TECHNICAL BRIEF
Food and Nutrition Technical Assistance III Project
January 2016

Giving Children the Best Start in Life: Integrating Nutrition and Early Childhood Development Programming within the First 1,000 Days

Zeina Maalouf-Manasseh, Lesley Oot, and Kavita Sethuraman

Introduction

Providing every child with the best start in life is not only essential for the child's individual well-being but is a necessary investment to protect human capital and achieve national development objectives. Chronic malnutrition (or stunting, low height-for-age) affects an estimated 165 million children worldwide, a majority of whom live in developing countries.[1] Most of these children are also not achieving their development potential due in large part to chronic malnutrition. In fact, it is estimated that more than 200 million children under 5 years of age in developing countries are not achieving their development potential due to both chronic malnutrition and poverty.[2] Adequate nutrition is critical for brain development and plays an important role in a child's physical, social, emotional, and cognitive development—the four domains of early childhood development (ECD) in which children need to develop to reach their potential. Aside from adequate nutrition, children also need a stimulating environment and social interaction with attentive caregivers to develop sufficiently in all four domains.

Adequate nutrition is critical to a child's optimal development, particularly during the first 1,000 days (pregnancy through the child's second birthday), a period of rapid growth where nutrient deficiencies can have long-term consequences. Studies have found that malnourished children are more likely to be older at school enrollment, repeat grades, be absent from school, drop out of school, and fail at least one grade, resulting in decreased learning and lower wages in adulthood.[3] Recent evidence also suggests that integrated nutrition and ECD programming is synergistic and

Source: Valerie Caldas, courtesy of Photoshare

Key Points

1. Investment in integrated nutrition and early childhood development programming during the first 1,000 days is critical to ensure that children can reach their potential.
2. There are five key nutrition risk factors for poor ECD: poor maternal nutrition, iodine deficiency during pregnancy, iron deficiency, poor linear growth, and severe acute malnutrition.
3. Integrated nutrition and ECD interventions have the potential for greater cumulative impact on nutrition and ECD outcomes compared to single-sector interventions.

that the benefits can extend to both improved child development and nutrition outcomes, laying the best foundation for children to do well in school and achieve their full potential as adults.

However, despite the interaction between optimal nutrition and child development during the first 1,000 days, most programs do not yet effectively integrate ECD interventions within nutrition and health services targeting children under 2, resulting in a missed opportunity.

One of the guiding principles of the U.S. Agency for International Development's 2014–2025 Multi-Sectoral Nutrition Strategy is the promotion and strengthening of coordinated multisectoral approaches, which include early child care and development, to address the multiple causes of malnutrition. This provides an opportunity to explore other critical interventions that can be integrated with nutrition programming to provide the best impact on child development.

This technical brief focuses on the interaction between nutrition and ECD during the 1,000-day window of opportunity. It outlines the key nutritional risk factors related to poor ECD and proven nutrition interventions to address them, with a particular focus on two distinct time periods: pregnancy and early childhood (defined in this brief as 0–23 months of age). It also outlines how current programs are implementing integrated programming to address both nutrition and ECD, the advantages and disadvantages of this integration, and the potential impact such integrated programs can have on improving a child's growth and development. The aim is to support evidence-based integrated program design that would seek to improve both nutrition and ECD outcomes in the future.

Nutrition's Impact on Early Childhood Development during the First 1,000 Days

Nutrition impacts ECD both directly and indirectly. Nutrition has a direct impact on brain development during the first 1,000 days, a period of rapid brain growth and development where sufficient quantities of key nutrients are needed in differing amounts at critical periods to ensure the brain is developing properly. This is because regions of the brain (e.g., the hippocampus) and brain processes (e.g., synapse formation) require different nutrients at different times and amounts to develop. For example, the brain's demand for zinc, which is necessary for cell division among other neurodevelopmental processes, is particularly high during the last four months of gestation and from 6 months to 10 years of age.[i,4]

