EARLYNUTRITION
Long-term effects of early nutrition on later health

EARLY NUTRITION ACADEMY

THE POWER OF PROGRAMMING 2016

International Conference on Developmental Origins of Adiposity and Long-Term Health

October 13 - 15, 2016 Munich, Germany

PROGRAMME AND ABSTRACTS

In collaboration with

ESPGHAN · DOHaD · UNITED EUROPEAN GASTROENTEROLOGY ueg · EFCNI · DEUTSCHE GESELLSCHAFT FÜR KINDER- UND JUGENDMEDIZIN e.V.

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- Nutrition and Lifestyle during Pregnancy
- Breastfeeding
- Infant Formula Feeding
- Complementary Feeding in Infancy

FOCUS MODULES

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- Epigenetics

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THE POWER OF PROGRAMMING

International Conference on Developmental Origins of Adiposity and Long-term Health

Campus of the University Hospital, Munich-Großhadern
http://munich2016.project-earlynutrition.eu/

Munich, Germany
13th - 15th October, 2016

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Welcome to Munich and to "The Power of Programming 2016 - International Conference on Developmental Origins of Adiposity and Long-Term Health"

On behalf of the Early Nutrition Project Consortium, the Scientific Committee and the Local Organizing Committee, I am delighted to welcome you to this international conference. Strong evidence has accumulated to show that environmental cues, including nutrition before and during pregnancy and in early childhood, have important long-term effects on development, performance and other health outcomes including obesity and associated disorders. Epidemiological observations are increasingly supported by experimental studies exploring biological mechanisms, as well as by prospective intervention trials providing indisputable evidence for causality in humans. The scientific understanding of such programming effects of early nutrition are of major importance with regards to biomedical research, public health and well-being of people, the practice of nutrition and health care, the economy and wealth of societies, and policy decisions. It is therefore both timely and pertinent to review the state of the art, new results and future perspectives in the area of programming research and its applications. In a multidisciplinary approach, outstanding leaders in the fields of developmental origins, biological and clinical sciences, nutrition, epidemiology, epigenomics, metabolomics and more present the latest knowledge in their fields. Abstract presentations provide most recent findings. Further exciting features of the programme are a dedicated "New Investigators Forum" to foster skills and the personal development of emerging researchers of excellence and a Guided Poster Tour. We trust there will be unique opportunities for trans-disciplinary and global research interactions and the development of further, refined study approaches, and for preparing steps towards translational application into policy and practice. Thereby, we hope that this meeting will contribute to achieving better health outcomes for future generations.

We are most grateful indeed that this meeting was made possible with financial support by the General Directorate Research of the European Commission as part of the European Early Nutrition Research Project (www.project-earlynutrition.eu), and by the German Research Council (Deutsche Forschungsgemeinschaft) as well as further sponsors and the help of the Ludwig Maximilians University (LMU) of Munich. I also wish to thank the very strong and dedicated team here at the LMU Children's Hospital that has worked extremely hard to make the conference happen.

Munich, with its Bavarian charm, the splendid panorama of the Alps, and the many attractions of the city and its surroundings will provide an excellent platform for delegates to share experiences, critically discuss latest findings and develop collaborative approaches for the improvement of early nutrition.

We hope you enjoy the Conference and benefit from it, and we wish you a very pleasant stay in Munich!

Berthold Koletzko

Meeting President, EarlyNutrition Coordinator and ENA Managing Director

Brigitte Brands

Scientific Director and Scientific Project Manager EarlyNutrition

Simone Cramer

Conference Secretary and Administrative Manager EarlyNutrition

Welcome from Razvan Anistoroaei,

Unit Agri-Food Chain, DG Research and Innovation, European Commission

Our society is confronting a time of many rapid changes and challenges and we have the responsibility to meet and address them in real time with tact and consideration. This nevertheless requires strong investment in research and innovation, needed to address pressing societal challenges such as climate change, ageing population, obesity epidemics or the move towards a resource efficient society. Such investments offer direct stimuli to the economy but are also vital to securing an excellent knowledge base and a competitive industry. It is the only way for Europe to remain competitive in a globalised world, drive economic growth, provide solutions, create jobs and sustain high standards of wellbeing.

Horizon 2020, which is the biggest EU Research and Innovation programme ever with more than €80 billion of funding covering the period (2014-2020), promises breakthroughs, discoveries and world-firsts by taking great ideas from the lab to the market. Horizon 2020 is the financial instrument to implement the Innovation Union, one of policy priorities of the Europe 2020 strategy. The goal is to ensure Europe produces world-class science, removes barriers to innovation and makes it easier for the public and private sectors to work together in delivering innovation.

As part of a Sustainable Food Security strategy, a new initiative - FOOD 2030 – is being launched in order to shape the research and innovation priorities for: reducing hunger & malnutrition; addressing food safety and diet-related illnesses; helping citizens adopt sustainable diets and healthy lives; building a climate and global change-resilient primary production system; implementing sustainability and circular economy principles across the whole food system; boosting market share via innovation and investment; and empowering communities. The "Power of Programming 2016" conference will present the latest results of the highly ambitious and successful FP7 EU project EARLY NUTRITION (Long term effects of early nutrition on later health), a project which is now in its most productive phase and which is expected to generate new knowledge and insights regarding maternal health and infant well-being related to feeding and lifestyle that will have impacts on policy, commercial activities and social norms.

This event provides the ideal platform for a critical review of current knowledge in the field of early nutrition, and offers the opportunity to help identify future research needs.
I wish you all a successful conference and fruitful discussions.

Razvan Anistoroaei

Unit Agri-Food Chain
Directorate General for Research & Innovation
European Commission

Welcome from Bernd Sibler

State Secretary at the Bavarian State Ministry of Education, Science and the Arts

Overweight and obesity are among the most severe health risks in the Western world. They significantly increase the likelihood of cardiovascular diseases, diabetes and cancer and have doubled in frequency over the last 30 years. Around half of all adults in Germany are affected. This trend is alarming. Once affected it is very hard for adults to reduce overweight and the risks for associated diseases. That is why effective prevention is one of the core elements of Bavarian health policy.

We know that pregnancy and infancy are crucial periods for humans in which many predispositions are fixed for the whole life. There is evidence that in this context the likelihood of developing obesity or overweight later in life can be strongly influenced by nutrition during infancy and early childhood. Coordinated by Prof. Koletzko of the Ludwig-Maximilians-University of Munich, "Early Nutrition" is the world leading project in investigating the scientific basis of these programming effects of early nutrition and lifestyle. Without doubt this approach promises to be the most effective and powerful way to prevent overweight and associated diseases as it aims to cut the roots of this health risk. This is why the work of this project is so precious and so highly appreciated.

As Bavarian State Secretary for Science I am delighted that scientists from all over the world have come to the Bavarian capital of Munich to discuss their findings and to exchange their latest results. I am sure that this conference will essentially contribute to effective obesity prevention and a healthier society in the future. With this in mind, I wish all of the conference participants much joy, new ideas and every success for their ongoing work as well as a good time here in Munich.

Munich, August 2016

Bernd Sibler

State Secretary at the
Bavarian State Ministry of Education, Science and the Arts

Welcome from Prof. Dr. Dr. h.c. Martin Wirsing

Vice President of Ludwig-Maximilians-Universität München

It is a great pleasure for me to welcome you at Ludwig-Maximilians-Universität München for the international conference on "The Power of Programming 2016". As one of the leading research intensive universities in Europe with a more than 500-year-long tradition, it is LMU's mission to combine excellent research with outstanding teaching, to conduct basic research and tackle the grand societal challenges of our time. Therefore research of LMU's medical faculty has one of its main focuses on the treatment and prevention of common diseases.

As one of the big third-party funded projects coordinated by the LMU, "EarlyNutrition" addresses such a serious health concern: the increase of overweight children worldwide. I am very pleased that this project will be complemented by a novel Erasmus Plus project supporting the Early Nutrition eAcademy (ENeA).

During this conference over ninety renowned speakers will present their most recent research results and discuss manifold aspects of this topic. Personal contacts which result from participating at this conference are very important for mutually beneficial exchanges on questions of scientific and clinical relevance, and the conference program offers many opportunities to deepen discussions in a stimulating environment.

LMU is pleased to host this international conference for the third time, after the great successes of the first two meetings which both were joined by more than 500 participants. I wish all participants a successful conference with a fruitful exchange of ideas and many occasions for networking with your colleagues. Enjoy your stay in Munich.

Prof. Dr. Dr. h.c. Martin Wirsing

Vice President of LMU München

Meeting Organiser

Project EarlyNutrition and the Early Nutrition Academy (ENA)

in collaboration with the:
Developmental Origins of Health and Disease Society (DOHaD)
European Society for Paediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN)
United European Gastroenterology (UEG)
European Foundation for the Care of Newborn Infants (EFCNI)
German Society of Pediatrics and Adolescent Medicine (DGKJ)

Meeting President

Berthold Koletzko

Professor of Pediatrics
EarlyNutrition coordinator and ENA Managing Director
Ludwig-Maximilians-University of Munich, Germany

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Scientific Information

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Thursday, 13th October 2016

10.00 – 10.45

Lecture Hall VI: live

Lecture Halls IV+V: live stream

Opening Session: Welcome Notes and Introduction

Bernd Sibler *(State Secretary, Bavarian State Ministry of Education, Sciences and the Arts)*

"Horizon2020: Research opportunities for safe and healthy diets" – **Razvan Anistoroaei** *(DG Research and Innovation, European Commission)*

Berthold Koletzko *(EarlyNutrition Co-ordinator, Ludwig-Maximilians-University of Munich)*

10.45 – 11.30

Lecture Hall VI: live

Lecture Halls IV+V: live stream

Plenary Session I: *Chair* Wendy Oddy *(Perth, Australia)*

The Importance of Investing in Early Nutrition – Gabriella Conti *(London, UK)*

11.30 – 11.50

Coffee and Tea Break

11.50 – 13.25

A.1: Lecture Hall VI

B.1: Lecture Hall V

C.1: Lecture Hall IV

A.1 Parallel Session

Pregnancy and Programming of Obesity and Related Disorders

Hosts/Chairs: Keith Godfrey & Susana da Silva Santos

- The Role of Epigenetic Processes in the Developmental Programming of Obesity
  – *Karen Lillycrop (Southampton, UK)*
- Maternal Body Mass Index, Gestational Weight Gain and Risks of Adverse Pregnancy Outcomes: Individual Participant Data Meta-Analysis of 230,000 Singleton Births
  – *S. Santos (Rotterdam, Netherlands)*
- Obesity, Related Metabolic Conditions and DNA Methylation – What Can Genome Wide DNA Methylation Studies in Cohort Studies Show Us?
  – *Rae-Chi Huang (Perth, Australia)*
- Effectiveness of a Normative Nutrition Intervention on Maternal Nutrition and Offspring Growth: The Chilean Maternal and Infant Nutrition Cohort Study (CHiMINCs)
  – *M.L. Garmendia (Santiago, Chile)*
- Maternal Obesity, the Gut Microbiome, and Long-Term Disease Risk
  – *Debbie Sloboda (Hamilton, Canada)*

B.1 Parallel Session

Breastfeeding and Later Health

Hosts/Chairs: Luisa Mearin & Maria Grunewald

- Breast Milk Components and Infant Growth
  – *Maria Grunewald (Munich, Germany)*
- Milk Cholesterol Concentration in Mice Is Resistant to Genetic and Dietary Hypercholesterolemia
  – *M.A.M. Lohuis (Groningen, Netherlands)*
- Breastfeeding and Celiac Disease, Allergy and Type 1 Diabetes
  – *Luisa Mearin (Leiden, The Netherlands)*
- Breastfeeding Status and Timing of Solid Food Introduction: The Risk of Adiposity in 6 Month Old Infants of Obese Mothers
  – *J. Engler (London, UK)*
- Persistent Environmental Toxicant and Nutrient Content in Human Breast Milk and Infant Growth
  – *Rachel Criswell (Oslo, Norway)*

C.1 Parallel Session

Programming of NCDs in Preterm Infants

Hosts/Chairs: Darek Gruszfeld & Marita de Waard

- Programming of NCDs in Preterm Infants – Focus on Growth
  – *Ken Ong (Cambridge, UK)*
- Growth and Body Composition in Extremely Preterm Infants Is Altered Early
  – *N. Altheyab (Queensland, Australia)*
- Programming of NCDs in Preterm Infants by Early Nutrition
  – *Alexandre Lapillonne (Paris, France)*
- Body Composition in Preterm Infants: Comparison of Air Displacement Plethysmography and Dual-Xray Absorptiometry
  – *C. Fusch (Hamilton, Canada)*
- Glucocorticoid-Programming in Very Preterm Birth
  – *Martijn Finken (Amsterdam, The Netherlands)*

Thursday, 13th October 2016 (continued)

13.25 – 15.15	**Lunch Buffet** **+ Poster Viewing**	**13.45 – 14.45** **Industry-sponsored Symposium** *- Lecture Hall IV -*	**13.45 – 15.15** **Lancet Symposium: Preconception and Maternal Obesity** • Preconception and Maternal Obesity: Implications for Pregnancy Outcomes – *Lucilla Poston (London, UK)* • Effects of Maternal Obesity on the Next Generation – *Keith Godfrey (Southampton, UK)* • Interventions to Prevent Preconception and Maternal Obesity – Mark Hanson *(Southampton, UK)* *- Lecture Hall V -*	**13.45 – 15.15** **ISRHML Symposium: Programming Potential of Breastfeeding** • Interindividual Variation of Allergen Transfer into Human Milk – *Frauke Schocker (Borstel, Germany)* • Perinatal Factors Influencing the Breast Milk Microbiota and Bioactive Compounds Composition and their Role for Infant Health – *Maria Collado (Valencia, Spain)* • Breastfeeding Effects on Neuroimaging – *Sean Deoni (Providence, USA)* *- Lecture Hall VI -*
15.30 – 16.15 Lecture Hall VI: live Lecture Halls IV+V: live stream	**Plenary Session II:** *Chair* Darek Gruszfeld **Complementary Feeding: An Opportunity for Programming Later Health?** – Mary Fewtrell *(London, UK)*			
16.15 – 16.45	***Coffee and Tea Break***			
16.45 – 18.20 **A.2:** Lecture Hall VI **B.2:** Lecture Hall V **C.2:** Lecture Hall IV	**A.2 Parallel Session** **Interventions to Prevent Adverse Fetal Programming** *Hosts/Chairs: Jodie Dodd & Lucilla Poston* • Antenatal Interventions to Improve Maternal and Infant Outcome – Results from the ROLO Study – *Fionnuala McAulliffe (Dublin, Ireland)* • Effect of a Dietary and Exercise Intervention during Pregnancy and Lactation on White Adipose Tissue Gene Profiles and Adiposity with Maternal Obesity – *I. Bloor (Nottingham, UK)* • The UPBEAT Trial; Obesity in Pregnancy and Developmental Programming – *Lucilla Poston (London, UK)* • Perinatal Taurine Supplementation Improves Renal Endothelial Dysfunction in the Offspring of Diabetic Rats – N. Somparn *(Pathumtani, Thailand)* • The LIMIT Randomised Trial – Longer-Term Effects on Maternal and Child Health – *Jodie Dodd (Adelaide, Australia)*	**B.2 Parallel Session** **GDM – Early Diagnosis of Women at Risk** *Hosts/Chairs: Mireille van Poppel & Sara White* • Studying Fetal Programming in South Asian Populations: The GIFTS Study – *Sarah Finer (London, UK)* • Maternal Dietary Protein Intake and the Risk for Gestational Diabetes Mellitus in a Multi-Ethnic Asian Cohort: The GUSTO Study – *W. W. Pang (Singapore, Singapore)* • GDM: Early Identification of Obese Women at Risk – *Sara White (London, UK)* • Longitudinal Assessment of Maternal Anthropometric Measurements in Obese Pregnant Women: Association with Gestational Diabetes Mellitus (GDM) and Treatment – *T. Serafimova (London, UK)* • Women with Early Diagnosed GDM in DALI: Characteristics and Outcomes – *Mireille van Poppel (Graz, Austria)*	**C.2 Parallel Session** **Metabolomics and Obesity in Humans** *Hosts/Chairs: Christian Hellmuth & Nashita Patel* • Opportunities of Metabolomic Studies in the Context of Early Programming – *Christian Hellmuth (Munich, Germany)* • Metabolomic Profiling Identifies a Signature of Gestational Diabetes Mellitus Associated with Diet, in a Multi-Ethnic Asian Cohort – *J. de Seymour (Auckland, New Zealand)* • Cord Blood Metabolomics and Weight Development Later in Life: Methods and Results from the GINIplus and LISAplus Studies – *Marie Standl (Munich, Germany)* • Transgenerational Metabolomics Reveal Significant Correlations among Mother-Child Pairs – *A. Kindt (Neuherberg, Germany)* • Analysis of Metabolic Profiles in Adolescents from the RAINE Cohort by Clinical Targeted Metabolomics: Metabolic Consequences of Early Programming – *Sebastian Rauschert (Perth, Australia)*
18.30	**Welcome Reception – following Program conclusion – Speaker's Dinner (19.30)**			

Friday, 14th October 2016

08.20 – 09.25	**Workshop (WS1): New Investigators Forum** *Hosts: Manja Fleddermann & Maite Seguro* • Evidence/Thoughts to Become a Good Researcher. A View from a University Professor's Perspective *– Lucilla Poston (London, UK)* • Learn from Other CV's. What are Essential Steps/Key Points for an Interesting CV? *– Hans van Goudoever (Amsterdam, The Netherlands)* • How the Society Can Benefit from University/Industry Collaboration *– Ricardo Rueda (Granada, Spain)* • What is important, if a YI applies for a position? A view from the industry *– Eline van der Beek (Utrecht, The Netherlands)* - Lecture Hall VI -	**Workshop (WS2): Methodological Aspects of Measuring Adiposity and Body Composition** *Hosts: Veronica Luque & Martina Weber* • Assessment of Neonatal Body Composition Using Anthropometry *– Sarah Kehoe (Southampton, UK)* • Using Bioelectrical Impedance and Leptin Levels to Predict Body Composition Leptin in Children *– Veronica Luque (London, UK)* • Linking Body Fat to Disease Risk *– Manfred James Mueller (Kiel, Germany)* - Lecture Hall V -	**Workshop (WS3): CME in Pregnancy – An e-Learning Live Course by the Early Nutrition eAcademy** *Hosts: Brigitte Brands & Simone Cramer* - Lecture Hall IV -
09.30 – 10.15 Lecture Hall VI: live Lecture Halls IV+V: live stream	**Plenary Session III:** *Chair* Matt Gillman **What is Normal Pre- and Postnatal Growth** – Michelle Lampl (Atlanta, USA)		
10.15 – 10.45	***Coffee and Tea Break***		
10.45 – 12.20 **A.3:** Lecture Hall VI **B.3:** Lecture Hall V **C.3:** Lecture Hall IV	**A.3 Parallel Session** **Postnatal Nutrition** *Hosts/Chairs: Wendy Oddy & Franca Kirchberg* • Infant Nutrition and Its Effect on the Metabolome *– Franca Kirchberg (Munich, Germany)* • Early High Protein Intake and Later Metabolic Health *– F. Budin-blancher (Lausanne, Switzerland)* • A Global Perspective on the Importance of Dietary ARA and DHA Intakes from Birth to Age 3 Years *– Stewart Forsyth (Dundee, Scotland)* • Infant Feeding and Growth Trajectories in Childhood and Body Composition in Young Adulthood *– W.H. Oddy (Hobart, Australia)* • Allergy Prevention by Early Nutrition: 15 years of Follow Up in the GINI Study *– Sibylle Koletzko (Munich, Germany)*	**B.3 Parallel Session** **Psychosocial Stress, Mental Health and Biological Impact** *Hosts/Chairs: Sonja Entringer & Karen Lindsay* • Interaction of Prenatal Psychosocial Stress and Nutrition: Implications for Maternal and Infant Metabolic Outcomes *– Karen Lindsay (Dublin, Ireland)* • Brainstem Oxidative Stress Is Associated with Hypertension and Elevated Cardiovascular Responses to Psychological Stress Following Maternal High Fat-High Sucrose diet *– S. K. Jayaratne (Sydney, Australia)* • Prenatal Stress and Fetal Programming of Obesity Risk: Association of Maternal Cortisol during Gestation with Infant Body Composition *– Pathik Wadhwa (Irvine, USA)* • Microglia Activation Precedes Sympathetic-Mediated Hypertension in Offspring of Obese Mice Dams *– A.-M Samuelsson (London, UK)*	**C.3 Parallel Session** **Placental Nutrient Transfer** *Hosts/Chairs: Gernot Desoye & Ian Bloor* • Maternal Gestational Diabetes Mellitus and Placental Lipids *– Olaf Uhl (Munich, Germany)* • Programming of the Endocrine Pancreas: Does Intra-Amniotic IGF1 Therapy Following Placental Restriction in Sheep Improve Insulin Secretory Capacity in Young Adulthood? *– E.J. Buckels (Auckland, New Zealand)* • Maternal Dietary Fats and Neonatal Outcome *– Mike Symonds (Nottingham, UK)* • Placental Expression of Fatty Acid Transporter Related to Maternal Pre-Pregnancy Weight *– M. T. Segura (Granada, Spain)*

Friday, 14th October 2016 (continued)

		• Newborn Insula Gray Matter Volume is Prospectively Associated with Early Life Adiposity Gain *– Claudia Buss (Berlin, Germany)*	• Placental Lipids and Fatty Acid Transfer in Maternal Overnutrition *– Gernot Desoye (Graz, Austria)*
12.20 – 14.15	***Lunch Break + Poster Viewing***	**13.15 – 14.15** **Guided Poster Tour** (max 10 posters, max. 5 min per poster) I - Clinical Trials II - Observational Studies III - Mechanisms (cell/animal studies) IV - Economic and/or Public Health Impact/ Consumer Attitudes, Recommendations, Systematic Reviews	**12.45 – 14.15** **DOHaD Society Annual Business Meeting (AGM):** **Closed meeting** - Lecture Hall IV -
14.30 – 16.05 **A.4:** Lecture Hall VI **B.4:** Lecture Hall V **C.4:** Lecture Hall IV	**A.4 Parallel Session** **Early Life Gut Microbiome and Long-Term Health** *Hosts/Chairs: Eline van der Beek & Merete Eggesbo* • Determinants and Duration of Impact of Early Gut Bacterial Colonization *– Christine Edwards (Glasgow, UK)* • Pediatric Obesity Is Associated with Altered Gut Microbiota Communities *– A. Riva (Milano, Italy)* • Dysbiosis in Health and Disease – the Microbiome at Early Life Stages *– Dirk Haller (Munich, Germany)* • Maternal Exposure to a Western-Style Diet Causes Differences in Intestinal Microbiota Composition and Gene Expression of Suckling Mouse Pups *– B.J.M. van de Heijning (Utrecht, Netherlands)* • Intestinal Microbiology of Early Life *– Jan Knol (Wageningen, The Netherlands)*	**B.4 Parallel Session** **Early Nutrition in Low Resource Settings** *Hosts/Chairs: Mark Hanson & Ying Huang* • How to Do Interventions in Early Nutrition with Your Bare Hands: An Example in Guatemala *– Michele Monroy Valle (Guatemala City, Guatemala)* • Pica Practices, Food Cravings and Aversions among Pregnant Women in Kenya *– L. Kariuki (Hohenheim, Germany)* • The Triple Burden of Malnutrition in Sub-Saharan Africa: Translating Knowledge into Action *– Reginald Annan (London, UK)* • The Influence of Socioeconomic Status on Gestational Weight Gain: A Systematic Review *– E. O'Brien (Dublin, Ireland)* • Early Life Nutritional Programming of Health and Disease in The Gambia *– Sophie Moore (Cambridge, UK)*	**C.4 Parallel Session** **Early Programming of Taste and Appetite** *Hosts/Chairs: Elvira Verduci & Natalia Ferre* • Development of Food Preferences and Appetite in the First Years *– Sophie Nicklaus (Dijon, France)* • Age at Introduction of Solid Foods and Feeding Difficulties in Childhood: Findings from the Southampton Women's Survey *– J. Hollies (Southampton, UK)* • Transmission of Food Aromas into Human Milk – an Active Early Programming Trigger or rather a Passive, Metabolically-Controlled Phenomenon? *– Andrea Büttner (Erlangen, Germany)* • Antecedents of Picky Eating Behaviour in Young Children *– P. Emmett (Bristol, UK)* • Early Exposure in Promoting and Programming Healthy Eating *– Marion Hetherington (Leeds, UK)*
16.05 – 16.30	***Coffee and Tea Break***		
16.30 – 18.05 **A.5:** Lecture Hall VI **B.5:** Lecture Hall V **C.5:** Lecture Hall IV	**A.5 Parallel Session** **Nutritional Epigenetics of Obesity** *Hosts/Chairs: Richard Saffery & Silvija Tokic* • Does Epigenetic Variation Impact Type 2 Diabetes? *– Charlotte Ling (Malmoe, Sweden)* • Epigenome-Wide Profiling Reveals Potential Differential DNA Methylation in Progeny of Women with Previous Macrosomic Babies Exposed to a	**B.5 Parallel Session** **Catch-up Growth** *Hosts/Chairs: Hans van Goudoever & Bartek Zalewski* • Modulating Mechanisms of Quality of Growth *– Martina Weber (Munich, Germany)* • New Innovative Concept to Predict Preterm Infant's Individual Growth Trajectories *– N. Rochow (Hamilton, Canada)*	**C.5 Parallel Session** **Translational Application of Programming Evidence: What is Needed?** *Hosts/Chairs: Cristina Campoy & Silke Mader* • Why Early Prevention of Childhood Obesity is More than a Medical Concern – A Health Economic Approach *– Diana Sonntag (Heidelberg, Germany)*

	Dietary Intervention in Pregnancy – *A. Geraghty (Dublin, Ireland) (No. 188)* • Development, Epigenetics and Later Obesity – *Keith Godfrey (Southampton, UK)* • Differential DNA Methylation within the Promoter of the Long Non Coding RNA ANRIL Is a Perinatal Marker for Later Adiposity – *K. Lillycrop (Southampton, UK) (No. 128)* • Epigenome-Wide DNA-Methylation and Body Composition at Age 5 - 5 Years in the European Childhood Obesity Project (CHOP)-Study – *Peter Rzehak (Munich, Germany)*	• Proven Benefits of Nutritional Modifications of Patterns of Growth – *Bernadeta Patro-Golab (Warsaw, Poland)* • Pre-Pregnancy Maternal Body Mass Index Impacts on Child Growth Trajectories to Six Years – *W. Oddy (Hobart, Australia)* • Long-Term Adverse Effects of Catch-Up Growth – *Atul Singhal (London, UK)*	• Science, Policy and Consumers – Understanding Infant Feeding Communication Practices – Monique Raats (Surrey, UK) • A Multi-Dimensional Breastfeeding Intervention – A Study Protocol – G. Alberdi (Dublin, Ireland) • How Do We Get Parents Involved? – Silke Mader (Munich, Germany)
19.30	**Conference Dinner: Bavarian Evening (Augustiner-Keller)**		

Saturday, 15th October 2016

09.00 – 10.05	**Breakfast Symposia**		
	Workshop (WS 4): Acting on DOHaD Concepts: Whose Responsibility? *Hosts: Mark Hanson & Ruth Mueller* *Chair: Michael Penkler* • Acting on DOHaD Concepts: Whose Responsibility? – *Ruth Mueller (Munich, Germany) & Mark Hanson (Southhampton, UK)* - Lecture Hall VI -	**Workshop (WS5): Fetal and Infant Growth Standards: International Practice and Applicability** *Hosts: Joaquin Escribano & Stefanie Kouwenhoven* • Curve Matching: New Technologies for Personalized Predictors of Growth in Children – *Stef van Buuren (Amsterdam, The Netherlands)* • Very preterm or very-low-birth-weight: what's in the name? – *Martijn Finken (Amsterdam, The Netherlands)* - Lecture Hall V -	**Workshop (WS6): DynaHEALTH Meets EarlyNutrition** *Hosts: Sylvain Sebert & Lise Geisler* • Introduction to the Challenge – *Sylvain Sebert (Oulu, Finland)* • Discovery in Large Scale Consortia – *Janine Felix (Rotterdam, The Netherlands)* • Nutritional Interventions During Pregnancy to Improve Metabolic Health in Mother and Offspring – *Ricardo Rueda (Granada, Spain)* • Life Course Modelling Methods and Challenges – *Estelle Lowry (Oulu, Finland)* - Lecture Hall IV -

Saturday, 15th October 2016 (continued)

10.10 – 11.45 **A.6:** Lecture Hall VI **B.6:** Lecture Hall V **C.6:** Lecture Hall IV	**A.6 Parallel Session** **The Future of Early Life Research** *Hosts/Chairs: Berthold Koletzko* • Finding Molecular Trackers of Early Life Environment in High-Dimensional Data *– Joanna Holbrook(Singapore)* • The Application of Lipid Profiling to Understand Dietary Fat Metabolism in Breast-Fed Infants *– A. Koulman (Cambridge, UK)* • Genetics and Epigenetics in DOHaD – Future Perspectives *– Richard Saffery (Melbourne, Australia)* • Women's Use and Preferences for Online Nutritional Resources in Pregnancy *– R.A.K. Kennedy (Dublin, Ireland)* • Maximising the Impact of DOHaD Research *– Mark Hanson (London, UK)*	**B.6 Parallel Session** **Obesity Prevention and Intervention in Infants and Young Children** *Hosts/Chairs: Ricardo Closa & Annick Xhonneux* • Early Obesity Prevention – the Role of Life Style. Experience from Toybox and Other Intervention Trials *– Zbigniew Kulaga(Warsaw, Poland)* • Cord Blood Adiponectin as a Predictor for Childhood Obesity at 5 Years of Age *– D. Meyer (Munich, Germany)* • Food Choices, Lifestyles and the Prevention of Overweight and Obesity in Children: Evidence from the IDEFICS Cohort and the I.Family Study *– Wolfgang Ahrens (Bremen, Germany)* • ROLO Kids Step Test: A Simple Method of Estimating Cardiovascular Fitness and Adiposity in 5 Year Old Children *– A. Geraghty (Dublin, Ireland)* • Determining Factors and Critical Periods in the Formation of Eating Habits: Results from the HabEat project *– Sylvie Issanchou (Paris, France)*	**C.6 Parallel Session** **The Contribution of Public Private Collaboration (PPC) to Translational Research** *Hosts/Chairs: Astrid Rauh-Pfeiffer & Rosalie Grivell* • Personalised Nutrition – What Does It All Mean? *– Rosalie Grivell (Adelaide, Australia)* • Evaluation of Pregnant Diet Quality on Social Media Project: The Use of the Healthy Eating Index for Brazilian Pregnancy *– V. Barros K. (Sao Paulo, Brazil)* • Framing Personalized Nutrition and the Food4me Experience *– Hannelore Daniel (Munich, Germany)* • Associations of Maternal B Vitamins during Pregnancy with Infant Neurocognitive Outcomes at 24 Months of Age *– M. Chong (Singapore)*
11.45 – 12.05	***Coffee and Tea Break***		
12.05 – 12.50 Lecture Hall VI: live Lecture Halls IV+V: live stream	**Plenary Session IV** *Chair* Berthold Koletzko **Early Life Nutrition – Recommendations and Perspectives? –** Jodie Dodd (Adelaide, Australia) & Hans van Goudoever (Amsterdam, The Netherlands)		
12.50 – 13.30 Lecture Hall VI: live Lecture Halls IV+V: live stream	**Closing Session** *Chair* Berthold Koletzko **Early Life Nutrition (WHO Europe Perspective & Public Health Impact)** – Martin Weber (WHO) **Farewell Note** – Berthold Koletzko (Munich, Germany)		
13.35 – 14.00	***Farewell Snack***		

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PLENARY SESSIONS

II. Complementary Feeding: An Opportunity for Programming Later Health?

Thursday 13th October, 15.30-16.15

Mary Fewtrell
UCL Institute of Child Health, LONDON, UK

Complementary feeding (CF) practices could potentially influence later health outcomes by a number of mechanisms including programming effects, but also by lasting influences on food preferences, appetite and eating behaviour. Evidence for an effect of nutritional aspects of CF - timing or content - on later health outcomes still comes largely from observational studies. These suggest, for example, that delaying the introduction of CF until 4 months may protect against later obesity; whilst a high protein intake during CF may be associated with increased later obesity risk, perhaps dependent on the type of protein. However, new data from randomised trials have provided important information on the impact of the age at introduction of allergenic foods and gluten on the development of food allergy and coeliac disease respectively; leading to changes in CF advice.
There is increasing focus on the role of CF practices in shaping taste/flavour preferences and subsequent food choices. For example, exposure to a more varied CF diet, including bitter-tasting vegetables, may be associated with more optimal dietary patterns later in childhood. Parenting behaviour can also influence infant feeding practices and growth; a recent systematic review concluded that the most promising interventions for reducing obesity are those focussing on diet and responsive feeding.
There is thus some evidence that the CF period represents an opportunity for influencing later health outcomes. However CF practices vary markedly between and within countries. Given the complex interplay between nutrition, feeding behaviour and psychological factors during this period, a holistic approach is required.

III. What is Normal Pre- and Postnatal Growth

Friday 14th October, 9.30-10.15

Michelle Lampl
Center for the Study of Human Health, Department of Anthropology - Predictive Health, Emory University, ATLANTA, GA, USA

As the body is constructed from the cellular level to the organs that make-up the units of structure and function, tissue composition and metabolic processes unfold. The nuances that determine these outcomes involve cross-talk amongst systems that negotiate energy demands and availability of constituents. This progression is a fundamental embodiment of growth, and programming is a central aspect of the complex network interactions. Details of the processes of normal pre- and postnatal growth are beginning to be described. Mechanisms remain to be discovered. Clarifying the process of normal growth is essential to supporting health, as documented by the substantial evidence of lifetime sequelae following growth perturbations in early life. It is important to clarify that what we think we know is both evidence-based and methodologically sound. Concepts of normal growth drive pediatric interventions, supplementary food formularies, recommendations and feeding decisions. The common image of growth that emerges from growth curve reference charts of size-for-age has been adopted as the representation of normal growth trajectories to be expected among children across development. These smoothed population-level statistical distributions are, problematically, not accurate representations of how growth as a biological process occurs within individuals. Normal pre- and postnatal growth occurs by discontinuous saltatory bursts against a background of stasis. These discrete critical periods organize complex cellular alternatives influencing growth rate, hence size, and the biology of body composition.

IV. Pregnancy Interventions – What Should Our Recommendations Be into the Future?

EARLYNUTRITIONMEMBER

Saturday 15th October, 12.05-12.50

Dodd JM
Discipline of Obstetrics & Gynaecology, and the Robinson Research Institute, The University of Adelaide, ADELAIDE, SOUTH AUSTRALIA

Overweight and obesity during pregnancy is common. There is an extensive observational literature highlighting the effects of excessive gestational weight gain among overweight and obese pregnant women and an increased risk of adverse pregnancy and birth outcomes. However, evidence from large-scale randomised trials which have utilised robust methodology indicate that provision of an antenatal dietary and lifestyle intervention during pregnancy is ineffective in limiting gestational weight gain to the extent required to potentially impact clinical pregnancy and birth outcomes.
This presentation will focus on the evidence available to date for antenatal interventions for pregnant women who are overweight or obese, in addition to challenging the current focus on gestational weight gain as a relevant clinical outcome, and considering alternative approaches which may be required if outcomes for women and their infants are to be improved.

Parallel Sessions

A.1: Pregnancy and Programming of Obesity and Related Disorders

Thursday 13th October, 11.50-13.25

The Role of Epigenetic Processes in the Developmental Programming of Obesity

Karen Lillycrop
Institute of Developmental Sciences, Centre for Biological Sciences, University of Southampton, SOUTHHAMPTON, UK

There is now substantial evidence from both human epidemiological studies and animal models that an adverse intrauterine environment induced by a variety of environmental and maternal factors such as diet, body composition or endocrine factors can induce a phenotype in the offspring that is characterized by an increased risk of developing chronic non-communicable diseases in later life. The mechanism by which cues about nutrient availability in the postnatal environment are transmitted to the fetus and the process by which different, stable phenotypes are induced are beginning to be understood and involve the epigenetic regulation of specific genes. Epigenetic processes induce heritable change in gene expression without altering gene sequence. The major epigenetic mechanisms include DNA methylation, histone modification and non coding RNAs. The epigenetic changes induced in response to nutritional cues from the mother may allow the fetus to adjust its developmental programme in order to be better adapted to the future environment, while inappropriate adaptations may predispose an individual to increased risk of a range of non-communicable diseases. Some studies have also suggested that environmental challenges in early life can induce an altered phenotype which can be transmitted between generations.

This talk will describe how early life environment influences later susceptibility to non communicable diseases through the altered epigenetic regulation of genes, and how epigenetic changes in early life may be used as predictive markers of future disease risk as well as providing valuable insights into the development of complex diseases.

Maternal Body Mass Index, Gestational Weight Gain and Risks of Adverse Pregnancy Outcomes: Individual Participant Data Meta-Analysis of 230,000 Singleton Births

EARLYNUTRITIONMEMBER

Santos S.[1,2], Gaillard R.[1], Kruithof C.[1], Jaddoe V.[1], on behalf of the MOCO Collaboration
[1] *Erasmus MC, University Medical Center, The Generation R Study Group, Department of Epidemiology, ROTTERDAM, NETHERLANDS*
[2] *EPI-Unit, Institute of Public Health, University of Porto, PORTO, PORTUGAL*

Objective: To assess the strength and consistency of the associations of maternal body mass index and gestational weight gain with pregnancy outcomes using individual participant data of 230,061 singleton births from 39 Western cohorts.
Methods: We used multilevel logistic mixed effects models to examine the separate and combined associations of maternal body mass index and total gestational weight gain with the risk of pregnancy outcomes (gestational hypertension, pre-eclampsia, gestational diabetes, preterm birth, small and large for gestational age).
Results: The risk of gestational hypertensive disorders, gestational diabetes and large for gestational age increased linearly with maternal body mass index, even within normal weight mothers. Obese mothers grade 3 (≥40 kg/m2) showed the highest risk of preterm birth as compared to normal weight mothers. The highest risks of gestational hypertension (Odds Ratio (OR) 4.74 (95% Confidence Interval (CI) 4.26, 5.26)), pre-eclampsia (OR 3.75 (95% CI 3.01, 4.67)) and large for gestational age (OR 3.54 (95% CI 3.32, 3.78)) were observed for obese mothers who gained excessive weight during pregnancy, as compared to normal weight mothers with sufficient gestational weight gain. For underweight mothers, increasing gestational weight gain per week tended to be associated with lower risk of any adverse outcome (lowest risk range: 0.6-0.7 kg per week), whereas for obese mothers, the risk of any adverse outcome increased with increasing gestational weight gain per week (lowest risk range: < 0.1 kg per week).
Conclusion: Maternal obesity and excessive gestational weight gain are associated with an increased risk of adverse pregnancy outcomes.

Obesity, Related Metabolic Conditions and DNA Methylation – What Can Genome Wide DNA Methylation Studies in Cohort Studies Show Us?

EARLYNUTRITIONMEMBER

Rae-Chi Huang
Telethon Kids Institute, University of Western Australia, PERTH, AUSTRALIA

Experimental studies have suggested that the early life environment makes a significant contribution to an individual's risk of developing obesity, through the altered epigenetic regulation of genes. Currently we have multiple gaps in knowledge as to how this occurs in humans. Despite genome wide DNA methylation arrays and large datasets being increasingly available in many birth cohorts around the world, and the progressive identification of loci associated with obesity and related phenotypes, a complete understanding of the role of the methylome in mediating early life environmental exposures on obesity and related diseases remains challenging. Uncertainty exists as to whether variability of the methylome after birth determines or is a consequence of obesogenic postnatal environmental influences.
In this talk, we discuss within the context of the Western Australia Pregnancy Cohort (RAINE), studies to assess epigenetic loci associated with obesity-related phenotypes. We also discuss approaches to understand how early life environmental exposures (maternal BMI, gestational weight gain, maternal smoking in pregnancy, maternal stress, breast feeding) and metabolomic endophenotypes mediate the association between the methylome and adiposity.
The Western Australia Pregnancy Cohort (RAINE) study (www.rainestudy.org.au) recruited 2900 pregnant women between 1989 and 1992. The offspring born to these women have longitudinal exposure data, and adiposity phenotypes. Follow-up of the offspring has been undertaken at birth, 1, 2, 3, 5, 8, 10, 14, 17 and 24 years. During adolescence, all subjects have datasets derived from Illumina Infinium HumanMethylation450 BeadChips and mass spectrometry based metabolomics.

Effectiveness of a Normative Nutrition Intervention on Maternal Nutrition and Offspring Growth: The Chilean Maternal and Infant Nutrition Cohort Study (CHiMINCs)

Garmendia M.L. [1], *Corvalan C.* [1], *Araya M.*[2], *Casanello P.*[3], *Kusanovic J.P.*[3,4], *Uauy R.*[1]

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[4] *Center for Research and Innovation in Maternal-Fetal Medicine (CIMAF), Department of Obstetrics and Gynecology, Sótero del Río Hospital, SANTIAGO. CHILE*

Introduction: Obesity and NCDs are currently the main causes of death and disability in Chile and worldwide. Although these conditions are observed in adulthood, there is now consistent evidence that NCDs originate in early life (first 1000 days). We assessed the effectiveness of a low-intensity and high-coverage nutrition intervention by enhancing existing nutrition health care standards and practices at the Chilean primary health care level.
Methods: The study is a cluster randomized controlled trial involving 12 primary health care centers from the South-East Area of Santiago randomly allocated to: 1)enhanced nutrition health care standards regarding optimal weight gain during pregnancy and diet and physical activity counseling-support (Intervention Group,IG) or 2) routine antenatal care according to national guidelines (Control Group,CG). The main outcome measures were: 1) achievement of adequate GWG and adequate glycaemic control during pregnancy, and 2) healthy infant growth during the first year of age. 2800 and 2300 pregnant women at the first prenatal visit (< 15 weeks) were enrolled at the IG and CG, respectively.
Results: Intent-to-treat analyses showed that the IG, compared with CG, had lower GWG (9.5Kg vs 10.6Kg) and decreased percentage of women who exceeded IOM recommendations (28.4% vs 34.5% ($p< 0.05$). No differences were found between the two groups regarding cesarean-section or birthweight.
Conclusion: A low-intensity intervention at the primary health care level during pregnancy reduced excessive gestational weight gain. Gathered information should contribute to a better understanding of how to develop effective interventions to halt the maternal obesity epidemic and NCDs in the Chilean population.

Maternal Obesity, the Gut Microbiome, and Long-Term Disease Risk

Deborah M Sloboda

Dept of Biochemistry and Biomedical Sciences, Farncombe Family Digestive Diseases Research Institute, McMaster University, HAMILTON, CANADA

Since the advent of the Developmental Origins of Health and Disease (DOHaD) hypothesis, many models have consistently shown that the early life environment plays a central role in offspring disease risk. Recent studies have identified new connections between the mother and its developing fetus through the maternal intestinal microbiome, suggestive of novel links between the maternal-fetal unit and new avenues of investigation into postnatal metabolic development and function. Although still controversial, it has been suggested that the developing fetal gut may be colonized before birth. Bacteria associated with the maternal gut have been isolated from meconium, fetal membranes and cord blood of healthy neonates. Experiments in mice support the notion that the fetus may be exposed to maternal gut-derived bacteria which may prime fetal gut development. There is currently no direct evidence of a fetal-microbial interaction in the context of maternal obesity - although maternal obesity results in offspring that have metabolic defects associated with intestinal dysbiosis, inflammation, and altered immune responses. Studies have shown that maternal microbial priming of neonatal intestinal development likely occurs during lactation through breast milk, and that bacterial populations are modifiable by diet and obesity. Whether early life exposure to maternal microbial/inflammatory triggers in the context of maternal obesity impairs offspring development and predisposes to postnatal obesity, is unclear, but is an exciting new avenue of obesity related programming research.

B.1: Breastfeeding and Later Health

Thursday 13th October 11.50 – 13.25

Breast Milk Components and Infant Growth

EARLYNUTRITIONMEMBER

Maria Grunewald [1], *Martina Weber* [1], *Franca F. Kirchberg* [1], *Hans Demmelmair* [1], *M. Luisa Mearin* [2], *Renata Auricchio* [3], *Gemma Castillejo* [4], *Ilma R. Korponay-Szabo* [5], *Isabel Polanco* [6], *Maria Roca* [7], *Sabine L. Vriezinga* [2], *Katharina Werkstetter* [1], *Berthold Koletzko* [1]

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Objectives and study: Human milk (HM) provides the important nutrients for healthy growth and development of the newborn infant, but nutrient concentrations are variable. We analyzed whether HM macronutrients and specific hormones influence infant weight and length.
Methods: Anthropometrical data was collected from 377 fully breastfed children from the European PreventCD (prevent celiac disease) study. HM protein, carbohydrate, fat, insulin, IGF-II, and adiponectin concentrations were determined. We tested the influence of HM component concentrations at each month of lactation (0, 1, 2, 3, and 4) on weight and length Z-scores at four months, one year, and

two years of age using a multiple linear regression model.
Results: We analyzed 597 HM samples. HM macronutrients and hormones were not associated with weight-for-age, length-for-age, and weight-for-length Z-scores at 4 months, 1 and 2 years of age.
Conclusion: We did not find an influence of HM components on infant growth. In particular, we could not confirm previously reported findings in both breastfed and formula fed infants linking a higher protein supply during infancy to a higher weight gain.

Acknowledgement: Partial financial support from the Commission of the European Communities (FP7-289346-EARLY NUTRITION, FP6- 036383-PREVENTCD) and the European Research Council (ERC-2012-AdG – no.322605 META-GROWTH) is gratefully acknowledged. Disclosure statement: The authors declare no conflicts of interest.

Milk Cholesterol Concentration in Mice Is Resistant to Genetic and Dietary Hypercholesterolemia

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Breast milk, in many species, contains high cholesterol concentrations, which impact long-term cholesterol homeostasis in the offspring. The regulation of milk cholesterol concentration is, however, largely unknown. We studied in mice to what extent milk cholesterol concentrations are influenced by genetic and dietary manipulations of plasma cholesterol levels.
We used a dietary intervention and genetic approaches to increase plasma cholesterol concentrations (LDL-receptor knock-out, ABCG8 transporter knock-out). The LDL-receptor mediates disposal of cholesterol-rich lipoproteins from the systemic circulation, while ABCG8 facilitates excretion of cholesterol from the body. We sampled blood, milk and organs at day 14 of lactation from C57BL/6J (WT), ABCG8-KO, and LDLR-KO dams on either control or high cholesterol (HCh; 0.5%, 3 weeks) diets. Milk was obtained after ~3h separation from their pups.
HCh-feeding induced hypercholesterolemia in each of the mouse models used (+48-150% plasma cholesterol; each $p< 0.05$). Similarly, liver and mammary gland cholesterol levels increased in these dams (+305-1396%, and +20-57%, respectively; each $p< 0.05$). Interestingly, these substantially increased plasma, liver and mammary gland cholesterol levels did not affect milk cholesterol concentration in either the WT or genetic knockout models. HCh-feeding decreased de novo cholesterol synthesis in liver and mammary gland, but this did not affect milk cholesterol concentration (-85 to -117%; each $p< 0.05$).
Our results demonstrate that milk cholesterol concentration in mice is stable under profoundly increased plasma cholesterol levels. We speculate that the robustness of milk cholesterol concentration points to an important function of early cholesterol supply for the offspring.

Breastfeeding and Celiac Disease, Allergy and Type 1 Diabetes

EARLYNUTRITIONMEMBER

M. Luisa Mearin
Dept. of Pediatrics, Leiden University Medical Center, LEIDEN, THE NETHERLANDS

Breastfeeding (BF) protection against coeliac disease (CD), allergy and type1 diabetes (T1D) has been suggested. Most of the studies were retrospective and easily biased.
A systematic review of prospective observational studies up until February 2015, showed that BF had no preventive effect for CD. The ESPGHAN position paper 2016 estates that although BF should be promoted for its other well established health benefits, neither any BF nor BF during gluten introduction has been shown to reduce the risk of CD.
A systematic review and meta-analysis on BF and asthma and allergies (2015) showed low grade quality evidence of a reduced risk of asthma, allergic rhinitis and eczema in children by longer duration of BF. No association was found between BF and food allergy. Later, a big population-based study in 1 year old Australian showed that duration of exclusive BF and use of partially hydrolyzed formula were not associated with food allergy. The results of the big prospective population study Generation Rotterdam, showed that BF may influence wheezing and asthma in childhood, which seems to be partly explained not by allergy, but by infectious mechanisms.
Some retrospective studies showed a small reduction in the risk of T1D with BF, but almost all the prospective birth cohort studies failed to find a protective effect. Studies showing that children who were still breastfed at the time of introduction to cereals had a reduced risk of T1D suggest that BF might play a protective role in the relationship between dietary factors and T1D.

Breastfeeding Status and Timing of Solid Food Introduction: Adiposity in 6 Month Old Infants of Obese Mothers

EARLYNUTRITIONMEMBER

Engler J. [1], *Pasupathy D.* [1], *Seed P.T.* [1], *Poston L.* [1], *Patel N.* [1], *On behalf of the UPBEAT consortium.*
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Background: Breastfeeding duration and timing of solid food introduction may influence infant adiposity. We sought to examine the relationship between mode of early feeding and age of solid food introduction with 6 months adiposity outcomes in offspring of obese women.
Method: 520 infants were studied from the UPBEAT Trial. The primary outcome for this study was infant adiposity at 6 months, as assessed by sum of two skinfold thicknesses (SFT). Secondary outcomes included other anthropometric measures such as abdominal/arm circumference and BMI-for-age-z-score. Exposures were early feeding status: exclusively breastfed ≥4 months, formula-fed or mixed fed, and age of solid food introduction (< 5 or ≥5 months). Multivariate regressions analyses were undertaken adjusting for maternal age, BMI, deprivation level and infant sex and age at follow-up.
Results: 37.3% infants were breastfed, 46.2% formula-fed and 25.4% mixed fed. Feeding status was associated with age at solid food introduction: formula-fed and mixed fed infants were significantly more likely to be weaned < 5 months than breast-fed infants (20.4% and 18.6% vs 9.3%; OR 2.94, 95% CI: 1.72 to 3.97; $p< 0.001$). Independent of confounders, among formula-fed infants only, weaning

< 5 months was significantly associated with increased weight (0.78kg; p=0.007), arm circumference (1.72cm; p=0.007) and length-for-age-z-scores (1.53 SD; p=0.004) at 6 months. Associations were not apparent in the other groups.
Conclusion: Among formula-fed infants, weaning < 5 months was associated with increased probability of adiposity, as assessed by anthropometry, suggesting that any duration of breastfeeding may protect against detrimental effects of earlier weaning.

