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Gunjeshree Gond

Doctoral Research Scholar,
Department of Vegetable
Science, CoA, I.G.K.V. Raipur,
Chhattisgarh, India

Annu Verma

Professor, Department of
Vegetable Science, CoA,
I.G.K.V. Raipur, Chhattisgarh,
India

Oshin Pali

Doctoral Research Scholar,
Department of Vegetable
Science, CoA, I.G.K.V. Raipur,
Chhattisgarh, India

Shreya Paikra

Doctoral Research Scholar,
Department of Vegetable
Science, CoA, I.G.K.V. Raipur,
Chhattisgarh, India

Corresponding Author:

Gunjeshree Gond

Doctoral Research Scholar,
Department of Vegetable
Science, CoA, I.G.K.V. Raipur,
Chhattisgarh, India

Development and sensory evaluation of roselle nectar using different natural sweeteners

Gunjeshree Gond, Annu Verma, Oshin Pali and Shreya Paikra

Abstract

Roselle is an underutilized crop with high nutritional and food processing potential. The roselle extract has a unique red colour, good flavour, low sugar and high acidic content. Roselle calyces are highly acidic and can not be consumed directly. The high acidity of roselle makes the juice sour hence, the research work was carried out by adding different types of sweetening agents. The current study was designed to develop roselle beverage in order to take advantage of the potential health and processing benefits of this crop using different natural sweeteners. This research experiment was conducted at the laboratory of Vegetable Science Department, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). The recipe standardization of roselle nectar with 4 treatments (Roselle + Sugar, Roselle + Date, Roselle + Jaggery and Roselle + Honey) and 3 replications were carried out under Completely Randomized Block Design. Sensory evaluation was performed for the prepared roselle nectar and the study revealed that, treatment T₁ having combination of roselle and sugar received the highest overall acceptability score of 8.2.

Keywords: Blended nectar, *Hibiscus sabdariffa* L., natural sweeteners, roselle, sensory evaluation

Introduction

Roselle, *Hibiscus sabdariffa* L. (2n=4x=72) is a shrub belonging to the family Malvaceae. It is a Hibiscus plant native to India and Malaysia that has been introduced to other parts of the world, including Central America, West Indies and even Africa (Bruke,1975) [2]. Roselle is a multipurpose plant and is used as a folk remedy in the treatment of cancer, cough, dyspepsia, fever, heart ailments, hypertension and strangury (Duke,1985) [4]. They are recorded to be antihypertensive, antiseptic, sedative, diuretic, digestive, purgative, emmollient and astringent (Odigie *et al.*, 2003) [8]. Calyces contain high amounts of organic acids, namely: citric acid, malic acid, tartatic acid and hibiscus protocatechuric acid (Kerharo,1971; Khafaga and Koch,1980; Tseng *et al.*,1996) [6, 7, 11]. It also contain antioxidants including flavonoids, gossypetine, hibiscetine and sadderetine. Red colour of roselle is due to pigment known as "Anthocyanin". The anthocyanin found in roselle calyces have been reported to contain delphinidin-3-sambubioside, cydine-3-sambubioside, delphinidin-3-monoglucoside and cynidin-3-monoglucoside (Hong and Wrostrand, 1990) [5]. Vitamins like ascorbic acid, niacin and pyridoxine were also present in appreciable amounts (Puro *et al.*, 2014) [9]. Roselle calyces is used in flavouring sauces, jellies, soft drinks and marmalades, also used for culinary and confectionary purpose or as a food colouring agent due to its brilliant red colour. The fresh calyces of roselle are rich in pectin (3.19%) and citric acid (3.74%). The fresh calyces per 100 g, contains 49 calories, 84.5 percent moisture, 1.9 g protein, 0.1 g fat, 12.3 g total carbohydrate, 14 mg ascorbic acid, 2.3 g fibre, 1.72 mg Ca, 57 mg P, 2.9 mg Fe (Duke and Atchley 1984) [3]. Fresh calyces of roselle contains 88.2 percent moisture, 1.46 percent crude fibre, 0.86 percent ash, 0.10 percent Ca, 0.051 percent P, 0.021 percent Fe along with 0.82 percent reducing sugars and 0.24 percent sucrose.

