UC SANTA BARBARA

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# Food fortification prevents 7 billion nutrient gaps annually — but could triple its impact

Fortifying staple foods with essential vitamins and minerals is a cheap and effective way to ensure that people have access to nutrients that may be lacking in their normal diets. These efforts have countered debilitating deficiencies that lead to conditions like rickets and pellagra, and have increased health and wellbeing around the globe.

A new study in The Lancet Global Health provides the first comprehensive global analysis of the impact of current food fortification programs — both the health benefits and costs. An international team of researchers found that large-scale food fortification programs currently prevent around 7 billion cases of micronutrient inadequacies worldwide each year. And the cost: a mere 18 cents per person.

“Our study shows that large-scale food fortification is a cost-effective intervention for preventing inadequate micronutrient intakes,” said co-lead author Christopher Free, a research professor at UC Santa Barbara. “And expanding food fortification to include more countries and foods could prevent billions more at low additional costs.”

## Getting your vitamins and minerals

Micronutrient inadequacies affect billions globally and are linked to poor health, low immunity, increased risk to diseases and poor cognitive development. The research further reveals that improving and expanding these programs could triple the impact to prevent 25 billion cases of micronutrient inadequacy annually. The large figure is due, in part, to the fact that a person can have inadequacies in more than one micronutrient. The study was led by researchers at the Global Alliance for Improved Nutrition (GAIN) with collaborators from the University of California, World Bank and Tufts University.

Food fortification is one of the most cost-effective public health interventions available. “Salt iodization alone prevents 3.3 billion iodine inadequacies each year — reducing global iodine inadequacy by 89%,” said co-author Florencia Vasta, lead of large-scale food fortification at GAIN. “But we’re also leaving major gains on the table. With targeted improvements, we could reach billions more people.”

The researchers modeled the impact of fortification across 185 countries, covering 99.3% of the global population, and examined six scenarios ranging from no fortification to optimized global programs. The team pulled data from the Global Dietary Database to describe the average daily nutrient intakes based on age and sex. They then used data from household dietary surveys, assembled in previous research, to describe the variability of daily nutrient intakes across the same groups.

The authors used data from the Global Fortification Data Exchange to identify countries that fortify foods and pinpoint which foods they fortify, with which nutrients, and by how much. They also looked at the level of compliance by industrial food processors in each country.

With data in hand, the authors used a straightforward mathematical model to estimate inadequate intakes for 13 micronutrients. They simply compared the distribution of nutrient intakes with the amount needed to meet requirements. The result was a lay of the land under current circumstances.

## A successful intervention

They found that existing programs prevent 7 billion people from receiving inadequate micronutrients every year at a global cost of $1.06 billion ($0.18 per person). Iodine fortification of salt accounts for nearly half of all benefits, followed by

iron fortification of flour. The team calculated implementation costs across five fortified foods — wheat flour, maize flour, rice, oil and salt — and posted their data and analysis code online.

Despite the success of current programs, an estimated 38.6 billion micronutrient inadequacies persist worldwide — driven by poor diet quality, suboptimal fortification standards, low industry compliance and limited program coverage in some regions. The curiously large number reflects the fact that some people have inadequacies in more than one micronutrient, contributing to the global count multiple times, Free explained.

This means there's untapped potential. The study identified three priority actions that could dramatically expand impact. Improving compliance with existing standards to 90% could prevent an additional 6.1 billion inadequacies at a cost of $0.23 per person annually. Meanwhile, aligning national standards with guidelines from the World Health Organization while improving compliance could prevent 10.3 billion additional inadequacies at $0.63 per person. Expanding programs to high-need countries with appropriate food vehicles — combined with improved standards and compliance — could prevent 17.7 billion additional inadequacies at $1.15 per person.

"Although many countries require food processors to fortify staple foods, compliance is often low," said Free. "Improving compliance with current laws could prevent 6.1 billion more inadequacies at an additional cost of only $0.05 a person annually."

## A cost-effective solution, with important safeguards

Currently, 2.6 billion people worldwide cannot afford a healthy diet, according to the UN Food and Agriculture Organization. Subsidized fortification programs increase health, wellbeing and productivity in these communities, and expanding these initiatives could multiply their benefits.

Even under the most comprehensive scenario, the annual cost of $9.2 billion globally ($1.15 per person) remains modest compared to the tens of billions of dollars in economic losses attributed to micronutrient deficiencies each year through reduced productivity, increased healthcare costs and lost human potential.

The authors also assessed potential risks from excessive micronutrient intake. They found that, while most nutrients pose minimal risk, careful monitoring is needed — particularly for iodine and zinc — as programs expand. Excess iodine intake can lead to thyroid dysfunction while excess zinc intake can interfere with copper absorption. This underscores the importance of setting fortification standards based on population needs and baseline dietary intakes.

## Fortification is necessary, but not sufficient

The researchers emphasize that even optimized fortification programs cannot eliminate all nutrient gaps. An estimated 20.9 billion inadequacies would remain under the best-case scenario, highlighting the need for complementary approaches.

“Fortification is a powerful tool, but it's not a silver bullet,” said co-lead author Valerie Friesen, senior technical specialist at GAIN. “Achieving optimal nutrition for everyone will require parallel investments in dietary diversity, supplementation for vulnerable groups like pregnant women and young children, and making healthy diets more affordable and accessible.”

*This story was written in collaboration with the Global Alliance for Improved Nutrition (GAIN). Their full release is available here.*

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