Persistent Environmental Toxicant and Nutrient Content Content in Human Breast Milk and Infant Growth

EARLYNUTRITIONMEMBER

Rachel Criswell [1], Hans Demmelmair [2], Nina Iszatt [1], Olaf Uhl [2], Virissa Lenters [1], Berthold Koletzko [2], Merete Eggesbø [1]
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[2] Dr. von Hauner Children's Hospital, Department of Metabolism and Nutrition, MUNICH, GERMANY

Background: Perinatal exposure to certain environmental toxicants is associated with rapid infant growth, a risk factor for obesity. Certain plasma lipid profiles in adolescents have been associated with obesity and insulin resistance, and perinatal n-6 and n-3 long chain polyunsaturated fatty acid (PUFA) status may influence long-term health. No studies have examined potential additive or interactive effects of these compounds in human milk.
Methods: We utilized the Norwegian HUMIS study, a multi-center cohort of 2,606 mothers and newborns enrolled between 2002-2008. Milk samples from a subset of 800 women were analyzed for triglyceride fatty acids, phospholipids, and 172 environmental toxicants, including persistent organic toxicants, heavy metals, and pesticides. Obese women were oversampled. Growth was defined as change in weight-for-age z-score between 0-6 months. We will use Bayesian model averaging, which deals with highly correlated mixtures, to determine significant exposures. The resulting frequently selected model will be refit using a multivariable logistic regression.
Results: Median age, pre-pregnancy BMI, and cumulative breastfeeding of mothers was 30 years, 24.0 kg/m2, and 5.78 months, respectively. Of infants, 18.2% (n=143) displayed rapid growth. The toxicant with the highest levels was p,p'-dichlorodiphenyldichloroethylene. Also present in high levels were polychlorinated biphenyls 153 and 138. Median concentrations of arachidonic and docosahexaenoic acids, which indicate levels of n-6 and n-3 PUFAs, respectively, were similar at 0.08 g/L (IQR 0.06–0.11 for arachidonic and 0.05–0.12 for docosahexaenoic acid). Analysis is ongoing. Anticipated results include triglyceride fatty acids, lipid species, and toxicants associated with rapid growth and their potential interactions.

C.1: Programming of NCDs in Preterm Infants

Thursday 13th October, 11.50-13.25

Programming of NCDs in Preterm Infants – Focus on Growth

Ken Ong
CAMBRIDGE, UK

Preterm infants typically exhibit poor initial weight gain between birth to term gestational age, with subsequent rapid catch-up growth. Rapid early growth is a suggested risk factor for metabolic diseases; conversely poor early growth in preterm infants is associated with adverse neurodevelopmental outcomes.
A recent systematic review summarized the available evidence on postnatal growth in preterm infants in relation to neurodevelopmental and metabolic outcomes. Only few intervention studies were identified, providing little evidence for beneficial effects of faster early growth. Observational studies showed generally consistent positive associations between postnatal weight gain (18 studies) or head growth (15 studies) and neuro-cognitive outcomes at ages ranging from 1y to adulthood, but no obvious period of weight gain or head growth was more consistently associated with later outcomes. Two of four observational studies reported positive associations between postnatal weight gain and later percent body fat; three of four studies reported positive associations with insulin resistance; and associations with various cardiovascular disease risk factors were more variable.
In summary, while observational studies report consistent positive associations between postnatal growth and neuro-cognitive outcomes, there is limited evidence from the few intervention studies. Evidence linking postnatal weight gain to later adiposity and cardiovascular risk factors is also limited. The dissonance between findings of intervention and observational studies raises the possibility of confounding by diseases or factors that affect both growth and cognition. Future nutritional intervention studies in preterm infants should report effects on weight gain and growth, as well as later body composition and neuro-cognitive outcomes.

Growth and Body Composition in Extremely Preterm Infants Is Altered Early

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Background: Extremely preterm babies experience significant post-natal growth retardation. However, preterm infants at term corrected age (CA) have increased %body fat (%FM) compared with infants born at term. This study aimed to assess growth and body composition at 32-36 weeks CA in extremely preterm infants.
Methods: Growth and body composition were assessed using the PEAPOD Infant Body Composition System to measure fat mass percentage (%FM) and fat free mass (FFM) in appropriately grown (AGA) preterm infants (n=113) born before 32 weeks gestation and studied at 32-36 weeks. Body composition was compared to a control group of AGA preterm infants (n=88) born at 32-36 weeks gestation and measured within five days of birth.
Results: Mean %FM in the extremely preterm infants at 32-36 weeks was 14.6% ± 7.2% (mean ± SD) and was significantly higher than control infants born at 32-36 weeks (7.5% ± 3.6%, p< 0.0001). FM% was higher than in control infants at 33, 35 and 36 weeks. The

mean FFM in extremely preterm infants (1.75kg ± 0.35kg) was significantly lower than in control infants (1.87kg ± 0.31kg, p < 0.019). FFM was higher than in control infants at 34, 35 and 36 weeks. %FM in extremely preterm infants correlated with weight at measurement (r=0.751, p< .0001) and with post-natal age at measurement (r=0.803, p< 0.0001).
Conclusions: Significant alterations in body composition are occurring as early as 33 weeks CA in infants born extremely preterm. Alterations are greatest in infants with the lowest gestational age at birth.

Programming of NCDs in Preterm Infants by Early Nutrition

Alexandre Lapillonne
Paris Descartes University and Necker Enfants Malades Hospital, PARIS, FRANCE

Prematurity continues to contribute disproportionately to neonatal morbidity and subsequent physical and neurodevelopmental disabilities. Epidemiological studies have described other long term health consequences, such as an increased risk of hypertension and insulin resistance in the adult. It is not known whether the influence of infant and childhood growth rates and early nutrition on long term outcomes is the same or different among preterm infants and growth-retarded term neonates. Our review suggests that growth velocity between birth and expected term and 12 to 18 months post-term has no or minimal effects on blood pressure and metabolic syndrome in young adult born preterm. In contrast, growth during late infancy and childhood appears to be a major determinant of later metabolic and cardiovascular well-being, which suggests that nutritional interventions during this period are worthy of more study. Our review also highlights the paucity of well-designed, controlled studies of preterm infants on the effects of nutrition during hospitalization or after discharge on the risk of developing hypertension or insulin resistance.

Body Composition in Preterm Infants: Comparison of Air Displacement Plethysmography and Dual-Xray Absorptiometry

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Background: Infant body composition is an emerging field, promising a more clinically relevant assessment of adequacy of nutrition than current weight gain evaluation. Air displacement plethysmography (ADP) and dual X-ray absorptiometry (DXA) have been independently validated against established reference methods. However, there is little to no literature comparing ADP with DXA, particularly in the preterm population.
Objectives: To compare body composition estimates from DXA and ADP of 72 preterm infants (born < 30 weeks).
Methods: 72 concurrent DXA (Hologic Discovery QDR4500) and ADP (PEAPOD,COSMED) measurements were compared. Measurements were performed at three time points: < 72 weeks of corrected gestational age, term and 3 months corrected age (n=21, 33, and 18 respectively). In addition, total mass measurements from DXA and ADP were compared against a third method, an electronic scale (SmartScale® Model65)
Results: DXA and ADP were significantly correlated for total body mass (R2=0.997), absolute fat mass (R2=0.910), absolute fat-free mass (R2=0.961) and %fat mass (R2=0.696). However, Bland-Altman analysis revealed significant bias (p≤0.001) in these estimates. ADP total mass against electronic scale showed a high correlation (R2= 0.995) and the Bland-Altman analysis showed no bias (p=0.887), whereas DXA total mass was highly correlated with the electronic scale (R2=0.999) but showed a significant bias (p< 0.001).
Conclusions: Estimates of body composition by DXA and ADP were highly correlated, but had a significant bias. Our results show that DXA overestimates total mass and underestimates %fat mass in comparison to ADP. Further studies are needed to identify the basis of the large inter-method biases.

Glucocorticoid-Programming in Very Preterm Birth

Martijn Finken
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The adrenal gland is not yet fully functional in newborns in the very preterm (i.e., <32 weeks of gestation) range; a considerable proportion of them manifest clinical signs of adrenal insufficiency, such as refractory hypotension. Conversely, children with a history of preterm birth displayed increased hypothalamus-pituitary-adrenal (HPA) axis activity, though studies have been inconsistent. They were also found to carry the pathophysiological correlates of increased HPA axis activity, such as increased abdominal fat contents, raised blood pressure and glucose intolerance.
The switch in HPA axis activity has repercussions for subsequent growth, body composition, metabolism, neurodevelopment and, ultimately, long-term disease risk. This talk provides an overview of studies that investigated HPA axis activity in very preterm newborns and how the axis changes throughout development, as a possible explanation for the association between prematurity and certain chronic diseases.

A.2: Interventions to Prevent Adverse Fetal Programming

Thursday 13th October, 16.45-18.20

Antenatal Interventions to Improve Maternal and Infant Outcome – Results from the ROLO Study

EARLYNUTRITIONMEMBER

Fionnuala McAuliffe
University College Dublin, DUBLIN, IRLAND

The ROLO randomised controlled trial is a low glycaemic index dietary intervention aiming to reduce macrosomia (large for dates infants). 800 secundigravida women who had previously given birth to a macrosomic baby (> 4kg) were randomised to receive low GI dietary advice or usual antenatal care, which did not include dietary advice. Low GI dietary advice was given at week 14 of pregnancy and demographic, well-being and lifestyle questionnaires were returned by 28 weeks gestation. 3-day food diaries were completed during each trimester of pregnancy.
Women in the intervention group lowered their glycaemic index and glycaemic load following dietary advice and demonstrated an attenuation in the normal rise in insulin resistance in late pregnancy. Significant maternal benefits were noted with less gestational weight gain and improved maternal glucose tolerance. No impact however was noted on birthweight, though neonatal thigh circumference was slightly less in the intervention groups. At 6 month and 2 years of age no differences were noted in infant anthropometry.
Additional findings from the ROLO study include a positive association between physical activity and wellbeing in pregnancy and relationships between maternal vitamin D status and childhood adiposity.
In summary a low glycaemic index diet was acceptable to pregnant women with good compliance noted and while it did not impact on birthweight significant maternal benefits were noted. This diet to be considered for women at risk of excessive gestational weight gain and those at risk for glucose intolerance in pregnancy.

Effect of a Dietary and Exercise Intervention during Pregnancy and Lactation on White Adipose Tissue Gene Profiles and Adiposity with Maternal Obesity

EARLYNUTRITIONMEMBER

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Background: The recent surge in maternal obesity has led to an increase in interventions designed to attenuate the potential adverse effects on the mother and offspring. Pregnancy and lactation are periods of great metabolic flux and regulation of adipose tissue metabolism which is one potential determinant of adverse outcome. This study focuses on gene expression profile of inguinal white adipose tissue with maternal obesity.
Methods: Rats were randomized to control (C; n=6), obesity (Ob; n=5) or obesity intervention (ObDEx; dietary (low glycaemic index diet) and physical exercise (n=6)) groups. At late gestation (G20) and postnatal day 14 (lactation) maternal adipose tissues were collected, weighed and stored in RNA later. Gene expression was determined by QPCR and normalized with the geNorm algorithm.
Results: Genes involved in energy sensing, inflammation and lipid handling pathways were all significantly higher in pregnancy compared with lactation for controls. These differences were further increased with obesity, but attenuated with the intervention during pregnancy but not lactation. ObDex also reduced both fat mass (C: 5.4±0.8; Ob: 8.3±0.7; ObDEx; 4.4±0.3 g ($P< 0.01$)) and serum leptin (C: 4.2±0.7; Ob: 11.9±1.7; ObDEx; 5.0±0.9 ng/ml ($P< 0.01$)) in pregnancy.
Conclusions: A combined dietary and exercise intervention improved the maternal metabolic gene profile within white fat and prevented excess adiposity. This effect appeared to be confined to pregnancy due to the pronounced metabolic adaptations within fat through lactation.

Acknowledgements: The research has received funding from the European Union's Seventh Framework Programme (FP7/2007-2013), project EarlyNutrition under grant agreement no. 289346.

The UPBEAT Trial; Obesity in Pregnancy and Developmental Programming

EARLYNUTRITIONMEMBER

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UPBEAT was a randomised controlled trial in 1555 obese pregnant women (BMI >30kg/m2) of a complex behavioural intervention to encourage change in diet (reduced glycemic load and saturated fat intake) and increase physical activity. The primary aim, to reduce gestational diabetes and large for gestational age deliveries was not met, but the intervention improved maternal diet, reduced gestational weight gain and lowered maternal adiposity (by anthropometry), all pre-specified secondary outcomes. Neonatal anthropometry assessed at birth was not different between intervention and standard care arms of the trial. 698 infants attended at 6 months of age for a follow up visit. Those in the intervention arm demonstrated lower values for sub-scapular skin fold thickness, an index of central adiposity, (difference -0.26 SD, -0.49 to -0.02; p=0.031]). Maternal dietary glycemic load and saturated fat intake were reduced in the intervention arm. Causal mediation analysis suggested that lower infant subscapular skinfold thickness was mediated by changes in antenatal maternal diet and gestational weight gain.
Conclusion: The UPBEAT trial has shown that modification of diet in pregnancy can reduce a measure of infant adiposity. The intervention was also associated with lasting improvement in the mother's diet. Follow up of children at 3-4yrs currently underway will determine whether the maternal intervention has led to persistent change in childhood adiposity.

Supported by the EU 7th Framework Programme (FP7/2007–2013), project EarlyNutrition;grant agreement no. 289346 and the National Institute for Health Research (NIHR) (UK) Programme Grants for Applied Research (RP-0407-10452).

Perinatal Taurine Supplementation Improves Renal Endothelial Dysfunction in the Offspring of Diabetic Rats

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Diabetic nephropathy is the most common complication found in diabetes. There have been evidences that maternal diabetes could induce perinatal renal injury in the offspring. Increased intercellular adhesion molecule-1 (ICAM-1) and decreased endothelial nitric oxide synthase (eNOS) are known to be involved in that pathogenesis. It has been reported that taurine administration prevented the occurrence and development of diabetic nephropathy. In the present study, the effects of taurine on kidney ICAM-1 and eNOS proteins expression as well as serum oxidative stress markers (malondialdehyde (MDA) and protein carbonyl (PC)) were measured in the offspring born from diabetic rats. The maternal diabetic rat model was established by a single intraperitoneal injection of streptozotocin as soon as the pregnancy was detected. Taurine treated groups were received 3% taurine in drinking water during pregnancy and lactation. Offspring from maternal diabetic rats were found to have an increased serum MDA, serum PC, increased ICAM-1 and decreased eNOS proteins expression in the kidney, indicating an increased oxidative stress and renal endothelial dysfunction, compared with the offspring from non-diabetic mother. In offspring from diabetic mothers, perinatal treatment with taurine significantly attenuated an elevation of serum MDA and reduced the overexpression of ICAM-1 whereas serum levels of PC and eNOS protein expression were not different compared with those from non-treated group. In conclusion, supplement with perinatal taurine improves renal endothelial function in the offspring from the maternal diabetic rats. This effect is likely to be associated with the downregulation of ICAM-1 expression on kidney via its antioxidant property.

The LIMIT Randomised Trial – Longer-Term Effects on Maternal and Child Health

EARLYNUTRITIONMEMBER

Dodd JM

Discipline of Obstetrics & Gynaecology, and the Robinson Research Institute, The University of Adelaide, ADELAIDE, SOUTH AUSTRALIA

Overweight and obesity during pregnancy is common. Robust evidence about the effect of antenatal dietary and lifestyle interventions on potential mechanistic pathways and longer-term maternal and childhood health outcomes is lacking.
The LIMIT randomised trial recruited and randomised 2,212 women during pregnancy with BMI >25kg/m2. Women randomised to Lifestyle Advice participated in a comprehensive dietary and lifestyle intervention over pregnancy, delivered by research staff. Women randomised to Standard Care received pregnancy care according to local guidelines, which did not include such information. Women who received the antenatal lifestyle intervention demonstrated improvements in their diet quality and physical activity, while significantly reducing the risk of infant birth weight above 4kg.
We have conducted follow-up of women and their children who participated in the LIMIT randomised trial at 6 months, 18 months, and 3-5 years of age. This presentation will discuss some of the findings obtained from childhood follow-up assessments.

B.2: GDM – Early Diagnosis of Women at Risk

Thursday 13th October 16.45-18.20

Studying Fetal Programming in South Asian Populations: The GIFTS Study

Sarah Finer

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The concept of fetal programming has developed from the study of extreme environments and phenotypes, often in historical contexts. To study fetal programming in current populations, and its effect on cardiometabolic disease, a contemporary view must be taken to understand a complex interplay of genetic, epigenetic, environmental, social, cultural and demographic factors. In this EU-funded study, we have sought to understand the complex environmental and molecular drivers of type 2 diabetes and obesity in the offspring of a global population of South Asian women, and develop novel insights to develop targeted interventions to mitigate their risk.
The GIFTS study used a multi-level experimental approach to study fetal programming of cardiometabolic disease in South Asian populations, incorporating epidemiological, molecular, clinical and qualitative techniques.
Data will be presented from selected GIFTS work packages, including epidemiological and clinical studies. These data will highlight the need to take a global perspective and to understand the complex socio-cultural and demographic setting in which fetal programming occurs and to develop effective strategies to prevent cardiometabolic disease. Preliminary evidence of an effective population-level intervention aimed at women of reproductive age, and its potential to break the intergenerational transmission of cardiometabolic disease will be presented.

Maternal Dietary Protein Intake and the Risk for Gestational Diabetes Mellitus in a Multi-Ethnic Asian Cohort: The GUSTO Study

Pang W.W. [1], *Colega M.* [2], *Cai S.* [1], *Chan Y.H.* [3], *Padmapriya N.* [1], *Han W.M.* [4], *Tan K.H.* [5], *Lee Y.S.* [2,6,7], *Saw S.-M.* [8], *Gluckman P.* [2,9], *Godfrey K.* [10], *Chong Y.-S.* [1,2], *van Dam R.* [8,11], *Chong M.F.-F.* [2,8]

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Background: Dietary protein may affect glucose metabolism through several mechanisms. However, data on the association of dietary protein intake and risk of gestational diabetes mellitus (GDM) are limited.
Objectives: We examined the association between dietary protein intake during pregnancy and risk for GDM in a multi-ethnic Asian population.
Design: We included 980 participants with singleton pregnancies from Growing Up in Singapore Toward healthy Outcomes (GUSTO) cohort. Protein intakes were ascertained from 24hr dietary recall at 26-28 weeks' gestation. GDM was defined as fasting glucose ≥7.0 mmol/L and/or 2-hour post-load glucose ≥7.8 mmol/L at 26-28 weeks' gestation. We evaluated the association of dietary protein intake with GDM risk by substituting carbohydrate with protein in an isocaloric model using multivariable logistic regression analysis.
Results: The prevalence of GDM was 17.9% among our participants. After adjustment for potential confounders, a higher total dietary protein intake was associated with a higher risk for GDM; the odds ratio (OR) comparing the highest versus the lowest quartile of intake was 2.15 (95% CI 1.27-3.62;P-trend= 0.016). Higher intakes of animal protein (OR 2.87;95% CI 1.58-5.20;P-trend=0.001) and vegetable protein (OR 1.78;95% CI 0.99-3.20;P-trend=0.009) were both associated with a higher risk for GDM. Among the animal protein sources, higher intakes of seafood protein (OR 2.17;95% CI 1.26-3.72;P-trend=0.023) and dairy protein (OR 1.87;95% CI 1.11-3.15;P-trend=0.017) were significantly associated with a higher GDM risk.
Conclusions: Higher intakes of animal and vegetable protein, and a variety of food sources of animal protein, were associated with higher risk for GDM in Asian women.

GDM: Early Identification of Obese Women at Risk

EARLYNUTRITIONMEMBER

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Background: Increasing obesity amongst pregnant women worldwide has been associated with a parallel increase in gestational diabetes (GDM). In clinical practice all obese women are categorised as being of equally high risk of GDM whereas the majority do not develop the disorder. Our aim was to develop an early prediction tool for identification of obese women at high risk of GDM.
Methods: Clinical and maternal anthropometric data and non-fasting blood samples were obtained at 15^{+0} – 18^{+6} weeks' gestation in 1303 obese pregnant women from UPBEAT, a randomised controlled trial of a behavioural intervention (diet and physical activity). Twenty one candidate biomarkers associated with insulin resistance, and a targeted nuclear magnetic resonance (NMR) metabolome were measured. Prediction models were constructed using stepwise logistic regression.
Results: 26% of women (n=337) developed GDM (International Association of Diabetes and Pregnancy Study Group criteria, IADPSG). A model based on clinical and anthropometric variables provided an AUC of 0.71 (95% CI 0.68-0.74). This increased to 0.77 (95% CI 0.73-0.80) with addition of candidate biomarkers but was not improved by addition of NMR metabolites (0.77; 95% CI 0.74-0.81).
Conclusions: It is feasible to identify obese women at high risk of developing GDM later in pregnancy using clinical characteristics and biomarkers measured at early gestation.

Longitudinal Assessment of Maternal Anthropometric Measurements in Obese Pregnant Women: Association with Gestational Diabetes Mellitus (GDM) and Treatment

EARLYNUTRITIONMEMBER

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Introduction: We undertook a longitudinal study to investigate the pattern of change in fat distribution during pregnancy to 6 months postpartum in obese women, and investigated the influence of GDM diagnosis and treatment.
Methods: Weight, mid-arm, mid-thigh, waist circumference, and four skin fold thicknesses (SFT) were measured at three time points in pregnancy and at 6months postpartum in obese pregnant women from the UPBEAT trial (n=1,279; mean age 30.2years). Analysis was undertaken using multivariable mixed modelling stratifying on diagnosis of GDM at 27+0-28+6 weeks'. The influence of GDM treatment was investigated by interaction tests.
Results: 29.4% of women were diagnosed with GDM. Women with GDM had higher BMIs, 1.47kg/m² (95% CI 0.80 to 2.14; p< 0.001), greater mid-arm (p< 0.001) and thigh circumferences (p< 0.001) at 15-18weeks' gestation than women without GDM. Those with GDM also had significantly higher total SFT at 15-18 weeks' gestation, (p< 0.001) which was less marked although significantly higher at 27-28 weeks' (p< 0.001), 34-36 weeks (p< 0.001) and 6 months postpartum (p=0.012) compared with women without GDM. Significant interaction tests identified treatment with metformin to be significantly associated with a greater reduction in biceps SFT at 34-36 weeks' and 6months postpartum; compared to other treatment modalities (Likelihood ratio test p=0.04).
Conclusion: Body composition was different between GDM and non-GDM mothers throughout pregnancy into the postpartum period. Anthropometric measurements may indicate risk of GDM and postpartum weight retention and promote earlier intervention.
Funding: NIHR RP-0407-104522 & BRC at GSTT&KCL; CSO Scotland, GSTT Charity Tommy's Charity.

Women with Early Diagnosed GDM in DALI: Characteristics and Outcomes

Mireille van Poppel, Jürgen Harreiter, Alexandra Kautzky-Willer, on behalf of the DALI consortium.
GRAZ, AUSTRIA.

Introduction: Controversies exist on the use of IADPSG/WHO 2013 GDM criteria for the diagnosis of gestational diabetes (GDM) in early pregnancy.
Research Design and Methods: Pregnant women with a body mass index (BMI)≥29.0 kg/m2 enrolled into the DALI pan-European multicentre trials, attended an oral glucose tolerance test in early pregnancy. Demographic, anthropometric and metabolic information were obtained at enrolment. GDM was diagnosed using IADPSG/WHO 2013 criteria. Birth outcomes were obtained from medical dossiers.
Results: GDM prevalence was high (23%) in early pregnancy. Women with early GDM were significantly older, with higher pre-pregnancy BMI, waist circumference, sum of skinfold callipers, blood pressure, triglycerides and free fatty acids. Histories of GDM, macrosomia and pregnancy induced hypertension (PIH) occurred more often in women with early GDM. Women with early GDM had significantly higher insulin resistance and secretion. Among women with early GDM, PIH, spontaneous abortion, caesarean delivery, and delivery of a large-for-gestational age baby occurred more often. Gestational age at birth was reduced, but without increased risk for preterm birth. No differences in birth weight, birth length or Apgar score were found.
Conclusion: The IADPSG/WHO 2013 GDM criteria identify a substantial subgroup of women in early pregnancy with marked insulin resistance and many features of the metabolic syndrome. Pregnancy and birth outcomes were less favourable. Such women might benefit from early treatment. Criteria for GDM in early pregnancy, supported by robust evidence of the benefits of early and late treatment are urgently needed to guide modern European GDM screening and treatment strategies.

C.2: Metabolomics and Obesity in Humans

Thursday 13th October, 16.45-18.20

Opportunities of Metabolomic Studies in the Context of Early Programming

EARLYNUTRITIONMEMBER

Christian Hellmuth
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Intra-uterine or early life exposures to environmental factors are bearing risks for several metabolic diseases, like diabetes or the metabolic syndrome. Pre-pregnancy BMI, maternal stress and diet, gestational weight gain, placental function, and duration of breast-feeding are considered to have effects on infant growth and development, but underlying mechanisms remain unclear. Thus, it is worthwhile to investigate metabolic alterations of the mother, the fetus and the newborn, to unravel the link between early programming factors and later disease risk. The scientific study of a large set of small molecules in a given biological matrix such as blood plasma is called "Metabolomics" and provides a tool to investigate metabolic changes in respect to environmental exposures or identify potential biomarkers of, for instance, obesity or insulin resistance. Beyond, Metabolomics will set the route for new interventions in pregnancy and infancy tackling these non-communicable diseases. The inclusion of several studies – even though not originally set up for mechanistic metabolomic studies - with various primary outcomes and diversity in the data as well as in the studied collectives offers the possibility to answer manifold questions and hypothesis. Recent findings identified a few metabolites, like dihomo-gamma linoleic acid or branched-chain amino acids, potentially involved in early programming pathways but evidence and causality are still missing.
However, in the absence of an appropriate animal model, evidence for programming mechanisms can only be achieved with repeated, standardized analysis in several longitudinal studies.

Metabolomic Profiling Identifies a Signature of Gestational Diabetes Mellitus Associated with Diet, in a Multi-Ethnic Asian Cohort

de Seymour J. [1], Chia A.2, Sulek K. [1,3], Wong G. [4], Jones B. [5], Godfrey K.M. [6], Kwek K. [7], Mei S.S. [8], Chong Y.-S. [2,4], Karnani N. [4], Conlon C. [5], McKenzie E. [1], Chong M.F.F. [4,8,9], Baker P. [1]

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Background: The prevalence of gestational diabetes mellitus (GDM) has risen in recent years. Compared with Caucasians, Asians are at greater risk. Previous studies, predominantly in Western populations, suggest an association between maternal diet and GDM. In search for dietary markers related to GDM development we analysed the plasma metabolome of pregnant women from a multi-ethnic Asian cohort.
Methods: At 26th-28th weeks' gestation oral glucose tolerance testing and 24-hour dietary recalls were undertaken in 790 Singapore GUSTO cohort participants. Foods were assigned to one of 68 food groups. Fasted plasma samples were analysed using Gas Chromatography-Mass Spectrometry and metabolites identified using an in-house mass spectral library.
Factor analysis was conducted to group metabolites into sets and food groups into dietary patterns. The relations of metabolite sets with GDM were examined using logistic regression, and with dietary patterns using linear regression.
Results: 18% of participants were diagnosed with GDM (1999 WHO guidelines). After adjustment for confounding variables and cor-

rection for multiple comparisons, three metabolite sets were significantly associated with an increased likelihood of GDM (Set One Odds Ratio (OR) (95%CI) = 1.30 (1.03, 1.64); Set Two OR (95%CI) = 1.70 (1.36, 2.13); Set Three OR (95%CI) = 1.81 (1.44, 2.27)); a vegetables-fruit-rice-based-diet demonstrated a significant positive linear association with two of the metabolite sets associated with GDM (Set Two β (95%CI) = 0.11 (0.04, 0.18); Set Three β (95%CI) = 0.09 (0.01, 0.16)).
Conclusion: We identified three metabolite sets related to GDM, two of which were associated with a maternal dietary pattern.

Cord Blood Metabolomics and Weight Development Later in Life: Methods and Results from the GINIplus and LISAplus Studies

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Exposure to maternal factors, like obesity or diabetes in-utero, may affect offspring metabolism, growth trajectories and later-life obesity, via effects potentially observable in cord blood metabolites. We aimed to characterize associations of cord blood metabolites with birth weight, postnatal weight gain, and BMI in adolescence. Cord blood samples from 753 LISAplus study participants were analysed. Glycerophospholipid fatty acids (GPL-FA) were measured by gas chromatography. Polar lipids, non-esterified fatty acids (NEFA) and amino acids were quantified by a mass-spectrometry based metabolomic platfrom. Associations were modelled using linear regression, adjusted for potential confounding factors. Of 581 metabolites, 209 passed quality control. Birth weight was associated with significant alterations in 14 analytes. Lysophosphatidylcholines C16:1, C18:1, C20:3, C18:2, C20:4, C14:0, C16:0, C18:3, GPL-FA C20:3n9, and GPL-FAC22:5 n6 were positively related to birth weight, while higher cord blood concentrations of NEFA C22:6, NEFA C20:5, GPL-FA C18:3n3 and PCe C38:0 were associated with lower birth weight. Postnatal weight gain and BMI z-scores in adolescents were not significantly associated with cord blood metabolites after adjustment for multiple testing. However, metabolites positively associated with birth weight appeared to be (non-significantly) associated with lower postnatal weight gain. In contrast, metabolites negatively associated with birth weight tended to be positively associated with both postnatal weight gain and BMI z-scores at age 15 years. Although cord blood metabolites were highly associated with birth weight, long-term programming effects of the intra-uterine environment and metabolism on later health cannot be predicted with profiling of the cord blood metabolome.

Transgenerational Metabolomics Reveal Significant Correlations among Mother-Child Pairs

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Children are at increased risk for obesity later in life after exposure to gestational diabetes mellitus (GDM) and obesity in utero. To investigate whether metabolic profiles correlate between mothers with GDM and their offspring several years postpartum, and to analyze the effect of maternal and offspring BMI on transgenerational metabolite correlations, targeted metabolomics were measured in 75 mother-offspring pairs participating at the POGO-study. Mean age at time of analysis was 40.6± 5.0 years in mothers and 6.7± 2.2 years in offspring. Metabolomic profiles (137 metabolites) were assessed from fasting plasma collected from mother-offspring pairs during a clinical study visit. Transgenerational correlations of metabolites and metabolite classes were calculated, adjusting for gender and age of the children and age of mothers. BMI was used to classify mother-offspring pairs into concordant BMI (both obese, n=3; both non-obese, n=51) and discrepant BMI (mother obese - child non-obese; n=21) groups to investigate the effect of maternal obesity on the child metabolome. The strongest correlations were observed "within" generations, i.e. between only maternal metabolites or between only offspring metabolites. Across generations, the phospholipid lysoPC C17:0 and the acylcarnitine C18:2 showed significant positive correlations. A cluster analysis identified significant positive transgenerational correlations in arginine, ornithine and hexoses. The BMI analysis showed that PCaa C34:2 and PCae C38:3 in non-obese offspring were affected differently by discrepant maternal BMI classes. In conclusion, we identified metabolites and metabolite classes correlating strongly across generations. Obese mothers may have a moderate impact on their offspring in case of no-obesity.

Analysis of Metabolic Profiles in Adolescents from the RAINE Cohort by Clinical Targeted Metabolomics: Metabolic Consequences of Early Programming

EARLYNUTRITIONMEMBER

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The Western Australian Pregnancy Cohort (Raine) Study offers a huge possibility to study the effect of early programming factors like breast-feeding on early adulthood health and risk for non-communicable diseases, with a special focus on underlying metabolic mechanisms. Sphingomyelin (SM), and phosphatidylcholine (PC) patterns have been identified as potential markers for waist circumference, while lyso-phosphatidylcholine C14:0 was associated with HOMA-IR.
The results suggest weight status-dependent mechanisms for the development of IR with the respective lyso-phosphatidylcholine C14:0

as a key metabolite in non-obese IR.
Further, an analysis according to sex showed significant differences, not only in general, but also disease specific. More than 100 metabolites have been significantly differently associated with sex and hormonal contraceptive use, 43 were significantly different in their effect size on disease markers for the metabolic syndrome and highlighted the importance and need for sex specific analysis in metabolomics and interventional studies that also take hormonal contraceptive-usage in females into account.
However, besides a non-significant tendency for NEFA and Carn to be lower with breast-feeding duration, a general breast -feeding (duration and cut-offs) influence on obesity and the metabolome at 20 years could not be shown. For this, principal components analysis have been performed for general differences based on different breast-feeding cut-offs in months, and multiple regression models were used to look more specifically, if there are metabolites associated with breast-feeding duration.
In conclusion, metabolomics seems to be valid for cross sectional analyses, but the early programming effect might be overlapped by the 20 year factors.

A.3: Postnatal Nutrition

Friday 14th October, 10.45-12.20

Infant Nutrition and Its Effect on the Metabolome

EARLYNUTRITIONMEMBER

Franca Kirchberg
MUNICH, GERMANY

With the increasing prevalence of non-communicable diseases such as diabetes or obesity, it becomes more important to investigate and understand the triggering mechanisms. A high protein intake during infancy is suspected to stimulate the secretion of insulin and IGF-1 which in turn enhances the infant's growth ("early protein hypothesis"). The underlying metabolic mechanisms, however, still need to be clarified.
Metabolomics is the study of small-molecule metabolites. Reflecting the interaction of the genome, epigenome, transcriptome, proteome, and the environment, metabolomics facilitates the characterization of pathological conditions.
As part of the double-blind, randomized, multicenter intervention CHOP trial, we examined the metabolic responses to infant formula milk with higher or lower protein content. We obtained 691 plasma samples of 6 months old infants and determined 163 metabolites. BCAA seemed to play a pivotal role in the effect of a high protein diet on the fatty acid oxidation and fat storage in this analysis. Furthermore, the infants were clustered based on their metabolic profile with the aim to unravel underlying metabolic phenotypes. However, we could not identify stable clusters containing infants with similar metabolic profiles.
In summary, a high protein intake resulted in increased BCAA concentrations that might negatively affect fat storage and fatty acids oxidation. Moreover, as we could not identify clusters that the children can be grouped into, we have highlighted the broad diversity of the infants metabolism and their response to the formula milk.

Early High Protein Intake and Later Metabolic Health

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Aim: To investigate the short and long- term effect of high protein intake from different source (casein vs. whey) during early weaning, on body composition and glucose homeostasis, in rats.
Methods: Two groups of male Sprague Dawley rats (n=26) were fed an early weaning diets with 36% protein energy form Casein or Whey (as carbohydrate exchange in AIN93 diet) from age of 2-6 weeks. Then, all groups received a chow diet (Kliba 3437) for 30 weeks, followed by a high fat diet (Kliba 2126) for 9 weeks. Food intake, body weight, body composition (using EchoMRI™) and glucose/insulin response to OGTT were measured at different ages.
Results: After 4 weeks of experimental diet, results show benefits of Casein relative to Whey for better glucose tolerance (AUC glucose, $p< 0.05$) and better body composition (% fat mass: 36±0.4 vs 41±0.4 , $p< 0.05$). The beneficial effect on the body composition was not sustained in the long-term, however both fasting glycemia and insulinemia were significantly lower in Casein group compared to Whey group ($p< 0.05$), resulting in a better insulin sensitivity Index (HOMA-IR : 3.6 ±0.4 vs 5.4 ±0.5, $p< 0.01$), in long-term (age of 287).
Conclusion: Results highlight the influence of the protein source of early weaning diet, at high intake level, for body composition and glucose homeostasis in the short-term and insulin sensitivity in long-term, with benefit of casein vs. whey in a rat model.

A Global Perspective on the Importance of Dietary ARA and DHA Intakes from Birth to Age 3 Years

Stewart Forsyth
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For international recommendations on ARA and DHA dietary intakes in early childhood to be valid, there needs to be a greater understanding of dietary patterns across both the developed and developing world. The aim of our studies was to provide estimates of intake of ARA and DHA in infants and young children, with a particular focus on developing countries.
Food Balance Sheets from the Food and Agriculture Organisation and fatty acid composition data from Australian food composition tables were utilised to generate median per capita intake estimates for ARA and DHA in 47 developed and 128 developing countries. Median daily intake of ARA and DHA in children age 6-36 months was determined by combining the estimated fatty acid intake from breast milk and complementary foods during this period. There was a direct relationship between per capita median dietary ARA and DHA intake and the per capita gross national income of the country. Regional analysis showed lowest ARA and DHA dietary intakes per capita were located in Sub-Saharan Africa and Central and Southern Asian populations.
The estimated median daily dietary intake of ARA and DHA in infants and young children aged 6-36 months across 76 developing

countries was 64 mg/day and 49 mg/day, respectively, with the major source being breast milk. The lowest ARA and DHA intakes from complementary foods were present in low income countries with the highest birth rates. There are many populations worldwide that have ARA and DHA intakes that do not reflect current international recommendations.

Infant Feeding and Growth Trajectories in Childhood and Body Composition in Young Adulthood

EARLYNUTRITIONMEMBER

Oddy W.H. [1], Rzehak P. [2], Mearin L. [3], Mori T.A. [4], Beilin L.J. [4], Huang R.-C. [5], Grote V. [2], Weber M. [2], Szajewska H. [6], Shamir R. [7], Koletzko S. [2], Koletzko B. [2], for the WP10 working group of the Early Nutrition Project

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Background: Growth patterns of breast-fed and formula-fed infants may differ, with formula-fed growing more rapidly than breast-fed. Our objectives were to identify growth trajectories and determine the effect of early infant feeding on these trajectories to six years and body composition in young adulthood.
Design: The West Australian Pregnancy Cohort (RAINE) Study and three European cohort studies (European Childhood Obesity Trial Study), HUMIS (Norwegian Human Milk Study), Prevent CD (Coeliac Disease) collaborating in the European-Union funded EarlyNutrition project collected data on full breastfeeding, anthropometry, body composition and other characteristics. Latent growth mixture modelling was used to identify trajectory classes from 6708 participating children. Full breastfeeding < 3 months compared to 3+ months was assessed on the trajectory classes by logistic regression, and alterations in body composition at six and 20 years were tested by ANOVA.
Results: Three BMI-trajectories were identified and labelled: Class 1: Persistent, accelerating rapid growth (5%); Class 2: Early, non-persistent rapid growth (40%); and Class 3: Normative growth (55%). Following adjustment for predictors, a shorter duration of full breastfeeding (< 3 months) was significantly associated with rapid growth trajectory class 1 (OR: 2.75 95% CI 1.53-4.95) and 2 (OR: 1.97 95% CI 1.52-2.55). Both classes continued to show significant associations with greater body composition at six and 20 years.
Conclusions: Full breastfeeding of < 3 months compared to full breastfeeding for 3+ months increases the risk of rapid growth to six years impacting body composition into adulthood. Rapid growth in childhood may link infant feeding type to long-term obesity risk.

Funding: Acknowledgments are extended to National Health and Medical Research Council (NHMRC) funded participation (EU-NHMRC collaborative project ID#1037966) in the European Union project 'Long-term effects of early nutrition on later health' FP7-289346-EarlyNutrition, Coordinator: Ludwig-Maximilians-University Munich, Germany Project Director: Professor Berthold Koletzko, MD PhD. The research leading to these results has received funding from project Early Nutrition.
First both mentioned authors contributed equally and should both be considered as first author.

Allergy Prevention by Early Nutrition: 15 years of Follow Up in the GINI Study

Sibylle Koletzko [1], Andrea v. Berg, Birgit Filipiak-Pittroff, Holger Schulz, Ute Hoffmann, Elke Link, Maike Sußmann, Markus Schnappinger, Irene Brüske, Marie Standl, Ursula Krämer, Barbara Hoffmann, Heinrich Joachim, Carl-P. Bauer, and Dietrich Berdel, for the GINIplus study group.

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Aim: To assess the association between early feeding with hydrolyzed formulas in high-risk infants and allergic outcomes in adolescence.
Methods: Between 1995 -1998 newborns at allergic risk were randomly allocated to receive double blind partial whey hydrolyzate (pHF-W), extensive whey hydrolyzate (eHF-W), extensive casein hydrolyzate (eHF-C) or cow´s milk formula (CMF) during the first four months of life as breast milk substitute if necessary. Children were followed at 1, 2, 3, 4, 6, 10 and 15 years. Outcomes included cumulative incidence and period prevalence of physician-diagnosed allergies and sensitization to common allergens. Logistic and Log-binomial regression models using generalized estimation equation for repeated measures were performed.
Results: Of 2252 infants (ITT), 637 were exclusively breastfed, of the remaining 988 consumed study formula per protocol (PP). At 15 year 61% (66%) of the ITT (PP) population were followed. Between 11 and 15 years, asthma prevalence was reduced in the eHF-C group (OR 0.49, 95% CI 0.26–0.89). The cumulative incidence of allergic rhinitis was lower in eHF-C (RR 0.77, 95% CI 0.59–0.99]) and the prevalence in pHF-W (OR 0.67, 95% CI 0.47–0.95) and eHF-C (OR 0.59,95% CI 0.41–0.84). The cumulative incidence of eczema was reduced in pHF-W (RR 0.75, 95% CI 0.59–0.96) and eHF-C (RR 0.60, 95% CI 0.46–0.77), as was eczema prevalence between 11 and 15 years in eHF-C (OR 0.42, 95% CI 0.23–0.79).
Conclusion: In high-risk children, early feeding with certain hydrolyzed formulas compared with CMF has long-term health effect on allergic diseases.

B.3: Psychosocial Stress, Mental Health and Biological Impact

Friday 14th October, 10.45-12.20

Interaction of Prenatal Psychosocial Stress and Nutrition: Implications for Maternal and Infant Metabolic Outcomes

EARLYNUTRITIONMEMBER

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Two of the most independently studied prenatal factors to influence fetal development and pregnancy/offspring outcome are maternal nutrition and psychosocial stress, yet their combined or interactive effects are considerably understudied. Evidence from non-pregnant animal and human studies suggests that psychosocial stress influences eating behaviour by inducing increased consumption of palatable foods high in fat and sugar. On a physiological level, the hormonal cascade response to stress influences metabolism by suppressing insulin action and promoting gluconeogenesis and lipolysis, in order to raise plasma glucose and free fatty acids. In pregnancy, endocrine function and glucose and lipid metabolism are substantially altered from the non-pregnant state and also naturally change across gestation to support the developing fetus. Thus, prenatal stress exposure has significant potential to alter maternal nutrition on both a behavioural and physiological level. Given the public health urgency of the current childhood obesity epidemic, the potential implications of prenatal stress-nutrition interactions on the programming of infant adiposity and subsequent offspring obesity warrant investigation. The UC Irvine Ecological Momentary Assessment (EMA) study prospectively assessed prenatal behavioural, psychological and physiological exposures among healthy pregnant women. Metabolomic analysis of maternal plasma samples facilitated detailed analysis of whole body metabolism at each trimester. In this cohort, we have identified metabolomic profiles significantly associated with raised maternal pre-pregnancy BMI that may contribute to "fetal programming" of adiposity in the neonate. This presentation will further describe interactions between maternal psychosocial and biological stress profiles with nutritional intake and metabolism, and the implications for infant adiposity.

Brainstem Oxidative Stress Is Associated with Hypertension and Elevated Cardiovascular Responses to Psychological Stress Following Maternal High Fat-High Sucrose diet

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There is mounting evidence that diets high in fat and sucrose (HFS) during pregnancy have epigenetic impacts on the offspring. We hypothesise that maternal HFS diets may elevate oxidative stress (OS) in brainstem cardiovascular control centres in the adult offspring and alter cardiovascular responses to psychological stress.
Sprague-Dawley dams were fed a HFS diet (21% fat, 34% sucrose; control, 4.8% fat, 0% sucrose) from 4 weeks prior to mating until weaning. Three-month old offspring were assessed for levels of the antioxidant glutathione and the OS marker protein carbonyl (PCs) in brainstem regions of male offspring. At 9-12 months, cardiovascular variables were acquired at rest and during mild (air jet, AJ) and moderate (restraint, RS) psychological stress using telemetry (control n=5; HFS=6).
HFS offspring exhibited greater retroperitoneal adiposity (p=0.02) and increased OS in the hypothalamus, comprising a two-fold increase in PCs (p=0.05) and 40% reduction in glutathione (p=0.08). A trend for greater medullary PCs was also observed (p=0.08). Resting mean blood pressure (BP) was higher in HFS (96±2.0mmHg vs 85±1.5mmHg, p=0.02) and cardiovascular responses to stress were enhanced. Both stressors elicited greater initial increases in BP (AJ, 22mmHg (p=0.001) vs 17mmHg (p=0.02); RS, 34mmHg (p=0.001) vs 28mmHg (p=0.05)) and slower recovery. At 45 minutes post-RS, BP remained elevated in HFS (+13±5.6mmHg from baseline, p< 0.05), but not controls (+0.2±3.1mmHg). RS also produced a greater heart rate (453bpm vs 394bpm, p=0.04).
We suggest that maternal HFS elicits increased OS and programs a pro-hypertensive phenotype characterised by exaggerated cardiovascular responses to stress.

Prenatal Stress and Fetal Programming of Obesity Risk: Association of Maternal Cortisol during Gestation with Infant Body Composition

EARLYNUTRITIONMEMBER

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Background: Glucocorticoids play a key role during intrauterine development in cellular growth and differentiation. Evidence supports the premise that exposure to excessive concentrations of glucocorticoids produce alterations in fetal physiological systems that may increase the risk for obesity in later life. However, this question has not yet been systematically addressed in humans.
Objective: To elucidate the magnitude and stage of gestation-specific prospective association in humans of maternal cortisol concentrations during pregnancy with infant adiposity in early postnatal life.
Methods: N=68 newborns from a prospective-longitudinal pregnancy cohort were followed over the early postnatal growth phase until 6 months age. Maternal diurnal salivary cortisol profiles were assessed at 4 consecutive days in early (≅3 wks gestation, T1), mid (≅24 wks gestation, T2) and late pregnancy (≅30 wks gestation, T3). Infant body composition was assessed in the newborn period and at 6 months postnatal age directly with Dual-energy X-ray absorptiometry (DXA) measures and also indirectly with ponderal index measures.
Results: 1) After adjusting for potential confounding factors, higher maternal cortisol concentrations during the beginning of the third trimester of pregnancy were significantly associated with a higher gain in percent body fat (%BF) from 0-6 months age (partial r (adjusted for covariates)=0.363, p=0.009), accounting for approximately 13% of the variance in this measure of childhood obesity risk. 2) Commonly-used weight- and length-based proxy measures of infant adiposity (i.e., ponderal index) were only weakly associated with the direct measures of infant adiposity used in our study and were not useful in elucidating the putative effects of maternal cortisol in pregnancy with childhood obesity risk.
Conclusions: The present findings suggest a stage of gestation-specific effect of maternal cortisol (early third trimester) on subsequent

infant adiposity gain in early postnatal life and add evidence in humans to support the role of glucocorticoids in fetal programming of obesity risk.

Microglia Activation Precedes Sympathetic-Mediated Hypertension in Offspring of Obese Mice Dams

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Objective: Mounting evidence suggests that overactive immune response during pregnancy alter the development of the central nervous system in the foetus. An increased concentration of pro-inflammatory cytokines has been demonstrated in amniotic fluid of obese pregnancy. This study investigates if low-chronic inflammation, during brain development may have enduring effects on hypothalamic immune system in the offspring leading to autonomic disturbances and sympathetic mediated hypertension arising from maternal obesity.
Design and method: C57BL/6J female mice were fed either a standard chow (7% simple sugars,3% fat) or a highly palatable obesogenic diet (33% simple sugars, 16% fat) 6 weeks prior to mating and throughout gestation and lactation. Offspring were then weaned onto standard chow. Serum samples were collected at gestational day 18 (GD 18), postnatal day 21 and 3 months of age for multiplex cytokine assay. Arterial pressure was telemetrically monitored at 2 and 3 months of age. Hypothalamic microglia, the resident immune cells were isolated using MACS flow cytometry in 2 month old (pre-hypertensive) offspring for pro-inflammatory QPCR analysis.
Results: Diet-induced obese dams demonstrated an enhanced serum pro-inflammatory cytokine profile at GD 18. Serum IL-6 and necrosis factor alpha (TNF- β) concentrations were twice as high in offspring of obese dams (OffOb) as neonates ($P < 0.05$, n=6) and adult ($P < 0.05$, n=10). Pre-hypertensive OffOb mice (at 2 months) demonstrated enhanced microglia (CD11β) activation.
Conclusions: Maternal obesity programmes hypothalamic microglial activation which precedes sympathetic mediated hypertension in offspring of obese mice.

Newborn Insula Gray Matter Volume is Prospectively Associated with Early Life Adiposity Gain

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Obese children are at greater risk of being obese as adults and developing obesity-related diseases of greater severity. The use of structural and functional MRI has recently helped elucidate the importance of energy homeostasis brain circuitry in adult obesity, yet the developmental time course of this circuitry is unknown. Here, we investigate the association between newborn gray matter (GM) volume in the insula, a brain region underlying energy homeostasis, and rate of fat accrual in the first six months of postnatal life, an outcome thought to be among the most reliable infant predictors of childhood and adult obesity. 52 neonates were assessed using structural MRI within the first month of life and longitudinal Dual X-Ray Absorptiometry shortly after birth and at six months of age. Insula gray matter (GM) volume was inversely associated with change in body fat percentage from birth to six-months postnatal age (R^2=19%; p=0.001). The association between insula volume and infant adiposity gain was driven by regions of the insula relevant for gustation and interoception, the direction of effect was in concordance with observations in adults, and the results remained statistically significant after adjusting for relevant confounding variables. Together, these findings suggest an underlying neural basis of childhood obesity that precedes influence from the postnatal environment, thus facilitating the identification of fetal determinants and the discovery of novel strategies for the primary prevention of childhood obesity.

