


# Soybean oil and coconut oil enhance the absorption of chlorogenic acid in humans

W. N. M. T. D. N. Weerakoon | N. V. P. Anjali | Nimanthi Jayathilaka |  
Kapila N. Seneviratne 

Department of Chemistry, Faculty of Science, University of Kelaniya, Kelaniya, Sri Lanka

## Correspondence

Kapila N. Seneviratne, Department of Chemistry, Faculty of Science, University of Kelaniya, Kelaniya, Sri Lanka.  
Email: kapilas@kln.ac.lk

## Funding information

University of Kelaniya, Grant/Award Number: RP/03/02/06/01/2017; Ministry of Higher Education and University Grants Commission, Sri Lanka, Grant/Award Number: AHEAD RIC; National Science Foundation Sri Lanka, Grant/Award Number: RG/2019/AG/02

## Abstract

The effect of a mainly polyunsaturated oil (soybean oil) and a mainly medium chain triglyceride oil (coconut oil) on the absorption of the phenolic antioxidant chlorogenic acid (5-caffeoylquinic acid) was investigated using 90 healthy volunteers. Serum concentrations and the absorbed percentages of chlorogenic acid of volunteers who received chlorogenic acid without oils ( $0.006 \pm 0.001$  mg/ml,  $5.7 \pm 0.2\%$ ), chlorogenic acid with soybean oil ( $0.012 \pm 0.001$  mg/ml,  $11.8 \pm 1.3\%$ ), and chlorogenic acid with coconut oil ( $0.067 \pm 0.014$  mg/ml,  $65.6 \pm 18.1\%$ ) were significantly different from each other ( $p < .05$ ). There was a strong positive correlation between the increase in serum and plasma antioxidant capacity and the absorption of chlorogenic acid. The major fatty acid of each of soybean oil and coconut oil also improved the permeability of chlorogenic acid in Caco-2 cell monolayers. The results suggest that the tested edible oils may improve the nutritional value of chlorogenic acid-containing foods by improving the absorption of chlorogenic acid.

## Practical applications

Small polar antioxidants such as phenolic acids and flavonoids are poorly absorbed through the intestinal epithelium. Chlorogenic acid was used in the present study as a model for small polar phenolic antioxidants. According to the present study, soybean oil with mainly polyunsaturated fatty acids and coconut oil with mainly medium chain fatty acids improve the absorption of these antioxidants. These findings suggest that proper planning of diets or food supplements containing phenolic antioxidants with medium chain or polyunsaturated fatty acid-rich edible oils may enhance the nutritional benefits expected from phenolic antioxidants.

## KEYWORDS

Caco-2 cells, chlorogenic acid, coconut oil, intestinal absorption, soybean oil

## 1 | INTRODUCTION

Chlorogenic acid is a phenolic antioxidant present in coffee beans, fruits, tea, and vegetables. Antioxidant, anti-inflammatory, antilipidemic, and antidiabetic activities of chlorogenic acid have been demonstrated using rat models treated with up to 50–60 mg/kg

body weight chlorogenic acid (Liang & Kitts, 2016; Meng et al., 2013). Chlorogenic acid also shows anticancer activity in different cell lines (Santana-Gálvez et al., 2017). Bioavailability of chlorogenic acid and other small polyphenolic compounds is strongly dependent on the efficiency of the absorption of such antioxidants. Absorption, distribution, metabolism, and excretion of chlorogenic acid in humans