

NMR-based Phytochemical Profiling of Palmyra Palm Syrup Infused with Dry Ginger, Black Pepper, and Long Pepper

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Background

Trikatu, a vital ingredient in many Indian Ayurvedic drugs, is a consortium of three spices, *viz.* dry ginger, black pepper, and long pepper, known for its peculiar pungency. To convert Trikatu into a widely acceptable palatable form, we blended these three spices in a decoction form and added them to syrup prepared from palmyra palm neera, which resulted in ‘Trikatu Syrup’ (TS). Recently, we reported *in vivo* immunomodulatory properties of TS.

Introduction

The immunomodulatory effects of spices are attributed largely to the presence of certain phytochemicals. The importance of phytochemicals in spices as immunomodulatory agents necessitate a thorough investigation of these bioactives in formulations comprising spices. In the present study, we have focused on understanding the

retention of spice and syrup-based phytochemicals in the formulated product that assists in product standardization of TS.

Methods

NMR serves as a highly reliable tool for explicit structural confirmation of phytochemicals when compared to HPLC or mass spectrometry tools. NMR spectra of a phytochemical, whether in pure form or when the phytochemical is a part of the mixture, enable qualitative and quantitative studies with a mixture of phytochemicals in organic extracts of food matrices. Hence, the NMR spectral comparison of compounds isolated from the organic extracts of TS is described here.

Results

Fractionation of TS using Diaion[®] HP-20 resulted in the partitioning of compounds based on their polarity. Purification of the acetone fraction by column chromatography aided in the efficient isolation of compound **1** (pellitorine), compound **2** (piperine), compounds **3-5** (trienamides), and compound **6** (pipataline). Acetonitrile fraction yielded compound **7** (uridine) and compound **8** (3-*O*-methyl-*myo*-inositol), which were neither reported in the three spices nor palmyra palm. A qualitative display of the acetone fraction of TS with its phytochemicals **1-6** served as a fingerprint of TS.

Conclusion

In summary, TS, a palatable spice-based nutraceutical in palmyra palm syrup with immunomodulatory potential, was thoroughly investigated for the phytochemical composition of its organic fractions. The process of fractionating TS using Diaion[®] HP-20, subsequent flash purification, and column chromatography facilitated the isolation of prominent phytochemicals. We report the utility of NMR as a reliable and efficient tool for fingerprinting phytochemicals in formulations, nutraceuticals, *etc.*, which assists in ascertaining their authenticity.

Keywords: Palmyra palm, trikatu, nutraceutical, phytochemicals, NMR analysis, food applications.