C.3: Placental Nutrient Transfer

Friday 14th October, 10.45-12.20

Maternal Gestational Diabetes Mellitus and Placental Lipids

EARLYNUTRITIONMEMBER

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Epidemiological observations have shown a link between maternal obesity, pre-pregnancy diabetes as well as gestational diabetes mellitus (GDM) and higher risk for offspring obesity. An unhealthy nutrient supply in early life which programs the fetal metabolism and stays persistent during infancy and childhood has been suggested as the underlying mechanistic background. Increased birthweight, related to childhood obesity, is a consequence of higher fetal fat accretion which is clearly related to lipid metabolism but not necessarily to enhanced placental fatty acid transfer. The study of a large set of small molecules related to energy and lipid metabolism in mothers during pregnancy, in placentas as well as in cord blood of large cohorts and intervention studies enables to investigate changes in the maternal, placental and fetal metabolism induced by metabolic abnormalities or diet. Specific questions such as the preferred transfer of long-chain poly unsaturated fatty acids, which is known to be limited in GMD, as well as the ability of the placenta to adapt for profuse nutrient supply e.g. in lipid droplets, are objectives of current research. Recent findings identified decreased glycerophospholipid species with dihomo-gamma-linolenic acid and increased species with arachidonic acid and docosahexaenoic acid in placentas of obese and lean GDM, with unknown consequences for the fetus. Glycerophospholipid species with dihomo-gamma-linolenic acid came under suspicion to be related to the transfer of obesity from mothers to the infant, since maternal plasma level of these species were related to pre-pregnancy BMI and cord blood level were associated with increased birth weight.

Programming of the Endocrine Pancreas: Does Intra-Amniotic IGF1 Therapy Following Placental Restriction in Sheep Improve Insulin Secretory Capacity in Young Adulthood?

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Intrauterine growth restriction (IUGR) is associated with a decreased ability to mount an insulin response to a metabolic challenge in adulthood. Identifying a treatment for IUGR that normalises pancreatic development could alleviate the risk of developing metabolic disease.
We investigated long-term effects on pancreatic function of intra-amniotic IGF1 treatment in IUGR fetal sheep. Singleton-bearing ewes underwent uterine artery embolisation between 103-107 days of gestational age, followed by five once-weekly intra-amniotic doses of 360µg IGF1 (IUGR-IGF1) or saline (IUGR-Saline), compared to an unmanipulated (Control) group. Eighteen-month old offspring underwent body composition assessment (DXA), intravenous glucose tolerance test and *post mortem*. RNA was isolated from snap-frozen pancreata, and RT-qPCR performed for 14 genes, normalised to a panel of housekeeping genes (Alpha=0.01).
Body composition was different between sexes but not groups. Insulin secretion following a glucose bolus was 58% greater in the first 15 minutes in IUGR-Saline males vs. control and IUGR-IGF1 males ($p< 0.05$). Expression of genes involved in insulin secretion and mitochondrial function were altered in IUGR-Saline vs. control animals: SLC2A2 (M: 1.39-fold; F: 1.25-fold), glucokinase (M: 1.30-fold; F: 0.81-fold), UCP2 (M: 2.06-fold; F: 1.67-fold) and insulin (M: 1.49-fold; F: no change). IGF1 treated animals only showed altered expression of glucokinase (M: 1.14-fold; F: 1.32-fold) and UCP2 (M: no change; F: 1.31-fold) genes, vs. control.
These data suggest that, in sheep, the effect of IUGR on pancreatic gene expression has been partially 'normalised' by intra-amniotic IGF1 treatment, suggesting possible amelioration of the risk of developing metabolic syndrome following IUGR.

Placental Expression of Fatty Acid Transporter Related to Maternal Pre-Pregnancy Weight

EARLYNUTRITIONMEMBER

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Placental fatty acid (FA) uptake and metabolism depend on maternal nutrient supply which may be compromised when women have a high pre-pregnancy body mass index (BMI). As a consequence, an impaired FA transport to the fetus may compromise fetal development. Placental adaptation of maternal-fetal glucose transfer in mild gestational diabetes has been already described; however, knowledge on placental FA acid metabolism and possible adaptations in response to other maternal unfavorable intrauterine environment, as obesity, is lacking. We aimed to analyze the expression of genes involved in FA uptake and metabolism in placentas from healthy-normal-weight pregnant women ($18.5 \leq BMI < 25$ kg/m2) and from obese pregnant women with high pre-pregnancy BMI ($BMI \geq 30$ kg/m2). Placental mRNA expressions of key FA transporters (FATP1, FATP4, FATP6, FABP3, FABP4, FABP7, FAT/CD36, EL, LPL) were quantified by RT-PCR. mRNA expression group comparison were performed by Kruskal-Wallis test due to non-normal distribution. High pre-pregnancy BMI was associated with decreased placental FATP1, FATP4, EL and increased FAT/CD36 and FATP6 expressions. LPL mRNA levels were found unchanged between groups. In addition, differences in weight of newborn and placenta were found in obese group compared to normal weight group (550±222 vs. 500±140 g, $P< 0.05$; 3540±637 vs. 3260±445 g, $P< 0.05$, respectively).
Conclusion: Our results suggest that high pre-pregnancy BMI alter mRNA expression levels of genes involved in FA uptake and metabolism which could affect fetal development and long-term health.

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Placental Lipids and Fatty Acid Transfer in Maternal Overnutrition

EARLYNUTRITIONMEMBER

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Fetal development in maternal overnutrion (gestational diabetes mellitus, obesity) is characterized by an excessive fat accretion. Because of its key role in mediating maternal-to-fetal nutrient transfer, the placenta has been regarded as contributing to this fetal/neonatal phenoytpe. The underlying assumption has been a placenta-mediated augmented maternal-to-fetal nutrient transfer, especially of glucose and fatty acids. However, recent *ex vivo* placental perfusion experiments as well as *in vivo* stable isotope studies failed to provide any evidence for an enhanced transfer of fatty acids making up the bulk of fetal adipose fat (C16:0 palmitic acid). Only docosahexaenoic acid (C22:6) transfer is altered. DHA is most important for brain and retinal development, but represents only a minor portion (<2%) of fetal fat.
Some placental fatty acid transporters (FATP1, FATP3) are upregulated in maternal obesity and correlate with maternal BMI. This may account for more fatty acids being taken up by the syncytiotrophoblast, the outermost placental tissue. There they enter metabolic pathways, predominantly leading to lipid storage. This is accompanied by changes in some proteins involved in the regulation of syncytiotrophoblast lipid storage. The placenta contains more triglycerides in maternal obesity than in lean pregnancies. Storage capacity is limited and at higher maternal BMI triglyceride mobilization may balance formation of new lipid droplets.
Thus, the placenta appears to serve as a buffer protecting the fetus from an oversupply with maternal nutrients. Only when the capacity of the buffer is exhausted, nutrients may spill over to other metabolic pathways (supported by FP7-project Early Nutrition, grant agreement n°289346).

A.4: Early Life Gut Microbiome and Long-Term Health

Friday 14th October, 14.30-16.05

Determinants and Duration of Impact of Early Gut Bacterial Colonization

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A significant role for the gut microbiota in chronic diseases ranging from obesity and cardiovascular disease to allergy, autoimmune diseases and autism has been proposed based on differences in the gut microbiome in these conditions as well as increasing knowledge of the effects of bacterial metabolites and fragments on several human systems. A key common element is low diversity in bacterial populations.
The gut is colonized in the first months of life and the microbiota matures slowly over the first two years. The early factors which have been established in different cohort studies to determine the diversity and composition of the microbiome include mode of delivery, perinatal antibiotics, infant feeding method, geography and weaning.
It has also been suggested that prenatal events such as placental transfer of bacteria and transmission of bacteria in breast milk are possible additional routes for colonisation of the newborn infant which may be selectively promoted by maternal physiology. The evidence for this is less clear.
As the adult microbiome is believed to be quite stable, it is important to consider ways that the initial colonisation process can be optimised. However, our understanding of the duration of the effects of early life events on the microbiota is uncertain but may be important in identifying the modifiable factors which can be manipulated to promote long term health.

Pediatric Obesity Is Associated with Altered Gut Microbiota Communities

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Gut microbiota co-develops with its host from birth and is subjected to a complex interplay that is influenced by host genome, nutrition, and lifestyle. The goal of the present study was to compare the gut microbiota of obese and normal-weight children communities with short chain fatty acids production (SCFAs) and BMI z-scores to gain insights into the structure and activity of the microbiota in pediatric obesity.
Seventy-eight children (36 males/42 females, 9-16 y) were enrolled at the Pediatric Department of San Paolo Hospital in Milan. Children's BMI was calculated by reported weight/height² (kg/m²), transformed to age and sex-specific z-scores. Fecal samples were collected, total bacterial DNA extracted and fecal SCFAs quantified by capillary electrophoresis. 16S rRNA gene sequencing was performed using Illumina MiSeq platform. Statistical analysis was made using the statistical software R.
Intestinal microbiota of obese children was enriched in *Firmicutes* (N: 60.9±14.1, O: 72.1±12.1; mean±sd) and depleted in *Bacteroidetes* (N: 30±12.6, O: 16.6±11.8). Accordingly, the *Firmicutes/Bacteroidetes* ratio was significantly elevated in obese children ($p < 0.0001$; N: 2.6 ± 1.83, O: 7.7 ± 7.1). We observed significantly higher concentrations of acetate, propionate, and butyrate, as well as total SCFAs, in feces of obese compared with normal-weight subjects ($p < 0.05$ for all comparisons). BMI z-score and SCFAs were significantly correlated with microbiota composition at every taxonomic level (OTU to phylum; $p < 0.05$) especially with *Bacteroidetes and Firmicutes*.
Our results suggest that gut microbiota dysbiosis and elevated fermentation activity may be involved in the etiology of childhood obesity.

Dysbiosis in Health and Disease – the Microbiome at Early Life Stages

Dirk Haller
Technical University of Munich, Chair of Nutrition and Immunology, ZIEL Institute for Food and Health, FREISING, GERMANY

Human cohort studies demonstrated changes in gut microbiota composition and function (microbiome dysbiosis) in a variety of different pathologies. Development of the gut microbiota in infants is a dynamic process suggested to be critically important for health later in life. Since the colonization mechanisms and factors associated with this process are still largely unknown, we designed a randomized, placebo-controlled intervention trial to assess the impact of early-life intervention with bifidobacteria-supplemented infant formula on the development of intestinal bacterial communities. Stool samples from 106 healthy neonates receiving infant formula with or without a mixture of bifidobacteria. High-throughput 16S rRNA amplicon sequencing and high-resolution mass spectrometry (UPLC-MS) were used to analyze fecal samples collected over a period of two years. Species richness and Shannon effective diversity was not significantly affected by the intervention. Distinct clusters of bacterial communities and metabolite profiles were observed between formula- and breast-fed infants at early age but then converged over time. These shifts were accompanied by the presence of lipid-related and unknown metabolites. Interestingly, none of the formula-derived bifidobacteria were detected in feces after two years. Independent of bifidobacteria supplementation, levels of pyruvate and lactate were high in breast-fed infants, while propionate and butyrate were abundant in both formula-fed groups. In conclusion, infant formula compared to breast milk influences the assembly and metabolite profile of the early life microbiome, particularly associated with increased bacterial diversity. Effects of bifidobacteria-supplemented formula disappeared shortly after the neonatal stage.

Maternal Exposure to a Western-Style Diet Causes Differences in Intestinal Microbiota Composition and Gene Expression of Suckling Mouse Pups

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Scope: The long-lasting consequences of nutritional programming during the early phase of life have become increasingly evident. The effects of maternal nutrition on the developing intestine are still underexplored.
Methods and results: We investigated in mice the effects of a maternal Western-style (WS) high fat/cholesterol diet, given perinatally, on gene expression and microbiota composition of two-week-old offspring.
Deep-sequencing analysis of colonic luminal content demonstrated dysbiosis in the microbiota composition of the offspring of WS diet-exposed dams including an increased Firmicutes : Bacteroidetes ratio and an altered relative abundance over various genera (i.e. Alistipes and Akkermansia). Microarray analysis revealed significant changes in gene expression in the small intestine and colon of the suckling offspring, which were strongly sexually dimorphic. However, pathway analysis of the differentially expressed genes displayed that in both sexes metabolic and immune functions were strongly affected. Integration of the microbiota and gene expression data, by applying multivariate correlation analysis revealed that Bacteroidaceae, Porphyromonadaceae and Lachnospiraceae were the bacterial families that most strongly correlated with gene expression in the colon and not with the bacterial families displaying the most pronounced change due to perinatal exposure to a WS diet. Amongst the genes demonstrating a strong correlation with one or more bacterial families were genes of key importance for intestinal development or functioning (i.e. *Pitx2* and *Ace2*).
Conclusion: Our data reveal that maternal consumption of a WS diet during the perinatal period alters both gene expression and microbiota composition in the intestinal tract of two-week-old offspring.

Intestinal Microbiology of Early Life

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The intestinal microbiota forms an integral part of normal human physiology, and in recent years disturbances of the normal gut microbiology have been linked to some important health and disease issues. Newborns are essentially sterile, but the complex, high density microbiota establishes from the very first minutes of life. The first colonizers play an important role in the development of the microbial ecosystem which may indeed steer the long-term composition and activity of the microbiota, and therefor also directly the symbiosis with the host that is so important for health. Considering the importance of the microbiota on the human immune, metabolic, and even neurological systems, it is important to understand the dynamics and driving determinants of this development.
Exclusive human milk feeding is considered the first choice of infant nutrition, not only providing optimal nutrition, but also bioactive components that are crucial for optimal gut development, immune maturation, metabolic development, and even cognitive development. Human milk also has an important impact on the microbiology of the gut as there are many components in human milk that have growth stimulating or growth inhibiting effects on the different types of micro-organisms that an infant can be exposed to. Besides the diet also host genetics, mode of delivery, the use of antibiotics and other variables can impact the early microbiota. Some of these microbiome drivers will be discussed, as will be the potential consequences for health in early and later life.

B.4: Early Nutrition in Low Resource Settings

Friday 14th October, 14.30-16.05

How to Do Interventions in Early Nutrition with Your Bare Hands: An Example in Guatemala

Michele Monroy-Valle [1], *Eunice López-Pazos* [2], *Maira Ruano* [3]
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Child community-based growth promotion as a Primary Health Care intervention is a policy in Guatemala, but it struggles constantly between lack of resources as money to train and pay the Community Health Workers, authorities trying to shorten the amount and coverage of interventions, and population demanding the services, in a county where minimum is the standard and social determinants of malnutrition as poverty, inequity, discrimination lead almost half of the children stunted. The objective is to resume the decisions and tasks that were done to institutionalize as a "package" scattered interventions to improve quality of healthcare focusing on 1000 days extending to under 5 by establishing a process where interventions such as immunization, acute malnutrition treatment, breastfeeding promotion, micronutrient supplementation, food fortification, and others were delivered to all in a frequency that would allow the health system to ensure timely action close monitoring cases of acute malnutrition and reduce mortality from this event. Through literature review, interviews and field observation; interventions and its coverage were identified. Strategy was designed as a "package" where weight length/height measurement and nutritional status is added as key to aware the caregiver, CHW and epidemiological surveillance. A booklet personalize by sex, delivery of services control forms and the online system were designed as inputs to ensure demand - delivery of personalized intervention. Then validated through a pilot field in 2009. Currently the system takes monthly data, generating early warnings of acute malnutrition and treatment of the country's 22 departments, but impact is difficult to measure.

Pica Practices, Food Cravings and Aversions among Pregnant Women in Kenya

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Pica, food cravings and aversions are common during pregnancy and may have a significant input on pregnancy progress and outcome. A study was carried out to determine the frequency and duration of pronounced dietary cravings, aversions and pica practices during pregnancy among 200 pregnant women attending health facilities in Kakamega, Kenya. Food craving was reported by (73.8%) of the study participants and nearly half (48.7%) had food aversions. Foods craved most were maize meal (12.5%), mangoes (9.5%), ripe banana (8.3%) beef (7.6%), and fish (5.7%). Foods avoided most were small fish (omena) (15.2%), beef (12.6%) kale (11.9%) and fish (10.6%). Eggs, tea and milk were also avoided. Reasons given for avoiding foods were to reduce nausea (45.8%), caused vomiting (21.9%) and heartburn (10.4%) others were unpleasant smell/taste, stomach ache and no particular reason. Pica prevalence was at 27.4%, geophagia (consumption of soil) and lithophagia (consumption of stones) was the most common. In this study there was a significant association between pica practice and level of education, history of child death/still birth and Hb level. Unhealthy cravings for non food items should be discouraged as there is no known nutritional benefit of such habits and can lead to intestinal worms, stomach pains and infections. Food cravings, aversions and pica practices should be accessed during antenatal care and pregnant women guided on proper food choices for better health.

The Triple Burden of Malnutrition in Sub-Saharan Africa: Translating Knowledge into Action

Reginald A. Annan

Department of Biochemistry and Biotechnology, College of Science, Kwame Nkrumah University of Science and Technology, KUMASI, GHANA

Undernutrition, overweight/obesity and associated Non-Communicable Diseases (NCDs), and micronutrient deficiencies persist in many resource-poor countries, including Sub-Saharan Africa (SSA). In spite of progress made over the years, stunting affects 51 million and wasting affects 10.9 million children under 5 years of age. About 14.0% of SSA children are born with low birth weight (LBW), and close to 4 in 10 women (76.7 million) have anaemia, a risk factor for maternal mortality. About half of pre-school children in the region are vitamin A deficient, over twice the global prevalence, and only 11 of 48 countries in the region have optimal iodine nutrition. Levels of overnutriton and associated chronic diseases are also increasing. Over 5% of under-5 children are overweight, 14% and 3.2% of adolescents are overweight and obese respectively, while 40% of adults are overweight or obese. The situation in the region confirms the understanding of foetal origins of adult diseases, implyinh that many undernourished girls/boys are ending up as stunted obese adults, with increased risk of NCDs. Undernourished pregnant women are giving birth to LBW children, who have increased risk of poor growth, cognitive and economic development. The intergenerational malnutrition cycle therefore perpetuates in the region, calling for concerted and coordinated action to address it. The role of proper nutrition prior to and during pregnancy, and for the first 1000 days of the child's life has been established. Effective interventions to achieve this, including breastfeeding, dietary diversification, food fortification and supplementation are known. Coherence of policy, coordination of action and financial commitment for scaling up these interventions are urgently required.

The Influence of Socioeconomic Status on Gestational Weight Gain: A Systematic Review

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Background: Gestational weight gain is associated with pregnancy outcome and recommendations for gestational weight gain were published by the Institute of Medicine in 2009. Despite a large number of publications that have examined the association between socioeconomic status and gestational weight gain, the findings in the literature are inconsistent. This, therefore, is a systematic review of current evidence relating to the association between socioeconomic status and gestational weight gain.
Methods: Six electronic databases were searched, with the final search run on 25th January 2016. The PRISMA Statement guidelines were followed and a modified version of the RTI Item Bank was used to assess risk of bias in individual studies. The primary outcome was inadequate, adequate or excessive gestational weight gain, as per the Institute of Medicine 2009 guidelines.
Results: The review identified 16 studies for inclusion. Maternal educational attainment was the most commonly identified socioeconomic status measures relating to gestational weight gain, with a positive skew in the number of studies that indicated that those who are less well educated are most at risk of gaining weight outside of the recommendations. Other measures of socioeconomic status were not significantly associated with gestational weight gain.
Conclusions: Low educational attainment is likely to be associated with women gaining outside the Institute of Medicine recommendations for gestational weight gain. Healthcare providers should provide additional support to pregnant women who are most at risk of gaining outside the recommendations, thus reducing the gap in health inequalities between those of high and low socioeconomic status.

Early Life Nutritional Programming of Health and Disease in The Gambia

Sophie E. Moore

MRC Human Nutrition Research, CAMBRIDGE, UK

Exposures during the early life (periconceptional, prenatal and early postnatal) period are increasingly recognised as playing an important role in the aetiology of chronic non-communicable diseases (NCD). The 'Developmental Origins of Health and Disease' (DOHaD) hypothesis asserts that adverse early-life exposures – most notably unbalanced nutrition – leads to an increased risk for a range of NCDs, including coronary heart disease, stroke, hypertension, Type 2 diabetes and osteoporosis, and that disease risk is highest when there is a 'mismatch' between the early- and later-life environments. Thus, the DOHaD hypothesis would predict highest risk in countries where food insecurity creates nutritional vulnerabilities for pregnant women and their offspring, yet within the same contexts we observe a rapid transition to nutritional adequacy or excess in adulthood.
In this presentation, I will review data from our work conducted in rural Gambia, West Africa. Using demographic data dating back to the 1940s, the follow-up of randomised controlled trials of nutritional supplementation in pregnancy and the 'experiment of nature' that seasonality in this region provides, we have investigated the DOHaD hypothesis in a population with high rates of maternal and infant under-nutrition, a high burden from infectious disease, and an emerging risk of NCDs.

C.4: Early Programming of Taste and Appetite

Friday 14th October, 14.30-16.05

Development of Food Preferences and Appetite in the First Years

Sophie Nicklaus

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Infants are born equipped to ingest nutrients, but have to learn how, what and how much to eat. This must occur early, because the mode of feeding evolves dramatically, from "tube" feeding in utero to eating table foods with the family. Eating habits established during early years contribute to the development of subsequent eating habits. Therefore, it is fundamental to understand the most important early periods for the development of eating habits and the drivers of this development. Here we will focus on the first three years of postnatal life. Several characteristics of the eating experience contribute to drive infant's eating and to shape preferences and energy intake control: food sensory properties; food energy density, social context of eating. The learning processes involve repeated exposure (including to a variety of flavours), association with post-absorptive consequences (energy density) and with contextual signals (interaction with family members). Beyond the first flavour discoveries during the prenatal and lactation periods (through the infant's exposure to flavours from foods of the mother's diet), the most important phases for learning food preferences and appetite control may be the beginning of complementary feeding. Infants discover the sensory (texture, taste and flavour) and nutritional properties (energy density) of the foods that will ultimately compose their adult diet; parents are still in charge of providing appropriate foods, timing, context for eating. Inter-individual differences in learning, related to temperamental dimensions, to sensitivity to food cues (sensory cues or energy density) are large and also have to be taken into account.

Age at Introduction of Solid Foods and Feeding Difficulties in Childhood: Findings from the Southampton Women's Survey

EARLYNUTRITIONMEMBER

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Aim: To determine whether age at introduction of solid foods in infancy is associated with feeding difficulties in children at 3 years of age.

Methods: The study was conducted using data from the UK Southampton Women's Survey (SWS). Women enrolled in the SWS who subsequently became pregnant were followed up during pregnancy and postpartum, and the offspring have been studied through childhood. Maternal sociodemographic and anthropometric data, and child anthropometric and feeding data, were collected through interviews and self-complete questionnaires. Mothers rated 6 questions focused on potential child feeding difficulties using a 4-point Likert scale, including 1 general question and 5 specific feeding difficulty questions. Age at introduction of solids as a predictor of feeding difficulties was examined, adjusting for child and maternal confounders.

Results: A total of 2,389 mother-child pairs were studied. The majority of mothers (61%) reported some feeding difficulties (general question) at 3 years. Mothers reported that their child was not eating enough food (61%), eating the right food (66%), and being choosy with food (74%). There were few associations between feeding difficulties in relation to age at introduction of solid foods. However, independent of potential confounding influences, children who were introduced to solid foods ≥ 6 months had a lower relative risk of infant feeding difficulties (adjusted RR=0.73 (95%CI=0.59; 0.91), p=0.004) than children introduced to solids between 4 and 6 months.

Conclusion: Among children aged 3 years, general feeding difficulties were less common among infants introduced to solid foods at or after 6 months of age.

Transmission of Food Aromas into Human Milk - an Active Early Programming Trigger or rather a Passive, Metabolically-Controlled Phenomenon?

A. Buettner [1], J. Beauchamp, M. Denzer-Lippmann, F. Kirsch, H. Loos, S. Sandgruber, L. Scheffler, C. Sharapa

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Exposure to flavors in early developmental stages is believed to influence food preferences in later stages of human life. Regular consumption of carrot juice during the breastfeeding period, for example, was demonstrated to influence facial expressions in infants whose mothers regularly consumed carrot juice, whereby those infants were found to react more positively to being exposed to carrot flavor themselves. Similarly, changes in consumption patterns and behavioral responses have been observed for garlic consumption, leading to the assumption that aromas are transmitted from foods into human milk and a presumed early conditioning effect. On the other hand, biotransformation processes may lead to substantial modification of ingested food aroma constituents, comprising both degradation and formation of sensorially active substances.

Chemo-molecular studies on this topic are scarce, thus our goal is to focus on characterizing the underlying physiological and chemical processes involved in the potential aroma transmission processes in human milk. Sensorially-relevant aroma substances from different nutritional interventions, together with their potential metabolites, are monitored in milk of human subjects, as well as in their urine and exhaled breath. Biotransformation and transmission, as well as elimination processes, are thereby monitored under real-life conditions. A specific focus is made on every-day dietary constituents that are of relevance for breastfeeding mothers.

Antecedents of Picky Eating Behaviour in Young Children

Emmett P. [1], Hays N.P. [2], Taylor C. [1], Avon Longitudinal Study of Parents and Children

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Picky eating behaviour in young children is of concern to parents and has been associated with lower intakes of some micronutrients and increased risk for underweight. Data from the Avon Longitudinal Study of Parents and Children were used to explore the antecedents of picky eating behaviour (n=6547). Parent-completed questionnaires were used to obtain feeding behaviours/practices and child diet at 15 months and to determine picky eater status (defined as having definite food likes/dislikes) at age 38 months. In regression analyses adjusted for sex, parity, birthweight, maternal age and education, being considered "choosy about food" at 15 months was strongly associated with being a picky eater at 38 months (odds ratio 3.2 [95% confidence interval: 2.5, 4.0], p< 0.001). If the parent was greatly worried about the child's choosiness this association was much stronger (6.0 [3.2, 11.3], p< 0.001). Giving the child main meals of ready-prepared foods was also associated with a greater likelihood of being a picky eater later (2.4 [1.4, 4.0], p=0.001). Feeding practices at 15 months that were associated with a reduced likelihood of later picky eating included the child mostly (0.27 [0.18, 0.41], p< 0.001) or sometimes (0.40 [0.27, 0.61], p< 0.001) eating the same meal as the mother, and the child being given fresh fruit daily (0.55 [0.39, 0.76], p< 0.001). Specific child and parental feeding behaviours/practices were associated with later picky eating, and the parent being worried about the child's choosy behaviour greatly increased the likelihood of the child continuing to be a picky eater.

Early Exposure in Promoting and Programming Healthy Eating

Marion M Hetherington
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Flavour exposure begins *in utero* and after birth babies experience a variety of flavours through breastmilk. Experience of flavour continues during complementary feeding which is a sensitive period for developing preferences for food flavours which can be enhanced by repeated exposure. In a series of small scale studies, we have explored the ways in which mothers provide their solid foods to their infants, specifically vegetables and we have tested systematically a step by step approach to adding novel vegetable flavours to breast or formula milk to encourage liking and intake, as well as exposure to novel vegetables during the pre-school period. Across all studies conducted to date through both the HabEat and VIVA projects, a consistent finding emerges that age predicts intake of familiar and novel vegetables, that intake increases by the 5th exposure and that individual differences contributing to food avoidance/approach are significantly associated with willingness to consume vegetables. Older children are more reluctant to try new vegetables and they express greater levels of neophobia than young children. Overall, food preference and acceptance develop early in life, it is enhanced by repeated and varied exposure specifically to novel vegetables forming the foundation of healthy eating.

A.5: Nutritional Epigenetics of Obesity

Friday 14th October, 16.30-18.05

Does Epigenetic Variation Impact Type 2 Diabetes?

Charlotte Ling
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It is well established that combinations of genetic and environmental factors affect the susceptibility for metabolic disease e.g. type 2 diabetes. While ageing, obesity and physical inactivity represent non-genetic risk factors for metabolic disease, genome-wide association studies have identified common genetic variants associated with disease. However, epigenetic modifications such as DNA methylation and histone modifications may also promote metabolic disease. Indeed, studies from our group demonstrate that epigenetic variation is involved in the pathogenesis of type 2 diabetes and altered metabolism in humans. We have identified altered DNA methylation patterns in pancreatic islets, the liver, skeletal muscle and adipose tissue from patients from type 2 diabetes compared with non-diabetic controls. We have also shown that environmental factors, including exercise and diet, affect the DNA methylation pattern in human skeletal muscle and adipose tissue. Moreover, we recently demonstrated that polymorphisms associated with type 2 diabetes directly modify the epigenetic pattern in human tissues. Finally, our data also support that an impaired intrauterine environment affect the epigenome in humans, which may contribute to metabolic diseases. Together, our studies support that epigenetic variation contributes to metabolic disease and type 2 diabetes.

Epigenome-Wide Profiling Reveals Potential Differential DNA Methylation in Progeny of Women with Previous Macrosomic Babies Exposed to a Dietary Intervention in Pregnancy

EARLYNUTRITIONMEMBER

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[2] *Murdoch Children's Research Institute, University of Melbourne, MELBOURNE, AUSTRALIA*

Background: Epigenetic profiles during pregnancy are sensitive to environmental influence, with mounting research suggesting a role of variable DNA methylation in fetal programming of risk for various common non-communicable diseases. Maternal diet has been shown to influence DNA methylation patterns in offspring but research in humans is generally limited to observational studies with poorly defined exposures. This study aims to investigate epigenetic associations of a maternal dietary invention during pregnancy and neonatal epigenetic profile using a genome-wide methylation approach.
Methods: Sixty-three infants from the ROLO study (Randomised cOntrol trial of LOw glycaemic index diet versus no dietary intervention) were analysed. DNA methylation was measured in over 850,000 CpG sites in cord blood serum-derived genomic DNA using the Illumina MethylationEPIC BeadChip. Principal components analysis (PCA) identified the main components of variation in the dataset. Regression analyses identified regions of methylation associated with maternal and fetal factors and exposure to the dietary intervention. False discovery rate was used to correct for multiple testing.
Results: PCA indicated that the dietary intervention resulted in altered DNA methylation patterns in the newborns. We identified CpG sites that were different between the groups and assigned each to specific genes. Pathway analysis identified common influences of the dietary intervention on multiple aspects of cellular function. These results were independent of gender.

Conclusions: In this detailed analysis of methylation data novel CpG sites were identified that may contribute to a further understanding of the epigenetic regulatory mechanisms in-utero and how maternal diet during this time can impact this.

Development, Epigenetics and Later Obesity

EARLYNUTRITIONMEMBER

Keith Godfrey

Professor of Epidemiology & Human Development, Director, Centre for the Developmental Origins of Health and Disease, and Director, NIHR Southampton Biomedical Research Centre in Nutrition, SOUTHHAMPTON, UK

Within the Southampton Women's Survey, we have shown greater adiposity in the offspring in association with higher maternal adiposity, poor quality maternal diets in pregnancy, low maternal vitamin D status, excess gestational weight gain, and short duration of breastfeeding. Studies in animals, and initial data in humans, suggests the environment during early life induces altered phenotypes in ways which are influenced or mediated by epigenetic mechanisms. Most is known about DNA methylation changes, and our studies have identified and replicated associations between a number of perinatal methylation marks and the child's later adiposity. Integrating the genotype with epigenetic marks holds the promise of better understanding the biology that underlies the complex interactions of inherited and environmental components that define the developmental origins of common non-communicable diseases. Neonatal methylomes contain molecular memory of the individual in utero experience but are also partly a consequence of DNA sequence polymorphisms that result in methylation quantitative trait loci (methQTLs) and, potentially, the interaction between fixed genetic variation and environmental influences. Among 237 neonates from the Singapore GUSTO cohort we found 1423 punctuate regions of the methylome that were highly variable across individuals, termed variably methylated regions; around 25% of these regions were best explained by MethQTLs, with the remainder best explained by the interaction of genotype with different in utero environments, including maternal smoking, maternal depression, maternal BMI, infant birth weight, gestational age, and birth order. Future insights will depend on considering both fixed genetic variation and environmental factors in interpreting epigenetic variation.

Differential DNA Methylation within the Promoter of the Long Non Coding RNA ANRIL Is a Perinatal Marker for Later Adiposity

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Experimental studies have suggested that early life environment makes a substantial contribution to an individual's risk of developing obesity through the altered epigenetic regulation of genes. Identifying such epigenetic changes may provide insights into the molecular mechanisms underlying the development of adiposity and allow the identification of individuals at increased risk of metabolic disease. To this end, we examined inter-individual DNA methylation differences in umbilical cord from children from the Southampton Women's Survey (SWS) cohort. Methylation of CpG loci within the promoter of the long non-coding RNA ANRIL at birth was negatively associated with total fat mass at 4 and 6 years (CpGs1-9, all $p \leq 0.02$, n=231). This association was replicated in three populations: in umbilical cord from ethnically diverse neonates from the Growing Up in Singapore with Healthy Outcomes (GUSTO) cohort ($p \leq 0.05$ for ponderal index and subscapular skinfold thickness, n=187), in peripheral blood from adolescents (BMI, $p \leq 0.05$, n=812) in the Western Australian Pregnancy (RAINE) cohort, and in adipose tissue from adults (% fatmass, $p \leq 0.05$, n=81) from the UK BIOCLAIMS cohort. CpG methylation at this locus was associated with ANRIL expression in vivo. CpG mutagenesis inhibited ANRIL promoter activity in vitro. Furthermore, CpG methylation enhanced transcription factor binding to an estrogen response element in the ANRIL promoter. Our findings demonstrate that perinatal methylation at loci relevant to gene function may be a robust marker of later adiposity. This provides substantial support for the central involvement of epigenetic processes in mediating long-term consequences of early life environment on human health.

Epigenome-Wide DNA-Methylation and Body Composition at Age 5 - 5 Years in the European Childhood Obesity Project (CHOP)-Study

EARLYNUTRITIONMEMBER

Peter Rzehak [1], Marcela Covic [1], Richard Saffery [2], Eva Reischl [3], Simone Wahl [3], Veit Grote [1], Martina Weber [1], Annick Xhonneux [4], Jean-Paul Langhendries [4], Natalia Ferre [5], Ricardo Closa-Monasterolo [5], Joaquin Escribano [5], Elvira Verduci [6], Enrica Riva [6], Piotr Socha [7], Dariusz Gruszfeld [7] and Berthold Koletzko [1], for the European Childhood Obesity Trial Study group

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Background: Epigenetic plasticity is considered to play an important role for developmental programming towards childhood and adult obesity. Epigenome-wide methylation signatures in relation to BMI and less frequently to body composition have been studied in adults but rarely in children.
Methods: In this epigenome-wide- association-study (EWAS) in 374 children from four European countries participating in the European Childhood Obesity Project, body size (BMI, WHO-standardized BMI) and body composition measures (fat mass (kg), fat free mass (kg), fat mass index (kg/m²) and fat free mass index (kg/m²)) were regressed on 431313 CpG methylation values determined in blood cells using the Illumina HumanMethylation 450 BeadChip array. EWAS analyses were adjusted for study characteristics (sex, age at blood draw, study centre, parental education) biological (white blood cell types) and technical effects (control probe derived principal components).
Results: BMI, fat mass, fat free mass and height related indices were associated with >200 CpGs in >32 genes. Consistent associations with at least four body size and composition measures were found for CpGs in 5 genes, *KLHL6, ZDHHC17, FARP1, SNED1/IRE-BP1* and *CILP2* and in three measures for 27 further genes.
Conclusion: This EWAS provides novel evidence linking DNA methylation at *KLHL6, ZDHHC17/IHIP14, SNED1/IRE-BP1, CILP2*, and *FARP1* genes with increased body size and body composition measures in preschool children. Replication in further populations is required to corroborate these findings. Assessment of epigenetic stability of these associations over the life course and investigation into metabolic function and gene expression seems worthwhile.

B.5: Catch-Up Growth

Friday 14th October, 16.30-18.05

Modulating Mechanisms of Quality of Growth

EARLYNUTRITIONMEMBER

Martina Weber [1], Berthold Koletzko, Joana Hoyos, Françoise Martin, Ricardo Closa-Monasterolo, Joaquin Escribano, Elvira Verduci, Alice ReDionigi, Dariusz Gruszfeld, Piotr Socha and Veit Grote for the EUROPEAN CHILDHOOD OBESITY TRIAL STUDY GROUP
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Beneficial and adverse effects of catch-up growth were observed in specific target groups. Although catch-up growth seems essential for preterm infants, high early weight gain leads to an increased risk for obesity and cardiovascular disease. Modulating factors of early growth in healthy-term infants of the CHOP trial are studied to find infants at risk and enlarge knowledge on possible modifications. Rapid growth was defined as a z-score weight gain bigger than 0.67 in the first year according to the WHO growth reference study. Risk factors for rapid growth were low birthweight (lowest quartile vs. above: odds ratio 3.95 (95% confidence interval 2.74; 5.68)), C-section birth (1.77 (1.24; 2.52), early gestational age (before 40th week: 2.22 (1.62; 3.03)) and formula feeding (2.17 (1.53; 3.09), with a significant difference regarding protein contents of infant formulas (higher vs. lower protein 1.49 (1.04; 2.15). Parental obesity, smoking in pregnancy, social status of parents showed no effects.
Associated to rapid growth were higher insulin-like-growth-factor-1 (IGF-1) levels at 6 months by 18 ng/ml (10; 26), which at the same time are increased in infants receiving higher protein by infant formula (19 ng/ml (10; 29)). Adverse outcomes of rapid growth were higher BMI by 1.0 kg/m² (0.68; 1.31), higher fat mass by 0.8 kg (0.5; 1.1), and higher risk for obesity OR: 2.38 (1.55; 3.65) at 6 years. Insulin-like-growth-factor-1 levels seem to be a nutritional modifiable factor to regulate early growth. Beside unchangeable birth conditions infant nutrition offers the highest potential to regulate healthy growth in infancy.

New Innovative Concept to Predict Preterm Infant's Individual Growth Trajectories

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Background/objectives: Physiological postnatal adaptation and weight loss in preterm and term infants between birth and day of life (DoL) 14-21 includes a one-time, irreversible loss of extracellular water. Subsequently, preterm infants downshift to a "new" growth trajectory earlier than term infants. Physiological growth trajectories for preterm infants that incorporate this phenomenon are missing. The objective is to compare two approaches for individual growth trajectories from DoL 21 to 42 weeks PMA and evaluate the difference to the term WHO growth standards (WHOGS) target weight corresponding to the birth weight percentile at 42 0/7 weeks PMA.
Methods: Two approaches were tested for infants born at 24-34 weeks PMA and for birth weights at 7 major percentiles. Postnatal-Percentile Approach: growth following the percentile achieved at DoL 21 until term; Growth-Velocity Approach: increasing weight using day-specific Fenton median growth velocities until term.
Results: Difference between predicted and target weights at 42 0/7 weeks with Postnatal-Percentile Approach: up to 930g; Growth-Velocity Approach: accurate and precise match with term WHOGS target weights at 42 0/7 weeks when optimized by a single factor of 1.0017.
Conclusion/significance: Individual growth trajectories for preterm infants could be predicted by applying the optimized Fenton day-specific median growth velocity for DoL21 to 42 weeks PMA. Predicted trajectories accurately and precisely matched with the WHOGS target weight at 42 0/7 weeks PMA. A growth trajectory calculator tool, which can be used at bedside by clinicians to predict individual growth trajectories for preterm infants, can be developed from these results.

Proven Benefits of Nutritional Modifications of Patterns of Growth

EARLYNUTRITIONMEMBER

Bernadeta Patro-Gołab
WARSAW, POLAND

Growth patterns have been characterized with the use of different models, often depending on the purpose of their application. Certain growth patterns in early childhood have been associated with adverse or beneficial health outcomes in later life. Particularly rapid weight gain in infancy has been associated with increased risk of subsequent obesity. Among many determinants of early growth, feeding practices have been considered to be of major importance. This is a systematic summary of current evidence on the influence of selected nutritional interventions or exposures (such as protein intake in infancy and breastfeeding) on growth patterns, described with the use of different growth parameters. At least 2 electronic databases and other sources of data were searched in order to identify all relevant studies. An attempt to translate particular effects of nutritional modifications on growth into selected long-term health outcomes (such as overweight and obesity) has been made.

Pre-Pregnancy Maternal Body Mass Index Impacts on Child Growth Trajectories to Six Years

EARLYNUTRITIONMEMBER

Oddy W.H. [1], *Rzehak P.* [2], *Mearin L.* [3], *Mori T.A.* [4], *Beilin L.J.* [4], *Huang R.-C.* [5], *Grote V.* [2], *Weber M.* [2], *Szajewska H.* [6], *Shamir R.* [7], *Koletzko S.* [2], *Koletzko B.* [2], *Koletzko for the WP10 working group of the Early Nutrition Project*

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Background: Growth patterns of children differ, with children of overweight and obese mothers growing more rapidly than children of normal-weight mothers. Our objectives were to identify child growth trajectory patterns to six years and investigate pre-pregnancy maternal body mass index (BMI) on these patterns.
Design: Four cohort studies collaborated in the EU-funded Early Nutrition project (West Australian Pregnancy Cohort (RAINE) Study, European Childhood Obesity Trial Study (CHOP), HUMIS (Norwegian Human Milk Study), PreventCD (Coeliac Disease)) to determine child growth trajectory patterns from 6708 children. Maternal pre-pregnancy weight and height were ascertained, pre-pregnancy BMI (kg/m^2) derived, and child anthropometry measured to six years. Data were pooled and harmonized, and using latent growth mixture modelling, child growth patterns were assessed. The impact of pre-pregnancy maternal BMI (per unit of BMI) on growth patterns, following adjustment for maternal and child-related predictors, was applied using logistic regression.
Results: Three BMI-trajectory classes were identified in children: Class 1: Persistent, accelerating rapid growth (5%); Class 2: Early, non-persistent rapid growth (40%); and Class 3: Normative growth (55%). A 1 unit (kg/m^2) increase in pre-pregnancy maternal BMI increased the odds of a child developing a persistent rapid accelerating growth trajectory (class 1: OR 1.13 95%CI: 1.07-1.18) or early non-persistent rapid growth trajectory (class 2: OR 1.05 95%CI: 1.01-1.08) compared to normative growth, following adjustment for predictors.
Conclusions: Pre-pregnancy maternal overweight and obesity as measured by BMI, increases the risk of rapid growth in the child to six years that has potential long-term impacts on health into adulthood.

Funding: Acknowledgments are extended to National Health and Medical Research Council (NHMRC) funded participation (EU-NHMRC collaborative project ID#1037966) in the European Union project 'Long-term effects of early nutrition on later health' FP7-289346-EarlyNutrition, Coordinator: Ludwig-Maximilians-University Munich, Germany Project Director: Professor Berthold Koletzko, MD PhD. The research leading to these results has received funding from project Early Nutrition.

Long-Term Adverse Effects of Catch-Up Growth

Atul Singhal
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The impact of catch-up growth (the higher than expected rate of growth seen following recovery from illness or starvation) or growth acceleration (upward centile crossing for weight or length) on later health has generated considerable interest. The fact that 'catch-up growth' occurs in animal species as diverse as mammals, birds, and fish, as well as humans, suggests that this pattern of growth must have a survival advantage. However, the observation
that animals or humans do not usually grow as fast as they are capable of (e.g. as seen during catch-up growth) suggests that faster growth must also have a biological cost. There is, therefore, a trade-off in order to optimise growth trajectories between short-term gains and long-term costs.
In infants born prematurely, faster post-natal growth improves long-term cognitive function but is associated with later risk factors for cardiovascular disease. So, on balance, current policy is to promote faster growth by increasing nutrient intake. Similarly, in low birth weight infants from low income countries, a global problem affecting 20 million births per year, the short-term benefits of faster post-natal growth may outweigh long-term disadvantages. However, whether similar considerations apply to infants from countries in transition is uncertain. For term infants from developed countries, promoting catch-up growth by nutritional supplementation has few advantages for short- or long-term health, but may increase long-term risk of obesity and metabolic disease. The present review considers the long-term effects of faster post-natal growth focusing on the biology and clinical impact.

C.5: Translational Application of Programming Evidence. What is needed? Friday 14th October, 16.30-18.05

Why Early Prevention of Childhood Obesity is More than a Medical Concern – A Health Economic Approach

Diana Sonntag
Mannheim Institut for Public Health (MIPH), Medical Faculty of Heidelberg University, MANNHEIM/HEIDELBERG, GERMANY

Childhood obesity is more than a medical concern; it is receiving an increasing economic attention. This is mainly due to substantial cost burden, particularly later in life. Childhood obesity results in direct and indirect costs; the direct costs are predominantly healthcare costs due to change in the risk of developing obesity-related comorbidities and responding to treatment, while the indirect costs are related to sick leave, reduced productivity and premature death. Indeed international cost-of-illness studies provide robust evidence that societies will face substantial additional lifetime costs related to childhood obesity. In Germany, for example, individuals who were overweight or obese during childhood cause 3-5 times higher lifetime costs than individuals who were normal weight as child.
Given high excess lifetime costs of childhood overweight and obesity, an obvious policy question is: how would changing the current childhood obesity trend result in cost savings and how to reallocate cost savings to implement new pediatric preventive programs? Recent systematic literature reviews confirm that there is an urgent need to conduct health economic evaluations assessing whether a new pediatric preventive programs offers good value for money. However, health economic evaluations had often not being planned from the beginning of an intervention and making it thus, difficult for intervention developers, health care specialists and economists to coordinate their efforts in an effective fashion. It is therefore advisable to involve health economists during the design phase of an intervention. Equally necessary is the development of a toolbox for efficient data acquisition.

Science, Policy and Consumers - Understanding Infant Feeding Communication Practices

Monique M. Raats
Food, Consumer Behaviour and Health Research Centre; University of Surrey; GUILFORD/SURREY, UK

Decisions about whether to breastfeed infants, and when to introduce complementary foods, are important health decisions that are in part influenced by the information environments in which parents and other caregivers find themselves. The emphasis in written advisory materials appears to relate to short term health effects of infant feeding decisions (e.g. infections or food allergy) rather than longer term consequences (the development of chronic conditions such as obesity, diabetes, cardiovascular disease and cancer later in life). This is in line with protection motivation theory that purports that more immediate threats are more likely to be more effective at generating health protecting behaviours than threats that are remote. The lack of emphasis on the long-term health effects of diet, and absence of any mention of programming theories in information materials, may reflect the uncertainties in the underlying science, and lack of consensus about mechanisms and impact. The prevalence of health-related claims and symbols on foods intended for babies and infants (e.g., milk formulas and follow-on foods) will also be discussed. Where the scientific evidence is scarce or inconclusive, policies and associated information for consumers may be cautionary. There may be scope to improve infant feeding practices by increasing the quantity and specificity of messages about health effects, including the implications of nutrition programming. Further research is required to explore how people process, interpret and respond to alternative means of providing information on infant feeding practices and related policies.

A Multi-Dimensional Breastfeeding Intervention - A Study Protocol

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Objective: Breastfeeding positively influences the early-nutrition programming of the offspring; however, only 2% of Irish mothers meet the WHO recommendation to exclusively breastfeed to 6 months. Multi-dimensional interventions that simultaneously tackle different aspects of breastfeeding are required to improve initiation and duration. Issues identified in Ireland include: lack of skills, sense of not having enough milk, fear of poorly nurturing the child and public embarrassment (considered taboo). The primary outcome of this pilot study is to assess participants' satisfaction with a multi-dimensional breastfeeding support intervention and their level of engagement with intervention components. Secondary outcomes include prevalence and duration of breastfeeding among mothers in the study compared with the general hospital population and the identification of barriers to breastfeeding in our cohort.
Methods: Primiparous women are recruited at 34-38 weeks' gestation, along with a support partner (or a mother-figure). The intervention includes a breastfeeding antenatal class (also attended by the partner/mother), a one-to-one session with a lactation consultant post-partum, weekly supportive emails, and an optional weekly breastfeeding clinic for 6 weeks post-partum. Questionnaires to assess prevalence of and attitudes toward breastfeeding are completed at the antenatal class and at 6-weeks, 3-months and 6-months post-partum. Participants will have exclusive access to a website on breastfeeding and a help-line to contact the lactation consultant.
Conclusion: This pilot study will aid the design of a National Multicentre Randomized Controlled Trial involving a perinatal intervention and including supportive members of the family to develop the most effective intervention for increasing breastfeeding prevalence.

How Do We Get Parents Involved?

Silke Mader
Chairwoman of the Executive Board, EFCNI, MUNICH, GERMANY

For parents of a preterm infant everything turns upside-down from one day to another with challenging and unexpected situations. Silke Mader, Co-founder and chairwoman of the European Foundation for the Care of Newborn Infants (EFCNI), knows from her own experiences that a family needs much more than medical care and support – parents also need to be empowered and involved in their parental role from the beginning.
Since a few years EU research grants demand patient involvements, but this is for both, scientists and patients a new development. The

challenge for a respective collaboration and partnership in research projects is to accept and to understand both opinions. It is a challenge, but also a chance for getting the best possible care, treatment and research for preterm and newborn infants. To face these challenges and to involve parents, research with children and parents needs more time and special communication trainings for developing a valuable and equal partnership. It is important to be transparent with all information, potential risk factors or side effects to get the acceptance from the families. Therefore, understandable patient and parent information has to be provided and the voices of parents and children have to be accepted and respected.
EFCNI collaborates with scientific and health professional societies as well as parent organisations to improve the situation for preterm and newborn health in Europe. Silke Mader and team members of EFCNI are involved in many research programmes and studies, having functions in the boards of different societies as patient representatives.

A.6: The Future of Early Life Research

Saturday 15th October, 10.10-11.45

Finding Molecular Trackers of Early Life Environment in High-Dimensional Data

Joanna D Holbrook
SINGAPORE

If the seeds of disease are sown early in our lives, it must be possible to detect changes to our biology, at the molecular level right at the beginning of disease etiology. Increasingly we are finding molecular correlates with early life environments, some of which can predict later life disease phenotypes. One particularly productive source of molecular biomarkers are DNA methylation marks, which putatively combine the influences of genotype and early life environment. We have turned to methylome wide association studies (methWAS) to search for these epigenetic trackers of early life environment and disease trajectory. MethWAS has inherent challenges in terms of statistical power and confounding but has uncovered some important general truths as well as robust examples of molecular trackers. Here I discuss our experiences of methWAS in the GUSTO birth cohort and how combining with data from other cohorts at different stages of the lifecourse has yielded hypotheses about cause and effect of DNA methylation biomarkers, early environment and disease.

