Practical Methods for Measuring Infant Development

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Assessing Infant Development

- Developmental psychologists have produced a variety of methods for measuring infant cognitive abilities
- Most of these assessments are not standardised
- However, many have been used as outcome measures in randomised controlled trials
- Several standardised developmental scales are also available
- Examples of both types of assessment from studies of the effects of LC-PUFAs on development
Speed of Information Processing
Visual Paired Comparison Task (Fagan Test of Infant Intelligence)

Brief Familiarisation

Fagan, 1974, Child Dev, 45, 351-356
Visual Paired Comparison Task (Fagan Test of Infant Intelligence)

Novelty Preference Test

Longer looking at the novel face indicates recognition

Fagan, 1974, Child Dev, 45, 351-356
Novelty Preference Test

Novelty Preference Measure

Novelty Preference (% time looking at novel face)

- Face not recognised: 50
- Face recognised: 70

Higher novelty preference indicates faster processing and is related to higher childhood IQ.
Higher Fagan Test Scores in Supplemented Groups


Clausen et al, Proc AOCS Conf, 1996, 12
Prenatal (Cord) DHA Associated With Higher Fagan Novelty Preference

6m Inuit Infants

$p < .01$ (adjusted for cord PCBs)

Infant Habituation – Decrease In Attention With Learning

Repeated exposure to a face stimulus

Shorter looking indicates faster processing

Shorter looking time is correlated with higher childhood IQ

Recording Infant Habituation
Higher Maternal DHA is Related to Shorter Look Duration

Colombo et al, 2004, Child Dev, 75, 1254-1267
Sustained Attention
Development of Sustained Attention

- Record looking time on each trial until infant loses interest in the stimulus
  - Habituation, information processing completed
- Identify three phases of attention
Three Phases of Infant Attention

• Orienting
  – Look at the stimulus
  – Engage attention

• Sustained attention
  – Information processing

  Important phase when learning takes place

• Termination
  – Prepare to look away
  – Disengage attention
Heart Rate and Attention

- Baseline
- Infant Looking
- Look away
- Sustained attention
- Engage attention
- Disengage attention

Looking Time, Sustained Attention and Cognitive Development

- Key measure is the percentage of looking time spent in sustained attention
- Some infants maintain high levels of sustained attention across the first year of life
  - more learning
- These infants perform better on tests of language and cognition at 3 - 4 years

Colombo et al, 2004, Infancy, 5, 1-38
Effects of LC-PUFAs on Development of Sustained Attention (DIAMOND STUDY)

• Term infants randomised to four formula groups:
  – 0.00% DHA, 0.00% ARA (control)
  – 0.32% DHA, 0.64% ARA
  – 0.64% DHA, 0.64% ARA
  – 0.96% DHA, 0.64% ARA

• Habituation test at 4, 6 & 9 months

• Heart rate measures to identify phases of attention

Colombo et al, 2011, Pediatric Res, 70, 406-410
LC-PUFAs Increased Duration of Sustained Attention

Colombo et al., Pediatric Res 2011;70:406-410
Prenatal DHA Supplementation Improves Infant Sustained Attention

• Women (n = 230) received either 600 mg/d DHA or placebo for last two trimesters
• Infant visual habituation tested at 4, 6 & 9 months
• Heart rate measures used to identify phases of attention

Prenatal DHA Supplementation Improves Infant Sustained Attention

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Problem Solving
Means-End Problem Solving

“The deliberate and planful execution of a sequence of steps to achieve a goal”

Willatts, Dev Psychol, 1999, 35, 651-667
Infant Planning Test (2-Step Problem)

1. Pull the cloth

2. Lift the cover and find the toy
Solving a 2-Step Problem
2-Step Failure
DHA Supplementation in Pregnancy

- Mothers consumed cereal bars with DHA (low EPA) or corn oil
- Average daily DHA intake was 214 mg
- From 24 weeks gestation until delivery
- Infants tested on 2-step problem solving at 9 months

Maternal DHA Improved 2-Step Problem Solving at 9 Months

A More Complex 3-Step Problem

1. Remove the block
2. Pull the cloth
3. Lift the cover and find the toy
Better 3-Step Problem Solving in Supplemented Infants

