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Physicochemical and Sensory Evaluation of [RTS] Beverage by Incorporating Banana Pseudostem Juice in Papaya

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Abstract: **Banana [Musa Paradiciaca] is one of the most abundant India grown in different states of India. Apart from fruit a huge quantity of waste is obtained from which Pseudo-stem contributes the absolute waste in most of the states of India. Researchers claimed that pseudostem core used for treatment of urological afflictions like urolithiasis. By utilizing pseudostem juice with papaya pulp an healthy and therapeutic Ready-To-Serve beverage is developed with different proportions of pseudostem juice and papaya pulp C [0:100], V_1 [50:50],V_2 [75:25] and V_3 [85:15].The best blend selected by using 9 point hedonic scale i.e. V_1 [50:50]. RTS is prepared as per FPO specifications. The quality characteristics of selected RTS [V_1] were compared with control papaya RTS [C]. Raw materials i.e. Banana pseudostem juice and Papaya juice was analyzed for some of its physicochemical parameters. Storage studies was carried out upto 90 days for various physicochemical parameters including Moisture content, Ash content, pH, Acidity, Total Soluble Solids [TSS], Turbidity, Brix Acid Ratio with Color and Viscosity measurement.**

Keywords: Banana Pseudostem, Papaya juice, Ready-To-Serve beverage, Sensory evaluation, physicochemical analysis.

I. INTRODUCTION

India is the largest producer of Banana, contributing to 27% of World's Banana production. Banana is one of the important fruit crops grown almost in every state of India (7.1 lakh ha). Apart from fruit, it generates huge quantity of biomass as waste in the form of pseudo-stem, leaves, suckers etc., of these, on an average about 60 to 80 t/ha is pseudo-stem

alone. Presently, the banana pseudo-stem is absolute waste in most of the states of India. In order to develop value added products exclusively from banana pseudo-stem on large scale, a project entitled, "A Value Chain on Utilization of Banana. Pseudo-stem for Fibre and Other Value Added Products" was sanctioned during June 2008 under World Bank funded – NAIP (Component II), ICAR, New Delhi in consortium mode with Navsari Agricultural University, Navsari (Gujarat) as lead centre and Central Institute for Research on Cotton Technology (ICAR), Mumbai (Maharashtra), Manmade Textile Research Association, Surat (Gujarat) and J. K. Paper Mills Ltd., Songadh (Gujarat) as partners. [1]

Pseudostem juice of *Musa paradisiaca* L was evaluated for its toxicity profiles. Toxicity studies were carried out. During entire period of study, behavioural changes, food intake, water intake and weekly body weight changes were evaluated. At the end of the treatment, serum samples were subjected to biochemical analysis. The results obtained claimed that the pseudostem juice of *Musa paradisiaca L* is not toxic, hence can be used as an adjuvant in diabetic and cancer therapies to prevent toxic effects that result due to the long term administration of chemo therapeutic agents.[2]

Papaya [Carica Papaya] rich source of phyto-nutrients, minerals, and vitamins. Papayas contain soft, easily digestible flesh with a good amount of soluble dietary fiber that helps to have normal bowel movements; thereby reducing constipation problems. Fresh, ripe papaya is one of the fruits with the highest vitamin-C content (provides 61.8 mg). Research studies have shown that vitamin C has many important functions like free radicals scavenging, immune booster, and anti-inflammatory actions. Together, these nutrients are known to promote the health of the cardiovascular system and protect against colon cancer [3]. Hence, for the present study, papaya was selected for preparation of functional fruit beverage.

The functional beverage industry encompasses a wide range of varieties targeting different health related concerns. In today's market RTS Beverages seeking a special acceptance and positive response with increase knowledge of nutritive value of fruits and vegetables. RTS prepared from fruits are rich in different minerals, vitamins and other nutritive components.

By taking into consideration of above facts in view, a nutritive and healthy Banana Pseudo-stem juice with papaya juice ready to serve drink was developed with evaluating its physicochemical characteristics and sensory acceptability.

II. MATERIALS AND METHODOLOGY

A. Preparation of Banana pseudo-stem juice

Banana Pseudo-stem juice was obtained by following the procedure. The Pseudostem was chopped in to small pieces than citric acid treatment for 10 mins, blanching for 1min followed by cooling then placed in to a hand driven mechanical juicer. The collected juice was filtered by whattman filter paper No. 40. [4]

B. Preparation of Papaya juice

The freshly ripe papaya fruits were collected and washed thoroughly in running tap water. Fruits were peeled with the help of stainless steel knife, cut into two half and seeds were removed manually. The pulp was grind in laboratory scale mixer grinder and used for processing.