The Application of Lipid Profiling to Understand Dietary Fat Metabolism in Breast-Fed Infants

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Different studies showed that formula feeding can lead to too rapid growth and catch-up growth predisposing the infant to obesity in later life. Lipid metabolism of breast-fed infants is significantly different to that of formula-fed infants. Breast-fed infants have lower levels of specific phospholipids such as PC(34:1), which has a positive association with weight at 3 months and higher levels of specific such as sphingomyelins SM(36:2), which has a negative association with weight gain from 3 to 12 months. We want to understand which components in the diet are driving these differences in lipid metabolism that are associated with growth.
Breast-milk samples and infant plasma samples from 30 mother-infant pairs were obtained 12 weeks post-partum in rural Gambia. Samples were extracted with an organic solvent and profiled by direct infusion mass spectrometry, using chip-based nanospray and high-resolution mass spectrometry.
Breast-milk lipids showed strong associations with specific plasma lipids, from different classes. Triglycerides and diglycerides containing palmitate and myristate in breast-milk correlated with sphingomyelins e.g. SM(36:2) but not with triglycerides in the infant's plasma. Higher levels of the breast-milk sphingomyelin SM(34:2) associated with higher levels of plasma triglycerides e.g. TG(54:2). These results suggest that the lipid composition of the infant's diet has a profound influence on which pathways are activated, to metabolise and repackage the dietary fatty acids.
It is well-documented that changes to fatty acid composition of milk affect infant development. Our study shows for the first time that intact dietary lipids in breast-milk determine how dietary fat is metabolised.

Genetics and Epigenetics in DOHaD – Future Perspectives

EARLYNUTRITIONMEMBER

Richard Saffery
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There is now compelling evidence for epigenetic variation as a mediator of developmental programming effects in humans. Specific exposures can induce predictable variation in the epigenome prior to birth, much of which is stable postnatally. It is also clear that genetic variation plays a key role in shaping the epigenome and modulating the effects of environmental exposures. For non-communicable diseases (NCD), the emerging picture is one of underlying genetic risk (shaped over generations) that interacts with the cumulative modern environment to determine risk. The breadth of inter-relationships is complex and variable, dependent on dose, duration and timing of exposure and underlying genetic profile. Thus, understanding NCD aetiology is far more complex than simply mapping genetic variation, requiring detailed measurement of exposures and phenotype with regular biological sampling of different tissues. There have been recent notable successes, largely driven by four key factors:

1. Availability of longitudinal pregnancy cohorts established decades ago.
2. Advances in 'omics technologies in reliability, sensitivity and affordability.
3. A wider acceptance of the DOHaD field and fetal programming.
4. An acknowlegement that the impact of data from team studies is greater than the sum of their individual outputs.

The field is still relatively young, but the way forward is clear. Modern longitudinal pregnancy cohorts are essential, preferrably utilising stadardised exposure and phenotype measures with extensive and harmonised biospecimen collection. Multidimensional 'omics data

remains prohibitively expensive and analytical approaches suboptimal, but this is likely to change in the near future. It is likely that our understanging of DOHaD causal pathways will mature rapidly in parallel to the many international pregnancy cohorts now underway.

Women's Use and Preferences for Online Nutritional Resources in Pregnancy

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Introduction: Maternal nutrition during pregnancy influences the long-term health outcomes of both the woman and her offspring. Increasingly, pregnant women are turning to web-based nutritional resources for information. This study examined the use of web-based nutritional information by women during pregnancy and explored their preferences in this area.
Methods: Participants were enrolled at their convenience in a large maternity hospital. Women completed a detailed questionnaire which collected clinical and sociodemographic details in addition to information on their use of online resources. Informed consent was obtained from all women. This study received ethical approval.
Results: Of the 101 women, 41.6% were nulliparous and the mean age was 33.1 years (19-47 years). All women had internet access and only 3% did not own a smartphone. Women derived pregnancy-related nutritional information from a range of online resources, most commonly: What to Expect When You're Expecting (15.1%), Babycenter (12.9%), and Eumom (9.7%), however, 24.7% reported using Google searches. There was minimal use of publically-funded or academically supported resources. The features women wanted in a web-based nutrition application were recipes (88%), exercise advice (71%), personalised dietary feedback (37%), social features (35%), videos (24%) and cooking demonstrations (23%).
Conclusions: These findings suggests that pregnant women use a variety of online resources, which are mainly commercial, with minimal use of publicly-funded or academically supported resources when seeking web-based nutritional information. This increases their risk of receiving dietary advice which is not scientifically based. It also identified features that pregnant women want from a web-based nutritional resource.

Maximising the Impact of DOHaD Research

Mark Hanson
LONDON, UK

The concepts which DOHaD research has established can have substantial impact in several areas. First, including them in educational curricula will help to engage young people in devising and evaluating interventions for primary prevention of NCD risk early in the life-course, to improve their future health and that of the next generation. The wider public is also ready to engage with such concepts, as the perception that NCD risk is not explicable largely in terms of genetics, and that adult lifestyle interventions are relatively ineffective, is spreading. Moreover, DOHaD research in developmental epigenetics is finally showing the irrelevance of the nature/nurture dichotomy, and receiving much media coverage
Secondly, DOHaD concepts are vital to the training of a wide range of healthcare professionals in order to meet 21st Century health challenges. Whatever their specialty, these professionals need to ensure that young people are aware of the need to adopt a healthy lifestyle, especially those of inaccessible population groups.
Next, there are substantial implications for public health policy. The scale of the DOHaD contribution to e.g. later NCD risk may not be known, but the interventions needed in the preconception, pregnancy and postnatal periods are not rocket science. Arguably, they should not be deferred until RCTs have been performed or the obligation on states to institute them be dodged by transferring responsibility to individuals/ parents.
Lastly, the SDGs open new avenues for international cooperation and a mandate for translating DOHaD research into action.

MAH is supported by the British Heart Foundation

B.6: Obesity Prevention and Intervention in Infants and Young Children

Saturday 15th October, 10.10-11.45

Early Obesity Prevention – the Role of Life Style. Experience from Toybox and Other Intervention Trials

Piotr Socha
WARSAW, POLAND

Obesity risk seems to be strictly related to nutrition and dietary habits in early life. Early interventions can decrease obesity risk in children and their eating habits. Early education of parents was tested in a randomized controlled trial in 667 mothers, who started education already in pregnancy. Results were analyzed at the age of 2y- BMI was lower in the intervention group (16.53 vs 16.82) and there was positive effect on vegetable consumption and TV viewing in those children (Wen LM, BMJ 2012). A systematic review of randomised controlled trials showed that interventions specifically designed to build maternal self-efficacy around infant feeding had impact on weight outcomes (Redsell SA, Maternal Child Nutr 2016).
We performed the EU project called ToyBox which was a mulitfactorial evidence based approach using behavioural models in understanding and promoting fun, healthy food, play and policy for the prevention of obesity in early childhood. The results of the intervention are being evaluated, still interesting finding concerning behaviours of preschoolers were also analyzed and published. Behaviours differ among countries and for example the specific problem for Poland and Belgium is high soft drink consumption. Children in both groups improved their eating habits but the effect as more significant in the intervention group for prepacked fruit juice consumption (AS Pinket 2016).

Acknowledgement: Toybox group led by Y Manios

Cord Blood Adiponectin as a Predictor for Childhood Obesity at 5 Years of Ageglucose tolerance

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Background/Objective: The role of cord blood adiponectin on infant/child growth and body composition characteristics remains unclear. We aimed to determine the relationship of early life adipokine concentrations in cord blood to predict obesity in children and observe changes in adipokine levels at a later stage in early childhood.
Subjects/Methods: Based on data obtained from the INFAT (impact of nutritional fatty acids during pregnancy and lactation on early human adipose tissue development) study, cord blood samples from 141 mother-child pairs and plasma blood samples from 40 3-year-old children were analyzed. The associations between total and HMW adiponectin levels in cord blood and child growth and fat mass measurements from birth to 5 years of age were assessed longitudinally using linear regression models.
Results: Cord blood adiponectin concentrations were higher than child plasma adiponectin levels at 3 years of life and were positively correlated [total adiponectin 0.578 ($P < 0.001$); HMW adiponectin 0.558 ($P < 0.001$)]. HMW cord blood adiponectin was positively associated with weight, BMI percentiles, and lean body mass at birth but not at later time-points. At 3 and 4 years, positive associations were found with skinfold thickness and percentage of body fat following adjustment for maternal and child covariates. However, this trend did not persist to the 5th year of life. Similar associations were obtained for total cord blood adiponectin.
Conclusion: Our results do not support the hypothesis that cord blood adiponectin is a useful biomarker for the prediction of adiposity at the age of 5 years.

Food Choices, Lifestyles and the Prevention of Overweight and Obesity in Children: Evidence from the IDEFICS Cohort and the I.Family Study

Wolfgang Ahrens

BREMEN, GERMANY

As extension of the IDEFICS cohort the I.Family study investigated the impact of dietary, behavioural and socio-economic factors on non-communicable chronic diseases in European children.
In 2007/2008 the baseline examination (T0) of 16,228 children aged 2 to 9.9 years took place in Belgium, Cyprus, Estonia, Germany, Hungary, Italy, Spain and Sweden. 11,041 of these boys and girls participated in the first follow-up examination (T1) in 2009/2010 and 7,105 in the second (T3) in 2013/2014. Half of them participated in a community-oriented primary prevention programme on obesity. Parents reported lifestyle data for their small children and families while self-reports were collected from adolescents. All children underwent detailed physical examinations.
We observed unfavourable health outcomes due to the lack of sleep and physical activity, excessive exposure to TV, unhealthy diet and rapid weight gain in pre-school age. An unfavourable built environment was associated with reduced physical activity levels. Exposure to TV advertisements was associated with unhealthy food choices. From T0 to T1 the prevalence of overweight/obesity increased to a similar degree in the control (18.0% to 22.9%) and the intervention group (19.0% to 23.6%). However, the intervention prevented unfavourable changes in sedentary time and light physical activity in those receiving a medium-high intervention dose. Also, intervention children being overweight/obese at baseline had a significantly greater probability of normalised weight status after 2 years. Although the intervention did not reduce the incidence of overweight/obesity its results may guide future interventions. This cohort enables us to identify early life factors affecting later health outcomes.

ROLO Kids Step Test: A Simple Method of Estimating Cardiovascular Fitness and Adiposity in 5 Year Old Children

EARLYNUTRITIONMEMBER

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Background: Cardiovascular fitness is closely related to health and body composition and having a way to reliably estimate this is vital for tracking children's health. There is currently no simple validated measure of fitness in 5 year old children.
Methods: A cohort of 110 children completed a step test which is based on maximal energy expenditure. Using a 25cm step, the children stepped up and down to maximum effort for 3 minutes. A pedometer was worn to record number of steps. Baseline heart rate was measured before starting stepping, immediately after the 3 minutes then every 30 seconds until it returned to baseline and the length of recovery time was noted. Child anthropometry including height, weight, circumferences and skinfold thickness were collected. Statistical analysis involved simple and multiple regression models.
Results: Gender was found to be influential with males having a lower heart rate after the step test and a faster recovery time. Heart rate recovery time was positively associated with all skinfold measures of triceps, biceps, subscap and thigh ($P< 0.03 - 0.002$). Controlling for gender and baseline heart rate, the sum of skinfold thicknesses was significantly associated with heart rate recovery time ($p=0.008$).
Conclusion: Skinfold thicknesses and general adiposity was found to be positively associated with heart rate recovery time after the step test. With heart rate recovery being a proxy for cardiovascular fitness this provides evidence that a stepping test could be used as a valid fitness tool in 5 year old children.

Determining Factors and Critical Periods in the Formation of Eating Habits: Results from the HabEat project

Sylvie Issanchou
PARIS, FRANCE

Eating habits form early during childhood and are likely to track until the beginning of adulthood. Thus, understanding the formation of eating habits is important.
In the HabEat* project we focused on the development of preferences for vegetables since they are the less liked foods for children. Based on the analyses of data from different European cohorts, HabEat found that breast milk may facilitate the consumption of vegetables in later childhood. HabEat found some evidence that introducing a variety of different vegetables in the complementary feeding period increases later acceptance of novel foods. Habeat also found that repeated exposure is as much or more efficient than flavour-flavour learning to increase vegetable intake even for 2- to 6-year-old children who are more likely to be neophobic.
Food intake adjustment in young children (aged 3 to 6 years) was also studied. HabEat found that when children ate a preload of energy-dense food less than one hour before a meal, they ate less during the meal but adjusted their food intake only partially for the energy ingested from the preload. HabEat found that when palatable foods were available freely after a meal, most children ate in the absence of hunger and consumed extra energy, and the extra-consumption was higher for children whose parents who used 'Food as a reward' than for children whose parents did not use this practice.

* The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/ 2007-2013) under the grant agreement n.FP7-245012-HabEat.

C.6: Personalised Nutrition and Counseling

Saturday 15th October, 10.10-11.45

Personalised Nutrition – What Does It All Mean?

Rosalie Grivell
ADELAIDE, AUSTRALIA

Background: There is much known about the importance of diet and physical activity during pregnancy. In both normal and overweight/obese women, diet and physical activity may mediate many health outcomes for women and their infants, as does weight gain during pregnancy. Related to this, gestational weight gain that is excessive in one pregnancy may further influence health for the woman later in life. Significant efforts are being made to develop and assess various interventions in pregnancy that could potentially improve diet, physical activity and related health. Many aspects may be considered when developing and implementing interventions in this field. Drawing on our research group's experience in designing and running large scale clinical trials in pregnancy, this presentation will attempt to provide an overview of personalised counselling and nutrition as it relates to improving outcomes for women and their infants.

Evaluation of Pregnant Diet Quality on Social Media Project: The Use of the Healthy Eating Index for Brazilian Pregnancy

Barros K.V. [1], Bizari G. [1], Covic Bastos A. [2], Ribeiro J.V.A. [3], Ulhôa Escobar A.M. [4], Welcoming the baby (Boas Vindas Bebê)
[1] Danone Early Life Nutrition, SAO PAULO, BRAZIL
[2] State University of Campinas (UNICAMP), Institute of Computing & Institute of Pilosophy, Social Sciences and History, CAMPINAS, BRAZIL
[3] Pontifícia Universidade Católica de São Paulo (PUC-SP), SAO PAULO, BRAZIL
[4] State University of Sao Paulo (USP), Faculty of Medicine, SAO PAULO, BRAZIL

Introduction: It is known that quality of maternal diet can influence fetal growth and pregnancy outcome. We tested the hypothesis that a social network used as a tool can improve diet quality during the pregnancy and influence birth outcome.
Methods: The healthy eating index for Brazilian pregnancy (HEIP-B) was used to evaluate the diet quality of 410 pregnant women participating on the "Welcome Baby" project. According to the number of meals and food groups, we classified the diet as adequate, requires modifications or inadequate. Pearson and Spearman analysis were performed to test the correlation between education level, diet perception of participants, engagement with posts and surveys (interativity/comments/likes), birth weight and gestational weight gain.
Discussion: Only 12% (n=49) of pregnant had adequate HEIP-B, while 49.8% (n=204) and 38.3% (n=157) were classified as requires modifications and inadequate, respectively. We found a correlation between higher education and better HEIP-B (p=0.015) and between pregnant perception about diet and HEIP-b calculated (p=0.049). The low number of intake portion/day of vegetables (1.6±0.8), fruits (2.0±1.2) and milk (1.7±0.9) were common factor identified in the diet as requires modifications. On the other hand, the adequate intake of dried beans group (dietary Brazilian habits) contributed to improve HEIP-B. No differences were found in others parameters.
Conclusion: The healthy eating index can be an useful tool to evaluate the quality of diet and contribute to nutritional counseling at prenatal consultations in order to adequate the intake of relevant food groups for fetal growth and pregnancy outcome.

Framing Personalized Nutrition and the Food4me Experience

Hannelore Daniel
Technische Universität München, MUNICH, GERMANY

Like in many other sectors, diversification and individualization is also driving the food markets with products and services. This is currently mainly based on food/taste preferences and enjoyment in product lines such as coffee, chocolate or beverages. The highest level of personalization is achieved by offers to compose your "own" food item such as a breakfast cereal or chocolate.
HEALTH is considered as a key market driver. When taken into the food and nutrition sector, the key question is, how health-promotion can be achieved at the level of the individual and the foods consumed. What can be predicted is that a wide range of web-based health

services will become available and those will also employ numerous electronic devices that allow assessment of food intake and measurements of a variety of lifestyle parameters (exercise, sleep, leisure time) and health indicators (blood pressure and glucose, metabolite profiles etc). Whether genetics should/will be included is to be seen, but is likely. Based on these parameters individualized dietary recommendations but also menu plans can be generated and those customized menus may be preordered in a restaurant or for home-delivery. Electronic devices will also be available as shopping guides. It is predicted that the entire supply of foods becomes personalized as more and more consumers outsource this to a food or menu service provider (e-commerce). Health insurances may be part of such services and the measures of compliance may be used in adjusting individual health insurance plans. Such a system of course challenges some fundamental principles of liberal societies and it remains to be seen how societies scope with this. Personalization can not only be the highest level of possible services but will clearly also be the highest level of personal responsibility. The EU-project *Food4me* was the largest project ever for testing the concept of personalized nutrition in the field. With 1.600 participants from seven European countries different levels of personalisation in dietary advice systems were defined and tested for compliance and their efficacy for changing dietary intake and life style parameters. I shall be presenting the Food4me framework, its main tools and the key findings.

Associations of Maternal B Vitamins during Pregnancy with Infant Neurocognitive Outcomes at 24 Months of Age

Chong M. [1,2], Mohamad Ayob M.N. [2], Cai S. [3], Kwek K. [4,5], Saw S.M. [1], Godfrey K. [6], Gluckman P. [2,7], Chong Y.S. [2,3], Meaney M. [2,5], Rifkin-Graboi A. [2], GUSTO study

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[7] *Liggins Institute, The University of Auckland, AUCKLAND, NEW ZEALAND*

Objectives: B-group vitamins are interconnected in a methyl donor pathway and responsible for several metabolic methylation reactions critical for infant neurocognitive development. As evidence of the relationships between maternal B vitamin status and infant neurocognitive development is limited in humans, we examined associations in the Singapore GUSTO mother-offspring cohort.
Methods: Maternal plasma was collected between 26 to 28 weeks of gestation and analysed for vitamin B12, B6 (pyridoxal phosphate) and folate concentrations. Infant neurocognitive outcomes were evaluated using the Bayley Scale for Infant and Toddler Development (BSID-III) at age 24 months. Multivariate analysis, adjusting for key confounders and including mutual adjustment of each B vitamin, was conducted.
Results: Of 434 mother-infant pairs, 15.7% of mothers were B12-deficient (< 200pg/ml), 41.9% insufficient (200 - 299pg/ml) and 42.4% sufficient (≥300pg/ml). 15.2% and 10.9% of mothers were B6 (< 20 nmol/L) and folate (< 6ng/ml) deficient respectively. Compared with infants from B12-sufficient mothers, those born to vitamin B12-deficient mothers had lower cognition (B=-0.98, p=0.005) and a trend for receptive language (B=-0.68, p=0.07) and fine motor scores (B=-0.62, p=0.052), while those born to B12-insufficient mothers had better gross motor score (B=0.64, p= 0.027). Associations with receptive language and fine motor scores attenuated after adjustment for gestational diabetes status. There was a trend for higher maternal B6 concentrations to be associated with higher gross motor scores (B=0.005, p=0.075). No associations were seen with maternal folate status.
Conclusion: Maternal vitamin B12 and B6 status during pregnancy may influence infant neurocognitive development at age 24 months.

WORKSHOPS AND SYMPOSIA

WS.1: New Investigators Forum

Friday 14th October, 8.20-9.25

Evidence/Thoughts to Become a Good Researcher. A View from a University Professor's Perspective

Lucilla Poston
LONDON, UK

Drawing from many years of experience as an academic, several suggestions can be made about how to become a good researcher. These include the importance of choosing the right supervisor who will provide opportunities for the acquisition of transferable skills and whose group has produces scientists with a good track record. Be bold and do not necessarily follow a subject with which you are familiar; most subjects are interesting if you work hard, but choose a project with obvious direction and relevance to clinical translation with funding opportunities. Do not be frightened of constructive criticism; invite others to give their objective assessment and always seek external collaborators; most senior scientists like to talk about their work and collaborate. Importantly, a good researcher is independent and builds his/her CV from the very start; do not wait to be told what to do- think for yourself!

Learn from Other CV's

Hans van Goudoever
AMSTERDAM, NETHERLANDS

There is no single "correct" way to write and present a CV but the following general rules apply:
•It is targeted on the specific job or career area for which you are applying and brings out the relevant skills you have to offer
•It is carefully and clearly laid out: logically ordered, easy to read and not cramped
•It is informative but concise
•It is accurate in content, spelling and grammar. If you mention attention to detail as a skill, make sure your spelling and grammar is perfect!
Often selectors read CVs outside working hours. They may have a pile of 50 CVs from which to select five interviewees. It's evening and they would rather be in the pub with friends or write an article themselves. If your CV is hard work to read: unclear, badly laid out and containing irrelevant information, they will just move on to the next CV. Some employers may spend as little as 45 seconds skimming a CV before branding it "not of interest", "maybe" or "of interest".
Essential steps in your career will be discussed during this workshop with several possibilities to succeed in your academic career. Your successful and possibly lacking topics will be identified when writing personal CV in order to set the scene for your own career.

How the Society Can Benefit from University/Industry Collaboration

Ricardo Rueda
Abbott Nutrition, GRANADA, SPAIN

Strategic partnerships between academic institutions and industry around the world enhance research productivity and effectiveness, accelerate innovation and can translate into multiple benefits for the society derived from efforts on different goals, including research and innovation, business development and education.
The University of Granada (UGR) and Abbott Nutrition (AN) constitute a good example of strategic partnership with more than 20 years of history. This partnership includes collaboration on multiple research projects to generate innovative solutions for public health nutrition issues. In addition, Abbott personnel contribute through membership of several Committees of UGR. Another important aspect to consider is partnership on educational efforts, including Abbott courses for both students from UGR and AN employees, internships for UGR students to complement studies with practical training, and participation of AN on UGR Master and PhD programs.
A key example of collaboration on educational efforts is the program connecting Abbott researchers with UGR students at satellite facility of AN located at UGR science park. Leads for key Abbott research projects are paired with postgraduate and undergraduate researchers to help Abbott extend research teams globally, explore new opportunities and accelerate research. In addition, UGR science park provides great infrastructure and services together to implement basic, translational and clinical research and offers opportunities to reinforce already established collaboration between AN and UGR on several efforts. In summary, Public-Private Partnership will continue to generate innovative solutions for local, national and international public health issues showing clear benefits for the society.

WS.2: Methodological Aspects of Measuring Adiposity and Body Composition

Friday 14th October, 8.20-9.35

Assessment of Neonatal Body Composition Using Anthropometry

Sarah Kehoe, Julia Hammond
MRC Lifecourse Epidemiology Unit, SOUTHHAMPTON, UK

It is generally accepted that where fat is stored on the body is associated with risk of developing coronary heart disease and diabetes in later life. Central fat (on the trunk) appears to be less favourable to health than peripheral fat (on the limbs).
Anthropometry is a practical tool for monitoring infant size, body composition and growth. It can be used in large epidemiological studies, where other clinic-based methods are unfeasible. The equipment required is inexpensive and portable and it is minimally invasive for the participant. However, it requires a high level of skill and accuracy by the fieldworker to ensure that measurements are valid and precise.
Length and weight are the most widely taken anthropometric measures. Both are used in the calculation of ponderal index which gives an indication of adiposity. Circumference measurements include head, mid-upper arm, chest and abdomen. Length and head circumference are measures of skeletal size. Mid-upper arm circumference is a measure comprising arm muscle and sub-cutaneous fat. Chest and abdominal circumference measures are indicators of viscera and intra-abdominal adipose tissue. Skinfold thickness measurements can be used to estimate body density and subsequently to predict body composition i.e. fat free mass and fat mass. Skinfolds can be taken at several sites on the body. Triceps and subscapular skinfolds are frequently used for assessing peripheral and truncal fat respectively.
Anthropometry can be useful for comparing the size of neonates at birth in different populations and in prospective studies to monitor growth of infants and children.

Using Bioelectrical Impedance and Leptin Levels to Predict Body Composition Leptin in Children

EARLYNUTRITIONMEMBER

Verónica Luque, Natalia Ferré
LONDON, UK

Obesity during childhood has been associated with increased risk of developing chronic disease later in life. Body mass index (BMI) is the most widely used method to diagnose obesity in clinical practise. However, this method cannot distinguish between the fat and the fat-free components, and may give misleading information on body fat content (1,2).
Other methods and techniques for measuring body composition include dual-energy X-ray absorptiometry (DXA), air-displacement plethysmography (ADP) and deuterium oxide dilution (DLW). All of these techniques are "2 components models", since these are able to divide the body in 2 components and rely on assumptions to predict the rest. All of these are sophisticated techniques that require high level of training, are time-consuming and/or expensive, and usually are only available for research purposes. The use of these different techniques in conjunction to assess body composition, which is named "4-component model", is considered the gold standard method in vivo to assess body composition.
The aim of this talk is showing alternative low cost techniques to approach body composition in children. On one hand, bioelectrical impedance analysis (BIA) is a simple, fast, inexpensive, portable and non-invasive technique that assesses total body water and predicts fat and lean masses based on algorithms with a certain degree of bias. Predictive equations are population specific, and several have been already published. On other hand, herewith we will explore the possibility to use biochemical parameters such as leptin to estimate fat mass content.

Linking Body Fat to Disease Risk

Manfred James Mueller
Christian-Albrechts-Universität zu Kiel, Institut für Humanernährung und Lebensmittelkunde, KIEL, GERMANY

Body composition measurements in infants, children and adolescents are challenging, because of the rapid growth- and development-related changes in height, weight, fat-free mass (FFM) and fat mass (FM). Postnatal changes in body composition are related to dietary intake, energy expenditure, and macronutrient oxidation occuring during infant growth. In addition, birth weight, a high FM and a low FFM are risk factors for childhood and adult obesity as well as obesity-associated metabolic disturbancies. When compared to FM the impact of fat distribution, subcutaneous and visceral adipose tissues (SAT, VAT as assessed by imaging technologies) during infancy and childhood is less clear. This is in part explained by the lack of standardized protocols, the limited feasibility as well as the high costs and the high workload of whole body MRI protocols. Methods for rapid imaging and fully automated postprocessing of VAT and SAT have been published only recently. Nevertheless there are already some MRI data on fat mass in the fetus, in infants, children and adolescents. These data show that VAT is prevalent already in childhood and may contribute to abnormal metabolic parameters, starting early in life. VAT and ectopic fat in liver and muscle seem to be interrelated but their patterns as well as their independent contribution on metabolic risk are not well characterized. VAT was positively correlated with insulin secretion with an inverse association with insulin sensitivity (IS). However, other authors described associations of SAT but not VAT with IS. When compared with young and older adults, VAT volumes are very small in infants and children and began to increase after puberty only. Most if not all of these data are cross-sectional, presently there is lack of longitudinal data. Alternatively, simpler or so-called 2-compartment techniques, e.g. DXA or densitometry (as assessed in a whole body air displacement plethysmograph, ADP) have been used to assess FM and FFM in greater groups of infants, children and adolescents. In addition, recent studies suggest that single-frequency and multi-frequency BIA-derived body composition and phase angle measurements are valuable to assess nutritional status and growth in children, The practicality of different pediatric body composition measurement methods in the clinical setting will be discussed

Acknowledgement: Our own work was supported by BMBF Kompetenznetz Adipositas, Core Domain "Body composition" (Ko¨rperzusammensetzung; 01GI1125).
Conflict of interest: MJM is a consultant of seca GmbH, Hamburg.

WS.3: CME in Pregnancy – An e-Learning Live Course by the Early Nutrition eAcademy

EARLYNUTRITIONMEMBER

Friday 14th October 8.20-9.25

Brigitte Brands[1], Simone Cramer[1]

[1] Ludwig-Maximilians-Universitat, Dr. von Hauner Children's Hospital, University of Munich Medical Center, MUNICH, GERMANY

The Early Nutrition eAcademy (ENeA) is a joint e-learning initiative of the Early Nutrition Academy (www.early-nutrition.org) and the University of Munich Medical Center. ENeA offers CME accredited e-learning modules for international Healthcare Professionals in English, Chinese and Turkish language. As to date, more than 5,600 users from 146 countries in the world have registered on the ENeA platform. One of the modules available is on "Nutrition & Lifestyle During Pregnancy".
Appropriate maternal nutrition and lifestyle before and during pregnancy is of high significance for favorable pregnancy outcomes. In this module, current international recommendations for adequate nutrient intakes through diet and supplements are addressed. Physiological explanations for nutrient transfer are given to better understand why appropriate maternal weight gain is so important for infant and maternal health. Similarly, physical activity and lifestyle recommendations are specified along with recommendations for the avoidance of food-borne illnesses. A particular focus is on the nutritional needs of the mother and fetus during normal pregnancies while also addressing special nutrition and metabolic challenges such as obesity, gestational diabetes and eating disorders.
Basic principles and key messages will be delivered during this workshop at the Power of Programming conference. This will prepare the participants to further continue with online tests with the option of obtaining a CME certificate.

WS.4: Acting on DOHaD Concepts: Whose Responsibility?

Saturday 15th October, 9.00-10.05

Acting on DOHaD Concepts: Whose Responsibility?

Ruth Mueller [1] & Mark Hanson [2]

[1] MUNICH, GERMANY

[2] SOUTHHAMPTON, UK

Research from the field of Developmental Origins of Health and Disease (DOHaD) has created new insights into how the circumstances of early life can impact health and illness in later life. Mediated often via epigenetic mechanisms, experiences and exposures in early and prenatal life such as nutrition status, infection and stress can distribute the possibilities for a long and healthy life unequally among the population. While understanding this nexus better opens up multiple avenues for intervention, it also raises significant question of responsibility. Who should be charged with acting on this new knowledge? Is the individual responsible for improving his/her own circumstances and by proxy those of their children? Or are there new forms of collective responsibilities emerging together with these new forms of knowledge? In this session, we aim to foster a critical discussion about the social and political dimension of DOHaD concepts and knowledge. The session will start of with brief input statements by the hosts of the session Prof. Mark Hanson (Institute of Developmental Sciences, University of Southampton) and Prof. Ruth Müller (Munich Center for Technology in Society, TU Munich), who will discuss questions of responsibility from a life science and a social science perspective. The session format will be interactive, aimed at sparking a lively interdisciplinary discussion with and among the session audience.

WS.5: Fetal and Infant Growth Standards: International Practice and Applicability

Saturday 15th October, 9.00-10.05

Curve Matching: New Technologies for Personalized Predictors of Growth in Children

Stef van Buuren [1,2]

[1] Netherlands Organisation for Applied Scientific Research TNO, LEIDEN, NETHERLANDS

[2] Dept of Methodology & Statistics, Utrecht University. UTRECHT, NETHERLANDS

Longitudinal growth data are valuable for predicting and interpreting future growth of individual children. In this talk I will explore 'curve matching', a new technique to improve prediction of future growth of an individual child. The key idea is to find existing children in existing databases who are similar to the target child for whom we desire prediction of future growth. The realized growth patterns of the matched children suggest how the target child might evolve in the future. I will discuss various conceptual and practical issues that need to be addressed. A (slow) demo can be found at http://vps.stefvanbuuren.nl:3838/ growthpredictor/

WS.6: DynaHEALTH Meets EarlyNutrition

Saturday 15th October, 9.00-10.05

Introduction to the Challenge

Sylvain Sebert[1,2,3], Lise Geisler-Bjerregaard [4]

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National Health care systems worldwide widely recognise the risk of inactive and unhealthy ageing resulting from obesity and type 2 diabetes. The pandemic strongly influences the risk of premature ageing or death due to the accumulation of cardio-metabolic disorders. Moreover, there is increasing evidence that obesity and diabetes co-segregates with alterations of multiple social and psychological factors affecting individual's functioning. Critically, the risk of poor metabolic and psychosocial health in later life is influenced by factors acting throughout the life-course, starting in early life. The DynaHEALTH European action (www.dynahealth.eu) brings together experts in Epidemiology, Epigenetics, Bio-statistics, Clinical Nutrition, Physiology, Health Care, Metabolomics, Genetics, Econometrics, European Policy and Knowledge Management to tackle the challenge. This includes 13 partners from Finland, Denmark, Germany, Spain, The Netherlands and the United Kingdom with the main objective of characterising the dynamic determinants and pathways leading to an impaired glucose tolerance and early onset cognitive decline through ageing. This includes i) demonstrating molecular and metabolic targets, ii) characterizing pathways and iii) the modifiable factors in order to implement new policies and tools supporting the health and economy of an ageing Europe.

Discovery in Large Scale Consortia

Janine F. Felix

The Generation R Study Group and Departments of Epidemiology and Pediatrics, Erasmus MC, University Medical Center Rotterdam, ROTTERDAM, THE NETHERLANDS

Large scale international consortia, in which multiple individual studies and research groups join forces, strongly facilitate the emergence of novel research findings. By combining data, usually in the form of summary statistics, these consortia increase the statistical power of their work and hence their potential to discover true associations. This concept applies in particular to "omics" studies, for which individual studies usually lack power. Genome-wide association studies (GWAs) have proven the potential of large scale international consortia, with the discovery of a multitude of common genetic variants associated with health and disease phenotypes. More recently, epigenome-wide association studies (EWAs) have emerged, in which the DNA-methylation status of hundreds of thousands of sites throughout the genome is associated with specific exposures, such as smoking or nutrition, or disease outcomes. DNA-methylation is the most studied epigenetic phenomenon in large populations and has been suggested as a potential biological mechanism underlying associations of early life exposures and later life health outcomes. Recent international consortium studies have described associations of maternal smoking, maternal folate levels and maternal exposure to air pollution during pregnancy with cord blood methylation. This presentation will discuss methods and results of these and other recent meta-analyses in large-scale international consortia.

Nutritional Interventions During Pregnancy to Improve Metabolic Health in Mother and Offspring

EARLYNUTRITIONMEMBER

Ricardo Rueda

Abbott Nutrition, GRANADA, SPAIN

Maternal obesity and obesogenic dietary intake through pregnancy program offspring to a broad spectrum of metabolic and physiological alterations later in life such as adiposity, obesity and diabetes. This work summarizes preclinical and pilot clinical results obtained up on NIGOHealth (Nutrition Intervention during Gestation and Offspring Health) study. The main goal for this study is to evaluate the effects of feeding with slow digesting carbohydrates (SDC) during pregnancy on programming health and prevention of disease in the offspring from obese mothers during infancy and later in life.

The inclusion of SDC on a high fat diet during pregnancy in obese rats was able to reduce adiposity in the mother and in the offspring at adolescence age. Reduction on adiposity was paralleled to reduced level of plasma glucose, as well as to reduction on some lipid species, analyzed by lipidomics. Offspring from pregnant rats fed with SDC also showed changes on adipose tissue glucose transporters and insulin signalling, that were consistent with reduced adiposity, at weaning and adolescence. Feeding with SDC during pregnancy also enhanced skeletal muscle development in the offspring. Results from pilot clinical study showed that consumption of a prototype with SDC significantly reduced the positive glucose AUC in and reduced daytime glucose in obese pregnant women suggesting improvement in glucose homeostasis. Results from this study point out the importance of nutrition during critical periods of development and show the role of carbohydrate profile on maternal diet influencing metabolism and several biochemical and physiological outcomes in the offspring.

Life Course Modelling Methods and Challenges

Estelle Lowry[1,2], Nina Rautio[1,3], Ville Karhunen[1], Sirkka Keinänen-Kiukaanniemi[1,3], Leena Ala-Mursula[1], Inga Prokopenko[5], Alex Lewin[4,5], Jouko Miettunen[1,6], Sylvain Sebert[1,2,5] and Marjo-Riitta Järvelin[1,2,5]

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Background: Early identification of patients with increased risk of developing type 2 diabetes (T2D) could provide an opportunity to promote healthy and active aging. Psychiatric disorders, which can vary by socio-economic strata, share a bi-directional association with T2D. We would hypothesize that psychosocial factors will mediate and or modulate the clinical risk factors for T2D. Thus, use of a bio-psycho-social model provides an ideal approach to capture and quantify the dynamic relationship between determinants of glucose and insulin metabolism and the neuroendocrine responses from exposure to psychosocial stress.
Methods: Confirmatory factor analysis (CFA) was used to determine the best factor structures explaining each of the three areas of health (biological, psychological and social). Structure equation modelling (SEM) enabled examination of more complex relationships and models, including the association of the factors with T2D and their interaction with each other.
Results: CFA confirmed a good model fit for a single factor explaining metabolic syndrome as shown in previous studies. Psychological and social indicators loaded onto two distinct factors. These three factors were then used in SEM to examine the associations with T2D and potential mediating effects of the psychosocial factors.
Conclusions: Factor analysis provides a good indication of the association of metabolic syndrome with T2D and potential mediating/ modulating effects of psychosocial factors. To fully explore this complex relationship, additional complementary methods are required. Additional modelling methods and study designs should allow insights to explore the mediators and the psychosocial stratification of the population according to the metabolic risk.

Lancet Symposium: Preconception and Maternal Obesity

Thursday 13th October, 13.45-15.15

Preconception and Maternal Obesity: Implications for Pregnancy Outcomes

EARLYNUTRITIONMEMBER

Poston L [1], Caleyachetty R, Cnattingius S, Corvalán C , Uauy R, Herring S, Gillman MW
[1] King's College London, LONDON, UK

By 2025 more than 21% of women in the world are likely to be obese and the speed of change in low and middle income countries has been faster than in developed countries. Obesity affects reproductive function before and during pregnancy. Obese women intending to become pregnant have a heightened risk of infertility, and assisted conception is often less successful than in women with a normal BMI. Co-morbidities of obesity including hypertension and type 2 diabetes increase the risk of complications if affected women become pregnant. A high BMI predisposes to gestational diabetes and related adverse pregnancy complications, including fetal macrosomia and difficulties at the time of delivery. Pre-eclampsia is also more prevalent amongst women with a high BMI. Effects may also persist; it is now well established that women who have had gestational diabetes or pre-eclampsia have a much heightened risk of type2 diabetes and cardiovascular disease respectively in later life.

Effects of Maternal Obesity on the Next Generation

EARLYNUTRITIONMEMBER

Keith Godfrey
Professor of Epidemiology & Human Development, Director, Centre for the Developmental Origins of Health and Disease, and Director, NIHR Southampton Biomedical Research Centre in Nutrition, SOUTHHAMPTON, UK

Alongside its immediate implications for pregnancy complications, increasing evidence implicates maternal obesity as a major determinant of health in the next generation. Experimental studies of animal models of maternal obesity provide strong indications for causal effects of maternal obesity on offspring outcomes, mediated at least in part through changes in epigenetic processes including alternations in DNA methylation, and perhaps through alterations in the gut microbiome. Human epidemiological cohort studies provide evidence for effects of maternal obesity on the offspring's risks of obesity, coronary heart disease, stroke, type 2 diabetes and asthma. Maternal obesity may also lead to poorer cognitive performance in the offspring and an increased risk of neurodevelopmental disorders including cerebral palsy. There is some evidence suggesting potential implications for immune and infectious disease related outcomes, but work in this area should currently be regarded as preliminary. To date few controlled intervention studies have reversed maternal obesity and examined the consequences for the offspring, although there is evidence that the offspring of obese women who lose weight prior to pregnancy have a reduced risk of obesity. The long term effects of maternal obesity may have profound public health implications and indicate the urgency of studies on causality, underlying mechanisms and effective interventions to reverse the epidemic of obesity in women of child-bearing age and to mitigate its consequences for the offspring.

Interventions to Prevent Preconception and Maternal Obesity

Mark Hanson [1,2], Mary Barker [2,3], Jodie Dodd [4], Shiriki Kumanyika [5], Shane Norris [6], Eric Steegers [7], Judith Stephenson [8], Shakila Thangaratinam [9], Huixia Yang [10]
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It is now widely recognised that prevention of obesity in women of reproductive age is important both for their health and for that of their offspring. At present, weight control interventions in overweight or obese pregnant women, including drug treatment, have not been shown to produce sufficient impact on pregnancy and birth outcomes. This suggests that the focus for intervention should be on the preconception or post partum periods. Further research is needed on the longer-term effects of nutritional and lifestyle interventions before conception. Improving preconception health requires an integrated approach to pregnancy prevention, planning and preparation, involving more than just the primary healthcare sector and adopting an ecological approach to risk reduction which addresses personal to societal and cultural levels of influence. Raising awareness of the period prior to pregnancy will require a new social movement involving generating 'bottom-up' mobilisation of communities and individuals complemented by a 'top-down' approach from policy initiatives. Intervening to reduce or prevent obesity at this time in the life course may contribute substantially to achieving the global Sustainable Development Goals, in terms of health, wellbeing, productivity and equity in the present and future generations.

ISRHML Symposium: Programming Potential of Breastfeeding

Thursday 13th October, 13.45-15.15

Perinatal Factors Influencing the Breast Milk Microbiota and Bioactive Compounds Composition and their Role for Infant Health

Maria Carmen Collado

Institute of Agrochemistry and Food Technology-National Research Council (IATA-CSIC), VALENCIA, SPAIN

Accumulating evidence suggest that human microbial contact begins in utero and later, it is driven and modulated by perinatal factors such as mode of delivery and infant diet. Breast milk constitutes one of the most important sources of postnatal microbes. Early intestinal microbial colonization is essential for the maturation of immune system. Alterations in this process of colonization have been shown to predispose to disease later in life. New techniques have allowed increasing our understanding on milk microbiota, but little information about its biological role in infants is available. Furthermore, the influence of perinatal factors affecting the breast milk composition is still poorly understood. We evaluated the impact of perinatal factors as maternal health, lactation time, mode of delivery and gestational age on the breast milk microbes. In addition, we investigated the effects on the other bioactive compounds as proteins, polyamines, cytokines and other immunological compounds. Based on our data, we suggest that perinatal factors affect the transference of human milk microbes and also, bioactive compounds from mother to infant via breast feeding. Taken all information available, adequate nutritional and microbial exposures during the perinatal period is key in promoting and supporting human health. Furthermore, our data might help to identify potential targets to guide an adequate colonization with major effects on early health mainly in those cases where microbial exposition is not optimal. This knowledge may provide a window of opportunity to reduce the risk of non-communicable diseases in infants, using targeted strategies aimed at modulating the microbiota during early life.

Poster Exhibitions

I - Clinical Trials

☆ *New Investigator Award*

I-1 Influence of Calcium Intake Adequacy to Recommendations on Bone Mineral Density. Data from the European Childhood Obesity Programme (CHOP)

EARLYNUTRITIONMEMBER *Poster of Distinction*

Zaragoza-Jordana M. [1], Luque V. [1,2], Escribano J. [1,3], Ferré N. [1], Rubio-Torrents C. [1], Grote V. [4], Koletzko B. [4], Closa-Monasterolo R. [1,2], European Childhood Obesity Project study group

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Aim: To analyse the influence of dietary calcium (Ca) on bone mineral density (BMD) in 7 years aged children.
Methods: Data of the CHOP study were evaluated. Ca was collected with 3-day food records at 4, 5 and 6 years. Ca probability of adequate intake (PA) was calculated following the Institute of Medicine guidelines for individual assessment, with FAO/WHO/UNU dietary recommendations. At 7 years, BMD was measured in the Spanish subsample, BMD z-scores were calculated. BMD z-scores below -1SD were considered osteopenia.
Results: BMD was measured in 179 children. Ca intake at 6 years positively correlated with lumbar spine (LS) BMD at 7 years (R=0.205, p=0.030). A Ca increase of 100 mg/d explained 19.4% (p=0.011) of BMD z-score variation, modifying it 0.089 (0.021, 0.157) units. Children with Ca PA>95% at 5 and 6 or from 4 to 6 years showed significantly higher BMD z-score at LS and whole body (WB) than children with Ca PA< 95% (p< 0.001 and p< 0.05 at LS and WB, respectively). PA>95% maintained over 2 years explained 26.3% of LS BMD z-score variation (p< 0.001), increasing it by 0.669 (0.202, 1.137). PA>95% maintained over 3 years explained 24.9% of BMD z-score variation, increasing it by 0.773 (0.282, 1.264). Effects of Ca adequacy on WB were similar.
Children with PA>95% over 2 years had 13.84 and 12 fold reduced osteopenia risk at LS and WB, respectively (p=0.001).
Conclusions: Ca intake adequacy during long periods in childhood increases BMD at 7 years and reduces osteopenia risk.

I-2 Micronutrient Intake Adequacy in European Children, from Birth to 8 Years. Data from the European Childhood Obesity Project (CHOP)

EARLYNUTRITIONMEMBER *Poster of Distinction*

Zaragoza-Jordana M. [1], Luque V. [1,2], Escribano J. [1,3], Gispert-Llauradó M. [1], Grote V. [4], Koletzko B. [4], Pawellek I. [4], Verduci E. [5], ReDionigi A. [5], Stolarczyk A. [6], Socha J. [6], Langhendries J.P. [7], Xhonneux A. [7], Closa-Monasterolo R. [1,2], European Childhood Obesity Project study group

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Background: Suboptimal intakes have been reported for several nutrients including calcium, iron, zinc and vitamins B_1, B_2, B_6, B_9 (folate) and D. So far, no studies reported on healthy children across different European countries using the same methodology. Our aim was to describe the prevalence of inadequate intakes during the eight first years in children from 5 European countries.
Methods: CHOP study data were analysed. 3-day food records were collected at 3, 6, 12, 24, 36, 48, 60, 72 and 96 months. Micronutrient intake adequacy was estimated following the Institute of Medicine (IOM) guidelines for groups and individual assessment, using FAO/WHO/UNU Estimated Average Requirements preferably. Intake was considered inadequate when prevalence of adequacy at group level was under 80% and when probability of adequate intake at individual level (PA) was under 75% in more than 20% of individuals.
Results: Intake data was available for a decreasing number of children over time, from 904 children at 3 months to 396 at 8 years. Zinc, calcium, iron, iodine, folate and vitamin D showed group adequacy levels below 80% at several ages. Zinc, calcium, iron, iodine and folate PA was < 75% in more than 20 % of individuals. Intake of phosphorus, magnesium, vitamin B_{12} and vitamin A were adequate.
Conclusion: The mean intakes of phosphorus, magnesium, vitamin B_{12} and vitamin A among European children were adequate, whereas a high proportion of children did not achieve adequate intakes of zinc, calcium, iron, folate, iodine and vitamin D from infancy to 8 years.

I-3 Children's Sleep Efficiency Are Related to Better Memory and Attention at 8 Years Old: NUHEAL Study

EARLYNUTRITIONMEMBER *Poster of Distinction*

Escudero Marín M. [1], Torres Espínola F.J. [1], Campos Consuegra D. [1], Segura Moreno M.T. [1], Martinez-Zaldívar Moreno C. [1], Campoy Folgoso C. [2]

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Importance of quality sleep on consolidation memory, attention and general cognitive performance has been described. Knowledge on the effect of sleep on neurodevelopment in pediatric healthy population is limited so far. We aimed to study the association among sleep at school days and neurodevelopment at 8 years old. Sleep duration and efficiency of 88 healthy Spanish children, participating in the NUHEAL Follow-up Study, were evaluated by accelerometry (*SenseWear® ArmbandPro3)* during 4 school days at 8 years. Recognition memory and visual spatial attention were assessed by using Recall of Objects Test and Cancellation Test, respectively. Potential effect of related variables was studied by mean comparison test: ANOVA for parametric, Kruskal-Wallis for non-parametric and Chi-square for categorical variables. MANCOVA multivariate general linear model were performed to evaluate the association between sleep and neurodevelopment using IBM SPSS Statistics V22.0. Parity (p=0.035), family status (p=0.044) and area of residence (p=0.047) determined statistical differences in sleep efficiency when it was classified below or above 75%. Better Sleep efficiency was significantly associated to less Recall of Objects Test mistakes (3rd test) (p=0.127; p_{adjust}=0.039) and more Cancellation Test hits (p=0.059; p_{adjust} =0.026).
Conclusion: Sleep efficiency during school days in children aged 8 years old is associated to better memory and attention development.

Longitudinal and intervention studies with larger sample size and the appropriate methodology are necessary to clarify the mechanisms of interaction between sleep efficiency and neurodevelopment.

*Study funded by European Commission: 6FP EARNEST European Project FOOD-CT-2005-007036; and, 7FP NUTRIMENTHE European ProjectKBBE-2007-1 - GA No: 212652.

I-4 Placental Lipid Droplet Composition Is Associated with Maternal Clinical Parameters and Cord Blood Metabolites

EARLYNUTRITIONMEMBER **Poster of Distinction**

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Background and objectives: Lipid droplets (LD) are intracellular structures implicated in storage and hydrolysis of neutral lipids. To better understand the role of LD in placental function, we investigated LD composition in placentas from obese women and associations with maternal and infant parameters.

Methods: LD were isolated from placentas of 43 obese pregnant women randomized to a behavioural intervention designed to improve glycaemic control (intervention; n=20, control; n=23) (UPBEAT trial). Triglycerides (TG) and cholesterol in LD were quantified by commercial kits. Total FA, phosphatidylcholines (PC) and sphingomyelins (SM) in LD and cord blood were analyzed by UPLC-MS/MS. Differences between groups were assessed by t-test and associations to clinical parameters by Pearson correlation.

Results: Lipid droplet TG, cholesterol, FA, PC and SM composition were not different between randomized groups. Placental weight was associated with more saturated PC and less polyunsaturated FA (PUFA) in LD (particularly arachidonic and docosahexaenoic (DHA) acids). The intervention changed the dietary glycaemic index (53.0±1.1 vs. 57.9±0.9, p=0.001) and the glycaemic index correlated inversely with % DHA in LD (R=-0.32, p=0.04). Dihomo-γ-linolenic acid was positively associated with gestational weight gain. PUFA and PUFA-containing complex lipids in placental LD were positively correlated with cord blood lipids (e.g. DHA: R=0.42, p=0.01; PC.18:0/20:4: R=0.70, p< 0.001).

Conclusions: A lifestyle intervention which improved diet and reduced gestational weight gain in obese pregnant women did not modify LD metabolic profiles. Placental LD PUFA appear to be a source of cord blood PUFA and could play a role in regulation of fetal growth.

I-5 The Influence of Gestational Diabetes on Fetal and Maternal Heart Rate Variability during an Oral Glucose Tolerance Test

Poster of Distinction

Fehlert E. [1,2,3], Willmann K. [4], Fritsche L. [1,2,3], Linder K. [1,2,3], Mat Husin H. [2,3], Schleger F. [2,3], Kiefer-Schmidt I. [5], Brucker S. [5], Weiss M. [5], Häring H.-U. [1,2,3], Fritsche A. [1,2,3], Preissl H. [1,2,6]

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Gestational diabetes mellitus (GDM) potentially harms the child before birth and may have consequences later in life. We previously found GDM to be associated with developmental changes in the central nervous system. We now hypothesize that GDM may also impact on the fetal autonomic nervous system under metabolic stress like an oral glucose tolerance test (OGTT).

