The Pharma Innovation Journal 2023; 12(12): 475-481

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(12): 475-481

www.thepharmajournal.com
Received: 18-10-2023
Accepted: 21-11-2023

Shubham V Borale
Department of Food Engineering, College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Bharat S Agarkar
Department of Food Engineering, College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Tejaswini K Ghongade
Department of Food Engineering, College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Rajesh B. Kshirsagar
Department of Food Engineering, College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Bhanudas M Patil
Department of Food Engineering, College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Corresponding Author:
Shubham V Borale
Department of Food Engineering, College of Food Technology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Studies on standardization, development and organoleptic evaluation of liquid jaggery based beverage (Squash) blended with Aonla and Beetroot juice

Shubham V Borale, Bharat S Agarkar, Tejaswini K Ghongade, Rajesh B Kshirsagar and Bhanudas M Patil

Abstract
An experiment was carried out to develop the liquid jaggery based squash beverage blended with aonla and beetroot juice. In the present study, the aonla juice, beetroot juice, lemon juice, tamarind juice and ginger juice were blended in the ratios of 25:0:5:5:2 (T_0), 20:5:5:5:2 (T_1), 15:10:5:5:2 (T_2), 10:15:5:5:2 (T_3), 5:20:5:5:2 (T_4) for the preparation of liquid jaggery based squash beverage. The squash was prepared using 45-degree brix TSS, 1.10 percent acidity, 600 ppm sodium benzoate and 25 percent blend from each blend combination. Among different proportions, the treatment T_2 comprising 15 percent aonla juice, 10 percent beetroot juice, 5 percent lemon juice, 5 percent tamarind juice and 2 percent ginger juice was found best on 9-point headonic scale by the panel of semi trained judges during organoleptic evaluation. The squash was filled in PET bottles and stored at refrigeration temperature (4 degree celsius) and subjected to physico-chemical, nutritional and organoleptic evaluation. It was observed that prepared beverage had, 34.06 percent total sugar, 9.0 percent reducing sugar, 25.06 percent non-reducing sugar as well as it also contains 50.95 mg per 100 ml ascorbic acid, 40.6 mg per 100 ml betalain. The nutritional study revealed that the prepared beverage contains 39 percent carbohydrates, 1.98 percent crude fiber, 0.83 percent proteins, 0.2 percent fat, 100 mg potassium, 120 mg calcium, 26.95 mg magnesium, 22.37 mg phosphorus, 17.20 mg iron and 11.9 mg per 100 ml zinc. Sensory evaluation revealed that the sample T_2, which contained 15 percent aonla juice, 10 percent beetroot juice, 5 percent tamarind juice, 5 percent lemon juice and 2 percent ginger juice was found superior.

Keywords: Squash, aonla juice, beetroot juice, liquid jaggery, nutritional study, organoleptic evaluation

Introduction
In India due to large population soft drinks have demand throughout the year. Our country has well known history for offering syrup or sharbat. But nowadays people are searching substitute for synthetic soft drinks due to health concern and it not only gives benefit to consumers but also fruit and vegetable growers. By considering large demand and health consciousness of consumer there is large scope for developing blended beverages. Blended beverages are easily digestible highly refreshing and gives thirst quenching effect. Fruit and vegetable juices are blended to enhance the vitamin, mineral, and nutritional value of beverage.

According to Food Safety and Standard Authority of India, squash is a type of fruit beverage which contains at least 25 percent fruit juice or pulp and 40-50 percent total soluble solids, commercially it also contains 1% acid. Squash is non-fermented nonalcoholic beverage and it is diluted before serving with water.

As Indian people are most sweet lover's sucrose is commonly used as sweetening agent in manufacturing confectionary, juices. By considering changes in consumer dietary needs, adverse effect of sucrose and to meet requirement and demand for sugar free products, alternative sweeteners such as jaggery can used for new product development.