C. Standardization of blended RTS beverage preparation

Healthy blended RTS beverage was prepared using 13% of total soluble solids (TSS) and 0.3% of acidity and 10% of blended juices of different blending ratio of (C) 0% Banana pseudostem juice + 100% Papaya juice as control, (V_1) 50% Banana pseudostem juice + 50 % Papaya juice, (V_2) 75% Banana pseudostem juice + 25 % Papaya juice, (V_3) 85% Banana pseudostem juice +15% Papaya juice. Best blended RTS beverage was selected by organoleptic test which was conducted on 9 point Hedonic scale [5] for appearance, color, taste, flavour and overall acceptability by a panel of 15 semi trained judges having prior experience of sensory evaluation of fruits and vegetable product.

D. Preparation of RTS

Blending of both the juices [Banana pseudostem juice + papaya pulp]. Followed by mixing with strained syrup, syrup was made with addition of sugar, citric acid and water as per required. Addition of Preservative [Sodium benzoate-100ppm]. Filling of RTS in sterilized bottles followed by crown corking. Then bottles were pasteurized at 80^{o}C for 20 mins. Cooling at room temperature, storage at refrigerated temperature.

E. Sensory quality evaluation

The beverage samples were evaluated for their sensory characteristics namely appearance, color, taste, flavor and overall acceptability by a trained panels comprising of 15 panelists drawn from faculty members and under graduate students of the Department. The panelists were asked to record their observations on the sensory sheet based on a 9 point hedonic scale (9 and 1 points showing like extremely and dislike).

F. Storage studies of Physicochemical Parameters

The RTS beverage with best blending combination and their ratio (on the basis of sensory evaluation) were packed in glass bottles and kept at refrigerated temperature and changes were determined during storage at monthly intervals up to 90 days. Moisture content, Ash content, TSS, pH, Acidity, Turbidity and Brix:acid ratio during storage was measured by standard method of AOAC [2000] [6], [7] of Raw materials [Papaya and Banana pseudostem juice] and best blended RTS beverage compared with control [Papaya RTS].

An alpha PW- 40 electrode calibrated with buffer solution of pH 4.0, 9.2 and 7.0 was employed which was connected to an to an pH meter with digital display [NIG 333].Total soluble solids [TSS] of raw material as well as control and selected RTS was measured. Turbidity meter/ Nephelometer [ELICO CL52D] is used to Estimation of Transparence. Brix:Acid ratio was measured.[8]

A viscometer (also called viscosimeter) is an instrument used to measure the viscosity of a fluid. Labman LMDV series is Rotational Digital Direct Reading Viscometer L4302 [LMDV-60 & LMDV-100 series] with L2 spindle has been used to measure the viscosity of control as well as selected samples.The color of control and selected samples [RTS] was measured by ELICO- double beam SL 210 UV-VIS Spectrophotometer.

III. RESULT AND DISCUSSION

A. Sensory quality evaluation of blended RTS beverage

Table 1: Sensory scores of control Papaya RTS with different variations of RTS blends

Sr. no.	Quality Attribute	C	V_1	V_2	V_3
1	Colour	7.66	7.22	6.72	6.52
2	Appearance	7.33	7.44	6.88	6.71
3	Aroma	7.44	7.44	7	6.40
4	Flavour	7.88	7.33	7.11	7
5	Sweetness	7.55	7.44	7.33	6.77
6	Overall Acceptability	9.11	8.11	7.22	6.10

Sensory quality of blended RTS beverage were determined on 9 Point Hedonic Scale and presented in Fig. 1. Results shows that color, appearance, aroma, flavor, sweetness and overall acceptability of beverage improved with increase in concentration of Banana pseudostem up to the level of 50% with concentration of papaya juice upto the level of 50% were excellent sensory score.

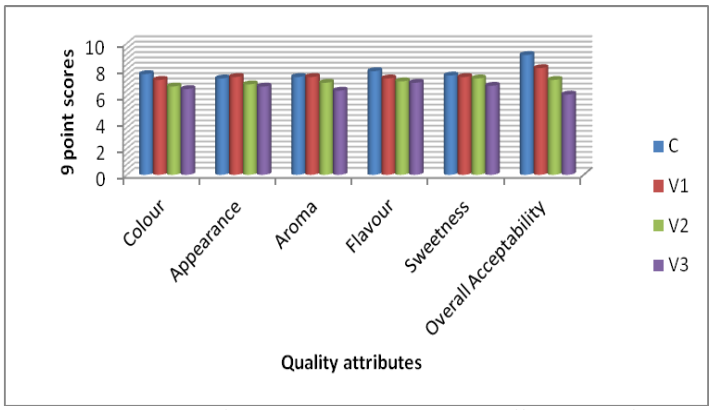

Fig. 1. Sensory quality of therapeutic RTS blended with different ratio of Banana pseudo-stem juice and papaya juice compared with control Papaya RTS