We measured heart rate variability (HRV) of mothers and fetuses during a 3-point OGTT in women with (n = 13) and without (n = 36) GDM using fetal magnetocardiography (fMCG). All women underwent the same examination setting with OGTT during which fMCG was recorded three times.

Compared to mothers with normal glucose regulation, mothers with GDM showed increased heart rate but no differences of maternal HRV. In contrast, HRV in fetuses of mothers with GDM differed from those in the metabolically healthy group regarding standard deviation normal to normal beat (SDNN) (p = 0.012), low frequency band (p = 0.008) and high frequency band (p = 0.031). These HRV parameters exhibit a decrease only in GDM fetuses during the second hour of the OGTT.

The results show an altered response of the fetal autonomic nervous system to metabolic stress in GDM complicated pregnancies. Thus, disturbances in maternal glucose metabolism might not only impact on the central nervous system of the fetus but may also affect the fetal autonomic nervous system. Since both alterations could have consequences in later life, good metabolic control is warranted during pregnancy.

I-6 Maternal Determinants of Neonatal Adiposity in Obese Pregnant Women in the UPBEAT Trial

EARLYNUTRITIONMEMBER **Poster of Distinction**

Patel N. [1], Pasupathy D. [1], Briley A. [1], Seed P.T. [1], Poston L. [1], on behalf of the UPBEAT Consortium

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Background: We sought to define in-utero exposures associated with neonatal adiposity in infants of obese pregnant women and define any interaction with gestational diabetes (GDM).

Methods: Anthropometric measures were performed in infants of obese women (BMI ≥30kg/m²) from the UPBEAT trial. Known and potential *in-utero* determinants of neonatal adiposity included maternal lifestyle, anthropometry, gestational weight gain (GWG) and biochemical variables. Multivariate regression with adjustment for confounders was undertaken, and associations between maternal exposures and GDM with neonatal adiposity were explored using interaction tests.

Results: Of 1522 neonates, 32.3% had anthropometric data (68.5% Caucasian, 27.9% with maternal GDM). The trial intervention did not affect neonatal adiposity (Poston et al, 2015). Increasing maternal birthweight (p=0.0023), multiparity(p=0.003), BMI (p=0.05),

triceps skinfold-thickness (SFT)(p=0.008) and subscapular SFT (p=0.001) in early 2nd trimester were linearly associated with neonatal adiposity; whereas black ethnicity (p=0.01) was negatively associated. GWG from 15-18+6 to 27-28+6 weeks' (p=0.003) was independently and positively associated. In the late 2nd trimester, maternal fasting blood glucose (p=0.009), insulin (p=0.015) and c-peptide(p=0.004), but not triglycerides were independently and positively associated. A measure of maternal central fat mass (subscapular SFT) interacted with maternal oral glucose tolerance test 1hr glucose)27-28+6weeks') at levels below the diagnostic threshold for GDM by IADPSG criteria at (p=0.01) to increase the probability of neonatal adiposity.
Conclusion: Several maternal modifiable factors of neonatal adiposity were identified which may be potential targets for intervention.
Funding: NIHR RP-0407-104522 & BRC at GSTT&KCL; CSO Scotland, GSTT Charity Tommy's Charity and the European Early Nutrition Project(FP7-289346-EarlyNutrition).

I-7 Gestational Weight Gain, BMI and Pregnancy Outcomes in the UPBEAT Trial

EARLYNUTRITIONMEMBER **Poster of Distinction**

Briley A. [1], Singh C. [1], Patel N. [1], Seed P.T. [1], Poston L. [1], on behalf of the UPBEAT consortium
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Introduction: Despite an absence of strong evidence the Institute of Medicine (IOM) recommends that all obese women gain 5-9 kg in pregnancy to optimise pregnancy outcomes, regardless of BMI category in early pregnancy.
Method: Using data from UPBEAT, a randomised controlled trial of a lifestyle intervention in obese pregnant women compared to routine antenatal care, we determined gestational weight gain (GWG) and its impact on pregnancy outcomes and postpartum weight retention, using multivariate logistic regression.
Results: The intervention reduced GWG by 550g (95%CI-1.1 to -0.02). Mean GWG in the whole cohort was 7.5kg, In the control arm 2% lost weight; 24% gained 0-4Kg; 37% gained 5-9 kg; 37% gained >9Kg. Treatment for GDM reduced subsequent GWG (34-36 weeks) by 2.0 kg.
GWG was associated with SGA infant (p=0.002) and postpartum blood loss (p=0.003), independent of potential confounders.
There was no association between GWG and pre-eclampsia, GDM diagnosis, CS, LGA in controls.
Postpartum weight retention was significantly associated with GWG defined by IOM categories. Women who gained < 0-4Kg, 5-9Kg >9Kg retained -0.5Kg, +0.2Kg and +4.4Kg respectively (p=< 0.001).
Conclusion: GWG is a good predictor of SGA and postpartum blood loss. Furthermore defining GWG as per IOM categories provides a risk assessment tool for postpartum weight retention within a clinical setting. However optimal GWG remains unclear in an obese cohort.
Funding: NIHR, CSO, Tommy's, CLAHRC

I-8 Does Maternal Pre-Pregnancy BMI Impact on Breastfeeding Behaviours in Obese Women? A Study from the UPBEAT Trial

EARLYNUTRITIONMEMBER **Poster of Distinction**

Ahmad M. [1], Patel N. [1], Seed P.T. [1], Singh C. [1], Poston L. [1], Briley A. [1], on behalf of the UPBEAT consortium
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Background: Maternal obesity is reported to be associated with poorer breastfeeding outcomes, attributable to delayed lactogenesis and decreased intention to initiate and establish breastfeeding.
Method: Using 6 month postpartum data from UPBEAT trial participants, breastfeeding practices of obese pregnant mothers, and by obesity class, were explored. Analyses were undertaken using multiple logistic regression with adjustment for confounders.
Results: Data were available for 708 women (45.5% of participants). 76.6% of women intended to breastfeed and 82.3% initiated breastfeeding. The UPBEAT lifestyle intervention (diet and physical activity did not influence breastfeeding outcomes. Treating the data as a cohort, average duration of exclusive breastfeeding(days) varied by BMI category (class 1, 94.4; class 2, 77.4; class 3, 76.5 p=0.01). Class 1 mothers were more likely to be breastfeeding at 6 months, than other classes (p=0.03). Initiation of breastfeeding was not associated with gestational weight gain >9kg, mode of birth, postpartum haemorrhage, macrosomic infant (>4kg) or postnatal depression. Conversely, GWG < 5kg and gestational diabetes were associated with initiation of breastfeeding (p=0.000 and p=0.01). Breastfeeding at 6months was associated with reduced weight retention (0.08 versus 1.96 Kg p=0.0003; classes combined).
Conclusion: Higher than previously reported rates of breastfeeding may be attributable to maternal participation in a randomised trial or midwifery practice. Longevity of exclusive breastfeeding is comparable with previous reports. Those in obesity class 3 may benefit most from encouragement to persist with breastfeeding. Reduction in maternal weight retention in women breastfeeding at 6months highlights health benefits of lactation longevity.
Funding: NIHR, CSO, Tommys, CLAHRC

I-9 Can Cooking Classes that Promote Homemade and Varied Food Reduce Food Skepticism in Children? A Randomized Controlled Intervention Study

Poster of Distinction

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Background: Concern has arisen due to the composition and lack of diversity in some children's diet and food neophobia or skepticism to new food is suggested to be related to this lack of diversity.
Methods: A randomized controlled intervention trial was carried out in 2012-2014 where one aim, presented here, was to investigate whether improving cooking skills in parents of infants would reduce infants' new food skepticism. In total 143 parents with infants aged 5-6 months were recruited from public health clinics in Southern Norway and randomized. The intervention group participated in two cooking courses. All participants filled in questionnaires at baseline (6 months of age), and at 15 and 24 months of age. New food skepticism was measured with only one question; to which degree do you feel that your child is skeptical when new food is introduced, response alternatives ranged from 1 to 6 where 1 was not skeptic and 6 was very skeptical and very typically picky eater. We dichotomized the responses and analyzed differences using chi-square analysis.
Results: There were no differences between the control and intervention group, respectively, in percentage reporting having children

who were non-skeptical regarding new food (71% vs. 80%, p= 0.404). There were still no differences in percentage being non-skeptical at 3 and 9 months after the intervention between control and intervention group respectively (80 vs 82 %, p=1.000 and 57% vs 68%, p=0.420).
Conclusion: Attending practical cooking courses did not have an effect on new food skepticism in young children.

I-10 GeliS - A Lifestyle Intervention Trial to Prevent Excessive Weight Gain during Pregnancy

Poster of Distinction

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Objective: Pregnancy and the early postnatal phase are probably critical periods for long-term health, but can also be considered as "window of opportunity" for lifestyle changes of pregnant women. The aim of the GeliS study (Gesund leben in der Schwangerschaft/ Healthy living in pregnancy) is to examine the effect of a lifestyle intervention programme to prevent excessive gestational weight gain and, hence, to reduce pregnancy and obstetric complications as well as the risk of maternal and offspring obesity.
Methods: GeliS is a lifestyle intervention study targeting maternal and foetal health by focusing on healthy diet, regular physical activity and self-monitoring of body weight. The study is designed as a multicentre prospective, cluster-randomised, controlled, open intervention trial. The cluster-randomisation was performed by matching five pairs of regions according to birth figures, sociodemographic and geographic criteria. Each pair is supervised by local project managers at expert centers for nutrition run by the Bavarian State Ministry of Food, Agriculture and Forestry. 72 practices in ten Bavarian regions and 2282 pregnant women take part in the project. The intervention comprises three structured and individualised counselling sessions during pregnancy and one session after delivery. The counselling sessions, given by 62 specifically trained and certified counsellors, are attached to routine pre- and postnatal visits. A 5-year follow-up of mothers and their infants is planned.
Conclusions: The GeliS intervention has been adapted to the existing routine health care system for pregnant women. If shown to be effective, it could be immediately implemented in routine care.

I-11 Impact of Nutritional Intervention in Early Life on Infant Visual Function During the First 12 Months of Life

EARLYNUTRITIONMEMBER

Nieto A. [1,2,3], Herrmann F. [1,2], Miranda M.T. [1,4], Morera M. [5], Guarro M. [5], García S. [6], Sáez J.A. [6], Arias M. [1,2], Campoy C. [1,2,7], EURISTIKOS

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Postnatal nutrition is essential for retinal and brain development and function. Cortical visual evoked potentials (cVEP) in infancy reflect the integrity and maturity of the visual system, and indirectly brain development. We analysed the influence of an infant formula supplemented with Nutriexpert® factor on visual function (VF) in healthy infants during the first 12 months of life. 170 healthy term infants were randomized in a double-blind study to receive a standard infant formula (F1: n=85) or a new one supplemented with Nutriexpert® factor (F2: n=85). As control, a cohort of 50 breastfed infants (BF) was also enrolled. VF was assessed by cVEP at 3 and 12 mo. Differences in latencies and amplitudes between study groups were analysed by ANOVA. McNemar test was performed to compare the proportion of babies at 3 and 12 months of age who showed a response at minimum angle of resolution (7.5' of arc). SPSS version 22.0 was used for the statistical analysis. At 12 months of age, BF (n=36) presented lower latencies at 15´ of arc (p=0.004) and higher amplitudes at 120´ of arc (p=0.007) compared to F1 (n=45) and F2 (n=58) infants. At 12 months, higher number of F2 (p< 0.001) and BF infants (p=0.049) presented a response at 7,5' of arc, compared to F1 infants.
Conclusion: Early nutritional intervention with Nutriexpert® factor promotes positive effects by determining better VF during the first 12 months of life and similar to BF infants.

I-12 Biomarkers IL-6, Resistin, SIRT1 Expression, Involved with Gestational Diabetes, Compared to Healthy Pregnant Women and their Offsprings

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Objective: Gestational diabetes (GD) affects 4-12% of all pregnancies, offsprings develop alterations in metabolic programming; studies showed that those could explain the fetal origin of metabolic diseases.
Identify biomarkers, IL-6, resistin, SIRT1 expression, involved with GD, compared to healthy pregnant women (HPW) and their offsprings.
Design/Methods: The study was approved by the Ethics Committee of the Hospital Dr Ignacio Morones Prieto in San Luis Potosi, Mexico and informed consent was obtained from parents. 20 pregnancy GD and 20 HPW and their offsprings. Blood samples were taken at birth for biochemical markers, IL-6, resistin (ELISA) and expression levels of SIRT-1 (RT-PCR). For statistical analysis we used chi square for categorical variables, t students for continuous, Correlation between the different quantitative parameters was performed using the Pearson correlation coefficient and p < 0.05 were considered statistically significant. Calculations were done in SPSS 19.
Results: Offsprings: GD vs HPW, gestational age 38.5±1.23 vs 38.3±0.84 weeks, p=0.69, weight: 3791±303 vs 3170±298 grams, p< 0.001. resistin 40.39±13.4 vs 41.20±18.3 ng/mL, p=0.48, IL-6 24.94±1.81 vs 6.40±0.65 pg/mL, p< 0.001.
Pregnancy women: GD vs HPW, resitin 27.21±7.56 vs 19.30±10.20 ng/mL, p=0.23, IL-6 8.51±2.19 vs 34.47±1.96 pg/mL, p< 0.001.
SIRT-1 was higher in GD and their offsprings. No statistical differences were found in biochemical markers.
Conclusions: The results of this study suggest that overexpression of SIRT1 may be involved as regulator in maintaining homeostasis in

metabolic disorders in GD and their offsprings. Elevated levels of IL-6 in the GD infants are similar to those with inflammatory intrauterine conditions.

I-13 Association between Rapid Weight Gain in Early Life on Neurodevelopment and Adaptive Behavior during the First 18 Months of Life in Healthy Infants

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Early postnatal life is an important period influencing long-term health and neurocognitive development. We investigated in healthy infants the association of rapid weight gain (WG) with neurodevelopment and adaptive behaviour during the first 18 months of life. 170 healthy term infants aged 0-2 months were double-blind randomized to receive either standard infant formula (F1,n=85) or a new formula supplemented with Nutriexpert® factor (F2,n=85). Anthropometric data and percentiles were obtained and weight/age z-scores were calculated based on WHO standards of growth. Infants were classified depending on weight gain (WG), based on z-scores Δ between birth and 6 months, as follow: slow (SWG) (< -0.67), normal (NWG) (-0.67 to +0.67) and rapid (RWG) (>0.67), respectively. Neurodevelopment was assessed by the quality of general movements (GMs) until 4 months of life and using Bayley III test at 6, 12 and 18 months. Student´s t-test and Chi-Square were performed using SPSS 22.0. At 4 months, RWG infants (n=89) showed more *mildly abnormal GMs* (p=0,027) than those with a NWG (n=56). At 6 months, SWG infants (n=47) presented lower scores in *motor skills* (p=0,007) than NWG ones (n=82). At 12 months, RWG infants (n=34) had lower scores in *social* (p=0,047) and *home living skills* (p=0,034) compared to those showing NWG (n=72). At 18 months, SWG infants (n=38) had higher scores in *functional pre-academics competences* (p=0,043) than those who exhibit RWG (n=32). **Conclusion:** Abnormal rate of growth during the first six months of life may predict a poorer cognitive and psychosocial development.

I-14 Early Food for Future Health - an E-Health Intervention Aiming to Promote Healthy Food Habits from Early Childhood

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Background: The early feeding environment is critical for establishing eating habits that may influence weight development and growth. The purpose of this study is to promote healthy feeding practices that may foster healthy dietary habits in children. The aim of this presentation is to describe the intervention.

Methods: *Early Food for Future Health* is a randomized controlled interventional study. We will recruit 1000 parents of children aged between 3 and 5 months. All parents will fill in a questionnaire before and after the intervention, when the child is 5 and 13 months old.

Results: For this intervention we have developed a website, www.spedbarnsmat.no , providing information on beneficial parental feeding practices, introduction of solid food in the weaning period and how to make healthy, homemade baby food. The intervention runs when the child`s age is between 6 and 12 months. We have developed 7 theme-films of 3-4 minutes duration addressing topics relevant for the age of the child, and13 films showing how to prepare age-appropriate food. The intervention group will receive an age-dependent link to the website every month. The recruitment started spring 2016, with 750 included per 01/05/2016. The data collection will be completed by February 2017.

Conclusion: Unhealthy eating habits and obesity are major challenges to public health. Primary interventions targeting parents has been called for. In this project we will investigate whether an e-health intervention for parents in the weaning period can promote healthy eating-habits from early childhood.

Key words: early nutrition, food-parenting, child obesity

I-15 The Use of an Electronic Application to Influence Maternal Behaviour

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Background: Health promotion efforts that are mediated by computers and other digital technologies, may have great potential to promote behaviour changes through unique features such as mass customization, interactivity and convenience. Such communication can improve behavioural outcomes.

Method: The Maternal Lifestyle and Behaviour Change Intervention (MLBCI) study is a randomised control trial recruiting primigravidas. It uses the digital delivery of information to improve the health of mothers. This is a unique study in that it targets the period between pregnancies. It utilises a custom built electronic application to deliver information from Irish healthcare professionals to Irish mothers. We aim to show that this study will decrease maternal weight postpartum as well as affect neonatal anthropometry and the growth velocity of her baby in the first year of life.

300 mother and infant pairs were randomised into control and intervention groups. The following outcomes are measured at 4 and 9 months postpartum: maternal weight (between booking for pregnancy 1 versus at 9 months post-partum), neonatal anthropometry, growth velocity of child from birth to 9 months, diet of mother and child, physical activity of mother and health literacy of mother.

Results: Assessment of the mother and infant pairs has commenced and we hope to show the successful influence of customised communication on behavioural outcomes.

I-16 The Association of Maternal Nutrition and Development of the Infant - Emphasizing the Role of Vitamin D

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Background: Maternal nutrition is an important determinant of later health of the offspring. We studied the impact of maternal dietary intakes of foods and nutrients during pregnancy on infant neurodevelopment. The hypothesis was that higher intake of certain nutrients advances offspring development.

Design: Dietary intakes of foods and nutrients of 207 mothers were recorded in each trimester of pregnancy using 3-day food diaries in a prospective mother-child follow-up study. Overall development of the one-year-old infants was assessed using Griffiths Mental Development Scale (GMDS). Associations between mean dietary intakes of foods and nutrients during pregnancy and infants' development were evaluated by chi-squared test and backward linear regression models.

Results: The infants were normally developed with median GMDS score of 106.5 (IQR 102.8-111.8). The strongest determinant of higher GMDS scores was total intake of vitamin D calculated from diet and supplements [median 9.8 µg/day (IQR 7.6-12.3), initial p=0.052, final p=0.002] analyzed with backward linear regression analysis including intakes of vitamins and minerals. Further the intakes of particular foods and nutrients were related to higher GMDS scores [vitamin D from supplements (p< 0.01), total vitamin D (p=0.04), fruits and berries (p=0.03), PUFA (p=0.02) and biotin (p=0.03), analyzed by chi-squared test]

Conclusion: Higher maternal total intake of vitamin D was associated with development of one-year-old infants as evaluated by higher GMDS scores. Also intakes of particular other nutrients and foods may have a role in supporting infants' neurodevelopment. The results support the importance of using vitamin D supplements during pregnancy.

I-17 The Use of the Local and Indigenous Plants and Weeds in the Cure and Prevention of Breast Cancer to Improve Breast Feeding Outcomes

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Child nutrition is a very important aspect in society without which, malnourished takes over and the chances child survival seriously compromised, mother's health is very important for child nutrition, breast cancer affects mother's health and hence child nutrition, breast cancer is one of the hinderances to breastfeeding, the biggest problem that has made women to fail breastfeed, we were able to handle the problem using the locally available weeds that were cheap and affordable. In this reasesch we found the particular weeds Mimosa pudica, Aloe vera and Phyllanthus niruri, were great in phytochemicals that prevented breastcancer in women. These weed helped in preventing and curing breast cancer, Mimosa pudica was found to have more comparatively greater of anticancer activities and killed the isolated cancer cells in comparatively short time. The flavonoids isolated from Mimosa pudica, Aloe vera and Phyllanthus niruri acted against human breast carcinoma cell line (MCF-7) using MTT assay. These results indicated the cytotoxicity activity of all the three flavonoids isolated and the Mimosa pudica was seen to be greatest of all the weeds in terms of destroying breast cancer cells.

Results showed that flavonoid from Mimosa pudica has the maximum cytotoxic effect than flavonoid from Aloe vera and Phyllanthus niruri against MCF-7, Human breast cancer cell line.

If breast cancer can be treated, prevented and cured, then we can help to improve on breast feeding of children who are very much dependant on breast milk for the first six months of their life.

II - Observational Studies

II-1 Maternal Body Mass Index, Gestational Weight Gain and Childhood Body Mass Index: Individual Participant Data Meta-Analysis of 162,745 Mothers and their Children

EARLYNUTRITIONMEMBER **Poster of Distinction**

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Objective: We assessed the strength and consistency of the associations of maternal pre/early- pregnancy body mass index and gestational weight gain with childhood body mass index, using individual participant data of 162,745 mothers and their children from 37 Western cohorts.

Methods: We used multilevel linear mixed effects models to examine the separate and combined associations of maternal pre/early-pregnancy body mass index and gestational weight gain with offspring body mass index in early, mid and late childhood (2-5 years, >5-10 years, and >10-18 years, respectively).

Results: As compared to children of mothers with a normal weight, children of mothers with overweight or obesity had a higher body mass index in early, mid, and late childhood. Childhood body mass index increased with increasing maternal pre/early- pregnancy body mass index, across the full range of maternal body mass index. Also, as compared to children of mothers with a normal weight and sufficient gestational weight gain, children of overweight or obese mothers had a higher body mass index for all categories of gestational weight gain. The strongest effect estimates were present for children of obese mothers with excessive gestational weight gain (differences: 0.37 Standard Deviation Scores (SDS) (95% Confidence Interval (CI) 0.33, 0.41), 0.69 SDS (95% CI: 0.66, 0.73), and 1.01 SDS (95% CI: 0.90, 1.12), in early, mid and late childhood, respectively).

Conclusion: Maternal pre/early- pregnancy body mass index across its full range and gestational weight gain are positively associated with childhood body mass index.

II-2 Maternal Protein Intake and Offspring Blood Pressure 20 Years Later

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Background: Results from two former cohort studies in Scotland (Aberdeen and Motherwell) suggested that high protein diet during pregnancy may adversely influence offspring blood pressure. Our objective was to examine this association in the Aarhus Birth Cohort (1988-89).

Methods: This was a prospective cohort of 965 women who gave birth in 1988-89 and whose offspring (n=434) participated in a clinical examination ~20 years later. Micronutrient intake was assessed in gestational week 30. Main analyses were adjusted for maternal total energy, pre-pregnancy BMI, age, parity, smoking status, educational level and offspring´s sex.

Results: The mean (SD) total energy intake was 8.7 (2.3) MJ/d. The mean carbohydrate, fat and protein intake was 51, 31, and 16%E respectively. Among women with high protein intake (quintile 5 ~20%E), 15%E came from animal protein and 5E% from plant protein, while 7%E came from animal protein and 6%E from plant protein among women with low intake (quintile 1 = ~13%E). After adjustment, mean offspring diastolic blood pressure increased with the maternal substitution of carbohydrates with protein (highest compared to the lowest quintile of protein: Δ=2.3 mmHg; 95% CI: 0.3, 4.3; p for trend 0.04). Similar, although not significant, differences were found for systolic blood pressure (Δ=2.7 mmHg; 95% CI: -0.0, 5.3; p for trend 0.08). Additional adjustment for offspring BMI and alcohol consumption did not appreciably alter effect estimates.

Conclusions: Increasing maternal dietary protein intake at the expense of carbohydrate was associated with higher offspring blood pressure in young adulthood.

II-3 Macronutrient Composition of Early Childhood Diet is Related to Growth and Adiposity up to the Age of 9 Years Irrespective of Diet in Later Childhood

Poster of Distinction

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We examined associations of intake of protein, carbohydrate and fat and their subtypes in early childhood with growth and detailed measures of body composition up to the age of 9 years among 3,564 children participating in the Generation R Study. Dietary intake was assessed with food-frequency questionnaires at the ages of 1 year and 8 years. We calculated intakes of total protein and protein from different sources; of total carbohydrates, fibre, polysaccharides, monosaccharides and disaccharides; and of total, saturated, monounsaturated and polyunsaturated fat. Height and weight were repeatedly measured between the ages of 1 and 9 years. Fat and fat-free mass were measured at 6 and 9 years using dual X-ray absorptiometry. We calculated age- and sex-specific SD scores for height, weight, body mass index (BMI), fat-mass index (FMI), and fat-free mass index (FFMI). Macronutrient intakes were expressed in energy percentages and entered in multivariable linear mixed models in which we examine the effects of different macronutrient replacement effect. Results from multivariable linear mixed models showed that higher intake of animal protein (both dairy and non-dairy) was associated with a higher height, weight, BMI and FMI up to the age of 9 years, irrespective of whether it was replaced by carbohydrates or fats. No significant associations were observed for the other macronutrients. The associations for protein remained significant after adjustment for protein intake at age 8 years. Our results suggest that later childhood diet does not abate the adverse effect of a high-protein diet in early childhood on later adiposity.

II-4 Critical Periods and Growth Patterns from Fetal Life Onwards Associated with Childhood Insulin Levels

EARLYNUTRITIONMEMBER **Poster of Distinction**

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Objective: Low birth weight and rapid childhood growth are associated with an increased risk of type 2 diabetes in later life. We aimed to identify critical periods and specific growth patterns from fetal life onwards associated with childhood insulin and c-peptide levels.
Methods: In a prospective population-based cohort study among 4,328 children, we repeatedly measured (femur-) length and (estimated fetal-) weight from the second trimester of fetal life until 6 years of age. Body mass index was calculated from 6 months onwards. At 6 years, insulin and c-peptide levels were measured.
Results: Preterm birth and low or high birth weight were not associated with childhood insulin levels. Conditional growth modelling showed that, independent of growth in other time intervals, weight growth from 6 months onwards, length growth from 12 months onwards and body mass index growth from 24 months onwards were positively associated with childhood insulin levels. The strongest associations were present for weight and body mass index at 72 months. Repeated measurement analyses showed that, as compared to children in the lowest quartile of childhood insulin, those in the highest quartile had a higher length from birth onwards and a higher weight from 24 months onwards. These differences increased with age. No associations were observed for fetal growth characteristics. Similar results were observed for c-peptide levels.
Conclusion: Our results suggest that rapid length, weight and body mass index growth from the age of 6 months onwards, but not during fetal life, is associated with higher insulin levels in childhood.

II-5 Influence of Fetal Blood Flow Redistribution on Fetal and Childhood Growth and Fat Distribution: The Generation R Study

EARLYNUTRITIONMEMBER **Poster of Distinction**

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Objective: A suboptimal intrauterine environment leads to fetal blood flow redistribution and fetal growth restriction. Not much is known about childhood growth consequences. We examined the associations of fetal blood flow redistribution with birth outcomes, and repeatedly measured fetal and childhood growth and fat mass measures.
Methods: In a population based chort study among 1195 pregnant
women and their children we measured umbilical and cerebral artery blood flow at a gestational age of 30.3 weeks (95% range, 28.5-32.6 weeks). A higher umbilical/cerebral (U/C) pulsatility index ratio is an indicator of preferential blood flow to the brain cerebral circulation at the expense of the lower body parts. Fetal and childhood growth were repeatedly measured from the third trimester until childhood. We measured the total body fat mass, lean fat mass and android/gynoid fat mass ratio by dual-energy-X-ray-absorptiometry and preperitoneal fat by ultrasound at 6-years.
Results: A higher fetal U/C ratio was associated with increased risks of preterm birth and small size for gestational age at birth [odds ratios, 1.41 (95% confidence interval, 1.08-1.85) and 1.63 (95% confidence interval, 1.21-2.19), respectively, per SDS increase in U/C ratio]. Longitudinal growth analyses showed that a higher fetal U/C ratio was associated with persistently lower head circumference, length and weight from third trimester fetal life until childhood (all $P < 0.05$). The fetal U/C ratio was not associated with total body and abdominal fat measures at 6-years.
Conclusion: Our results suggest that fetal blood flow redistribution
affects fetal development and has persistent consequences for childhood growth.

II-6 Maternal Psychological Distress, Body Mass Index and Weight Gain during Pregnancy

EARLYNUTRITIONMEMBER **Poster of Distinction**

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Background: Observational studies suggest an association between depression and increased body mass index. Depressive symptoms during pregnancy leading to psychological distress may also affect body mass index and weight gain during pregnancy.
Aim: We examined whether overall psychological distress, and depression and anxiety symptoms affect body mass index and weight gain during pregnancy.
Methods: We performed a population-based prospective cohort study among 6,536 pregnant women. Information about psychological distress was obtained in the second trimester of pregnancy using the Brief Symptom Inventory questionnaire. Body mass index (BMI) was assessed during second and third trimester. Gestational weight gain was estimated as the difference between weight in the third trimester of pregnancy and weight before pregnancy.
Results: In total, 10.8% of all women experienced psychological distress. Higher psychological distress was associated with higher second and third trimester BMI (differences 0.61 kg/m² (95% Confidence Interval (CI) 0.33, 0.89) and 0.68 kg/m² (95% CI (0.40, 0.95), respectively)). These associations attenuated into non-significant after adjusting for potential confounders. Similar results were observed for anxiety and depression. Overall psychological distress, anxiety and depression were not associated with gestational weight gain.
Conclusions: Our results do not strongly support the hypothesis that psychological distress affects BMI and weight gain during pregnancy.

II-9 General and Abdominal Adiposity and Liver Enzymes in School-Age Children

Poster of Distinction

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Background: Obesity is the major risk factor for non-alcoholic fatty liver diseases (NAFLD). We explored the associations of body mass index (BMI) and measures of general and abdominal adiposity, all across the full spectrum, with alanine aminotransferase (ALAT) and aspartate aminotransferase (ASAT) concentrations in childhood as markers of liver cell damage.

Methods: We performed a population-based cohort study among 4,337 children. At the median age of 6 years (95% range 5.7, 8.0) we measured childhood BMI. We measured fat mass index, fat free mass index and android/gynoid ratio by dual-energy X-ray absorptiometry and preperitoneal fat area by ultrasound. Liver enzymes were measured by non-fasting blood samples.

Results: BMI, fat mass index, fat free mass index, android/gynoid ratio, and preperitoneal fat area were positively associated with ALAT concentrations (p-values < 0.01), whereas BMI, fat mass index and android/gynoid ratio were negatively associated with ASAT concentrations (p-values < 0.01). Adjusted for BMI, each 1-SD preperitoneal fat area was associated with 0.05 SDS (95% CI: 0.01, 0.09) higher ALAT concentrations, whereas each 1-SD fat mass index and fat free mass index were associated with 0.13 SDS (95% CI: -0.17, -0.08) lower and 0.10 SDS (95% CI: 0.06, 0.13) higher ASAT concentrations, respectively.

Conclusion: Our results suggest that, next to BMI, more specific measures of body composition and body fat are associated with higher ALAT concentrations and lower ASAT concentrations in childhood.

II-10 Genetic Variants Associated with Body Mass Index and Eating Behavior in Childhood

EARLYNUTRITIONMEMBER *Poster of Distinction*

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Background: Fussy eating is a common eating behaviour during childhood and is associated with body mass index (BMI). The genetic background of fussy eating has not been investigated. Recent genome-wide association studies have identified many single nucleotide polymorphisms (SNPs) associated with adult and childhood BMI. We hypothesized that these SNPs influence eating behaviour.

Methods: In a population-based prospective cohort study among 3,179 children with a mean age of 4 years, we tested two weighted genetic risk scores, based on 97 adult and 15 childhood BMI SNPs, for association with five eating behaviours: food responsiveness, enjoyment of food, satiety responsiveness, food fussiness, and slowness in eating. We ran linear regression models for each of these outcomes, adjusting for sex, age and principal components.

Results: The adult BMI risk score was nominally associated with food responsiveness. Food responsiveness increased by 0.008 SDS (95% confidence interval (CI): 0.001, 0.014, *P*=0.026) per additional risk allele in the genetic score. The child BMI risk score was nominally associated with satiety responsiveness and slowness in eating, with scores decreasing by 0.024 SDS (95% CI: -0.044, -0.004, *P*=0.017) and 0.021 SDS (95% CI: -0.041, -0.001, *P*=0.037), respectively, per additional risk allele in the genetic score. The directions of the effect for the other associations fitted our hypothesis, but did not reach significance.

Conclusion: Our results suggest a potential role for SNPs associated with BMI in eating behaviour during childhood. Additional research in larger populations is needed to confirm our findings.

II-11 Associations of Maternal Blood Pressure Patterns and Hypertensive Disorders during Pregnancy with Childhood Blood Pressure

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Background and objective: Gestational hypertensive disorders may affect offspring cardiovascular risk. We examined the associations of maternal blood pressure throughout pregnancy and gestational hypertensive disorders with childhood blood pressure. Specific focus was on the comparison with paternal blood pressure effects, the identification of critical periods and the role of birth outcomes and childhood body mass index in the observed associations.

Methods: This study was embedded in a population-based prospective cohort study from early pregnancy onwards among 5310 parents and their children. We measured maternal blood pressure in early, mid- and late pregnancy and paternal blood pressure once. Information about gestational hypertensive disorders was obtained from medical records. We measured childhood blood pressure at the median age of 6.0 years (95% range 5.7, 8.0).

Results: Both maternal and paternal blood pressure were positively associated with childhood blood pressure (all p-values < 0.05), with similar effect estimates. Conditional regression analyses showed that early, mid- and late pregnancy maternal blood pressure were all independent positively associated with childhood blood pressure, with the strongest effect estimates for early pregnancy. As compared to children from mothers without gestational hypertensive disorders, those from mothers with gestational hypertensive disorders had 0.13 SDS (95% Confidence Interval: 0.05 to 0.21) higher diastolic blood pressure. The observed associations were not materially affected by birth outcomes and childhood body mass index.

Conclusion: Both maternal and paternal blood pressure affect childhood blood pressure, independent of fetal and childhood growth measures, with the strongest effect for maternal blood pressure in early pregnancy.

II-12 Differential SLC6A4 Methylation: An Epigenetic Marker of Obesity from Birth to Adulthood

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The early life environment influences susceptibility to obesity and metabolic disease in later life, and a central role for epigenetic mechanisms in mediating these effects has been proposed. SLC6A4 is an important mediator of serotonin bioavailability, and consequently plays a key role in energy balance. Here, we examined the hypothesis that perinatal methylation of the SLC6A4 gene predicts adiposity throughout the lifecourse, and measured DNA methylation of SLC6A4 in umbilical cord from children in the Southampton Women's Survey cohort, in peripheral blood from adolescents in the Western Australian Pregnancy cohort, and in adipose tissue from lean and obese adults from the BIOCLAIMS cohort. Lower umbilical cord methylation of SLC6A4 CpG +1487 was associated with higher total fat mass at 4 years (p=0.031), total and % fat mass at 6 years (p=0.0001, p=0.004), and with triceps skinfold thickness from birth (p=0.013) through to 6 years (p=0.013). At 17 years old, lower methylation of SLC6A4 CpG+1487 in peripheral blood was also associated with greater concurrent BMI (p=< 0.001), waist circumference (p=0.032), subcutaneous fat (p=0.037), subscapular skinfold thickness (p=0.007), abdominal skinfold thickness (p=0.011) and supraliac skinfold thickness (p=0.015). Methylation of *SLC6A4* CpG+1487 was also reduced in adipose tissue from obese compared to lean adults (p=0.019) and here the decrease in methylation was accompanied by a decrease in SLC6A4 expression (p=0.008). These data suggest that altered methylation of CpG loci within SLC6A4 may provide a robust marker of adiposity across the life course.

II-13 Proportionately Higher Brown Adipose Tissue is Associated with Lower Adiposity in Healthy Asian Children Aged 4.5 years: GUSTO Study

EARLYNUTRITIONMEMBER

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Background: Recent research studies suggested that brown adipose tissue (BAT) persists from infancy to adulthood, and may play a role in preventing obesity/metabolic diseases. An inverse relationship between BAT and obesity has been observed among individuals with medical indications for Positron-Emission-Tomography and Computed-Tomography scans in Western populations. Using MRI in healthy Asian children, we examined the relation of BAT with adiposity.

Methods: Color maps of fat-signal fractions (FF) were created from MRI images of the base of the neck to the inferior border of the scapula (n=180 healthy children aged 4.5 years). Supraclavicular and axillary fat pads (FP) were manually segmented. Regions within these FP with FF 20~60% and 80~90% were defined as BAT and white adipose tissue (WAT), respectively, and quantified. Abdominal subcutaneous adipose tissue (SAT) volume was derived using MRI and intra-myocellular lipid (IMCL) from calf-muscle magnetic-resonance-spectroscopy.

Results: An inverse linear association was observed between BAT and WAT within segmented FP (r=-0.362, p< 0.001). BMI was positively associated with absolute WAT volume (0.428, p< 0.001) but not with BAT. However, adjusting for sex, ethnicity, age, scanning time and height (for skinfold), within the highest BAT-tertile, each 1ml increase in BAT was associated with reductions in BMI (-0.31kg/m^2 (95%CI -0.60,-0.01)), supraclavicular skinfold thickness (-0.43mm (-0.80,-0.07)), SAT (-73.86ml (-135.2,-12.5)) and %IMCL(-0.05(-0.09,-0.01)).

Conclusion: Deposits consistent with BAT are present in supra-clavicular/axillary regions of healthy Asian children aged 4.5 years. In children in the highest BAT-tertile, increasing BAT was associated with lower adiposity, suggesting BAT may play a role in preventing adiposity.

II-14 Folate, Vitamin B12 and Homocysteine Concentrations during Pregnancy and at Birth and Childhood Kidney Outcomes

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Background: Folate, vitamin B_{12} and homocysteine concentrations during pregnancy may influence kidney function in their offspring. We examined the associations of maternal first trimester and fetal cord blood folate, homocysteine, and vitamin B_{12} concentrations with kidney outcomes in school-aged children.

Design: In a population-based prospective cohort study among 4,226 pregnant women and their children, we measured folate, homocysteine and vitamin B_{12} concentrations in blood samples collected in early pregnancy (median gestational age 13.2 weeks (95% range 9.8, 17.4) and fetal cord blood (at birth). At the median age of 6.0 years (95% range 5.6, 7.9) we assessed combined kidney volume, estimated glomerular filtration rate (eGFR) and microalbuminuria using urine albumin-creatinine ratios.

Results: Higher maternal folate concentrations were associated with larger childhood combined kidney volume. Higher maternal vitamin

B12 concentrations were associated with higher childhood $eGFR_{cystC}$. Maternal homocysteine concentrations were associated with smaller combined kidney volume and lower childhood $eGFR_{cystC}$ per 1- standard deviation (SD) increase in homocysteine concentrations (p-values < 0.05). The association of maternal homocysteine concentrations and childhood $eGFR_{cystC}$ was largely explained by combined kidney volume. Higher cord blood homocysteine concentrations were associated with larger combined kidney volume and lower eGFR (p-values < 0.05).
Folate, vitamin B12 or homocysteine concentrations were not associated microalbuminuria.
Conclusion: Our findings suggest that folate, vitamin B12 and homocysteine concentrations during fetal life are associated with offspring kidney development. Further studies are needed to replicate these findings and assess the causality and long-term consequences for kidney health in later life.

II-15 Perinatal DNA Methylation at the CDKN2A Locus Is Associated with Later Childhood Bone Indices: The Southampton Women's Survey

EARLYNUTRITIONMEMBER ☆ *New Investigator Award*

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There is increasing evidence that associations between poor early growth and the risk of osteoporosis in later life may be mediated through epigenetic mechanisms. We used a population-based mother-offspring cohort to explore relationships between DNA methylation at the *CDKN2A* gene locus (a region involved in cell cycle regulation) in umbilical cord tissue at birth, and bone size and density measured by DXA in childhood.
Pyrosequencing was used to assess methylation across the *CDKN2A* locus in umbilical cords from independent discovery (n=332) and replication (n=337) cohorts of SWS children assessed by whole-body-minus-head DXA (Hologic Discovery) at 4 and 6 years old.
Adjusting for age and sex, there were consistent negative associations between *CDKN2A* methylation at 6 of 9 CpG sites (CpG 4-9) and bone area (BA), bone mineral content (BMC), and areal density (BMD) in both cohorts at 4 and 6 years, and in further analyses on the pooled dataset (all p< 0.01). Thus, for example, for each 10 percentage points increase in methylation at CpG 4-9, BMC decreased by 6-9g at age 4 years (p≤0.001). Associations remained robust after adjustment for batch effect, maternal height, smoking, walking speed and triceps skinfold thickness in late pregnancy; and offspring lean mass, fat mass or birthweight.
We have demonstrated that perinatal *CDKN2A* methylation is negatively associated with childhood bone size, mineral content and density. These findings, if replicated in other cohorts, suggest a potential role for *CDKN2A* in skeletal development and its use as a biomarker for later osteoporosis risk.

II-16 Maternal Obesity, Gestational Weight Gain and Childhood Cardiac Outcomes: Role of Childhood Body Mass Index

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Background: Maternal obesity may affect cardiovascular outcomes in the offspring. We examined the associations of maternal prepregnancy body mass index (BMI) and gestational weight gain with childhood cardiac outcomes and explored whether these associations were explained by parental characteristics, infant characteristics, or childhood body mass index.
Methods: In a population-based prospective cohort study among 4,852 parents and their children, we obtained maternal weight before pregnancy and in early-, mid- and late-pregnancy. At age 6, we measured aortic root diameter (AOD) and calculated left ventricular mass (LVM), LVM index (LVMI, $g/m^{2.7}$), relative wall thickness (RWT), fractional shorting (FS), eccentric left ventricular hypertrophy (LVH) and concentric remodeling.
Results: A one standard deviation score (SDS) higher maternal prepregnancy BMI was associated with higher LVM (0.10 SDS (95% CI 0.08, 0.13)), LVMI (0.06 SDS (95% CI 0.03, 0.09)) and AOD (0.09 SDS (95% CI 0.06, 0.12)), but not with RWT or FS. A one SDS higher maternal prepregnancy BMI was associated with an increased risk of eccentric LVH (OR 1.21 (95% CI 1.03, 1.41)), but not of concentric remodeling. When analyzing the effects of maternal weight in different periods simultaneously, only prepregnancy and early pregnancy weight were associated with LVM, LVMI and AOD (p-values< 0.05). All observed associations were independent of parental and infant characteristics, but attenuated to non-significance after adjustment for childhood BMI.
Conclusion: Maternal prepregnancy BMI and weight gain in early pregnancy are both associated with offspring cardiac structure in childhood, but these associations seem to be fully explained by childhood BMI.

II-17 Prenatal Maternal Very Severe Obesity and Neuropsychiatric Problems in Early Childhood

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Prenatal maternal obesity has been associated with increased neuropsychiatric problems in children. However, the findings are inconsistent and few studies have examined psychopathology risk among offspring born to very severely obese (SO) women or assessed familial confounding by maternal mental health. We studied neuropsychiatric symptoms in 112 children aged 3-5 years whose mothers had participated in a prospective study of obesity in pregnancy [50 children born to SO (BMI≥40 kg/m^2) and 62 to lean (BMI≤25 kg/m^2) mothers]. The mothers completed the Conner's Hyperactivity Scale for child attention deficit hyperactivity disorder symptoms, Strength and Difficulties Questionnaire and Child Behavior Checklist/1½-5 for child general neuropsychiatric symptoms. The associations were exam-

ined with linear regression analyses, adjusting for child sex, age, birthweight, gestational age, socio-economic deprivation level, maternal parity, smoking during pregnancy, gestational diabetes and maternal concurrent anxiety and depressive symptoms. Prenatal exposure to maternal SO independently predicted significantly higher child scores on Conner's Hyperactivity Scale (β=0.55, 95% Confidence Interval (CI)=0.06-1.03); on Strength and Difficulties Questionnaire hyperactivity (β=0.73, 95% CI=0.31-1.15) and total difficulties (β= 0.67, 95% CI=0.21-1.13) scales; and on Child Behavior Checklist externalising (β=0.66, 95% CI=0.17-1.15) and total problems (β=0.58, 95% CI=0.08-1.08) main scales, aggressive behaviour (β=0.67, 95% CI=0.18-1.17) and other problems (β=0.62, 95% CI=0.14-1.09) syndrome scales and anxiety (β=0.58, 95% CI=0.08-1.08) and attention-deficit/hyperactivity (β=0.75, 95% CI=0.26-1.24) DSM-oriented scales. Our findings suggest developmental programming of early childhood mental health by prenatal exposure to maternal very severe obesity. With rising prevalence of maternal obesity these findings represent a public health concern.

II-18 Associations of Maternal Protein Intake during Pregnancy with Cord Blood Hormone Levels

EARLYNUTRITIONMEMBER ☆ *New Investigator Award*

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Background: Maternal protein intake during pregnancy is a key determinant of fetal growth, and we previously demonstrated an inverse association with fetal and early postnatal growth. Associations of maternal protein intake with hormones that regulate growth in utero have received little attention.

Methods: We studied 938 mother-child pairs in Project Viva, a Boston-area pre-birth cohort recruited in 1999-2002. Using multivariable linear regression models, we examined associations of 2nd-trimester maternal protein intake (g/kg pre-pregnancy weight/d) reported by food frequency questionnaire with IGF-1, IGF-2, IGFBP-3 and insulin levels in cord blood, adjusting for child sex, maternal race, height, parity, education, smoking, and household income.

Results: Mothers were predominantly white (75%), college-educated (64%), and non-smokers (67%). Mean (SD) protein intake was 1.35 (0.35) g/kg/d. Each 1-SD (0.35 g/kg/d) increment in 2nd-trimester protein intake corresponded to a change of -0.31 (95% CI:-2.03, 1.42) ng/mL in IGF-1, -10.3 (95% CI: -17.2, -3.41) ng/mL in IGF-2, -28.1 (95% CI: -51.0, -5.24) ng/mL in IGFBP-3 and -0.78 (95% CI: -1.31, -0.24) uU/mL in insulin. After further adjustment for IGFBP-3, estimates (95% CIs) were 1.04 (-0.25, 2.33) for IGF-1 and -4.50 (-9.54, 0.53) for IGF-2. The association between protein intake and IGF-2 was stronger in girls (β: -20.7 (95% CI: -30.5, -11.0)) than in boys (β: -0.44 (95% CI: -10.3, 9.43)), p interaction=0.03.

Conclusions: In a cohort of pregnant women with relatively high average protein intakes, higher intake was associated with lower concentrations of growth-promoting hormones in cord blood, suggesting a pathway linking protein intake to fetal growth.

II-19 Associations between Fatty Acids and Inflammation in Children

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Background: The influence of fatty acids (FA) on inflammation may play a role in cardiovascular disease risk. Studies on the effects of fatty acids on markers of inflammation in children are scarce. We aim to analyse the associations between FAs and high-sensitivity C-reactive protein (hs-CRP) in 10-year-old children.

Methods: Complete information on FAs and hs-CRP was available for 1003 participants from the 10-year follow-up of the LISAplus birth cohort study. FA composition was assessed in serum glycerophospholipids. Measured hs-CRP was categorized into 3 levels (hs-CRP < 0.02, hs-CRP ≥0.02 and < 75th sex-specific percentile, hs-CRP ≥75th sex-specific percentile). Associations of FAs with hs-CRP were assessed using multinomial logistic regression, adjusting for sex, region, age, maternal education level, BMI, sedentary behaviour and whether the child was ever breastfed. Sensitivity analyses were run stratified by sex.

Results: Higher palmitic acid, arachidonic acid, sum of n-6 highly-unsaturated fatty acids, ratio of arachidonic to linoleic acid, and total saturated fatty acids (SFA) were associated with higher hs-CRP levels; while higher linoleic acid, α-linoleic acid, and ratio of n-6 to n-3 PUFAs were associated with lower hs-CRP levels. Sex-stratified analyses indicated stronger associations in males than in females.

Conclusions: A detrimental role of arachidonic acid and SFA is suggested by their consistent associations with elevated hs-CRP concentrations in children. Our data suggests associations between FAs and hs-CRP occur more strongly in males.

II-20 Postnatal Growth Velocity Calculation: Accuracy of Different Methods

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Background: Growth is assessed as increase in weight over time. However, absolute weight gain has different clinical implications depending on infant weight. Hence, growth velocity (GV) normalized for body weight expressed as g/kg/day is an important parameter of growth assessment. Currently, there is no agreement for the calculation of GV.

Objectives: to compare different methods of GV calculation in real infant dataset

Methods: Real weight data (n=91, GA < 29weeks) was used with six different methods of GV calculation: 2-point linear (2PLin), 2-point exponential (2pExp), daily average method (DA), linear regression (LinReg), exponential regression (ExpReg), and generalized reduced algorithm (GRA). We used mean growth velocity of all methods as a reference, and correlated it with GV estimated from individual methods.

Results: Mean variation between six methods was 3.7±2.2g/kg/day. GV calculated with GRA method has the most agreement with line of identity. Regression methods have better agreement with line of identity compared to 2-point methods (Fig. A). Based on the R^2, best

methods are as follows: GRA(0.94), ExpReg(0.93), LinReg(0.92), 2PExp(0.90), 2Plin(0.89) and DA(0.87).
Conclusions: GV estimates vary depending on method of calculation. 2-point methods overestimate low growth rates and underestimate high growth rates. This has significant implications for clinical trials as it could mask a potential effect. Since clinical trials are often powered to detect a difference of 2-3 g/kg/day, such a difference may be clinically significant. Incorporating all available information appears to be better than using only 2-points. GV calculation needs to be standardized to allow for comparison across nutritional studies.