Jaggery (gur) is a traditional sweetening agent made from sugarcane juice by concentrating sugar cane juice which is available in market in various forms such as solid blocks or semi liquid form. Jaggery is also called as 'medicinal sugar'. It has been used in Ayurveda from 3000 years. It is used to treat throat and lung infection. Jaggery is also rich in various vitamins which help to boost immunity, maintain temperature of body and also used to treat cold and cough. Jaggery has been consumed to treat or prevent constipation, anemia, control blood pressure.

Recently in COVID 19 pandemic situation jaggery was mostly used to treat flue like symptoms such as cold and cough, to boost immunity to increase resistance against infection. Jaggery also consumed to increase hemoglobin content in blood. Jaggery helps to prevent respiratory problems as asthma, bronchitis (Mahata 2021) [5].

Aonla or Indian gooseberry (*Emblica officinalis*) is the oldest minor fruit of deciduous tree found in India. This plant comes under the family Euphorbiaceae. Aonla is native of India, Sri Lanka, Malaysia, and China. The main varieties of aonla grown in India are Kanchan, Krishna, Banarasi, Chakaiya, Hathijhool, Bansi red, Pinki-tinged, NA-7, Anand Aonla-II, etc. The NA-6 variety found better attributes for processing of various value-added products of economic importance and Chakaiya suitable for beverages (nectar, squash and syrup) and jams.

The fruit, due to its sour and astringent taste, has very limited table value. The fresh fruits are generally not consumed due to their high astringency but it has got great potential in processed forms. Aonla fruits are highly perishable in nature and hence its storage in atmospheric conditions after harvesting is very limited. The fruit is used in the preparation of various ayurvedic tonics like chavanprash, triphala, etc. However, aonla fruits are processed into a number of food products like preserve, jam, jelly, candy, toffee, pickle, sauce, squash, juice, RTS, shreds, dried powder (Goyal *et al*., 2007; Naseer *et al*., 2021) [3, 7].

Beetroot (*Beta vulgaris*) is an herbaceous biennial from *Chenopodiaceae* family and describes number of varieties of edible taproot that are mostly grown throughout the America, Europe and Asia. In India beetroot is mainly cultivated in Haryana, Uttar Pradesh, Himachal Pradesh, West Bengal and Maharashtra throughout the year.

Beetroot contributes to consumer's health and wellbeing because it has antioxidant property due to the presence of nitrogen pigment betalain. Beetroot is also known for its antimicrobial and antiviral effects and it can also inhibit the cell proliferation of human tumor cells (Reddy *et al*., 2005). Beetroot is one of the natural food which boosts the energy as it has one of the highest nitrates and sugar contents. Beetroot makes an excellent dietary supplement as it is not only rich in minerals, vitamins and nutrients but also has unique phytochemical compounds (betalains, phenolic acids, ascorbic acid) which have many medicinal uses.

Beet root is used in Indian traditional system of medicine, specifically for the treatment of fertility, cancer, hypertension and urinary tract disorders. It makes a wonderful dietary supplement being not only rich in nutrients, minerals, amino acids and vitamins but also has unique phyto-constituents, which have numerous medicinal properties such as anti-oxidant, anti-depressant, anti-microbial, anti-inflammatory, diuretic and expectorant. It is one of the natural food, which boosts the energy in athletes. It is used as natural food colour in dairy and meat products. Traditionally, beet root was consumed as food. It is now being recognized as a functional food. (Yadav *et al.*, 2016) [2].

In the view of above information regarding the nutritive status and therapeutic importance of liquid jaggery, aonla and beetroot, the present work has been undertaken to formulate and evaluate the qualities of liquid jaggery based squash beverage blended with aonla and beetroot juice.

Materials and Methods

Raw materials

The raw materials required for preparation of squash beverage such as aonla, beetroot, liquid jaggery, tamarind, lemon, ginger, etc. procured from the local market of Parbhani. Chemicals and reagents will be obtained from laboratory, Department of Food Engineering, College of Food Technology, VNMKV, Parbhani.

Chemicals

All the chemicals, organic solvents and acids used were of analytical grade. The chemicals required for processing of raw materials, preparation and analysis of formulated product were obtained from Department of Food Chemistry and Nutrition, College of Food Technology, VNMKV, Parbhani.

