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## Iron and Zinc Intake From Complementary Foods: Some Issues From Pakistan

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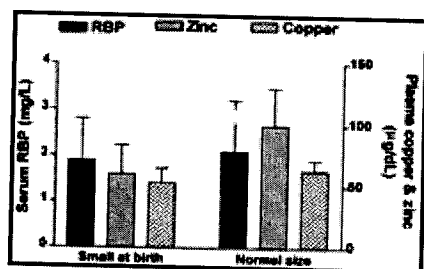
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The recent WHO/UNICEF review of complementary feeding in developing countries recognized that iron and zinc requirements may be difficult to meet from nonfortified complementary foods.<sup>1</sup> This may be compounded by iron and zinc deficiency in mothers,<sup>2</sup> predisposing to deficiency in young and especially low birth weight infants.<sup>3</sup> Diarrheal illnesses and helminthiasis may increase micronutrient requirements. [Figure 1](#) shows plasma levels for retinol-binding protein and zinc among young infants presenting with diarrhea in Karachi, Pakistan, indicating that plasma zinc concentration was significantly lower among those who were considered "small" at birth.



**Fig. 1.** Plasma levels for retinol-binding protein and zinc among young infants presenting with diarrhea in Karachi, Pakistan.

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Although low rates of exclusive breastfeeding are a major predisposing factor to high infant morbidity rates, delayed introduction of suitable complementary foods, sometimes to beyond 12 months of age, is another contributory factor to malnutrition.<sup>3</sup> [Table 1](#) summarizes complementary feeding practices in Pakistan; complementary foods were often introduced late and in too small amounts.<sup>4-23</sup> The majority of

culturally acceptable and affordable complementary foods are plant- and cereal-based with relatively high phytate content which decreases iron and zinc bioavailability.<sup>24</sup> [Tables 2](#) and [3](#) indicate the iron, zinc, and phytate content of the complementary foods most commonly consumed by young infants in Pakistan, as well as the estimated daily intakes and absorption from these diets.<sup>25-29</sup> The intakes were barely sufficient to meet requirements for growth, and replenishment of depleted body stores. Various dietary strategies are available eg, improved bioavailability of iron and zinc by fermentation and malting of cereal-based staples, adding vitamin C to increase iron uptake, fortification of complementary foods, and maternal/infant supplementation. These strategies require evaluation in large-scale effectiveness studies.

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**TABLE 1**  
Complementary Feeding in Pakistan: A Country Review of Available Information

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**TABLE 2**  
Iron and Zinc Content of Complementary Foods in Pakistani Infants (6-12 Months of Age)

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**TABLE 3**  
Average Daily Intake and Estimated Absorption of Iron and Zinc (mg/day) From Commonly Consumed Complementary Foods by Young Infants (6-12 Months Old) in Pakistan

### Research Issues for Improving Iron and Zinc Intake From Complementary Foods

The following merit further effort:

1. The effect of maternal iron and zinc supplementation in pregnancy on micronutrient needs of young infants.
2. An evaluation of exclusive breastfeeding for 6 months on micronutrient, especially iron, status in diverse populations, particularly among those with high rates of maternal malnutrition and low birth weight.<sup>30</sup>
3. Qualitative studies of diet preferences for feeding young infants in traditional populations.
4. Effectiveness studies to assess impact of soaking, germination, or fermentation of foods on bioavailability of iron and zinc from home-available diets.
5. Impact of improving intake of citrus fruits and fermented milk (yogurt) on iron and zinc status in infancy.
6. Fortification of dietary staples with iron or zinc (eg, iron supplementation of wheat flour, low-phytate maize). Alternatively, production of genetically modified staples eg, rices with improved micronutrient content and bioavailability.

- Evaluation of multiple micronutrient supplements in developing countries in comparison with balanced food-based approaches such as with multimixes.

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