy Value	63.41

Proximate analysis of squash:

The squash were analyzed for ash, moisture, fat, protein, total carbohydrates and ascorbic acid , energy value properties Belscak *etal*. (2011). The approximate composition showed in the table 5.

Microbial Analysis

Total Viable Counts (TVC) were high ranging from 1.68 ×104 cfu/mL at zero time and reached 1.96 ×104 cfu/mL after 30 days of storage period in Guava-Mint-Basil squash. Yeast count was 1.32 ×104 cfu/mL, at zero time and reached 1.89 ×104 cfu/mL, respectively, the same trend was reported by Ismail et al. (2011) and Mahale et al. (2008).

CONCLUSION

Development of innovative and nutritional sqash are always area of research for food processors. In this research work, was effectively used to produce a Green mango-Mint-Basil squash having acceptable sensory and nutritional properties as well as good shelf life. Physicochemical and sensory parameters of Green mango-Mint-Basil squash were observed at refrigerated storage temperature (4 °C) for 30 days. During storage, decline in total solids, viscosity and titratable acidity, were observed, while pH, total plate count, and yeast and mold count were increased. However, the overall acceptability of the Green mango-Mint-Basil squash was good after 30 days of storage at refrigeration temperature.

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