In vivo kinetic study of the materno-fetal fatty acid transfer in obese and normal weight pregnant women

Antonio Gázquez\textsuperscript{1,2}, María T. Prieto-Sánchez\textsuperscript{3}, José E. Blanco-Carnero\textsuperscript{3}, Dewi van Harskamp\textsuperscript{4}, Simone Perazzolo\textsuperscript{5,6}, J. Efraim Oosterink\textsuperscript{4}, Hans Demmelmair\textsuperscript{2}, Henk Schierbeek\textsuperscript{4}, Bram G. Sengers\textsuperscript{5,6}, Rohan M. Lewis\textsuperscript{6,7}, Johannes B. van Goudoever\textsuperscript{4,8}, Berthold Koletzko\textsuperscript{2} and Elvira Larqué\textsuperscript{1}

\textsuperscript{1}Department of Physiology, School of Biology, Biomedical Research Institute of Murcia (IMIB-Arrixaca-UMU), University of Murcia, Murcia, Spain,
\textsuperscript{2}LMU - Ludwig-Maximilians-Universität Munich, Division of Metabolic and Nutritional Medicine, Dr. von Hauner Children’s Hospital, Munich, Germany,
\textsuperscript{3}Obstetrics and Gynecology Service, Biomedical Research Institute of Murcia (IMIB-Arrixaca-UMU), University Clinical Hospital “Virgen de la Arrixaca”, University of Murcia, Murcia, Spain,
\textsuperscript{4}Department of Paediatrics, Emma Children’s Hospital, Academic Medical Center, Amsterdam, Netherlands,
\textsuperscript{5}Bioengineering Science Research Group, Faculty of Engineering and the Environment, University of Southampton, Southampton, United Kingdom,
\textsuperscript{6}Institute for Life Sciences, University of Southampton, Southampton, United Kingdom,
\textsuperscript{7}University of Southampton, Faculty of Medicine, Southampton, United Kingdom and
\textsuperscript{8}Department of Paediatrics, Free University of Amsterdam, Amsterdam, Netherlands

Abstract

Introduction: Placental function can be modified by maternal obesity affecting the materno-fetal fatty acid transport process. We analyze for the first time the in vivo materno-fetal kinetic transfer of fatty acids (FA) labeled with stable isotopes in control and obese pregnant women.

Materials and Methods: Labelled FA with similar metabolism (stearic acid: \textsuperscript{13}C-SA, palmitic acid: \textsuperscript{13}C-PA and oleic acid: \textsuperscript{13}C-OA) were orally administered at -4 h, -8 h, and -12 h, respectively prior to elective caesarean section to 10 pregnant women with a body mass index (BMI) > 30 and 10 with BMI 25–30 (control). Placenta, venous and arterial cord blood were collected obtaining a wide range of FA enrichments. A combined experimental and computational modeling analysis was applied.

Results: FA Fractional synthesis rate (FSR) in placenta was 11–12\% per hour. No differences were observed between control and normo-lipidemic obese pregnant women. It was not possible to estimate FA FSR in cord blood with this oral bolus dose approach. Computational modelling demonstrated a good fit to the data when all maternal plasma lipid classes were included but not with modelling based only on the non-esterified FA fraction (NEFA). The estimated materno-fetal \textsuperscript{13}C-FA transfer was around 1\%.

Conclusions: Our approach using multiple \textsuperscript{13}C-FA tracers allowed us to estimated FSR in placental/maternal plasma but not in fetal/maternal compartments. Computational modelling showed a consistent time course of placental \textsuperscript{13}C-FA transfer and predicted total fetal FA accumulation during the experiment. We conclude that in addition to NEFA in the maternal circulation, maternal plasma VLDL and other lipoproteins are important contributors to placental FA transfer to the fetus.

Conflict of Interest

There is no conflict of interest