

Development of Spiced Tender Coconut Water Ready to Serve Beverage

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Abstract: Tender coconut (*Cocos nucifera*) water is one of the highest sources of electrolytes known to man. It contains sugars, fibre, proteins, antioxidants vitamins, minerals such as potassium, magnesium. It reduces/destroys intestinal worms. It cleans the urinary system, stimulates digestion, increases semen, cardiac tonic and relieves thirst and burning. Efforts on product development are not in commensurate with the availability of the coconut which is underutilized and unexplored. Low cost food processing technology can offer excellent opportunities for folks in the production of processed foods in the rural sector. So the work was undertaken to develop value added products from tender coconut water with addition of spices. Ready to Serve (RTS) beverage prepared from tender coconut water with the blend of ginger and cardamom extracts and packed in glass bottles and stored at room temperature (27±32°C) and refrigerated temperature (7±1°C). The prepared RTS is complying with Indian standards for RTS fruit beverages. The blended RTS were analyzed for its different physiochemical as well as sensory quality evaluated by adopting 9 point hedonic scale. The developed RTS had the shelf life of 120 days for both at room temperature and refrigerated temperature and hence it was safe and fit for consumption.

Keywords: Tender coconut water, spices, glass bottles. RTS beverages

1. Introduction

Coconut (*Cocos nucifera*) is one of the oldest known tropical crops and is referred as the “Tree of Life”. Every part of the coconut palm is used for many purposes by many millions of people in the different part of the world. It is a primary source of food, water, drink, purifier, fluid re-hydration, isotonic, energy, tonic, fuel, soil rejuvenator from the fibre, animal feed and shelter [1]. Tender coconut water is mainly consumed as soothing natural beverage and also contains greater amount of minerals such as sodium, potassium, phosphorus, chlorides, magnesium, zinc, selenium, iodine, sulphur, manganese, boron, molybdenum, ascorbic acid and also sugars [2]. As a tropical plant, tender coconut water has many medicinal values when compared to its flesh. Some of them are effective in the treatment of kidney and urethral stones; they do not produce heat and do not destroy red blood cells. Being readily accepted by the body, it is excellent for oral re-hydration and as natural isotonic, maintain the human body's natural fluid levels which in turn maintain proper blood pressure, circulation, kidney and liver functions[3].

Food habits of people are rapidly changing towards the natural, soft and safer drinks, with lower amounts of calories free from added ingredients. In recent years, emphasis is focused on product diversification, by products utilization and development of value added coconut products to improve the coconut economy. Coconut water is a natural beverage product with distinct sensory attributes such as aroma, taste and nutritional values. The natural form of the tender coconut water is sterile and also considered as energy drink for sport personals due to its nutritional characteristics. Ginger scientifically known as *Zingiber officinale* belongs to the family Zingiberaceae. Ginger is contraindicated in people suffering from gallstones as the herb promotes the release of

bile from the gallbladder. Ginger may also decrease joint pain from arthritis, though studies on comparison of vitamin C content in common fruits this have been inconsistent and may have blood thinning and cholesterol lowering properties that may make it useful for treating heart disease [4].

Cardamom refers to several plants of the similar *genera Elettaria*. They are recognized by their small seed pods, triangular in cross-section and spindle-shape. They contain thin, papery outer shell and small black seeds. This exotic spice contains chemical compounds that are known to have been anti-oxidant, disease preventing and health promoting properties. Cardamom also helps in cleansing the body as it has detoxifying properties. It improves blood circulation to the lungs and can be helpful in prevention of spasms or convulsions. Hence, cardamom in small quantities is beneficial for those suffering from asthma or bronchitis. Cardamom enhances appetite and provides relief from acidity in the stomach. It is used to cure of halitosis. It is beneficial for those suffering from various kinds of respiratory allergies [5].

Spiced ready to serve beverage based on blends of tender coconut water with ginger and cardamom extracts continues to receive a considerable amount of attention reflecting a growing awareness of the potential of these products in the market place. These beverages have high nutritional quality and increased energy value especially therapeutic properties into the beverages. Therefore, keeping in view of the nutritional and functional attributes of tender coconut water RTS beverages to be used in nutritious and health promoting beverages, the study was undertaken to develop process for preservation of spiced tender coconut water, to analyze the proximate composition and sensory evaluation of the processed tender coconut water.

2. Materials and Methods

2.1 Raw material

Tender coconuts of 7-8 months were purchased from Central Farm, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai.

