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Quality Evaluation and Antioxidant Potential of Papaya RTS Spiced Beverage

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ABSTRACT

Papaya, one of the major fruit crops of India, is subjected to heavy post-harvest losses. Developing value added products utilizing papaya would help prevent losses and enhance its market potential. The present study involves development of papaya based ready to serve (RTS) spiced beverage and characterization of its quality and antioxidant potential. The formulated product was evaluated for various physico-chemical attributes like titrable acidity, total soluble solids, total and reducing sugars; bioactive compounds like vitamin C and polyphenols; antioxidant activity using reducing power and total antioxidant capacity assay. Instrumental colour index was determined. Microbial quality and sensory acceptability were also evaluated. The results demonstrated the developed spiced papaya beverage to have high sensory acceptability, along with good content of antioxidant compounds and activity. The formulated beverage was also characterized by good colour and absence of microbial load. This fruit beverage with immense health benefits could be easily adopted for large scale production by the beverage industry.

Keywords: Papaya, RTS beverage, antioxidant profile, instrumental colour, microbial quality, sensory acceptability.

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INTRODUCTION

Fruits are rich sources of nutritional and bioactive compounds which confer immense health benefits. Of the wide variety of tropical fruits available in India, papaya occupies a primary position, mainly owing to its wide availability and nutritional value. Papaya is a rich source of nutrients, particularly vitamins like vitamin A. It is a popular fruit for fresh consumption as well as for development into processed products. However, very less quantity of papaya is subjected to processing. Owing to its highly perishable nature, papaya fruits are subjected to large post-harvest losses. Development of processed papaya products could help in not only increasing the utilization of papaya but also in improving public health by delivering antioxidant rich papaya products.

Of the wide variety of processed foods available in the market, RTS beverages are very popular. They are nutritionally rich and also well-liked by the consumers due to their refreshing flavours and taste. Recognition of the nutritional benefits of the fruit based beverages has led to a gradual but distinct shift of the customer's preference from aerated drinks to fruit beverages. To improve the palatability of the beverages, ingredients such as spices could be added. Spices used in the present study i.e. aniseed, pepper and ginger not only act as appetizers but also have proven therapeutic value.

The focus of the present investigation was to standardize the preparation of a papaya based RTS spiced beverage and to evaluate its quality characteristics. This study paves the way for further research like carrying out storage studies in the developed product, addition of other nutraceutical and therapeutic ingredients, and development of spiced beverages with other fruits.

MATERIALS AND METHODS

Formulation of beverage

Papaya fruit (*Carica papaya L.*) procured from the local market was thoroughly washed and peeled. It was cut into pieces and homogenized using a mechanical pulper. The fruit pulp was strained by passing through a stainless steel strainer, to obtain a uniform pulp.

Initial experiments were carried out to decide the best combination of TSS, acidity and spice extract required for good sensory acceptability. Various combinations were tried out and sensorily evaluated by a panel. The combination found to be most acceptable was selected.

The TSS of the fruit pulp was standardized to be 10^0Brix. Sugar syrup (filtered through a muslin cloth) and citric acid were added to the homogenized pulp to obtain a TSS of 15 ^{0}Brix and 0.15%, respectively. Spice extract was prepared from aniseed, pepper and ginger in 5:2:1 proportion, by boiling the spices in hot water for 10 minutes and straining through muslin cloth. The spice extract was added to the beverage at 20% level.

The beverage was hot filled into sterile glass bottles and sealed by crown corking. Bottle sterilization was done at 121^0C for 15 minutes. The bottles were immediately cooled to room temperature and taken for analysis.

Physico-chemical analysis

The samples were analysed for various physico-chemical parameters. Titrable acidity was determined by titration of aliquots against 0.1 N NaOH using phenolphthalein as indicator to a pH of 8.1, and was expressed in percentage of malic acid [1]. The total soluble concentration in ºBrix was determined using Abbe's hand refractometer at 28^oC. The non-enzymatic browning in samples was determined according to the method given by Ranganna[1].

The color of the samples was measured using a color reader (Konica MINOLTA CR-10), using the Hunter L*, a* b* units, where L* indicates luminosity or brightness, a* corresponds to greenness (-)/ redness (+) and b* corresponds to blueness (-)/ yellowness (+). The L*, a* and b* data were transformed to colour index [CI= 1000 x a*/ L* x b*].

