

Application Note

Food Beverages

Analysis of Sugar Composition in Natural and Artificial Sweeteners Using RID-20A

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Food & Beverages

1. Introduction

Sweeteners are widely used in the food industry to enhance flavor and sweetness while influencing nutritional value and health outcomes. They can be broadly classified into natural and artificial sweeteners.

Natural sweeteners, such as honey, maple syrup, and fruit extracts, contain varying proportions of sugars, primarily fructose, glucose, sucrose, and lactose. On the other hand, artificial sweeteners, such as aspartame, saccharin, and sucralose, are synthetically produced to provide sweetness with little to no caloric content.

Understanding the composition of sugars in different sweeteners is essential for assessing their nutritional impact and potential health effects. Fructose and glucose, which are simple sugars, are naturally present in many fruits and honey, whereas sucrose, a disaccharide, is commonly found in table sugar and processed foods. Lactose, another disaccharide, is primarily present in dairy-based sweeteners¹.

This study aims to analyze and compare the sugar content—specifically fructose, glucose, lactose, and sucrose—in various natural and artificial sweeteners. By evaluating their sugar profiles, this research will contribute to a better understanding of their potential effects on human health and their suitability for different dietary needs.

This research presents a validated approach for detecting four different sugars (see Fig. 1) in natural and artificial drinks using LC-2060C 3D coupled with RID-20A from Shimadzu Corporation Japan.

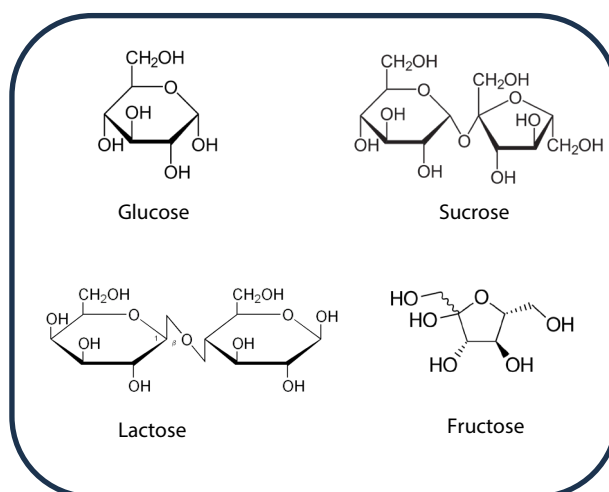


Fig. 1 Representative structures of sugars.

2. Materials and methods

The Sugar analysis was conducted using fructose, glucose, lactose and sucrose standards procured from Himedia to ensure accurate quantification. A total of 7 samples, comprising various natural and artificial sweeteners procured from the local market were analyzed using HPLC-2060C 3D coupled with RID-20A as shown in Fig. 2.

2.1. Analytical Conditions

Table 1 Analytical conditions LC

LC	
Chromatographic mode	: HILIC
Column	: Amino (NH ₂) Column, 80Å, 5 µm, 4.6 mm X 250 mm
Mobile phase	: Acetonitrile : Water (75:25)
Elution mode	: Isocratic
Flow rate	: 1.2 mL/min
Column temperature	: 35°C
Injection volume	: 10 µL
Run Time	: 25.0 min



Fig. 2 Shimadzu LC-2060 3D.

2.2. Sample preparation

In this study, standard and sample preparations were carried out simultaneously and followed the same procedure to ensure consistency and accuracy in the analysis of sugar concentrations. For the preparation of standards, approximately 1 g each of fructose, glucose, lactose, and sucrose was weighed and transferred into separate 10 mL volumetric flasks. Each flask was filled to the mark with deionized water and sonicated for 10 minutes to ensure complete dissolution. A series of calibration standards ranging from 0.2% to 10% were then prepared by diluting the stock solutions with a 50:50 mixture of acetonitrile and deionized water.

