



ISSN (E): 2277- 7695

ISSN (P): 2349-8242

NAAS Rating: 5.03

TPI 2019; 8(4): 776-780

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www.thepharmajournal.com

Received: 07-02-2019

Accepted: 08-03-2019

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Development of health drink from fruit and vegetables (Beetroot, Pineapple and Moringa leaves)

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Abstract

The consumers' demand for fresh fruits and vegetables has increased in recent years. Optimal fruit and vegetable (F&V) consumption has been recognized as one of the cornerstones of a healthy diet for decades. F&Vs provide key nutrients those are essential for promoting and maintaining health. The present study was undertaken with a view to optimize the percentage of beetroot, *moringa* leaves and pineapple for blended health drink preparation, as well as to study storage analysis (at room temperature (28 ± 4 °C) and refrigeration (4 ± 2 °C) temperatures) of the beverage till it's safe to consume. On the basis of above findings, it may be concluded that 25:15:60 concentration of beetroot, *moringa* leaves and pineapple was most suitable for the preparation of blended health drink beverage and can be stored satisfactorily for a period of 10 weeks at refrigeration temperature (4 ± 2 °C) and 6 weeks at room temperature with addition of sodium benzoate. Further blended health drink beverage which was stored at refrigeration temperature was more acceptable than beverage stored at room temperature (28 ± 4 °C).

Keywords: Health drink, ascorbic acid, storage, sensory evaluation, antioxidant, phenolic compound

Introduction

India is the world's largest producer of many fresh fruits and vegetables. India's vast geographical area coupled with varied climate conditions facilitates to grow a variety of fruits and vegetables. India produced around 81.285 MT fruits and 162.187 MTs of vegetables which accounts for nearly 14.0% of country's share in the world production of vegetables (Rais and Sheoran, 2015) [1]. Although It has been found that 30 – 40 percent of fruits and vegetables are wasted due to post harvest losses. Waste percentages in each step of the food supply chain in India which is the cause of low availability of fruits and vegetables for consumers and the need for import of them in spite of India being second largest producer. India, the world's second largest fruit and vegetable producer encounters a waste of close to 25% worth of produce (Rais and Sheoran, 2015) [1].

The beetroot (*Beta vulgaris*) is the taproot portion of the beet plant, also known as the table beet, garden beet, red or golden beet or informally simply as the beet. In recent years increased attention has been focused on utilization of healthy foods. The beetroot (*Beta vulgaris*) being an alkaline food with pH from 7.5 to 8.0 has been acclaimed for its health benefits, in particular for its disease fighting antioxidant potential, significant amount of vitamin C and vitamins B1, B2, niacin, B6, B12 and excellent source of vitamin A. The claimed therapeutic use of beetroot includes its antitumor, carminative, emmenagogue and hemostatic and renal protective properties and is a potential herb used in cardiovascular conditions. Beetroot is known to be a powerful antioxidant. Consumption of natural produce beetroot juice which is rich in antioxidant compounds may help to redress the balance between RON's production and endogenous protection when the body is under oxidative stress. Beetroot is an excellent source of folate and a good source of manganese. Betaine has several noted effects related to human health and function, including acting as an osmolyte (protecting cells against dehydration), as an antioxidant agent (protecting cells against free radicals), as a methyl group donor (lowering potentially harmful levels of homocysteine), and as a vascular protectant.

Pineapple is one of the most popular tropical fruit that is well known for its juicy sweet taste. This fruit is rich in nutrition and contains high amount of vitamins, minerals, fibers and enzymes. Pineapples are a good source of vitamin-C and free from cholesterol. This healthy nutritious fruit can be eaten raw as well as can be used in preparing various tasty recipes. The sodium content of the fruit is also very low. The micro nutrients content of this fruit helps to protect us from many diseases like cancer, stroke and other heart problems. Pineapple juice also helps to kill intestinal worms and helps to relieve intestinal disorders.

The chemicals that this fruit contain stimulate the kidneys and aids in removing toxic elements in the body (Petronella. 2011) [10].

Moringa oleifera belonging to the family of *Moringaceae* is an effective remedy for malnutrition. Every part of *Moringa oleifera* is a store house of important nutrients and antinutrients. The leaves of *Moringa Oleifera* are rich in minerals like calcium, potassium, zinc, magnesium, iron and copper. Vitamins like beta-carotene of vitamin A, vitamin B such as folic acid, pyridoxine and nicotinic acid, vitamin C, D and E; are present. In fact, *moringa* is said to provide 7 times more vitamin C than oranges, 10 times more vitamin A than carrots, 17 times more calcium than milk, 9 times more protein than yoghurt, 15 times more potassium than bananas and 25 times more iron than spinach. *Moringa* is rich in phytosterols like stigmasterol, sitosterol and kampesterol which are precursors for hormones. The phytochemicals such as tannins, sterols, terpenoids, flavonoids, saponins, anthraquinones, alkaloids and reducing sugar are present along with anti-cancerous agents like glucosinolates, isothiocyanates. The fact that *moringa* is easily cultivable makes it a sustainable remedy for malnutrition. Children It is used to treat malnutrition in children younger than 3 years. About 6 spoonfuls of leaf powder can meet a woman's daily iron and calcium requirements, during pregnancy reported by Gopalakrishnan *et al.* (2016) [8].

