



Development and quality evaluation of fig based rts (ready-to-serve) beverage

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Abstract

The present work evaluates the development and quality of a ready-to-serve (RTS) beverage based on figs. Seeing that figs have high nutrition and a short life span, the beverage was created to keep them fresh, prevent spoilage and add value. To make the RTS beverage, we added 25% fig pulp, adjusted it to 17° Brix TSS and included 0.3% citric acid, 0.1% pectin and 90-ppm sodium benzoate. The results of physical and chemical tests proved that the beverage continued to meet strict safety and quality rules, with a pH of 3.6 and stable acidity and preservatives throughout. The nutritional analysis showed that the product supplied plenty of energy (88 kcal/100g), a high amount of carbohydrates (21.08 g) and no fat (0.00 g) and therefore suggested it to health-conscious shoppers. Results of this research suggest that drinks made with figs in RTS processes can help people with rural incomes and benefit public health. Further study should be carried out to test adequacy over long periods, how successful it is with people and whether it can be scaled up.

Keywords: [Fig, RTS, beverage, nutrition]

Introduction

India's packaged-juice sector has expanded rapidly over the last two decades, driven by rising disposable incomes, urbanization and the growing preference for convenient, health-oriented foods (Mahajan *et al.*, 2021) [7]. Ready-to-serve (RTS) beverages, which marry convenience with perceived nutritional benefits, have therefore become a strategic focus for food-processing companies (Ahmed *et al.*, 2017) [1]. Although carbonated soft drinks still dominate overall beverage sales, the fruit-juice and nectar segment are registering strong year-on-year gains as consumers seek natural alternatives (Sharma *et al.*, 2020) [11]; a comparable trajectory has been reported in other large markets such as the United States and China (Singh *et al.*, 2015) [12].

Non-alcoholic drinks are broadly divided into carbonated and non-carbonated categories. Packaged fruit juices, flavored waters and energy drinks fall into the non-carbonated class and have gained widespread acceptance in India because they are portable, affordable and marketed as healthy choices (Ahmed *et al.*, 2017) [1]. Current industry estimates suggest that the compound annual growth rate (CAGR) of India's juice market will continue to rise throughout the coming decade (Mahajan *et al.*, 2021) [7]. Product developers increasingly exploit juice blending to improve flavour balance, colour and nutrient density, thereby creating beverages with superior organoleptic and functional attributes (Singh & Gaikwad, 2012; Verma *et al.*, 2018) [13, 16].

Fig (*Ficus carica*) is an under-utilised but nutrient-dense fruit, rich in dietary fibre, polyphenols, natural sugars, vitamins A and C, and essential minerals such as potassium and calcium (Solomon *et al.*, 2006; Veberic *et al.*, 2005; Vinson, 1999) [14, 15, 17]. Despite these attributes, commercial exploitation of figs in India remains limited because of their

high perishability and short post-harvest life (Joseph & Raj, 2010; Al-Farsi *et al.*, 2005) [2, 6]. Purandar Taluka in Maharashtra, recognised with a Geographical Indication (GI) tag for its premium figs, offers a unique opportunity for value addition through local processing (Deshmukh *et al.*, 2020; Pawar & Chavan, 2021) [4, 9].

Transforming Purandar figs into an RTS beverage can extend shelf-life, reduce post-harvest losses and create new income streams for growers (Patil *et al.*, 2019) [8]. Moreover, such a product aligns with Food and Agriculture Organization (FAO) guidelines promoting fruit-based beverages as sustainable, nutrient-dense alternatives to sugar-sweetened soft drinks (FAO, 2017) [5].

Accordingly, the present study was undertaken to formulate an RTS fig nectar using GI-tagged Purandar figs, and to evaluate its physicochemical and nutritional properties with a view to establishing a sustainable processing model for the region

Material and Methods

1. Materials

About five kilograms of figs were taken from orchards in Purandar Taluka, Maharashtra. To maintain the same taste, the mixture was created only from mature, same-sized and unblemished fruits. Washed all the figs with running water before further use, this removed any dust or other bacteria.

