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Standardization of Blending of Guava Pulp with Pineapple Juice for Preparation of Ready-To-Serve (RTS)

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A B S T R A C T

A laboratory experiment was conducted during the period of August to November 2015 at the Department of Horticulture, SASRD, Medziphema Campus, Nagaland University to standardize the blending of guava pulp (Gp) with pineapple juice (Pj) for preparation of Ready-to-Serve (RTS). The experiment was composed of six treatments with four replications and arranged in a complete randomized design. The treatment comprised of: T_1 100% (Gp), T_2 (90% Gp: 10% Pj), T_3 (80%Gp: 20% Pj), T_4 (70%Gp: 30%Pj), T_5 (60%Gp: 40%Pj) and T_6 (50% Gp: 50% Pj). Fully ripen guava fruits cv. L-49 and 3/4th matured pineapple cv. Kew were collected to carry out the experiment under hygienic condition in laboratory. Various chemical constituents including organoleptic evaluation (adopting five expert panel with 9 point Hedonic scale) were analyzed for two and half months at 15 days interval at ambient storage condition for standardization and evaluation the qualitative changes and storage of best blended ratio. TSS, total sugar, non-reducing sugar, TSS: acid ratio and pH increased with increased level of pineapple juice with guava pulp and decreased in ascorbic acid and reducing sugar with increased level of pineapple juice. In the experiment, it was found to increase in total sugar, reducing sugar, TSS, pH and TSS: acid ratio of drinks, whereas ascorbic acid, acidity, non-reducing sugar and overall acceptability gradually declined with advancement of storage period. The added 50% guava pulp and 50% pineapple juice improved the drink quality with special reference to TSS (15.54 ^{o}B), total sugar (8.65%) and TSS acid ratio (49.85). But the ratio of 60% guava pulp and 40% pineapple juice reached the highest sensory characters for overall acceptability (7.74 score out of 9 point hedonic scale) with 15.29 ^{o}B TSS and 0.317% acidity. Particularly in the blended beverage more emphasis is given on the basis of the consumer satisfaction and overall acceptability. So in the present study, it was concluded that the combination of 60% guava pulp and 40% pineapple juice was the best blended ratio.

Keywords

Ready-to-Serve, Blending ratio, Chemical composition, Organoleptic taste, Storage.

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Introduction

Blending of two or more fruit juices in an appropriate proportion for the preparation of ready-to-serve beverage may be a convenient alternative refreshing health drink and excellent source of several important vitamins and minerals compared to synthetic beverages. The demand of synthetic beverages is several million bottles annually. If real fruit juices could be substituted for these synthetic preparations, it would be great

for the fruit growers and consumers. There is always a demand for the consumers all over the world for new food products which should be nutritious and delicately flavoured. Moreover, owing to high acidity, astringency, bitterness and such other factors in some of the fruits, the utilization of these fruits for the preparation of various processed products becomes limited, despite having high nutritional qualities. Various workers have reported that two or more fruit juices or pulps may be blended in various proportions for the preparation of more palatable and nutritious beverages. It also enhances the appearance, nutrition, flavour of the product and lead to new product development. Fruits like guava and pineapple are most common fruits grown in subtropical condition of Nagaland and coincides each other for fruiting but due to its high perishable nature more than 80% fruit loss every year. Therefore there was an immediate requirement for processing to avoid post- harvest losses. So, keeping this in view, the present investigation was undertaken to standardize the blending proportion of guava pulp with pineapple juice and to evaluate the qualitative changes and storage of best blended ratio.