Materials and Methods

Raw material

Beetroot, Pineapple will be purchased from the local market and necessary pre-treatments such as washing, grading, sorting etc., will be carried out. *Moringa* leaves will be collected from department of botany Shivaji University

Kolhapur and further Beetroot, Pineapple and *Moringa* leaves would be use for preparation of juice for blending purpose.

Preparation of Juice

1. Beetroot was peeled out and sliced, crushed in a grinder, then juice extract by using hydraulic press and the extracted juice was again filtered by using a four layer muslin cloth to remove remaining pomace (Ashurst, 1995) [3].
2. Pineapple was peeled out, remove feves and sliced crushed in a grinder, then juice extract by using hydraulic press and the extracted juice was again filtered by using a four layer muslin cloth to remove remaining pomace (Ashurst, 1995) [3].
3. *Moringa* leaves was washed, blanched to remove flavour and bitterness, crushed in a grinder, then juice extract by using hydraulic press and the extracted juice was again filtered by using a four layer muslin cloth to remove remaining pomace(Ashurst, 1995) [3].

Preparation of blended drink

Blended drink were prepared using 15% of blended juice extracts of pineapple juice beetroot juice, and moringa leaves juice, 15% of total soluble solid (TSS) and 0.3% of acidity at the time of preparation in all the formulated blends. The blended juice of different ratio of pineapple, juice beetroot juice, and moringa leaves juice 75:20:05 (T₁), 75:15:10 (T₂), 75:10:15(T₃), 70:20:05(T₄), 65:25:10(T₅), 60:25:15(T₆) and 55:25:20(T₇) respectively with 15% of sugar, 0.3% of acidity as % of anhydrous citric acid and 100 ppm of sodium benzoate one liter of treated water. The controlled RTS beverage having 100 per cent pineapple juice without beetroot juice and moringa leaves juice (Control).

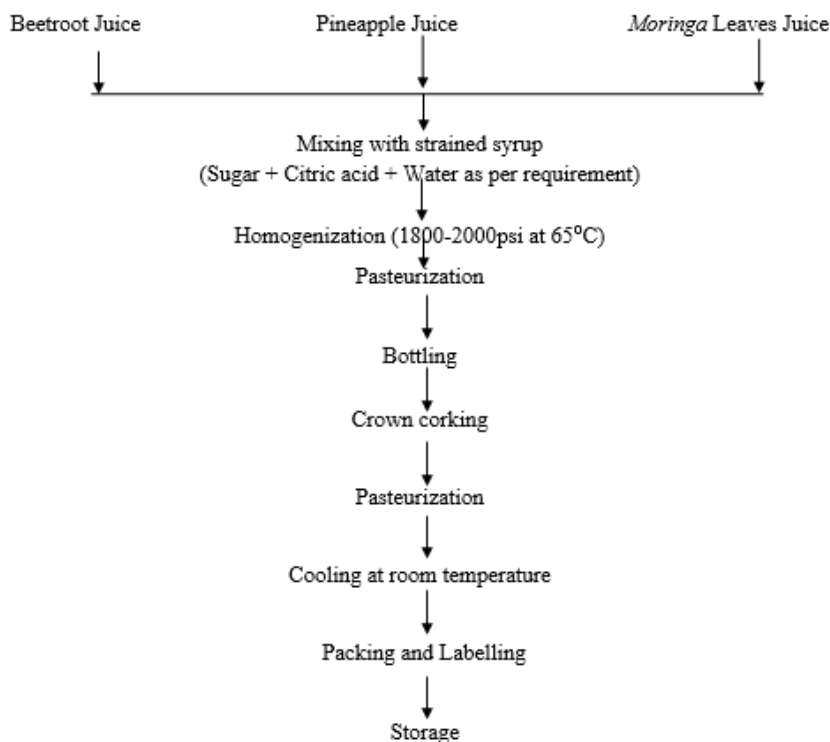


Fig 4: Preparation of blended health drink.