II-21 Maternal Protein Intake during Pregnancy and IGF-1 Impact Child Anthropometry up to Two Years of Age: Findings from the ROLO Study

EARLYNUTRITIONMEMBER ☆ *New Investigator Award*

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Background: The in-utero environment influences fetal development however many mechanisms remain unknown. Insulin-like growth factors (IGFs) are thought to play a vital role in early development with low levels of IGF at birth being associated with low birth weight. It is hypothesised that dietary protein intake can influence IGF levels.
Methods: Analysis was carried out on 290 mother-child pairs from the ROLO study (Randomised cOntrol trial of LOw glycaemic index diet). Protein intake (grams) was recorded using 3-day food diaries in each trimester of pregnancy and percentage energy from Protein (%EnPro) was calculated. IGF-1 was measured in fetal cord blood. Infant weight and anthropometry were recorded at birth, 6 months and 2 years of age.
Results: No associations were found between IGF-1 levels and dietary protein during pregnancy. Trimester 2 dietary protein was positively associated with birth weight (P< 0.001) however after controlling for IGF-1 this association was lost. %EnPro was positively associated with birth length and negatively with length at 2 years of age. Protein intakes were positively associated with bicep skinfolds at 6 months and central adiposity measures at 2 years. The associations were not mediated by IGF-1.
Conclusion: Maternal protein was associated with weight and body composition up to 2 years of age. Interestingly, IGF-1 appeared to mediate this association with weight but not adiposity measures. Maternal protein intake may exert an in-utero influence on infant body composition and further research is needed to elucidate the mechanisms by which dietary protein and IGF-1 modulates fetal growth.

II-22 Size at Birth and Childhood Growth as Predictor of Bone Health in Icelandic Older Adults

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Background: It has been hypothesized that childhood growth could be an important determinant of later bone health. Results from previous studies have, however, been conflicting. This study examined the association between birth weight and BMI in childhood with bone health in Icelandic older adults.
Methods: 835 Icelandic older adults born between 1921 and 1935 and living in the Reykjavik area. Birth weight and childhood BMI (age 8 - 13 years) were collected from national archives. During follow-up between 2002 and 2006 bone mineral volume, content and density were measured with Quantitative CT-scans and transformed into sex-specific z-scores.
Results: Mean age at follow-up was 77 years. Birth weight and childhood BMI were positively associated with bone mineral volume and content but not density. As an example 1-kg increase in birth weight among male offspring was associated with 0.35 z-score (95% confidence interval (CI): 0.14, 0.56) increase in bone mineral volume, 0.26 z-score (95%CI: 0.05, 0.47) in bone mineral content and -0.02 z-score (95%CI: -0.23, 0.18) in bone mineral density in adulthood. Similar results were observed for females. Between ages 8 to 13 years, children who were underweight had on average 0.34 (95%CI: 0.05, 0.63) higher z-score for bone mineral density in adulthood compared with normal weight children while non-significant differences were observed for overweight children 0.16 (95%CI: -0.38, 0.69).
Conclusion: Growth measures at birth and during childhood did not predict higher bone mineral density in older adults except under relatively extreme conditions such as for underweight children.

II-23 How Can Pre-Pregnancy Weight Be Assessed? Comparison of Approaches Using Longitudinal Data from the Southampton Women's Survey

EARLYNUTRITIONMEMBER

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Background: Pre-pregnancy weight is of interest in itself and as a pre-requisite for assessment of pregnancy weight gain. Few women have clinical or research weight measurements before pregnancy. Two methods are used: women's recall of pre-pregnancy weight; and a measure of weight taken in early pregnancy. The Southampton Women's Survey (SWS) allows a comparison of these methods against measured pre-pregnancy weights.
Methods: The SWS is a mother/child cohort in which the mothers were recruited before the child's conception. 198 women with an estimated date of conception within three months of their recruitment interview form the analysis sample. Bland Altman plots were used to compare the 'gold standard' of pre-pregnancy weight measured at the recruitment interview with: (1) recalled pre-pregnancy weight, during early pregnancy and (2) measured weight in early pregnancy (around 11 weeks' gestation). Sensitivity analyses were conducted of women who became pregnant within one month of recruitment interview.
Results: Mean (SD) recalled weight was 1.65 (3.03)kg lighter than measured pre-pregnancy weight, while measured weight in early pregnancy was 0.88 (2.34)kg greater. Limits of agreement for recalled weights were -7.59 to 4.29kg, wider than those for early pregnancy

measured weights: -3.71 to 5.47kg. In a sensitivity analysis of the 61 women who conceived within one month of recruitment interview, the limits of agreement for early pregnancy measured weights were slightly narrower still (-3.14 to 4.92kg).
Conclusions: Measured weight in early pregnancy appears to be a more reliable assessment of pre-pregnancy weight than recalled weight.

II-24 White and Brown Adiposity in Infants of Mothers with Diabetes at 2 and 12 Weeks of Age

☆ ***New Investigator Award***

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I**ntroduction:** Infants born to diabetic and/or obese mothers are more likely to be macrosomic at birth and have a higher risk of developing obesity and the associated metabolic diseases such as diabetes in adulthood. Brown fat is a thermogenic tissue with a high energy expenditure which is especially abundant in early infancy. It is unknown whether infants of mothers with diabetes and/or obesity differ in their volume and activity of brown fat. Since glucose and fatty acids fuel brown adipose activity, and since infants of diabetic and/or obese mothers have been found to have more white adipose tissue these infants may also have more active brown adipose tissue. Alternatively, since those infants have better insulation by white fat they may require less thermogenesis and have a less active brown fat. Since infants born to mothers with diabetes and/or obesity are at a higher risk of becoming diabetic and/or obese themselves, their energy balance may be reset by a lower energy expenditure from early on in life.
Methods: Using novel magnetic resonance sequences we are characterising brown fat as well as quantifying white fat and intrahepatic lipid content in infants born to mothers with and without any type of diabetes during pregnancy and with (BMI 30-40) and without obesity (BMI 19-25 kg/m²) at the Nottingham University Hospitals, with n=10 in each of the four groups. Scans are performed at 2 and 12 weeks of age.
Results: We are currently recruiting for this study and will be presenting preliminary data.

II-25 Maternal Circadian Fasting Intervals during Pregnancy and Neonatal Adiposity

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Background: Circadian feeding and fasting patterns, when synchronized, may improve metabolic health, but its potential programming effect on an offspring's metabolic outcomes are unknown. We examined the relations of maternal day-time and night-time fasting intervals during pregnancy with neonatal adiposity.
Methods: Mother-newborn pairs (n=149) from a Singapore prospective cohort were studied. At 26-28 weeks' gestation, maternal day-time and night-time fasting intervals were determined from a one-day food diary, and classified according to the longest fasting interval during the day (0700 to 1859h) and night (1900 to 0659h), respectively. At birth, neonatal weight was measured and converted to weight-for-age z-score (WAZ). At postnatal day 7, neonatal adiposity was measured by air displacement plethysmography, which determined percentage total body fat (TBF).
Results: Mean (standard deviations, SD) maternal fasting intervals were 5 hours (1.4) during the day-time and 9.7 hours (1.5) during the night-time. Mean (SD) neonatal WAZ and TBF percentage were -0.4 z-score (0.9) and 11.7% (4.7), respectively. Using adjusted multiple linear regression, each hourly decrease in the night-time fasting interval was associated with 0.15 z-score reduction in WAZ (95% CI 0.01, 0.29) and 0.96% reduction in TBF (95% CI 0.23, 1.68). The associations of day-time fasting interval with WAZ or TBF were not significant.
Conclusion: Decreased night-fasting intervals during pregnancy are associated with reduced birth weight and adiposity, possibly due to altered maternal intestinal permeability and function, resulting from increased oxidative stress or glucocorticoid levels. This preliminary finding opens a novel line of research into the developmental programming effects of chrononutrition.

II-26 Prospective Associations of Maternal Betaine Status with Offspring Weight and Body Composition at Birth: The GUSTO Cohort Study

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Background: Betaine supplementation has been associated with lower body weight and fat mass, and a higher lean mass in animals and adult humans. However, the relationship between maternal betaine status and offspring birth weight and body composition is less known. We therefore studied the association between maternal betaine status and neonatal birth size and adiposity in an Asian mother-offspring cohort.
Design: We included 955 pregnant women whose plasma betaine concentrations were measured at 26-28 weeks' gestation. Neonatal anthropometry was measured at birth. Magnetic resonance imaging assessment of abdominal adipose tissue compartments was undertaken in a subset (n=307). Multivariate general linear models were used to adjust for gestational age, fetal sex, maternal age, height, educational level, ethnicity, pre-pregnancy BMI, plasma folate, vitamin B12, and choline concentrations.
Results: Mean (SD) plasma concentration was 13.2(2.7) µmol/L (range 5.3 25.0 µmol/L). After adjustment for covariates, higher maternal plasma betaine was associated with lower birth weight [β -57.6 g (95% CI -109.9, -5.3) per 5 µmol/L increment], shorter birth length [β -0.29 cm (95% CI -0.55, -0.03], smaller head circumference [β -0.20 cm (95% CI -0.38, -0.02)], smaller mid-upper arm circumference [β -0.16 cm (95% CI -0.30, -0.03)], lower volumes of abdominal superficial subcutaneous adipose tissue [β -4.53 ml (95% CI -8.70, -0.36)] and a higher risk of small-for-gestational-age birth [OR 1.57 (95% CI 1.05, 2.35)].
Discussion: Higher maternal betaine status was associated with smaller infant birth size and lower fat mass. Further studies are needed to replicate these findings and understand their mechanistic basis.

II-27 Food Sources of Energy and Macronutrients Intakes among Infants during Complementary Feeding

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Introduction: Appropriate nutrition during complementary feeding is important for the growth, development, and well-being of children. We examined variations in energy intakes and food sources of macronutrients in infants at 6, 9 and 12 months.
Methods: Single-day dietary records of 576 infants from the GUSTO study were analysed. Estimations of breastmilk consumption were based on methods described by Ponza et.al, 2004. Infants were assigned into mutually exclusive feeding groups at ages 6, 9 and 12 months: breast-fed (BF) (19%, 10%, 8%, respectively), formula-fed (FF) (62%, 74%, 81%, respectively) and mixed-fed (MF) (19%, 16%, 11%, respectively). Food sources of energy and macronutrients were determined using population proportion methodology.
Results: Energy intakes (mean ± SD) of infants at 6, 9 and 12 months were 641 ± 152, 675 ± 172 and 759 ± 200 kcal, respectively. Compared to BF and FF infants, MF infants had the highest energy intakes only at 9 and 12 months. FF infants had the highest carbohydrate and protein intakes (% of energy), while BF infants had the highest fat intakes (% of energy) at 6, 9 and 12 months (all $p < 0.05$). Infant formula and breastmilk were major contributors of energy (86.5%, 72.7% and 66.4% of energy at 6, 9 and 12 months), followed by infant cereals and rice porridge. Other key contributors of macronutrients at 9 and 12 months were fish, meat and biscuits.
Conclusion: An understanding of key food sources of energy and macronutrients provided during complementary feeding can inform local dietary recommendations and policies.

II-28 Maternal Vitamin D Status and Development of Childhood Atopy - Findings from the ROLO Study

EARLYNUTRITIONMEMBER

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Background: Vitamin D status is of interest in the development of atopic diseases due to its effect on the lung development, immune system development and function. There is conflicting evidence in the relationship between maternal vitamin D status and atopy in offspring. Our objective was to assess if 25(OH)-D in maternal or fetal blood was associated with atopy in children at 6 months, 2 or 5 years.
Methods: This was an analysis of 293 mother-child pairs from the ROLO study. 25(OH)-D was measured in blood samples at 13 weeks, 28 weeks and in fetal blood from the cord at delivery. Development of childhood atopy (asthma or eczema) was self-reported by mothers at 6 months, 2 and 5 years.
Results: The average 25(OH)-D in early and late pregnancy was 44.99nmol/l±19.24 and 40.21nmol/l±21.46 and in fetal blood 44.69nmol/l±26.73. Those who developed an atopic disease at 5 years had significantly lower levels of 25(OH)-D in cord blood than those who did not (24nmol/l vs. 42nmol/l, $p < 0.05$). Cord levels of 25(OH)-D were associated with a small reduction in risk of atopy at 5 years, (OR: 0.990, 5%CI: 0.969-1.012).No association was observed between maternal 25(OH)-D in pregnancy and development of childhood atopic disease at any time point.
Conclusion: The development of atopy at 5 years is associated with reduced 25(OH)-D concentrations in cord blood at birth. Further research is required to fully understand the relationship between vitamin D and atopy, and if vitamin D supplementation should be prioritised in pregnancy to reduce childhood atopy.

II-29 Maternal Stress and Low Mood Preconception is Associated with Offspring Atopic Eczema at Age 12 Months

EARLYNUTRITIONMEMBER

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Perinatal maternal stress and low mood have been linked to the offspring's risk of atopic eczema. We examined the relation of maternal stress/mood with atopic eczema in the offspring, with particular focus on stress/mood preconception.

Within the UK Southampton Women's Survey, at recruitment preconception maternal reports of perceived stress in daily living and the effect of stress on health were recorded; in a sub-sample maternal mood was assessed (12-item General Health Questionnaire). Infants were followed up at ages 6 (n=2956) and 12 (n=2872) months and atopic eczema ascertained (UK Working Party Criteria for the Definition of Atopic Dermatitis). At 6 months postpartum, mothers were asked if they had experienced symptoms of depression since childbirth and completed the Edinburgh Post-natal Depression Scale.

Preconception perceived stress affecting health (OR 1.21 (95%CI 1.08-1.35), p=0.001) and stress in daily living (OR 1.16 (95%CI 1.03-1.30), p=0.014) were associated with an increased risk of offspring atopic eczema age 12 months but not age 6 months. These associations were robust to adjustment for potentially confounding variables. Findings were similar for lower maternal mood preconception. Low maternal mood between delivery and 6 months postpartum was also associated with an increased risk of infantile atopic eczema at age 12 months, but no significant association between postnatal mood and eczema was seen after taking account of preconception stress/mood variables.

This is the first study linking maternal stress at preconception to the risk of atopic eczema, supporting an important developmental contribution to this multifactorial condition and pointing to potentially modifiable influences.

II-30 Maternal Characteristics and Antenatal Mental Health in Relation to Postpartum Dietary Patterns

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Background: Diet in the first month postpartum, otherwise known as 'confinement diet', has unique Asian characteristics influenced by traditions, cultures and beliefs. We aimed to examine maternal characteristics associated with confinement diets in the Singapore GUSTO mother-offspring cohort.

Methods: Mothers were recruited during pregnancy and used questionnaires to ascertain information on socio-demographic characteristics and maternal mental health status (EPDS and STAI) at 26-28 weeks' gestation. Infant feeding and maternal diet 1 month post-delivery were ascertained using 3-day food diaries. Dietary patterns were identified by factor analysis. Multivariable linear regression adjusting for confounders was conducted.

Results: In a subset of 200 mothers, three dietary patterns were identified: *Traditional-Chinese-Confinement-diet* (TCC), *Malay-Indian-Confinement-diet* (MIC) and E*at-Out-diet* (EO). Mothers who scored higher on TCC diet tended to be Chinese, younger in age and more likely to exclusively breastfeed their newborns in the first month post-delivery ($p< 0.05$ for all). Indian mothers were more likely to follow the MIC diet ($p< 0.0001$), and there was a trend for mothers with higher antenatal state-anxiety to have higher MIC diet scores ($p=0.064$). The EO diet was primarily followed by Malay mothers, and EO diet scores were higher in women with lower state-antenatal anxiety, those exposed to smoking during pregnancy and those who breastfed their newborns in the first month ($p< 0.05$ for all). Other maternal characteristics, including antenatal depression, were not associated with confinement dietary patterns.

Conclusion: A better understanding of the maternal determinants of confinement diets would help health professionals provide more targeted and appropriate postpartum dietary advice.

II-31 The Role of Early Pregnancy Fasting Plasma Glucose in Programming Birth Weight at Term

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Background: The HAPO study reported that untreated maternal hyperglycemia at 24-32 weeks gestation increased the risk of large-for-dates (LGA). Subsequently, new international guidelines have been published for gestational diabetes mellitus (GDM) which make diagnostic criteria more sensitive and laboratory handling more stringent. The aim of this study was to prospectively examine the association between fasting plasma glucose (FPG) < 18 weeks gestation and birth weight at term.

Methods: Women booking for antenatal care were recruited at their convenience. Women had a fasting plasma glucose (FPG) < 18 weeks gestation and were screened selectively as usual at 24-30 weeks. Clinical and sociodemographic data were collected. Univariate analysis identified independent variables associated with birth weight and LGA. Predictive variables identified in the univariate model were included in regression models to examine the adjusted independent association.

Results: Of 268 women included, 42.9% were nulliparas, 13.4% were obese. The mean FPG was 4.9±0.3 mmol/L and 27.1% (n=60) had a FPG ≥5.1mmol/L diagnostic for GDM. Subsequently, 47 were excluded: 13.4% (n=36) were diagnosed with GDM and treated with diet or medications (1 FPG=8.0mmol/L); 11 delivered < 37 weeks. Using linear regression, increasing FPG was not strongly associated with BW centile (r^2=0.009; P=0.13). Univariate analysis showed no association between elevated FPG in early pregnancy and LGA overall (OR= 0.29; P=0.24).

Conclusions: In this well-characterised population with stringent implementation of laboratory standards, 27.1% of universally-screened women would have been classified as GDM in early pregnancy. Mildly increased maternal FPG in early pregnancy, however, did not programme LGA.

II-32 Association of Age of Menarche and Risk for Gestational Diabetes Mellitus in a Multi-Ethnic Asian Population

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Introduction: Earlier age of menarche has been associated with an increased risk of Type-2 diabetes. However, there are few studies relating age of menarche to the risk of gestational diabetes mellitus (GDM); we examined this association in a multi-ethnic Asian population.

Methods: From the Singapore GUSTO cohort, 1029 mothers provided self-reported menstrual history during the first trimester of pregnancy. GDM was defined as fasting glucose ≥7.0 mmol/L and/or 2-hour post-load glucose ≥7.8 mmol/L at 26-28 weeks' gestation. Multivariate logistic regression adjusted for age, ethnicity, educational background, parity, pre-pregnancy BMI, antenatal physical activity, family history of diabetes, length of menstrual cycle and weight gain by 26 weeks' gestation. Mediation analysis calculated the proportions of effects mediated through pre-pregnancy BMI.

Results: The prevalence of GDM was 19.6%. Participants had an 18% increased risk of developing GDM with every 1 year increase in age at menarche (adjusted odds ratio (adjOR) 1.18 (95% CI 1.02-1.37)). Women of Chinese and Indian ethnicity with an early age at menarche (≤11 years old) had a significantly lower risk of developing GDM compared to average menarcheal age (13 years) (adjOR 0.32 (0.11-0.94), 0.13 (0.02-0.81) respectively). Mediation analysis indicated that 69.5% of the effect was mediated through pre-pregnancy BMI.

Conclusions: Earlier age of menarche was associated with a decreased risk of GDM. This association was largely mediated through lower pre-pregnancy BMI.

II-33 Maternal Blood Lipid Profile during Pregnancy and Associations with Child Adiposity: Findings from the ROLO Study

EARLYNUTRITIONMEMBER

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Background: The in-utero environment affects fetal development and it is vital to understand how maternal diet during pregnancy influences childhood body composition. While research indicates that triglycerides in hyperglycaemic women may increase birth weight, little is known about this relationship in euglycemic women. This study examines the relationship between maternal blood lipid status and infant adiposity up to 2 years of age.

Methods: Data from 331 mother-child pairs from the ROLO longitudinal birth cohort study was analysed. Maternal dietary intakes were recorded and fasting blood lipids, leptin and HOMA were measured in early and late pregnancy and cord blood. Infant anthropometric measurements were recorded at birth, 6 months and 2 years. Correlation and regression analyses were used.

Results: All maternal blood lipids increased significantly during pregnancy. Maternal dietary fat intake was positively associated with total cholesterol levels in early pregnancy. Late pregnancy triglycerides were positively associated with birth weight (P=0.03) in mothers with BMI > 25 while fetal triglycerides were negatively associated with birth weight (P=0.01) in mothers with BMI < 25. Cord HDL-C was negatively associated with infant weight at 6 months (P=0.005). No other maternal blood lipids were associated with infant weight or adiposity up to 2 years of age.

Conclusion: Maternal triglyceride concentrations were associated with birth weight and cord HDL-C with weight at 6 months. Thus, maternal lipid concentrations may exert an in-utero influence on infant body composition. There may be potential to modulate infant body composition through alteration of maternal diet during pregnancy.

II-34 Differences in Neurodevelopmental Outcomes in Boys and Girls at 3.5 Years Born to Obese and Diabetic Mothers

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We examine the associations between sex and cognitive development in children aged 3.5 years, born to overweight (Ov), obese (Ob) or gestational diabetic (GD) mothers. The study was performed in 161 (85 boys/76 girls) children participating in the PREOBE study (www.ClinicalTrials.gov NCT01634464). Participating pregnant women were subdivided into four groups: *healthy-normo-weight (18.5≤BMI< 25) (n=54), Ov (25≤BMI< 30) (n=31), Ob (BMI≥30) (n=27) and GD (n=49).* Offspring's neurodevelopment was assessed at 3.5 years using the Cumanin test and K-ABC test. ANOVA Statistical analysis was performed using SPSS (version 23.0). No adjustment was implemented as no differences among confounding variables were observed between groups. Significant differences between *boys vs girls in Centile visoperception (68.56 vs 75.83,* p=0.036) and in *expressive vocabulary (106.66 vs 100.46*, p=0.025) were shown. Statistical differences between boys and girls within groups were demonstrated.

Cumanin test: *children born to Ov*: Centile Spatial Structure (*57.41 vs 63.00*, p=0.038); *children born to Ob*: Centile psychomotricity (*63.44 vs 79.45*, p=0.036); and, *children born to GD*: Centile Rhythm (*61.52 vs 45.14*, p=0.043). In **K-ABC test** there were significant differences between boys and girls depending on their mothers group; *children born to obese*: Faces and Places (*110.13 vs 104.73*, p=0.026) and *children born to GD*: Hand-movements (*13.44 vs 11.14*, p=0.016), Gestalt Closure (*11.11 vs 9.05*, p=0.016), Simultaneous-processing (*96.81 vs 87.14*, p=0.016) and Mental-processing (*105.30 vs 94.10*, p=0.012), respectively.

Conclusion: Girls and boys brain have a different pattern of neurodevelopment, but it seems to be also driven by mothers' obesity and GD conditions during pregnancy.

II-35 As long as You Have Breath - The Effects of In-Utero Exposure to Ramadan on the Occurrence of Wheezing in Adulthood

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The prenatal roots of airways diseases such as wheezing are traced back to gene-environment interactions. Inter alia maternal smoking has been named as important environmental risk factor (Martino & Prescott, 2011). Lopuhaä et al. (2000) showed that prenatal famine exposure increases risks for obstructive airways disease, and especially for wheezing when exposure occurred in mid-gestation.
Effects of less extreme nutritional exposures on lung functioning have thusfar hardly been investigated. We aim to fill this gap by studying effects of Ramadan in utero on wheezing in adulthood using data from four waves of the Indonesian Family Life Survey. A majority of Indonesian pregnant women are thought to fast during Ramadan (Majid, 2015) and prenatal Ramadan exposure has been linked to multiple other health conditions (Van Ewijk, 2011). Taking the sub sample of Muslims (22,696 observations), we determine whether subjects experienced a Ramadan in utero by calculating overlap between Ramadan and the 266 days before birth. Our control group consists of Muslims without such overlap. Our analyses are logistic regressions that adjust for age, age squared, sex and birth month (Ramadan each year occurs on different dates).
Our results show that wheezing prevalences are increased in those exposed to Ramadan during any phase of pregnancy. However, effects are only significant for those older than 50 years and particularly male Muslims. This fits with medical theory suggesting that the lung system has multiple critical growth periods and fetal programming theory suggesting that impacts of in-utero exposures often only show after the reproductive age.

II-36 The Association between Vitamin D Status in Pregnancy and Leptin at Birth

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Background: Fetal leptin is associated with neonatal and early childhood weight and adiposity. In addition, fetal leptin is known to be affected by maternal factors, such as BMI, however evidence is scarce regarding its association with other modifiable maternal factors. We aimed to examine the association between 25-hydroxyvitamin D (25OHD) in pregnancy and leptin at birth.
Methods: This is an observational study of 334 pregnant women originally recruited to the ROLO Study at the National Maternity Hospital, Dublin, Ireland. Serum 25OHD and serum leptin were measured in early pregnancy (13 weeks' gestation), late pregnancy (28 weeks' gestation) and in fetal cord blood at birth.
Results: Serum 25OHD < 30 nmol/L (at risk of vitamin D deficiency) was observed in 31.3%, 37.6% and 34.1% of early pregnancy, late pregnancy and fetal samples, respectively. Compared to those with sufficient 25OHD (≥ 50 nmol/L), 25OHD insufficiency (30-50 nmol/L) in early pregnancy and in fetal samples were associated with higher fetal leptin concentrations ($P = 0.032$, $P = 0.018$, respectively). However, on regression analysis, no association was found between 25OHD in pregnancy and fetal leptin (controlling for BMI, intervention, supplements, education and season).
Conclusion: Serum 25OHD in pregnancy may be associated with leptin concentrations at birth, however this relationship may be mediated through other maternal factors such as BMI. Further research is required to fully elicit the relationship between 25OHD and leptin, and to determine if maternal vitamin D status in pregnancy is a mediating factor of offspring leptin and future childhood obesity risk.

II-37 Maternal Early-pregnancy BMI and determinants of Childhood Blood Pressure at 6 years: Children of SCOPE

EARLYNUTRITIONMEMBER

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Recent epidemiological and animal studies suggest that maternal obesity may permanently change the central regulatory pathways involved in offspring blood pressure (BP) regulation. We hypothesized an association between maternal obesity and altered autonomic control of BP in 6-year-old children.
A random sample of mother-child pairs was selected from the Children of SCOPE Study. The exposure of interest was maternal BMI at 14-16 week's gestation. Outcomes included offspring BP and heart rate variability (HRV) at 6 years-of-age under resting conditions. Linear regression was used to explore association and adjustment for current child BMI z-score was performed.
Mean pregnancy BMI for the 177 participants was 25.2±5.1(SD) kg/m2. After adjustment for child's BMI z-score, there was no association between maternal BMI in early pregnancy and child's systolic BP (β 0.03; 95%CI -0.20 to 0.26, p=0.80) or time/frequency domains of the HRV including low frequency:high frequency ratio (LF/HF) of the HRV (β -0.01; 95%CI -0.03 to 0.01, p=0.29). Maternal BMI was associated with child BMI z-score (β 0.05; 95%CI 0.02 to 0.08, p<0.001) and the latter was found to be associated with child's systolic BP (β 2.20; 95%CI 1.02 to 3.38, p<0.001). A non-significant trend was observed between child BMI z-score and LF/HF ratio (β 0.10; 95%CI -0.01 to 0.21, p=0.054).
Child BMI z-score is apparently a stronger determinant of child cardiovascular function at 6 years-of-age than maternal BMI, however, maternal BMI is associated with child BMI.

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II-38 Maternal-Neonatal Transfer of Selenoproteins at the Time of Birth

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Background and aims: Selenium is an essential micronutrient which has been involved in adverse outcomes during pregnancy. The

maternal-neonatal transfer of selenium and selenoproteins at the time of birth has not been thoroughly elucidated.
Objective: The current study was designed to determine total selenium and selenoproteins (glutathione peroxidase (GPx), selenoprotein P (SelP), selenoalbumine (SeAlb) and selenometabolites (SeMetab)) in healthy women and their newborns.
Methods: A cross-sectional study included 83 healthy mother-baby couples. Total selenium and selenoproteins were measured in maternal serum and cord blood through a coupling based on in series two-dimensional size exclusion and affinity high-performance liquid chromatography (2D/SE-AF-HPLC), GPx activity, Selenoprotein P1 (by ELISA) and thyroid function were also measured.
Results: The total selenium was significantly higher in maternal serum compared to cord blood (68,9 ±15,2 and 56,1±14,6 µg/L respectively; $p< 0,01$). Selenoproteins significantly correlated between mothers and newborns, although they also show significant differences: GPx (11,2±3,7 vs 10,5±3,5 µg/L) SelP (42,5±9,5 vs 28,1±7,7 µg/L) and SeAlb (11,6±3,6 vs 14,1±4,3 µg/L) in maternal serum and cord blood respectively. GPx activity correlated positively with GPx levels in mothers (r=0,33; p=0,038) but not in newborns. The GPx activity in cord blood significantly correlated with gestational age (r=0,44; p=0.009).
Conclusions: Simple diffusion failed to explain the maternal-neonatal transfer of selenium and selenoproteins at birth. GPx levels in mothers and babies at delivery are related to maternal selenium status, while the GPx activity in cord blood depends on gestational age.

II-39 Could Very Low Birth Weight Be Associated to a Higher Risk for Cardiovascular and Renal Diseases in Pre-Pubertal Children?

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Objective: To assess lipid profile, kidney function, insulin resistance and inflammation in children aged 5-10 years old born with very low birth weight (VLBW).
Method: It was performed a cross-sectional and controlled study with 44 pre-pubertal children (5-10years old) born with VLBW (birthweight 1.15±0.24kg and gestational-age 30±2.3weeks, 34.1% small-for-gestational-age) matched for gender and age with 30 healthy controls born at term. Weight, height and head circumference were collected at birth and at 12 months old considering corrected age. We collected: waist-circumference; arterial blood pressure; lipid profile (HDL-C, LDL-C, triglycerides, apolipoprotein-AI, apolipoprotein-B); insulin resistance (HOMA-IR); renal function (neutrophil-gelatinase-associated-lipocalin; estimated glomerular filtration rate, serum cystatin-C, microalbuminuria/creatinuria ratio); inflammatory markers (asymmetric-dimethylarginine; C-reactive-protein,CRP) and liver enzymes (aminotransferase-alanine; gamma-glutamyl-transferase,GGT).
Results: In the study group the mean age was 7.0±1.5years (43.2% males and 11.4% obese). At 12-months corrected-age the Z-score mean for BMI-for-age, weight-for-age, height-for-age and head circumference-for-age were -0.26±1.7;-1.55±1.5;-2.3±1.7 and -0.25±1.6, respectively. It was observed a higher waist-to-height-ratio (0.47±0.04vs0.44±0.03cm/cm;p=0.006); logCRP (0.93±0.54vs0.69±0.37mg/dL;p=0.029); logGGT (2.3±2.1vs0.18±0.7U/L;p=0.013) and lower HDL-c levels (60.1±10.1vs69.0±10.0mg/dL;p< 0.001) in the study group in comparison to control group. In the multivariate analysis lower HDL-c concentrations were independently associated to the study group (β=0.936;95%CI 0.881-0.994;p=0.031). There was no difference between groups considering blood pressure, renal function and HOMA-IR.
Conclusion: Pre-pubertal children born with VLBW showed lower HDL-c levels and central obesity; inflammation and oxidative stress could be related to these study findings. The preferential use of breast milk in neonatal unit care and a catch-up growth not so intense may explain the absence of kidney damage.

II-40 Pre-Pregnancy Body Mass and Maternal Stress during Pregnancy Are Associated with Infant Birth Weight and Child Mental Health

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Background: Overweight and obese women are likely to give birth to larger infants than normal weight women, whereas women reporting high levels of stress during pregnancy are more likely to give birth to smaller infants. The interplay between pre-pregnancy body mass index (BMI) and women´s stress during pregnancy is unexplored. Further, it is unknown whether these factors together impact on infant and child health.
Method: Prospective cohort of nulliparous women consecutively recruited at booking to prenatal care in Sweden and followed-up at child age 7 years (N=290). Women reported stress across pregnancy at gestational weeks 10, 12, 20, 28, 32, and 36. Pre-pregnancy BMI and infant birth weight were abstracted from the medical record.
Results: There were no differences in stress by BMI. Overweight/obese (BMI > 25) women who perceived high stress had infants who were 303gr and 298g, heavier than infants exposed to low or moderate levels of maternal stress, repectively. In contrast, women who were underweight prior to pregnancy (BMI < 18.50) and perceived high level of stress during pregnancy had infants who were and 237g and 383g lighter than those exposed to low or moderate stress, repectively. Associations with child inattentiveness at the age of 7 years were also differential.
Conclusions: The observed differences in birthweight were both statistically and clinically significant. Stress during pregnancy was associated with both increased and decreased birthweights depending on maternal BMI. Inattentiveness, an important neurodevelopmental marker of mental health, also differed in childhood, suggesting long-lasting impact of nutrional availabilty in utero.

II-41 Development of a New Nordic Diet-Score for 7 Year Old Children in the Norwegian Mother and Child Cohort Study (MoBa)

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Background: The New Nordic Diet (NND) encompasses a concept of a potentially healthy and suistainable diet with foods that are traditionally consumed and locally available in the Northern countries. We have previously constructed a NND-score for the mother's diet

in the Norwegian Mother and Child Cohort Study (MoBa). A similar score has, however, not yet been developed for children. We here present a NND-score for 7 year old children based on the original NND-score.
Methods: The score was constructed from available data from MoBa. Food Frequency Questionnaire responses from 35 978 7-year olds were included for this presentation. The developed score is a sum of 9 subscales measuring the consumption of: *1) Local fruits (apple, pear and grapes); 2) Root vegetables (carrot); 3) Cabbages; 4) Potatoes vs rice and pasta; 5) Whole grain bread; 6) Oatmeal and müsli*; *7) Fish; 8) Milk vs juice and 9) Water vs sweetened beverages*. Subscales were dichotomized by the median and coded to give either 0 or 1 point. The score (0-9 points) was further trichotomized into
low (0-3 points), medium (4-5 points) and high (6-9 points) NND adherence.
Results: Distribution according to NND-adherence was as follows; low 28.8% (n = 10 075), medium 43%
(n = 15 036) and high 28.2% (n = 9875).
Conclusion: The score will be used to investigate potential associations with child growth pattern, obesity risk, mental health and cognitive development. Similar scores will be developed for children at 6 months, 18 months and 3 years of age.

II-43 Postnatal Weight Loss of Healthy Preterm Infants and Crossing of Percentiles on Growth Charts during Postnatal Adaptation

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Background: During postnatal adaptation, preterm infants undergo preterm contraction of extracellular water spaces (PreCES) with postnatal weight loss (PWL) and adjustment to a new percentile. We hypothesized that infants with lower birth weights will cross more percentiles during PreCES due to lower fat mass and higher total body water.
Objective: To analyze PWL and change in percentiles during PreCES.
Methods: International, multi-center study at five NICUs. Daily weights until day of life (DoL) 21 for infants (A): 30-36 weeks GA and (B): 24-29 weeks GA, admitted from 2008-2012 with undisturbed postnatal adaptation were analyzed. Exclusion criteria: (A) and (B): maternal diabetes/substance use, nosocomial sepsis (positive blood culture until DoL 21); (A): nCPAP>3 days, not on full enteral feeds by DoL 10, (B): mechanical ventilation on DoL>3, FiO2≥0.3 within first 21 DoL, NEC>stage 2, IVH>2, PVL.
Results: 1188 healthy infants included. PWL was higher in infants born at earlier GAs. Maximum weight loss was for (A):7% and (B):11% by DoL 5. While relative PWL was similar, infants born at higher birth weight percentiles crossed more percentiles compared to those **born at lower percentiles.**
Conclusions/Significance: This study provides a robust estimate for physiological PWL in preterm infants after undisturbed PreCES. Crossing more percentiles during PWL for infants with higher birth weights could be explained by skewed percentile distributions of reference growth charts, which do not take into account PreCES.

II-44 Evaluating the Relationship between Gut Microbiota and Neurodevelopmental Outcomes in Infants

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At birth, human infants start accumulating intestinal microbiota until a relatively stable state is reached. This process is influenced by environmental factors including the mode of delivery, feeding, duration of gestation and hygienic conditions. The acquisition and establishment of the gut microbiota is hypothesized to have a considerable impact on later health outcomes.
We aimed to study the possible associations between the gut microbiota, assessed by 16S rRNA gene sequencing, and infants' neurodevelopment using the Bayley Scales for Infant Development III. We studied 131 children at 6 (n=52) and 18 months (n=79), participating in the PREOBE project, an observational case-control study on healthy normo-weight (18.5≤BMI< 25), overweight (25≤BMI< 30), obese (BMI≥30) and gestational diabetic pregnant women (GD). Statistical analyses were performed using the SPSS statistical software package for Windows and Lefse Galaxy. An important shift in gut microbiota composition from 6 to 18 months old was observed, showing a significant enrichment of Bacteroidetes and Verrucomicrobia. At 6 months of age, gut microbiota was significantly enriched in *Clostridium XIX genus* in those infants whose Composite Language and Cognitive scores were < P25. Furthermore, the relative abundance of *Fusobacterium* was significantly elevated in infants showing the Gross Motricity score between P25 and P75.
Conclusion: Gut microbiota composition seems to be linked to neurodevelopment outcomes during early life.

II-45 Children Feeding Practices in the Rice Surplus Areas, Central Java, Indonesia

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Central Java is one of the main national stock for rice production. Although rice production in this area is high, poor nutritional status was found among children, a key indicator of improper nutrition. Therefore, this study is conducted for assessment of feeding practices among children under five years old living in the rice-surplus area in Central Java. A structured and quantitative questionnaire was used for data collection. During the data collection, mothers were interviewed about sociodemographic parameters, nutritional knowledge, feeding practices, and a 24-hour recall of food intake. Food habits were asked among women in two focus group discussions. In this study, about two-thirds of the mothers presented pre-lacteal foods and practiced supplementary feeding as well as too early complementary feeding based on traditional belief that child was exhausted after delivery process, and if the baby cries, he/she is hungry and

breastmilk is not sufficient. Only 10.9% of the children were exclusively breastfed during the first six months of life. Exclusive breastfeeding was not encouraged by husbands, mothers, or mothers-in-law and society. Around 69% experienced sub-optimal complementary feeding practices. The main reason of inappropriate breastfeeding and complementary feeding practices in this area is poor knowledge of mothers, mothers in laws, fathers. Breastfeeding and complementary feeding practices in this study did not meet the WHO/UNICEF recommendation due to the lack of knowledge of mothers, families, and health workers. More nutrition knowledge should be implemented for women and their family members for promoting breastfeeding and complementary feeding practices in this area.

II-46 The Programming of Fetal Growth Associated with Maternal Smoking and Alcohol

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The purpose of this large observational study was to examine the relationship between fetal programming, maternal smoking and other modifiable lifestyle behaviours.

Clinical and sociodemographic data were collected at the first antenatal appointment for all women attending a large maternity hospital between 2009 and 2013. Birth outcome data were collected following delivery from the hospital's computerised system and used to analyse the relationship between smoking status, alcohol intake and drug use during pregnancy and birth weight.

Of the 41,550 women the mean age was 30.7 ± 5.6y, mean BMI was 25.5 ± 5.0kg/m^2 and 40.6% were nulliparas. Babies born to women who smoked >20 cigarettes per day, consumed >10 units of alcohol per week and used illicit drugs in pregnancy were on average 318g, 382g and 161g lighter than women who did not participate in these behaviours respectively following adjustments for age, BMI, parity and gestation (all p< 0.001). The likelihood of having a baby < 10th decile for birth weight was 2.71 (95% CI 1.81- 4.06, p< 0.001) in heavy smokers (>20 cigarettes per day). This likelihood increased to 4.49 (95% CI 1.92-10.51, p=0.001) if heavy smokers also consumed 1-10units of alcohol per week, 8.98 (1.26-63.75, p=0.028) if they consumed >5units of alcohol at least once in their pregnancy and 3.83 (2.39-6.11, p< 0.001) if they used illicit drugs in pregnancy.

Maternal cigarette smoking reported at the first antenatal visit increases the likelihood of intrauterine growth restriction and is further elevated by alcohol and illicit drug use in pregnancy.

II-47 Pre- and Postnatal Exposure to Developmental Risk Factors and Early Childhood Obesity - Findings from the Growing Up in Ireland Cohort Study

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Background: Exposure to hypernutrition during the intrauterine period increases the risk of of becoming obese later in life. It has also been suggested that postnatal events can correct perinatal metabolic programming of childhood obesity. The aim of this study is to examine the effect of developmental risk factors and the risk of childhood overweight at 9 months and age 3 years.

Methods: The sample comprised of 8,407 infants and their caregivers, participating in the Growing Up in Ireland study, a nationally representative cohort study of children living in the Republic of Ireland. Anthropometric measurements were collected when the infants where 9 and 36 months old. An ordered logit regression analysis was conducted to determine the association between pre and postnatal factors and early childhood obesity.

Results: Multivariate statistical analysis showed that being born large for gestational age (LGA), and rapid weight gain were independently associated with CHO in both infants and young children. Small for gestational age (SGA) decreased the risk of early childhood obesity. Interestingly, parental obesity and smoking during pregnancy were significantly associated with an increased risk of being overweight or obese at 3 years of age but not in infants.

Conclusion: LGA, but not SGA, and rapid weight gain are strong independent predictors of early CHO. If the child was overweight at 9 months it is at an increased risk of being overweight at 3 years. This suggests that rapid increases in weight pre and/or postnatally can determine an obesogenic pathway resulting in an early obesity phenotype.

II-48 The Role of Mother´s Obesity, Overweight or Gestational Diabetes on their Offspring Behavioral Development at 3.5 Years of Age

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The intrauterine environment associated with overweight/obesity and/or gestational diabetes is characterized by a number of prenatal factors that have been linked to problems with central nervous system development and later mental health outcomes. We investigated the relationship between behaviour development at 3.5 years in children born to obese, overweight and gestational diabetic mothers. From a total of 331 pregnant women participating in the PREOBE study, 156 pregnant women and their offspring were included for the present study. The mothers were divided into 4 groups according to their pre-gestational body mass index or the development of gestational diabetes: overweight (n:31), obese (n:26), gestational diabetic (n:48), and healthy normal weight controls (n:51). Mothers rated behavior problems using the Child Behavior Checklist (CBCL) when their children were 3.5 years of age. Differences in CBCL scores were analysed using MANCOVA and Chi-Square Test, performed using SPSS version 22.0. Significant group differences in child´s *withdrawn* (p=0.016) and *affective problems* (p=0.019) were found. Statistical analysis revealed that those children born to overweight/obese mothers showed higher scores in behavioral problems compared to those born to normal weight-healthy mothers. Additionally the offspring born to gestational diabetic mothers showed significantly higher scores in *aggressive behavior* (p=0.046) compared to those born to the healthy-normal weight group. **Overweight/obesity and Gestational Diabetes during** pregnancy are associated to elevated scores of

behaviour problems. These results suggest that the increased inflammatory milieu demonstrated in these type of gestations may represent a biological condition that may be implicated in the development of child´s psycho-behaviour problems.

II-49 Does Adherence to Canada's Food Guide Dietary Recommendations During Pregnancy Promote Excessive Gestational Weight Gain? Findings from the Alberta Pregnancy Outcomes and Nutrition Study

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Weight gain recommendations for pregnant women in Canada are based on pre-pregnancy BMI. Pregnant women are typically referred to Canada's Food Guide (CFG), which recommends consuming 2-3 extra servings/d from any food group to achieve an additional 340kcal/day. However, CFG recommendations do not account for pre-pregnancy BMI and provide no guidance on 'less-healthy' foods. This study explored associations between compliance with CFG recommendations, consumption of 'less healthy' foods and gestational weight gain (GWG) in a cohort of pregnant women in Alberta, Canada.

A 24-hour recall was completed in participants 2nd trimester (n=1630). A compliance score was created on the basis of each CFG recommendation met, ranging from 0-11. For consumption of eight 'less-healthy' food groups, a score of 0 (none), 1, 2 or 3 (lowest, middle or highest tertile, respectively) was derived and summed giving a score of 0-24. Total GWG for was calculated by subtracting pre-pregnancy body weight from highest weight during pregnancy.

In total 26%, 40%, 70% and 66% of those underweight, normal, overweight and obese pre-pregnancy, respectively, exceeded GWG guidelines. Overall, each unit increase in CFG-compliance score was associated with 0.3kg increase in total GWG (95% CI:0.14,0.46). In women who were obese, higher CFG-compliance scores was associated with a 48% increased risk of exceeding GWG guidelines (RR:1.48 95%CI:1.12,1.77), independent of less-healthy score.

In the absence of widespread individual dietary counseling for pregnant women, these results suggest that attention needs to be paid to the production and dissemination of dietary recommendations that take account of pre-pregnancy BMI.

II-50 Two-Year-Follow Up of IUGR-Fetuses' Cognitive Development

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Background: In a previously conducted fetal-magnetoencephalographic (fMEG) study we demonstrated delayed visual evoked responses (VER) in intrauterine growth restricted (IUGR) fetuses as compared to eutrophic fetuses and small for gestational age fetuses (without placental insufficiency). Hence, impaired cognitive development in IUGR fetuses was shown for the first time. Here, we present follow-up data of our fMEG study to investigate the effects of IUGR on cognitive development during early childhood.

Methods: 48 children were assessed using Bayley Scales for Infant Development (2nd edition) at the age of 24 months. Eight of them were formerly IUGR fetuses (abnormal umbilical artery Doppler velocity, birth weight < 10. percentile) and 40 were controls (eutrophic, normal course of pregnancy).

Results: Children with IUGR had a significantly lower Mental Development Index (MDI) as compared to eutrophic children (95.5 vs. 103.3; p = 0.028).

Conclusion: IUGR may lead to impaired cognitive development during childhood. As we have shown previously that IUGR affects fetal brain function, ongoing studies are investigating whether the fMEG method is suitable to predict developmental alterations. With respect to interventions during early childhood, this may be of high clinical value.

II-51 Associations between Maternal Feeding Practices and Child Food Intake and Weight Status in Asian Families: The GUSTO Cohort

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Parents' feeding practices have been shown to influence children's food intake and weight status, but existing literature is largely based on questionnaire data, with limited representation of Asian populations. We used behavioral observation to compare mothers' feeding practices with their children's intake and food choices in a Singaporean birth cohort.

Methods: Preschool children and their mothers participated in an ad-libitum buffet meal. Their interactions were coded for mothers' feeding practices: suggesting foods to select, prompting to eat (controlling or autonomy-supportive prompts), restricting child intake, talking about food, and hurrying or slowing child eating. Number of food items and calories the child consumed were recorded. Preliminary results from the first 100 coded dyads are presented.

Results: Mothers prompted children to eat on average (median) 6 times (IQR: 3-11). 57% of parents restricted child intake at least once

during the meal. Children whose mothers made more prompts to eat consumed a wider variety of items (r=0.23); this pattern held for autonomy-supportive prompts (r=0.24), but not controlling ones. Mothers who made more controlling prompts to eat had children with greater energy intake (r=0.25). Children whose mothers used restriction chose more food items and had greater energy intake than those who did not use this practice (p< 0.05), but this relationship may reflect mothers' reactions to child intake. Other feeding practices were not significantly associated with intake or variety.
Conclusions: In Singapore, mothers' feeding practices were associated with children's intake during a buffet meal. The relationship with child BMI and adiposity will be discussed.

II-52 Maternal Metabolite Profile Is Associated with Altered Infant Birth Size in a Multi-Ethnic Asian Population

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Research question: Evidence linking maternal metabolite profiles during pregnancy with infant birth size is limited, particularly in Asian populations. We examined for associations among women in the Singapore GUSTO mother-offspring cohort.
Methods: In maternal fasting plasma obtained at 26-28 weeks' gestation, 79 metabolites were identified using gas chromatography-mass spectrometry and metabolite profiles were generated by exploratory factor analysis. Gestational age was established by first trimester ultrasound and birth measurements from hospital records. Associations were assessed by multivariable linear and multinomial logistic regression for birth weight and length, and small (SGA; birth weight below 10th percentile) and large-for-gestational age (LGA; birth weight above 90th percentile), respectively.
Results: Of 821 infants, mean ±SD birth weight was 3086 ±442 g; 13% were SGA and 15% LGA. We identified 8 metabolite profiles, accounting for 57% of the variance in concentrations of the 79 metabolites. A branched-chain amino acid (BCAA)-related profile (characterised by elevated levels of valine, leucine, isoleucine, phenylalanine, 3-methyl-2-oxopentanoic acid, 4-methyl-2-oxopentanoic acid, 2-hydroxybutyric acid, 2-oxovaleric acid and creatinine) was associated with higher birth weight (37 g per SD increase in BCAA score; 95% CI: 4, 70), longer birth length (0.3 cm per SD increase; 95% CI: 0.1, 0.5) and lower risk of SGA (RR per SD increase=0.77; 0.60, 0.99). No associations were seen between the other 7 metabolite profiles and birth size.
Conclusion: A maternal BCAA-related metabolite profile was positively associated with larger birth size and a lower incidence of SGA.

II-53 Growth Evolution of Infants Born to Obese Women during the First 2 Years of Life Depending on Type of Feeding

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We aimed to analyse the growth of infants born to obese women during the first 24 months of age, based on infant feeding type in the first months of life. The study was performed on 90 mother-child pairs participating in the PREOBE study (www.proyectopreobe.com, www.ClinicalTrials.gov NCT01634464). Children born to obese mothers (n=28) and in those born to normal women (n=62) were included. Infants' anthropometric measurements were performed at 3,6,12,18 and 24 months of age, and were compared to the WHO growth standards. Infant feeding type at 3 months of age was classified in 3 groups: exclusive breastfeeding, infant formula feeding and mixed feeding. ANOVA with Bonferroni post-hoc correction was applied using SPSS 21.0 software. Results are expressed in z-score. At 6 months of age the breastfed infants born to obese women showed lower z-scores for weight-for-length (W/L) and Body-Mass-Index (BMI) than those born to normal women (z-score W/L: -1.38±0.79 vs -0.04±0.78, p=0.01; and, BMI: -1.49±0.78 vs -0.14±0.78, p=0.01). Similarly, the z-score for middle-upper-arm-circumference in breastfed infants born to obese women was lower than those born to normal women (-0.85±0.74 vs 0.62±0.82, p=0.001). Finally, infants born to obese women fed with infant formula showed a similar z-score for BMI to breastfed infants born to normal women (-0.59±0.74 vs -0.14±0.78, p>0.05). These results did not remain to 24 months of age. Infants born to obese women fed with infant formula and breastfed infants born to normal women, show a similar BMI at 6 months of age, although this difference is short lived.

II-54 Mercury Levels and Ph in Cord Blood at the Time of Birth in Healthy Newborns

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Prenatal exposure to mercury (Hg) is associated to a potential damage on fetal neurodevelopment and infant growth.

Objective: To determine the concentrations of mercury in maternal serum and cord blood at the time of birth and to analyze any relationship to infant growth.
Design: A cross-sectional study included 47 mother-baby couples (healthy pregnant women without obstetric or neonatal risks factors).
Methods: Maternal serum and cord blood samples were collected at the time of birth. The anthropometric parameters were recorded 24 hours after delivery. Cord blood pH was measured at the time of birth. Mercury levels were determined in maternal serum and cord blood by inductively coupled plasma mass spectrometry (ICP-MS).
Results: The mean mercury level in cord blood was 8,87 ±6,56 µg/L. 24 in 47 babies (51%) had mercury levels above the international recommendations. Mercury levels strongly correlated within the mother-baby couples (*Pearson's r*=0,55*, p< 0,01*). Neonatal mercury concentration inversely correlated to neonatal height at birth (*r*= -0,*31, p< 0,05*). There was a significant difference in cord blood pH between newborns with high mercury levels and those who had normal levels (7,33 ±0,03 vs 7,30 ±0,05, respectively, *p< 0,05*).
Conclusion: The levels of mercury in cord blood can be a good marker of prenatal exposure to mercury during vulnerable periods (such as pregnancy and childhood). The exposure to mercury in pregnant women and their newborns in Spanish population is high. Specific recommendations regarding fish consumption are needed.

