Early-Life Nutrition and Developmental Programming of Obesity and Non-Communicable Disease

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Early Origins of Disease

Non-Communicable Disease

Nutritional Environment

Theoretical Functional Capacity (%)

Morbidity threshold

Increased age-related decline

Reduced peak capacity

Combination of both

Dr David S Gardner, Food Matters Live, London 2015
Relative risk of Disease

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Ficks Principle (e.g. $O_2$ uptake in heart)

$\propto$ product of concentration difference

**Checkpoints**

Delivery: $\text{Rate of flow} \times \text{concentration}$

Net consumption or production

Output: concentration
Ficks Principle (e.g. Energy in body)

\[ \text{\(\propto\) product of concentration difference} \]

**Checkpoints**

1. Delivery: Volume of intake, energy density of food
2. Net consumption (BMR \(\times\) PAL) or production
3. Efficiency
4. Output: concentration
5. Feedback

Dr David S Gardner, Food Matters Live, London 2015
Obesity: Early Life Evidence

Human: by *association* rather than *experimental* data are all patients being treated for diabetes (325,000) in Austria, 2007; born 1917-1961.

Thurner *et al*. PNAS 2013

**witness the large spikes during famines**

Suggests that early adversity predicts later diabetes risk

Dr David S Gardner, Food Matters Live, London 2015
Obesity: Early Life Evidence

Animal: by *experimental* rather than association

50 generations of undernutrition, rats

Increased abdominal FAT

Insulin resistance

epigenetic alterations to insulin gene

** Phenotype not rescued after 2 further generations of recuperation **
Programmed checkpoints?

1) Volume of intake (appetite, satiety)
2) Density of intake (fat preference)
3) Metabolic efficiency (ability to gain weight)
4) Physical activity level (sedentary lifestyle)
5) Metabolic feedback (all of above!!)
"How important is programming..." 

Ahima & Lazar. Science 2013

..."fetal life and early childhood are periods...during which imbalanced nutrients may...increase later risk of chronic disease"

..."experimental evidence suggests causality..."

**effect size is uncertain**
Early intervention is possible

Biomarker of programming

Rescue of phenotype

When to intervene

http://www.thousanddays.org/

Nutrition in the First 1,000 Days
State of the World’s Mothers 2012

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Further human evidence...

Explored importance of period from 0-2 years (i.e. first 1000 days) on body composition (8362 individuals) in LMIC (Adair et al)

- High relative weight gain at 2 years, higher adult fat-mass in many different LMIC cohorts
Conclusions

Obesity has early origins

Identified early, intervention is possible

Transgenerational effects occur

Avoid weight gain

Feed Less. Eat Well.

Move More.
** Thankyou for your attention **

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