Total and reducing sugars were estimated by Lane & Eynon method, as described by Ranganna [1].

Analysis of bioactive compounds and antioxidant activity

A direct colorimetric method as given by Ranganna [1] was used for the estimation of vitamin C content. Total polyphenols were determined according to the Folin-Ciocalteau procedure [2]. The analysis of antioxidant activity was carried out using the reducing power assay, as per the method given by Oyaizu [3]. Total antioxidant activity was estimated as per the method given by Prieto *et al* [4].

Microbial analysis and sensory acceptability

The beverage was analysed for total bacterial count and yeast and mold count, using nutrient agar and potato dextrose agar, respectively. The sensory acceptability of the samples was determined using five point hedonic rating scale, by semi-trained panel members. The parameters evaluated include appearance, colour, taste, flavor, consistency and overall acceptability.

Statistical analysis

The values reported are mean of three evaluations.

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RESULTS AND DISCUSSION

The results of the physico-chemical analysis reveal the papaya based spiced RTS beverage to have titrable acidity of 0.27 and TSS of 15.6^0 Brix (table 1). In a study conducted by Tandon *et al*. [5], on bael papaya RTS beverage, the TSS was found to range from 14.8-15^0 Brix whereas the acidity was reported to be 0.26%.

The value for non-enzymatic browning (NEB) as given in table 1, was found to be 0.015. Kaushal *et al*. [6] reported the NEB of seabuckthorn RTS beverage to be 0.07.

Analysis of sugars showed the developed beverage to contain 16.7% total sugars and 6.7% reducing sugars (table 1). In a study on papaya nectar by Thakre and Jain [7], the total sugars were reported to be 20.2% and reducing sugars as 5.73%. Tandon *et al*. [5], reported the total sugars to range from 13.4%-13.9% and reducing sugars from 2.83%-8.11%, for bael-papaya RTS beverage prepared using different ratios of bael and papaya. In another study on jackfruit RTS beverage, total and reducing sugars were reported to be 15.6% and 5.8%, respectively [8].

The L*, a* and b* values of the beverage were found to be 45.6, 1.63 and 9.23, respectively (table 2). The colour index was recorded as 3.87. Positive values for a* and b* and higher value of b* indicated that the beverage obtained had the desirable yellow-orange colour, typical of a papaya product.

The vitamin C content of the developed beverage was found to be 5.2mg% (table 1). Similar range of vitamin C of 4.11 has been reported by Thakre and Jain [6]. Sogi *et al* [9], reported the ascorbic acid content of kinnow RTS to be 5.9mg%. Ascorbic acid content of jackfruit RTS beverage was reported to be 5.85mg% [8], whereas that of whey based pineapple beverage was found to be 3.5mg%. Appreciable amount of vitamin C in the developed RTS papaya beverage could be attributed to the fact that papaya is a moderately good source of vitamin C, and that it could be retained during processing.

Table 1: Physico-chemical characteristics, sugar profile and antioxidant compounds of papaya based RTS spiced beverage

Parameter	Papaya RTS spiced beverage
Total soluble sugars (^{o}Brix)	15.6 ± 0.4
Titrable acidity (%)	0.27 ± 0.1
Brix/Acid ratio	57.7 ± 0.1
Non-enzymatic browning (O.D)	0.015 ± 0.1
Total sugars	16.7 ± 0.6
Reducing sugars	6.7 ± 0.2
Non-reducing sugars	10 ± 0.3
Vitamin C (mg/100g)	5.2 ± 0.1
Total polyphenols (mg/100g)	225 ± 2.3

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Table 2: L*, a*, b* values and instrumental colour index of papaya based RTS spiced beverage

Parameter	Papaya RTS spiced beverage
L*	45.6
a*	1.63
b*	9.23
Colour index	3.87

Results for total polyphenols revealed the developed papaya RTS beverage to contain 225mg% (table 1). In a study by Seeram *et al*., [10], the polyphenol content of various commercially available ready to drink beverages has been reported to be about 400mg% for pomegranate beverage, 250mg% for grape beverage and 100mg% for orange beverage. This shows that the developed beverage has good polyphenol content comparable to commercial beverages.

