THE BURDEN OF VITAMIN AND MINERAL MALNUTRITION IN INDIA

An estimated 2 billion people worldwide suffer from vitamin and mineral deficiencies. The country with the highest burden is India.

Iron deficiency anemia, vitamin A deficiency, and iodine deficiency disorders are prevalent throughout India. Anemia, primarily caused by iron deficiency, occurs across communities, income brackets, and age groups. An estimated 79 percent of children between 6 and 35 months of age, 55 percent of women between 15 and 49 years, and a quarter of Indian men are anemic.1

Folic acid deficiency, a main cause of birth defects of the brain and spine, is also widespread. Several studies undertaken among pregnant women and children suggest a prevalence ranging from 20 to 50 percent.2-8 Further, these deficiencies do not occur in isolation. Deficiencies in the vitamin B group, zinc, and vitamin D are also prevalent and have a devastating impact on health and productivity. Each year, India loses more than US$12 billion in gross domestic product due to nutrient deficiencies.5 Addressing this gap is essential not only to improve health but also to sustain economic growth and development.

FOOD FORTIFICATION: A PROVEN HEALTH INTERVENTION

Several strategies have been identified to address micronutrient malnutrition, including dietary diversification, nutrient supplementation, increased public health measures, and food fortification. Of these, food fortification is the most effective intervention to deliver vitamin- and mineral-rich food to a large population. Fortification involves adding minute quantities of nutrients, such as vitamin A, iron, and
iodine, to commonly consumed foods, including rice, wheat flour, oil, and milk. By improving daily nutrient intake among consumers, fortified food prevents vitamin and mineral deficiency-related diseases, strengthens the immune system, and improves productivity and cognitive development.

Globally, 86 countries have mandated cereal grain (wheat, rice, maize, etc.) fortification, and dozens more are fortifying edible oils, sauces, and condiments. The strategy is also easy to expand. For example, Costa Rica has reached its entire population with fortified food. In India, food fortification, especially of rice, can dramatically improve health and nutrition. It is cost-effective and easy to implement, and it generally has minimal effects on taste and cooking properties, making it appealing to consumers.

“\text{A team of Nobel laureate economists found that micronutrient interventions designed to increase nutrient intake were the most effective investment that could be made, with massive benefits for a tiny price tag.}”

—Copenhagen Consensus Center, 2012

**PATH’S RICE FORTIFICATION EXPERTISE**

A leader in global health innovation, PATH is at the forefront of finding and implementing effective approaches to improve maternal, newborn, and child health and nutrition. For more than ten years, our experts have helped develop the best methods to fortify rice with vitamins and minerals. To ensure that the benefits of fortified rice reach as many people as possible, we are expanding evidence, developing global markets, and working to broaden adoption worldwide. As a result, PATH has become a pioneer in rice fortification technology. Our projects and partnerships have included work in India, Brazil, Burundi, Cambodia, Myanmar, and Vietnam.

Fortified rice is produced using extrusion technology. Milled rice is powdered and mixed with a premix containing vitamins and minerals that can be matched to local nutrient needs. Fortified rice kernels are produced from this mixture using extruder (pasta making) equipment. These fortified kernels are then added to traditional rice in a ratio ranging from 1:50 to 1:200, resulting in fortified rice nearly identical to traditional rice in aroma, taste, and texture.

**PROVEN BENEFITS OF FORTIFIED RICE**

More than 17 scientific studies have demonstrated that extruded fortified rice is safe and effective when used among women and children and can significantly improve micronutrient status. It can reduce the prevalence of iron-deficiency anemia; improve hemoglobin status; and improve total body and serum retinol, vitamin A, zinc, folic acid, vitamin B12, and thiamine status, improving cognition and physical performance. Additional studies in more than 25 countries worldwide support the acceptability and safety of extruded fortified rice.

**EXPANDING USE OF FORTIFIED RICE IN INDIA**

India is the second largest producer of rice worldwide. Rice is the staple food for an estimated 65 percent of the population, for whom it constitutes 31 percent of energy intake. It also has the highest uptake in government distribution programs. In this context, rice fortification is an ideal vehicle to bridge dietary nutrient gaps and improve health, particularly among vulnerable populations.
In India, PATH is supporting stakeholders to introduce, test, use, and scale fortified rice to combat malnutrition and improve lives. Our work includes:

- **Generating clinical evidence for the use and safety of fortified rice.** A 2008 study conducted by the National Institute of Nutrition and Department of Biotechnology with support from PATH showed that consumption of fortified rice significantly improved iron stores and reduced iron deficiency among schoolchildren.\(^\text{12}\)

- **Strengthening the domestic supply chain.** To expand availability in India, PATH has transferred fortified rice technology to leading rice mills so they can produce grains for distribution through public-sector channels and private-sector markets. With partners, we have also developed blending devices and quality validation systems to ensure that rice is of consistently high quality.

- **Establishing operational feasibility.** In 2010, PATH facilitated a pilot in Andhra Pradesh to determine technical and operational feasibility of integrating fortified rice in the midday meal scheme. Under this pilot, 61,000 children were fed fortified rice. The pilot was successful as the fortified kernels were able to withstand Indian conditions of transport, cooking, and usage with no change in taste, color, odor, homogeneity, or nutrient composition. Fortified rice was well accepted by the children. It was concluded that distribution of fortified rice through centralized kitchens could be easily integrated, making it feasible for large-scale adaptation. PATH also tested the feasibility of giving rice kernel sachets to families at the Telemedicine Center, in Uttar Pradesh, a market-based approach to increasing uptake.

- **Providing technical guidance.** PATH draws on its expertise to provide technical support to government, local, and global partners in various capacities. For example, PATH played an important role in supporting the regulatory authority to formulate staple food fortification regulation. The regulation was operationalized in October 2016.

- **Integrating fortified rice into public-sector programs.** PATH is supporting the government of India and other stakeholders to integrate fortified rice into safety net programs. We have facilitated pilots to distribute fortified rice in various states, including Andhra Pradesh in 2010 and Rajasthan in 2011, which reached 185,000 children. We are now expanding efforts to Karnataka. In Karnataka, the state government, along with Akshaya Patra, is distributing cooked fortified rice in more than 2,500 schools in three districts, benefitting 450,000 children every day. In terms of the reach of safety net programs, this is the largest rice fortification initiative to date. The effort is coupled with other complementary activities, such as imparting nutrition and hygiene education among students to encourage healthy behaviours.

Fortified rice has the potential to reach 740 million vulnerable people in India, especially women and children, through the government’s safety-net programs, making it viable for addressing vitamin and mineral deficiencies for a large section of the population. Also, the cost of fortification is minimal (between 30 and 80 paise), especially compared to the negative health and economic costs of vitamin and mineral deficiencies.

Scaling up rice fortification will not only improve the health of India’s families and communities but improve the productivity of the country at large. PATH is supporting the government of India in its endeavors and initiatives to expand fortification.
PATH is the leader in global health innovation. An international nonprofit organization, we save lives and improve health, especially among women and children. We accelerate innovation across five platforms—vaccines, drugs, diagnostics, devices, and system and service innovations—that harness our entrepreneurial insight, scientific and public health expertise, and passion for health equity. By mobilizing partners around the world, we take innovation to scale, working alongside countries primarily in Africa and Asia to tackle their greatest health needs. Together, we deliver measurable results that disrupt the cycle of poor health. Learn more at www.path.org.

References


For more information, please contact:
PATH India Country Program office
Email: india@path.org
Phone: +91-11-4064 0036