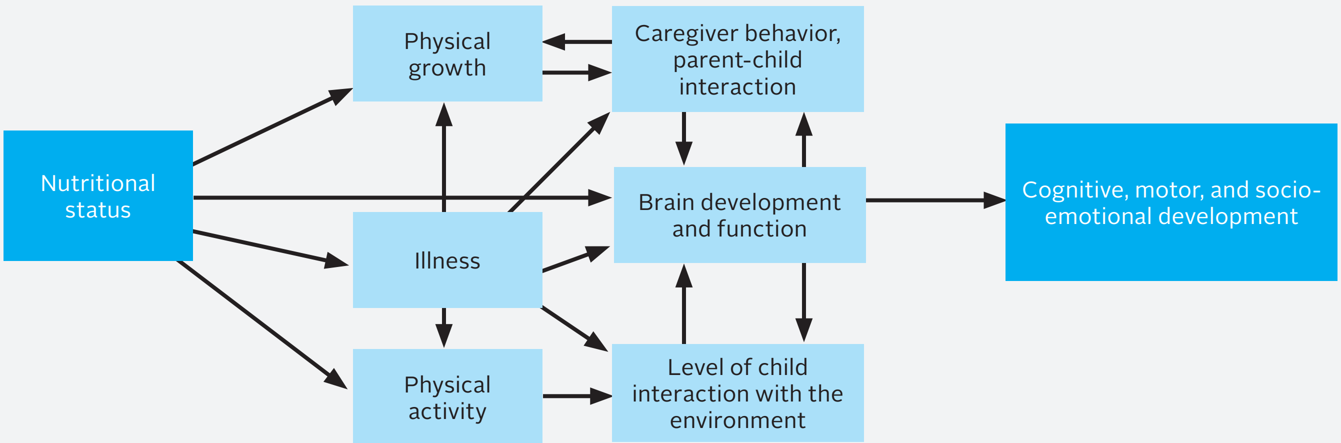
Children's nutritional status can also influence their behavior, indirectly impacting their development through two key pathways—childhood exploration and caregiver interaction. Without proper nutrition, children may not have the energy or interest to explore their environment, limiting their interaction with new situations, senses, and experiences.[5] In addition, children who are adequately nourished may be more active and demand greater attention and responsiveness from their caregiver, while malnourished children may be frequently ill and therefore more irritable, eliciting negative and less stimulating responses from a caregiver.[6] Malnourished children may also be harder to feed, leading caregivers to provide less food and use a non-responsive and less stimulating manner of feeding.[7] Finally, since malnourished children may appear younger than they actually are (either due to reduced weight or height), they may receive stimulation that is not appropriate for their actual age, further stunting their development.[8] Figure 1 shows the different pathways by which malnutrition may directly and indirectly affect ECD.

Key Nutrition Risk Factors Associated with Early Childhood Development during the First 1,000 Days

Adequate intake of energy, protein, fatty acids, and micronutrients (including iron, folic acid, thiamine and other B vitamins, iodine, vitamin A, zinc, vitamin D, and calcium) during the first 1,000 days is critical to a child's optimal development and growth. For example, sufficient folic acid intake before and during pregnancy is critical to the forming of the neural tube and the brain stem. Deficiency during pregnancy can cause the neural tube to form improperly and cause birth defects.[9] Although each of these micronutrients and macronutrients is essential for brain development and its functioning

[i] Global evidence indicates that while zinc has a direct effect on brain growth and morphology, current evidence does not suggest that zinc supplementation influences early childhood development outcomes.

Figure 1. Potential Mechanisms by Which Malnutrition May Influence a Child's Early Development



Source: Prado and Dewey 2012, adapted from Levitsky, D.A. and Barnes, R.H. 1972. "Nutrition and Environmental Interactions in the Behavioural Development of the Rat: Long-Term Effects." *Science*. Vol. 176, pp. 68–71 and from Pollitt, E. 1993. "Early Supplementary Feeding and Cognition: Effects over Two Decades." *Monographs of the Society for Research in Child Development*. Vol. 578, pp. 1–99.

throughout life, this technical brief focuses on the following key nutrition-related risk factors that evidence shows have a measured association with ECD: poor maternal nutrition, iodine deficiency during pregnancy, iron deficiency, poor linear growth (stunting), and episodes of severe acute malnutrition (SAM).[ii] The risk factors have been divided into two time periods: pregnancy and early childhood.

Pregnancy

POOR MATERNAL NUTRITION

Poor maternal nutrition can contribute to low birth weight (LBW)—when an infant weighs less than 2,500 g (5.5 lbs) at birth—which is associated with poor developmental outcomes. LBW is an outcome of intrauterine growth restriction and/or preterm birth.[10] Maternal stunting (height <145 cm) and underweight (low body mass index) during early pregnancy are associated with increased risk of poor fetal growth. In addition, maternal obesity and deficiencies in calcium and zinc during pregnancy are associated with preterm birth, while iron deficiency anemia during pregnancy is associated with LBW.[11] The 2007 and 2011 Lancet series on child development in developing countries found that LBW infants with intrauterine growth restriction are at significant developmental risk—including lower cognitive scores, poorer problem-solving skills, and behavioral issues.[12] Small-for-gestational-age and preterm births are also important contributors to stunting in children, a risk factor for poor ECD that is discussed below.[13]

IODINE DEFICIENCY

Iodine, which is required for the production of thyroid hormones, is also critical for brain development and cognition.[15] Global evidence identifies iodine deficiency as one of the key risk factors for poor ECD. Iodine deficiency during pregnancy, the main cause of preventable brain damage worldwide, can lead to irreversible brain damage of various degrees in the infant.[16] While the most severe manifestation is cretinism—an irreversible disorder characterized by mental retardation, deaf-mutism, facial deformations, and severely stunted growth—even milder iodine deficiency can have an impact on ECD by reducing intelligence and cognitive ability. On average, iodine deficiency can lead to a reduction in IQ of up to 13.5 points.[17]

[ii] Note that the relationships between these risk factors and poor ECD could be direct and biologically causal, an indirect association, or a combination of direct and indirect relationships.

