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Replacement of table sugar with clarified rice syrup in beverages

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Abstract

The worst element in the modern diet is white sugar, which contains the toxic fructose. As a result, many people have started avoiding fructose and switching to fructose-free sweets. Rice Syrup, for example, contains no fructose. White sugar was replaced with clarified rice syrup in this study. At a pilot plant scale, products such as red herbal syrup, chocolate syrup, cardamom syrup, aloe vera syrup, and plum syrup were made utilizing rice syrup in place of white sugar. During the shelf-life study, all parameters, including microbiological, physicochemical and sensory properties, were found acceptable. In addition, at zero weeks and 48 weeks, the effect of storage days on pH, acidity, brix, sugars content, and sensory attribute was determined. During storage, no notable changes in quality metrics were found.

Keywords: Fructose; Rice syrup; Sweetener; White sugar; Beverages

Introduction

Added sugar is the single worst ingredient in the modern diet. It is now-a-days believed to be the leading cause of some of the world's biggest killers, which includes not only obesity but also type 2 diabetes, heart disease and cancer. White sugar is made up of two simple sugars; glucose and fructose. Fructose is one of the key reasons sugar is toxic. For this reason, many people have started trying to avoid fructose and have turned to fructose-free sweeteners instead. One of these is Rice Syrup which is essentially all made up of glucose. Glucose is also found in starchy foods like potatoes and is not considered harmful for fructose metabolic health. The fructose gets to turn into fat, which either lodges in the liver (causing fatty liver and insulin resistance) or is shipped out, raising blood triglycerides (Elliott *et al.,* 2002). Without getting into the gory details, these metabolic problems can lead to all sortsof diseases. There is no fructose in rice syrup, so it doesn't negatively affect liver function and metabolic health as regular sugar. In this project, sugar has been replaced with rice syrup in different beverages.

Material and methods

Raw material purchase

Rice syrup was procured from Shafi Gluco Chem (PVT.) Ltd. Lasbella, Balochistan. The Clarified Rice syrup is a colourless syrup with a clean sweet flavour with light buttery and honey flavour notes. It is made from the enzymatic treatment of rice using GMO-free natural enzymes filtered and concentrated to heavy syrup. It is a healthy alternative to refined sugar and is gluten-free, hypoallergenic. The rest of all the material used in the production of red herbal syrup, chocolate syrup, cardamom syrup, aloevera syrup and plum syrup was procured from the local market of Lahore. Filtered water was used in the production of all said products. Red herbal syrup, chocolate syrup, cardamom syrup, aloevera syrup, and plum syrup were produced and packed in Pet bottles purchased from the local market.

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All the studies were conducted in the food and biotechnology research centre of PCSIR laboratories complex Lahore with the financial assistance of Ministry of Science and Technology Pakistan.

Methodology

Forty-eight bottles of 750 ml of each product were stored at dry ambient conditions away from sunlight to study shelf life and quality evaluation. Each sample was analyzed after 15 days interval for the following mentioned parameters, as shown in Table I. Each time fresh bottles were opened for sensory evaluation (Meilgaard *et al.*, 2007) and chemical analysis as per methods described in AOAC, 2016 separately. The results of chemical and sensory analysis at firstweek and 48th week were discussed. All the works were done at the food pilot plant of PCSIR Labs Complex Lahore, Pakistan.

Results and discussion

White table sugars causing liver damage and increased cholesterol level in the body were successfully replaced with clarified rice syrup in daily used beverages like Red herbal syrup, chocolate syrup, cardamom syrup, aloevera syrup and plum syrup by replacement of table sugar with clarified rice syrup. Physicochemical and sensory evaluations of all the products were carried out for each product. Among physicochemical parameters pH, acidity, sugars, brix and antioxidants evaluation was carried out (Table I). The products prepared by replacing table sugar with rice syrup have a mild sweet taste and a unique mouthfeel that was liked very much, as shown in sensory evaluation. The products have the same good sensory characteristics as of conventional products. Productions of products were carried outat pilot plant scale. As per feedback proforma, consumers appreciated the products and raised demand for more developments regularly. The food processing industry of Pakistan has also purchased production technology from PCSIR. Some consumers also feltless sweetness in the final ready to use drink, particularly in squashes compared to conventional products. The issue was resolved by modifying the formulation in the very next trial. The prepared products with clarified rice syrup were also introduced to the industry producing beverages to create awareness for replacing sugar with clarified rice syrup in beverages. A good response was received from the industry.

