Dept meeting on 09 Nov 2010 (Umezaki)

Title: Zinc Deficiency Is Common among Healthy Women of Reproductive Age in Bhaktapur, Nepal.
Authors: Ram K. Chandyo et al.
J. Nutr. 139: 594–597, 2009.

<Abstract>
Zinc deficiency is a major public health problem in many developing countries. However, its prevalence is still unknown in most populations. Women of reproductive age in developing countries are highly vulnerable to nutritional deficiencies, including that of zinc. To estimate the prevalence of zinc deficiency and to identify important dietary sources of zinc, we undertook a cross-sectional survey in 500 nonpregnant Nepalese women and measured their plasma zinc concentrations. We also examined the associations between plasma zinc and dietary intake of zinc or phytate, iron status, plasma concentrations of C-reactive protein, albumin, and hemoglobin. Food intake was estimated by 2 24-h dietary recalls and 1 FFQ for each woman. The plasma zinc concentration was (mean+-SD) 8.5+-2.4 mmol/L and more than three-quarters of the women were zinc deficient. Dietary zinc intake did not predict plasma zinc concentration, whereas phytate intake was negatively and significantly associated with plasma zinc. The other variables that were associated with plasma zinc were plasma albumin and hemoglobin concentration. Rice contributed 50% to the total estimated daily zinc intake and wheat and meat each contributed 15%. Rice also contributed 68% to the daily intake of phytate. In conclusion, we found that zinc deficiency was common in women of reproductive age and that the foods contributing substantial amounts of zinc also contributed importantly to the intake of phytate.

1. Introduction

1.1. Zn
- Zinc is an essential element:
  - immune system, DNA synthesis, cellular division, proliferation, growth.
- Poor maternal zinc status:
  - Spontaneous abortion, congenital malformation, LBW, preterm delivery.
- Micronutrients (i.e., Zn) deficiency is common among Nepali women

1.2. Nepali diet
- Cereal + limited animal protein
- Phytate in cereal inhibit zinc absorption; phytate: zinc molar ratio >15 = critical

1.3 Objective
- Prevalence of Zn deficiency
  - plasma Zn concentration
  - plasma albumin and CRP
- Dietary source of Zn
  - 24h dietary recall+FFQ

2. Subjects and Methods
2.1. Study area and food habits
- Sep 2000 to Nov 2001
- Bhaktapur in Kathmandu
- 80% Newar + migrants who worked in carpet factories (CF)

2.2. Sample size = 500 women
- Prevalence of Zn deficiency =25%, 10% of participants will not provide samples

2.3. Selection procedures and dietary recalls
- Healthy non-pregnant, 13-35 years of age,
- Randomly selected 500 (403 Newari + 97 CF migrants), pooled for analysis
- For 379 women (of 500): FFQ + two sets of 24h recall (1wk apart on different weekdays)
- Indian Food Composition Table

- Not perfect fasting blood: time of collection recorded
- Anthropometric measurements

2.4. Laboratory analysis
- Blood collection between 900 and 1500 (72% before 1200)
- Centrifuged, separated, refrigerated (<5 h), -45 degree C, dryiced, and shipped to Norway.
- Zinc measurements: ICP-AES (inductively coupled plasma atomic emission spectrometry)
- Reference standard: Teknolab
- CV between analyses <6.5%
- 2 samples not measured
- Plasma CRP: immunotubidimetric assay （免疫比濁法）(Tina Quant, Roche) on a Modular P analyzer
- Plasma albumin: Bromcresol Green colorimetric assay（ブロムクレゾールグリーン比色定量）on a Modular P analyzer

2.5. Definitions
- Zinc deficiency (IZiNCG, 2007): plasma Zn <11.3 micro-mol/L for fasting/morning samples
<10.7 micro-mol/L for non-fasting/morning samples
<9.3 micro-mol/L for afternoon samples
- Dietary requirement of Zn: 9 mg/d for women 13-18 y (unrefined plant based diet)
7 mg/d for non-pregnant women 18 years or older
- P:Z molar ratio: estimated by a std algorism (WHO, 1996; Gibson and Ferguson, 1999)

2.6. Statistical analysis
- STATA (v.9)

3. Results

3.1. Difference between Newar and CF migrants > pooled

3.2. Subject characteristics (Table 1)
- 59% of women married, of them 71% used contraceptives.
- Wgt: 48.8 kg (7.5), Hgt: 149.6 cm (5.8); 17% <145 cm
- 33% no meal in the morning (7% complete fasting) + 67% had a morning meal (2.3h: 0.55-6.25 h)

