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Fluoride uptake and translocation in food crops grown in fluoride-rich soils

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Abstract

BACKGROUND

The East African Rift Valley (EARV) area is characterized by an intense volcanic activity, which largely influences the nature of soils, ground and surface waters causing a transfer of fluoride from volcanic emissions to the environment. Field experiments were conducted in F-contaminated areas of Ngarenanyuki (Arumeru district) in North Tanzania. In order to evaluate the potential fluoride exposure from the diet and the related health risk for the local population, the content of fluoride in soil and plant tissues was assessed, focusing on the edible portions (leaves, fruits or seeds) of the main cultivated and consumed food crops in the area.

RESULTS

Average fluoride contents of 8.0, 11.4, 11.3 and 14.2 mg kg⁻¹ of dry matter were observed respectively for maize (*Zea mays* L.), tomato (*Lycopersicon esculentum* Mill.), bean (*Phaseolus vulgaris* L.) and kale (*Brassica* sp. pl.) edible parts. The cumulative estimated average daily dose (EADD) ranged from 0.026 to 0.165 mg F d⁻¹ kg⁻¹ among different rural population groups and considering two different hypotheses of absorption fraction (75% or 100%), i.e. the amount of fluoride that is absorbed during the digestion process. The associated hazard index (HI) values varied from 0.43 to 2.75.

CONCLUSIONS

Considering the dietary habits of the local population, the outcomes of the present study suggest that the investigated crops can substantially contribute to fluoride related diseases, especially in earlier ages.

Keywords

Maize; Tomato; Bean; Kale; Soil contamination; Translocation Factor