Early life nutrition and the Microbiome

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APC Research Themes

RESEARCH THEMES

ONE
Microbes to Molecules

TWO
Diet & Microbes at the Extremes of Life

THREE
Brain- Gut Axis

FOUR
Host-Microbe Dialogue

http://apc.ucc.ie
Theme 1. Microbes to Molecules

- Identify and characterise the mode of action of **selected probiotics**
- Develop **prebiotics** with high selectivity for bifidobacteria
Theme 2. Extremes of Life

• Determine mechanistic links between diet, microbiota and health status
• Manipulate microbiota composition and function in selected populations; infancy & elderly
• Identify new microbiota-related biomarkers predictive of health status
• Develop new food ingredients for infants and elderly
• Define the composition and functional performance of the baseline microbiota in developing infants (0-2yrs)
• C-section v Natural delivery v Pre-term
• Breast-fed v Formula fed

• Ultimate aim: Programme the early infant gut microbiota in a manner closer to mother’s milk
Optimal Pregnancy & Health Outcomes

• Appropriate weight gain
• Absence of gestational diabetes
• Vaginal delivery
• Full-term and healthy infant birth weight
• Reduced hospital stay
• Initiation and continuation of breastfeeding
• Influence cognitive development, asthma, diabetes, gut-illnesses (reflux) & obesity
Many questions remaining, e.g.

• What exactly is a healthy infant microbiota?
  – Genus, species, strain-specific
  – Based on fecal samples

• Mother-to-infant microbiota transfer?
  – Placenta, birth canal, breast milk, skin, siblings

• Mode of action?
  – NEC, ectopic diseases (short/long term)

• Effect of (timing of) weaning (or when to stop breast feeding)?

• What is best nutrition for weaning?
Opportunities & Challenges

• Dietary guidelines & education for mothers
• Develop evidence-based infant nutrition to support early life development and healthy ageing
• Innovative products targeting expectant mothers
• Contribute to sustainable healthcare systems
• Unravelling the role of the microbiome in early life development (mode of action)
• End-user engagement & acceptance
• Breast milk samples/biobank
• Regulation & policy (data & new products)
JPI: Healthy Diet for a Healthy Life

EarlyMicroHealth → TOOLS

APPROACH

Microbiomics
- UP, UCM, WU, CSIC, ZU
- UP, UCC
- WU, ZU

Phageomics
- UP, UCC
- WU

Metatranscriptomics
- WU

Metaproteomics
- UCM, CSIC

Metabolomics
- UP, UCC, CSIC

Resistomics
- UP, UCC, UCM, WU

Culturomics

Recruitment
- Newborns and mothers: 1 week, 1, 2, 3 and 6 months, 1, 2, 3 years + follow-up

- Questionnaire (Basic and health data)
- Fecal sample (DNA/RNA extraction, culture, metabolites)
- Breast-Milk sample (DNA/RNA extraction, culture, Metabolites)

Longitudinal Cohort study
- Effect of early diet (including nutrition and antibiotics) upon microbiota establishment and health

Dietary Intervention study
- Effect on minimizing impact on microbiota homeostasis

Nutritional assessment
- Monitoring of energy/macro/micronutrients intake, impact of weaning protocol and later diet on microbiome

Data integration, maintenance and updating of accessible database
- CSIC, UCM, WU
- UCM, CSIC, WU
- UP, CSIC, UCM, WU

Basic knowledge (framework)

Improved early nutrition/habits
Bacteriophages and the infant microbiota

• Analyse impact of phages on infant microbiota
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