

Simple and rapid determination of trans-10-hydroxy-2-decenoic acid in nutritional supplements containing royal jelly by high-performance liquid chromatography

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Abstract

A simple and rapid high-performance liquid chromatography (HPLC) method was developed for the analysis of trans-10-hydroxy-2-decenoic acid (10-HDA) in royal jelly (RJ) products. In sample preparation, 10-HDA in RJ was extracted with methanol, and supernatant obtained by centrifugation was used as HPLC test solution. The HPLC separation was achieved on a reversed-phase C18 column using an isocratic mobile phase of 0.6 % phosphoric acid–methanol (1:1, v/v) at a flow rate of 0.8 mL/min, followed by ultraviolet (UV) detection at 215 nm. The detector response for 10-HDA was linear ($r > 0.999$) in the concentration range 1–100 $\mu\text{g/mL}$. Spiked 10-HDA recovery for tablet, liquid drink and raw material were 93.0–110.4 %. The method was applied to 21 RJ commercial products. The concentration of 10-HDA was 0.2–45.8 mg/g, and the ratio of calculated RJ contents to labeled value was 58.1–94.6 %.

Keywords: trans-10-hydroxy-2-decenoic acid, royal jelly, nutritional supplements, high-performance liquid chromatography

I Introduction

Royal jelly (RJ) is the whitish cream, and secreted from the pharyngeal and mandibular glands of young worker honeybees¹⁾. RJ is well known to be a necessary food for the growth of queen honeybees, and has been used worldwide as nutritional supplements, medical products and cosmetics.

According to a current research, chemical composition analysis has shown that RJ consists mainly of sugars, vitamins, free amino acids, and fatty acid²⁾. The main fatty acid in RJ is trans-10-hydroxy-2-decenoic acid (10-HDA, Fig. 1). Recent research indicates that 10-HDA has various pharmacological effect, such as antitumor activity³⁾, antihyperglycemic effect⁴⁾ and antirheumatic activity⁵⁾. 10-HDA was also used as a chemical marker for RJ in commercial products⁶⁾.

Determination of 10-HDA in RJ has been reported previously, by high-performance liquid chromatography (HPLC)⁷⁻⁸⁾ and gas chromatography (GC)⁹⁾. However, sample preparation was cumbersome and complicated in these methods⁷⁻⁹⁾, for example, pH adjustment was necessary for the extraction step.

In this study, we investigated the extraction solvent to

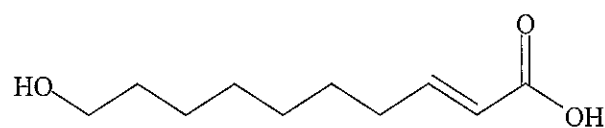


Fig. 1. Chemical structure of trans-10-hydroxy-2-decenoic acid (10-HDA)

obtain the test solution of 10-HDA in RJ by simplified sample preparation without pH adjustment. We have used reversed-phase-HPLC (RP-HPLC) with a photo-diode array (PDA) detector. Furthermore, the proposed method was applied to the estimation of RJ contents. In the nutritional supplements on the market, the quantitative results were compared to the label claims of the products.

II Materials and methods

1. Chemicals

All solvents were purchased from Wako Pure Chemical