Methods

Preparation of aonla juice

Fresh aonla fruits were procured from local market of Parbhani. Fruit washed to remove unwanted impurities like mud, dust and dirt particles. Washed fruit were kept in alkali solution (2 percent sodium hydroxide solution at 100 °C) for 4 to 5 min. After that seed and segments were separated and passed through mixer with adding water. Obtained pulp was passed through muslin cloth or strainer to get clear aonla juice.

Preparation of beetroot juice

Fresh beetroots were procured from local market of Parbhani. Beetroots washed to remove unwanted impurities like mud, dust and dirt particles. Peel was removed. The peeled beetroots were cut into small slices and passed through mixer with addition of little water. Obtained pulp was passed through muslin cloth to get clear beetroot juice.

Preparation of tamarind juice

Tamarind pods were obtained from local market of Parbhani, they are peeled and soaked in mild water for 4 to 5 hours. Soaked tamarind pods are subjected to mashing to extract pulp. The seeds and fibers were removed on loosing of tamarind. The pulp slurry was passed through muslin cloth to get clear pulp. Then pulp is homogenized and water is added to get tamarind juice.

Preparation of ginger juice

Fresh and sound quality ginger were selected for preparation of juice. Ginger was washed to remove impurities. Then peeling and cutting was carrried out. Cut pieces of ginger were passed through mixer with addition of water (1:2). The pulp was passed through muslin cloth to get clear ginger juice.

Standardization of recipe for preparation of liquid jaggery based squash beverage blended with aonla and beetroot juice

The liquid jaggery based squash beverage was prepared with varying proportion of aonla juice and beetroot juice. The formulation was prepared by blending the beetroot and aonla juice with liquid jaggery as presented in below Table 1. The proportion of tamarind juice, lemon juice and ginger juice in each sample was kept constant

Table 1: Formulation of juice blend for liquid jaggery based beverage by using different level of aonla and beetroot juice

Sample	Aonla juice	Beetroot juice	Lemon juice	Tamarind juice	Ginger juice
Control (T_0)	25	-	5	5	2
T_1	20	5	5	5	2
T_2	15	10	5	5	2
T_3	10	15	5	5	2
T_4	5	20	5	5	2

The following combinations of aonla, beetroot, tamarind, ginger, lemon juice and liquid jaggery were evaluated to standardize the blend for the development of good quality squash beverage:

- T_0: 25% blend comprising 25% aonla juice + 0% beetroot juice + 5% tamarind juice + 5% lemon juice + 2% ginger juice and adjusted to 45 °Bx TSS, 1.10% acidity and 600 ppm sodium benzoate.
- T_1: 25% blend comprising 20% aonla juice + 5% beetroot juice + 5% tamarind juice + 5% lemon juice + 2% ginger juice and adjusted to 45 °Bx TSS, 1.10% acidity and 600 ppm sodium benzoate.
- T_2: 25% blend comprising 15% aonla juice + 10% beetroot juice + 5% tamarind juice + 5% lemon juice + 2% ginger juice and adjusted to 45 °Bx TSS, 1.10% acidity and 600 ppm sodium benzoate.
- T_3: 25% blend comprising 10% aonla juice + 15% beetroot juice + 5% tamarind juice + 5% lemon juice + 2% ginger juice and adjusted to 45 °Bx TSS, 1.10% acidity and 600 ppm sodium benzoate.
- T_4: 25% blend comprising 5% aonla juice + 20% beetroot juice + 5% tamarind juice + 5% lemon juice + 2% ginger juice and adjusted to 45 °Bx TSS, 1.10% acidity and 600 ppm sodium benzoate.

Preparation of liquid jaggery based squash beverage blended with aonla and beetroot juice

The flow chart for the preparation of squash beverage is given in Fig.1. The fruit juices were prepared by above method. Then fruit juices are blended in different proportions in which required amount of liquid jaggery and water is added and mixed thoroughly. The mixture is heated at 80 °C for 5 minutes and allowed to cool. The required amount of sodium benzoate was added in squash beverage and mixed well. The prepared squash was poured in a sterilized bottle (capacity 250 ml) leaving headspace 2 cm and capped airtight and stored at refrigeration temperature.