Natural sweeteners are food additives that are used or intended to be used to add sweetness to food or as a tabletop sweetener. These are added to foods to replace the sweetness normally provided by sugars while not significantly contributing to available energy and are a means for customers to limit their caloric or carbohydrate intake. Natural sweeteners have gained popularity as a result of rising health concerns about sugar consumption, as well as concerns about the safety of some non nutritive artificial sweeteners.

Roselle is one of the underexploited leafy crop with potential for processing by the dietary and food industries. The extract of roselle calyces has a distinctive red colour, good flavour, low sugar and high acidic content.

But due to its high acidity and strong astringent taste, it is not consumed fresh. However, roselle calyces have unlimited potential in their processed form in world trade. Blended beverages are an alternative for the development of novel products which provides benefit of taste, nutrition as well as medicinal properties. Developing nutritionally value added drinks may therapeutically help in improving the health of consumer.

Table 1: Treatment Combination of roselle nectar

Treatments	Proportions of the blends	
	Roselle	Sweetening agent
T ₁	100%	Sugar
T ₂	100%	Date
T ₃	100%	Jaggery
T ₄	100%	Honey

Materials and Method

Roselle calyces were collected from fields of local farmer from Dantewada. Other raw material like sugar, honey, date, jaggery, citric acid, sodium benzoate and bottles were collected from nearby local market.

Extraction of roselle juice

Some healthy, diseased free mature capsule were selected, peeled for calyces and washed with water before extraction of juice. The Roselle juice was extracted by using the Hot Water Extraction (HWE) method described by (Wong *et al.*, 2003)^[12] and was performed by using 1kg dried calyces per 5 litre of distilled boiling water at (100 °C) for 20-25 minutes as described by (Aina and Odipe, 2006)^[1]. The HWE method was the most effective extraction method resulting in high anthocyanin and ascorbic acid contents of 43 g/l (as delphinidin-3- glucoside) and 234 g/kg respectively. Fresh roselle extract were filtered with a muslin cloth.

Extraction of date juice

A good quality dates were purchased from the market and used for the juice extraction. The dates were washed with water to remove any impurities from the surface then soaked in water overnight. Seeds were removed from the soaked dates and then the pulp was made by boiling it with water for 10-15 minutes. The juice was then extracted from the pulp using a clean muslin cloth.

Preparation of nectar

Roselle and different sweetening agents like sugar, date, jaggery, honey were used for the preparation of nectar. The extracted juice of roselle was blended with different sweetening agents according to the treatment combinations. Total soluble solids and acidity of the nectar were adjusted to 15 percent and 0.3 percent by using sweetening agents and citric acid as needed, by heating at 85 °C for 10 minutes. The TSS was measured with the help of hand refractrometer. Sodium benzoate @ 0.6 percent is added as preservative followed. The nectar was immediately filled into pre-sterilized glass bottles with a capacity of 200 ml keeping a head space of 1.5-2 cm. The filled nectar bottles were airtightly sealed using crown caps with a crown corking machine. The bottles were then pasteurized for 15 minutes at 85 °C, cooled and stored at room temperature.

Sensory analysis

Sensory analysis is a scientific discipline used to evoke, measure, analyze and interpret reactions to those characteristics of foods as they are perceived by the sense of sight, smell, taste, touch and hearing. This is a test which measures the consumer's acceptability for the product. In this method, a semi-trained panel consisting of several judges, belonging to different age groups and having different eating habits was constituted to evaluate the sensory qualities of the product. The sensory qualities were evaluated using 9 point hedonic rating test method as suggested by Ranganna (2001)^[10].

