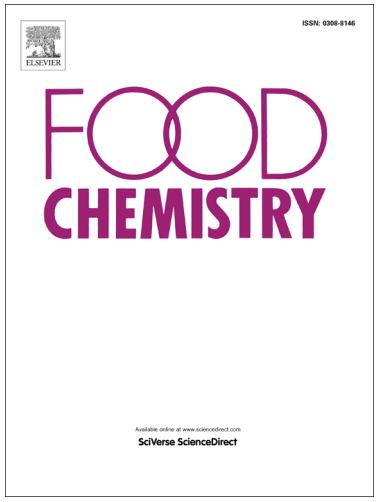

Studying the real-time interplay between triglyceride digestion and lipophilic micronutrient bioaccessibility using droplet microfluidics. 1 Lab on a chip method

Hoang Thanh Nguyen, Mélanie Marquis, Marc Anton, Sébastien Marze

PII: S0308-8146(18)31668-6
DOI: https://doi.org/10.1016/j.foodchem.2018.09.096
Reference: FOCH 23583

To appear in: *Food Chemistry*

Received Date: 4 July 2018
Revised Date: 10 September 2018
Accepted Date: 16 September 2018

Please cite this article as: Nguyen, H.T., Marquis, M., Anton, M., Marze, S., Studying the real-time interplay between triglyceride digestion and lipophilic micronutrient bioaccessibility using droplet microfluidics. 1 Lab on a chip method, *Food Chemistry* (2018), doi: https://doi.org/10.1016/j.foodchem.2018.09.096

Studying the real-time interplay between triglyceride digestion and lipophilic micronutrient bioaccessibility using droplet microfluidics. 1 Lab on a chip method

Hoang Thanh NGUYEN, Mélanie MARQUIS, Marc ANTON, Sébastien MARZE

Biopolymères Interactions Assemblages, INRA, 44300 Nantes, France

Abstract

This article is the first part of a series reporting on real-time digestion kinetics of triglyceride droplets containing different lipophilic micronutrients. This part focuses on the design, fabrication, and operation of a polydimethylsiloxane microfluidic device which enables the generation and digestion of oil droplets. The micro-channels were made hydrophilic to obtain oil droplets in an aqueous continuous phase. Optimized chip design and outlet control were implemented to provide efficient oil droplet generation, manipulation, and immobilization on a single chip. Highly monodisperse oil droplets were generated, immobilized in an array of traps and monitored in real time by fluorescence using a confocal microscopy method. The device was used to study the kinetics of beta-carotene release during tricaprylin digestion (intestinal lipolysis and micellar solubilization). The effect of the gastric phase on beta-carotene degradation was also investigated using the same method.

1. Introduction

Over the past decades, the development of technologies based on microfluidics has expanded in analysis and research domains (Huebner et al., 2009; Šalić, Tušek, & Zelić, 2012). Indeed, the use of micro-scale experimental devices involves small sample volumes with a high surface-volume ratio that allows reduction of costs and rapid kinetics study. In addition, the optical transmission of the materials commonly used in microfluidics (mostly polydimethylsiloxane (PDMS), poly(methyl methacrylate) (PMMA), and glass) provides high flexibility to use external light-based analysis techniques for real-time monitoring (Desai & Zaman, 2015; Heus et al., 2010; Mongersun, Smeenk, Pratx, Asuri, & Abbyad, 2016; Windbergs & Weitz, 2011). With the trend of further reducing the sample volume, droplet microfluidics was developed. In this technique, each droplet is used as an independent micro-reactor of pico- to nano- litre scale (Huebner et al., 2009; Huebner, Abell, Huck, Baroud, & Hollfelder, 2011; Mongersun et al., 2016). However, most of the studies are based