OPUS 28

Analysis of the transmission of overweight/obesity in the mother-breastmilk-child triad in relation to maternal cardiometabolic status and diet

Overweight and obesity rates are growing at alarming rates, creating a global public health crisis. Maternal excessive body mass increases the risk of childhood obesity, which often leads to adult obesity. Breastfeeding can reduce obesity risks for both mother and child, but mothers with excessive body weight frequently face challenges, including difficulties in breastfeeding initiation, continuation, and altered breastmilk composition compared to mothers with normal body weight. However, the exact changes in breastmilk composition caused by maternal overweight or obesity, the mechanisms behind these changes, and their impacts on infant growth and metabolic health remain poorly understood. This is mainly due to a lack of comprehensive studies, small sample sizes, and limited approaches to analyzing breastmilk as a biological system.

The main objective of this project is to explore how maternal overweight/obesity influences breastmilk composition, infant anthropometric development, and metabolic outcomes, considering the role of maternal diet and cardiometabolic status. The proposed research will allow for a comprehensive assessment of:

- maternal dietary habits, including intake of crucial nutrients, dietary patterns, and maternal nutritional status of selected nutrients which breastmilk levels are diet-dependent (fatty acids, vitamins A, E, D, carotenoids, choline);
- cardiometabolic status, including low-grade inflammation, glucose metabolism, insulin sensitivity/resistance, lipid profile, oxidative stress, adipokine levels, metabolomics;
- breastmilk composition as a complex biological system, evaluating energy, macronutrients, glucose, fatty acids, vitamins A E, carotenoids, adipokines, lipidomic profile, inflammatory biomarkers, and immunological properties;
- Infant development, including growth trajectories, adiposity, carotenoid status, oxidative stress level, and urine metabolomics.

This allows us to understand how breastmilk influences the transmission of overweight and obesity risk and shapes metabolic health within the mother-breastmilk-infant triad. This approach will allow us to identify mechanisms by which maternal overweight/obesity affects breastmilk composition and determine whether maternal diet can mitigate or worsen these effects of excessive body mass on breastmilk composition..

The study will involve 150 mother-infant pairs, categorized into three groups based on maternal body mass index (BMI): normal weight (BMI 18.5 - 24.9 kg/m2), overweight (BMI 25.0 - 29.9 kg/m2), and obese (BMI ≥30 kg/m2). These pairs will be monitored from the first to the sixth month postpartum, with visits at 1, 3, and 6 months postpartum. We will collect data using gold standard and novel analytical methods, including non-invasive DXA scans, as well as metabolomic and lipidomic analyses. We will then analyse the collected data using standard and novel statistical techniques, e.g. k-mean, moderated mediation analysis, and discriminant analysis (OPLS-DA).

The project results will allow for the first time to understand of the metabolic pathways of obesity transmission across the mother-breastmilk-infant triad. It addresses critical gaps in the worldwide literature on metabolic/nutritional programming and the Developmental Origins of Health and Disease (DOHaD) hypotheses. Our project's interdisciplinary and complex nature will allow us to identify and understand the role of modifiable maternal factors like diet and cardiometabolic status in shaping breastmilk composition and infant outcomes in mothers with excessive body mass. These findings will provide the basis for tailored, evidence-based interventions, thereby breaking the cycle of intergenerational obesity. In the longer term, this will reduce the global health burden of overweight and obesity. This will have multiple health, societal, and economic benefits and reduce the public health burden of overweight and obesity.

In addition, this project will support the implementation of the World Health Organization's 2025 Global Nutrition Targets (for children under 5) and one of the Targets for Noncommunicable Disease reduction for adolescents and adults.