Materials and Methods

To standardize the blending of guava pulp (Gp) with pineapple juice (Pj) for preparation of RTS, the experiment was composed of six treatments viz. T_1 100% (Gp), T_2 (90%Gp: 10% Pj), T_3 (80%Gp: 20% Pj), T_4 (70%Gp: 30%Pj), T_5 (60%Gp: 40%Pj) and T_6 (50% Gp: 50% Pj) with four replications and arranged in CRD. The blended beverage was analyzed in the laboratory at 15 days interval stored the products under room condition. Uniform and fully ripen blemish less guava fruits cv. L-49 and freshly 3/4th matured pineapple cv. Kew were taken in the experiment. Cleaned guava fruit were sorted out and skin were peeled off. After cleaning in running water, fruits were cut into small pieces and put into a large blender jar. The guava fruit were chopped into small pieces for grinding properly. But it was not grind too much so that the seeds do not get ground and give sand like feel in the juice and sieved through double layered muslin cloth to get rid of the seed grits if there any. And it was stirred continuously with stainless steel spoon so that smooth pulp is extracted in the bowl. The well matured ripened pineapple fruits were selected and peeled with the help of stainless steel knife and the crown, rind, eyes and core was removed. Then the fruit was cut into small pieces and fed into blender for extraction of pineapple juice. The juice was strained through a double layered muslin cloth into a stainless steel container. Appropriate quantities of the extracted juice of pineapple and guava pulp of different proportion were mixed thoroughly. After that, the prepared strained syrup solution (sugar + water + acid) was added into the mixture of juice and processed upto 100 ^{o}C for 2 minutes and filled into the pre-sterilized colourless glass bottles of 200 ml capacity and sealed air tight using crown caps with the help of a crown corking machine. The products were pasteurized in boiling water (90 ^{o}C) for 30 min. The glass bottles were then allowed to cool down rapidly to room temperature under a fast moving ceiling fan. One set of bottles from each combination was examined immediately after preparation, both in regard to chemical and organoleptic quality. The recipe for preparation of RTS was sugar 750 g, water 4620 ml, citric acid 16.8 g and KMS 0.12 g (Srivastava and Kumar, 1998). Before starting the experiment, initial physical and bio-chemical composition of fruit juice/pulp were measured to make the experiment more accuracy. In guava, the average fruit weight was 149.50 g, TSS 9.39 ^{o}B, total sugar 6.94 % fresh weight, acidity 0.368% fresh weight and ascorbic acid 115.48 mg 100 g^{-1} of pulp. In pineapple, average fruit weight was 969.83 g,

TSS 17.82 ^{o}B, total sugar 9.84 % fresh weight, acidity 0.31 % fresh weight and ascorbic acid10.8 mg 100 g^{-1} of pulp. Biochemical attributes like TSS, total sugar, acidity, Vit-C, juice p^{H} and TSS: acid ratio of juice were estimated under the investigation.

Total soluble solids (TSS) were determined with the help of hand refractometer calibrated in ^{0}Brix at 20 ^{0}C with necessary correction factor. Total sugar were estimated by standard procedure of A.O.A.C. (Anon, 1984) using Fehling's A and Fehling's B reagents with methylene blue as an indicator through copper reduction method. Total titratable acidity was determined by titrating the juice against N/10 NaOH using phenolphthalein as indicator and expressed in percentage. 2, 6- dichlorophenol indophenol dye titration method was used to estimate the ascorbic acid content of juice and expressed as mg 100 ml^{-1} of juice. The electronic pH meter was calibrated using 7 pH and 4 pH standard buffer solutions. The function selector switch was set to pH and reading of digital display was allowed to stabilize. The sensory evaluation was carried out by using 9 point hedonic scale consisting of a panel of five semi trained judges (Amerine *et al.*, 1965).

Results and Discussion

Among the different treatment, the added 50% guava pulp and 50% pineapple juice improved the drink quality with special reference to TSS (15.54 ^{o}B) which was followed by T5 (60% Gp+40%Pj) with 15.29 ^{0}B TSS. The total soluble solids content in the RTS increased apparently with gradual passage of storage time which might be due to hydrolysis of insoluble polysaccharides and organic acids into sugars. These results were also inconformity with Deka *et al.*, (2005) in mango-pineapple RTS beverages stored in white and amber coloured bottles for 6 months. It was also found to gradual increase in TSS by storage period in aonla and guava blended RTS (Kumar and Godara, 2011)