Stunting and Early Childhood Development

A 1999 study, "Behaviour and Development of Stunted and Nonstunted Jamaican Children," found that stunted Jamaican children showed less enthusiasm than non-stunted children when they explored their environment, were more apathetic and less happy, were fussier, and cried more.[14]

Early Childhood (0–23 months)

IRON DEFICIENCY

Iron deficiency during infancy can have both short- and long-term consequences, including impaired mental and motor development, poorer socio-emotional behavior, and reduced school achievement.[18] The fetal/neonatal and infancy/toddlerhood (6 months to 3 years) period is a time of particularly high vulnerability to iron deficiency but is also a period when children's needs are greatest.[19] Numerous longitudinal studies have consistently demonstrated that children who had iron deficiency anemia in the first 2 years of life continue to show deficits in cognition and school achievement later in life.[20] Longitudinal studies also demonstrate that despite treatment with iron, children who were severely iron deficient before 2 years of age continue to show signs of reduced cognitive ability at 4–19 years of age, indicating that iron deficiency anemia, especially early in life, appears to have long-term impacts.[21] Studies on supplementation during pregnancy have yielded inconsistent results, indicating that maternal supplementation alone may not be enough to prevent the negative cognitive consequences of iron deficiency during early infancy.[22]

POOR LINEAR GROWTH (STUNTING)

Due to poor maternal nutrition, a child's poor linear growth often begins before the child is even born. About one-fifth of childhood stunting starts during the fetal period.[23] Poor infant and young child feeding (IYCF) practices (lack of exclusive breastfeeding and inadequate complementary feeding from 6–23 months) and repeated infections (often due to a lack of access to safe water and sanitation and poor hygiene practices) contribute further to poor linear growth, resulting in stunting. Consistent global evidence indicates that stunting is associated with negative socio-emotional behaviors and poor cognitive performance, including deficits in literacy, numeracy, reasoning, and vocabulary.[24] In addition, stunting is associated with overall lower school achievement and a variety of educational challenges, such as later enrollment in school, increased likelihood of grade repetition, absenteeism, dropping out of school, and risk of failing at least one grade.[25] Longitudinal studies have also found that stunting is associated with reduced economic opportunities and wages, indicating long-term consequences.[26]

SEVERE ACUTE MALNUTRITION

Severe acute malnutrition (SAM) is the result of recent (short-term) protein, energy, and micronutrient deficiency. Evidence consistently associates SAM with poor developmental outcomes.[27] Studies found that children who suffered from SAM in early childhood had increased negative social-emotional behaviors and lower IQ, cognitive function, and school achievement than matched control groups or siblings who had not had SAM during early childhood.[28] In addition, evidence showed that adults who had suffered an episode of moderate or severe malnutrition in their first year of life had more attention problems and a lower adult social status (based on occupation and educational attainment) and standard of living than matched controls even 40 years later, despite good rehabilitation after the episode.[29]

Key Nutrition Interventions

Key nutrition deficiencies can be effectively reduced and prevented by implementing a set of evidence-based nutrition interventions (noted below) at scale and with high quality and coverage. Reducing and/or preventing these nutrient deficiencies can improve maternal and child nutritional status and health as well as developmental outcomes. Although this technical brief only covers nutrition interventions, increasing evidence highlights the importance of water, sanitation, and hygiene interventions along with other nutrition-sensitive interventions in addressing the underlying causes of malnutrition, which are critical to sustaining long-term improvements in nutrition.[30]

- **Universal salt iodization:** Promoting and monitoring universal salt iodization to ensure that adequate levels of iodine are being consumed—especially by women of reproductive age and particularly during early pregnancy.
- **Iron-folic acid supplementation and consumption of iron-rich/fortified foods:** Preventing iron deficiency anemia in pregnant and lactating women and young children through consumption of iron-rich foods, iron-folic acid and/or multiple micronutrient supplementation (including multiple micronutrient powders such as "sprinkles"), delayed umbilical cord clamping, supplementation for infants, and promotion of iron-rich complementary foods for young children.
- **Optimal breastfeeding practices:** Promoting early (within 1 hour of birth), exclusive (for children under 6 months), and continued breastfeeding (for up to 2 years and beyond with appropriate complementary feeding) through behavior change communication, support from health service providers, and advocacy for supportive breastfeeding policies. (Note: Strong global evidence supports the linkage between ever being breastfed/increased breastfeeding duration and increased years of schooling, improved cognition, and higher performance on intelligence tests.[31] This also indicates that breastfeeding may help improve economic and social outcomes in adulthood.[32])
- **Dietary diversity and appropriate complementary feeding:** Promoting consumption of safe (hygienic), healthy, diversified diets—including high-quality, nutrient-rich foods in the complementary feeding period (age 6–23 months)—with an emphasis on animal-source foods and using responsive feeding approaches (see box on responsive feeding).
- **Identification and treatment of acute malnutrition in children:** Providing inpatient treatment for children with SAM with medical complications and using community-based approaches to identify and treat moderate acute malnutrition and cases of SAM without medical complications.
- **Improved maternal nutrition:** Addressing some of the underlying determinants of LBW births by strengthening maternal nutrition through balanced protein/energy supplementation, calcium supplementation, iron supplementation, and multiple micronutrient supplementation.
- **Protein/energy supplementation:** Improving balanced protein/energy consumption through supplementation with protein/energy-rich drinks and snacks during the first 1,000 days for both mothers and children. (Note: While there is somewhat limited evidence from a variety of populations, multiple studies from a well-designed intervention in Guatemala indicate that adding protein and energy to a child's diet during early childhood can help improve cognition, educational attainment, and economic potential.[33])

