



Development of Seaweed based Palmyra (*Borassus flabellifer*) Jam and Determination of its Quality Parameters

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Abstract

Ceylon moss (*Gracilaria*) is rich in nutrients and contains high amount of agar-agar. The present study was carried out with a view to develop Ceylon moss jam incorporating palmyra pulp as a good source of Vitamin A and C, to improve the sensory properties of the final product. Instead of seaweed pulp and Palmyra pulp citric acid and sugar was added without pectin. Seaweed pulp was extracted using a different method. Dried *Gracilaria edulis* was soaked in water for 15 min, soaked and drained seaweed was steamed for 10 min, and grinded properly for 10 min to obtain the pulp. Different concentrations of seaweed pulp were evaluated based on sensory attributes including flavour, colour, aroma, spread ability and acidity to optimize the content of seaweed pulp in jam, without using Palmyra pulp and 40% was selected. Then seaweed pulp was replaced by incorporating different contents of Palmyra pulp to enhance the colour, aroma and flavour. It was observed that the product containing 24% of seaweed pulp and 16% of Palmyra pulp was showed highest score point (5) in sensory quality compared to than other treatments. The pH, titratable acidity and total soluble solid of the seaweed jam were 3.07, 1.045% (w/w) and 65%, respectively. Developed seaweed jam consists of 13.8, 0.59, 5.23, 0.42 and 4.89 % (w/w) of moisture, protein, fat, total ash, total dietary fiber, respectively. Finally the shelf life of the product determined more than one year period. The technologies developed, in this study; to extract seaweed pulp from *G. edulis* and to produce Palmyra incorporated seaweed jam has potential to commercialize as an industry.

Keywords: Palmyra; Seaweed; Sensory Properties; Pulp

Introduction

There is thousands of seaweed species in the world and of them about 340 seaweed species have been identified in Sri Lanka. Edible seaweeds are very nutritious food materials and rich in micronutrients such as Ca, K, I, Na and dietary fibre. Though the seaweeds are high in nutritional properties, they are not having good organoleptic properties due to available in phenolic compounds.

When it is added in the production of the jam as a pulp, incorporation of flavour and colour enhancers such as mango, wood apple are required. Palmyra is a tropical fruit that grows well in arid zone in Sri Lanka and it is rich in vitamin A and C [1]. Though it has recognized as an under-utilized product it carries high sensory properties like sweet taste, colour pigments which gives an attractive colour and volatile substances. Therefore, Palmyra pulp is a good source to improve the sensory attributes in a product like jam.

The aim or the present study was to develop the technology of extracting the pulp from Ceylon moss (*Gracilaria edulis*) and to develop a Palmyra pulp incorporated Ceylon moss jam which is applicable to the Sri Lankan jam manufacturing industry.

Materials and Methods

About 12 kg of raw dried *Gracilaria edulis* (Ceylon moss) were purchased from intermediate merchant in Kalpitiya area in August 2016. Sun dried *Gracilaria* were packed in 18gauge polypropylene bags and transported to Processing Pilot Plant in National Aquatic Resources Research and Development Agency. Properly ripened Palmyra (*Borassus flabellifer* L) was collected from Kalpitiya and Jaffna areas and they were transported to processing plant in rigid foam boxes.

Purchased unclean seaweeds were sorted manually to remove other contaminant seaweeds and extraneous matter. Then seaweeds were washed thoroughly by running water and sun dried three days. Trial and error method was used for the preparation of *Gracilaria edulis* pulp and collected palmyra fruits.

To obtain the most appropriate seaweed content in the jam with favorable sensory properties (flavor, aroma, spread ability, acidity, taste, overall acceptance) initial sensory evaluation was conducted (step-1). Then another sensory evaluation step-2 was done to select the best Palmyra concentration in the final product. Therefore con-

sumer oriented tests were done using 30 in-house panelists. The proximate content [2] and mineral content and Titratable Acidity, total plate count (SLS 516 part 1: 1991) and fungi count SLS 824 Part-2 (1989) of the end product was determined. SPSS 20 statistical software was used to analyze the data. Sensory evaluation data were analyzed at the 5% significant level using kruskal- Wallis test.

