Assessing child development in the context of nutrition trials in developing countries: Principles for test selection, adaptation, and evaluation

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Background: This study is part of the International Lipid-Based Nutrient Supplements (iLNS) Project. We report preliminary data from the iLNS-DOSE project that we are currently conducting in rural Malawi and from the iLNS-ZINC project that we are currently conducting in rural Burkina Faso.

Infancy and early childhood are crucial periods for the development of motor, cognitive, and socio-emotional skills. Many children in developing countries fail to reach their developmental potential in these areas, affecting later academic achievement and adult life. Lipid-based nutrient supplements (LNS) during pregnancy and infancy may improve these aspects of development, since brain development depends on adequate nutrition. For example, during fetal and infant development, lipids and micronutrients are necessary for neuron proliferation and myelination.1,2 The effect of LNS during pregnancy and infancy on motor, cognitive, and socio-emotional development is not yet clear.

In order to accurately evaluate the effect of various formulations of LNS on these abilities, child development must be assessed in a way that is reliable and valid in the areas where LNS interventions are conducted in developing countries. The assessment of child development in developing countries can be challenging since the most well-established and widely-used tests have been produced and standardized in developed countries. Tests produced and standardized in one language, culture, and setting cannot be assumed to be valid in a setting that is different from that of the original target population. For example, children’s test performance depends on their familiarity with the test format and materials.4 Such familiarity levels may be quite different for children who grow up in different cultures and contexts. Therefore, test items, materials, and procedures must be adapted to the local setting of the LNS intervention, and the adapted tests must be evaluated for reliability in the local population.

To assess child development in developing countries, other issues must also be considered. For example, it can be difficult to find and hire personnel with expertise in child assessment. Therefore, it is necessary to select assessments that can be administered without prior experience or extensive training. In addition, assessment by direct observation of the child may be appropriate in certain contexts, while assessment by parent interview may be appropriate in others.

Objectives: To systematically address the issues related to the assessment of child development in the iLNS-DOSE and iLNS-ZINC trials and to ensure that the assessments were appropriate and reliable for the local settings.

Methods: We developed a set of principles for selecting, adapting, and evaluating the child development assessments for the iLNS-DOSE and iLNS-ZINC trials. The issues that we faced and the principles that we developed are presented in Table 1. We selected several assessments developed in Kenya, including the Kilifi Developmental Inventory (KDI)3, the Profile of Socio-Emotional Development (PSED), and an adapted version of the Developmental Milestones Checklist (DMC)2. We also adapted the MacArthur-Bates Communicative Development Inventory (CDI)2, originally produced in the USA, based in part on previous adaptations of this tool in Bangladesh8 and Kenya9. We evaluated the discriminatory power, inter-scorer agreement, internal reliability, and test-retest reliability of the tests in the local contexts.

Results. The selected and adapted assessments proved to be appropriate in the local contexts and to yield substantial variance in scores among 18-month-old children. The available data demonstrated sufficient inter-scorer agreement, internal reliability, and test-retest reliability (see Table 1).

References.
Table 1. The issues that we considered and the principles that we developed for the assessment of child development in the iLiNS-DOSE and iLiNS-ZINC trials.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Principle</th>
<th>iLiNS-DOSE, Malawi</th>
<th>iLiNS-ZINC, Burkina Faso</th>
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<td>Many different abilities develop during infancy and early childhood and are likely to be influenced by nutrition.</td>
<td>Select tests that assess a wide range of abilities that may be influenced by LNS.</td>
<td>The KDI assesses fine and gross motor development. The PSED assesses socio-emotional development. The MacArthur-Bates CDI assesses language development. The A not B task assesses working memory and executive function.</td>
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| Few or no developmental tests have been produced in the local setting. | Select tests that have been produced in a similar setting or adapt tests that have been produced in a dissimilar setting. In both cases, evaluate the tests for reliability in the local context. | The KDI and PSED were produced in Kenya, in a setting similar to the iLiNS-DOSE study area. The A not B task was previously adapted for Kenya. The MacArthur-Bates CDI has been successfully adapted to similar settings (Kenya and Bangladesh). Data from the first 71 iLiNS-DOSE children evaluated at age 18 months:  
  Internal reliability  
  Cronbach’s Alpha  
  r  
  KDI: .67  
  PSED: .69  
  CDI: .98  
  A not B: Not yet available  | The DMC was produced in Kenya, in a setting similar to the iLiNS-ZINC study area. Data from the first 25 iLiNS-ZINC children evaluated on the adapted DMC at age 18 months:  
  Internal reliability  
  Cronbach’s Alpha  
  Motor: .87  
  Language: .72  
  Personal-social: .55  
  Test-retest reliability: Not yet available  |
| The data collectors may not have a very high level of education or previous experience with developmental assessment. | The testers should be able to be trained in 2-3 weeks without prior experience. Scoring should be relatively clear and straightforward, which can be evaluated by inter-scorer agreement. | For each test, the testers were trained in 2-3 weeks. Inter-scorer agreement was evaluated at the completion of training.  
  Inter-scorer agreement (n = 18):  
  KDI: 95%  
  PSED: 89%  
  CDI: 96%  
  A not B: 98%  | The testers were trained in 3 weeks. Inter-scorer agreement: Not yet available  |
| In order to detect any effect of LNS, test scores should be able to differentiate between children of the same age (18 months) with different abilities. | Test scores should show a substantial amount of variance in children at the target age (18 months). | Data from the first 71 iLiNS-DOSE children evaluated at age 18 months:  
  KDI: n = 45, range = 35-47, mean=41, SD=3  
  PSED: n = 71, range = 4-34, mean=16, SD=6  
  CDI: n = 65, range = 0-90, mean=34, SD=25  
  A not B: n = 54, range = 0-10, mean=6, SD=2  | Data from the first 25 iLiNS-ZINC children evaluated on the adapted DMC at age 18 months:  
  Motor: n = 18, range = 36-60, mean=48, SD=8  
  Language: n = 24, range = 15-28, mean=21, SD=3  
  Personal-social: n = 20, range = 38-52, mean=46, SD=4  |
| The location may be crowded and noisy therefore not conducive to direct assessment of the child. It may be difficult to get a clear picture of certain skills when spending a limited amount of time with the child. | When direct assessment is problematic, evaluate the child based on parent interview. | It is difficult to obtain a complete picture of a child’s language ability and socio-emotional ability in a short (~ 1 hour) test session. However, parents spend substantial amounts of time with their children and observe them in a wide variety of situations and contexts. Therefore, we used parent interviews to assess these skills (the CDI and PSED). | The developmental assessments were conducted at clinic visits where the atmosphere was not conducive to extensive observation of the child. Therefore, we used a parent interview (the adapted DMC) in combination with direct observation of certain skills.  |
| Limited time and resources. | The assessments should be relatively brief to administer. | KDI and A not B: ~45 minutes  
  PSED: ~20 minutes  
  CDI: ~10 minutes  | DMC: ~20 minutes  |