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ORIGINAL RESEARCH

Serum Micronutrients in Helminth-infected Pregnant Women and Children: Suggestions for Differential Supplementation During Anti-helminthic Treatment

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Abstract

BACKGROUND The prevalence of helminth infection, which is known to affect nutritional status of the host, varies with age. The complex interplay between ages, nutrient requirements, and infection necessitated the need to recommend micronutrient supplementation during helminth infection among different age groups.

OBJECTIVE The aim of this study was to determine the pattern of alteration in selected micronutrients in pregnant women and preschool- and school-aged children with helminth infection.

METHODS We screened 245 pregnant women and 349 children for helminth infection. Of these, 17 (6.9%) pregnant women and 102 (29.2%) children (42 preschool- and 60 school-aged) had helminth infection. Only *Ascaris lumbricoides* was found in pregnant women, whereas the children had *A lumbricoides*, hookworm, *Fasciola hepatica*, and *Trichuris trichiura* infections. The helminth-infected (HI) pregnant women, preschool-aged children, and school-aged children were matched with helminth-negative (HN) pregnant women (n = 21), preschool-aged children (n = 42), and school-aged children (n = 50) who served as controls. Venous blood samples were obtained and analyzed for iron (Fe), zinc (Zn), selenium (Se), and vitamins A and C. Statistical analysis was done using Student's *t* test, and $P < 0.05$ was considered statistically significant.

FINDINGS Serum levels of Fe, Zn, and Se were significantly lower in HI pregnant women than HN pregnant women. In preschool-aged children, serum levels of Fe, Zn, and vitamin A were significantly lower in the HI than in the HN group. Similarly, serum levels of Zn and vitamin A were significantly lower in HI school-aged children than in the HN group. However, serum levels of Se were significantly higher in HI children (both age groups) than in the corresponding HN group.

CONCLUSION Helminth infection alters different types of micronutrients in children and pregnant women. Results from the present study therefore suggest monitoring Fe, Zn, or vitamin A supplementation with an anti-helminthic regimen.

KEY WORDS children, essential minerals, helminth infection, pregnant women, supplementation, vitamins

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INTRODUCTION

Malnutrition and infections are common health problems in developing countries. Although the conditions can exist independently, they are intricately associated.[1] About 826 million people worldwide have been reported to be undernourished.[2] Similarly, about 2 billion people worldwide are affected by deficiency of micronutrients such as vitamins A, C, and E and essential minerals such as zinc (Zn) and iron (Fe). This undernourishment has been identified as the primary cause of immunodeficiency affecting infants, children, adolescents, pregnant women, and the elderly.[1,3]

Soil-transmitted helminth (geohelminth) infections are common chronic infections.[4,5] They are transmitted by eggs present in human feces that contaminate soil, especially in areas where sanitation is poor. The main species that infect people are the roundworm (*Ascaris lumbricoides*), whipworm (*Trichuris trichiura*), and hookworms (*Necator americanus* and *Ancylostoma duodenale*).[6]

The 2010 Global Burden of Disease Study estimated that more than 5.2 million disability-adjusted life-years are because of helminth infection, and infection affects mainly children because of their increased behavioral risk, frequent outdoor exposure, and poor personal hygiene. Based on this information, the World Health Organization resolved that children at risk for morbidity from helminth infection are to be treated.[7-9]

Helminth infection is a significant burden in pregnancy.[10] Annually, hookworm alone infects about 44 million pregnant women.[11] Reports have shown that pregnant women are more susceptible to helminth infections and usually suffer from protein-energy malnutrition and deficiencies of micronutrients, such as Fe and Zn.[12,13] This helminth-induced chronic malnutrition increases the maternal risk for future parasitic infections and adverse pregnancy outcomes such as premature delivery, low birthweight, poor growth, and infant immune system downregulation.[14-16]

Diverse associations have been reported between helminth infections and micronutrient deficiencies. Poor intake of vitamin A, Fe, and Zn predisposes individuals to helminth infections, which can aggravate nutritional deficiencies, thereby helping helminth survival.[17,18] Helminths impair nutritional status in multiple ways. They feed on host tissues (including blood), thereby causing loss of iron and protein. They also increase malabsorption of nutrients and may compete for vitamin A in the intestine. Furthermore, some soil-transmitted helminths cause loss of appetite, whereas some such as *T trichiura* can cause diarrhea and dysentery.[6]

Existing evidence suggests that the addition of supplements to deworming programs might offer some benefits[5]; however, these evidences are insufficient to enable any clear or reliable suggestions to be made. It is even more difficult in developing countries (where micronutrients and helminth infections are common), as there are a limited set of clear treatment and supplementation recommendations that focus on individual micronutrients.[3] Additionally, there is a dearth of information on the pattern of micronutrient deficiency in vulnerable groups such as infants, children, and pregnant women who are more at risk for both malnutrition and helminth infection. The present study was carried out to determine the pattern of alteration in selected micronutrients in pregnant women and children with helminth infection.

MATERIALS AND METHODS

Participants. We screened 245 pregnant women who were in their third trimester and 349 children for helminth infection. After screening, 17 (6.9%) pregnant women and 102 (29.2%) children were diagnosed with helminth infection. They were matched with 21 pregnant women and 92 helminth-negative (HN) children who served as controls. The children included 42 helminth-infected (HI) preschool-aged children (matched with 42 HN) and 60 HI school-aged children (matched with 50 HN). The pregnant women were recruited from the Adeoyo Maternity Hospital, Yemetu, Ibadan; St. Mary's Catholic Hospital, Eleta, Ibadan; and Our Lady of Apostle Catholic Hospital, Oluyoro, Ibadan, and the children were recruited from selected semi-urban areas: Gbada Alabata and Laleye communities of Ibadan.

Informed Consent and Ethical Approval. Participants were enrolled into the study after providing a written informed consent or assent from each of them or their parents. Ethical approvals were obtained from the Oyo State Ministry of Health and the University of Ibadan/University College Hospital Joint Ethics Committee.

Data and Blood Sample Collection. Demographic data were obtained using a short-structured questionnaire. About 5 mL of venous blood was obtained from each study participant and dispensed into plain bottles to obtain sera, which were stored at -20°C until analyzed.