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Fortification of staple foods with zinc for improving zinc status and other health outcomes in the general population.

Shah D[1], Sachdev HS, Gera T, De-Regil LM, Peña-Rosas JP.

Author information

Abstract

BACKGROUND: Zinc deficiency is a global nutritional problem, particularly in children and women residing in settings where diets are cereal based and monotonous. It has several negative health consequences. Fortification of staple foods with zinc may be an effective strategy for preventing zinc deficiency and improving zinc-related health outcomes.

OBJECTIVES: To evaluate the beneficial and adverse effects of fortification of staple foods with zinc on health-related outcomes and biomarkers of zinc status in the general population.

SEARCH METHODS: We searched the following databases in April 2015: Cochrane Central Register of Controlled Trials (CENTRAL, Issue 3 of 12, 2015, the Cochrane Library), MEDLINE & MEDLINE In Process (OVID) (1950 to 8 April 2015), EMBASE (OVID) (1974 to 8 April 2015), CINAHL (1982 to April 2015), Web of Science (1900 to 9 April 2015), BIOSIS (1969 to 9 April 2015), POPLINE (1970 to April 2015), AGRICOLA, OpenGrey, BiblioMap, and Trials Register of Promoting Health Interventions (TRoPHI), besides regional databases (April 2015) and theses. We also searched clinical trial registries (17 March 2015) and contacted relevant organisations (May 2014) in order to identify ongoing and unpublished studies.

SELECTION CRITERIA: We included randomised controlled trials, randomised either at the level of the individual or cluster. We also included non-randomised trials at the level of the individual if there was a concurrent comparison group. We included non-randomised cluster trials and controlled before-after studies only if there were at least two intervention sites and two control sites. Interventions included fortification (central/industrial) of staple foods (cereal flours, edible fats, sugar, condiments, seasonings, milk and beverages) with zinc for a minimum period of two weeks. Participants were members of the general population who were over two years of age (including pregnant and lactating women) from any country.

DATA COLLECTION AND ANALYSIS: Two review authors independently assessed the eligibility of studies for inclusion, extracted data from included studies, and assessed the risk of bias of the included studies.

MAIN RESULTS: We included eight trials (709 participants); seven were from middle-income countries of Asia, Africa, Europe, and Latin America where zinc deficiency is likely to be a public health problem. Four trials compared the effect of zinc-fortified staple foods with unfortified foods (comparison 1), and four compared zinc-fortified staple foods in combination with other nutrients/factors with the same foods containing other nutrients or factors without zinc (comparison 2). The interventions lasted between one and nine months. We categorised most trials as having unclear or high risk of bias for randomisation, but low risk of bias for blinding and attrition. None of the studies in comparison 1 reported data on zinc deficiency.Foods fortified with zinc increased the serum or plasma zinc levels in comparison to foods without added zinc (mean difference (MD) 2.12 µmol/L, 95% confidence interval (CI) 1.25 to 3.00 µmol/L; 3 studies; 158 participants; low-quality evidence). Participants consuming foods fortified with zinc versus participants consuming the same food without zinc had similar risk of underweight (average risk ratio 3.10, 95% CI 0.52 to 18.38; 2 studies; 397 participants; low-quality evidence) and stunting (risk ratio (RR) 0.88, 95% CI 0.36 to 2.13; 2 studies; 397 participants; low-quality evidence). A single trial of addition of zinc to iron in wheat flour did not find a reduction in proportion of zinc deficiency (RR 0.17, 95% CI 0.01 to 3.94; very low-quality evidence). We did not find a difference in serum or plasma zinc levels in

participants consuming foods fortified with zinc plus other micronutrients when compared with participants consuming the same foods with micronutrients but no added zinc (MD 0.03 µmol/L, 95% CI -0.67 to 0.72 µmol/L; 4 studies; 250 participants; low-quality evidence). No trial in comparison 2 provided information about underweight or stunting.There was no reported adverse effect of fortification of foods with zinc on indicators of iron or copper status.

AUTHORS' CONCLUSIONS: Fortification of foods with zinc may improve the serum zinc status of populations if zinc is the only micronutrient used for fortification. If zinc is added to food in combination with other micronutrients, it may make little or no difference to the serum zinc status. Effects of fortification of foods with zinc on other outcomes including zinc deficiency, children's growth, cognition, work capacity of adults, or on haematological indicators are unknown. Given the small number of trials and participants in each trial, further investigation of these outcomes is required.

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