For sample preparation, approximately 1.0 g of each sample was weighed and transferred into 10 mL volumetric flasks. Diluted up to the mark with 50:50 water - acetonitrile mixture then further diluted to a 1:2 ratio. To remove suspended particulate matter, the samples were filtered through a 0.45 µm membrane filter before injection to prevent clogging of the instrument.

3. Result and Discussion

The calibration curves exhibited excellent linearity, with correlation coefficients (R^2) exceeding 0.99 for all sugars, indicating a high degree of accuracy and reliability in the measurements.

The results revealed that natural sweeteners such as honey, date syrup, and jaggery contained higher amounts of fructose and glucose, whereas white and brown sugar were primarily composed of sucrose. Date syrup and honey exhibited a balanced mix of fructose and glucose, while jaggery and brown sugar predominantly consisted of sucrose.

Interestingly, the zero-calorie sweetener contained detectable levels of glucose. All four sugars glucose, fructose, lactose, and sucrose were not detected in the artificial sweetener. Detailed calibration curve results are shown in Fig. 3-6, while Fig. 7 presents a representative comparison chromatogram. The result summary is displayed in the Table 2.

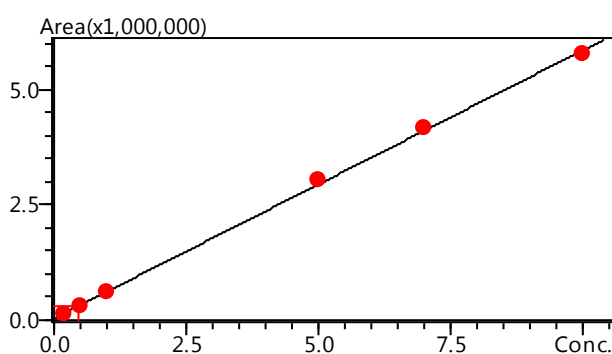


Fig. 3 Calibration curve for fructose.

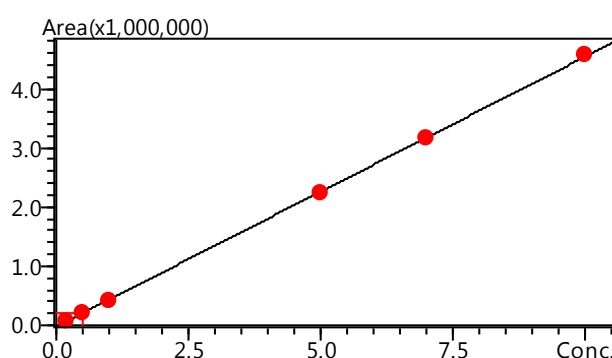


Fig. 4 Calibration curve for glucose.

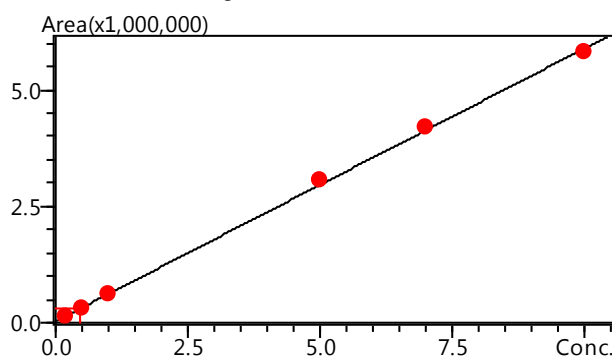


Fig. 5 Calibration curve for sucrose.

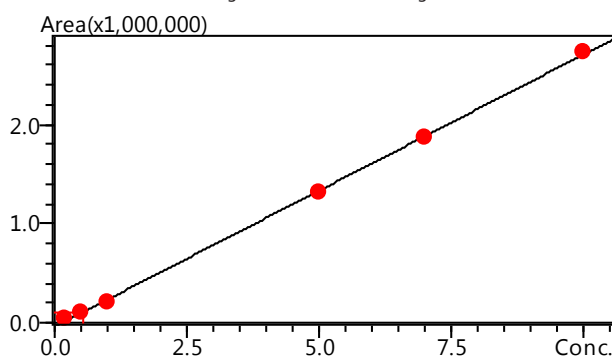


Fig. 6 Calibration curve for lactose.

