

Helpdesk Report: Studies on Undernutrition and Malaria

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Query: To what extent is undernutrition (including micronutrient deficiency, particularly Vitamin A and Zinc deficiency) a risk factor for malaria and the extent to which nutritional interventions can reduce incidence, duration and severity of malaria episodes.

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1. Introduction

A basic search brought up approximately 100 articles from the past 10 years directly related to malaria and nutrition. These addressed different stages of the lifecycle, both vivax and falciparum malaria, and varying nutritional interventions. Of these, the 5-10 most-cited trials and reviews relating to each of general undernutrition, micronutrient deficiency, vitamin A, or zinc were selected for review and the ten most relevant are included.

2. Undernutrition as a potential risk factor for Malaria

Undernutrition as an underlying cause of child deaths associated with diarrhea, pneumonia, malaria, and measles

Caulfield, L.E., de Onis, M., & Blossner M., Black RE, 2004, *Am J Clin Nutr*, 80:193-198

Caulfield et al (2004) analyse the association of undernutrition (weight-for-age) with child malaria deaths and have been cited 214 times. Authors found that 57% of malaria deaths in under-five children in the three studies they pooled were attributable to undernutrition. This article provides a good overview.

Nutritional modulation of malaria morbidity and mortality

Shankar, A.H., 2000, *J Infect Dis* 182 Suppl 1:S37-53.

Shankar (2000) reviews the evidence on the associations of protein-energy malnutrition with malaria mortality and morbidity and the potential impact of micronutrient supplementation on malaria incidence and severity. It has been cited 118 times. It provides detail on evidence for vitamin A, zinc, iron, folate, riboflavin, thiamine and pyridoxine, vitamin E and other antioxidants.

Undernutrition as an underlying cause of malaria morbidity and mortality in children less than five years old

Caulfield L.E., Richard S.A., Black R.E., *Am J Trop Med Hyg* 2004, 71:55-63.

Caulfield et al (2004b) review the association between underweight and various nutrient deficiencies with malaria morbidity and mortality in under-five children. It has been cited 80 times. It provides good general information similar to, but somewhat more recent than Shankar 2000.

3. Micronutrient supplementation as a potential intervention

Effects of routine prophylactic supplementation with iron and folic acid on admission to hospital and mortality in preschool children in a high malaria transmission setting: community-based, randomised, placebo-controlled trial

Sazawal S. et al., 2006, *Lancet* **367**:133-143.

Sazawal et al (2006) conducted a randomised placebo-controlled trial of the effect of iron/folic acid supplementation on mortality and hospital admission among preschool children in Zanzibar. It has been cited 206 times. They found that children receiving supplements were 12% more likely to die or need treatment than were controls, thus demonstrating that routine prophylaxis is not advisable in all contexts.

Zinc and iron supplementation and malaria, diarrhea, and respiratory infections in children in the Peruvian Amazon

Richard S.A. et al, 2006, *Am J Trop Med Hyg* 2006, **75**:126-132.

Richard et al (2006) conducted a randomised placebo-controlled trial of zinc and iron supplementation to reduce mortality among Peruvian Amazon children. It has been cited 78 times. Authors found no protective effect of zinc supplementation against health centre visits for vivax malaria episodes but a 38% reduction in visits for falciparum episodes. This was one of the first studies to find an exacerbative effect of iron supplementation on falciparum malaria, while iron/zinc had a protective effect on vivax malaria in children under five. Study findings were different from those of Sazawal et al and provide insight into the complex interaction of supplementation and infectious disease in children.

Major reduction of malaria morbidity with combined vitamin A and zinc supplementation in young children in Burkina Faso: a randomized double blind trial

Zeba A.N. et al, 2008, *Nutr J* 2008, 7:7.

Zeba et al (2008) conducted a randomised double-blind placebo-controlled trial of the effect of vitamin A (VA)/zinc supplementation in children 6-72 months in Burkina Faso. This has been cited 12 times, more than most articles of its age on this topic. Authors found a 34% reduction in malaria prevalence and 22% fewer fever episodes in the intervention group compared to controls.

4. Vitamin A supplementation as a potential intervention

Effect of vitamin A supplementation on morbidity due to Plasmodium falciparum in young children in Papua New Guinea: a randomised trial

Shankar A.H. et al., 1999, *Lancet*, 354:203-209.

Shankar et al (1999) conducted a randomised double-blind placebo-controlled trial of VA supplementation to reduce malaria morbidity among young children in Papua New Guinea that has been cited 134 times. Authors found 30% fewer falciparum malaria febrile episodes in the VA intervention group than in controls.

Malaria and vitamin A deficiency in African children: a vicious circle?

Sanjoaquin M.A. & Molyneux M.E., 2009, *Malar J* 2009, 8:134.

SanJoaquin & Molyneux (2009) review the evidence on malaria and VA deficiency in African children. This has been cited twice, but provides a good overview of current knowledge and the second author is one of the foremost experts on child malaria in Africa. Authors conclude that VA supplementation is a good strategy for children in malaria-endemic regions.

5. Zinc supplementation as a potential intervention

Zinc deficiency, infectious disease and mortality in the developing world

Black R.E., 2003, *J Nutr*, 133:1485S-1489S.

Black (2003) reviews zinc supplementation, including secondary analysis of three studies on its association with malaria incidence. It was cited 120 times. The author found that while evidence was not conclusive, zinc supplementation appeared to reduce health facility visits for clinical malaria by about one-third.

Effect of zinc supplementation on mortality in children aged 1-48 months: a community-based randomised placebo-controlled trial

Sazawal S. et al., 2007, *Lancet*, 369:927-934.

Sazawal et al (2007) conducted a randomised double-blind controlled trial of zinc supplementation on mortality (including malaria mortality) among children aged 1-48 mo and has been cited 46 times. Authors found a non-significant 7% reduction in all-cause mortality most of which was attributable to malaria in boys and those over 12 months old. Gender and age differences may be due to chance, but do support findings in other zinc supplementation studies. More research is needed on dosage, and age and gender differences.

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