MICROBIOME AND GROWTH: AN OVERVIEW

Judd Walson, MD, MPH
University of Washington
Departments of Global Health, Medicine (Infectious Disease), Pediatrics and Epidemiology
Different environments lead to different growth

**FIGURE.** Recommended childhood and adolescent immunization schedule, by vaccine.

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Ages of administration of routine immunization services</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCG</td>
<td>At birth</td>
</tr>
<tr>
<td>OPV</td>
<td>At birth, 6wk, 10wk and 14wk</td>
</tr>
<tr>
<td>DPT-HepB-IPV</td>
<td>6wk, 10wk and 14wk</td>
</tr>
<tr>
<td>Pneumococcal vaccine (PCV 10)</td>
<td>6wk, 10wk and 14wk</td>
</tr>
<tr>
<td>Measles</td>
<td>9 months</td>
</tr>
<tr>
<td>Yellow Fever</td>
<td>9 months</td>
</tr>
</tbody>
</table>
Maternal BMI
Weight gain in pregnancy
Infant weight
Gestational age

Linear Growth
Cognitive Function
Robust Immune Protection

Anemia due to blood loss/chronic disease, Fe, ferritin
Micronutrient status (Zn, Vit A, Vit D)

Systemic activation/inflammation
Bacterial translocation
Metabolic/Energy balance
Appetite/satiety
Growth hormone axis regulation

Immune function/responsiveness
Vaccine response
Functional immunology/antigen challenge
Pathogen carriage

Nutritional Enteric Failure/EED
Intestinal Permeability (L:M)
Microbiome maturity
Children live in environments where contamination of food and water is common
“Dirty chicken” hypothesis

- Poor health and impaired growth among chicks raised in filthy conditions
- Antibiotics reversed changes associated with dirty conditions
Dirty environments + undernutrition lead to changes in the gut

- **Environmental Enteric Dysfunction**: A subclinical disorder of the small intestine observed among children living in settings of poor hygiene and sanitation, marked by:
  - Villous atrophy (↓absorption)
  - Villus crypt proliferation
  - ↓ barrier integrity
  - Mucosal inflammation

- Alterations in the gut microbiome may link EED to growth faltering

Microbiome maturity is linked to normal child growth
Composition of gut microbiome changes with age in healthy children

Bangladesh

Malawi


Microbiome maturity & physical growth

Microbiome maturity is linked to growth status

Bangladesh

Malawi

Microbiome transfer results in growth deficit

Microbiome transfer results in growth deficit


Childhood Acute Illness & Nutrition Network

A multi-country, multi-site collaboration which will identify mechanisms and modifiable factors involved in death and treatment failure of acutely ill malnourished children, and establish a platform for pilot studies and definitive trials”
Sites & Investigators

- Migori
- Nairobi
- Kampala
- Kilifi
- Blantyre
- Karachi
- Dhaka
- Matlab
Cohort Overview

<table>
<thead>
<tr>
<th>ADMISSION</th>
<th>OBSERVATION &amp; SAMPLE COLLECTION</th>
<th>DISCHARGE</th>
<th>POST-DISCHARGE FOLLOW–UP</th>
</tr>
</thead>
<tbody>
<tr>
<td>First 24 hours</td>
<td>Day 2</td>
<td>Day 5</td>
<td>Day 7</td>
</tr>
</tbody>
</table>

**Samples**
- 1st set
- 2nd set
- 3rd set
- 4th set
- 5th set
- 6th set
- 7th set

**Key CRFS**
- Admission Form
- Daily Review Form
- Household Survey
- Verbal Autopsy & Study Conclusion Forms
Acknowledgements

Funding

- Bill and Melinda Gates Foundation: CHAIN, EED planning grant, BEED grant
- NIH U19 AI090882
- NIH R01 HD079695-01A1
- Center for AIDS Research (CFAR)
- Kenya Research Program

Collaborators

- Michael Arndt
- Tahmeed Ahmed
- Mustafa Mahfuz
- Baitun Nahar
- Donna Denno
- Patricia Pavlinac
- Emily Mosites
- Guy Palmer
- Peter Rabinowitz
- Grace John-Stewart

International Centre for Diarrhoeal Disease Research, Bangladesh

UW Global Center for Integrated Health of Women, Adolescents, and Children
References