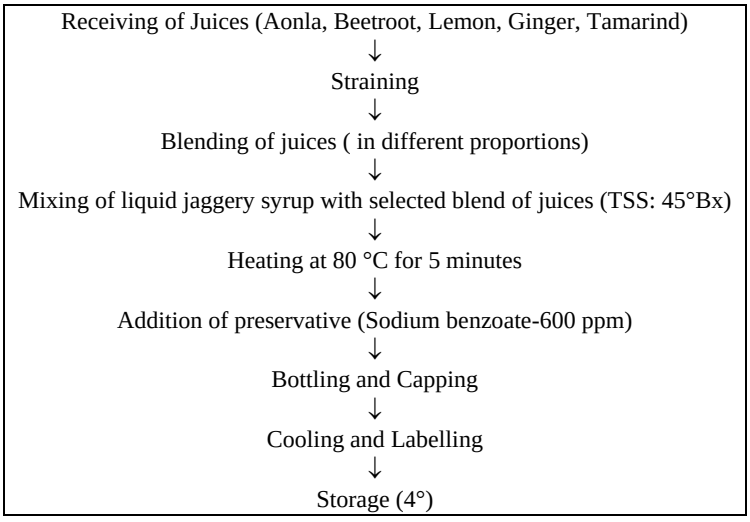

Fig 1: Flow chart for preparation of squash beverage

Fig 2: Liquid jaggery based squash beverage blended with aonla and beetroot juice

Methods of chemical analysis

formulated samples were evaluated for chemical parameters via estimation of moisture content, carbohydrate, proteins, fat, crude fiber, ash, TSS, pH, acidity, total sugar, reducing sugar, non-reducing sugar, ascorbic acid, betalain. The moisture content of beverage was determined according to oven method (AOAC, 1990) [10]. Titratable acidity, total sugar, reducing sugar content of sample was determined by method given by Ranganna, 1986 using Fehling A and Fehling B solution. Protein content was determined by the Kjeldahl method as described in AACC (2000) [11]. Crude fiber content of sample was calculated by method described in AOAC, 2005 [12]. Carbohydrate content of sample was calculated by using difference method (AOAC, 2005) [12].

Sensory evaluation of liquid jaggery based squash beverage blended with aonla and beetroot juice

Sensory evaluation has been defined as a scientific method used to evoke, measure, analyzed and interpret those responses to products as perceived through the senses of sight, smell, touch, taste and hearing. Prepared liquid jaggery based beverage was evaluated for sensory characteristics like color, flavor, taste, and overall acceptability by a panel of semi trained judges, comprised of postgraduate students and academic staff members of College of Food Technology, V.N.M.K.V., Parbhani. Samples were scored based on a nine-point hedonic scale. Judges were asked to rate the product on 9-point Hedonic scale with corresponding descriptive terms ranging from 9 to 1 as 'like extremely' to 'dislike extremely' (Meilgaard *et al*. 1999) [6].

Result and Discussion

Physicochemical properties of control sample and selected sample of beverage

The selected sample (T_2) and control sample (T_0) of squash beverage was analyzed for physicochemical properties such as TSS, pH, titratable acidity, reducing sugar, total sugar, ascorbic acid and betalain. The results are tabulated in table 2 and represented graphically in figure 3. Both Control sample and selected sample were evaluated for TSS, pH, titratable acidity which was found to be 45 °Bx, 2.35 and 1.18 percent in control sample and 45°Bx, 2.37, 1.10 percent in selected sample respectively. Total sugar content in control sample was 35.9 percent while reducing sugar content was 9.4 percent. The selected sample contain higher amount of total sugar i.e., 34.06 percent and reducing sugar i.e. 9.0 percent than control sample. The non-reducing sugar content in control sample was found to be 26.5 percent and in case of selected sample it was 25.06 percent.