Responsive Feeding: Integrating Nutrition and ECD

The promotion of responsive infant feeding is an example of an activity that integrates nutrition and ECD. When done correctly, responsive feeding allows the caregiver to be attentive to the child's cues of hunger and satiety and her/his feeding needs and preferences; helps ensure the child's dietary intake is well matched to his/her needs; and improves communication between the child and the caregiver, which helps develop the child's nonverbal and verbal communication skills.

Integrated Nutrition and ECD Programming

Guidelines for addressing children's health in developing countries highlight the importance of integrated interventions, with nutrition and ECD as part of a package that better addresses children's needs.[34] There are a few documented experiences of integrated nutrition and ECD programs in the first 1,000 days that have significantly improved nutrition and ECD outcomes and that share some common program elements. Table 1 (below) highlights these common elements as demonstrated in well-studied and documented integrated programs in Pakistan, Bangladesh, India, Uganda, Chile, and Jamaica.[35] These programs do not constitute all the available evidence on effective integrated nutrition and ECD programs, but they are representative of such programs from around the globe and are among the few with documented program descriptions and measures of impact on both nutrition and ECD outcomes. Table 2 presents the design and results of the studies or evaluations that documented the impacts of some of these integrated programs. As noted in Table 1 and illustrated in the examples in Table 2, the nutrition and ECD interventions are

Table 1. Common Elements of Nutrition-ECD Programs

Program beneficiaries: Children under 2 and their caregivers	
Program content	
Nutrition component	• Tended to focus on nutrition education or messaging on improved IYCF and breastfeeding practices • Often included distribution of a dietary supplement such as iron supplements, micronutrient powders, cereal-based food, and milk-based formula for the infant combined with a household ration or therapeutic feeding in the case of malnourished children
ECD component	• Focused on responsive stimulation and developmentally appropriate play, responsive feeding, or both • Delivered through teaching the concepts to parents, practicing the ECD-stimulating behavior with the child, or both • In a few cases, developmentally appropriate toys were given or loaned to caregivers
Program delivery	
Where	• Most delivered through home visits, group sessions in the community, or both • In one case, intervention was delivered at community clinics
When	• Contacts usually occurred weekly but occurred every other week in a couple of cases and monthly in one case
How long	• Interventions' duration varied considerably; most lasted for 3 months to 2 years but some were as brief as 6 weeks in an emergency setting
By whom	• Often delivered by peer educators who generally had 8–10 years of education; in most interventions, peer educators were married mothers and members of beneficiaries' villages or communities, although one intervention in an emergency context relied on university graduates with the assistance of nutrition support workers • Intervention staff and volunteers often received around 1 week of theoretical and/or supervised on-the-job training, with manuals frequently used for training
Program outcomes	
All interventions had a positive impact on either nutrition outcomes (as measured by the effect on weight, linear growth, or intake of key nutrients), ECD outcomes (measured in various ways depending on the study, e.g., the Bayley Scale for Infant and Toddler Development[iv] and the HOME inventory scores[v]), or both. In about half of the interventions, the effect of the integrated intervention was greater than the sum of the effects of the nutrition intervention or of the ECD intervention alone, indicating the synergy achieved by integrating the two components.	

[iv] The Bayley Scale for Infant and Toddler Development, Third Edition is a standard series of measurements used to assess the motor, language, and cognitive development of infants and toddlers (age 0–3 years).

[v] The Home Observation for Measurement of the Environment (HOME) inventory is designed to measure the quality and quantity of stimulation and support available to a child in the home environment.

quite different from program to program, with the nutrition component ranging from the provision of one to multiple micronutrients, to the provision of complementary food or fortified milk, etc. This illustrates the variety of interventions that can bring nutrition and ECD together in the first 1,000 days and that could have an effect on nutrition and ECD outcomes.