C-Control papaya RTS; **V_1**- 50% papaya +50% banana pseudo-stem RTS; **V_2**- 25% papaya + 75% banana pseudo-stem RTS, **V_3**- 15% papaya + 85%banana pseudo-stem RTS

B. Physicochemical analysis

Table 2: Physicochemical parameters of Raw Materials [Banana pseudo-stem juice & Papaya juice

Sr.no	Parameters	Banana pseudostem juice	Papaya juice
1	[TSS] °bx	4	12
2	pH	4.9	4.8
3	Turbidity[NTU]	440	600
4	Acidity[%]	0.15	0.2
5	Bx:acid ratio	53.3	120
6	Moisture [%]	94.85	86.0
7	Ash [%]	0.11	0.25

Banana Pseudo-stem juice and Papaya juice in the present study was initially characterized for few important physiochemical parameters. [Table 2] shows that Papaya juice found to have TSS of 12°Brix and pH [4.8]. Comparable to TSS of 10.50°Brix and pH 4.22 data given [9] and Banana Pseudo-stem juice recorded to have less TSS of 4°Brix and pH of [4.9]. A higher value of Turbidity was estimated in Banana pseudo-stem juice 600 NTU, whereas that of papaya juice was found to be 440 NTU. Acidity of papaya juice and Banana pseudo-stem juice was result to have [0.15], [0.2]. The result recorded for Brix:Acid ratio of papaya juice 120 and that of Banana pseudo-stem was 53.3. Moisture and ash content of pseudostem was 94.85 and 0.11 and of papaya 86.0 and 0.25 respectively.

C. Storage studies of Physicochemical Parameters of Control and Selected RTS beverages

Table 3: Physicochemical parameters of Control sample [Papaya RTS]

Time period [days]	Moisture content [%]	Ash content [%]	TSS [%]	Ph	Turbidity [NTU]	Acidity [%]	Bx:acid ratio
0	85.2	0.1	13	3.8	860	0.3	43.3
15	85.5	0.107	14	3.8	753	0.3	46.6
30	85.5	0.108	15	3.9	701	0.3	50
45	85.6	0.11	15	4.0	666	0.29	51.72
60	85.7	0.12	15	4.0	641	0.29	51.72
75	85.8	0.12	16	4.1	630	0.28	57.14
90	85.8	0.12	16	4.1	622	0.28	57.14

Table 4: Physicochemical parameters of Selected sample [V_1]

Time period [days]	Moisture content [%]	Ash content [%]	TSS [%]	pH	Turbidity [NTU]	Acidity [%]	Bx:acid ratio
0	87.2	0.17	13	3.5	932	0.35	37.14
15	87.5	0.173	14	3.5	909	0.35	40
30	87.5	0.173	15	4.0	899	0.34	44.11
45	87.6	0.174	15	4.1	861	0.34	44.11
60	87.7	0.174	15	4.1	855	0.34	44.11
75	87.8	0.175	16	4.2	850	0.33	48.48
90	87.8	0.175	16	4.2	842	0.33	48.48

The storage studies for both the beverages i.e. control RTS and selected RTS was carried for 90 days at storage of refrigerated temperature. [Table 3, 4] demonstrate the results of control [Papaya RTS] as well as selected [50%Banana pseudo-stem juice+ 50% papaya juice RTS].

Thus the records claimed that the moisture content of selected RTS [87.2%] was greater than control RTS [85.2%] on the initial day thus gradually increases in moisture content had been seen but in small variation. Ash content of both the RTS beverages shows 0.1% in control sample and 0.17% in selected sample on the initial day. It was observed that Ash content in selected RTS was increase in very minute quantity.

From 13°Bx the TSS of both the sample had increased to 16°Bx. Total soluble solids increased gradually during storage. Increase in TSS during storage might be attributed in conversion of polysaccharides and other constituents of juice into sugar.

It was observed that in both the samples there was gradual increase in pH thereby decreasing the acidity of both the sample.

Turbidity measurement gives the level of transparency of the sample. Turbidity of selected RTS sample was reported to be greater than control RTS sample which on storage seems to be decreased.

Brix:acid ratio gives the degree of sweetness of the product. Results revealed that control RTS possess more bx:acid ratio than selected RTS. As the TSS increases bx:acid ratio also increased.