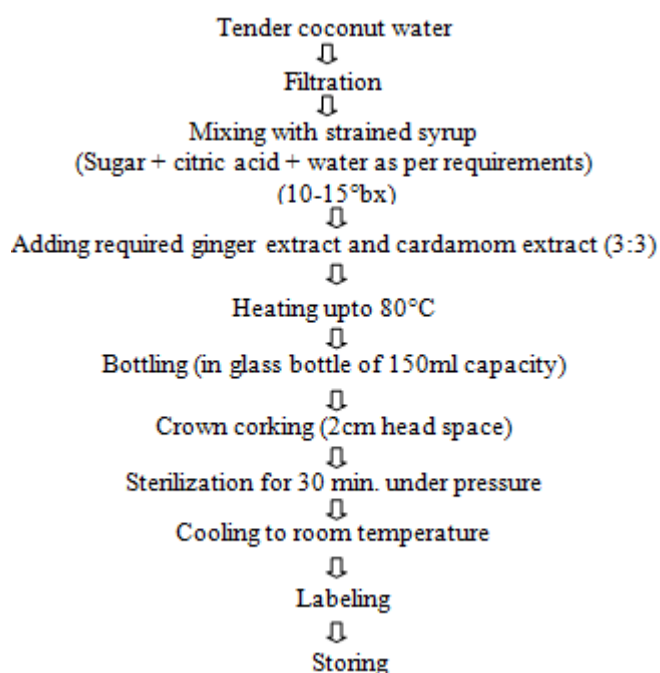
2.2 Preparation of flavouring extracts

Fifty grams of fresh flavoring agent such as ginger and cardamom was powdered. They are mixed in 500ml of water, boiled for 20 min. in a closed vessel and then cooled. The extract of the flavoring agent was filtered and used as a flavoring agent and added to the tender coconut water in varying proportions. In the case of blends of flavour extracts such as ginger and cardamom at various proportions after many trials, it was found that 3:3 of the ginger and cardamom blend was highly acceptable.

2.3 Preparation of spiced tender coconut water RTS beverages

When preparing a RTS, tender coconuts were cut on the top and the water was collected. Sugar, citric acid and water required for RTS preparation were calculated as per FPO (Food Product Order) specification. The extract of flavoring agent was added to the RTS beverage. The prepared spiced tender coconut water RTS beverage was heated up to 80°C, packed in sterilized glass bottle with a capacity of cap 150 ml leaving a head space of 2 cm and capped air tightly. The RTS bottles were pasteurized for 30 min in water bath and stored at room temperature (27±32°C) and refrigerated temperature (7±1°C).

Flow chart for the preparation of spiced tender coconut water RTS beverage



2.4 Proximate analysis of spiced tender coconut water RTS beverages

The spiced tender coconut water was analyzed for Total Soluble Solids (TSS), pH, titrable acidity, ash, ascorbic acid, reducing sugar and total sugar. A refractometer was used for determination of TSS of the spiced tender water. The pH was determined in a digital pH meter [6]. Acidity was estimated with standard NaOH using phenolphthalein as an indicator. AOAC method was used for determination of ash. The ascorbic acid was determined using procedure given by [7]. The total and reducing sugar content of the sample was determined by the Shaffer Somogyi micro method described by [8]. Mineral content of the spiced tender coconut water was estimated by dissolving the ash in 3N HCL and the analysis was carried out by flame atomization technique using Atomic Absorption Spectrometer (Varian, model; Varain spectra A280 FS, Germany) and expressed as mg/100g. The microbial load of the stored samples was enumerated initially and at the end of the storage period by the method described by [9].

2.5 Sensory Quality Evaluation

The sensory analysis was performed on a 9-point Hedonic scale by a panel of 20 semi trained members. The beverage was evaluated for color, appearance, flavor, taste and overall acceptability. The evaluation was done at an interval of 15 days during the storage period of 120 days [10].

2.6 Statistical Analysis

The data obtained were subjected to statistical analysis to find out the impact of packaging material and storage periods on the quality of spiced tender coconut water Completely Randomized Design was applied for the analysis [11].

2.7 Storage Study

The spiced tender coconut water RTS beverage was stored at room temperature and refrigerated. Chemical composition, organoleptic characteristics and microbial load were observed at an interval of one month.

3. Results and discussion

3.1. Physico-Chemical Characteristics

The physico-chemical characteristics of spiced tender coconut water RTS beverage was evaluated once in a month for a period of 120 days and are shown in Table 1. The initial and final values were taken for the discussions.

Table 1: Changes in chemical composition of spiced tender coconut water RTS beverage during storage

Nutrients	Initial	Room temp.	Refrigeration Temp.	SED	CD 0.05
		120 days	120 days		
TSS (°brix)	11	13	12	0.015	0.04165**
pH	2.23	2.12	2.18	0.00825	0.04493**
Acidity (%)	0.35	0.45	0.42	0.01118	0.03104**
Ascorbic acid (mg/100g)	1.98	1.75	1.86	0.00935	0.02597**
Reducing sugar (g/100g)	2.23	2.45	2.54	0.01241	0.01789**
Total sugar (g/100g)	9	8.72	8.85	0.05026	0.02652**
Ash (%)	0.6	0.57	0.58	0.00707	0.01963**
Sodium (mg/100g)	106.1	98.53	101.78	0.03159	0.02458**
Potassium (mg/100g)	280.35	268.95	272.42	0.00452	0.02349**

3.1.1 Total Soluble Solids

The initial TSS of the spiced tender coconut water RTS beverages had 11.0° Bx in room and refrigerated temperature. The Brix value increased during storage from 13.00 in room temperature and 12.00 in refrigerated temperature. Increase in TSS might be due to the solubilization of insoluble portion of the products due to presence of acids. [12] also observed an increase in the TSS of developed papaya – aloe vera blended Ready-to-Serve beverage.