II-55 The Association between Sleep Duration, Quality, and Disturbance and Metabolic Health among Overweight and Obese Pregnant Women

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Introduction: Poor sleep is associated with metabolic derangements in non-pregnant populations. Although it is known that sleep quality deteriorates throughout pregnancy, the association between sleep and metabolic health has not been extensively studied among pregnant women. Given that poor sleep during pregnancy is particularly pronounced in overweight and obese women, our aim was to explore the association between sleep and metabolic health in this population.
Methods: Data were obtained from a subsample (n = 220) of participants in a prospective, cohort study of overweight and obese pregnant women conducted at the National Maternity Hospital, Dublin, Ireland. Data on sleep duration, quality, and disturbance were collected by validated questionnaires in the 1st and 3rd trimesters, along with blood samples for biomarker analysis. We used multiple linear regression to assess the association between sleep variables and markers of metabolic health in both trimesters, controlling for confounders.
Results: Sleep duration, quality, and disturbance worsened significantly throughout pregnancy. In the 1st trimester, sleep disturbance was associated with increased body mass index (*P*< 0.001) and increased insulin resistance (*P*=0.02). In the 3rd trimester, sleep disturbance was associated with reduced fasting blood glucose (*P*=0.03) and reduced HDL cholesterol (*P*=0.04). Increased sleep quality throughout pregnancy was associated with higher glucose levels (*P*< 0.001).
Conclusion: The association between sleep disturbance and reduced fasting blood glucose in this population is contrary to findings of other researchers. It is possible that sleep disturbance is associated with increased maternal movement and thus, increased glucose utilization. This novel finding warrants further investigation.

II-56 Feeding Practices in Low Birth Weight Infants

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Objective: To assess the quality of feeding practices in infants aged 6 to 24 months old born with low birthweight (LBW).
Method: It was performed a cross-sectional and control study with 37 infants (6-24 months old) born with LBW (birth weight 2.3±0.3kg and gestational age 35.8±2.1weeks, 51.3% small for gestational age). The control group was composed by 20 health infants with normal birth weight and born at term, followed in the same outpatient clinics. Data about weight, height, head circumference and gestational-age at birth were collected. We also got data on exclusive/predominant (BFE) and total breastfeeding (BFT) duration; time of solid food introduction and nourishing feeding practices through validated questionnaire of World Health Organization (WHO, "*Indicators for assessing infant and young child feeding practices*").
Results: In LBW group the mean age was 12.3±3.5 months and 54.0% were male. Infants of LBW group showed shorter BFE duration (2.6±2.7 vs 4.6±2.3 months; p = 0.009) and earlier introduction of solid foods (5.6±1.4 vs 6.0±0.6,p=0.039) when compared to control group. There were no differences between the groups regarding WHO nourishing feeding practices. Bottle feeding started earlier in LBW group (2.4±2.1 vs 4.8±2.0; p< 0.001).
Conclusion: The shorter duration of breastfeeding and earlier introduction of solid foods in infants born with LBW might impair the adequate growth, development and increase the risk of micronutrients deficiency and non-communicable diseases in these children who already have a higher risk for disease in short and long term.

II-57 Birth Size, Childhood Growth and Later Obesity in the Newcastle Thousand Families Study

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Obesity prevalence continues to rise which has been partially attributed to the growing obesogenic environment. This project investigates the hypothesis that the move towards an obesogenic environment has increased the likelihood of a child being overweight and obese at age 9. This study will employ cohort data from two birth cohorts (1946 Thousand Families Study and 2000 Gateshead Millennium Study) from the same region (North-East England) to investigate if socioeconomic status and early life factors have become more important over time in explaining the likelihood of obesity in childhood.
Multivariate regressions will be estimated on data from both cohorts and appropriate post-estimation statistical tests will be conducted to determine if the magnitude and significance of socioeconomic status and other early life factors has increased over time between the two cohorts. BMI z-scores will be examined using linear regression methods, and overweight and obesity using non-linear techniques. These unique datasets, which cover the same region at two very different time points, provide us with the opportunity to determine if an increasing obesogenic environment has altered the impact of socioeconomic status and early life factors on the likelihood of being

overweight/obese at age 9. Data arising from this project will be important for the development of effective interventions to attempt to reduce childhood obesity.

II-58 Maternal Nutritional Knowledge in Early Pregnancy

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Nutritional intakes during pregnancy are a key determinant of fetal growth and maternal health outcomes. This study aimed to determine maternal nutritional knowledge levels in early pregnancy.

Women were recruited at their convenience after sonographic confirmation of a singleton ongoing pregnancy. Women's demographic details were recorded. Weight and height were measured and BMI was calculated. Women completed a nutritional knowledge questionnaire adapted for pregnancy from a validated nutritional knowledge questionnaire(1). Nutrition knowledge scores were calculated and categorised as low level (< mean - 1 standard deviation), medium level (mean ± 1 standard deviation) or high level (> mean + 1 standard deviation)(2).

Of the participants recruited (n=100), the mean age was 31.6 (SD 6.0) years and 54% were nulliparous. Mean BMI was 25 (SD 4.9) kg/m², with 16% obese. Of the study population, 70% had a third level qualification or above. Of the nutritional knowledge scores, 16% (n=16) had a low score, 69% (n=69) had a medium score and 15% (n=15) had a high score. Nutritional knowledge scores were not associated with parity or BMI. However, 62.5% of women with an educational qualification lower than third level had a low level of nutritional knowledge versus 37.5% of those with a third level education ($P < 0.001$).

These findings highlight the need for nutrition education in early pregnancy, especially for those with lower formal education.

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II-59 Determinants of Excessive or Inadequate Gestational Weight Gain among Pregnant Women in Batu Pahat District of Johor State, Malaysia

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This study aims to determine factors associated with gestational weight gain (GWG) among pregnant women in Batu Pahat district of Johor state, Malaysia. A total of 192 pregnant women aged 18-40 years in the second and third trimesters of pregnancy attending seven selected health clinics in Batu Pahat participated in this study. The socio-demographic characteristics, physical activity, and dietary intake of the pregnant women were interviewed by the researcher. Their anthropometric measurements and obstetrical history were extracted from medical records. GWG was calculated by comparing the current body weight with pre-pregnancy weight divided by gestational age and categorized into insufficient, adequate, or excessive according to their pre-pregnancy BMI based on Institute of Medicine (IOM) recommendations. Logistic regression analysis was used to determine the factors contributed to GWG. More than half of the respondents (55.2%) had inadequate GWG and 18.2% had excessive GWG. Prior to pregnancy, 56.8% of them were normal weight, 29.2% were overweight or obese, and 14.1% were underweight. The mean total activity of the pregnant women was 192.7±92.9 MET-hour/week and their mean energy intake was 2358±707 kcal/day. Pre-gestational normal weight (Expβ=0.315, 95%CI=0.102-0.974) and overweight/obesity (Expβ=0.079, 95%CI=0.023-0.279) were associated with increased risk of inadequate GWG, while pre-gestational overweight/obesity (Expβ=10.882, 95%CI=1.888-62.725) were associated with increased risk of excessive GWG. In short, almost three-quarters of the pregnant women experienced inappropriate GWG with majority had inadequate GWG. Prenatal nutrition care and management focusing on promoting healthy pre-pregnancy body weight status is essential to prevent inadequate or excessive GWG among pregnant women.

II-61 Pilot Study of Nutritional Composition of Breast Milk in Hong Kong Lactating Mothers

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Introduction: The nutritional compositions of breast milk in regard to the unique local diet in Hong Kong have remained under-studied. The aim of this study is to investigate the influence of maternal diet on the nutritional composition of breast milk, including fatty acids, calcium, iron, zinc and iodine.

Methods: Breast milk samples from ninety-five healthy Hong Kong lactating women aged 19-40 were collected in this study. Subjects were divided into 3 groups according to their duration of lactation (0-6 month, 7-12 month and over 12 month) and further sub-divided into groups according to their dietary supplementation habit. Mothers' dietary intake were assessed using a 3-day diet record. The contents of fatty acids and minerals in the breast milk were determined by GC-MS and ICP-MS respectively.

Results: In samples of breast milk for infants aged 0-6 months, the mean DHA and EPA content were 0.79±0.54% and 0.32±0.24% by weight of total fatty acids. In this group of lactating women, approximately half fulfilled the recommendation of weekly fish and daily DHA intake. In regard to minerals, the mean contents of calcium, iron, zinc and iodine were 266.8±33.1, 0.51±0.14, 1.40±0.77, 0.12±0.06 mg/L.

Conclusion: The pilot study findings suggest that most Hong Kong lactating women can provide their infants especially aged 0-6 months with sufficient omega-3 fatty acids which is associated with the maternal fish intake. But the zinc content in the breast milk may not meet the infant's needs. This indicates the needs to improve the quality of maternal diet.

II-62 Maternal DHA is Related to Lower Change in Infant Total and Central Fat Mass

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Background: Data are inconclusive as to whether prenatal docosahexnoic acid (DHA; n-3 fatty acid) exposure programs a protection for offspring body composition and adipose tissue (AT) distribution.
Methods: Infant body composition (fat mass; FM, fat-free mass; FFM) was measured using the Pea Pod at birth and 3 months (n=55). Skinfolds were measured centrally and peripherally to represent AT distribution using standardized procedures. Maternal RBC DHA was measured at 36 weeks in pregnancy and categorized by the median; low (< 50th percentile) or high (≥50th percentile). Gestational weight gain (GWG) was categorized as appropriate (n=23) or excessive (n=32) based on the 2009 IOM guidelines. ANCOVA examined the main effects and interaction of maternal DHA status on GWG category.
Results: The interaction approached significance (p=0.187). In post-hoc analysis, no difference was found by maternal DHA status in offspring exposed to appropriate GWG. However, in offspring exposed to excessive GWG, infants exposed to low maternal DHA status had a greater change in offspring FM (Δ 1432.0 g) when compared to infants exposed to high maternal DHA status (Δ 1167.0 g; p=0.069). No difference for FFM was found. Independent of the exposure to excessive GWG, offspring born to woman with a greater DHA status had a lower change in central FM when compared to offspring born to a woman with a lower DHA status (Δ central FM 3.7 mm vs. 4.6 mm; p=0.05).
Conclusion: These preliminary data suggest DHA may be protective against excessive FM accumulation and promote a more favorable AT distribution.

II-63 Ghrelin, Leptin and Insulin in Cord Blood and Anthropometric Parameters of Infants at 11 Months

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Introduction: Various factors acting during fetal life may affect the metabolism of the newborn. Assessment of appetite-regulating hormones concentrations in cord blood may be helpful in predicting the development of children. Ghrelin, leptin and insulin are involved in the regulation of satiety. This study aimed to investigate the correlation of appetite regulating hormones concentrations in cord blood with infants´ anthropometric parameters at 11 months.
Material and methods: The study covered 67 samples of cord blood, from term newborns. Active ghrelin and acyl ghrelin concentrations were measured by radioimmunoassay, leptin and insulin - by immunoenzymatic test ELISA. At 11 months anthropometric measurements(body weight; circumferences of head, chest, stomach, arm and thigh) were collected.
Results: Active ghrelin correlated negatively with body weight(p=0,041). Total ghrelin correlated negatively with head circumference(p=0,034) in the whole group and in male infants(p=0,022) and positively with arm circumference in female infants(p=0,010). Leptin correlated negatively with arm circumference in female infants(p=0,007).
Conclusions: Appetite-regulating hormones may play an important role in the development of children. There are many other factors which may affect the predisposition to abnormal body weight in children, which should be taken under consideration. Determining which one could be a biomarker of overweight and obesity requires further research on a larger group of patients and longer follow-up. Anthropometric parameters changes are dynamic in the first months of life, thus more studies seeking for a potential determinants of early childhood programming mechanisms for obesity are needed.

II-64 Low Breastfeeding Rates among Infants Born to Obese Women

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We aimed to identify the relationship between maternal pre-pregnancy body mass index (BMI) or gestational diabetes condition and type of infant feeding in the first months of life. The study was performed on 197 mother-child pairs participating in the PREOBE study (www.proyectopreobe.com, www.ClinicalTrials.gov NCT01634464). Women were classified according to their pre-pregnancy BMI as G1: healthy and normal weight n=71 (18.5≤BMI< 25) (control group); G2: overweight n=35 (25≤BMI< 30); G3: obese n=35 (BMI≥30) and G4: gestational diabetes mellitus (GDM) n=56. Feeding type was enquired to the mothers at 3 and 6 months of life in the offspring, and it was classified in 3 groups: Exclusive breastfeeding (EBF), infant formula feeding (IFF), and mixed feeding (MF) when the babies received both types of feeding. Chi-squared test with Bonferroni post-hoc correction was applied using SPSS software version 21.0. There was no difference in child´s sex: 51% males and 49% females (p=0.46). Moreover, it was seen that at 3 and 6 months of age, children received 45% and 17% EBF, 35% and 31% MF and, 20% and 52% IFF; respectively. At 3 months of age those children born to obese women received less exclusive breastfeeding (31.5%) and were mainly fed by infant formula (37%), respect to those children born to control group (EBF 56%; IFF 9%) (p=0.01). Infant feeding type in the first months of life is related to pre-pregnancy BMI of the mothers. Infants born to obese women receive less breast milk than children born to healthy and normal weight pregnant women.

II-65 Growth Velocity in Infancy and Physical Activity in Adolescence: Results from Prospective Birth Cohort Studies

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Background: Growth velocity in infancy affects the risk of common chronic diseases later in life. Inactive subjects are at higher risk of developing diseases. Thus, some studies suggest that physical activity (PA) might be a mediator in this relationship.
Objective: To investigate the association between peak weight (PWV) and height velocity (PHV) in infancy with PA in adolescence.

Methods: Data from 1311 adolescents from the German GINIplus and LISAplus studies were analysed. PWV and PHV were calculated from repeated weight and height measurements obtained between birth and age two. Data on PA was obtained at age 15 from one-week-accelerometry (hip-worn ActiGraph GT3X) and categorised into sedentary, lifestyle and moderate-to-vigorous PA (MVPA) according to Freedson et al cut-offs. Associations between sex-specific PWV and PHV tertiles with PA were analysed using negative binomial regression adjusted for potential confounders including birth weight and BMI.
Results: The association between PWV and MVPA was inversely U-shaped, with 7% more MVPA among subjects in the middle compared to the first tertile (p=0.048). Sensitivity analyses stratified by sex showed significant associations between PWV with sedentary and lifestyle PA only among males, presenting 2% lower sedentary behaviour (p=0.038) and 5% higher lifestyle PA (p=0.038) in the middle compared to the first tertile. No associations were observed with PHV.
Conclusion: These results suggest that early gain in weight, but not in length, is associated with PA in adolescence and support the speculation on a mediating role of PA in the well-established association between early weight gain and later diseases.

II-66 Procalcitonin and Apo-e in Extrahepatic Biliary Atresia

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Objective: Extrahepatic biliary atresia (EHBA) is one of the main causes of neonatal cholestasis. Its early diagnosis could increase the survival of the infants with early surgery. We evaluated the diagnostic accuracy of procalcitonin and apolipoprotein E (Apo-E) levels in infants with and without EHBA.
Methods: This prospective study included 18 infants with EHBA and 15 infants with other causes of cholestasis. Blood samples were taken from each patient and different markers including procalcitonin and Apo-E levels were measured. ROC analysis was used to define sensitivity, specificity, positive and negative predictive value (PPV and NPV) for procalcitonin and Apo-E.
Findings: There was a significantly positive correlation between Apo-E and SGOT (r=0.37, P=0.03), SGPT (r=0.38, P=0.02) and GGT (r=0.38, P=0.02), and an inverse correlation between procalcitonin and GGT (r=-0.45, P=0.01). Area under curve (AUC) for procalcitonin was 0.69 (P=0.05) with cut-point of 0.735 ng/ml. The sensitivity, specificity, PPV and NPV was 67%, 61%, 69% and 59%, respectively. AUC for Apo-E was 0.68 (P=0.06) for cut-point of 61.25 ng/ml with sensitivity, specificity, PPV and NPV of 67%, 67%, 71% and 67%, respectively.
Conclusion: Both PCT and Apo-E have relatively good accuracy in diagnosing EHBA cases; we could not rely on these markers for diagnosis of EHBA, however, combinations of these biomarkers with other markers and imaging tests could improve their accuracy and may help to achieve a rapid and accurate diagnosis of EHBA.

II-67 Maternal and Cord Blood Leptin and Correlation with Fetal Growth

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Purpose: Leptin is a protein secreted mainly by the adipocyte in proportion to fat mass. The serum leptin concentration reflects the amount of adipose tissue in the body and has potential role on the fat deposition in the fetus. In this study, we investigated whether umbilical and maternal serum leptin concentrations correlate with fetal growth.
Method: We studied 100 newborn infants (48 female and 52 male; gestational age, 34 - 40 weeks) and their mothers at Alzahra hospital in Tabriz city. Serum leptin concentrations were measured by ELISA and linear regression analysis was used to evaluate correlation.
Results: There was no significant correlation between umbilical and maternal leptin concentrations (r = 0.011; p = 0.459) in all study groups. There was a correlation between umbilical leptin concentration and birth weight of newborns (r = 0.278; p = 0.003) and correlation with body mass index (BMI) of the newborns (r = 0.249; p = 0.006). Maternal leptin concentrations correlated with maternal weight and BMI (r = 0.277; p = 0.003, r = 0.290; p = 0.002, respectively). There was no correlation between maternal leptin concentrations and birth weight (r = - 0.162; p = 0.054) and with BMI of the newborns (r = - 0.158; p = 0.058). There was gender difference in leptin concentrations in the newborns (r = 0.331; p = 0.00025) with greater level in females.
Conclusion: We have shown a pivotal role of fetal leptin in regulating fetal growth and development.

II-67 Do Commercial-/Ready-to-Eat Snacks Lead to Stunting in Indonesian Children? A Case study in Demak Regency, Central Java

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Paradox between high rice productivity and poor nutritional status of children was existed in Demak Regency, Central Java, therefore this study intended to analyze the underlying factors of stunting prevalence of under-five children. In December 2014-February 2015 a cross-sectional survey was carried out in three sub-districts in Demak. The oldest under-five children from farmer family background were selected. Data on general characteristics, anthropometric and dietary intake of the children, as well as household socio-economic including agriculture characteristics were obtained. Of the 335 children 31.9% of them were stunted (HAZ-score < -2 SD). Stunting prevalence among children ≥24 months was 35 % slightly higher than that of children from 6-24 months (26.4%). No correlation was discovered between agriculture data and nutritional status of the children, except land-size. Binary logistic regression model to predict stunting in children shows that child's height was a prominent factor of stunting children (p< 0.001), while increased expenditure on child's commercial-/ready-to-eat snacks was a risk factor of being stunted (p=0.027). Dietary diversity, energy, protein, zinc, calcium and iron intake of both group of children were similar. Generally, snack intake contributed about 15% of protein and 14.8% of energy, followed by zinc (10%), iron (5.5%) and calcium intake (1%) of the children per day. By increasing child's age group, consumption of snack and stunting prevalence were also increased. The snacks that high in energy but low in micronutrient content seemed to have contribution to stunting in children in Demak, Central Java.

III - Mechanisms (cell/animal studies)

III-1 Role of Human Milk Oligosaccharides in Fetoplacental Endothelial Function in Gestational Diabetes Mellitus

EARLYNUTRITIONMEMBER **Poster of Distinction**

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Background & Objective: Human milk oligosaccharides (HMO) recently have been found in maternal serum during pregnancy, raising the question whether HMO also reach fetal circulation. If so, HMO might impact endothelial functions in placenta and fetal vasculature, affecting placental development and fetal programming. Here, we asked a) whether HMO can indeed be detected in cord blood, b) whether their composition or concentration is altered in gestational diabetes mellitus (GDM) pregnancies, and c) whether HMO affect feto-placental endothelial cells (fpEC).

Methods: HMO were isolated from cord blood serum, collected from healthy and GDM pregnancies (n=20). 2AB-labeled HMO were analyzed using HPLC with fluorescence detection, and identified peaks were confirmed by exoglycosidase digest and MS. To investigate effects on fpEC isolated from healthy term placentas (n=15), cells were pretreated with HMO and subjected to an in vitro angiogenesis assay.

Results: HPLC-FL analysis of cord blood serum revealed the presence of 17 HMO, including 3'Sialyllactose (3'SL), 2'Fucosyllactose, and Lactodifucotetraose. Total HMO concentrations did not differ between GDM and healthy pregnancies. However, 3'SL concentration was higher in GDM compared to healthy pregnancies (187±80ng/ml vs. 140±43ng/ml, p=0.0384). In network formation assays, pooled HMO increased total tube length in fpEC by 35±27% (p=0.018).

Conclusion: This study provides the first evidence that HMO are present in cord blood and affect fpEC, pointing towards a previously unappreciated role of HMO in the feto-placental unit. The higher concentration of 3'SL in GDM pregnancies suggests a contribution to altered endothelial function seen in GDM, and warrants further investigations.

III-2 Associations between Leptin and Leptin Receptor Gene Polymorphisms, Maternal and Cord Blood Leptin Levels and Iron Metabolism

Poster of Distinction

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Obesity is characterized by increased leptin (LEP) and a higher risk of iron deficiency, possibly by increased hepcidin. Both conditions have adverse consequences for maternal and offspring´s health. A link between iron and leptin has been suggested. This study aims to investigate LEP and leptin receptor (LEPR) polymorphisms in relation to LEP levels, placental transferrin receptor (pTFR) and cord blood iron parameters. LEP gen (A19G, rs2167270) was genotyped in 103 mother-baby pairs, and LEPR Q223R (rs1137101) in 97 mothers/93 offspring. Serum transferrin receptor (sTfR) was measured by ELISA-R&D; Serum LEP by luminex, hepcidin by ELISA, pTfR expression by Western blotting and pTfR RNA by real time RT-PCR; Statistical analysis was performed using SPSS v.21. Obese LEPR-RR women exhibited higher maternal LEP (34.62±19.19 vs 17.35±9.22, p=0.018) and lower maternal and neonatal ferritin, compared to QR (12.44±4.57 vs 23.73±7.77, p=0.006; 139.53±23.89 vs 224.15±30.05 p=0.010, respectively). LEPR-RR offspring presented the highest pTfR expression compared to QR (p=0.027), but no differences in cord blood iron status parameters were found. Maternal LEP-AA19 was associated with lower LEP, sTFR and transferrin in their offspring. LEP was negatively correlated to Transferrin Saturated Index (r=-0.423, p=0.002) and serum iron (r=-0.330, p=0.020) in the neonates.

Conclusion: Obese LEPR-RR women are at higher risk of iron deficiency during pregnancy and their offspring presented lower iron stores. LEPR-RR offspring are protected for iron deficiency by increased pTfR. Maternal and offspring´s LEP levels and LEP19 gen are associated to neonatal iron parameters, though the mechanisms are still unknown.

III-3 Mammary Gland Development, Apoptosis and Breast Cancer-Related Gene Expression Analysis in Female C57BL/6 Mice Offspring of Mothers and/or Fathers Treated with Blackberry Polyphenols-Enriched Extract

Poster of Distinction

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Maternal and paternal nutrition could represent important factors influencing breast cancer developmental programming. Impact of maternal and/or paternal blackberry extract on mammary gland development, apoptosis and breast cancer-related gene expression was evaluated in female offspring. The extract was offered through drinking water to fathers from prepuberty onwards and mothers during gestation and lactation. Morphological analysis of 50 day-old offspring mammary glands revealed that compared to controls, offspring of mothers and/or fathers that received the extract presented lower ($p< 0.05$) number of terminal end buds, increased ($p< 0.05$) epithelial elongation and differentiated structures, and higher ($p< 0.05$) level of apoptotic cells. Breast cancer-related gene expression analysis (Qiagen RT2 Profiler PCR Array; panel of 84 genes) revealed that compared to controls, offspring of mothers that received the blackberry extract presented decreased ($p< 0.05$) expression of *cdh1, krt8, src, p21, rarbeta, sfn, thbs1* and increased ($p< 0.05$) expression of *ccnd2* and *gli1*; of fathers that received the extract presented decreased ($p< 0.05$) expression of *cdh1, krt8, src* and *mapk3* and increased ($p< 0.05$) expression of *bcl2, igfbp3, twist1* and *gli1*; and of mothers and fathers that received the extract presented decreased ($p< 0.05$) expression of *mapk3, p57, ctsd, foxa1, mgmt, notch1* and *slit2* and increased ($p< 0.05$) expression of *il6* and *gli1*. Combined or isolated

maternal and paternal blackberry extract consumption altered mammary gland development in the female offspring. Modulation of genes associated with cell cycle control, tissue morphology and cell differentiation could be associated with this programming effect.
Financial support: FoRC/FAPESP

Poster of Distinction

III-4 Supplementation with Myo-Inositol and Probiotics (Bifidobacterium Lactis and Lactobacillus Rhamnosus) Lowers Fat Accretion in Female Goto-Kakisaki Rats

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Introduction: In this study we evaluated the effects of myo-inositol or a mix of Bifidobacterium Lactis CNCM I-3446 (B12) and Lactobacillus rhamnosus CGMCC1.3724 (LPR), alone or in combination on body weight and body composition in female rats of reproductive age at risk of metabolic disease.
Methods: Female Goto-Kakizaki (GK) rats (n=20 per group) were fed ad-libitum during 10 weeks with different diets as follows: (1) Control (AIN93-G diet), (2) Myo-inositol (AIN93-G diet supplemented with 1% of myo-inositol), (3) Probiotics (AIN93-G diet + LPR and B12 at 10^9 CFU/day, respectively), (4) Myo-inositol + Probiotics (AIN93-G diet supplemented with 1% of myo-inositol + LPR and B12 10^9 CFU/day, respectively). Body weight and body composition (EchoMRI™) were recorded at baseline and after 10 weeks of treatment.
Results: After the treatment, no differences were observed on body weight or body composition between Myo-inositol or Probiotics groups compared to the Control group. Significant differences ($p< 0.05$) were observed between Myo-inositol + Probiotics group compared to the Control group in fat mass gain (36g vs 41 g), percentage of lean mass (69% vs 66%), fat mass gain /weight gain ratio (0.25 vs 0.29) and the delta in % of fat mass (6.8% vs 8.5%).
Conclusion: The results suggest that while neither ingredients alone had an effect, a combination of myo-inositol, B12 and LPR decreased fat accretion. This combination could be an efficient pre-pregnancy nutritional strategy to promote a healthy pregnancy in women at risk, and thus contribute to reduce the vicious cycle of metabolic disease.

Poster of Distinction

III-5 Significant Reduction in Allergic Features in the Offspring of Mice Supplemented with Specific Non-Digestible Oligosaccharides during Lactation

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Aim: Maternal supplementation with non-digestible carbohydrates during pregnancy has been shown to reduce the development of allergic asthma features in adult offspring. In the current study, it was investigated whether maternal supplementation during lactation only would have similar effects.
Experimental approach: After two weeks of acclimatization, the breeding protocol was started. Directly after birth of the offspring, mice in the intervention group were transferred to a diet supplemented with short-chain galacto- and long-chain fructo-oligosaccharides (scGOS/lcFOS; ratio 9:1). Male offspring were sensitized to OVA at 6 weeks, and acute allergic skin responses (ASR) were measured at the age of 8 weeks. Airway hyperreactivity (AHR) was measured after 3 airway challenges with OVA. Specific plasma immunoglobulins were measured; T-cell populations were analyzed in spleen and thoracic lymph nodes, and cell populations in bronchoalveolar lavage fluid (BAL) were assessed.
Results: ASR and AHR did not differ significantly between the control and the intervention group, but total cells numbers, percentages of eosinophils and lymphocytes in BAL as markers for allergic inflammation were significantly decreased in the intervention group, as well as OVA-specific IgG1 and total IgG1 levels and levels of total IgE.
Conclusion: Maternal supplementation with scGOS/lcFOS during lactation down-regulated allergic inflammation in the lungs. Immunoglobulin levels were down-regulated as well. In contrast, allergic skin reactions and lung functions were not affected. Our data suggest that early life dietary intervention with non-digestible carbohydrates may be beneficial for allergic outcome later in life, which is highly relevant for the development of atopic disease in humans.

Poster of Distinction

III-6 Cardiovascular and Renal Function in a Rodent Model of Maternal Protein Restriction and Rapid Post-Natal Growth

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Introduction: Previous studies using a rodent model have reported that intrauterine growth restriction followed by rapid post-natal growth (recuperation) is associated with premature renal ageing. Ageing has been described as an intrinsic phenomenon, leading to a progressive loss in function. Telomeres, the repeated DNA sequence TTAGGG at the end of eukaryotic chromosomes are proposed to play a critical role in this process. We have determined whether this is the result of hypertension and associated with renal dysfunction.
Methods: Pregnant Wistar rat dams were allocated to a control (8% protein) (n=8) or a low protein diet (20% protein) (n=8) group. Post-natal overfeeding was induced by cross-fostering low protein exposed offspring to dams fed the control protein diet. All animals were weaned onto a standard breeding diet (LAD1). At 3 months (before evidence of renal ageing) male offspring blood pressure (BP) and heart rate were recorded by radio telemetry. Renal morphology, renal mRNA expression of components of the renin-angiotensin system and oxidative stress pathways were also assessed.
Results: There was no difference in baseline BP (MAP: Control=116mmHg ±5; Recuperated=115mmHg ±5) or in response to a stressor test between control and recuperated offspring. No morphological differences were observed. However, mRNA expression of renin ($P< 0.0001$) and nox-4 (NADPH oxidase 4, $P< 0.0008$) were increased.
Conclusions: Premature renal ageing in this model is not preceded by elevated BP at 3 months. However, abnormalities of the renin-angiotensin system and oxidative stress pathways may play a role.
This work was funded by the British Heart Foundation.

III-7 Maternal High Fat Diet-Induced Programming of Metabolic Dysfunction in Male Rat Offspring Is Prevented by Conjugated Linoleic Acid Supplementation

Poster of Distinction

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Emerging evidence demonstrates that early life nutritional interventions may prevent developmental programming of metabolic dysfunction in offspring. We examined the impact of a maternal obesogenic diet supplemented with the nutritional anti-inflammatory lipid conjugated linoleic acid (CLA) on adult offspring outcomes. Female Sprague-Dawley rats were assigned to control (CD), control with CLA (CLA), high fat (HF) or high fat with CLA (HFCLA) diets 10 days before mating and throughout pregnancy and lactation (*n*=5-6/group). Post-weaning, offspring consumed a standard chow diet *ad-libitum* (*n*=10/group). Body composition (DXA scan), oral glucose tolerance tests and insulin response curves were performed on adult male offspring. On postnatal day 150, offspring were culled for plasma and tissue collection. Plasma was analysed by ELISA and adipose tissue morphology and gene expression was assessed. Overall fat mass and the fat:lean ratio were significantly increased in HF offspring compared to all groups. HF offspring had a significantly increased insulin response to a standard glucose load compared to all groups. Circulating leptin and IL-1β concentrations were significantly reduced in HFCLA offspring compared to HF offspring. Histological analysis revealed that HF offspring had larger, hypertrophic adipocytes compared to all groups. Retroperitoneal adipose tissue expression of *Dlk1* and *Cd68* was reduced in HFCLA offspring compared to HF, indicating impaired adipogenesis and greater inflammation in HF offspring. These results suggest that maternal CLA supplementation may ameliorate HF diet-induced programming of metabolic and adipose tissue dysfunction in offspring. Therefore, CLA may represent a novel nutritional agent to optimise early life nutrition and offspring postnatal health.

III-8 Early Dietary Supplementation with Essential Micronutrients Protects Against Early-Life Stress Induced Cognitive Impairments

Poster of Distinction

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Early-life stress (ES) is associated with lasting cognitive impairments later in life. Because prevention of ES is often not possible, intervention strategies are highly needed, yet the underlying mechanisms remain largely unknown. We investigated in an established ES animal model, the possible role of nutrition in programming later cognition. We focus on methyldonors (MD)(e.g. methionine, B vitamins), important for development and epigenetic modifications, implicated in programming. We study: *i)* if ES alters micronutrient availability; *ii)* the epigenetic, structural and behavioral effects of ES, and *iii)* if early MD-supplementation can reverse ES-induced changes in the offspring.

ES was induced in C57Bl/6 mice from postnatal day (P) 2-9, while dams received either control or MD-enriched diet. Nutrient content was measured at P9 in stomach milk, plasma and brain of the offspring. Next, we studied effects of MD-supplementation on ES-induced alterations in maternal behavior, the offspring's stress axis activity, neurogenesis, DNA methylation levels (global and Nr3C1 specific) and DNA methyltransferase expression in the hippocampus, a brain region important for cognition.

We found that early stress (ES) reduced methionine levels in offspring plasma and brain. Importantly, the MD-diet ameliorated ES-induced cognitive impairments in adulthood, abolishing deficits in spatial learning and memory. MD-diet did not only restore methionine levels in the offspring, but also prevented ES-induced stress axis hyperactivity.

These findings show that a short and early nutritional intervention can prevent lasting ES-effects on hippocampal function. They open new avenues for early nutritional intervention, which is non-invasive and easily applicable.

III-9 Effects of Long-Chain (lc) and Short-Chain (sc) Inulin on Cholesterol Metabolism in Mice

Poster of Distinction

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Non-digestible carbohydrates, such as inulin, can program the metabolism of the offspring when supplemented to the maternal diet during pregnancy and lactation. They are widely reported to improve health via gut microbiota-derived metabolites such as short-chain fatty acids (SCFA). However, SCFA can also serve as precursors for lipid and cholesterol synthesis, what may adversely result in hyperlipidemia. The effects of inulin on cholesterol homeostasis are unclear in human and animal studies. To clarify this issue, we selected two different types of inulin namely long chain (lc)- and short chain (sc)- inulin, based on their intestinal microbial fermentation characteristics. We aimed to provide an in-depth characterization of both inulin-types on cholesterol synthesis, absorption and elimination. We fed wildtype C57BL/6 mice a control diet or a diet supplemented with 10% lc- or sc-inulin for two weeks. Mice fed inulin diets had increased fecal SCFA concentration (+60%, $p< 0.01$) compared to control group. Neither of the experimental diets affected plasma or liver cholesterol concentration. Inulin receiving animals had slightly altered fecal and plasma bile acid composition. Significant increase of plasma beta-muricholic acid was observed in both inulin groups (+50%, $p< 0.05$). Hepatic *Cyp8b1* (+60%, $p< 0.01$) and *Fxr* (+40%, $p< 0.01$) mRNA expression were unregulated relative to the control group by lc- and sc-inulin respectively. Nevertheless, intestinal cholesterol absorption, fecal cholesterol excretion and trans-intestinal cholesterol excretion remained unchanged. In conclusion, our study shows that neither lc- nor sc-inulin have adverse effects on cholesterol metabolism in mice, despite a profound increase in SCFA production.

III-10 Paternal Selenium Deficiency Breast Cancer Risk Programming Involves Cell Growth, Epigenetic Marks and Gene Expression Alterations in the Mammary Gland of Female Rat Offspring

Poster of Distinction

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Recent evidence show that paternal experiences such as nutritional status may program the susceptibility of their offspring to non-communicable diseases including breast cancer. Selenium has been highlighted as a micronutrient with important role in central aspects of breast carcinogenesis. Previously we showed that male rat consumption of a selenium-deficient diet (0.05ppm) during preconception increased their female offspring susceptibility to mammary carcinogenesis induced by 7,12 dimethylbenz[a]antracene compared to male selenium-control diet (0.15ppm) consumption. We evaluated the potential mechanisms involved in this programming effect. Seven-week old Selenium-deficient fathers' female offspring presented in the mammary gland increased ($p \leq 0.05$) number of terminal end buds, higher cell proliferation ($p \leq 0.05$) in the lobules and lower apoptosis ($p \leq 0.05$) in the ducts and lobules compared to Selenium-control fathers offspring (controls). Selenium-deficient fathers' female offspring presented in the mammary gland increased ($p \leq 0.05$) expression (Qiagen RT^2 Profiler PCR Array; 84 breast cancer-related genes) of *Abcg2, Blc-2, Gata3, Igf1r* and decreased ($p \leq 0.05$) expression of *Igf1, Igfbp3, Ccnd2* and *Mgmt*, as well as increased ($p \leq 0.05$) global H3K27me3 levels (western blot) compared to controls. CHIP analysis showed that Selenium-deficient fathers' female offspring presented increased ($p \leq 0.05$) levels of H3K27me3 in the promoter region of *Ccnd2* when compared to controls. These data show that male consumption of a Selenium-deficient diet during preconception induced cell cycle, gene expression and epigenetic marks alterations in the mammary gland of their female offspring and this could be associated with the paternal breast cancer programming effect.

Financial support: CNPq and FAPESP

III-11 Sex-Specific Prenatal Programming of Gene Expression in the Dentate Gyrus during Postnatal Hippocampal Development

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Background: The aim of the study was to assign mechanistic links between disturbed intrauterine development in rats due to (1) uteroplacental insufficiency induced by ligation (LIG) of the uterine vessels, (2) prenatal stress by sham operation (SOP) and (3) low protein (LP) nutrition throughout pregnancy and hippocampal gene expression on postnatal day P7.

Methods: In all animals, we unilaterally isolated the dentate gyrus and performed a whole genome expression array (Affymetrix rat gene 2.0 ST, n=5 males and n=5 females per group). Data was processed to create lists of signal strengths for each gene. We performed a principal component analysis and group comparisons to find all molecules with a fold change > 1.5 (p-value < 0.05) between groups. All molecules identified were tested for known or predicted interactions on the protein level with the help of string database and KEGG database.

Results: Principal component analysis showed a clear gender effect of the 3 prenatal interventions. In females only, string analysis identified two identical protein networks in both LIG and LP offspring, i.e. a cluster of mitochondrial genes / oxidative phosphorylation and a cluster of ribosomal genes. The top five associated (KEGG database; sorted by p-value) disorders were 1. Disorders of oxidative phosphorylation (n=21 molecules involved), 2. Parkinson's disease (n=10 molecules), 3. Huntington´s disease (n=19 molecules), 4. Ribosomal disorders (n=17 molecules) and 5. Alzheimer´s disease (n=18 molecules).

Discussion: Differential regulation of hippocampal genes in intrauterine growth restricted (IUGR) offspring may sex-dependently contribute to predisposition towards neurodegenerative diseases.

III-12 Paternal High Fat Diet Breast Cancer Risk Programming Effects Involve Alterations in Epigenetic Marks and Gene Expression in the Female Offspring Mammary Gland

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Background: Although developmental programming is an expanding field, studies examining the role of paternal influences have received less attention. We showed previously in rats that paternal consumption of lard based high fat diet increased, while consumption of corn oil based high fat diet decreased breast cancer risk in their female offspring. Epigenetic mechanisms could be among the key mediators of this intergenerational programming.

Methods: In order to understand the potential mechanisms underlying this breast cancer programming effect we performed global DNA methylation (HPLC-DAD) and histone marks (western blot), as well as breast cancer-related gene expression (qPCR and western blot) analysis in the mammary gland of female offspring of control diet, lard and corn oil based high fat diets fed fathers.

Results: Female offspring from lard fed fathers had higher ($p \leq 0.05$) DNMT3a mRNA and protein levels compared to female offspring from control diet and corn oil fed fathers. There was no statistical difference ($p > 0.05$) regarding global DNA methylation pattern among groups. Female offspring from lard fed fathers had lower ($p \leq 0.05$) H3K4me, H3K9ac and H3K27me3 histone levels compared to control diet or corn oil fed fathers. These alterations were accompanied by increased ($p \leq 0.05$) ERalpha, FOXP3, IRbeta, LC3B1 and PPARgamma1 protein levels in female offspring from lard fed fathers compared to control diet or corn oil fed fathers.

Conclusions: Paternal high fat diet breast cancer risk programming involves alterations in epigenetic marks and gene expression in the female offspring mammary gland.

Funding: CNPq and FAPESP

III-13 Fiber Type Consumed in Early Life Affects Future Obesity Susceptibility and Metabolic Health in the Ossabaw Pig Model of Diet-Induced Obesity

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We investigated the effect of early life fiber type consumed on future obesity susceptibility in the Ossabaw obese pig model. Sixty-three pigs at 28 days of age were fed 2 fiber sources (inulin and cellulose) and 2 fat levels (5 and 15%; Low and high fat). Pigs received diets

containing 4% of either inulin or cellulose for the first 56 days (nursery phase) and thereafter were fed low fat or high fat diets containing no added fiber source from day 56 to 140. On day 140, back fat was thickness was measured and blood samples taken for insulin, glucose, and triglyceride (TAG) analyses. There were fiber x fat interactions for final body weight (P=0.02) as pigs fed cellulose had greater (*P*< 0.05) final body weight (63.96 and 70.31 kg, compared to pigs fed inulin (65.26 and 66.45 kg), for low and high fat diets respectively. Feeding high fat diet, regardless of fiber source, tended to increase average daily gain and tended to reduce feed intake (*P*=0.07). High fat diet, regardless of fiber source, resulted in higher back fat thickness (*P*< 0.01). There was a tendency for a fiber x fat interaction (*P*=0.07) for serum TAG concentration, as pigs that received cellulose had higher TAG than those fed inulin (*P*< 0.05). High fat diet resulted in higher serum insulin and glucose concentrations (P< 0.05). Therefore, dietary fiber type consumed early in life affects indices of metabolic health and body weight in the future. Dietary inulin appeared to be protective than cellulose.

III-14 White and Brown Adipose Tissue Characteristics Influenced by High Fat, High Sucrose Diet and Thermoneutral Temperature in Non-Pregnant Females and during Pregnancy

EARLYNUTRITIONMEMBER

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Introduction: Transgenerational programming of obesity may play a significant role in the increase of childhood obesity seen today. Brown fat, a thermogenic tissue abundant in early postnatal life, but found to also be active in adult humans, may be part of an approach to prevent obesity due to its high energy expenditure. Brown fat is less likely to be present in obese adults and its activation reduced in a warm environment. It is not known how these factors interact during pregnancy.

Methods: Female rats were raised on a low fat (chow) diet or a high fat, high sucrose diet (HFHSD) and housed at either a cool (20°C) or thermoneutral temperature (27°C) from 4 weeks of age, and 6 females of each group were dissected at 10 weeks of age. The remaining females were mated and sampled at either 10 (mid-gestation, n=6) or 19d gestation (late-gestation, n=6). Gene and protein expression of brown and white adipose tissues as well as the hypothalamus were determined.

Results: HFHSD females had a higher food intake and greater white fat mass than chow fed females but at a similar body weight. Brown fat mass was similar in the non-pregnant females but was differentially altered by pregnancy, with a higher BAT mass in HFHSD females, especially pronounced at 20°C.

Conclusions: Diet has a major influence on body composition of these animals which is modulated by housing temperature. We aim to demonstrate the interaction of environmental temperature with excess fat mass on brown fat thermogenic capacity.

III-15 Maternal High Fat and Salt Diet Has Differential Effects on Markers of Gut Inflammation, Lipid Transport and Renin-Angiotensin System Regulation in Adult Male Rat Offspring

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Maternal high fat or high salt diets can independently program adverse cardiometabolic outcomes in offspring. Despite the relevance to current Western-style diets, there is a paucity of evidence examining the combination of a maternal high fat and high salt diet on metabolic function in adult offspring. Female Sprague-Dawley rats were assigned to one of four diets: CD (10% kcal from fat, 1% NaCl), SD (10% kcal from fat, 4% NaCl), HF (45% kcal from fat, 1% NaCl) or HFSD (45% kcal from fat, 4% NaCl) 21 days prior to mating and throughout pregnancy and lactation. Post-weaning, male offspring consumed a standard chow diet *ad-libitum*. On postnatal day 130, offspring were culled for plasma and tissue collection. Gene expression analysis was conducted on the gut. Data was analysed by two-way ANOVA with *post-hoc* Holm-Sidak tests. HF offspring were heaver, had increased HOMA-IR and circulating leptin concentrations, which were normalised in HFSD offspring. Gene expression of inflammatory (*Il1r, TNFα, Il6, Il6r*) and renin-angiotensin system (*Agtr1a*, *Agtr1b*) markers were significantly reduced in HFSD offspring compared to HF offspring. There was a significant interaction in expression of *Cd36*, a key transporter of fatty acids in the gut, with a reduction in the HFSD group compared to the SD group. Therefore, the addition of high salt mitigates some adverse offspring outcomes associated with a maternal HF diet, which may be mediated by altered inflammatory, lipid transport and renin-angiotensin regulation in the gut.

III-16 Early-Life Programming by Maternal Obesity on Offspring Metabolic Health and Behaviour: A Cross-Fostering Approach

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There is evidence to suggest that exposure to maternal obesity during early-life is associated with abnormal glucose homeostasis, obesity, and sedentary behaviour in rodent offspring. To understand the mechanisms behind this, a cross-fostering experiment assessed the relative contributions of maternal obesity before birth and during lactation. Female Wistar rats were fed either a control (C; *n*= 16) or cafeteria diet (O; *n*=16) for 8 weeks before mating, throughout pregnancy and lactation. Offspring were cross-fostered at birth to a dam on the same or alternate diet to before birth (CC,CO,OC,OO) and weaned on a chow diet. Locomotor activity was measured in offspring aged 5,8,and 11 weeks and tissue was collected at 2,4 and 12 weeks. 12 week old offspring underwent an intraperitoneal glucose tolerance test.

Low birth weight was seen in OC and OO offspring ($P = 0.002$) and significant effects of overnutrition before birth and during lactation were apparent for offspring weights up to adulthood. Reduced locomotor activity ($P < 0.05$) and rearing behaviour ($P < 0.05$) were seen in female OC and OO offspring in novel and adapted conditions, and reduced mobility was seen in adapted conditions only ($P = 0.035$). Cafeteria feeding during lactation was associated with increased female gonadal fat mass ($P = 0.030$) and elevated fasting blood glucose in both male and female offspring ($P = 0.031$).

Cross-fostering successfully separated the effects of maternal obesity during pregnancy and lactation, supporting the view that metabolic and behavioural processes are particularly vulnerable to effects of overnutrition during early-life.

III-17 Microarray Analysis of Metabolic Programming Effects on Gene Expression Profiles in Longissimus Muscle of Fatty Type Cattle (Wagyu)

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The study was conducted to clarify how early nutrition as metabolic programming events affected intramuscular adipogenesis of Japanese Black cattle fattened with only roughage. As a control group, the roughage group (R: n=11) was fattened only roughage *ad libitum* from 4 to 31 months of age (mo) after nursing at standard level (replacer milk intake of 0.6 kg/day) until 3 mo. As a treatment group, the high-energy group of metabolic programming events (MP: n=12) was also fattened only roughage *ad libitum* from 11 to 31 mo after intensively nursing and feeding a high-energy diet until 10 mo. Two-Color Microarray-Based Gene Expression Analysis (Agilent Technologies) was used for this experiment to identify regulation of gene expression by using biopsy samples (we used pooled sample of each group) at 3, 10, 14, 20 and 30 months of age. The up- and down-regulation of 8,759 genes was determined by microarray analysis in MP and R groups at five time points of 3, 10, 14, 20 and 30 months of age. The heatmap indicated that metabolic imprinting affected gene expression regulation on a large scale. Among the time points tested the greatest number of genes that were highly expressed occurred at 3 and 10 months of age, whereas adaptive, responsive and re-adaptive periods to changes in nutrition were seen at 14, 20 and 30 months of age, respectively. Therefore, metabolic programming changed expression pathways on a large scale, particularly for genes involved in myogenesis and adipogenesis.

III-18 Urine Metabolomics Offers Unique Opportunities in Infant Nutrition Research

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Exclusive breastfeeding is recommended for all infants and is associated with optimal growth and health. However, exact mechanisms that define infant health outcomes are poorly understood. Urine metabolomic profiles offer opportunities in infant nutrition research given the non-invasive nature of sample collection and ability to characterise diet and phenotypic differences in metabolism. This research will examine infant feeding practices, growth and metabolomic profiles in early life.

Healthy mothers with singleton pregnancies aged 18-45 were recruited during their final trimester (n=60). Socio-demographics, diet and lifestyle data was collected from mothers during pregnancy. Anthropometrics, infant feeding practices and urine samples were collected at birth and monthly up to 4 months. 1H-NMR spectra were acquired for infant urine samples. Data were analysed using a combination of univariate and multivariate methods.

Over 80% of mothers initiated exclusive breastfeeding at birth; however this dropped to approximately 50% at 1-month. Multivariate analysis showed clear separation of urine metabolomic profiles from month-1 and month-4. Metabolites identified included higher myo-inositol and taurine in month-1, and higher creatine in month-4. Further investigation showed a more distinct separation of samples from exclusively breastfed infants at 1-month compared to differences between groups at 4-months.

Urine metabolomics offered interesting insights into metabolic development in early life as well as changes associated with different infant feeding practices. Future work will explore relationships between components of milk and urine metabolomic profiles to help define the infant metabolome and further develop metabolomics applications in infant nutrition research.

III-19 Serum Lipidomic Profiles after Ingestion of an Enriched Diet with Rice Protein Hydrolysate, Probiotic and Omega-3 Fatty Acids in Porcine Model of Prepuberal Obesity

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The effect of a western-type diet supplemented with bioactive ingredients on the circulating lipidomic profile was investigated in a porcine model of prepuberal obesity compared to a standard diet. We fed 42 Duroc female littermates *ad libitum* with four diets from 60 to 130 days of age. Diets used were: Standard diet (SD1): 2480 Kcal/kg and 5% fat; Western diet (WD2): 3660 Kcal/kg and 12% fat; Western diet (WD3) with 50% of protein as rice protein hydrolysate and supplemented with *Bifidobacterium breve* ($5x10^{10}$ cfu/day); Western diet (WD4): equal to WD3 but containing 2% omega-3 fatty acids. Diet consumption and weight were measured. Lipidomic circulating profile was evaluated by Q-TOF coupled to liquid chromatography and by tandem MS/MS. Results showed that WD2 was associated with increased weight gain ($p< 0.01$) and marked changes in circulating lipidomic profile. Univariate statistics showed a high number of differentiating lipid species (74 with p values ranging between 2.18 E-18 and 0.047). These lipids comprised obesity-associated lipid species and inflammatory related lipids, such as a lactosyl ceramide. The introduction of specific ingredients and probiotics led to a significant attenuation in weight gain in WD3 and WD4 groups ($p< 0.007$). As expected by the introduction of omega-3 fatty acids, most of the changes were present between WD4 and WD2 (n=76), whereas a low number of lipids differed between WD2 and WD3 (n=9). Noteworthy, 12 of the 74 changed lipids by WD2 (with reference to SD1) were significantly affected by the intake of active ingredients.