Standardization of Beetroot, Pineapple and Moringa leaves blended Health drink

In the present investigation samples were prepared, firstly optimized blended juice prepared from pineapple juice and

beetroot juice i.e. sample T₁ using 100:00, sample T₂ using 95:05 proportion, sample T₃ using 90:10 proportion, sample T₄ using 85:15 proportion, sample T₅ using 80:25 proportion, sample T₆ using 75:25 proportion, sample T₇ using 70:30

proportion, sample T₈ using 65:35 proportion (as shown in table no. 4) respectively. Then secondly optimized blended juice prepared from pineapple juice, beetroot juice and *moringa* leaves juice i.e. sample T₁ using 75:25:00, sample T₂ using 75:20:05 proportion, sample T₃ using 75:15:10 proportion, sample T₄ using 75:10:15 proportion, sample T₅ using 70:25:05 proportion, sample T₆ using 65:25:10 proportion, sample T₇ using 60:25:15 proportion, sample T₈ using 55:25:20 proportion (as shown in table no. 5) respectively.

Sensory Evaluation

The beverage samples were evaluated for their sensory characteristics namely appearance colour, taste, flavor and

overall acceptability by a trained panels comprising of 20 panelists drawn from faculty members and post 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).

Results and Discussion

The results obtained during present investigation are presented and discussed under suitable headings in view of available relevant scientific literature.

Physicochemical properties of Beetroot, pineapple and *Moringa* leaves

Table 1: Physical properties of Beetroot, pineapple and *moringa* leaves

Parameter	Beetroot	Pineapple	<i>Moringa</i> leaves
Color (exterior)	Reddish purple	Yellowish green	Green
Weight of fruit (g)	250	1000	250
Height of fruit (cm)	9.0±0.40	19.0±0.80	1.0±0.20
Length of fruit (cm)	11.0±1.10	18.0±1.50	1.50±0.20
Juice obtained (ml)	156	278	36

*Each value represents the average of three determinations

A range of physical properties of Beetroot, pineapple and *moringa* leaves were determined. The average color, weight, height, width and length of fruits were determined and given in the table 1. Digital Vernier caliper with the sensitivity of 0.01 mm was used to measure the axial dimensions of randomly selected beetroot, pineapple ; diameter, length etc as given in the above table. The quantity of beetroot, pineapple

and *moringa* leaves per kg was measured using an electronic digital balance with 0.01 gm sensitivity. The results of the physical analysis were resembled with values of Byanna *et al.* (2012) [4] Gopalakrishnan, L. *et al.* (2016) [8] respectively.

Physicochemical Analysis of Beetroot, pineapple and *moringa* leaves

Table 2: Proximate Analysis of Beetroot, pineapple and *moringa* leaves

S. No	Parameter (%)	beetroot	Pineapple	<i>Moringa</i> leaves
1.	Moisture (%)	89.2±0.45	87.1±0.55	72.26±1.67
2.	Ash (%)	2.26±0.30	2.1±0.25	3.26±0.30
3.	Protein (%)	1.56±0.06	0.39±0.03	8.1±0.12
4.	Fat (%)	0.2±0.011	0.45±0.07	1.7±0.10
5.	Crude fiber (%)	1.87±0.02	1.37±0.24	7.05±0.32

Data are expressed as mean ± standard deviation of triplicate experiments (n=3)

The chemical composition of the red beetroot, revealed that it was a poor source of crude fat (0.20 per cent) and protein (1.57per cent). Fiber and ash content was 1.37 and 2.1 percent respectively. The results obtained in present investigation are in close agreement with the results reported in the scientific literature.

The chemical composition of the pineapple revealed that it was a poor source of crude fat (0.45 per cent) and protein (0.39per cent). Fiber and ash content was 1.87 and 2.26 percent respectively. The results obtained in present investigation are in close agreement with the results reported

in the scientific literature.

The chemical composition of the *moringa* leaves revealed that it was a rich source of crude protein (8.1 percent) and fiber (7.0 percent). Fat and ash content was 1.7 and 3.26 percent respectively. The results obtained in present investigation are in close agreement with the results reported in the scientific literature of Gopalakrishnan, L. *et al.* (2016) [8].

Physicochemical Analysis of Beetroot juice, pineapple juice and *moringa* juice

Table 3: physicochemical Analysis of Beetroot juice, pineapple juice and *moringa* leaves juice

S. No	Parameters	beetroot juice	Pineapple juice	<i>Moringa</i> leaves juice
1.	Moisture (%)	92.13±0.90	91.26±0.11	91.80±20
2.	Ash (%)	0.53±0.11	0.83±0.03	1.2±0.20
3.	Protein (%)	0.22±0.04	0.13±0.02	4.65±0.15
4.	Fat (%)	0.11±0.01	0.02	0.5±0.11
5.	Crude fiber (%)	0.48±0.017	0.50±0.04	1.29±0.05
6.	Vit. c(mg/100gm)	4.20±0.60	17.60±0.69	88±0.85
7.	Betalain (mg/100gm)	180±2.03	-	-
8.	T.S.S (Brix)	6.0±0.70	12.0±0.90	5.0±0.30
9.	Acidity (%)	0.05±0.003	0.66±0.01	0.11±0.004
10.	Ph	6.50±0.32	4.50±0.50 0.50	5.50±0.42. 42

