Zinc in Food Chain

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Abstract. Zinc is an essential trace element widespread in soil, water, flora and fauna. In the food chain, soil is the main source of zinc. The objective of the work is to summarize the nutritional and toxicity data about the spread of Zn in soils and food from vegetal or animal origin. Zinc toxicity in the plant kingdom was rarely detected (at concentrations > 300 mg kg⁻¹), due mainly by plant capacity to regulate homeostasis accumulation of heavy metals, including zinc. Zn contents in plant foods are between 2-10 mg kg⁻¹, the highest concentrations can be found in roots and seeds.

Keywords: zinc, food chain, soil, vegetables, fruits, feed, toxicity.

Introduction. Zinc is an essential trace element widespread in soil, water, flora and fauna. In the food chain, soil is the main source of zinc. Although soil total Zn contents are considerable (100-200 mg kg⁻¹), it is strongly retained, so that available zinc absorbed by plants is only a small fraction (1-10%) of total zinc. As with Cu, Cd and Pb, the highest Zn content in soils have been identified in anthropic areas, water or crops from these areas or in areas of mining polymetallic deposits and in areas that process them industrially. Normal total Zn contents in soil are below 100 mg kg⁻¹, 300 mg kg⁻¹ at the warning level and 600 mg kg⁻¹ at the intervention level (Lăcătușu et al., 2009). Zn is an essential trace element, participating in the formation of many metal enzymes (over 200). It is an essential micronutrient necessary for many biological processes including growth and development, neurological function, reproduction, and immunity. Zn deficiency conducts to immune dysfunction including thymic atrophy, lymphopenia, impaired adaptive immunity, and chronic inflammation (Wong and Ho, 2012).

Aims and objectives. The objective of the work is to summarize the nutritional and toxicity data about the spread of Zn in soils and food from vegetal or animal origin.

Materials and methods. All data for metal concentration in soils and foods were discussed in term of total form analyzed by specific methods (FAAS, ETAAS or ICP OES).

Results and Discussion. The phenomena of deficiency in the plant kingdom are rarely encountered due to appreciable content in the soil as well as high bioavailability of zinc. But it is possible Zn deficiency in sensitive plants and in conditions of excessive fertilization with P or alkaline soils.

In the animal kingdom, including humans, deficient in this trace metal can occur in general due to malnutrition. Oral reference doses (RfD) and upper tolerable daily intakes (UL) for Zn are: 0.300 mg kg⁻¹ day⁻¹ and 40 mg day⁻¹ respectively. Normal daily food intake is considered to be 10 - 20 mg day⁻¹ (FDA, 2001; SCF, 2003).

Zinc toxicity in the plant kingdom was rarely detected (at concentrations > 300 mg kg⁻¹), due mainly by plant capacity to regulate homeostasis accumulation of heavy metals,
including zinc. Zn contents in plant foods are between 2-10 mg kg\(^{-1}\), the highest concentrations can be found in roots and seeds.

The animal has a high storage capacity of this metal; toxic phenomena are manifested only at high levels of zinc concentration in the feed or food. Maximum limits are: 3 mg kg\(^{-1}\) for bread and bakery products, milk yogurts 5 mg kg\(^{-1}\), sour cream, cereal, tomato juice mg kg\(^{-1}\) ppm, 20 mg kg\(^{-1}\) in eggs, bouillon, cheese 25 mg kg\(^{-1}\), 30 mg kg\(^{-1}\) in vegetable pastes, concentrate juice, 50 mg kg\(^{-1}\) in meat, fish and oyster, 60 mg kg\(^{-1}\) in halvah and 70 mg kg\(^{-1}\) in cocoa (FAS, 2007; Gergen, 2004; SCF, 2003). Naturally, in foods zinc accumulation occurs only in areas with geological loading and that in limited concentrations that rarely exceed maximum permissible doses (Harmanescu et al., 2011).

**Conclusion.** Excessive accumulation of zinc in food occurs only through anthropogenic or raw materials from anthropogenic polluted areas with the metal or from processing steps if worn or used equipment and inappropriate material or dosage was used.

**REFERENCES**