

WHY FORTIFY WITH ZINC?

by Sarah Zimmerman, Food Fortification Initiative (FFI)

Figure 2: In the Democratic Republic of Congo, 54 percent of the population is at risk of inadequate zinc intake - higher than in other country. Photo by CIFOR@Flickr Creative Commons.

For chemists, zinc is a transition metal represented by the letters ‘Zn’ on the periodic table. For nutritionists, zinc is an essential mineral required for healthy immune systems and normal growth. For millers, zinc is a nutrient that can be added to flour or rice to improve their customers’ nutrition.

Infants and children need zinc for normal growth. Children who are too short for their age are considered stunted. As adults, they often remain shorter than their peers, and this can limit their work productivity. Pregnant women who are stunted can also have difficult deliveries.

In a paper published in 2012, researchers used information on stunting prevalence and dietary patterns to estimate zinc nutrition. Their conclusion was that 17 percent of the global population is at risk of inadequate zinc intake. While people only need small amounts of zinc, the World Health Organization (WHO) estimates that “worldwide, zinc deficiency is responsible for approximately 16 percent of lower respiratory tract infections, 18 percent of malaria and 10 percent of diarrhoeal disease.”

A study published in *The Lancet Infectious Diseases* in June 2017 noted that diarrhea remains a leading cause of death globally. The study estimated that 1.31 million people died from diarrhea in 2015, including 499,000 children under age five. While unsafe water and unsafe sanitation remain the leading risk factors, vitamin A and zinc deficiencies contribute to diarrhea.

Zinc is often associated with protein in foods. Thus, red meat, poultry, and seafood are good sources of zinc. This means that vegetarians and people who cannot afford to purchase meat are at higher risk of zinc deficiency. In addition, the human body has no mechanism to store zinc, so a daily supply is needed. To increase the population’s zinc intake, 34 countries include zinc in their standards for wheat flour, maize flour, and/or rice fortification,

according to the Food Fortification Initiative (FFI).

Cameroon, Fiji, and China

Fortifying with zinc has improved people’s zinc status around the world. In Cameroon, researchers evaluated people’s nutritional status two years before and one year after wheat flour fortification was implemented. After fortification, they found improvements in iron, zinc, folate, and vitamin B12 status among women and children in urban areas, according to a study recently published in *The Journal of Nutrition*. Maternal anemia prevalence was also significantly lower after fortification.

In Fiji, a national mandate requires flour to be fortified with zinc, iron, and folic acid, niacin, riboflavin, and thiamin. A report from the National Food and Nutrition Centre in Fiji indicates that before fortification, 39 percent of women of childbearing age had zinc deficiency. After fortification was initiated, zinc deficiency among this population was zero.

A three-year project in China showed that fortifying wheat flour with zinc increased zinc levels in blood. Researchers provided fortified flour to 4,700 rural adult women and unfortified flour to 2,750 rural adult women. The fortified flour included zinc as well as iron, vitamin A, and the following B vitamins: folic acid, thiamine, riboflavin, and niacin. Blood samples were taken annually. Women who received fortified flour had increased amounts of zinc in their blood samples each year, while the women who received unfortified flour showed no change in the blood zinc levels.

The Cameroon and Fiji national programmes as well as the China research project use zinc oxide for fortification. Annette Bütter, Technical Applications Manager for Flour Fortification at Mühlenchemie, said this is the most common zinc compound for flour fortification because it has the highest zinc content of all compounds and is usually the lowest price. Zinc sulfate, which is water soluble, is sometimes used in cereal formulations.

The China research project and the Fiji national programme both used 25 parts zinc oxide per million parts flour, which is the same as 25 milligrams zinc per kilogram flour. This is slightly lower than WHO recommendations for fortifying wheat flour with zinc. The WHO recommendations range from 30 to 95 parts per million, depending on the amount of wheat flour available for human consumption in the country. The Cameroon standard calls for 95 milligrams of zinc oxide per million parts flour. For maize flour, the WHO recommendations for zinc range from 40 to 100 parts per million, also based on the amount of maize flour available for human consumption.

Fibre and phytates in plant-based foods inhibit the body's ability to absorb zinc. High extraction flour retains more of wheat's natural fiber and phytate content than low extraction flour. Consequently, the WHO recommended levels of zinc for high extraction wheat flour range from 70 to 100 parts per million.

WHO has not yet published recommendations for rice fortification. Legislation in Panama and Nicaragua calls for fortifying rice with zinc at 25 parts per million. Costa Rica fortifies rice with zinc at 7.5 parts per million.

In Africa, a study of fortification's effect on food's sensory properties used wheat flour that was fortified with zinc at 55 parts per million; maize flour was fortified with zinc at 30 parts per million. Researchers reported that fortification did not lead to changes in baking or cooking properties. Another study in Senegal showed that fortifying flour with zinc had no adverse effect on bread made from the flour. A similar study in Asia

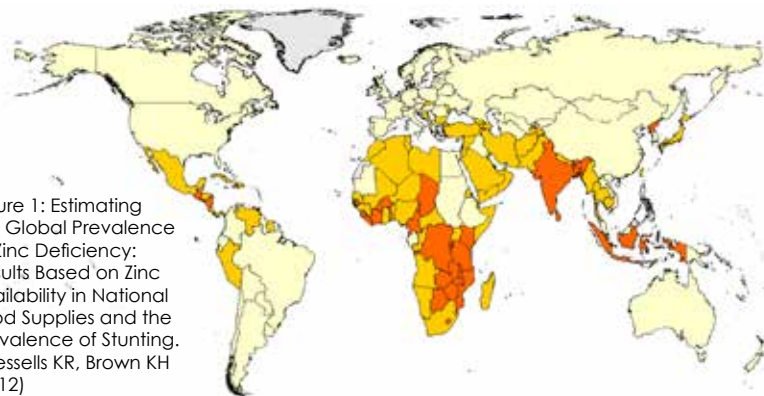


Figure 1: Estimating the Global Prevalence of Zinc Deficiency: Results Based on Zinc Availability in National Food Supplies and the Prevalence of Stunting. (Wessells KR, Brown KH (2012))



used wheat flour that had been fortified with zinc at 55 parts per million. It showed minimal differences in processing and organoleptic qualities between fortified and unfortified products, and all differences were acceptable.

Mühlenchemie has also studied the rheological properties of fortified wheat flour. No differences were noted when flour was fortified with zinc oxide up to 60 parts per million. Slight effects were noted at 80 parts per million. Strong effects were noted at 120 parts per million, which is higher than any of the WHO recommendations for wheat or maize flour.

The percent of each country's population that is at risk for inadequate zinc intake is indicated in the country profiles on FFI's website. If it is greater than 25 percent, it is considered an elevated public health concern. In those countries, millers can be part of the solution to a public health problem by fortifying their products with zinc. ☹