A mathematical model for investigation of intestinal changes on the postprandial bile acid profile

Published in:
Book of abstracts of BioSB 2016

Published: 01/01/2016

Document Version
Publisher’s PDF, also known as Version of Record (includes final page, issue and volume numbers)

Please check the document version of this publication:
• A submitted manuscript is the author's version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
• The final author version and the galley proof are versions of the publication after peer review.
• The final published version features the final layout of the paper including the volume, issue and page numbers.

Link to publication

Citation for published version (APA):

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

• Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
• You may not further distribute the material or use it for any profit-making activity or commercial gain
• You may freely distribute the URL identifying the publication in the public portal ?

Take down policy
If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.
A mathematical model for investigation of intestinal changes on the postprandial bile acid profile

F.L.P. Sips¹, H.M. Eggink², P.A.J Hilbers¹, M.R. Soeters², A.K. Groen³,⁴, N.A.W. van Riel¹,³
¹. Department of Biomedical Engineering, Eindhoven University of Technology, The Netherlands
². Department of Endocrinology and Metabolism, Academic Medical Centre, University of Amsterdam, The Netherlands
³. Amsterdam Diabetes Center, Department of Vascular Medicine, Academic Medical Centre, University of Amsterdam, The Netherlands
⁴. Departments of Pediatrics and Laboratory Medicine, University of Groningen, University Medical Center Groningen, The Netherlands

E-mail: f.l.p.sips@tue.nl, h.m.eggink@amc.uva.nl, p.a.j.hilbers@tue.nl, m.r.soeters@amc.uva.nl, a.k.groen@amc.uva.nl, n.a.w.v.riel@tue.nl

1. Introduction

Bile acids (BA) have surfaced as potential regulators of metabolic health. Although much is known about the elements that drive the enterohepatic circulation of BA, comprehensive understanding of BA dynamics in metabolic health and disease remains a challenge. Systemic understanding of BA metabolism is impeded by the complexity of BA metabolism and the difficulty in obtaining direct measurements of the main BA pools in the enterohepatic circulation. In order to investigate the dynamics of BA metabolism and the relationships between the sizes of the various pools of BA, we have developed a mathematical model of the enterohepatic circulation of BA.

2. Materials & Methods

The model is composed of a system of differential equations describing BA circulation as transportation between connected components. The model encompasses the complete enterohepatic and systemic circulation of BA. In particular, intestinal BA metabolism is included in detail (Fig 1). Intestinal transit is non-homogeneous, and is affected by a postprandial increase of transit which propels the intestinal contents forward.

3. Results

Results show the model reproduces main characteristics of the healthy postprandial BA response. The simulated postprandial response consists of two phases (Fig 2). First, the gastro-colic reflex causes an immediate rise of ileal BA concentrations, and thus, systemic BA concentrations. Following this initial response, the pool of BA released by the gallbladder after the meal arrives in the ileum, causing a secondary peak.

4. Discussion

The model has applications in elucidating effects of dietary or genetic perturbations on BA kinetics. As the model includes a more detailed description of intestinal transit than previously published models of BA circulation [1], it is particularly suited to investigate BA metabolism after changes of the gastrointestinal system, such as the increase of peripheral BA seen following Roux-en-Y Gastric Bypass.

5. References