The total sugar content of the guava-pineapple blended RTS beverage had increased gradually with increment of pineapple juice from initial stage viz. T_1 (6.47%), T_2 (6.72%), T_3 (7.40%), T_4 (7.86%), T_5 (8.01%) and T_6 (8.25%) and at the end of the storage, it was found in T_1 (7.53%), T_2 (7.80%), T_3 (8.39%), T_4 (8.41%), T_5 (8.50%) and T_6 (8.88%). The highest total sugar content was found in T_6 (50%Gp: 50%Pj) with 8.65% followed by T_5 with 8.32%. The increase in total sugar is might be due to the hydrolysis of polysaccharides like pectin, cellulose, starch etc. and its conversion into simple sugars like glucose and fructose reported by Sindumathi and Premalatha (2013) in the study of papaya and pineapple juice using ginger and cardamom as flavouring agents.

It was observed that there was a significant decrease in titratable acidity content in guava-pineapple blended RTS beverage during storage. Initially acidity was observed as T_1 (0.378%), T_2 (0.375%), T_3 (0.365%), T_4 (0.363%) T_5 (0.361%) and T_6 (0.368%) which showed the final decrease to T_1 (0.317%), T_2 (0.276%), T_3 (0.279%), T_4 (0.280%), T_5 (0.275%) and T_6 (0.260%) respectively on 75^{th} day of storage. But the results of storage at day of 0 and day of 75 did not show significant variation among the treatments during storage. The lowest average titratable acidity was noticed in treatment T_6 (0.316%) followed by T_5 (0.317%). However there was a significant decrease in titrable acidity on day 15, 30, 45 and 60 during storage period in all the treatments. And the decrease in titrable acidity might be attributed to the bioconversion of acids into sugars or it could be attributed to the chemical interaction between the organic constituents of the juice induced by the temperature and action of

enzymes (particularly invertase). Salari *et al.*, (2012) also noticed to gradual decrease in acidity in muskmelon RTS blended with pomegranate juice. The gradual decrease in acidity was in corresponding increase in pH reported by Patil *et al.*, (2014) to develop RTS by blending rose apple and jamun in different proportions.

A marginal decrease in ascorbic acid content in blended juice was found apparently with the advancement of storage during the entire period. There was successive decline in the ascorbic acid content with the increased ratio of pineapple juice concentration. The average ascorbic acid content in juices was found to vary from 29.82 to 61.98 mg 100 ml^{-1} juice. It was noticed that ascorbic acid content was maximum in T_1 at initial stage (65.75 mg 100 ml^{-1} juice) which was found to decrease in 59.55 mg 100 ml^{-1} juice at 75th day of storage. Ascorbic acid content of guava-pineapple based blended RTS beverages decreased with the advancement of storage period because of the fact that ascorbic acid being sensitive to oxygen, light and heat and was easily oxidized in presence of oxygen by both enzymatic and non-enzymatic catalyst and also it might have been destroyed during processing and subsequently during storage.

Similar results about the changes of ascorbic acid in juice was reported by Pathak *et al.*, (2012) and found that there was a significant and continuous decline in ascorbic acid during entire period of storage in litchi and pomegranate blended RTS and nectar beverage. The gradual decrease in ascorbic acid content of juice was also found by Byanna and Gowda (2013) during standardization of sweet orange and kokum blended RTS beverage.

Table.1 Changes in TSS (°Brix) and total sugar (%) content of blended guava and pineapple RTS beverage during storage