11.	Total sugar (%)	7.20±0.23	13.0±0.38	2.62±0.13
12.	Non reducing sugar (%)	4.02±0.11	6.19±0.21	1.37±0.11
13.	Reducing Sugar (%)	3.20±0.12	6.81±0.44	1.25±0.02
14.	Total Phenolic compound (mg/g)	1.38±0.016	0.208±0.02	41.07±0.23
15.	Antioxidant (%RSA)	60 ±0.095	21.23±0.77	90.02±0.14
16.	Calcium (mg/l.)	85.2	1.78	145.80
17.	Iron (mg/l.)	2.73	63.20	0.54

Data are expressed as mean ± standard deviation of triplicate experiments (n=3)

Table 3 gives the summary of the analysis of the three juice samples such as Beetroot juice, pineapple juice and *moringa* leaves juice. The percentages of crude protein in beetroot juice pineapple juice and *moringa* leaves juice of values is 0.22%, 0.13%, 4.65 respectively. The protein content in *moringa* leaves higher than beetroot and pineapple juice. The presence of ascorbic acid, phenolic compounds and antioxidant content in beetroot juice, pineapple juice and *moringa* leaves juice is indicate of above table 5. The

moringa leaves juice containing high amount of ascorbic acid, total phenolic compound and free radical scavenging activity as compare to beetroot juice and pineapple juice is shown in above table 2. Beetroot and pineapple juice contained less amount of vitamin C, total phenolic compound and free radical scavenging activity as a result *moringa* leaf juice is been added which is a high source of vitamin C, TPC and antioxidant.

Table 4: Sensory Evaluation of control drink by varying beetroot juice and pineapple content

Sample code	Appearance	Taste	Flavor	Texture/body	Overall acceptability
T1	7.5	7.0	6.5	6.0	6.5
T2	7.0	7.0	7.0	6.5	7.0
T3	7.5	6.5	6.5	7.0	7.0
T4	7.0	6.5	7.0	6.5	7.5
T5	7.5	7.5	7.5	7.0	7.0
T6	8.5	8.0	8.0	8.3	8.5
T7	8.0	7.5	7.6	7.7	8.0
T8	7.5	7.0	7.5	7.5	7.5

Out of the above results obtained from table No.4 sample T6 i.e 75% Pineapple juice and 25% beetroot juice gives good characteristics of drink and sample containing more than 25ml beetroot juice gives more flavour and dark colour of beetroot to drink and below 25ml beetroot juice cannot give proper taste as well as proper colour.

finally prepared drink with pineapple juice i.e. sample T6 gives a good sensory parameter and over acceptability. Therefore sample T6, containing 75% pineapple juice and 25% beetroot juice was selected as a standard for further reference and will be comparing with prepared drink.

Table 5: Sensory Evaluation of control drink by varying beetroot juice, pineapple and *moringa* leaves juice

Sample code	Appearance	Taste	Flavour	Texture/body	Overall acceptability
Control	8	8.5	8.0	8.0	8.5
T1	7.9	7.4	7.3	7.7	7.6
T2	7.5	7.4	7.3	7.6	7.9
T3	7.5	7.0	7.3	7.9	7.3
T4	7.8	7.4	7.6	7.9	7.8
T5	7.9	7.5	7.7	8.0	7.8
T6	8.5	8.0	8.2	9.0	8.5
T7	7.5	7.7	7.7	8.0	7.5

Out of the above results obtained from table No.5 sample T6 i.e 60% Pineapple juice, 25% beetroot juice and 15% *moringa* leaves juice gives good characteristics of drink and sample containing more than 15ml of beetroot juice gives more flavour of *moringa* leaves to drink and below 15ml *moringa* leaves juice cannot give proper taste as well as the overall acceptability prepared drink. Finally sample T6 gives a good sensory parameter and over acceptability. Therefore sample T6, containing 60% pineapple juice, 25% beetroot juice and 15% of *moringa* leaves juice was selected as a standard for further reference and will be comparing with prepared drink.

Conclusion

It is possible to blend pineapple, beetroot and *moringa* leaves in different proportion to prepare ready-to-serve beverage. The colour and flavour of any processed product plays an important role while tasting the same. The processed RTS

beverages was found to be highly acceptable in taste and secured the organoleptically scores as 8.5. The blended pineapple, beetroot and *moringa* leaves ready-to-serve beverages are having high potential for commercialization and marketability. The introduction of new types of value added and nutrient enriched fruit juice based beverages might improve socio-economic status of the country by enhancing the export trades. This study suggest that beetroot, pineapple and *moringa* leaves drink has high amount of nutritive chemical constituents that can be beneficial to human being.

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