The brand sources all the sugar for its beverage from a nearby store in Loni-Kalbhor, Pune. Essential analytical chemicals and reagents for our analyses were supplied by HiMedia Laboratories Pvt. Ltd., Mumbai and the MIT College of Food Technology laboratory. From Swar-gate, Pune, a company was found that offered PET bottles because they provided what we wanted, were affordable for us and were considered safe for customers.

2. Methodology

The values shown are obtained from triplicate analyses and are expressed as percent or the number of milligrams fresh tissue per 100 milligrams of tissue. Glassware was placed in an oven at 105 °C to dry it and cooled inside a desiccator before use; reagents were all chosen as AR grade. I used scaled-up versions of Ranganna's methods (Ranganna, 1986) ^[10], making some minor transformations for the fig-based process.

2.1 Overview

a. Fruit selection

Figs from the Purandar cultivar were harvested by hand when they were commercially ripe (^oBrix above 17 and their due colour and firmness) and brought to the laboratory within 4 hours. Bad or early fruits were thrown away (Ranganna, 1986) ^[10].

Fruit should be cleaned before further treatment twice, the fruit was washed with fresh water, dipped for 2 minutes in water with 100 ppm chlorine and rinsed one more time with sterile water. It was not necessary to remove the pedicels since the skin, which is eaten, is rich in color and phenolics (FAO, 2017) ^[5].

b. Separating Pulp

To soften the figs and inactivate enzymes, halved them and steam-blanch them for three minutes before grinding them. A 1 mm stainless-steel sieve was used to screen the slurry and obtain smooth pulp (Ranganna, 1986) ^[10]. At 65 °C, the mixture of pulp, water, sugar, citric acid and pectin was stirred lightly until everything dissolved. To filter away air and any fine particles, homogenised the blend (for 2 min at 10,000 rpm) and then pushed it through two layers of muslin.

c. Pasteurisation

Clarified nectar was pasturised at a consistent temperature of 80 °C for 10 minutes, based on the probe readings (± 0.1 °C). Hot-filled so that liquid is sterile and vacuum-packaged for preservation. A hot-fill process was used to place the (≈ 78 °C) product into pre-sterilised PET bottles, each holding 250 mL with 20 mm left as headspace. To make the bottles commercially sterile, capped them using induction-sealed HDPE closures, flipped them upside down for 30 seconds and left them at 80 °C for another 10 minutes (Patil *et al.*, 2019) ^[8].

d. The use of Cold Storage

All filled bottles were kept below 35 °C in cooled water, dried, labelled and kept in storage.

Ambient conditions used in this study were held at 25 ± 2 °C with relative humidity at 65%.

Refrigeration: 4 ± 1 °C (research related to keeping the product's quality)

Samples were obtained at chosen intervals (at the start and after 30, 60, 90 and 120 days) to test for physical, microbiological and sensory properties.

