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Short Communication

Bioavailability of Echinacea Ingredients: Pharmacokinetics of Caco-2 Monolayer and Alkyl Amide and Caffeic Acid Conjugates

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Abstract

We evaluated the potential bioavailability of alkylamides and caffeate conjugates in Caco-2 monolayer abuse and compared them to actual bioavailability in highly ongoing Phase I clinical trials. Caffeic acid conjugates are almost impervious to the Caco-2 monomolecular layer [1]. Alkylamides have been found to diffuse rapidly through the Caco-2 monolayer. Fluctuations in the diffusion rate of each alkyl amide are associated with structural variation, with saturation and N-terminal methylation contributing to the reduced diffusion rate. The results of artificial alkylamides were consistent with those found in related grade ethanol formulations of the genus Echinacea, as diffusion of alkylamides is not accompanied by the presence of alternative components [2].

PREFACE

Echinacea has been used for many years as a means of enhancing the function of the immune system, and many clinical studies have been conducted to evaluate its effectiveness as an immunomodulator [1-4]. There are two major difficulties in comparing these studies. First, the actual biologically available components have not been determined, and second, the phytochemical profile of Echinacea used in each study has not been reported. The compounds contained in Echinacea extract have three major groups that are thought to be responsible for immunomodulatory activity. Of these, due to their low solubility, polysaccharides are not found in high-ethanol Echinacea extracts. The traditional method of preparing herbs for therapeutic purposes and are therefore not relevant to this study [3]. After ingesting Echinacea tablets made from an ethanolic liquid extract, we studied plasma from healthy volunteers for 12 hours. Caffeic acid conjugates were not identified in any plasma sample after ingestion of tablets. Alkylamides were detected in plasma 20 minutes after ingestion of the tablets, establishing a pharmacokinetic profile for each alkyl amide. The data are consistent with a regimen of one tablet given three times daily, supporting its use as a primary marker for high quality Echinacea formulations.

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The main weakness of most in vitro studies investigating plant and biological activity is how much of a particular extract or compound actually enters the cells or body of the model under study. Therefore, it is essential to study the bioavailability of the various components of the Echinacea species. Most of the published studies focus on the bioavailability and pharmacokinetics of various alkamides and caffeic acid derivatives in human and cell culture models.

RESULTS AND DISCUSSION

Echinacea ethanol formulations contain both caffeic acid conjugates and alkylamides [5]. Herbal formulations are a complex mixture of many different compounds. The Echinacea formulation, which is a mixture of Echinacea angustifolia and Echinacea purpurea roots examined in

these two studies. Caffeic acid derivatives (caffeic acid, echinacoside, and sicoleic acid) are individually identified along with the alkyl amide moiety. Separation of specific alkyl amides from Echinacea mixture.

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