Table 2: Physico-chemical properties of control sample and selected sample

Parameter	Control sample (T_0)	Selected sample (T_2)
Colour	Orange	Dark red
TSS (°Bx)	45	45
pH	2.35	2.37
Titratable acidity (%)	1.18	1.10
Total sugar (%)	35.9	34.06
Reducing sugar (%)	9.4	9.0
Non-reducing sugar (%)	26.5	25.06
Ascorbic acid (mg/100 ml)	62.40	50.95
Betalain (mg/100 ml)	ND	40.6

The betalain content in selected sample was 40.6 mg/100 ml while it was absent in control sample, because formulation of control sample does not involve beetroot juice. The amount of ascorbic acid in control sample (62.40 mg/100 ml) was more than selected sample (50.95 mg/100 ml). Less content of Ascorbic acid in accepted sample than control sample was observed which might be due to lower concentration of aonla juice used as compare to control sample. Similar observation was reported by Chandra *et al*., (2018) [1].

3.2 Nutritional composition of control sample and selected sample of beverage

The control sample and selected sample of beverage was analyzed to determine parameters like moisture, protein, fat, carbohydrate, crude fiber. Obtained results are presented in table 3 and represented graphically in figure 4.

Table 3: Nutritional composition of control sample and selected sample of beverage

Chemical parameter	Control sample (T_0)	Selected sample (T_2)
Moisture (%)	57.6	57.1
Total carbohydrate (%)	39.4	39
Total proteins (%)	0.61	0.83
Total fat (%)	0.14	0.2
Crude fiber (%)	1.25	1.98
Ash (%)	1.0	1.4

The data obtained from the Table 4.9 revealed that the moisture content in control (T_0) and selected sample (T_2) was 57.6 percent and 57.1 percent respectively. Total carbohydrate content in control sample was 39.4 percent, proteins was found to be 0.61 percent, fat 0.14 percent, crude fiber 1.25 percent and ash 1.0 percent. The selected sample had moisture, fat, carbohydrate, protein, ash and crude fibre content as 57.1percent, 0.2 percent, 39 percent, 0.83 percent, 1.4 percent, 1.98 percent respectively. The protein content of control sample was observed to be less than selected sample and that was due to variation in use of aonla and beetroot juice during formulation. The selected sample (T_2) was best in crude fiber content than control sample while it can be seen from the results that there was least deviation in ash content of beverage.

Mineral composition of liquid jaggery based beverage

Both the control and selected sample of beverage were subjected for analysis of different minerals such as calcium, iron, magnesium, phosphorus, potassium, magnesium and zinc. The results for these minerals are presented in table 4 and represented graphically in figure 5.

The data in Table 4 indicate the mineral composition of control and selected sample of beverage which states that the calcium content in control sample was 100±1.1 mg while in case of selected sample it was 80±0.8 mg per 100 ml. The phosphorus and magnesium content in control and selected sample was 35.10±0.9 mg, 25.30±0.70 mg and 45.37±1.13 mg, 26.95±1.06 mg per 100 ml. While the potassium content in control sample was found to be 48.85±1.04 mg per 100 ml and in selected sample it was 100.6±1.17 mg per 100 ml.

Table 4: Mineral composition of control sample and selected sample of beverage

Minerals (mg/100 ml)	Control sample (T_0)	Selected sample (T_2)
Calcium	100±1.1	80±0.8
Phosphorus	35.10±0.9	45.37±1.13
Magnesium	25.30±0.70	26.95±1.06
Potassium	48.85±1.04	100.6±1.17
Iron	13.20±1.31	10.14 ±0.8
Zinc	12.5±0.6	11.9±1.09

Iron content in control and selected sample was found to be 13.20±1.31 mg per 100 ml and 10.14 ±0.8 mg per 100 ml respectively. The control sample was superior in the amount of zinc which was found to be 12.5±0.6 mg per 100 ml than selected sample which contain 11.9±1.09 mg per 100 ml.

