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Standardization of recipe for the preparation of low calorie RTS beverage from pineapple (*Ananas comosus*) using sugar substitutes

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SUMMARY :

The investigation on standardization of recipe for preparation of low clorie RTS beverage from pineapple (*Ananas comosus*) using sugar substitutes was conducted. The experiment was laid out in Factorial Completely Randomized Design with aspartame, sucralose and their combination with cane sugar (sucrose) with 15 per cent juice and 0.3 per cent acidity. The RTS beverage with sucrose was the control. Sugar substitutes were used in place of sugar based on sugar equivalents. The prepared RTS beverages were analysed for chemical composition and sensory quality attributes. Among different combination sugar substitutes, sample D prepared by using 50 % sucrose + 50% sucralose was reached with highest sensory scores for overall acceptability.

KEY WORDS : Pineapple, Chemical analysis, Low calorie sweeteners, RTS beverage

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Pineapple (*Ananus comosus)* is a wonderful tropical fruit having exceptional juiciness, vibrant tropical flavour and immense health benefits. it contains good amount of various vitamins, carbohydrates, crude fibre, water and different minerals that is good for health. Pineapple fruit is consumed fresh and juice as source of many essential minerals and vitamins. Fresh pineapples are rich in bromelain that used as anti-inflammatory, reducing swelling in inflammatory conditions such as acute sinusitis, sore throat, arthritis, gout (Hossain *et al.,* 2015). It is an excellent source of antioxidant, vitamin C which is required for the collagen synthesis in the body. It contains micronutrients and it protects against cancer and this micro-nutrient break up blood clots is beneficial to the heart (Tochi *et al.,* 2008).

Sugar substitutes are also called sugar substitutes. Low-calorie sweeteners are ingredients added to foods and beverages to provide sweetness without adding a significant amount of calories. In fact, they can also play an important role in a weight management programme

that includes both good nutrition choices and physical activity.When added to foods and beverages, these low-calorie sweeteners provide a taste that is similar to that of table sugar (sucrose), and are generally several hundred to several thousand times sweeter than sugar. They are often referred to as "intense" sweeteners. Because of their intense sweetening power, these sweeteners can be used in very small amounts and thus add only a negligible amount of calories to foods and beverages. As a result, they can substantially reduce or completely eliminate the calories in certain products such as diet beverages, light yogurt and sugar-free pudding.

The usage of sugar substitutes in fruit beverages preparation is an innovative area of research and therefore an investigation was carried out to standardize RTS beverage preparation using sugar substitutes.

EXPERIMENTAL METHODS

The present investigation was carried out in Department of Food Engineering with collaboration of Department of Food Chemistry and Nutrition in College of Food Technology, VNMKV, Parbhani during year 2014-16. Pineapple and sweeteners were obtained from the market area of the Parbhani.

Preparation of pineapple juice :

Ripe pineapples were selected, the crown and stem portion were removed and the fruit was washed in tap water. The pineapples were peeled with knives, eyes were removed and sliced. The prepared slices were crushed in a mixer and the juice was recovered by pressing the crushed mass in a hydraulic press. The juice was filtered through muslin cloth.

Preparation of low calorie pineapple RTS beverage:

RTS was prepared as per the procedure shown in (Fig. A) by mixing calculated amount of the juice, sugar, sweeteners, citric acid and water according to different blending ratio. The recipe of RTS beverage with 15 per cent juice, 14 per cent sugar (sucrose) and 0.3 per cent citric acid was used as standard control recipe However, sugar substitutes were used in place of sugar (based on sugar equivalents) for preparation of RTS beverages. The treatments include RTS beverage with aspartame, sucralose, 50 % sucrose +50 % sucralose, 50 % sucrose +50 % sucralose.

The following blending ratios were tested for preparation of low calorie pineapple RTS and evaluated their organoleptic quality.

Control- With addition of sugar (sucrose)
A - Aspartame(0.3%)
B - Sucralose(0.2%)
C - 50% sucrose+ 50% aspartame
D - 50% sucrose+50% sucralose