Advantages and Challenges of Integration

Integrating nutrition and ECD programs in the first 2 years of life has many advantages. Given that physical growth and development occur simultaneously in a child, addressing nutrition and ECD in an integrated manner is logical. As noted from the interventions described above, integrated programs can potentially use the same personnel, the same platforms, and the same points of contact, which may result in efficiencies, cost-effectiveness, and synergistic effects. Since the opportunity costs for caregivers to participate in programs can be prohibitive, integrating programs may ease the burden of participation and give children greater access to nutrition and ECD services. Integrating ECD within nutrition/health programs also can be

Table 2. Key Studies of Integrated Nutrition-ECD Programs

Nutrition Intervention	ECD Intervention	Beneficiaries/ Delivery Strategy/ Intervention Duration	Study Design	Outcome/Impact
India: Vazir, S. et al. 2013. "Cluster-Randomized Trial on Complementary and Responsive Feeding Education to Caregivers Found Improved Dietary Intake, Growth, and Development among Rural Indian Toddlers." *Maternal & Child Nutrition*. Vol. 9, pp. 99–117.				
Nutrition education messages on sustained breastfeeding and complementary feeding	Messages and skills on responsive feeding, developmental stimulation messages, provision of developmentally appropriate toys	Children age 3 months Home visits every other week for 12 months	Cluster-randomized; 3 groups: • Regular Integrated Child Development Services (ICDS) • ICDS + nutrition intervention • ICDS + nutrition + ECD interventions	The integrated program was associated with a significant increase in children's intakes of energy, protein, vitamin A, calcium, iron, and zinc and with a significant improvement in both their motor and mental development.
Bangladesh: Aboud, F.E. and Akhter, S. 2011. "A Cluster-Randomized Evaluation of a Responsive Stimulation and Feeding Intervention in Bangladesh." *Pediatrics*. Vol. 127, pp. e1191–e1197.				
Daily micronutrient powder (MNP)	Sessions with peer educators on responsive feeding and responsive play	Children age 8–20 months Weekly group sessions for 7 months	Cluster-randomized field trial (efficacy); 3 groups: • Control (12 regular health, nutrition, and child development sessions) • Regular sessions + 6 peer sessions • Regular + peer sessions + provision of MNP for 6 months	The integrated program was associated with a significant improvement in mothers' responsive behavior, opportunities for stimulation in the home, children's language development, mother's handwashing behavior, and children's weight gain.

Table 2. Key Studies of Integrated Nutrition-ECD Programs (continued)

Nutrition Intervention	ECD Intervention	Beneficiaries/ Delivery Strategy/ Intervention Duration	Study Design	Outcome/Impact
Uganda: Morris, J. et al. 2012. "Does Combining Infant Stimulation with Emergency Feeding Improve Psychosocial Outcomes for Displaced Mothers and Babies? A Controlled Evaluation from Northern Uganda." *American Journal of Orthopsychiatry.* Vol. 82(3), pp. 349–357.				
Emergency feeding program + home visits on standard nutrition education	6 weekly group-based sessions on ECD + 1- to 2-hour home visits to discuss and practice what was learned in group sessions	Children age 6–30 months with SAM or moderate acute malnutrition Weekly mother-and-baby group sessions and home visits for 6 weeks	Purposive sample; 2 groups • Nutrition support • ECD intervention + nutrition support	The integrated program was associated with mothers' greater involvement w/babies, more access to play materials, and less sadness and worry.
Chile: Lozoff, B. et al. 2010. "Home Intervention Improves Cognitive and Social-Emotional Scores in Iron-Deficient Anemic Infants." *Pediatrics*. Vol. 126, pp. e884–e894.				
15 mg/d oral iron as ferrous sulfate for children 6 mo.; 30 mg/d for children 12 mo.	1-hour weekly home visits to foster child development by supporting mother-infant relationship	Children age 6 months or 12 months Weekly home visits for 1 year	Stratified randomized controlled trial (strata based on children's iron-deficiency/ anemia status); random assignment to: • ECD intervention • Weekly surveillance *Both groups received iron supplements	The integrated program was associated with improved mental and socio-emotional development in children who had iron-deficiency anemia at enrollment, but not in non-anemic children.
Jamaica: Grantham-McGregor, S.M. et al. 1991. "Nutritional Supplementation, Psychosocial Stimulation, and Mental Development of Stunted Children: The Jamaican Study." Lancet. Vol. 338(8758), pp. 1–5.				
Supplementation with 1 kg milk-based formula/ week (+ 0.9 kg cornmeal and skimmed milk for household to minimize sharing)	Weekly play sessions at home with a community health aide	Stunted children age 9–24 months Weekly home visits for 2 years	Random assignment to one of four groups: • Control • Supplementation only • Stimulation only • Supplementation + stimulation	The mental and motor development of children receiving supplementation or stimulation improved significantly and independently. Treatment effects were additive: Combined interventions significantly better than either alone.

beneficial because these programs are among the few that reach children in the first 1,000 days. In addition, integrating services can make it easier for programs to communicate and repeat coordinated and developmentally appropriate nutrition and ECD messages, increasing the chances that caregivers will hear them, internalize them, and act on them.