From table 4 it can be concluded that the phosphorus, magnesium, potassium content of selected sample was found to be more than control sample that may be due to use of beetroot juice in selected sample as well as control sample was found to contain more amount of calcium, iron, zinc as compare to selected sample which may be due to more proportion of these minerals in aonla juice.

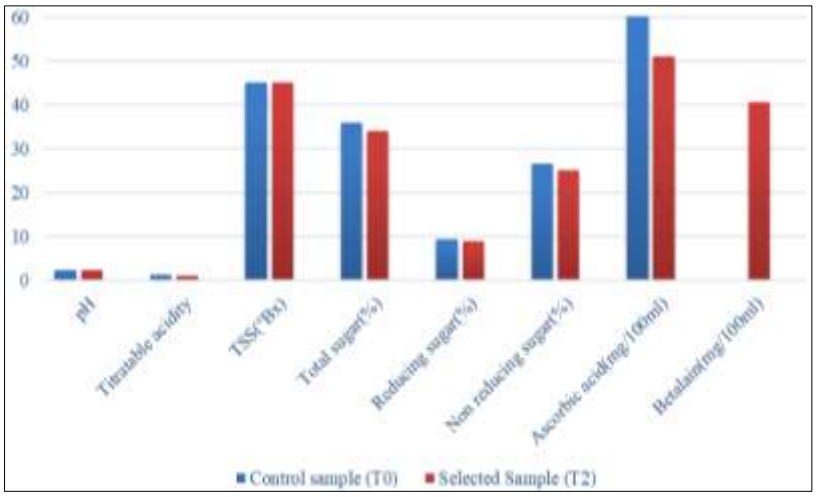

Fig 3: Physico-chemical properties of liquid jaggery based beverage

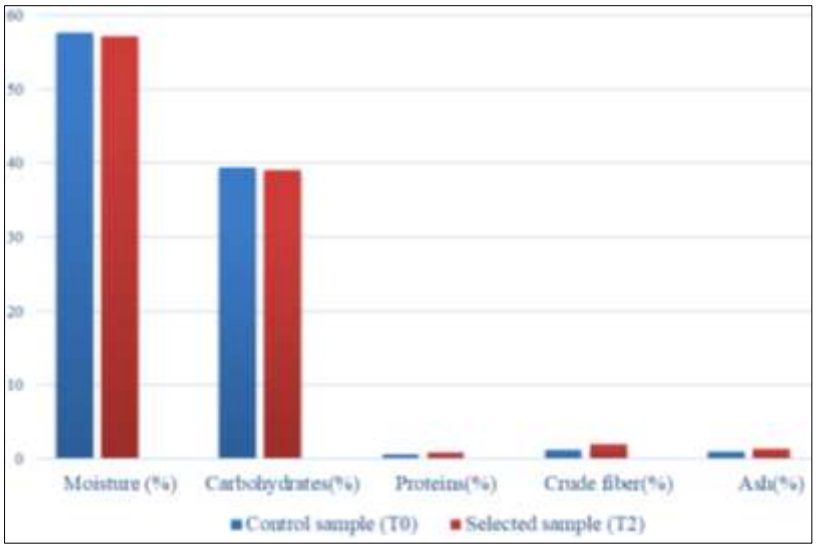

Fig 4: Nutritional composition of liquid jaggery based beverage

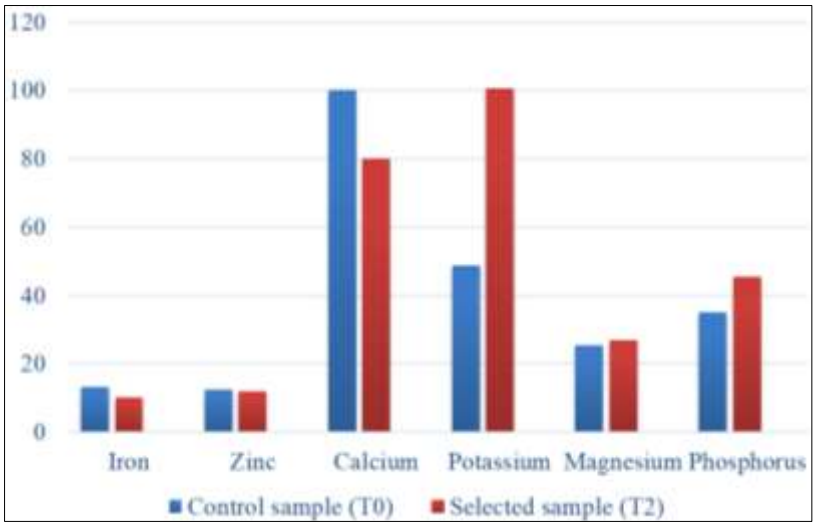

Fig 5: Mineral composition of liquid jaggery based beverage

Sensory evaluation of liquid jaggery based squash beverage blended with aonla and beetroot juice

The organoleptic evaluation of liquid jaggery based squash beverage blended with aonla and beetroot juice was carried out by a ten-semi trained panel and the scores were given by evaluating color and appearance, flavor, taste and overall acceptability which was compared with control sample. The results are tabulated in table 4 and represented graphically in figure 6.

Table 5: Sensory evaluation of prepared liquid jaggery based squash beverage blended with aonla and beet root juice

Sample	Sensory attributes				
	Colour	Appearance	Flavour	Taste	Overall acceptability
T_0	8.5	8.5	8.0	8.5	8.5
T_1	8	8	8.5	8.0	8
T_2	8.5	8.5	8.5	8.5	8.5
T_3	8	8	7.7	8.0	7.9
T_4	7.5	7.5	7.4	8.0	7.6
SE	0.06415	0.11404	0.08114	0.05592	0.04626
CD @5%	0.19311	0.34328	0.24427	0.14835	0.13925