Results and Discussion

Standardization of nectar

The preliminary trials were carried out in order to determine the optimal level of ingredients for the nectar preparation. The best combination of juice, sweeteners, citric acid, sodium benzoate, and water was chosen. The best combination level was 20% juice, sweeteners at 15% TSS, citric acid 1 gm, sodium benzoate @0.6% and water 800 ml for 1000 ml nectar.

Sensory Evaluation

Table 2 shows the sensory evaluation data for freshly prepared nectar. Four samples of nectar were prepared by combining roselle and various natural sweeteners and were presented to a group of panellists for sensory evaluation. The outcome was determined using a 9-point hedonic scale, with 9 indicating like extremely, 8 indicating like very much, 7 indicating like moderately, 6 indicating like slightly, 5 indicating neither like nor dislike, 4-dislike slightly, 3-dislike moderately, 2-dislike extremely and 1 indicating dislike extremely.

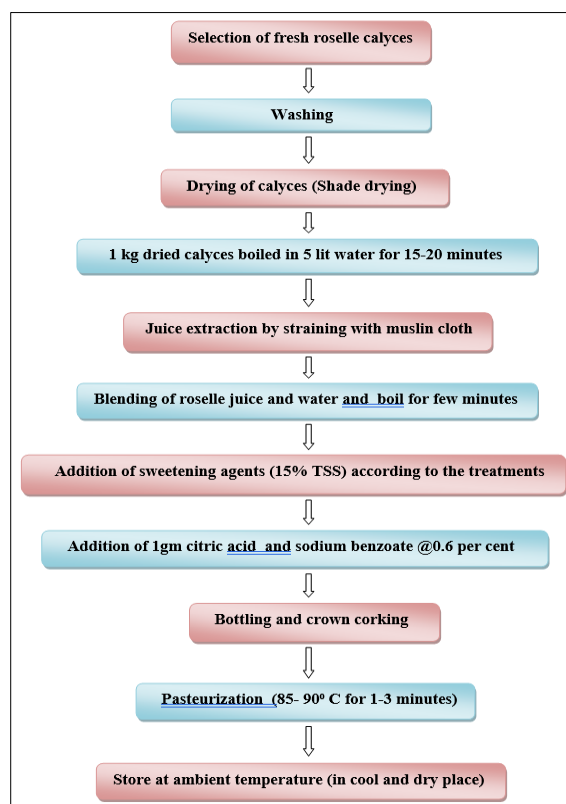


Fig 1: Flow sheet for the preparation of roselle nectar during recipe standardization

Color and appearance

The evaluation for colour and appearance of the nectar revealed that T₁ observed the highest score of 8.3, which was superior to all treatments, followed by T₃ which had a score of 7.2. T₂ received a minimum score of 6.3, followed by T₄, which received a score of 6.2.

Flavour

T₁ received the highest organoleptic score of 8.3 for flavour, followed by T₃ with a score of 7.0, T₂ received a minimum score of 6.4, followed by T₄ which received a score of 6.5.

Taste

According to the data on organoleptic score for taste, T₁

received the highest score of 8.6, followed by T₄ with a score of 6.2. T₂ received the lowest score of 5.4, followed by T₃ which received 5.5 score.

Overall acceptability

According to the data, T₁ received the highest overall acceptability score of 8.2, followed by T₃ with a score of 6.5 and T₂ received a lowest score of 6.2, followed by T₄ with a score of 6.4. T₁ was determined to be the best treatment and superior to all others after evaluating all of the organoleptic attributes. It scored the highest and was well-liked by the judging panels. T₁ contains roselle and sugar as a sweetener, which was discovered to be the best combination among other treatments and was deemed the most acceptable.