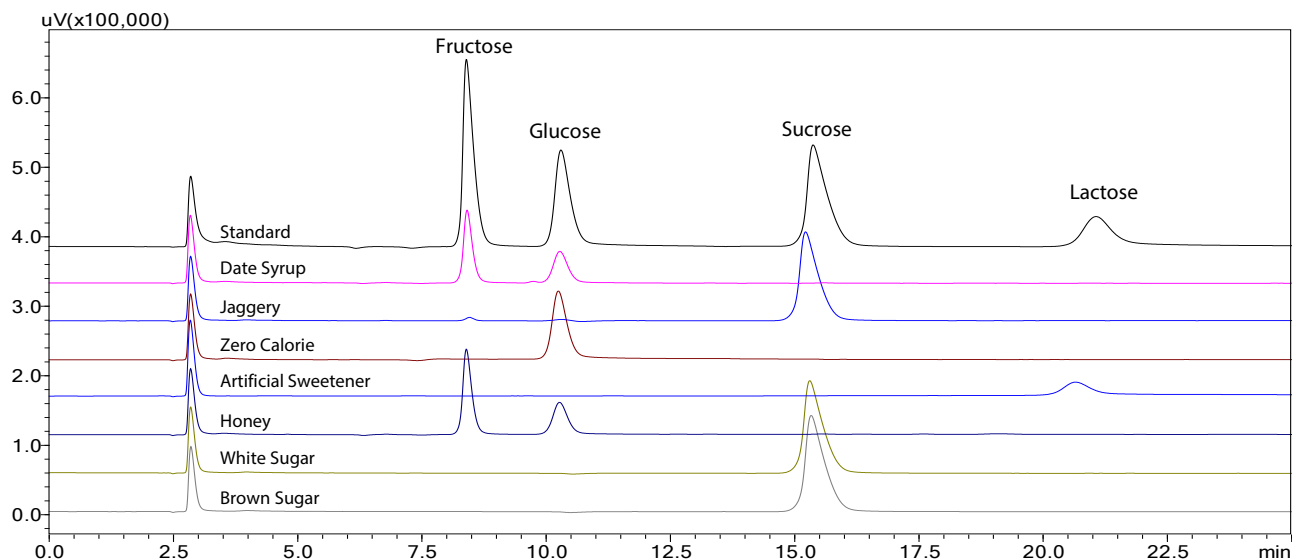


Fig. 7 Comparison chromatograms between standard and samples.

Table. 2 Summary

SI No	Sample Name	Fructose (%)	Glucose (%)	Sucrose (%)	Lactose (%)	Total (%)
1	Date syrup	59.19	40.81	ND	ND	100.00
2	Jaggery	3.68	2.94	93.38	ND	100.00
3	Zero Calorie Sweetener	ND	100.00	ND	ND	100.00
4	Artificial sweetener	ND	ND	ND	ND	ND
5	Honey	60.33	39.11	0.56	ND	100.00
6	White Sugar	ND	ND	100.00	ND	100.00
7	Brown Sugar	ND	ND	100.00	ND	100.00

Note : ND-Not detected

4. Conclusion

The results highlight significant variations in sugar content across different sweeteners, which is crucial for dietary considerations, especially for individuals managing diabetes, lactose intolerance, or calorie intake. Natural sweeteners provide different sugar compositions, contributing to nutritional intake, while artificial sweeteners generally do not contribute to sugar intake but may contain lactose as a filler. Understanding these compositions can help consumers make informed dietary choices. The validated HPLC method used in this study proved reliable approach for sugar analysis, reinforcing its applicability in food and beverage research.

5. Reference

1. Sesta, G. (2006). Determination of sugars in royal jelly by HPLC. *Apidologie*, 37(1), 84–90.



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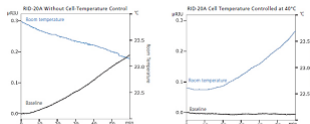
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