While there are very few documented cost-effectiveness and cost-benefit analyses of integrated nutrition and ECD interventions, Gowani et al. (2014) found that, based on results on child development outcomes, an integrated nutrition and ECD intervention in Pakistan was more cost-effective than separate nutrition and ECD interventions mainly because of lower labor-related costs, primarily savings from supervisors' salaries.[36]

The integration of nutrition and ECD programs presents challenges as well. Staff training and capacity for delivering both nutrition and ECD services must be addressed. Frontline health service providers and volunteers often have a full workload when delivering even a single program component. Adding another program component could potentially increase their workload and, if not very carefully managed, could affect the quality of their work. Programs need to provide appropriate training, including training on prioritization, time management, and problem solving. A strategy for continuous training and recruitment of peer educators is needed for programs that use this model. A related issue is the challenge of supervising the workers delivering the integrated programming. It is essential to both cross-train supervisors to ensure they have knowledge and skills in both sectors and to pay attention to their own and their staff's workload. Additional challenges include the need to develop new materials, such as counseling

Lessons from an Integrated Pilot Program in India

In India's Andra Pradesh, an integrated nutrition and ECD program for children age 3–15 months was piloted for 12 months through the country's Integrated Child Development Services (ICDS) program.

PROGRAM CONTENT

The control group received routine ICDS services, which consist mainly of supplemental food provided to children age 1–6 years and pregnant/lactating women at health centers, counseling on breastfeeding and complementary feeding during home visits, and monthly growth monitoring. There were two intervention groups. The first, called the complementary feeding group (CFG), received the routine ICDS services and additional IYCF messages on sustained breastfeeding and complementary feeding two to four times a month (depending on the infant's age) through home visits by trained village women using flip charts, other visual materials, demonstrations, and counseling sessions. Compared to the control group, this group received IYCF counseling more frequently and through multiple channels. The other intervention group, called the responsive complementary feeding and play group (RCF&PG), received the standard ICDS services, the additional IYCF counseling given to the CFG, and training and messages on responsive feeding and developmental stimulation using five simple toys.

PROGRAM OUTCOMES

The evaluation of the outcomes in the three groups at the end of the 12 months showed that the addition of more intensive counseling on IYCF and counseling on developmental stimulation (responsive feeding and stimulating toys) to routine ICDS services increased diversity in the children's diet, increased their intake of key nutrients, and improved their cognitive development scores. While children in both intervention groups had higher mental development scores than the control group, only the RCF&PG had significant differences. There were no differences in the three groups' motor development. These results highlight the importance of both intensive IYCF counseling and the integration of nutrition and ECD interventions for the greatest impact on nutrition and ECD outcomes.

Source: Vazir et al. 2013

job aids and guidelines that support an integrated approach to programming, and the possibility that integrated programming may also require revised indicators and a monitoring and evaluation system that captures the synergistic, integrated delivery of services, performance, and outcomes expected from integrated programming. It will take time, resources, and communication to bring distinct activities and services into a coherent system that serves the needs of children and their communities effectively and efficiently.

Conclusion

Improving nutrition and ECD is essential to protecting a country's human capital and economic productivity, both necessary prerequisites for a nation's development. The interaction between nutrition and ECD warrants integrated programming, and evidence suggests that integrated programming that addresses both a child's nutritional status and ECD is highly beneficial. Moreover, integrated nutrition and ECD interventions can have a greater impact on both nutrition and ECD outcomes than single-sector interventions and may also be more cost-effective. While there are many advantages, the infrastructure- and workload-related challenges of using a common provider or platform for delivery must also be considered. Nonetheless, future programs can seize the opportunity to integrate nutrition and ECD interventions that support children's growth and development during the critical first 1,000 days, giving children a promising start in life and the opportunity to reach their full potential.

References

[1] Black, R.E. et al. 2013. "Maternal and Child Undernutrition and Overweight in Low-Income and Middle-Income Countries." *Lancet*. Vol. 382(9890), 427–451.

[2] Grantham-McGregor, S. et al. 2007. "Developmental Potential in the First 5 Years for Children in Developing Countries." *Lancet*. Vol. 369(9555), pp. 60–70.

Walker, S. et al. 2007. "Child Development: Risk Factors for Adverse Outcomes in Developing Countries." *Lancet*. Vol. 369, pp. 145–157.

[3] Grantham-McGregor et al. 2007

[4] Prado, E.L. and Dewey, K.G. 2014. "Nutrition and Brain Development in Early Life." *Nutrition Reviews*. Vol. 72(4), pp. 267–284.

Wachs, T.D. et al. 2014. "Issues in the Timing of Integrated Early Interventions: Contributions from Nutrition, Neuroscience, and Psychological Research." *Annuals of the New York Academy for Sciences*. Vol. 1308, pp. 89–106.

[5] Yousafzai, A.K.; Rasheed, M.A.; and Bhutta, Z.A. 2012. "Annual Research Review: Improved Nutrition—A Pathway to Resilience." *Journal of Child Psychology and Psychiatry*. Vol. 54(4), pp. 367–377.