3.1.2 pH

The initial value of pH was 2.23. After 120 days of storage, pH was 2.12 and 2.18 for spiced tender coconut water RTS beverages stored at room and refrigerated temperature respectively. A slight decrease in pH was observed in ready-to-serve bael and guava blended beverage during 60 days of storage [13].

3.1.3 Acidity (%)

The freshly prepared spiced tender coconut water RTS beverages contained 0.35 per cent acidity which had increased up to 0.45 per cent in room temperature and 0.42 per cent in refrigerated temperature. The decrease in acidity during storage was also observed by [14] in anola juice. The juice blended with natural antioxidant (spice extract) declined conversion of acids into sugars and salt by enzymes and oxidation.

3.1.4 Vitamin C (mg/100g)

The vitamin C content reduced from an initial value of 1.98mg/100g to 1.75mg/100g in room temperature and 1.86mg/100g in refrigerated temperature. A gradual loss in ascorbic acid during storage of litchi beverages was observed by [15] which may be due to the effect of storage temperature and catalytic activity of fructose in the catabolization of vitamin C.

3.1.5 Reducing sugar (g/100g)

Reducing sugar of spiced tender coconut water RTS was increased gradually during storage. The increase in reducing sugar content of the sample stored at refrigeration temperature was slightly lesser than the sample stored at room temperature. In the samples the reducing sugar content changed from 2.23 to 2.45 and 2.54g/100g at room and refrigeration temperature respectively. There was continuous increase in the values of reducing sugars (4.8 to 11.5%) in the RTS beverage prepared from pineapple and guava blends during three months of storage [16].

3.1.6 Total sugar (g/100g)

The initial total sugar of spiced tender coconut water RTS beverage was 9.00g/100g which was decreased to 8.72 and 8.85g/100g stored at room and refrigerated temperature respectively. The breakdown of total sugar into simple sugar would have been decreased the quantum of total sugar.

3.1.7 Ash (%)

The ash content was found to be 0.35 per cent which indicated that tender coconut water had appreciable amount of minerals. There was slight reduction in ash content was observed during storage. [17] quoted that an appreciable amount of ash content was present in the pineapple – watermelon ready – to drink.

3.1.8 Sodium and potassium (mg/100g)

The initial sodium content was 106.10mg/100g which was decreased to 98.53mg/100g in room temperature and 101.78 mg/100g in refrigerated temperature. The spiced tender coconut water RTS beverages had an initial potassium content of 280.35 mg/100g in room and refrigerated temperature. A slight reduction of potassium content in the product was observed during storage. [18] was observed that the ash content was found to be 0.385% which indicated that tender coconut water had appreciable amount of minerals.

3.2 Microbial load

Table 2 showed the enumeration of microbial load in spiced tender coconut water during storage period. Initially there was no bacterial and fungal population in the product. At the end of the storage period the bacterial count was 4.00×10^6 cfu/g in room temperature and 2.00×10^6 cfu/g in refrigerated temperature. Fungal population was 3.00×10^2 cfu/g in room temperature and 2.00×10^2 cfu/g in refrigerated temperature at the 120th day of storage period in spiced tender coconut water. The safe of microbial has been observed at the end of the storage period.

Table 2: Enumeration of microbial load in spiced tender coconut water

Microorganisms	Room Temp.		Refrigerated Temp.	
	0d	120d	0d	120d
Bacteria ($\times 10^6$ cfu/g)	-	4.00	-	2.00
Fungi ($\times 10^2$ cfu/g)	-	3.00	-	2.00

Minimum increase in the microbial population was recorded when juice was blended with spices like ginger, mint and black pepper. This might be due to the inhibitory effect of

spices towards microorganisms [18]. They reported that no bacterial growth was observed in the spice mixed fruit juice RTS beverage. However, there was negligible growth of mold and yeast in the drinks.

3.3 Organoleptic characteristics of spiced tender coconut water RTS beverage

Table 3: Organoleptic characteristics of spiced tender coconut water RTS beverages during storage

Quality attributes	Room Temp.		Refrigerated Temp.	
	0d	120d	0d	120d
Colour and appearance	9.0	8.0	9.0	8.6
Flavor	9.0	8.3	9.0	8.5
Texture	9.0	8.2	9.0	8.3
Taste	9.0	8.0	9.0	8.2
Overall acceptability	9.0	8.2	9.0	8.5

The spiced tender coconut water stored in glass bottle at room and refrigerated temperature were subjected to the organoleptic characteristics and the mean scores for colour and appearance flavor, texture taste and overall acceptability are presented in Table 3. From the results, it is evident that the mean score for all the quality attributes was initially 9.00. At the end of the storage period, the scores revealed that the product stored at refrigerated temperature had maximum than the product stored at room temperature. [3] observed that the sensory evaluation of the ready to serve green coconut water was highly acceptable after 12 months of storage at refrigerated temperature and 10 months of storage at room temperature.

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