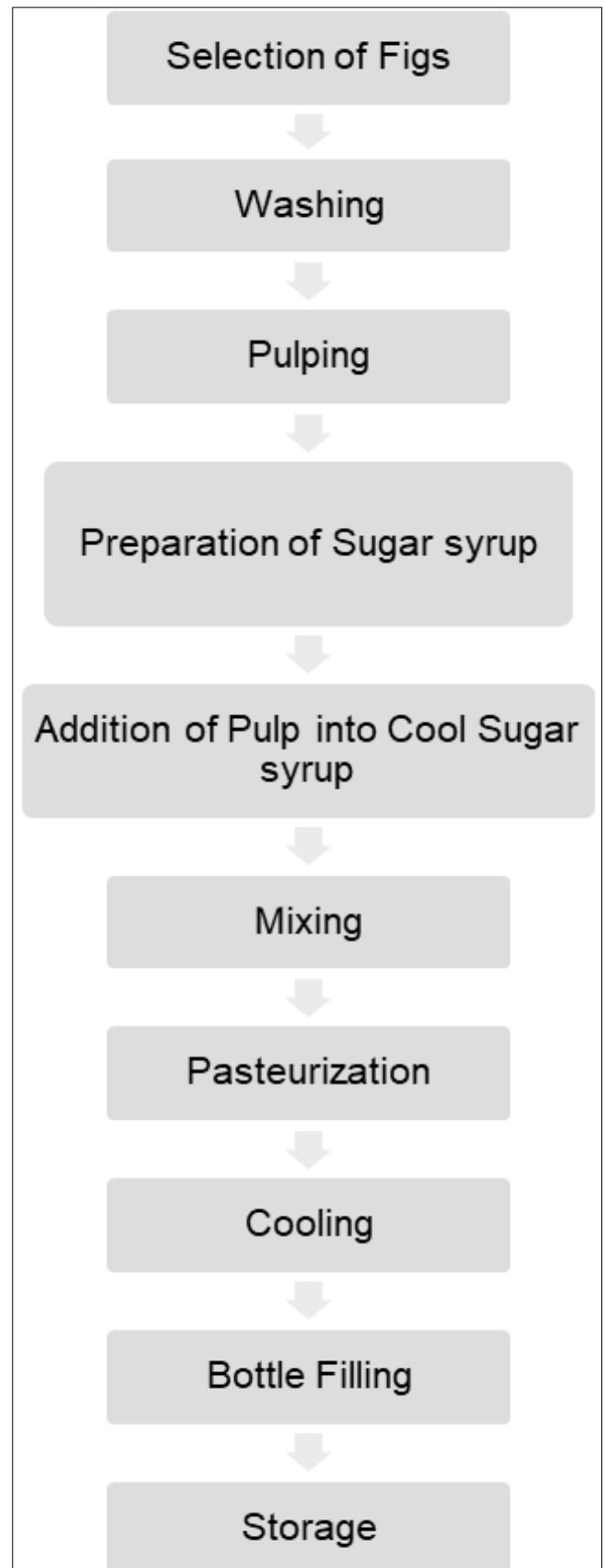


Fig. 1 Processing Diagram

2.2 Methodology

a. Crude fat

The Soxhlet was used to take out crude fat, using petroleum-ether and left to run for 16 hours (Ranganna, 1986) ^[10]. A Soxhlet flask was dried, weighed (W_1) and 3 g of oven-dried

sample were added to a cellulose thimble (W_2). After that, extraction was performed. After solvent recovery, the flask was dried at 100 °C for one hour, placed in a desiccator to cool and weighed again (W_3). This was calculated by:
 % Crude fat = [(Weight of flask and residue - Weight of empty flask) / Weight of sample] * 100

b. Moisture Content

About 10 g of the homogenized sample were put into pre-dried dishes (W_1) and left to dry at 110 °C until they stopped losing mass. The dishes were measured again (at W_2) after they had cooled for an hour in the desiccator (according to Ranganna, 1986) [10].

This was calculated by:

$$\% \text{ Moisture} = (\text{Weight of Water} / \text{Total Weight of Sample}) * 100$$

c. Estimation of Proteins

Total nitrogen was analyzed with the Kjeldahl method (Official Method 978.04 from the AOAC, Ranganna, 1986) [10]. An aliquot of 0.40 g was reacted with 2.5 g catalyst and 10 mL H_2SO_4 at 420 °C until boiling stopped. After cooling, 50 mL 40% NaOH were poured in and the digest was distilled; the released NH_3 was captured in 25 mL 3% boric acid mixed with indicator and titrated with 0.116 N HCl.

$$\text{Protein (g/100g of food)} = \text{Total Nitrogen (g/100g of food)} \times 6.25q. \text{ (Ranganna, 1986) [10].}$$

d. Estimation of Carbohydrates

Carbohydrates, can be determined by the Anthrone assay. The amount of total carbohydrate was estimated using the anthrone method (Ranganna, 1986) [10]. Each 0.1–0.5 mL sample or glucose standard was diluted with 0.9 mL of distilled water. When 3 mL of hot anthrone reagent was added, the tubes were put into a water bath and boiled for 8 min. Immediately after cooling them down, the absorbance was measured at 630 nm. A standard curve was drawn using measurements of glucose equivalents.