Table 2: Organoleptic evaluation of roselle nectar during recipe standardization

Treatments	Color and Appearance	Flavour	Taste	Overall Acceptability	Ratings
T ₁ (Roselle + Sugar)	8.3	8.3	8.6	8.2	Liked Very Much
T ₂ (Roselle + Date)	6.2	6.4	5.4	6.2	Liked Slightly
T ₃ (Roselle + Jaggery)	7.2	7.0	5.5	6.5	Liked Slightly
T ₄ (Roselle + Honey)	6.3	6.5	6.2	6.4	Liked Slightly
SE (m) ±	0.164	0.151	0.155	0.114	-
CD at 5%	0.54	0.49	0.50	0.37	-

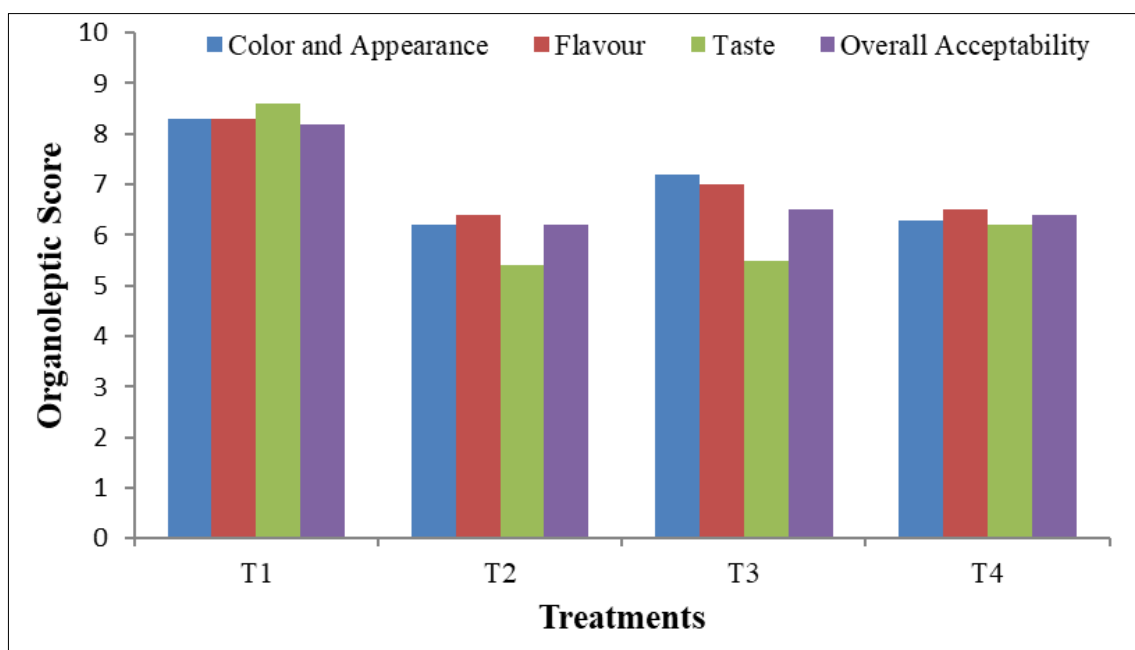


Fig 2: Organoleptic evaluation of roselle nectar during recipe standardization

Conclusion

The results revealed that, the treatments having sugar as a sweetening agent was most accepted by the judges. This may be due to the traditional preference of people for sugar as sweetener. This replacement may take some time but will be a good choice for people concerning health. Consuming more sugar increases the risk of consuming more calories, which leads to diseases such as obesity, diabetes, and cardiovascular problems in the human body. Now- a- days natural sweeteners is gaining popularity day-by-day as a people are realising the importance of health, as well as concerns about the safety of some non nutritive artificial sweeteners. As a result, many food industries now use low-calorie natural and artificial sweeteners instead of sugar. The current study was designed to develop roselle nectar in order to take advantage of the potential health and processing benefits of this crop using

different natural sweeteners. After evaluating all the sensory attributes *viz.* Colour and appearance, flavor, taste and overall acceptability, it can be concluded that T₁ was determined to be the best treatment and superior to all others. Though the overall acceptability is highest for sugar but for health purpose other treatments containing date, honey and jaggery should be considered best.

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