[6] World Health Organization (WHO)/Department of Child and Adolescent Health and Development. 1999. *A Critical Link: Interventions for Physical Growth and Psychological Development—A Review*. Geneva: WHO.

Yousafzai, Rasheed, and Bhutta 2012

[7] Yousafzai, Rasheed, and Bhutta 2012

[8] Prado and Dewey 2014

[9] Pitkin, R.M. 2007. "Folate and Neural Tube Defects." *American Journal of Clinical Nutrition*. Vol. 85 (supplement), pp. 285S–288S.

[10] UNICEF and WHO. 2004. *Low Birthweight: Country, Regional, and Global Estimates*. New York, NY: UNICEF.

[11] Black et al. 2013

[12] Walker et al. 2007

[13] Black et al. 2013

[14] Gardner, J.; Grantham-McGregor, S.M.; Himes, J.; and Chang, S. 1999. "Behaviour and Development of Stunted and Nonstunted Jamaican Children." *Journal of Child Psychology and Psychiatry*. Vol. 40(5), pp. 819–827.

[15] Zimmermann, M.B. et al. 2006. "Iodine Supplementation Improves Cognition in Iodine-Deficient Schoolchildren in Albania: A Randomized, Controlled, Double-Blind Study." *American Journal of Clinical Nutrition*. Vol. 83(1), pp. 108–114.

[16] WHO; UNICEF; and International Council for the Control of Iodine Deficiency Disorders. 2007. *Assessment of Iodine Deficiency Disorders and Monitoring Their Elimination*. 3rd ed. Geneva: WHO.

[17] Bleichrodt, N. and Born, M.P. 1994. *A Metaanalysis of Research on Iodine and Its Relationship to Cognitive Development: The Damaged Brain of Iodine Deficiency*. J. Stanbury. New York: Cognizant Communication Corporation, pp. 195–200.

Bougma, K. et al. 2013. "Iodine and Mental Development of Children 5 Years Old and Under: A Systematic Review and Meta-Analysis." *Nutrients*. Vol. 5(4), pp. 1384–1416.

Qian, M. et al. 2005. "The Effects of Iodine on Intelligence in Children: A Meta-Analysis of Studies Conducted in China." *Asia Pacific Journal of Clinical Nutrition*. Vol. 14(1), pp. 32–42.

[18] Lozoff, B. and Georgieff, M.K. 2006. "Iron Deficiency and Brain Development." *Seminars in Pediatric Neurology*. Vol. 13(3), pp. 158–165.

Prado and Dewey 2014

[19] Wachs et al. 2014

[20] Walker et al. 2007

Lozoff and Georgieff 2006

[21] Walker, S.P. et al. 2011. "Inequality in Early Childhood: Risk and Protective Factors for Early Child Development." *Lancet*. Vol. 378(9799), pp. 1325–1338.

Lozoff and Georgieff 2006

[22] Prado, E. and Dewey, K. 2012. "Nutrition and Brain Development in Early Life." Insight Technical Brief. Washington, DC: Alive & Thrive/FHI 360.

[23] Black et al. 2013

[24] Gardner, J.; Grantham-McGregor, S.M.; Himes, J.; and Chang, S. 1999. "Behaviour and Development of Stunted and Nonstunted Jamaican Children." *Journal of Child Psychology and Psychiatry*. Vol. 40(5), pp. 819–827.

Grantham-McGregor, S. and Baker-Henningham, H. 2005. "Review of the Evidence Linking Protein and Energy to Mental Development." *Public Health Nutrition*. Vol. 8(7A), pp. 1191–1201.

Grantham-McGregor, S. 1995. "A Review of Studies of the Effect of Severe Malnutrition on Mental Development." *The Journal of Nutrition*. Vol. 125(8 Supplement), pp. 2233S–2238S.

[25] Black et al. 2013

Martorell, R. et al. 2010. "Weight Gain in the First Two Years of Life Is an Important Predictor of Schooling Outcomes in Pooled Analyses from Five Birth Cohorts from Low- And Middle-Income Countries." *The Journal of Nutrition*. Vol. 140(2), pp. 348–354.

[26] Thomas, D. and Strauss, J. 1997. "Health and Wages: Evidence on Men and Women in Urban Brazil." *Journal of Econometrics*. Vol. 77, pp. 159–185.

Hoddinott, J. et al. 2008. "Effect of a Nutrition Intervention during Early Childhood on Economic Productivity in Guatemalan Adults." *Lancet*. Vol. 371(9610), pp. 411–416.

[27] Grantham-McGregor and Baker-Henningham 2005

Grantham-McGregor 1995

[28] Grantham-McGregor 1995

[29] Galler, J.R. et al. 2012a. "Infant Malnutrition Is Associated with Persisting Attention Deficits in Middle Adulthood." *The Journal of Nutrition*. Vol. 142, pp. 778–794.

Galler, J.R. et al. 2012b. "Socioeconomic Outcomes in Adults Malnourished in the First Year of Life: A 40-Year Study." *Pediatrics*. Vol. 130, pp. e1–e7.