$$\text{Carbohydrate (mg 100 mg-1)} = \text{Glucose equivalent (mg)} \times 100 / \text{Volume of test sample } (\mu\text{L})$$

e. Determination of Ash Content

Five grams of the sample were added to a pre-dried, tared silica crucible (its mass was W_1 g). The material was darkened on a low flame, then burned for 6 hours inside a muffle furnace at 525–550 °C. Crucibles were cooled for at least six hours in a desiccator and then re-weighed (W_3 g).

$$\text{Ash Content (\%)} = (\text{Weight of Ash Residue} / \text{Weight of Original Sample}) * 100$$

f. Determination of Energy Value

$$\text{Energy value} = (\text{Carbohydrates} + \text{Proteins}) * 4 + \text{Fat} * 9. \text{ (Ranganna, 1986) [10].}$$

Results and Discussion

1. Formulation and Standardization

Several trials were conducted to select the optimum combination (Pulp, TSS, Acidity and Preservative)

Table 1: Standardization table for fig-based beverage

Trials	Pulp (Fig)	TSS	Acidity	Preservative
Trial 1	18%	20°Brix	0.7%	90 PPM
Trial 2	20%	20°Brix	0.7%	90 PPM
Trial 3	21%	18°Brix	0.7%	90 PPM
Trial 4	22%	18°Brix	0.5%	90 PPM
Trial 5	15%	18°Brix	0.5%	90 PPM
Trial 6	22%	17°Brix	0.3%	90 PPM
Trial 7	25%	17°Brix	0.1%	90 PPM
Trial 8	25%	17°Brix	0.3%	90PPM

Table 2: Final Formulation

Ingredients	In Percent	In Grams
Fruit Pulp	25%	250 gm
T.S. S	17°Bx	170 gm
Water	75%	750 gm
Acidity (as Citric acid)	0.3%	0.3 gm
Preservative (Sodium Benzoate)	90 PPM	0.009 gm
Pectin	0.1%	1 gm

2. Sensory evaluation of fig based RTS beverage

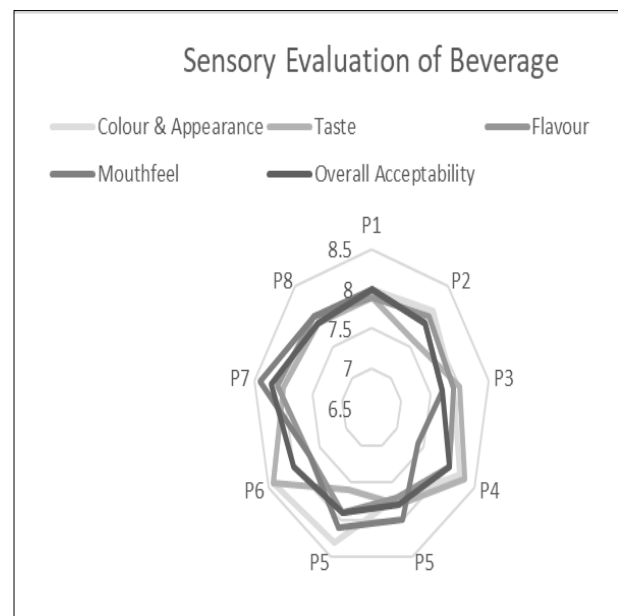


Fig 2: Sensory evaluation



Fig 3: Product Image



Fig 4: Product Image 2

3. Proximate Analysis

Table 3: Proximate Analysis

Sr No.	Parameters	Results
1	Energy	88 Kcal
2	Protein	0.6%
3	Carbohydrates	12.8%
4	Fat	0.2%
5	Ash	0.35%
6	Total Sugars	17°Brix
7	Moisture content	88%
8	Fiber	0.22%

Conclusion

GI tagged figs from Purandar was used to develop an RTS beverage based on figs and the beverage proved to be nutritious. It displayed appropriate physicochemical and nutritional properties and satisfied the need for healthy type beverages. This also promises a valuable route for rural income generation and value addition. Research for acceptance by the consumer and long-term shelf life is still to be done

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