Treatments	Day 0	Day 15	Day 30	Day 45	Day 60	Day 75	Average
TSS (°Brix)							
T_1 (100%)	13.83	14.07	14.35	14.61	14.70	14.77	14.39
T_2 90:10)	14.12	14.18	14.41	14.57	14.78	14.85	14.48
T_3 (80:20)	14.25	14.31	14.54	14.60	14.82	15.02	14.59
T_4 (70:30)	14.62	14.68	15.08	15.29	15.43	15.48	15.09
T_5 (60:40)	14.81	15.12	15.22	15.40	15.56	15.61	15.29
T_6 (50:50)	15.06	15.31	15.53	15.70	15.81	15.81	15.54
S.Em (±)	**0.072**	**0.108**	**0.076**	**0.070**	**0.053**	**0.051**	**-**
C.D. (P=0.05)	**0.216**	**0.322**	**0.226**	**0.209**	**0.159**	**0.153**	**-**
Total sugar (%)							
T_1 (100%)	6.47	6.64	6.91	7.27	7.48	7.53	7.05
T_2 90:10)	6.72	6.93	7.22	7.56	7.72	7.80	7.32
T_3 (80:20)	7.40	7.69	7.80	8.11	8.37	8.39	7.96
T_4 (70:30)	7.86	8.19	8.30	8.34	8.41	8.41	8.25
T_5 (60:40)	8.01	8.11	8.37	8.40	8.51	8.50	8.32
T_6 (50:50)	8.25	8.43	8.70	8.75	8.87	8.88	8.65
S.Em (±)	**0.054**	**0.034**	**0.033**	**0.023**	**0.031**	**0.047**	**-**
C.D. (P=0.05)	**0.162**	**0.102**	**0.098**	**0.070**	**0.092**	**0.140**	**-**

Table.2 Changes in acidity (%) and ascorbic acid (mg/100ml of juice) content of blended guava and pineapple RTS beverage during storage

Treatments	Day 0	Day 15	Day 30	Day 45	Day 60	Day 75	Average
Acidity (%)							
T_1 (100%)	0.378	0.359	0.348	0.329	0.317	0.317	0.341
T_2 90:10)	0.375	0.355	0.345	0.325	0.315	0.276	0.332
T_3 (80:20)	0.365	0.346	0.337	0.315	0.284	0.279	0.321
T_4 (70:30)	0.363	0.341	0.332	0.314	0.292	0.280	0.320
T_5 (60:40)	0.361	0.341	0.325	0.307	0.294	0.275	0.317
T_6 (50:50)	0.368	0.340	0.329	0.309	0.293	0.260	0.316
S.Em (±)	**0.009**	**0.002**	**0.002**	**0.003**	**0.003**	**0.014**	**-**
C.D. (P=0.05)	**NS**	**0.005**	**0.006**	**0.009**	**0.011**	**NS**	**-**
Ascorbic acid (mg/100ml of juice) content							
T_1 (100%)	65.75	64.12	62.54	60.10	59.85	59.55	61.98
T_2 90:10)	56.26	53.98	53.00	52.84	51.72	51.70	53.25
T_3 (80:20)	50.06	48.78	48.50	47.77	45.90	45.70	47.78
T_4 (70:30)	43.22	42.00	40.53	40.05	39.98	39.86	40.94
T_5 (60:40)	39.12	37.98	36.25	36.20	35.50	34.90	36.66
T_6 (50:50)	33.63	31.21	30.00	28.71	27.68	27.67	29.82
S.Em (±)	**0.581**	**0.259**	**0.616**	**0.086**	**0.070**	**0.084**	**-**
C.D. (P=0.05)	**1.725**	**0.770**	**1.831**	**0.257**	**0.210**	**0.251**	**-**

Table.3 Changes in pH and TSS/acid ratio of blended guava and pineapple RTS beverage during storage