III-20 Monosaccharides in Post-Weaning Diet of Young Mice Program Body Composition and Feeding Behaviour in Adulthood

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Nutrition at various stages of early life, including the early post-weaning period, has permanent consequences affecting development and later health. However, the role of carbohydrates is presently unknown. In the present study we investigated whether different monosaccharides in the post-weaning diet program adult metabolic health. Female C57BL/6JRccHsd breeders were time-mated and fed a purified low fat diet (LFD) *ad libitum*. Litters were culled to a similar sex ratio and randomly assigned to foster dams. From postnatal day (PN) 21 to PN44, male and female offspring received a post-weaning LFD containing 32 energy% as either glucose (GLU), fructose (FRU) or an equimolar mixture of glucose and galactose (GAL). From PN44 to PN105, all mice received a high fat diet. Food intake, body weight and body

composition were measured weekly. Whole body metabolism and metabolic flexibility were analysed using indirect calorimetry directly after the weaning diet and after the high fat diet. An oral glucose tolerance test (OGTT) was performed at PN77. At PN105, cumulative food intake and adiposity was significantly lower in GAL females compared to GLU females, whereas GLU and FRU groups were similar. No effects of post-weaning monosaccharides were found in the males. No effects were found of post-weaning monosaccharides in either males or females in whole body metabolism and metabolic flexibility. In conclusion, these results indicate that monosaccharides in post-weaning foods can program adiposity and eating behaviour in females. Our findings could contribute scientific evidence to support dietary guidelines for infant complimentary feeding.

III-21 The Role of *Zbtb16* in Metabolic Response of Pregnant Rats to High-Sucrose Diet

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Dietary effects of over-nutrition in gravidity and lactation are associated with altered fetal development followed by metabolic disorders in adulthood. However, the susceptibility to these detrimental metabolic effects is substantially modulated by genetic factors. We derived a single-gene congenic rat strain containing mutant *Zbtb16* gene from a metabolic syndrome model, the PD/Cub rat strain, within the spontaneously hypertensive rat (SHR) strain genomic background and tested whether this gene is involved in nutrigenetic interactions involving high-sucrose diet in pregnant rat dams.

Methods: 16-week-old female rats of SHR and SHR-*Zbtb16* (n=6/strain/diet) were fed standard diet during pregnancy and 4 weeks of lactation (control groups) or a high-sucrose diet (HSD, 70% calories as sucrose) in the same period. We assessed comprehensively the metabolic profiles of the four groups including glucose tolerance tests, levels of insulin and interleukins and also concentrations of triglycerides and cholesterol in 20 lipoprotein fractions. Two-way ANOVA with STRAIN and DIET as major factors was used.

Results: SHR dams displayed overall worse glucose tolerance when fed HSD compared to SHR-*Zbtb16*. We identified significant STRAIN*DIET interactions for levels of M-CSF, IL-13, VEGF, PYY and insulin. In both strains we observed an increase of cholesterol and triglyceride concentrations in large particles (chylomicrons, VLDL) and decrease of cholesterol and triglyceride concentrations in medium to very small LDL particles when fed HSD. Our results show that *Zbtb16* gene is involved in metabolic changes in pregnant rat dams exposed to HSD. The nutrigenomic aspects of HSD programming effect on offspring is currently under investigation.

III-22 Sex-Dimorphic Effect on Developmental Programming of Glucose and Insulin Response in the Offspring of a Maternal Hyperglycemia Model

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Introduction: Gestational diabetes impact metabolic health of the offspring. This experiment aimed to study the programming effects of maternal hyperglycemia on hybrid offspring of Goto-Kakizaki (GK) and Wistar (WI) rats.

Methods: Female GK and WI rats were mated to WI male rats. After birth, the litter size was fixed at 8 pups with an equal sex balance. Pups were weaned at 21 days and assigned to either control or high-sucrose/high-fat diet. Oral glucose tolerant tests (OGTTs) were conducted at P21, P51 and P99 days.

Results: During pregnancy GK rats were hyperglycemic and glucose intolerant. At weaning, all GK hybrids had significantly lower body fat than WI offspring but this difference was not observed at P51 and P99. The glucose area under the curve (AUC) during the OGTT was significantly higher in GK hybrids at P21 compared to WI offspring. This difference was exacerbated at P51 and P99. Interestingly, female GK hybrids had a significantly lower insulin AUC during OGTT as well as HOMA-IR value than male GK hybrids which developed at P51 and P99. Diets did not significantly impact on glucose and insulin AUCs.

Conclusion: These findings provide additional evidence of the developmental programming effect of maternal hyperglycemia on metabolic features of the offspring. Also, they suggested a sex-dimorphic developmental programming effect in the regulation of insulinemia and insulin sensitivity. Interestingly, no dietary effects were detected for all measured outcomes in this model.

III-23 Methylating Micronutrient Supplementation during Pregnancy Impact on mRNA Abundances of Genes Driving Myogenesis

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Methylating micronutrients have become chronically supplemented during pregnancy seeking to benefits regarding the mother's and offspring's health. Despite proven bio-positive effects of synthetic one-carbon cycle compounds, distinct maternal dietary supplementation regimens have been shown to affect skeletal muscle tissue. Particularly, secondary muscle fibres are known to be susceptible to dietary challenges. Aiming to elucidate acute and persistent effects of an overloaded one-carbon cycle, pregnant Pietrain sows were randomly assigned to receive either a standard diet (C) or a standard diet supplemented with folate, vitamins B6, vitamins B12, methionine, choline, and zinc (M). Samples of *M. longissimus dorsi* were collected at important time points of primary and secondary muscle fibre development (63 and 91dpc [days-post-conception]) and in juvenile pigs (150dpn [days-post-natum]). Gene expression of transcripts associated with myogenesis and muscle development was assessed using the Fluidigm platform. At 63dpc, foetal weight and gene expression were unaffected by diet and sex. At 91dpc, both M-males and M-females showed increased foetal weight. The mRNA abundances of *FABP3* and *FABP4* were increased, suggesting dietary impact on foetal health. Postnatally, M-males showed decreased live weights, whereas live weights of M-females appeared unaffected by diet. Phenotype variation was reflected by compensatory transcriptional variation, since M-males showed increased mRNA abundances of *MyoG, MyoD1*, and *Pax7*. These findings in an animal model suggest that excessive supplementation of methylating micronutrients during pregnancy impact on early myogenesis with persistent implication in muscular maturation processes. Hence, current dietary recommendations should be discussed regarding their reliability to promote foetal and postnatal health.

III-24 Effect of Tilacora Triandra Leaf on Impaired Glucose Metabolism in High-Fat Diet-Induced Obesity in ICR Mice

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Aim: Tilacora triandra is a plant native to Southeast Asia. It has been widely used as part of local cuisines and used in traditional medicine. It has several pharmacological properties including antioxidant, anticarcinogenic and antimycobacterial activities. However, there is limited data of *Tilacora triandra* leaf in improving glucose tolerance in obesity state. Therefore, the present study was designed to investigate the effect of *Tilacora triandra* leaf in high-fat diet-induced insulin resistance in a mouse model.

Methods: To induce obesity, male ICR mice were fed with a high-fat diet (45% fat) for six weeks. The mice were divided into four groups (n = 8): non-obese control mice were treated with 5% Gum Arabic and obese mice were treated with *Tilacora triandra* (250 and 500 mg/kg/day), or 5% Gum Arabic. After six weeks of treatment, fasting blood glucose, serum insulin, OGTT and glucose transporter 4 (GLUT4) expressions
on fat cells were determined.

Results: *Tilacora triandra* (500 mg/kg/day) showed significantly reduced high blood glucose level ($P < 0.05$) and inhibited an abnormal increase of blood glucose level during OGTT. Furthermore, *Tilacora triandra* treatment decreased serum insulin of obese mice compared with the obese control mice (2.83 ± 0.21 and 5.47 ± 0.58 ng/mL for *Tilacora triandra* treated and obese control groups, respectively). Moreover, the protein expression of GLUT4 was effectively increased by *Tilacora triandra*.

Conclusions: These findings suggest that the extract from *Tilacora triandra* leaf possesses antihyperglycemic action in obese mice by improving insulin sensitivity and stimulating GLUT4 expression in adipose tissue.

III-25 Consumption of Allium Cepa Linn Mixed Diet Improved Maternal Dexamethasone Induced Oxidative Stress Indices in the Heart of a Male Offspring of Wistar Rats

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It has been reported that maternal treatment with dexamethasone during lactation may increase the level of oxidative stress in the offspring. *Allium cepa L* (onion) has been reported to reduce oxidative stress by improving the activities of the antioxidant enzymes. This study was designed to investigate the ameliorative effect of *Allium cepa Linn* juice mixed diet on maternal dexamethasone induced oxidative stress in the heart of a male offspring of Wistar.

Twenty lactating dams (180-200g) were divided into four groups (n=5). Group 1 and 2 were administered 0.02ml/100g/day normal saline subcutaneously (Sc) and 30% *A. cepa* juice mixed diet during lactation respectively. Group 3 and 4 were administered 100µg/Kg/day dexamethasone only and 30% *A. cepa* juice mixed diet+100µg/Kg/day (Sc) during lactation respectively. The male offspring were sacrificed at 12 weeks of age. The heart was collected rinsed in ice-cold 1.15% KCl solution, homogenized in 0.25M sucrose solution. Malondialdehyde (MDA) level, Superoxide dismutase (SOD) and catalase activities were measured as indices of oxidative stress.

Maternal dexamethasone treatment during lactation significantly increased MDA and total protein level in the heart. This was accompanied with a significant reduction in the SOD and catalase activities when compared with the control. Consumption of *A. cepa* juice mixed diet significantly increased SOD and catalase activities when compared with the dexamethasone only administered group.

The result suggests that maternal consumption of A. cepa juice mixed diet during lactation may improve some of the indices of oxidative stress in the heart of a male offspring.

III-26 Uterine PPARα Activation Increases Thermogenic Gene Expression in Subcutaneous Fat of Male C57BL/6J Mice Confronting a High-Fat Diet at Adulthood

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In this study, we hypothesized that uterine PPARα activation, through upregulation of its target gene encoding a thermogenic hormone, fibroblast growth factor 21 (FGF21), could increase the beige cell population in neonatal white adipose tissue (WAT), thus leading to a resistance to diet-induced obesity (DIO) at adulthood. To test this hypothesis, pregnant C57BL/6J mice were divided into two groups to receive a basal diet without (Ctrl) or with 0.5% clofibrate (CF, a PPARα agonist) throughout the whole gestational period. After parturition, only male offspring were used and raised under the same conditions, which were nursed by dams fed with a basal diet (litter size 6-9/litter), weaned onto a standard chow diet for 4 wk, and shifted to a high-fat diet for 5 wk. Paralleled with PPARα activation, increase in serum and hepatic mRNA levels of FGF21 occurred only at fetal period, but displayed a lower levels at adulthood, in CF offspring compare to Ctrl littermates. At adulthood, there was no difference in tissue weight of retroperitoneal and inguinal fat, but epididymal fat was significantly smaller in CF relative to Ctrl group. Among three fat depots, inguinal fat of CF group showed the most prominent WAT browning characteristics (thermogenic protein UCP1 and beige cell markers *CD137, Tmem26* and *Tbx1*). We conclude that uterine PPARα activation by maternal clofibrate administration leads to a greater exposure of FGF21 during fetal development, which may determine the thermogenic activity of subcutaneous WAT and contribute to a resistance to DIO in adult male mice.

III-27 Effects of Maternal Metformin Exposure during Lactation on Lactation Characteristics and Mouse Offspring Metabolic Health

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Background: Metformin administration during pregnancy has become more accepted as clinical trials and pharmacokinetic exploration has expanded. New clinical trials are underway to investigate the potential benefits of metformin use during lactation. Aside from metformin's ability to regulate maternal blood glucose, here we provide data demonstrating modifications to lactation leading to programming effects in the mouse offspring.

Objective: To establish how metformin administration during lactation in a rodent model impacts maternal lactation physiology and pup metabolic health.

Methods: Metformin was delivered in drinking water to C57BL/6J mice at 2 different doses from postnatal day 1 (P1) and continued throughout lactation (Met PN group). Animals were examined at mid-lactation and during young adulthood. Mothers were also examined during lactation and upon weaning.
Results: Dams given a lower dose of metformin from day 1 of life showed increased milk output in estimated milk volume experiments. Metformin exposed pups also had increased body weight during the first 3 weeks of life. In a separate set of experiments pups from dams given a higher dose of metformin demonstrated an increase in beta-cell mass at postnatal day 11 (P11). Male offspring exhibited improved glucose tolerance at 2 months of age and an increase in glucose stimulated insulin secretion. Offspring body weight in this experiment was lower than control pups and remained so throughout young adulthood.
Conclusions: These findings suggest that metformin may have an impact on lactation characteristics at lower doses. Treating lactating dams with metformin also results in long-term programming of offspring metabolic health.

III-28 Measuring Cholesterol Metabolism and Synthesis after Nutritional Programming

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The WHO estimated that in 2006-2012 only 25% of European babies were exclusively breastfed for the first 6 months. Early nutrition such as infant formula, which is used as a supplement to or a replacement of breastfeeding, has a profound long-term effect on cholesterol absorption, metabolism and synthesis; thereby affecting health in later life. Testing the long-term effect of infant nutrition on cholesterol parameters requires robust yet rapid methods suitable for small rodent animal models that are compatible with Good Research Practice and the 3 Rs of animal research. Herein we describe the methodology to determine dietary intake of cholesterol, fractional cholesterol absorption, fecal neutral sterol output, biliary cholesterol excretion, TICE (trans-intestinal cholesterol efflux), cholesterol synthesis, peripheral and whole-body cholesterol balance in mice/rats within a timeframe of 14 days of animal experimentation. The non-invasive aspects are, after adjusting for dosage, suitable and safe for use in human subjects including infants. In brief, the percentage of absorbed cholesterol (i.e. the difference between oral and I.V. uptake) is calculated from the ratio of two distinctive stable-isotope labelled cholesterol tracers. Cholesterol synthesis rate is calculated after ^{13}C-acetate enrichment. Biliary excretion of cholesterol is measured by collecting bile. Non-biliary excretion (and TICE) is calculated from measured parameters.
The design of novel pharmaceutical/nutraceutical/nutritional interventions in early life as well as the development of infant formula can greatly benefit from the described technique to in-depth investigate the effect on cholesterol metabolism and thereby improve long-term health.

III-30 Intrauterine Growth Restriction Predisposes to Alterations in Free Fatty Acid Metabolism and Endoplasmic Reticulum Stress in Aged Female Mice

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Background: Low birth weight is a risk factor for development of chronic metabolic diseases in later life. It was proposed that this includes alterations in metabolic responses. Given that the endoplasmic reticulum (ER) acts as metabolic stress sensor and serves as a major site for phospholipid synthesis we hypothesize that adult IUGR offspring have metabolic dysregulation and ER stress.
Methods: Biochemical plasma parameters were analyzed in fasted 12 months old IUGR (Tpbpa-Cre:Tfap2c-/-) mice and controls. Glucose clearance was assessed by intraperitoneal glucose tolerance test (IPGTT). White adipose tissue was used for gene expression analysis.
Results: We observed that placental insufficiency in Tpbpa-Cre:Tfap2c-/- mice (later on referred as IUGR) results in smaller offspring at birth and the weight decline continues to 12 months of age. At this age, the glucose clearance is not affected, but the plasma biochemical analysis showed increased free fatty acids (FFA) only in the IUGR female mice. White adipose tissue gene expression analysis showed increased expression of genes involved in the free fatty acid synthesis, again only in the IUGR female mice. In addition, this group had increased mRNA expression levels of ER stress markers, which is consistent with the previously observed increased systemic FFA.
Conclusion: Our data suggest that aged IUGR mice show sex-specific differences in metabolic parameters that can contribute to ER stress in the white adipose tissue. Further research should resolve whether these metabolic changes can increase the susceptibility to chronic non-communicable diseases in later life.

III-31 Attenuated Growth in Early Postnatal Life Extends Life-Span and Protects Against a High Fat Diet Challenge

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The major physiological function of milk is the transport of amino acids, carbohydrates, lipids and minerals to mammalian offspring. Caseins are the major milk proteins and are secreted in the form of a micelle consisting of protein and calcium phosphate. Inactivation of the a-casein gene significantly curtails secretion of all casein proteins, suggesting a role for a-casein in the establishment of casein micelles. The growth of pups nursed by a-casein deficient dams during lactation is significantly delayed [1]. After weaning growth-impaired pups show compensatory growth but do not reach the weight of control mice nursed by wild-type dams throughout life. Despite the growth deficiency, the general development of pups is only delayed transiently [2]. The reduction in adult body weight is associated with a 25% extension of median life-span. Pups nursed by a-casein deficient females display an increased resistance against a high fat diet challenge compared to pups nursed by control dams in that they show reduced weight gain, reduced body fat, improved glucose tolerance, and lower serum leptin and insulin levels. Nevertheless pups which were nursed by a-casein deficient dams show an increased food intake on both, control and high fat diets. This suggests that early post-natal nutrition alters the way in which diet-derived energy is utilised in mice.
References: [1] Kolb et al. (2011) PLoS One, 6(7):e21775; [2] Huber et al. (2013) Nutritional Neuroscience, 16, 125-134

III-32 Programming Effects of Glucose, Fructose or Galactose in Post-Weaning Diet on Adiposity and Serum Adipokines in Adult Mice

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Nutrition in the perinatal period can program for a better (metabolic) health at adulthood. If solid foods after weaning can affect adiposity in the long run is scarcely known, and knowledge on the role of carbohydrates is lacking. This study assessed programming of adult adiposity, serum parameters and tissue weight by different monosaccharides in post-weaning diet.

Three-week-old male and female C57BL/6JRccHsd mice were fed a low fat post-weaning diet with 32en% glucose (GLU), 32en% fructose (FRU), or 16en% galactose (GAL). After three weeks, all mice were switched to a high fat diet (40en% fat) for nine weeks. Body weight, body composition and food intake were measured until 15 weeks of age. Serum leptin, serum adiponectin, liver triglycerides levels and tissue weights were analysed at the end of the study.

GAL females showed lower food intake on the high fat diet, which resulted in lower body weight and adiposity compared to GLU females. In line with these findings, gonadal and mesenteric adipose depot weights were lighter in GAL compared to GLU females. Leptin levels and adiponectin levels were also lower in GAL compared to GLU females. FRU females did not differ from the GLU females. In males, none of the parameters was affected by the post-weaning monosaccharide intervention.

In conclusion, monosaccharides in post-weaning diet have sustained effects on adult fat mass and serum adipokines. Galactose appears to have a favourable effect on adult body composition and metabolic profile compared to glucose and fructose, yet only in females.

III-33 Intrahepatic Cholestasis of Pregnancy and Metabolic Programming: Towards Optimal Animal Models

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Maternal intrahepatic cholestasis of pregnancy (ICP) has recently been shown to program the development of metabolic syndrome (MetS) in the offspring. ICP is characterized by elevated serum bile acid levels, pruritus and abnormal liver function tests, and is associated with adverse fetal outcomes. Children of mothers with ICP are prone to develop hyperinsulinemia and increased BMI at adolescent age. The underlying mechanisms, however, are poorly understood. Proper translational model systems are therefore needed to investigate the origin of ICP-induced metabolic programming, and to evaluate the efficacy of preventive strategies. Several mouse models for ICP have been developed, including genetic or hormonal inhibition of hepatic bile secretion, and bile acid treatments. All of these models result in maternal ICP but differ in fetal outcomes. Offspring of Abcb11 (encoding the hepatocytic bile acid export protein) knockout mothers exhibit early perinatal lethality due to respiratory failure. Estrogen administration increases bile acid levels in the amniotic fluid, but the fetal phenotype has yet not been evaluated. Cholic acid feeding causes maternal ICP, and predisposes the offspring to develop MetS. Although the latter model allows for detailed investigation of the mechanisms underlying early-life programming of MetS risk in ICP offspring, its translational relevance is limited. Based on the comparison of the currently available models for ICP and the state-of-research of the maternal and fetal phenotypes, we are developing a novel translational animal model for future research on ICP-induced metabolic programming, combining pregnancy-related increase in estrogen levels and genetic inhibition of the bile acid export protein.

III-34 Association of Pre-Pregnancy Body Mass Index (BMI) with Maternal Genetic Variants of the FADS and ELOVL Gene Clusters on Polyunsaturated Fatty Acid (PUFA) Levels

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Long-chain (LC) PUFAs are key nutrients for growth and development. Fatty acid desaturase (FADS) and elongase (ELOVL) enzymes catalyze LC-PUFA synthesis, thus maternal polymorphisms (SNPs) in these enzymes may alter production during pregnancy compromising the fetus supply. We aimed to determine how these SNPs in pregnant women influence their FA response and if weight changes this.

Eighty-seven pregnant women were selected from the population-based PREOBE cohort and divided according to their pre-pregnancy BMI, group 1 (BMI< 25, n=49) and group 2 (BMI≥25, n=38). Plasma samples were analyzed at 24 weeks of gestation to measure PUFAs in the phospholipid fraction. Tag SNPs were genotyped (7 in the FADS1 cluster, 5 in FADS2, 3 in ELOVL2 and 2 in ELOVL5).

Minor alleles for rs174545, rs174546, rs174548 and rs174553 (FADS1) and rs1535 and rs174583 (FADS2) showed higher obesity risk. In group 1, minor allele carriers showed lower AA:DGLA and AA:LA indexes for FADS1 (rs174537, rs174545, rs174546, rs174548, rs174553 and rs174547), and AA:LA for FADS2 (rs1535 and rs174583) than major homozygotes. Similarly in group 2, minor allele carriers showed lower AA:DGLA for the same SNPs above in FADS1 and DHA:DPA for ELOVL2 (rs2236212 and rs3798713). When group 2 had no significant differences between allele carriers, they presented the same behavior than group 1.

Minor alleles of SNPs in FADS1 and FADS2 are associated with greater obesity risk. The drop of enzymatic activity by genetic variants in FADS genes is not necessarily changed by a high pre-pregnancy BMI but it weakens the diminution of activity.

III-35 Safety and Fatty Acid Tissue Deposition after Ingestion of Novel DHA-Rich Microalgae Oil in a Newborn Rat Model of DHA Deficiency

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Long-chain omega-3 polyunsaturated fatty acids (LC n-3 PUFA) exert health benefits which are dependent upon their incorporation into blood and tissues. The objective of the present study was to evaluate safety and bioavailability of novel DHA-rich microalgae oil (supplied by Neol Bio) in rats after a period of deprivation of essential omega-3 fatty acids. Pregnant Sprague Dawley rats received a diet deficient in omega-3 fatty acids from day 4-5 of pregnancy. At birth, male pups were selected and fed mother's milk and omega-3 deficient diet after weaning, and were assigned to different supplementation groups: i) CONTROL, receiving sunflower oil, ii) FO, receiving fish oil and iii) MO, receiving DHA-rich microalgae oil (n=10 in each group). The oils were administered to the pups by oral gavage from day 10 until day 30 of life. A reference group of pregnant rats and pups fed normal diet was also followed. At sacrifice, plasma and different tissues were obtained, among which cerebral cortex. The results of the study showed that there were no differences in growth between the omega-3 deficient groups. Regarding plasma and cortex fatty acid profile, administration of omega-3 deficient diet to pregnant rats caused a significantly lower content of DHA both in plasma and cerebral cortex which was reversed by FO and MO supplementation. There were no differences in DHA percentages neither in plasma nor in cerebral cortex between MO and FO groups. In conclusion, MO oil was safe and restored DHA levels in omega-3 deficient rats.

III-36 Vitamin C and Lemon Grass Extract Supplementation Ameliorates Paracetamol Induced Neurotoxicity in Rats

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Paracetamol (PCM) is widely prescribed for treatment of mild pain and fever. The most frequently reported adverse effect associated with PCM is hepatotoxicity, Recently, a direct neurotoxic action by PCM both in vivo and in vitro in rats has been reported. Thus, this present study aims to investigate the effect of chronic PCM administration of on nerutoxicity and the protective effect of *Cymbopogon citratus* Stapf. (CS), or lemongrass extract and vitamin C on paracetamol (PCM)-induced neurotoxicity in rats. Rats were treated with PCM (500 mg/kg BW,orally) in the morning and with or without CS extract or vitamin C (1,000 mg/kgBW/day,orally) in the afternoon to avoid drug interaction for 15 days. Oxidant/antioxidant markers: (Malondialdehyde (MDA) and glutathione (GSH)) in cortex were investigated. The cortex were fixed and stained with H&E for examination of structure abnormality. H&E staining demonstrated neurotoxicity as shown by inflammation of cortical neurons in rat treated with PCM. Moreover, the elevation of MDA and reduction of GSH in cerebral cortex were also found in rat treated with PCM. Treatment with vitamin C or CS significantly reduced oxidative stress injury induced by PCM as shown by elevated of GSH level with reduction of MDA compared to the rat treated with PCM alone ($P < 0.05$) but the abnormality of liver and cortex did not changed. The data presented here shown a direct neurotoxic action by PCM in the cortex. Supplementation with the CS extract or vitamin C can ameliorate oxidative stress induced neurotoxicity in rat- treated with chronic paracetamol.

III-37 Protective Effects of Carica Papaya against Endothelial Cell Death Induced by Hydrogen Peroxide

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This study was aimed to investigate the reactive oxygen species (ROS) scavenging activity and biological activity of *C. papaya* fruit juice (CPW) against oxidative stress. The in vitro scavenging activity was evaluated for hydroxyl radical and hypochlorous acid. The cytoprotection ability of CPW against oxidative stress induced by hydrogen peroxide (1 mM, 2 h incubation) was evaluated in human endothelial cell (EA.hy926) using MTT assay. Changes in the intracellular ROS were detected by flow cytometry. Western blot analysis was applied to monitor the alteration in survival signal through Akt, JNK, and p38. CPW possessed considerable hydroxyl radical scavenging activity (IC50 = 785.81 ± 33.82 µg/mL) but hypochlorous acid scavenging activity was not detectable. CPW at 0.1 and 1 mg/mL significantly increased cell viability after exposure to hydrogen peroxide. Under oxidative stress, CPW dose-dependently abrogate the effect of hydrogen peroxide-induced increases in intracellular ROS levels. Hydrogen peroxide significantly increased phosphorylation of Akt, JNK, and p38. The survival signaling through Akt was not significantly modified by CPW pretreatment. On the other hand, the stress signaling via JNK phosphorylation was downturned by CPW preincubation (0.1 and 1 mg/mL) but CPW did not significantly change p38 signaling. These findings suggest that CPW effectively scavenged hydroxyl radical and protected endothelial cell death against oxidative stress induced by hydrogen peroxide. The mechanism may involve the antioxidant capacity of CPW that decreased the detrimental intracellular ROS-induced cell death. However, the signaling pathway underlining the protective mechanism of CPW should be further investigated.

III-38 Chemoreception in the Golden Apple Snail Pomacea Canaliculata: Towards the Development of Snail-Specific Control Methods and Novel Baiting Strategies

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The large freshwater snail Pomacea canaliculata is a constant and intractable pest to Thailand's native fauna and agriculture plants, upsetting fragile ecosystems as well as destroying beneficial crops and livelihoods. Thus, considerable research needs to be done on the molecular cellular events that take place during feeding, partner location and reproduction. In the present study, we explored the neural control centre of P. canaliculata,to isolate genes responsible for driving chemoreception and reproductive behaviour. Using high-throughput sequencing technology, Further analysis using Liquid Chromatography Mass Spectroscopy (LCMS), and our own pipeline for identification of G-protein coulpled receptors and peptides, it led to the identification of 30 gene transcripts directly involved primarily in reproduction for P. canaliculata. To target genes involved in chemoreception, we isolated the upper and lower tentacles of the snail and performed another transciptome analysis. Using CLC genomics suite (v.7.1), we performed a general assembly analysis of both tissues, with the analysis revealing ≈ 3.8 Gb and 4.15 Gb clean data respectively. From this 34 putative G-protein coupled receptors were identified using THMM 2.0, with preliminary bioassays suggesting that anyone of these receptors could be stimulated by rice leave extract. We expect that some of these receptors when activated, are the initial player in a signal transduction cascade which ultimately produces a nerve impulse that is transmitted to the brain stimulating chemoattracting behavior. Future studies are now underway to break down the attracting components in rice leaves and characterize the active receptors that initiate those attracting responses.

III-39 The Study of *Lagerstroemia Speciosa* L. Aqueous Extract on *Histological Changes* of the Pancreas in Streptozotocin-Induced Diabetic Rats

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The purpose of this study is to investigate histological changes of pancreas in normal and streptozotocin (STZ)-induced diabetic rats after receiving various doses of aqueous extract of Lagerstroemia speciosa L. (LSL extract). Diabetes Mellitus (DM) was induced in rats by intraperitoneal injection of STZ at a dose of 45 mg/kg. Then, the vehicle, glibenclamide (3 mg/kg) and LSL extract (500, 1000 and 2000 mg/kg) were administered orally for 12 days. At the end of the experiment, the rats were sacrificed and their pancreas were collected for histological examination. The pancreatic histology of all diabetic rats receiving the extract showed well-defined boundaries of the islets of Langerhans and cells within an islet were larger and rounder than those of control diabetic rats in a dose-dependent manner. Whereas, the islets of Langerhans of diabetic rats receiving vehicle showed unclear cell boundary, irregular cell size and granulated appearance of cytoplasm when compared to diabetic rats receiving the extract. The results of this study demonstrated that administration of LSL extract could improve the histological appearances of pancreas of diabetic rats.

III-40 *In Vitro* Effects of Plant Extracts on the Procollagen Type 1 and MMP-1 Expression: Discovering the Herbs from Edible Vegetable Garden for Anti-Aging Skin

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Skin has been demonstrated to reflect the general inner-health status and aging. The literature "linking" nutrition with skin aging has been firmly established. Vitamins, carotenoids, tocopherols, flavonoids and a variety of plant extracts have been reported to display potent anti-oxidant properties and have been widely used in the skin care industry either as topically applied agents or oral supplements in an attempt to prolong youthful skin appearance. Although *Ocimum tenuiflorum, Curcuma longa, Moringa oleifera, Zingiber officinale* and *Ocimum basilicum* have been used as traditional medicine for treatment of various diseases, their biological effects on aging in UVB-induced fibroblast cells have not been investigated. In this cell-based study, the effect of three fractions (dichloromethane, ethanol and petroleum ether) of extracts derived from five Thai edible plants on the expression of aging markers including procollagen type 1 and MMP-1 was investigated in human dermal fibroblast cells. Three fraction of both *O. tenuiflorum* and *Z. officinale* extracts and both ethanol and petroleum ether fractions of *M. oleifera* extract could protect UVB-induced aging through procollagen type 1 induction and MMP-1 reduction. Collectively, the extracts of *O. tenuiflorum, M. oleifera* and *Z. officinale* exhibit the great potentials against UVB-induced aging.

III-41 Diet-Induced Maternal Obesity Alters the Maternal Gut Microbiota and Is Associated with Altered Maternal Intestinal Mucus Production and Placental M1 Macrophage Infiltration.

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Introduction: We have previously shown that maternal obesity results in shifts in maternal gut microbiota throughout gestation. We investigated whether these microbial shifts are associated with maternal gut and placental inflammation.

Methods: C57Bl/6 female mice were fed a high-fat or control diet 6 weeks prior to mating and throughout gestation (n=10). Maternal weight, food intake and fecal samples were collected at gestational day (GD) 0.5, 6.5, 10.5 and 14.5. At GD 14.5 dams underwent intestinal permeability assays, and gut and placental tissue were collected. Gut microbial communities were investigated via 16S rRNA gene sequencing (V3 region). Gut and placental gene expression was assessed by RT-qPCR.

Results: Obese females weighed more than controls at mating and throughout gestation. At GD 14.5, maternal blood glucose, serum insulin, and leptin levels were higher in obese dams compared to controls. Pregnancy resulted in gut microbial shifts that were further modulated by obesity. Intestinal permeability was unchanged by pregnancy or obesity. Maternal intestinal mRNA levels of Muc5ac were elevated in obese dams. Fetal and placental weights were similar between groups. In obese placentae, mRNA levels of MCP1, F4/80 and TNF-α and TLR-4 signaling components were elevated compared to control. Maternal obesity increased placental GLUT1, 3 and SNAT2 mRNA levels.

Conclusions: Obesity and pregnancy modulated the gut microbiota and were associated with altered intestinal mucus production, elevated M1 macrophage infiltration and altered nutrient transport in the placenta. These data could suggest a microbial-immune interaction in mediating the impacts of obesity on maternal adaptation to pregnancy.

IV - Economic and/or Public Health Impact/Consumer Attitudes, Recommendations, Systematic Reviews

IV-1 Childcare Attendance Influences Childhood Adiposity at 2 Years: Analysis from the ROLO Study

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Background: The first two years of life are instrumental for childhood physical development, factors contributing to childhood obesity are difficult to determine. Childcare attendance is one consideration, influencing food preference and physical activity development.

Objective: To investigate childcare attendance and its association with adiposity at 2 years.

Methods: Data were collected as part of the ROLO study (Randomised cOntrol trial of LOw glycaemic index diet). Mothers were recruited antenatally and followed up at 2 years postpartum. Maternal and childhood anthropometric data and lifestyle questionnaires,

reporting on childcare attendance, defined as non-parental care, and infant feeding practices, were collected.
Results: Anthropometric measures and lifestyle data were collected for 273 mothers and children aged 2 years, 52.7% of which attended childcare. Childcare was predominately provided by a non-relative (83.7%), in a crèche (57%) or by a childminder (26.7%). Over half (56.2%) of infants attended childcare part-time (≤30hours/week). Central adiposity measures (abdominal circumference, waist:height ratio) and total adiposity (sum of all skin folds) were significantly elevated in children attending childcare. After adjusting for confounders (birth weight, gender, socioeconomic status, duration of breastfeeding, age at 2 year exam and maternal BMI at 2 years), a trend ($P = 0.05$) towards increased adiposity was found. No difference in the infant feeding practices was identified between the childcare groups.
Conclusions: Children attending childcare have higher total and central adiposity. More research is required to investigate this link to appropriately design health promotion and obesity prevention programmes in pre-school children attending childcare.

IV-2 Managing Iron Deficiency Anaemia with Fortified Toddler Milk

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[2] The University of Queensland, School of Public Health, Herston, Australia

Background: Globally, iron deficiency is one of the most common nutrient deficiencies in children. Iron deficiency anaemia in early life is associated with poor growth, as well as poor motor and cognitive development. Consequences of these health effects can be life-long and are of significant public health concern. One of strategies to address iron deficiency is the use of fortified foods including fortified milk.
Aim: To systematically review published randomised controlled trials using iron fortified milk with outcomes in reducing iron deficiency anaemia in young children.
Method: Five electronic databases were searched to identify trials comparing the effect of iron fortified milk with non-fortified milk in children aged 6 months to 4 years. Trials that included changes in haemoglobin concentration (g/L) and cases of anaemia as outcomes were selected to conduct meta-analyses.
Results: Nine trials conducted in developing and developed countries reported changes in haemoglobin concentration and anaemia. The mean increase in haemoglobin concentration in the iron fortified group was 5.89g/L (95%CI: -0.24, 12.02, p=0.06). The risk of anaemia was significantly reduced in the fortified milk group compared to the control group (OR 0.32 95%CI: 0.15, 0.66).
Conclusion: These results provide evidence for the effectiveness of iron fortified milk in improving iron status in young children. As milk is one of most commonly consumed and accepted food groups for young children, iron fortified milk is a suitable intervention method to reduce the risk of anaemia in this group, which may have long-term benefits for a child's health and development.

IV-3 Growing Up Milk - Does It Affect Children's Growth?

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Background: Nutrition in early life is vital for growth and development. Ideally, young children should be eating a balanced diet; however, diet during early-years is not always optimal due to food neophobia and picky/fussy eating. Growing-up milk (GUM) fortified with nutrients is designed to supplement children not meeting nutritional requirements. As GUM contributes to increased energy intake, it is important to evaluate the potential impact on growth in young children.
Aim: To systematically investigate the effect of GUM on growth in young children from randomised controlled trials.
Method: Five electronic databases were used to search for randomised controlled trials (RCTs) comparing GUM with non-fortified milk in young children aged 9.00-47.99 months. RCTs reporting growth as an outcome following an intervention of > 4months duration were selected to conduct meta-analyses.
Results: Based on seven RCTs, children receiving GUM had a significant mean weight gain of 0.17kg (95%CI: 0.02, 0.31 $p< 0.00$) over a 5 to 12 month period compared to the control group. Six studies reported length/height (cm) but differences between groups were not statistically significant. BMI was reported in only three studies, therefore, it was not feasible to conduct a meta-analysis.
Conclusion: Results from this study indicate GUM does not adversely affect growth of young children, neither causing a decrease or excessive growth. Given that rapid growth during early childhood is linked with later overweight and obesity, it appears GUM promotes normal growth and therefore may be of benefit for children who are at risk of nutritional deficiencies.

IV-4 Social Network as a Health Tool to Promote Breastfeeding

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Encourage breastfeeding should be a practice constantly renewed in all regions of the world. We live in the era of communication. People nowadays communicate with electronic devices connected on social networks. The search for health information comes to all, daily, in the palm of the hands. This project, called The Welcome Baby Project 2, aims to demonstrate that a social network can be used as a tool to promote breastfeeding.
Methods: we are following 210 women and their babies since the first trimester of pregnancy to one year after birth, in a closed group within Facebook, which is the social network used. Participation is on a voluntary basis. The children are now about one year old. All women who were interested, accepted the terms and conditions, and filled out an online form. Every day we provide online behavior-changing health information, encouraging them to breastfeed their infants.
Results: The exclusive breastfeeding rate up to 6 months of age in our group is 70%, well above the brazilian average, which is 41%. There was no statistically significant difference related to educational level or socioeconomic status (Pearson Chi squared p=0,562 for schooling, p=0,813 for students, p=0,856 for independent professionals and p=0,207 for formal contract professionals).
Conclusion: this is an innovative project in its form and content. The social network can be used as a tool to promote health, clarify important issues and promote breastfeeding in all educational and social groups.

IV-5 Social Network as a Health Promotion Tool for Prenatal Consultation

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Attendance to prenatal care is essential for healthy monitoring of pregnancy, as it can prevent medical complications that contribute to low birth weight babies and all the consequences that this fact can determine to future life.
Research question: can a social network be used as a tool for prenatal consultation promotion?
Methods: We followed 649 women since the first trimester of pregnancy to one month after birth, in a closed group within Facebook, the social network used. We called it the Welcome Baby Project. Participation was on a voluntary basis. All pregnant women who were interested, accepted the terms and conditions, and filled out an online form. Every day we provided online behavior-changing health information, encouraging them to attend prenatal.
Results: Brazilian official data indicates that only 57.1% of women achieve 7 or more prenatal consultations; 32% attended between 4 to 6 consultations and 9.5% from 0 to 3 consultations. Our results found that 89% of pregnant women attended 7 or more prenatal consultations, 11% attended between 4 to 6 consultations (where 9% attended to 6 and 2% attended to 5 consultations). There was no correlation between the number of prenatal consultations with educational level (Pearson p = 0.691) or income (Pearson p = 0.400).
Conclusion: This is an innovative project in its form and content. The social network can be used as a tool to promote health, clarify important issues and encourage the need of prenatal consultation of all educational and social groups.

IV-6 Instrumental Report to Use Technology in Digital Social Networks and Health Promotion of Pregnant Women and Mothers in Early Childhood

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This article is an attempt to answer the question: "To what extent can one use online social networks to promote health improvements and research" The first step was to define the goal of improving prenatal care, the metrics to be compared are: the number of prenatal consultations, birth length and weight, head circumference, gestational age and APGAR. The lines of action are:
We selected a group of 649 pregnant women via digital social network nationwide, the network of choice for the research was Facebook because it possessed the largest number of users in Brazil and an appropriate framework for the project. The social network was used to contact people and also for the broadcast of weekly posts focused on the health of pregnant women, nutrition guidelines and wellnes inside a closed network group. To operationalize the research were implemented a SQL databases and 5 questionnaires that were answered during and after pregnancy, implemented in PHP and delivered under SSL for privacy. Regarding the material created, were written 140 posts for the closed group and 25 surveys to promote iterativity, we also have averaged 29.54 Comments, 117.48 likes and 5.49 responses to polls per capita.
The group dropout rate over the full period is 6,16% and the complete response rate to all questionnaires is 13.56%, the respondents have a significant improvement(Pearson p< 0,05) in the number of prenatal consultations and all other health metrics are also improved, thus showing that online social networks can be used intelligently in health promotion.

IV-7 The Body Mass Index with Breast and Prostate Cancers

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The World Health Organization (WHO) says that overweight and obesity are the most important known avoidable causes of cancer after tobacco. Obesity arises from the interaction between genes, environment and behaviour.
Objective: The aim of this study was to find the incidence of obesity in new cases of breast & prostate cancer patients, attending the National Cancer Institute (NCI), Gezira State, Sudan.
Materials and methods: We retrospectively reviewed the records of 500 cases of females' breast & prostate cancer patients (age ranging between 25-90 years). A questionnaire was filled in order to obtain information regarding demographic factors and stages of cancer and habits. Anthropometrics measurements determined were weight, height and the body mass index (BMI).
Results: 50.8% of females breast cancer and 67.2% of prostate cancer patients were having normal or underweight based on BMI < 25 kg/m^2. (45.6%) of the female breast cancer patients were overweight & obese, but 15.2% of the prostate cancer patients were overweight & obese with BMI≥25.The prevalence of obesity were highly significant effected, with low education level, North and central tribes, inactive occupations, and with early stage I & II of cancer diseases.
Conclusion: In conclusion, obesity is an increasing problem in Sudan, especially among young female breast cancer. These findings should be considered in planning public health action to prevent obesity.

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Conference Language
All lectures and discussions will be held in English. There will be no simultaneous translation.

Conference Venue
University Hospital of Munich - Campus Grosshadern
Auditorium Section
Marchioninistr. 15
81377 Munich, Germany

Conference Hours
Thursday, 13 October 2016 10.00 - 18.20
Friday, 14 October 2016 08.20 - 18.05
Saturday, 15 October 2016 09.00 - 14.00

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Registration is possible at the registration desk located on the first floor of the auditorium section. Onsite registrations are subject to availability.

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Thursday, 13 October 2016 08.30 - 18.30
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Due to a renovation process in the auditorium section, the plenary sessions are taking place in all 3 lecture halls. Hall VI is the main lecture hall. In Hall IV and Hall V we provide an equivalent live stream. You will be able to follow the lecture of the speakers and slides incl. audio transmission. You will also be able to ask questions via audio transmission.

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The New Investigators' travel grants will be awarded to the best submitted abstracts by New Investigators. The winners have been informed separately and will receive their award at the registration desk.

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The poster areas are located on the 1st and on the 2nd floor of the auditorium section (please see floor plan):

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Posters must be mounted on Thursday, 13 October by 13.00. Presentation of the poster is requested during the whole conference as the poster viewing is scheduled accompanying the entire programme. Posters of distinction will be introduced by the main authors within the Guided Poster Session on Friday, 14 October from 13.15 – 14.15. Posters must be removed on Saturday, 15 October by 14.00 at the latest. Posters which have not been removed by this deadline will be subject to disposal. Neither the Scientific Committee nor the venue is responsible for removing and returning posters.

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All necessary materials needed to fix the posters will be provided at the Poster Desk located on the 1st floor. The poster desk is open on Thursday, 13 October from 8.30 – 15.30.

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The posters of distinction will be introduced by the first authors during the Guided Poster Session on Friday, 14 October from 13.15 to 14.15. After a short introduction by the Chair each poster will be presented in a 5 minutes talk. The authors are requested to be in the poster area at least 15 minutes before the guided tour starts.

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Social Programme

Welcome Reception
On the first congress evening all participants are warmly invited to the Welcome Reception.

Location:	University Hospital of Munich Campus Grosshadern Auditorium Section Marchioninistr. 15 81377 Munich, Germany
Date/Time:	Thursday, 13 October 2016 after the Scientific Programme
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On Friday night we will celebrate a Bavarian Evening with traditional food and entertainment in a relaxed atmosphere.

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Date/Time:	Friday, 14 October 2016 at 19.30
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"Latest findings on nutritional needs during the first 1000 days of life"
Lecture Hall IV

Introduction: Multiple micronutrient needs in pregnancy, lactation, and infancy – *Manfred Eggersdorfer*

The role of vitamin K for newborns – *Henkjan Verkade*

Vitamin D in pregnancy and lactation – *NN*

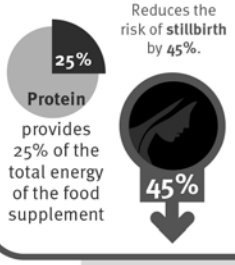
PUFA supply with human milk and infant formula – *Bert Koletzko*

Good nutrition plays a profound role during pregnancy

Pregnant women need a sufficient amount of **iron, vitamins, minerals, DHA, calcium and protein.**

The first 1000 days between conception and the child's 2nd birthday builds the foundation for the ability to grow, learn and thrive.

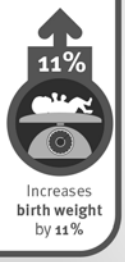
Protein



provides 25% of the total energy of the food supplement

Reduces the risk of **stillbirth** by 45%.

Reduces the risk of **SGA** by 34%.

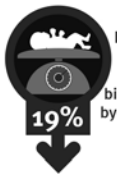


Increases **birth weight** by 11%

Iron and folate

Pregnant women often get **iron** and **folate** supplementation only. Although they are important, all nutrients are essential for a healthy mother and child.

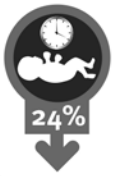
Iron reduces the risk of maternal anemie by 70%



Iron & folate reduce the incidence of low birth weight by 19%

Calcium

Reduce **preterm birth** by 24%.



Reduce **maternal hypertensive disorders** by 35%.

Reduce risk of **preeclampsia** by 52%.

DHA

There is a strong correlation between **DHA** and **cognitive and visual development** in children during pregnancy and the first years of life.

The **rapid growth** of a child in the first two years of life is also accompanied by an increase in organs and tissues.

Brain development is fast in fetal life and in the first years of life.

Vitamins and minerals

Recent studies have shown that **Vitamin E** reduces risk of miscarriage and **Vitamin D3** reduces the risk of pre-eclampsia

Small for gestational age (SGA) decrease by 12%.

Reduce **preterm birth** before week 37 by 3%.

References: Bhutta ZA, Das JK, Rizvi A, et al. Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost?. Lancet 2013; 382: 452-477.

Christian P, Lee SE, Donahue Angel M, et al. Risk of childhood undernutrition related to small-for-gestational age and preterm birth in low- and middle-income countries. Int J Epidemiol. 2013 Oct; 42(5):1340-55.

World Health Organization. Guideline: Calcium supplementation in pregnant women. Geneva: WHO, 2013.

DSM offers a wide range of solutions for this target group to ensure that mothers have a safe and healthy pregnancy and that children get the very best start in life and the best chances to grow and develop.

Contact us at www.dsm.com

* Benefits of calcium supplements are evident in women at risk for low calcium intake.
* A food supplement with balanced protein-energy confers benefits in birth weight when the mother is undernourished.

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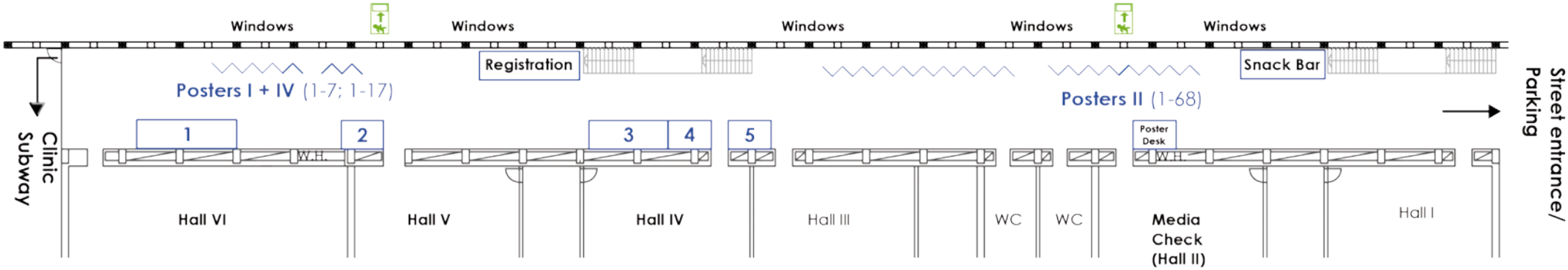
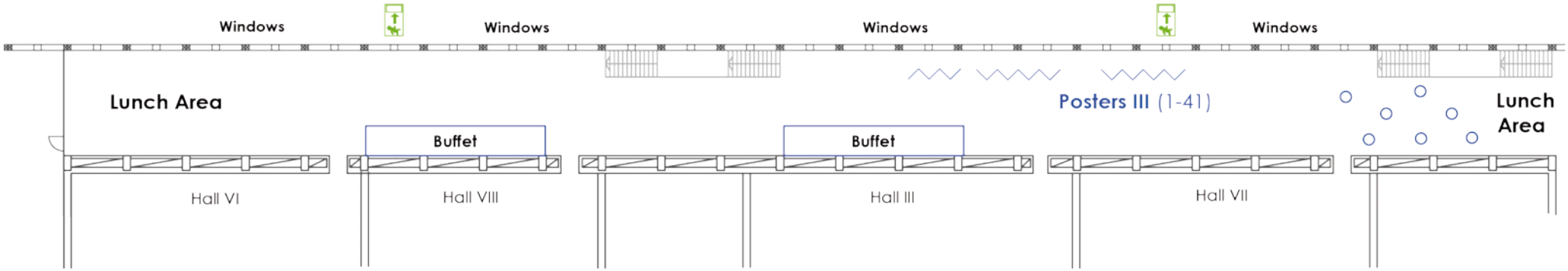


2nd FLOOR



As of 16 September 2016. The floor plan is subject to changes.