3.3. Energy and Zn intakes (Table 2)
- 76%< energy RDA (9205 kJ).
- Zn intake: 7.2 (25^{th} %tile) – 9.4 mg (75^{th} %tile)
- 29% of >18y and 69% of 13-18y < adequate intake of Zn

3.4. Source of Zn and phytate and Z:P molar ratio (Table 3)
- Rice: 50% of Zn intake, wheat: 15%, meat: 15%
- Rice: 68% of phytate intake
- P:Z molar ratio was 26.4; 90% of the women <P:Z 15

3.5. Plasma Zn and its relation with albumin, Zn intake, and phytate intake (Table 2)
- The plasma Zn: 8.5 (2.4) mmol/L (mean), 5.3 mmol/L (2.5th %tile), 14.1 mmol/L (97.5th %tile)
- 78–90% = zinc deficiency
- Zinc intake * plasma Zn: no association
- Plasma Zn * phytate intake: r = -0.15; P=0.003.
- P:Z molar ratio * plasma Zn: no association

3.6. Plasma Zn status and its relation with iron status and intake of iron
- Fe intake * Zn intake: r = 0.79; P = 0.001
- Zn intake * plasma ferritin: r= 0.17; P <0.001
- * plasma transferrin receptor: r=-0.10; P=0.056
- * plasma Hb: r=0.26; P<0.001

- Plasma Zn * plasma Hb: r = 0.16; P < 0.001
  * plasma transferrin receptor: P = 0.9
  * ferritin: r = 0.07; P = 0.08)

4. Discussion

4.1. >3/4 women were zinc deficient, in agreement with the previous studies (11, 23, 24).
- Usually, Zn deficiency = Fe deficiency: animal meat is the source.
- In this population, Fe deficiency < Zn deficiency, which was also reported in Ethiopia

4.2. Measurement by ICP-AES
- ICP-AAS (atomic absorption spectrometry) > ICP-AES

4.3. Inhibition of intestinal zinc absorption by phytate
- Phytate in rice ↓ in cooking? Overestimate the phytate intake?
- Indian study: a limited lowering of phytate concentration.

4.4. No association between Zn intake and plasma Zn
- Plasma zinc: an individual's usual zinc intake over a few weeks or months
- Meat (highest concentration of bioavailable Zn) consumed not on a regular basis
- not regular consumption of meat and high phytate intake = reasons?
- Indian food tables: not the best

5. Conclusion
- A high prevalence of Zn deficiency in women of reproductive age in Bhaktapur, Nepal.
- An increase of the risk of infections and poor pregnancy outcomes.
- Moreover, food that contributed most to the intake of zinc also contributed substantially to the intake of phytate, which seemed to have a negative impact on their zinc status.

A randomized controlled trial of the effect of zinc as adjuvant therapy in children 2–35 mo of age with severe or nonsevere pneumonia in Bhaktapur, Nepal

Palle Valentiner-Branth et al.

Am J Clin Nutr 2010;91:1667–74.

Design: In a double-blind, placebo-controlled clinical trial, children aged 2–35 mo with severe (n = 149) or nonsevere (n = 2479) pneumonia defined according to criteria established by the World Health Organization were randomly assigned to receive zinc (10 mg for children aged 2–11 mo, 20 mg for children aged 12 mo) or placebo daily for 14 d as an adjuvant to antibiotics. The primary outcomes were treatment failure, defined as a need for change in antibiotics or hospitalization, and time to recovery from pneumonia.

Conclusion: Adjuvant treatment with zinc neither reduced the risk of treatment failure nor accelerated recovery in episodes of nonsevere or severe pneumonia.

Effectiveness and Efficacy of Zinc for the Treatment of Acute Diarrhea in Young Children

Tor Arne Strand et al.

Pediatrics 2002;109;898-903.

Methods. Seventeen hundred ninety-two cases of acute diarrhea in Nepalese children were randomized to 4 study groups. Three groups were blinded and the children supplemented daily by field workers with placebo syrup, zinc syrup, or zinc syrup and a massive dose of vitamin A at enrollment. The fourth group was open and the caretaker gave the children zinc syrup daily. Daywise information on morbidity was obtained by household visits every fifth day.

Conclusions. Three Recommended Daily Allowances of zinc given daily by caretakers or by field workers substantially reduced the duration of diarrhea. The effect of zinc was not dependent on or enhanced by concomitant vitamin A administration.