

# Predicted Zinc (Zn) Absorption from High-Zn Wheat in Young Children

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## INTRODUCTION

The importance of the prevention of Zn deficiency as a global public health challenge is most apparent in young children. Therefore, if high-Zn crops are to be optimal for human nutrition, the Zn content should be sufficient to benefit young children. The bioavailability of Zn will depend on the quantity of Zn ingested and on phytate content, which will vary with post-harvest treatment of the crop and extent of extraction of flour. Zinc stable isotope methods to measure the quantity of absorbed Zn offer an important strategy for a first stage efficacy trial of high-Zn crops. The goal of this research is to utilize saturation response modeling of the quantity of absorbed Zn as a function of dietary Zn and phytate to derive preliminary estimates of Zn absorption from crops by young children.

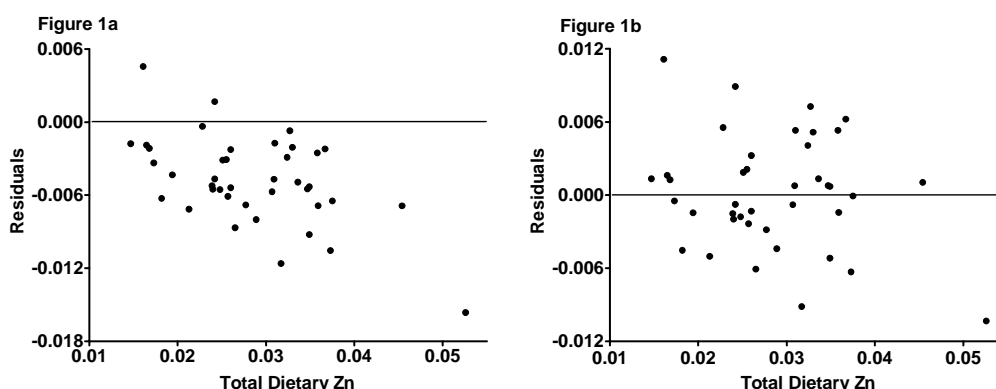
### Specific Aims:

1. To evaluate effect of adjustment for gut length (Weaver et al. 1991) on the fit of Zn absorption and dietary Zn and phytate data for toddlers (Sheng et al. 2006) to a trivariate model for Zn absorption as a function of dietary Zn and phytate based on adult data (Miller et al. 2006).

2. To utilize the gut length-adjusted trivariate model to evaluate Zn absorption from a high-Zn wheat in young children.

## METHODS AND RESULTS

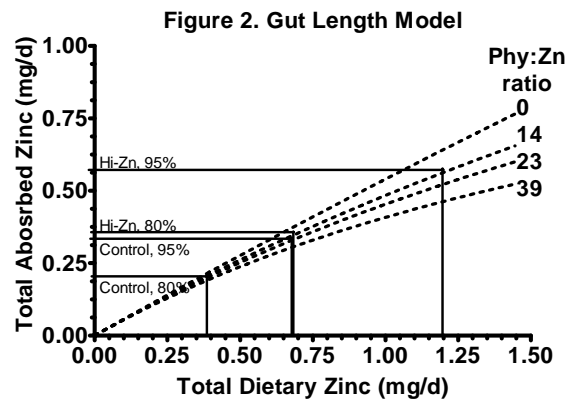
Figure 1a depicts the residuals for individual toddler data compared with the corresponding surface area of the adult trivariate saturation response model. Note that 38/40 individual data points are below the adult surface depicted by the 0.000 line. Figure 1b depicts the same points following adjustment for gut length difference vs. adults (Weaver et al. 1991). The trivariate model provides now a good fit for the same data points.



Following this evidence of the validity of a gut length adjusted trivariate model, the model was adjusted for gut length, which increases only very slowly across late infancy and

early childhood (Hambidge et al. 2006). Figure 2 is a 2-D depiction of this model for selected phytate:Zn ratios. At 0 phytate, the  $A_{max}$  for this model is 1.7 mg Zn/d, which is very close to that previously determined for infants consuming a zero phytate diet using a one-site binding model.

Also included in Figure 2 (below) are the quantities of Zn intake from 30g high-Zn and control wheat flour at 95% and 80% extraction. Corresponding phytate intakes are depicted by the curves and the intersect of the Zn, and phytate intake gives the predicted quantity of Zn absorbed on the y-axis.



**Table 1. Quantities of absorbed Zn from 30g high- and control-Zn wheat at 95 and 80% extraction.**

	Extraction	Zn intake (mg/30g)	Absorbed Zn (mg)
<b>Control wheat</b>	95%	0.7	0.34
	80%	0.4	0.20
<b>High-Zn wheat</b>	95%	1.2	0.57
	80%	0.7	0.35

## CONCLUSIONS

Estimated Zn absorption from the high-Zn wheat/high extraction, together with estimated Zn absorption from breast milk, is sufficient to meet physiologic requirements (Food and Nutrition Board 2001). Overall these estimations encourage proceeding with actual measurements of Zn absorption by toddlers fed diets that include at least one ounce of high-Zn wheat flour/d.

## ACKNOWLEDGEMENTS

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