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ABSTRACT No.9

The Quantity of Zinc Absorbed from Wheat in Adult Women Is Enhanced by Biofortification

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Biofortification of staple food crops with micronutrients could reduce micronutrient malnutrition at relatively low cost. Zinc is especially important in this consideration as a lack of dietary zinc is a major cause of early childhood morbidity and mortality. Indicators of zinc deficiency and quantitative data on the negative effects of phytates on zinc absorption are also limited. Measurements of zinc bioavailability and the effect of phytates on these, as addressed in this paper, are thus of extra significance.

The primary hypothesis was that absorption of zinc from zinc biofortified wheat is greater than from nonbifortifed control wheat when fed to adult women as their primary food source.

Experimental Methods

Control whole grain wheat(23.6 μg/g Zn) and biofortified whole grain wheat(41.3 μg/g Zn) were used. The wheat was then milled to provide flour at 95% and 80% extraction. Extraction is the yield of flour obtained from milling process; 100% would be whole wheat flour. At progressively lower extraction rates, more of the wheat bran and germ are removed during the milling process. The wheat flour was fed as wheat tortillas for 2 consecutive days to 27 adult women whose habitual diet was high in grains and phytate. Participants were randomized to receive either of the two extractions of biofortified wheat flour, with control wheat at the corresponding extraction rate fed on either day 1 or 2 of the study. Meals prepared from wheat flour for the 2 day feeding trials, were extrinsically labeled with Zinc stable isotopes. The fractional absorption of zinc was determined by using a dual isotope tracer ratio technique.

> "There is a substantial increase in intake of bioavailable zinc from zinc-biofortified wheat…"

Results

Zinc concentrations in 95% extracted flour was similar to the respective whole grain content both for the biofortified and control wheat. However, the 95% extracted biofortified wheat flour had 76% more zinc than the extracted control wheat. The 80% extracted biofortified flour zinc concentration was also 65% higher than its control. Zinc intake from the biofortified wheat was 5.7 mg/d (72%) higher at 95% extraction ($P < 0.001$) and 2.7 mg/d (68%) higher at 80% extraction compared with the corresponding control wheat ($P = 0.007$). Zinc absorption from biofortified wheat was (mean ± SD) 2.1 ± 0.7 and 2.0 ± 0.4 mg/d for 95 and 80% extraction, respectively. These were both 0.5 mg/d higher than for the corresponding control wheat ($P < 0.05$).

There was no difference in phytate concentration between biofortified and control whole grain. The same was true for biofortified and control flours at the same extraction level.

Discussion

Zinc absorption is greater from biofortified wheat, than from typical wheat with lower zinc concentration, from the same quantities of each type of wheat flour consumed. While substantial amounts of zinc are lost with 80% extraction, absorption is still significantly higher than from the control. Because of the greater reduction in phytate with increased extraction at 80%, the quantity of zinc absorbed is similar to that from 95% wheat. Along with the model-based predictions, this suggests that phytate intake must be considered in setting zinc target levels.

There is a substantial increase in intake of bioavailable zinc from zinc-biofortified wheat especially from the higher extraction flour (95% versus 40% for the lower extraction flour).Under the scenario presented 300g wheat flour could provide about two thirds the physiological zinc requirements of adult women.

It should be noted that the control wheat used for this experiment had zinc concentrations at the lower end of the range found. In addition, zinc content in the grain is affected by acroecological conditions. Keeping this in mind, the data presented in this study justify the verification of the efficacy of absorption of zinc-biofortified wheat through longer-term feeding trials and studies. It is also important that these studies be carried out in target regions for zinc-biofortified wheat to account for environmental conditions.

SOURCE: **Jorge L. Rosado, K. Michael Hambidge, Leland V. Miller, Olga P. Garcia, Jamie Westcott, Karla Gonzalez, Jennifer Conde, Christine Hotz, Wolfgang Pfeiffer, Ivan Ortiz-Monasterio and Nancy F. Krebs.2009. The Quantity of Zinc Absorbed from Wheat in Adult Women Is Enhanced by Biofortification. *Journal of Nutrition* Oct 139 (10) 1920-5**