Treatments	Day 0	Day 15	Day 30	Day 45	Day 60	Day 75	Average
pH of RTS							
T_1 (100%)	2.63	2.71	2.78	2.85	3.14	3.16	2.87
T_2 90:10)	2.89	3.08	3.14	3.23	3.30	3.38	3.17
T_3 (80:20)	2.66	2.75	2.81	2.87	3.18	3.21	2.91
T_4 (70:30)	2.88	2.95	2.99	3.03	3.12	3.19	3.02
T_5 (60:40)	2.93	3.01	3.07	3.13	3.21	3.28	3.10
T_6 (50:50)	3.08	3.16	3.25	3.33	3.38	3.45	3.27
S.Em (±)	**0.065**	**0.329**	**0.097**	**0.041**	**0.042**	**0.375**	**-**
C.D. (P=0.05)	**0.195**	**NS**	**0.290**	**0.121**	**0.125**	**NS**	**-**
TSS/acid ratio							
T_1 (100%)	36.56	39.19	41.25	44.34	46.28	46.51	42.36
T_2 90:10)	37.74	39.91	41.71	44.83	46.83	54.18	44.20
T_3 (80:20)	39.03	41.35	43.09	46.36	52.12	54.28	46.04
T_4 (70:30)	40.29	43.02	45.38	48.72	52.72	55.31	47.57
T_5 (60:40)	41.06	44.26	46.74	50.11	52.82	58.02	48.84
T_6 (50:50)	41.27	45.04	47.19	50.78	53.97	60.83	49.85
S.Em (±)	**1.068**	**0.371**	**0.359**	**0.496**	**0.603**	**2.879**	**-**
C.D. (P=0.05)	**3.173**	**1.103**	**1.067**	**1.473**	**1.792**	**8.550**	**-**

Table.4 Mean sensory scores obtained by blended guava and pineapple RTS beverage during storage

Characteristics	T_1 (100%)	T_2 (90:10)	T_3 (80:20)	T_4 (70:30)	T_5 (60:40)	T_6 (50:50)
Taste	5.73	6.15	6.98	7.11	7.74	7.22
Appearance	6.76	7.00	7.09	7.33	7.70	7.77
Flavour	6.10	6.58	7.07	7.42	7.80	7.53
Over all acceptability	6.19	6.57	7.04	7.28	7.74	7.51

All the treatments showed a significant increase in pH of fruit juice throughout storage period. Among different treatments, the average highest pH in juice was noticed in T_6 (3.27). There was a significant increase in pH throughout storage except the storage at day of 15 and day of 75 that showed a non-significant result in pH. Islam *et al.*, (2014) also found in the experiment of different ratio of pineapple and orange juice with gradual decrease in titratable acidity and vitamin-C along the storage period and increment of TSS and progressiveness of pH during storage period.

There was a significant increase in TSS/Acid ratio during storage period in all the treatments from the initial average of T_1 (36.56), T_2 (37.74), T_3 (39.03), T_4 (40.29), T_5 (41.06) and T_6 (41.27) with final increase during storage was T_1 (46.51), T2 (54.18), T_3 (54.28), T_4 (55.31), T_5 (58.02) and T_6 (60.83). The increase in the TSS/Acid ratio might be due to increased TSS and decreased acidity during storage by the conversion of oligosaccharides into sugars. The similar results were also reported by Shaheel *et al.*, (2015) with karonda juice blended with guava, papaya and pineapple juices in different proportions through increasing of TSS, TSS/Acid ratio and total sugars with increase in storage period.

Organoleptic evaluation is generally the final guide of the quality from the consumer's point of view. In the experiment, results indicated that taste, appearance, flavour and overall acceptability of juice blends gradually decreased with the advancement of storage period. The ratio of 60% guava pulp and 40% pineapple juice (T_5) reached the highest sensory characters regarding flavour (7.80), taste (7.74) and overall acceptability (7.74) out of 9 point hedonic scale. The appearance which gradually decreased with storage perio might be due to break down of pigments and oxidative loss of pigments. Similar findings were reported by Deka *et al.*, (2005) showing a gradual decrease in sensory quality on the RTS beverage prepared from dashehari mango and kew pineapple over six month storage. Decrease in overall acceptability scores in bael-aonla RTS during storage because of declining in colour, taste and flavour by six month storage was also reported by Singh *et al.*, (2015).

Particularly in the blended beverage more emphasis is given on the basis of the consumer satisfaction and overall acceptability. So in the present study, it was concluded that the combination of 60% guava pulp and 40% pineapple juice was the best blended ratio

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