Are the psychological tests valid?

Dear Sir:

The article by Black et al (1) provides insufficient information to claim that weekly administration of iron and zinc supplements benefits exploratory behavior. The iron and the iron-plus-zinc treatments had a significant effect on the orientation-engagement factor of the Bayley Behavior Rating Scale (2), which includes one item (out of 11) on exploration. This factor also includes items that assess “...arousal, positive affect, energy, initiative, enthusiasm, exploration, social engagement, and lack of fearfulness” (3). At issue is not a simple change of labels but whether the 11 items included in the orientation-engagement factor measure the concept of exploration. No evidence to this effect was presented, and the statement that “Orientation-engagement factor served as the measurement of exploration” trivializes both the scale and the very nature of construct validity (4). The definition of exploration should not be left to common sense; it requires careful consideration of the behavioral and developmental components of the concept.

There was no treatment effect on the Mental Development Index (MDI) from the Bayley Infant Development Scale II administered at 12 mo. This finding was not surprising. The MDI obtained at 12 mo has a track record of poor sensitivity to detect developmental delays secondary to micronutrient deficiencies, and its construct validity is questionable (5, 6). Accordingly, the authors could have predicted that the MDI would not discriminate among groups after treatment. The probabilities of detecting effects on the mental scale, if any were indeed present, would have increased if the authors had charted a developmental trajectory after age 12 mo (6, 7).

The author had no conflicts of interest.

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REFERENCES


Reply to E Pollitt

Dear Sir:

We thank Pollitt for his interest and comments regarding our investigation of the effect of micronutrient supplementation on children’s development (1).

The first comment made by Pollitt concerned our use of the term “exploration.” Exploration refers to infants’ use of their senses, motivation, and emerging motor and mental skills to learn about their physical and social environment. Exploration and child development are thought to be interactive, bidirectional processes; exploration enriches infants’ developmental skills, and, as infants’ mental and motor skills mature, they are capable of more sophisticated exploration.

In our investigation of micronutrient supplementation, we were particularly interested in exploration because it plays an important role in the theory of functional isolation (2), which serves as a possible explanation for the association between nutritional deficiency and delays in children’s development. Infants with low rates of exploration may miss opportunities for the physical and social enrichment that advance their developmental skills. If micronutrient supplementation promotes exploration, as we found in our recent investigation (1), it may be an important mechanism in understanding associations between micronutrient deficiency and delays in early child development.

Exploration is often assessed through the observation of infants during play. In our investigation, we observed infants during a warm-up period and during the administration of the Bayley Scales of Infant Development, II (3). We used the “orientation-engagement” factor of the Behavior Rating Scale of the Bayley Scales as an operational definition of exploration because it measures “the child’s proclivities toward approaching or avoiding environmental interactions that are task-related or social in nature” (3). For 6–12-mo-old infants, the orientation-engagement factor includes 11 behaviors: social engagement, enthusiasm, persistence in completing tasks, exploration, initiative, interest in materials, energy, positive affect, lack of fearfulness, state of arousal, and stability of state of arousal. Each behavior is assessed by a trained examiner using a 5-point Likert scale after administration of the mental and motor scales of the Bayley Scales. In keeping with the psychometric properties reported for
the standardization sample (3) in our investigation, the internal consistency of the orientation-engagement factor exceeded 0.87 during both observations. High scores represent endorsement of the behaviors related to the factor. Thus, a 6–12-mo-old infant with a high score in the orientation-engagement factor was observed to be alert, to be enthusiastic, to be persistent, and to have initiated interactions with materials and people in the testing setting—behaviors that are consistent with exploration in the second 6 mo of life.

The second comment by Pollitt involved the use of the Mental Developmental Index (MDI) of the Bayley Scales of Infant Development, II to examine changes in mental development related to micronutrient supplementation. The MDI represents a complex integration of empirically derived cognitive skills that are based on maturation and other theories of infant development. Although the MDI is probably the most well-standardized, widely used assessment of infant mental development in the world, evidence substantiates the low predictive validity of infant assessments of mental development, such as the MDI, for infants younger than 24 mo to subsequent measures of intelligence (4, 5). The lack of continuity may be partially explained by the multidimensional and rapidly changing aspects of infant mental development and by variations in performance during infancy, variations in tasks used to measure intellectual functioning throughout childhood, and variations in environmental challenges and opportunities that may influence development. Predictability appears to be better when investigators focus on specific cognitive, motivational, or behavioral processes (6).

One might ask why the MDI is so widely used to investigate associations between nutritional supplements and mental development despite its limited predictability. The reasons are many. First, the MDI is a well-standardized, psychometrically strong measure of infant mental development. Because it is an age-normed test, MDI scores can be used to compare the performance of children with that of same-age peers across ages, cultures, and conditions from birth through 42 mo of age. Second, MDI scores are sensitive to deviations in early development associated with environmental and nutritional conditions, such as low birth weight (7). For example, changes in MDI have been reported in response to both iron (8) and zinc (9) supplementation in infants younger than 18 mo. Third, predictability appears to be better among infants with early medical or environmental challenges and opportunities (12). Our investigation of changes in motor, mental, and behavioral development from 6 to 12 mo of age related to micronutrient supplementation (1) is a step in that process.

Neither author had a conflict of interest.

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Erratum


On page 1604, paragraph 3 of the abstract, the age of the children mentioned (28–60 mo) is inaccurate. The sentence should read, “The study involved the longitudinal follow-up of children aged 0–95 mo for clinical malaria episodes and anthropometric measurements through 4 cross-sectional surveys.”

Erratum


The legend printed with Figure 1 of this article was not complete. The figure and the complete legend appear below.

![Graph](image-url)

**FIGURE 1.** Plot of log₁₀thyroid volume (Tvol) and log₁₀urinary iodine (UI) concentration showing a Lowess smoothed line calculated for an international sample of 6–12-y-old children (n = 3319), with sexes and sites combined. Log (Tvol) begins to increase at log (UI) > 2.7 (dotted line), which, transformed back to the linear scale, corresponds to a UI concentration of ~500 μg/L.