Ingredients	Quantity %			
	T1	T2	T3	T4
Seaweed pulp	32.0	28.0	24.0	20.0
Palmyra pulp	8.0	12.0	16.0	20.0
Sugar	59.56	59.61	59.71	59.7
Citric acid	0.44	0.39	0.29	0.29

Table 1: Prototypes of jam used for the sensory evaluation 2 (step-2).

According to the spider web diagram 40% has obtained the maximum score for sensory attributes and it was selected from the step 1. As the step 2 four different percentages of Palmyra (treatment F1, F2, F3, F4) was incorporated to the selected the best treatment in step 1. then treatment F3 was selected as the best formula in step 2.

Results and Discussion

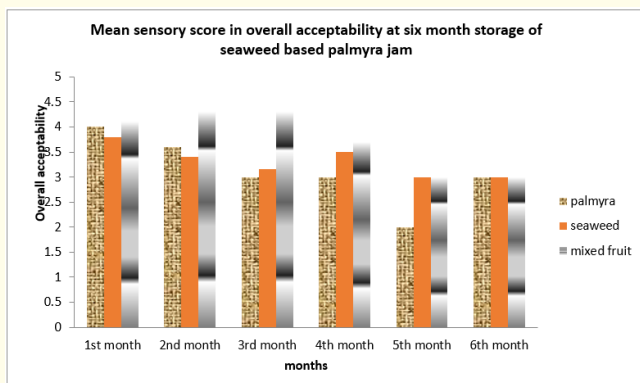


Figure 1: Mean overall acceptability of six month storage different jam types.

The overall acceptability was decreased in all the samples with storage period. The slightly decreased of acceptability from score point 5-to 3 started after four months period in seaweed based jam. There weren't significant difference at 5% level between shelf life of commercial Palmyra jam and Palmyra incorporated Ceylon moss jam produced in the laboratory. The differences between shelf life of jams were depended on preservatives such as Sorbic acid used for commercial jams. All the jams were observed quite stable more than six months. Shelf life was determined by sensory evaluation. Sensory evaluation was conducted using 30 in-house panelist of NARA using 7 point hedonic scale. Slight improvement of total plate count 15X10¹cfu/g and yeast and mould counts were observed in the analysis during storage time period during the six

month. The colonies were counted using a colony counter in subdued light and the results were expressed as "yeast and mould colony forming units (CFU) per 1 gram of the sample. The number of colonies was estimated as a round Figures. However product did not show any symptoms of spoilage such as mould growth, off colours and off odours. Microbiological counts of developed jam was a complied with SLSI standards (SLSI-265:2011) (P<0.5) during six months of storage time.

Parameter	Palmyra pulp incorporated <i>Gracilaria edulis</i> Jam
As	ND
Pb	ND
Mg	45.78mg/kg
Na	126.09 mg/kg
Fe	23.97 mg/kg
K	528 mg/kg
Ca	90.17mg/kg
Cu	0.09µg/kg
Zn	0.67

Table 2: Mineral composition and gel strength of the developed product.

The palmyra pulp incorporated *Gracilaria edulis* Jam was found highest K composition. The second highest mineral was Na level. The toxic metals weren't observed in the product. This developed product was rich source of micro and macro mineral such as Ca, K, Na, I [3-12].

Conclusion

As Sri Lanka is an island bordered by the sea, seaweed culture can be practiced along the coast line and satisfactory amount of seaweeds can be harvested from both the wild collection and the cultured stocks. Coastal communities can engage in seaweed industry and seaweed cultivation can be established as an industry in Sri Lanka. If this is established, seaweed can be utilized in different productions and it will create more employment opportunities for the locals as well.

Ceylon moss can be incorporated into jam as a fruit pulp and it will provide gelling properties as well instead of application of pectin into it. Palmyra fruit, rich in vitamin A and C can be used to improve the sensory qualities of the product and quite tasty pulp to utilize in jam preparation. This product can be consuming for four weeks of time period according to the research findings. But the shelf life study should be extent to at least 6 months of time period.

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