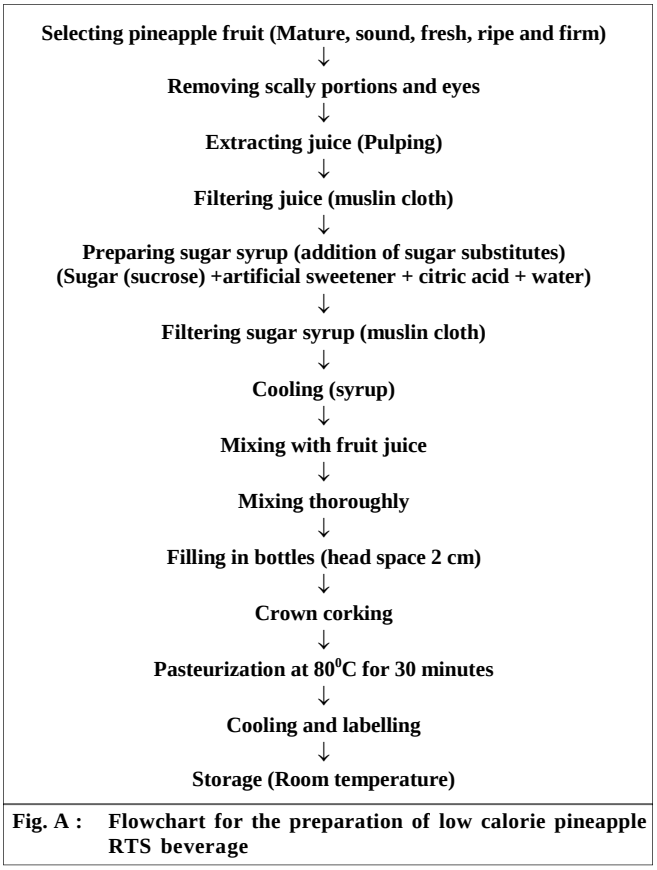

Fig. A : Flowchart for the preparation of low calorie pineapple RTS beverage

Low calorie pineapple RTS beverage was prepared as per the method adopted by Amaravathi *et al.* (2014).

Proximate analysis:

The proximate analysis of RTS beverages were done for different parameter. The prepared beverage was analysed for TSS, pH, titrable acidity and ascorbic acid content. TSS was measured by Abbe refractrometer, The pH of each sample measured by digital pH meter, titrable acidity and ascorbic acid as per given by Ranganna (1986).

Sensory evaluation:

Sensory evaluation was made through panel of 10

semi trained judges. The panel evaluated the acceptable level of beverage for colour, flavour, taste and overall acceptability. A 9 point hedonic scale was used for this purpose. The data obtained were subjected to statistical analysis. The data obtained was analyzed statistically by Completely Randomized Design (CRD) as per the procedure given by Panse and Sukhatme (1967). The analysis of variance revealed at significance of $P< 0.05$ level, S.E. and C.D. at 5 per cent level is mentioned wherever required.

EXPERIMENTAL FINDINGS AND ANALYSIS

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Chemical characteristics of pineapple juice :

The chemical characteristics of pineapple juice *viz.*, total soluble solids, pH, acidity, ascorbic acid were determined and results obtained are presented in Table 1.

Table 1: Chemical characteristics of pineapple juice

Constituents	Pineapple juice
TSS(^{0}Bx)	11
pH	4.2
Acidity (%)	0.71
Ascorbic acid (mg/100ml)	35.5

*Each value is average of three determinations

It is evident from Table 1 that ascorbic acid in pineapple juice was found to be 35.5(mg/100ml), and the values TSS (11 ^{0}Brix), pH (4.2), acidity (0.71 %).

Pineapple juice contains ascorbic acid and is a good source of Vitamin C. Ascorbic acid or vitamin C fights bacterial andviral infections which is an effective antioxidant and helpsthe bodyabsorb iron. Half a cup of pineapple juice provides50 per cent of an adult's daily recommended amount of vitamin C (Hossain *et al.*, 2015).

Table 2 : Mineral composition of pineapple juice

Mineral composition	Results (mg/100ml)
Calcium (Ca)	14.31
Magnesium (Mg)	12.01
Iron (Fe)	0.74
Copper (Cu)	0.09
Zink (Zn)	0.69
Manganese (Mn)	0.97

*Each value is an average of three determinations

The macronutrients (Ca and Mg) and Micronutrient (Fe, Cu, Zn, Mn) wear analyzed from pineapple juice, the concentration of these minerals were 14.3, 12.01 and 0.41, 0.34, 0.51 and 0.97 (mg/100ml) (Table 2), respectively.

The concentration of Mg and Ca was found much higher than the other inorganic minerals. Copper was found very low as compared to other minerals tabulated in the Table 1.

Several essential minerals exist in pineapples, including manganese, a trace mineral instrumental to the formation of bone, as well as the creation and activation of certain enzymes. Pineapples also include copper, another trace mineral. It assists in the absorption of iron and regulates blood pressure and heart rate (Debnath *et al.,* 2012).

Effect of addition of different sweeteners on low calorie pineapple RTS beverages:

The physico-chemical properties of beverage such as TSS, pH, acidity and ascorbic acid were affected significantly by changing the ingredients. Selected sweeteners like aspartame and sucralose are low caloric and it slightly effect on TSS of RTS beverage therefore it was suitable for preparation of low calorie pineapple beverage.