Supplemented formula: DHA = 0.21%; ARA = 0.35% (total FA)
Control formula: DHA = 0.00%; ARA <0.10% (total FA)

LCPUFAs Improved 3-Step Problem-Solving
Poorer Problem Solving in the Control Group
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Ages & Stages Questionnaire
ASQ3: Ages & Stages Questionnaires
3rd Edition

• **ASQ3** is a parent-completed child monitoring system
• Children aged 2 months to 5.5 years
• **21 Questionnaires**
  – 7 in year 1, 6 for year 2
  – 4 in year 3, 3 for year 4
  – 1 in year 5
• Cost-effective
• Easy to score in a few minutes
• Researched and tested with a large sample of diverse children
Structure of Questionnaires

• Section 1 contains five parts, each with six questions
  – Communication
  – Gross Motor
  – Fine Motor
  – Problem Solving
  – Personal-Social

• Scoring (by professionals, takes 2-3 minutes)
  – Yes: if child does the skill (10 points)
  – Sometimes: if child does the skill but not all the time (5 points)
  – Not yet: if child does not do the skill yet (0 points)
Translation of ASQ3

• UNESCO funded project (INGI-2105-29) for “Translation and validation of the measuring instrument Ages and Stages Questionnaire, 3rd edition” - Croatia

• Duration 2016-2017

• The Maria Grzegorzezska Academy of Special Education (Warsaw)

• Dr Urszula Markowska-Manista (u.markowska@fu-berlin.de)

• They hope to complete a similar Polish translation
# PROBLEM SOLVING

<table>
<thead>
<tr>
<th></th>
<th>YES</th>
<th>SOMETIMES</th>
<th>NOT YET</th>
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<tbody>
<tr>
<td>1. Does your baby pass a toy back and forth from one hand to the other?</td>
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<td>2. Does your baby pick up two small toys, one in each hand, and hold onto them for about 1 minute?</td>
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<td>3. When holding a toy in his hand, does your baby bang it against another toy on the table?</td>
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<td>4. While holding a small toy in each hand, does your baby clap the toys together (like “Pat-a-cake”)?</td>
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<tr>
<td>5. Does your baby poke at or try to get a crumb or Cheerio that is inside a clear bottle (such as a plastic soda-pop bottle or baby bottle)?</td>
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<td>6. After watching you hide a small toy under a piece of paper or cloth, does your baby find it? (Be sure the toy is completely hidden.)</td>
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**PROBLEM SOLVING TOTAL**
The ASQ3 Is Effective

• A good screening instrument should be able to identify at least 70% of children with developmental delay (Glascoe & Foster, 1997)

• ASQ2 identified 83% of children with developmental delay (Limbos & Joyce J Dev Behav Pediatr 2011;32:1-13)

• Many studies show that ASQ3 can identify at least 70% of children with Bayley Scale MDI scores <70 (severe developmental delay)

• “ASQ-3 may be recommended for routine paediatric developmental screening” (Schonhaut et al. Pediatrics 2013;131:e1468–e1474)
DHA Supplementation of Human Milk Improved Cognitive Development in VLBW Infants

- 141 VLBW infants fed breast milk supplemented with DHA (1.12% total fats) or no supplement (0.7% total fats)
- Cognitive development assessed at age 6 months
- Supplemented infants had higher problem-solving scores on the Ages and Stages Questionnaire
- Supplemented infants also had better visual recognition memory

*Henriksen et al., Pediatrics 2008; 121:1137-1145*
Main Conclusions

1. Range of tests are available to measure specific cognitive abilities (speed of processing, sustained attention, problem solving)

2. These tests have been used as outcome measures in many RCTs (e.g. effects of LC-PUFAs on infant development)

3. Specific tests of development provide useful information about differences in infants’ abilities
Main Conclusions

4. Most specific infant tests are not standardised and cannot be used as screening tools

5. Parent-completed questionnaires are standardised and can be effective outcome measures in RCTs

6. Questionnaires provide a quick and effective way of screening infants for developmental problems (e.g. ASQ3) and are recommended