LINKS BETWEEN MATERNAL NUTRITION, MATERNAL COGNITION AND MENTAL HEALTH, AND CAREGIVING

Elizabeth Prado
UC Davis
Summit Institute of Development
Potential Pathways from Nutrition to Child Development

Adapted from Levitsky & Barnes (1972), Pollitt (1993), Prado & Dewey (2014)
Maternal Nutrition and Maternal Cognition

- Nutrition and brain function in adults
- Associations in women of reproductive age
  - Iron-deficiency anemia (Murray-Kolb, 2011)
- 3 RCTs during pregnancy
  - Positive effect of iron supplements
    - 25 women in the US (Groner et al. 1986)
    - 81 women in South Africa (Beard et al. 2005)
  - Positive effect of multiple micronutrients (MMN) compared to iron/folic acid (IFA)
    - 640 women in Indonesia (Prado et al. 2012)
Maternal Nutrition and Maternal Depression/Anxiety

- Associations
  - Deficiencies in iron, zinc, B-vitamins and essential fatty acids have been associated with perinatal depression/anxiety (Leung & Kaplan 2009, Ramakrishnan 2011)

- 4 RCTs during pregnancy
  - Positive effect of iron supplements in IDA women in South Africa (Beard et al. 2005)
  - No effect of MMN vs IFA in Indonesia (Prado et al. 2012)
  - Positive effect of MMN vs IFA in Bangladesh (Frith et al. 2009)
  - Positive effect of MMN vs placebo in HIV-positive women in Tanzania (Smith Fawzi et al. 2007)
Supplementation with Multiple Micronutrients Intervention Trial (SUMMIT), Lombok, Indonesia

262 midwives randomly assigned to distribute a daily tablet to >30,000 women, containing:

**MMN:**
- Iron
- Folic Acid
- Vitamin A
- Vitamin D
- Vitamin E
- Vitamin C
- Vitamin B1
- Vitamin B2

or **IFA:**
- Iron
- Folic Acid
- Niacin
- Vitamin B6
- Vitamin B12
- Zinc
- Copper
- Selenium
- Iodine

First visit to local pre-natal care clinic from 3 months post-partum to 3 months post-partum birth

**Cognitive Participants:**

640 (344 MMN, 296 IFA) mothers tested after a mean of 25 WEEKS of supplementation (10% in the 1st or 2nd trimester, 39% in the 3rd trimester, 51% after birth).

Test Selection Criteria (1) to (4) - Theoretical issues

1) Tests that are designed to primarily tap aspects of specific cognitive and other brain-related functions, particularly those that have been associated with micronutrient deficiency in previous studies.

2) Tests that have been tied to particular brain structures and mechanisms, particularly those in which micronutrients play a role.

3) Tests that play a role in practical skills important for daily life.

4) Tests that are well-established and widely used.
Criteria (5) to (7) – Cross-cultural issues

5) Tests that are appropriate for the local setting.
6) Tests that are able to distinguish between different individual’s abilities, so should result in a wide distribution of scores.
7) Tests with high reliability in the local setting.
8) Tests that do not require extensive training for the testers (at maximum ~ 2-3 weeks), do not require previous experience in cognitive assessment, and do not require subjective judgments from the testers, such as the type of judgments a highly trained clinician would make.

9) Tests that are relatively brief to administer

10) Tests that do not require special equipment (only paper, pencil, stopwatch, and digital recorder).
## Reliability and Validity

<table>
<thead>
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<th>Test</th>
<th>Set X</th>
<th>Internal Reliability</th>
<th>Test-Retest Reliability</th>
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Effect of MMN on each Cognitive Motor, and Mood Test

Effect of MMN on Maternal Cognition

- Mean z-score across all cognitive tests

![Graph showing the effect of MMN on maternal cognition with mean z-scores across all cognitive tests. The graph compares IFA and MMN groups, with significant differences indicated by asterisks for participants with MUAC < 23.5 cm and Hb < 110 g/L.]
Maternal Cognition and Caregiving

- Positive associations between maternal cognition and:
  - Infant and toddler dietary intake in Peru, Egypt, Kenya (Wachs et al. 2001, 2005; Bhargava et al. 2003)
  - HOME Inventory scores in Jamaica (Baker-Henningham et al. 2003)
  - Listening and reading comprehension of general health messages in Zambia (Stuebing et al. 1997)
Maternal Depression/Anxiety and Caregiving

- Association between maternal depression/anxiety and
  - Lower HOME Inventory scores in Jamaica (Baker-Henningham et al. 2003)
  - Reduced preference for breastfeeding in Barbados (Galler et al. 1999)
  - Use of health services in India (depressed mother were more likely to use health services than non-depressed mothers) Patel et al. (2002)
International Lipid-Based Nutrient Supplements (iLiNS) Project, Malawi

864 pregnant women randomized to 3 groups:

- Iron and Folic Acid
- Placebo
- Multiple Micronutrients
- Maternal LNS: 20g/day
- Child LNS: 20g/day

- Pregnancy
- Maternal perceived stress and basal cortisol
- Maternal depression

- Birth
- Maternal perceived stress and basal cortisol
- Maternal depression

- 6 months
- Maternal cognition, and mother-child interaction

- 18 months
- Child growth, activity, and development
  - Motor
  - Language
  - Socio-Emotional
  - Executive Function
Potential Pathways from Nutrition to Child Development

Adapted from Levitsky & Barnes (1972), Pollitt (1993), Prado & Dewey (2014)
Methods

- Maternal Depression/Anxiety
  - WHO Self-Reporting Questionnaire
  - Edinburgh Postnatal Depression Scale
  - Perceived Stress Scale

- Maternal Cognition
  - Digit Span Forward and Backward
  - Verbal Fluency
  - Mental Rotation
  - Functional Health Literacy

- Mother-Infant interaction
  - HOME Inventory

- Activity
  - Accelerometers

- Child Development
  - Motor: Kilifi Development Inventory (KDI)
  - Language: Adapted MacArthur-Bates Communicative Development Inventory
  - Socio-Emotional: Profile of Socio-Emotional Development (PSED)
  - Executive Function: A not B task
Thank you!

SUMMIT Team:
- Anuraj Shankar
- Husni Muadz
- Michael Ullman
- Katie Alcock
- Mandri Apriatni
- Susy Sebayang
- Aditiawarman
- Ben Harefa
- Josephine Kadha
- Dini Prihatini
- Abas Jahari

iLiNS-Malawi Team:
- Kay Dewey
- Per Ashorn
- Ken Maleta
- Ulla Ashorn
- Steve Vosti
- John Phuka
- John Sadalaki
- Atupele Luwayo
- Rob Stewart
- Christine Stewart
- Anna Pulakka

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