Total soluble solids (TSS):

Perusal of data in Table 3 reveals a significant difference in TSS of different recipes. Highest TSS was found in with sugar (sucrose) followed by sample D, while least was in sample A. Increase in the proportion of sugar substitutes in place of sugar in RTS beverages decreased TSS content. This is attributed to the fact that sugar substitutes are used in very small quantities to sweeten sweet orange RTS beverage and they do not possess carbohydrates/ sugars and thus have low soluble solids and calories. Similar results were reported in sweet orange RTS by Byanna and Gowda (2012).

pH :

The pH of control sample of RTS beverage was (pH 4.10) similarly sample A of (pH 3.42), sample B (pH 3.45), sample C (pH 3.52) and sample D (pH 3.54). Control sample had the highest pH due to addition of sugar, while A had lowest pH among all samples. The pH of the sample A and B was found to be less than the

control sample; it may be due to addition of sweeteners. The pH of the samples had slightly decreasing trend similar trend was reported by Sasikumar (2013).

Titratable acidity :

Acidity of control sample of RTS beverage was (0.24 %) similarly sample A of (0.25 %), sample B (0.26 %), sample C (0.27 %) and sample D (0.27 %). Acidity of RTS beverage was increasing with the addition of sweeteners smillar increasing trend of acidity was found in low calorie herbal aonla-ginger RTS beverage by Gaikwad *et al.* (2013).

Ascorbic acid :

The ascorbic acid content of the control samples were found to be highest (4.6mg/100ml) followed by sample D (4.5mg/100ml), while it was lowest in sample A (4.2mg/100ml) and B (4.2mg/100ml).The content of ascorbic acid is higher in control sample containing sucrose as compare to other sample containing alternative sweeteners. A reducing trend was observed in ascorbic acid similar results was reported by Sasikumar and Vivek (2015). The sample D containing 50% sucrose + 50 % sucralose was found to be stastically significant over other samples. All the sample are found to be stastically at par with each other in TSS, pH, acidity and ascorbic acid.

Effect of different sweeteners on sensory characteristics of pineapple RTS beverages:

Effect of different sweeteners on sensory characteristics of prepared RTS beverages were carried out by a ten semi trained panel members with respect to colour, flavour, taste and overall acceptability.

The data in the Table 4 showed that the maximum score was recorded for control sample (8.9) followed by sample D (8.8). It was indicated from Table 3 that RTS beverage prepared with sugar record high sensory score

Table 3 : Effect of of different sweeteners on low calorie pineapple RTS beverages

Sample	TSS (°Bx)	pH	Acidity (%)	Ascorbic acid(mg/100ml)
Control	15	3.6	0.34	4.6
A	2.1	3.42	0.35	4.2
B	2.3	3.45	0.36	4.2
C	9.7	3.52	0.37	4.4
D	10	3.54	0.37	4.5
Mean	7.82	3.506	0.358	4.38
S.E.±	0.56364	0.07112	0.00667	0.06667
C.D. (P=0.05)	1.69672	0.21409	0.02007	0.20069

*Each value is average of three determinations

Table 4 : Effect of different sweeteners on sensory characteristics of pineapple RTS beverages

Samples	Sensory attribute			
	Colour	Flavour	Taste	Overall acceptability
Control	9.0	8.9	8.9	8.9
A	8	7.5	8	7.8
B	8.2	8	7.5	7.9
C	8.4	8.2	8.2	8.2
D	8.7	8.5	8.4	8.8
Mean	8.46	8.22	8.2	8.32
S.E±	0.10499	0.08743	0.14787	0.04807
C.D. (P=0.05)	0.31604	0.2632	0.44514	0.14472

*Each value is average of three determinations

Table 5 : Total energy value of low calorie pineapple RTS beverages

Sample	Carbohydrate (Kcal)	Protein (Kcal)	Fat (Kcal)	Total energy (Kcal/100 ml)
Control	60.8	0.24	0.09	61.1
Selected (D)	32.2	0.4	0.09	30.53

in all quality attributes as compared to beverage prepared with addition of aspartame and sucralose sweeteners.

From the Table 4 it was clear that the sample D (8.8) with added 50 % sucrose + 50 % sucralose ranked best among all sample after control sample. RTS with 50 % sucrose+50 % sucralose were rated superior in terms of overall acceptability and taste and thus, rated as best recipes. Similar results on sensory acceptability of product were investigated by Byanna and Gowda (2012).

It can be concluded from the Table 5 that 100 ml of low calorie pineapple RTS beverage (30.53 Kcal) which was almost half than that provided by control sample. In the preparation of low calorie RTS and squash half amount of the sugar can be successfully substituted by alternative sweeteners without impairing the quality of beverage (Singh *et al.,* 2014).

Conclusion:

It can be finally concluded that RTS with 50 % sucrose + 50 % sucralose were rated superior in terms of over all acceptability and taste and thus, rated as best recipes. The prepared low calorie pineapple RTS beverage provide almost half calories than that provided by control sample.

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