It could be revealed from table 4 that the maximum score for colour and appearance was recorded for sample T_0 (8.5) followed by sample T_2 (8.5) which was comparatively higher than the samples T_1, T_3 and T_4. T_4 scored lower than all the samples and altered appearance of liquid jaggery based beverage, which forced the panel members to rank lower. Scores of all the samples for color and appearance parameter were above the acceptable level. By comparing scores given by panel members it was clear that color and appearance of beverage depends on amount of beetroot juice added to the beverage. Control sample had highest score for colour due to due to no addition of beetroot juice. The sample T_2 containing 15:10 percent aonla beetroot juice got highest score on headonic scale in all the sensory quality attributes and found to be highly acceptable whereas significant difference in sensory score was observed in sample T_3, T_4 and T_2.

It was observed that sample (T_2) received highest score for flavor (8.5) followed by T_1 and T_4. The least flavor score for sample T_0 may be attributed due the bland test of beetroot juice. Taste of beverage samples significantly changed due to variation in amount of aonla and beetroot juice. Selected sample T_2 ranked highest among all the remaining samples due to significant addition of aonla and beetroot juice. The maximum overall acceptability score was recorded for control sample T_0 (8.5) and selected sample T_2 (8.5) for color and appearance which was higher than samples T_1, T_3 and T_4.

Moreover, among the entire liquid jaggery based beverage prepared with aonla and beetroot juice, sample T_2 containing 15 percent aonla juice and 10 percent beetroot juice reported the highest score in all the sensory quality attributes and found to be overall acceptable whereas significant difference in sensory score was observed in sample T_0, T_3 and T_4.

