

Iron deficiency in children resolved by biofortified pearl millet

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Schoolchildren in Maharashtra, India are served bhakri, a flat bread made from pearl millet.

Anemia affects more than 1.6 billion people worldwide, and iron deficiency is the leading cause of the condition. Pearl millet bred with 2 to 4 times more iron than conventional varieties could offer a novel solution, according to a Cornell-led study testing the new grain's efficacy.

Published recently in the *Journal of Nutrition*, the study describes how the iron biofortified pearl millet resolved iron deficiency in a group of school-aged children in India within four to six months, compared to a control group fed conventional pearl millet over the same time period. The iron-rich grain used in the study was developed by the HarvestPlus program, in partnership with the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in India.

For the past year, companies have been selling and distributing seeds of the new high-iron pearl millet crossed with local varieties to western Indian farmers. In India, pearl millet is typically ground into flour to make bhakri, a staple flat bread.

The study tested the efficacy of the bio-fortified pearl millet on iron status in children, and examined how long the increased iron took to accumulate in the body.

"We estimated it would take somewhere between four and six months," said Jere Haas, professor emeritus of maternal and child nutrition in the Division of Nutritional Sciences, the paper's senior author. Julia Finkelstein, assistant professor of epidemiology and nutrition and the Follett Sesquicentennial Faculty Fellow in the Division of Nutritional Sciences, is the paper's first author.

"After four months we could see a significant difference in accumulated body iron for the high iron bio-fortified pearl millet group versus the control group," Haas said.

The randomized controlled feeding trial – no one knew which participants were fed high-iron pearl millet flat bread and which were fed conventional pearl millet bread – was conducted in 246 low-income, boarding-school children between 12 and 16 years old in Maharashtra, India.

Conventional pearl millet contains 21 parts per million (ppm) of iron, while the new iron-rich variety has 83 ppm – almost four times more. It also contains more zinc. In addition, the new crops have higher yields and are disease and drought tolerant.

"ICRISAT was able to substantially increase iron content for pearl millet, but there is a limit" to how much iron the plant can store, Haas said. "This is less than one sees in diet supplements, which is why it takes longer to see an effect."

Haas conducted a previous trial to test efficacy of rice bio-fortified with iron. Rice has a low iron content to start with, and studies revealed that people needed to consume a significant amount, about 4 to 5 cups of cooked rice, over nine months to achieve small effects, Haas said.

At the start of the pearl millet study, 41 percent of the children were iron deficient, and 28 percent were anemic. Among children who were iron deficient, those who ate the high-iron pearl millet bread were more than one and a half times more likely to have normal iron levels after six months, compared to children in the [control group](#) who ate conventional pearl millet bread.

The researchers noted that it was much harder to discern the impact of bio-fortified millet on anemia, since many factors can play a role in anemia. Also, the new millet can replenish low body iron in apparently healthy people, since excess dietary iron is well regulated in the body.

Future studies will examine the effects of introducing such seeds across a population, to see how widely the [iron](#)-rich grain integrates into the food system, and what effect it has on overall [iron deficiency](#) over many years.

More information: "A Randomized Trial of Iron-Biofortified Pearl Millet in School Children in India." *J. Nutr.* 2015 145: 7 1576-1581; first published online May 6, 2015. [DOI: 10.3945/jn.114.208009](https://doi.org/10.3945/jn.114.208009)

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