RELATIONSHIP BETWEEN NUTRITION & COGNITIVE DEVELOPMENT

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Nutrition During Infancy & Toddlerhood & Life Course Development

- Prenatal Maternal Nutrition
- Birth
- Complementary Feeding
- Breastfeeding
- Early Childhood
- Academic Performance
- Adolescent Development
- Adolescence
- Adult
- Human Capital

Achieve developmental potential

<table>
<thead>
<tr>
<th>Prenatal</th>
<th>Birth-24 months</th>
<th>25-60 months</th>
<th>5-10.9 years</th>
<th>11-14.9 years</th>
<th>15-19.9 years</th>
<th>20+ years</th>
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Black et al., Lancet, 2017
What are the first thousand days?

In first 1000 days optimum nutrition is essential for

• Maternal health and child survival
• Growth and neurodevelopment
• Foundations of health

270 days of pregnancy
+ 365 days of first year
+ 365 days of second year = 1000 days
Why Initial 1000 Days are Important?

- Period of rapid brain growth and maturation: 80% by 2 years
Developmental Perspective

Human Brain Development

1000 days

Cell Migration (6-24 Prenatal weeks)

Formation

Sensation (hearing)

Motor cortex (frontal lobe)

Visual cortex (occipital lobe)

Myelination (-2 months to 5-10 years)

Synaptogenesis (-3 months to 15-18 years?)

Experience-dependent synapse formation

Neurogenesis in the Hippocampus

Adult Levels of synapses

Correlation

Months

Years

Decades

Fetus

Late Infancy/Toddler

Pubertal

Thompson & Nelson, 2000
Macronutrients
Necessary for Growth

- **Carbohydrates**
  - Fuel provide most calories
  - Fibre that body cannot digest pass through the intestinal tract and remove waste.

- **Proteins**
  - Growth, immune functioning, tissue repair

- **Fats and cholesterol**
  - Concentrated calories
Micronutrients
Specific functions

- Vitamins and minerals
- Not made by the body
- Poor diet quality (low fruits and vegetables, low animal source food)
- Not necessarily impact growth
IODINE-T3/T4 essential to neurodevelopment

• Severe Iron deficiency during pregnancy may lead to cretinism
• Associated with ADHD and intellectual disabilities.
• Iodized salt is a powerful prevention measure.
• Maternal iron supplementation, delayed clamping or milking umbilical cord and early iron supplementation improve the iron status of at-risk infants.

Recommended Dietary Allowance
Iodine
Adult women_ 150 mg
Pregnancy _ 220 mg
Lactation_ 290 mg
IRON-aids transport of oxygen to brain

- Most common nutritional deficiency globally.
- Primary cause of anemia.
- Necessary for myelination

Iron or iodine deficiency is associated with:
- Poor birth outcomes and physical growth.
- Impaired cognitive and motor development
- Poorer quantitative and language abilities

Recommended Dietary Allowance
Iron
- Adult women_ 18 mg
- Pregnancy_ 27 mg
Breast feeding is the best source of nutrition for baby

Breast Feeding reduces health risks and reduces medical costs

For baby
- Ear and respiratory infections
- Gastrointestinal infections
- Sudden infant death syndrome
- Asthma
- Obesity

For mother
- High blood pressure
- Type 2 diabetes
- Breast cancer
- Ovarian cancer
30 year Follow up from brazil

- Cohort enrolled 1982

- High rates of breast feeding initiation (few socioeconomic differences)

- At age 30, Wechsler Intelligence Scales administered, data on educational attainment and annual income

IQ At Age 30 by Breast feeding Duration, Reference No bf

Adjusted for family income, parent ed, household index, skin color, mat smoking preg, birth wt, breastfeeding duration
Diet patterns established in Infancy & Early Childhood set foundation for healthy eating habits

• At about 6 months of age begin nutrient-rich complementary foods

• Taste texture and variety of foods are important.

• Iron rich foods essential to prevent iron deficiency.

• Nutrient requirements high in young children.
  - Little room for low calorie, non nutrient dense food.
Response to Food Insecurity

• Quality - Food decreased
  - Proteins (Eggs and meat)
  - Fruits and Vegetables

• Quality - Food increased
  - Starches

• Quantity
  - Decreased
Stunting and Poverty

• Stunting- (Length for age 2 SD below median)
  ➢ Often present at birth
  ➢ Potential marker of long term under nutrition.

• Long term consequences
  ➢ Growth
  ➢ Cognition
  ➢ Economic Productivity
  ➢ Next Generation
**Effects of Poor Nutrition**

India, Nigeria and Pakistan are home to almost half (47%) of all stunted children.

**Stunted Children in the World**

- **India**: 46.6 million
- **Nigeria**: 13.9 million
- **Pakistan**: 10.7 million

India also accounts for the largest number of wasted children in the world: 25.5 million.

Globally, 150.8 million children under five years are stunted and 50.5 million are wasted.

38.3 million children globally are overweight.

China, Indonesia, India, Egypt, US, Brazil and Pakistan have more than a million children overweight.
Stunting by age 2 associated with:

- **Childhood**: poor school performance
- **Adulthood**: low human capital
- **Subsequent generation**: similar growth pattern, offspring benefit from maternal intervention

- **Economic impact** of reducing stunting

Effects of Stunting

**Short-term**
- Impaired brain development
- Lower IQ
- Weakened immune system

**Long-term**
- Lost productivity & healthcare costs
- Premature death
- Greater risk of diabetes & cancer
Relations Between Poverty, Stunting, Child Development & school achievement

Poverty

- Nutritional deficiencies/infections

Stunting

Primary caretaker
- Stress/depression
- Low responsivity
- Low education

Poor care and home stimulation

Poor cognitive, motor, socio-emotional development

Poor school achievement

Source: Lancet, 2007
Poverty & Early Development

- Stunting and severe poverty used to estimate prevalence of children at risk of not reaching developmental potential

- 249 million children < age 5 years. 43% of world’s children do not reach their developmental potential

Consequences of undernutrition

The effects of undernutrition on health, survival, growth and development of a child are as follows:
Government Initiatives for Improving Nutritional Status of children

- Integrated Child Development Services (ICDS)
- Special Nutrition Programme (SNP)
- Mid-Day Meal scheme
- Weekly Iron Folic Acid Supplementation (WIFS)
- National Deworming Day
- School Health Programme under Ayushman Bharat Scheme (Pradhan Mantri Jan Arogya Yojana)
- Poshan Abhiyan or National Nutrition Mission
Strategies under Poshan Abhiyan or National Nutrition Mission

- Inter-sectoral convergence for better service delivery
- Use of technology (ICT) for growth monitoring and tracking of women and children in real time
- Health and Nutrition services in an intensified way for the first 1000 days
- Jan Andolan
THANK YOU