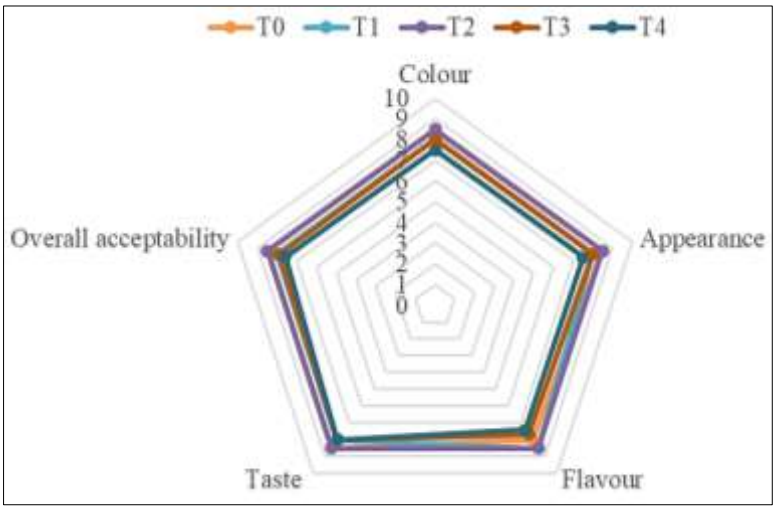

Fig 6: Sensory evaluation of liquid jaggery based squash beverage blended with aonla and beetroot juice

Moreover, it could also be seen that all the samples were found to be acceptable. The sample T_2 containing 15 percent aonla juice and 10 percent beetroot juice was found to be statistically significant over sample T_4 containing 5 percent aonla juice and 20 percent beetroot juice. However, samples T_1, T_2 and T_3 are found to be statistically at par with each other in color, flavor, and taste except overall acceptability. However, sample T_2 was found to be significantly superior over other samples in terms of color, flavor, and taste. Considering all the above sensory attributes sample (T_2) was highly acceptable and hence selected by panel members. Sample T_2 liked very much having moderate acidity content which will fulfill the taste and acceptability requirement for panelists.

Conclusion

In the present investigation efforts were made to develop liquid jaggery based squash beverage by varying the proportions of aonla juice and beetroot juice. The study revealed that the organoleptic characteristic of squash beverage *viz*., colour, flavour, taste, appearance, overall acceptability was significantly influenced by different recipe treatments. It can be finally concluded that the liquid jaggery based squash beverage with 15:10 (T_2) aonla to beetroot received highest sensory score (i.e., 8.5) in case of all sensory attributes.

References

1. Chandra N, Sarkar S, Sinha R, Sharma B. Development and evaluation of ready to serve beverage from blend of awala, *Aloe vera*, mint and ginger. International Journal of Current Microbiology and Applied Sciences. 2018;7:3467-3472.
2. Chawla H, Parle M, Sharma K, Yadav M. Beetroot: A health promoting functional food. Inventi rapid: Nutraceuticals. 2016;1:1-5.
3. Goyal RK, Kingsly ARP, Kumar P, Walia H. Physical and mechanical properties of aonla fruit. Journal of Food Engineering. 2007;82(4):595-599.
4. Kulkarni P, Pandey H, Sharma KA, Joshi CD. Physico-

chemical properties of aonla fruit and juice. Chemical Science Review and Letters. 2017;6(22):1343-1347.
5. Goutam M. Sugarcane juice and jaggery; An immunity booster in COVID-19 pandemic situation. Just Agriculture. 2021;1(11):1-5.
6. Meilgaard M, Civille GV, Carr BT. Sensory Evaluation Techniques. Boca Raton, Florida: 3rd edition, CRC Press Inc, 1999.
7. Naseer B, Qadri T, Fatima T, Bhat T. Aonla (*Emblica officinalis*): Morphology, taxonomy, composition and health benefits. Springer Nature; c2021. p. 193-206.
8. Reddy MK, Lindo RL, Nair MG. Relative inhibition of lipid peroxidation, cyclooxygenase enzymes and human tumor cell proliferation by natural food colors. Journal of Agriculture and Food Chemistry. 2005;53(23):9268-9273.
9. Singh J, Solomon S, Kumar D. Manufacturing a jaggery a product of sugarcane, as health food. Agrotechnology. 2013;S11:07.
10. AOAC. Official Methods of Analysis of the Association of Official Analytical Chemists, Vol. II, 15th ed. Sec.985.29. The Association: Arlington, VA; c1990.
11. AACC. Approved Methods of the AACC. 10th Edition, American Association of Cereal Chemists, St. Paul; c2000.
12. AOAC. Official Methods of Analysis. 18th edn. Association of Official Analytical Chemists; Arlington, VA, USA; c2005.