

Micronutrient deficiency — an underlying cause of morbidity and mortality

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“Micronutrients” is the collective term applied to essential vitamins and trace minerals. Inadequate intake of them is now recognized as an important contributor to the global burden of disease through increased rates of illness and death from infectious diseases, and of disability such as mental impairment. Severe micronutrient deficiency causes clinical manifestations in humans that are also demonstrable in animal experiments using selectively restricted diets. Mild to moderate deficiencies also have important consequences for human health.

Deficiencies of some micronutrients are highly prevalent in low- and middle-income countries and may affect the risk of illness or death from infectious diseases by reducing immune and non-immune defences and by compromising normal physiology or development. While deficiencies in any of the essential micronutrients can result in health problems, there are a few that are particularly important.

Iodine deficiency in pregnancy has long been linked to cretinism and possible fetal wastage. Recognition of this has led to highly effective programmes for making iodized salt available in iodine-deficient areas (1). As a result, while more than two billion people live in areas that used to be iodine-deficient, it is estimated that the current burden of disease caused by iodine deficiency is only 0.2% of the global total as measured in lost disability-adjusted life years (DALYs) (2).

By contrast, iron deficiency also affects about two billion people, but interventions have been less successful in controlling it. Recent estimates find iron deficiency anaemia is responsible for a fifth of early neonatal mortality and a tenth of maternal mortality. It also reduces cognitive development and work performance. Thus, about 800 000 deaths and 2.4% of global DALYs have been attributed to iron deficiency (2, 3).

Vitamin A deficiency is now recognized not only to harm the eyes but to increase childhood and maternal mortality. Globally, 21% of children have vitamin A deficiency and suffer increased rates of death from diarrhoea, measles and malaria. About 800 000 deaths in children and women of

reproductive age are attributable to vitamin A deficiency which, along with the direct effects on eye disease, account for 1.8% of global DALYs (2, 3). This appears to be lower than previous estimates (4), possibly because of vitamin A supplementation or food fortification programmes during the last decade.

The consequences of severe human zinc deficiency have been known since the 1960s, but only more recently have the effects of milder degrees of zinc deficiency, which are highly prevalent, been recognized. Trials have shown that zinc supplementation results in improved growth in children, lower rates of diarrhoea, malaria, and pneumonia, and reduced child mortality (5, 6). In total about 800 000 child deaths per year are attributable to zinc deficiency. These deaths and increased rates of infectious diseases result in 1.9% of global DALYs being attributed to zinc deficiency (2, 3).

It is important to put these disease burden estimates in perspective. According to WHO there are 10.8 million child deaths globally a year. The number attributed to zinc, vitamin A, and iron deficiencies is 2 082 000, or 19% of the total. Malaria, for comparison, causes less than one million child deaths a year (2). It also causes 2.7% of global DALYs, compared to the roughly 6% caused by iron, vitamin A and zinc deficiencies (2, 3).

In low- and middle-income settings there are commonly deficiencies of several micronutrients in the same population, so it is important to find out whether their risk relationships to the burden of disease are independent or overlapping. At this point, it appears that the effects of iron, vitamin A and zinc deficiencies are largely independent. However, it is also important to understand the interactions of the essential micronutrients. When provided in supplements, vitamin A may enhance iron nutrition and zinc may increase vitamin A absorption. On the other hand, iron and zinc may interfere with the absorption of each other. Thus, it should not be assumed that providing supplements with multiple micronutrients

will have the same benefits as supplements with single micronutrients.

Public health interventions aimed at preventing or correcting micronutrient deficiencies can be expected to reduce both mortality and disability substantially, especially in children. To achieve the maximum benefits, such interventions need to be done on the appropriate scale in deficient populations. Recent estimates indicate that fortification or supplementation with iron, vitamin A and zinc are among the most cost-effective interventions available (2), even in areas that are very poor or have high rates of HIV infection, as in much of sub-Saharan Africa.

Interventions to control these deficiencies can have broad benefits across a range of important infectious diseases, the prevention or treatment of which by other means has proved to be difficult in many settings. Furthermore, the reduction of illness and of disabilities such as cognitive impairment and decreased work capacity can have a strong positive effect on social and economic development in low- and middle-income countries. Public health interventions that can prevent or correct these micronutrient deficiencies merit the highest priority for national programmes and donor investment. ■

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