Table 5: Color measurement of Control and Selected RTS

Sr.no	Colour wavelength[nm]	Absorbance	Absorbance
		Control sample	Selected sample
1	400	1.60	1.85
2	450	1.67	1.93
3	500	1.73	2.00
4	550	1.83	2.10
5	600	3.01	3.00
6	650	3.04	3.02
7	700	2.97	2.83
8	750	2.87	2.91
9	800	2.73	2.75

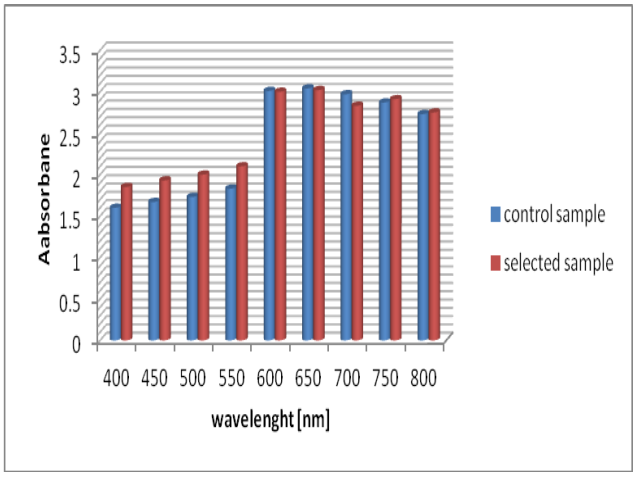

Fig. 2. Color measurement of control & selected RTS

[Table 5] shows that for control RTS the maximum absorbance of light [Beer's and Lambert's law] by sample was at 600 to 650nm i.e. [3.01], [3.04]. In case of selected RTS the maximum light was absorbed at 600 to 650nm i.e. [3.00], [3.02], respectively. Fig 2 indicates the product possess orange color due to maximum absorbance was seem at 600 to 650nm by referring the Visible Light Spectrum Scale.

Table 6: Viscosity of Control RTS

Sr. no	Speed [rpm]	Temp [°C]	Viscosity [mpa.S]	Torque [%]
1	50	13.1	223.9	55.2
2	50	13.2	210.9	35.2
3	50	13.3	198.6	33.1
4	50	13.4	167.2	27.9
5	50	13.5	142.1	21.0

Table no.7: Viscosity of Selected RTS

Sr.no	Speed [rpm]	Temp [°C]	Viscosity [mpa.S]	Torque [%]
1	50	13.1	185.7	31.0
2	50	13.2	168.2	28.0
3	50	13.3	160.6	25.5
4	50	13.4	152.0	21.0
5	50	13.5	144.1	18.3

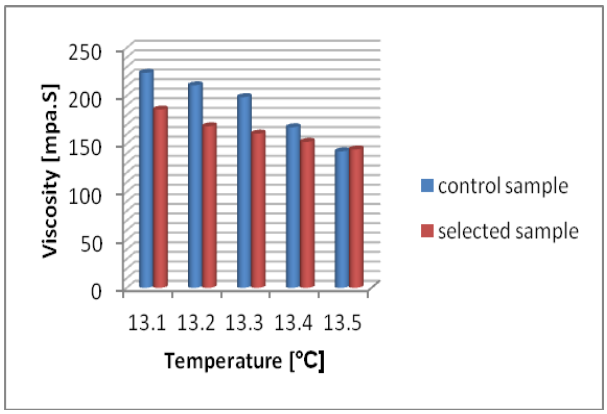

Fig.3. Viscosity of control & selected RTS

[Table 6 & 7] shows study of viscosity was carried out at constant temperature and spindle speed for both the samples. At constant speed of 50rpm the viscosity of control RTS at 13.1°C was 223.9mpa.S with 55.2% torque. Fig.3 shows increase in temperature the viscosity of sample was decreased i.e. at 13.5°C it was 142.1mpa.S with 21% torque. In case of selected RTS the viscosity at 13.1°C was 185.7mpa.S with 31.0% torque. As the temperature increases the viscosity decreases in case of selected RTS also.

IV. CONCLUSION

In the present study, efforts were made to develop blended therapeutic and healthy RTS using Banana pseudo-stem and Papaya. Banana pseudo-stem juice contained higher moisture content, pH, acidity, while Papaya juice contained greater TSS, Turbidity, brix:acid ratio, Ash content, Color and Viscosity measurement. Sensory quality revealed that Banana pseudo-stem juice could be successfully incorporated with Papaya juice in development of blended therapeutic RTS with improved sensorial quality profile of 50% Banana pseudo-stem juice and 50% Papaya juice. The storage studies revealed that blended therapeutic RTS made from Banana waste [pseudo-stem] with Papaya juice could be successfully stored for the period of 90 days with significant change in chemical and sensory qualities.

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