With regard to the antioxidant activity, the reducing power assay demonstrated increasing antioxidant activity with increase in concentration of the beverage extracts, as depicted in figure 1. At 20 mg/ml concentration, the absorbance was found to be 0.39, which increased to 0.55 and 0.62 at 60mg/ml and 100mg/ml concentrations, respectively. Assay for total antioxidant capacity (TAC) also demonstrated increase with increasing concentration of the extract (Fig. 2). TAC ranged from 0.12 to 0.27 at 20mg/ml to 100mg/ml concentration, respectively. The antioxidant activity demonstrated could be attributed to the presence of antioxidant compounds like vitamin C and polyphenols.

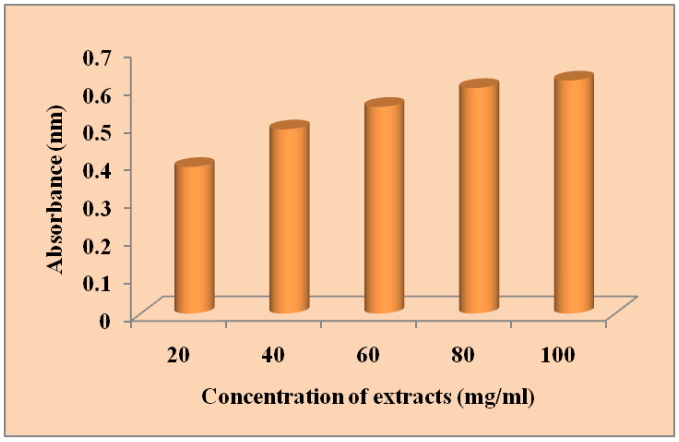

Fig 1: Reducing power of papaya based RTS spiced beverage

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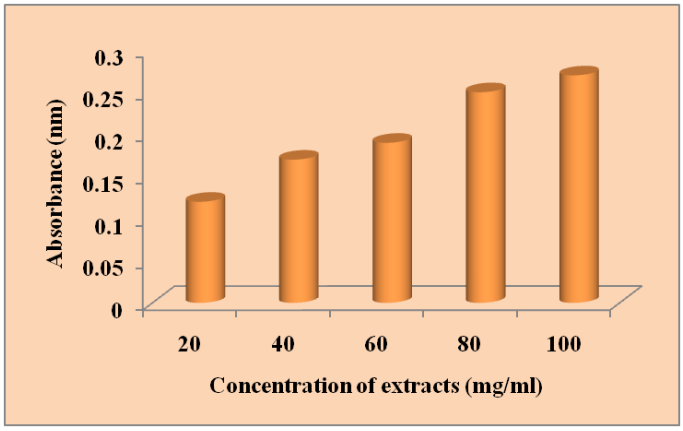

Fig 2: Total antioxidant capacity of papaya based RTS spiced beverage

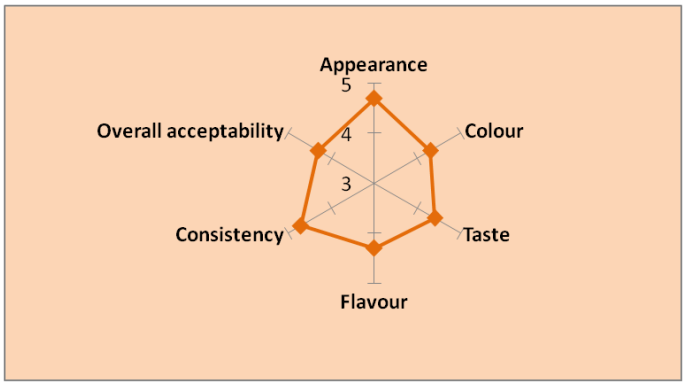

Fig 3: Sensory acceptability of papaya based spiced RTS beverage

The results of microbial analysis revealed that the developed beverage was free from bacteria as well as yeasts and molds. This could be due to the sterile conditions maintained during processing, packaging and storage. The spices added to the beverage could have also contributed to its microbial safety.

Sensory acceptability of the papaya RTS beverage is depicted in figure 3. The scores for appearance, colour, taste, flavor, consistency and overall acceptability were found to be 4.7, 4.3, 4.4, 4.3, 4.7 and 4.3, respectively. The scores show that the beverage was well-liked by the panel members.

CONCLUSION

The present investigation demonstrated the feasibility of preparing antioxidant rich papaya based RTS spiced beverage with good colour, taste and flavour. Further studies are being carried out to evaluate the storage stability of the beverage. Value addition with potential nutraceutical ingredients is also being explored.

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