

2 How Micronutrients Affect Human Health

Chapter 2 briefly describes the benefits of:

- ✓ vitamin A
- ✓ iodine
- ✓ iron
- ✓ zinc
- ✓ folate

SINCE THE EARLY 20TH CENTURY, scientific and technical discoveries have led to improved health and prosperity for those who have been able to benefit from them. One is the discovery that food contains important vitamins and minerals, and that a deficiency in some of these can cause a range of health and developmental problems.

As research progresses and micronutrient interventions expand, evidence continues to emerge of their impressive impact on survival and development. Remarkably powerful for the tiny levels required, micronutrients support an array of critical biological functions including development of the brain and the nervous system, skeletal development and growth, immune function, and eye function.⁶

Five micronutrients stand apart, both because of their importance and the numbers of people who are deficient in them. These micronutrients have become the focus of highly successful programmes that have reached millions of children and adults. Table 2 shows just how much difference they make.

VITAMIN A: Vital for survival and sight

Thanks to its powerful ability to boost the immune system, vitamin A is a critical micronutrient for the survival and physical health of children exposed to disease.

This significant contribution to child health was first explored in the mid 1980s in Indonesia. A study showed remarkable reductions in deaths of children under five years of age when supplemented with vitamin A.⁷ Subsequent research showed that, where a population is at risk of vitamin A deficiency, supplementation reduces mortality in children between six months and five years of age by an average of 23%.⁸

In preventing blindness in childhood, few factors are as important as levels of vitamin A. Also known as retinol, it is indispensable to the retina's ability to adapt to dark lighting conditions. People without this ability suffer from night blindness, which is the inability to see shapes in low light.

Vitamin A also promotes healthy eye surface membranes, helping prevent scarring of the cornea. This makes adequate vitamin A vital for the prevention of a widespread condition called xerophthalmia, a serious eye disorder that is the primary cause of sight loss among the five million visually disabled children in the world.⁹ Studies have shown reductions of up to 70% in the prevalence of xerophthalmia in children after sustained vitamin A supplementation.¹⁰



Young children in Gonaives, Haiti. Iodine is one of the most important elements required by a developing fetus because of its effect on brain development.

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Table 2. Micronutrients: at the core of survival, development and health

MICRONUTRIENT	IMPACT THROUGH PROGRAMMES
VITAMIN A	<ul style="list-style-type: none"> • 23% reduction in under-five mortality rates • 70% reduction in childhood blindness
IODINE	<ul style="list-style-type: none"> • 13-point increase in IQ
IRON	<ul style="list-style-type: none"> • 20% reduction in maternal mortality
ZINC	<ul style="list-style-type: none"> • 6% reduction in child mortality • 27% reduction of diarrhoea incidence in children
FOLATE	<ul style="list-style-type: none"> • 50% reduction in severe neural tube birth defects, such as spina bifida

IODINE: Fundamental for the intelligence of the next generation

Iodine is one of the most important elements required by a developing fetus because of its effect on brain development. While the link between iodine and goitre – the most visible effect of severe iodine deficiency – has been known since the early 20th century,¹¹ it was not until the 1970s and 1980s that the links between iodine and fetal cognitive development began to be understood.¹²

When the intake of iodine is increased through the consumption of iodized salt, the results are impressive. In communities where iodine intake is sufficient, average IQ is shown to be on average 13 points higher than in iodine-deficient communities.¹³

IRON: Essential for maternal and fetal health, learning, and productivity

Iron is an essential mineral for human development and function. It helps produce haemoglobin, the oxygen-carrying component of red blood cells. As these cells carry oxygen to the muscles and brain, iron is critical for motor and cognitive development in childhood, and for physical activity in all humans. If iron levels are too low, the body makes too few red blood cells, and individuals develop anaemia.

Iron is also critical to the health of a pregnant mother and her unborn child. A woman needs more iron during

pregnancy because the fetus and placenta both need additional iron. Iron supplementation during pregnancy lowers the risk of maternal mortality due to haemorrhage, the cause of more than 130,000 maternal deaths each year.¹⁴ Supplementation also helps to lower the risks of premature birth and low birth weight.

Eliminating anaemia in adults can result in productivity increases of up to 17%. These increases are equivalent to 2% of GDP in the worst affected countries.

Studies have shown that infants with anaemia caused by iron deficiency have lower mental scores and lower motor scores than infants without anaemia.¹⁵ Ensuring sufficient iron levels in the first months and years of life is, therefore, critical.

ZINC: Fights diarrhoea and infections and promotes growth

Zinc promotes immunity, resistance to infection, and the growth and development of the nervous system. It also promotes the production of antibodies against intestinal pathogens.¹⁶

Diarrhoeal disease causes 18% of deaths in children under five years of age.¹⁷ Studies have shown that zinc supplementation, given with oral rehydration therapy, can



Children play in a village in Nepal. Zinc supplements, when used in addition to oral rehydration, reduce the duration of persistent diarrhoea by approximately 27%. © MI

reduce the incidence of diarrhoea in children by 27%.¹⁸ It can also reduce the incidence of acute lower respiratory tract infections by 15%.¹⁹ A 10–14-day course of zinc supplementation has also been shown to increase children's resistance to further episodes of diarrhoea and other disease for two to three months following supplementation.²⁰

FOLATE: Essential for healthy fetal development

In the earliest days of fetal development, folate is one of the most important micronutrients for the emerging human

being. Necessary for the production of new cells, folate promotes the healthy early development of the spine, spinal cord, skull and brain.

Debilitating and sometimes deadly neural tube defects – including spina bifida – occur three to four weeks after conception if part of the neural tube does not close as it is developing. Ensuring sufficient levels of folate in women prior to conception has been shown to reduce by 50% the number of cases of neural tube defects.²¹