[30] Ngure, F.M. et al. 2014. "Water, Sanitation, and Hygiene (WASH), Environmental Enteropathy, Nutrition, and Early Childhood Development: Making the Links." *Annuals of the New York Academy for Sciences*. Vol. 1308, pp. 118–128.

[31] Victora, C.G.; Barros, F.C.; Horta, B.L.; and Lima, R.C. 2005. "Breastfeeding and School Achievement in Brazilian Adolescents." *Acta Paediatrica*. Vol. 94, pp. 1656–1660.

Anderson, J.W. et al. 1999. "Breast-Feeding and Cognitive Development: A Meta-Analysis." *American Journal of Clinical Nutrition*. Vol. 70(4), 525–535.

Horta, B.L. and Victora, C.G. 2013. *Long-Term Effects of Breastfeeding: A Series of Systematic Reviews*. Geneva: WHO.

[32] Victora et al. 2015. "Association between Breastfeeding and Intelligence, Educational Attainment, and Income at 30 Years of Age: A Prospective Birth Cohort Study from Brazil." *The Lancet*. Vol. 3, pp. e199–205.

[33] Maluccio, J.A.; Hoddinott, J.; Berhman, J.R.; and Martorell, R. 2009. "The Impact of Improving Nutrition During Early Childhood on Education among Guatemalan Adults." *The Economic Journal*. Vol. 119(537), pp. 734–763.

Hoddinott et al. 2008

[34] Ashworth, A.; Khanum, S.; Jackson, A.; and Schofield, C. 2003. *Guidelines for the Inpatient Treatment of Severely Malnourished Children*. Geneva: WHO.

[35] Aboud, F.E. and Akhter, S. 2011. "A Cluster-Randomized Evaluation of a Responsive Stimulation and Feeding Intervention In Bangladesh." *Pediatrics*. Vol. 127; pp. e1191–e1197.

Grantham-McGregor, S.M.; Powell, C.A. et al. 1991. "Nutritional Supplementation, Psychosocial Stimulation, and Mental Development of Stunted Children: The Jamaican Study." *Lancet*. Vol. 338(8758): pp. 1–5.

Lozoff, B.; Smith, J.B.; Clark, K.M. et al. 2010. "Home Intervention Improves Cognitive and Social-Emotional Scores in Iron-Deficient Anemic Infants." *Pediatrics*. Vol. 126: pp. e884–e894.

Morris, J.; Berrino, A.; Okema, L. et al. 2012. "Does Combining Infant Stimulation with Emergency Feeding Improve Psychosocial Outcomes for Displaced Mothers And Babies? A Controlled Evaluation From Northern Uganda." *American Journal of Orthopsychiatry*. Vol. 82(3): pp. 349–357.

Nahar, B.; Hossain, M.I.; Hamadani, J.D. et al. 2012. "Effects of a Community-Based Approach of Food and Psychosocial Stimulation on Growth and Development of Severely Malnourished Children in Bangladesh: A Randomized Trial." *European Journal of Clinical Nutrition*. Vol. 66: pp. 701–709.

Vazir, S.; Engle, P.; Balakrishna, N. et al. 2013. "Cluster-Randomized Trial on Complementary and Responsive Feeding Education to Caregivers Found Improved Dietary Intake, Growth, and Development among Rural Indian Toddlers." *Maternal & Child Nutrition*. Vol. 9; pp. 99–117.

Yousafzai, A.K.; Rasheed, M.A.; Rizvi, A. et al. 2014. "Effect of Integrated Responsive Stimulation and Nutrition Interventions in the Lady Health Worker Programme In Pakistan on Child Development, Growth and Health Outcomes: A Cluster-Randomised Factorial Effectiveness Trial." *Lancet*. Vol. 384(9950): pp. 1282–93.

[36] Gowani, S. et al. 2014. "Cost Effectiveness of Responsive Stimulation and Nutrition Interventions on Early Child Development Outcomes in Pakistan." *Annals of the New York Academy of Sciences*. Vol. 1308(1), pp. 149–161.

www.fantaproject.org

@FANTAproject

Contact Information:
Food and Nutrition Technical Assistance III Project (FANTA)
FHI 360
1825 Connecticut Avenue, NW
Washington, DC 20009-5721
Tel: 202-884-8000
Email: fantamail@fhi360.org

Recommended Citation: Maalouf-Manasseh, Z; Oot, L; Sethuraman, K. 2015. *Giving Children the Best Start in Life: Integrating Nutrition and Early Childhood Development within the First 1,000 Days*. Washington, DC: FHI 360/FANTA.

This technical brief is made possible by the generous support of the American people through the support of the Office of Health, Infectious Diseases, and Nutrition, Bureau for Global Health, U.S. Agency for International Development (USAID) under terms of Cooperative Agreement No. AID-OAA-A-12-00005, through the Food and Nutrition Technical Assistance III Project (FANTA), managed by FHI 360.