Table I. Analysis of different parameters of Clarified Rice Syrup

	Parameter	Value
1.	Dextrose equivalent	60%
2.	Brix	80.2
3.	pH	5.4
4.	Total Protein	< 0.1 %
5.	Ash Contents	0.45 %
6.	Total Fat	< 0.1 %
7.	Total carbohydrates	79%
8.	Dietary fiber	0%
9.	Sodium	< 10 mg/100g
10.	Arsenic	< 10 mg/100g
11.	Lead	<0.05 ppm
12.	Cadmium	<0.05 ppm
13.	Mercury	< 0.01 ppm
14.	Energy	316 kcal/g
	Microbiological analysis	
15.	Total plate counts	<1000 cfu/g
16.	Total coliforms	Not detected
17.	*E. coli*	Not detected
18.	Yeasts	<10 cfu/g
19.	Molds	<10 cfu/g

Table II. Results of the chemical analysis of products produced by replacement of table sugar with clarified rice syrup at 0 weeks

Sl. No.	Product	pH	Acidity	Brix	Reducing Sugar	Non Reducing Sugar	Antioxidant activity (% Inhibition)
1.	Red Syrup	5.35	0.12	67	66.2	Nil	44.0
2.	Plum syrup	3.85	0.31	65	64.4	Nil	54.0
3.	Chocolate syrup	6.87	0.07	54.60	54.0	Nil	64.39
4.	Cardamom Syrup	5.35	0.13	65	64.3	Nil	38.0
5.	Aloe Vera syrup	4.30	0.16	65	64.3	Nil	82.9
6.	Falsa Squash	3.54	0.52	64	63.2	Nil	18.59

Table III. Results of the chemical analysis of Products produced by replacement of table sugar with clarified rice syrup at 48 week

Sl. No.	Product	pH	Acidity	Brix	Reducing Sugar	Non Reducing Sugar	Antioxidant activity (% Inhibition)
1.	Red Syrup	5.45	0.11	67.4	66.3	Nil	42.0
2.	Plum syrup	3.90	0.30	65.7	64.6	Nil	50.0
3.	Chocolate syrup	6.94	0.06	54.80	54.5	Nil	60.39
4.	Cardamom Syrup	5.47	0.12	65.30	64.6	Nil	35.0
5.	Aloe Vera syrup	4.44	0.15	65.50	64.6	Nil	79.0
6.	Falsa Squash	3.60	0.50	64.60	63.5	Nil	18.0

The results of physicochemical parameters like pH, acidity, total soluble solids, sugars, antioxidants, sensory characteristics and shelf life of all said food products were determined at each week interval. There were no significant changes in the quality parameters from 0 weeks until 48 weeks, as shown in Table II and III. The overall increasing trend in pH was observed with the storage period.

The results show that acidity during the storage period decreased in syrup concentrates and increased the pH. The

Table IV. Sensory Characteristics of Products produced by replacement of table sugar with clarified rice syrup

Sl. No.	Product	Color	Taste	Aroma	Overall Acceptability
1.	Red Syrup	Very Good	Good	Good	Fair
2.	Plum syrup	Good	Good	Good	Good
3.	Chocolate syrup	Good	Good	Good	Good
4.	Cardamom Syrup	Good	Good	Good	Good
5.	Aloevera syrup	Good	Good	Good	Good
6.	Falsa Squash	Good	Good	Good	Good

increased pH may be due to the hydrolysis of some polysaccharides into disaccharides like starch into sucrose, fructose, glucose, etc. These reactions increase the sweetness and decrease sourness, as a result of which pH rises. The present investigation results are similar to the finding of (Rehman *et al.* 2014). The total soluble solids (Brix) values increased throughout the storage period. The present results align with the finding of (Akala *et al.* 2003), who also reported that the total soluble solids increased during the storage period. Results regarding antioxidant activity showed that reducing power decreased with an increase in storage time. These results follow the results of (Gorsi *et al.* 2019), who elaborated a remarkable decrease in reducing the ability of different fruits and vegetables during storage. Products were found relatively stable till the final week of storage. Nonotable changes in any of the quality parameters except some minor changes in both chemical and sensory quality were observed throughout the study period, as shown in Table IV. High sugar contents and lower pH of products may have inhibitory effects on microbial contamination and support high product stability.

Conclusion

Products were found relatively stable till the end of storage. No remarkable changes in any of the quality parameters, particularly sensory quality, were observed throughout the study period. All the developed food products were merely acceptable as that of conventional products. Awareness among industrialists needs to create to replace hazardous table sugar with rice syrup in beverages.

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