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Introduction: Contamination from trace metals is a major problem globally, with a large share of this problem presently occurring in developing countries like Bangladesh. Soil acts as a sink and also as a source of pollution to foodstuffs that are grown on contaminated soil. In recent years, food safety is a critical issue in the world. In this regard, research on trace metal contaminations in foods has been increased. The risk associated with the consumption of contaminated foods that are grown in the vicinity of industrial area may be a potential health concern.

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Materials and methods

Objectives: To assess trace metal contamination in soil and health risk via the consumption of different foods

Results and Discussion

Study area and sampling:

About 9 composite soil and 173 locally grown foods were collected from the selected fields during February-March, 2012 and August-September, 2013.

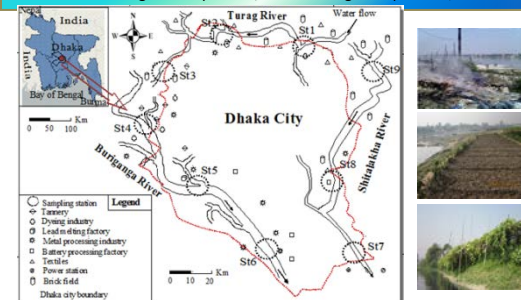


Fig. 1. Map of study area in Bangladesh

Analytical procedure:

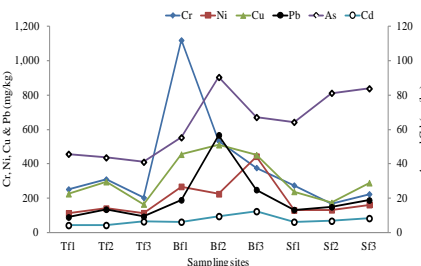


Fig. 2. Total metal content (mg/kg) in soil sample

- High Cr concentration in Buriganga River side field due to tannery industries
- Higher Ni, Cd and Pb in soil samples might be due to the effect of metal processing, batteries and Pb smelting factories
- Metals in soil exceeded the international standard for soil quality, indicating the severe pollution by trace metals.

Table 1. Comparison of soil metals content (mg/kg) with other guideline values

Observed and Guideline values	Cr	Ni	Cu	As	Cd	Pb
This study (mean value)	384	192	311	64	7	199
Background value of Bangladesh soil	NA	22	27	3	0.01-0.2	20
Dutch soil quality standard (Target Value)	100	35	36	29	0.8	85
SEPA limits, China	250	60	100	NA	0.6	350

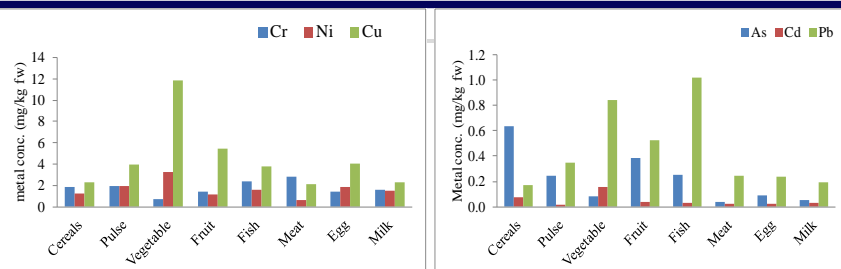


Fig. 3. Metal concentrations (mg/kg fw) in foodstuffs collected from Dhaka City, Bangladesh

- The highest metal concentrations were observed in vegetables, especially Cu, Cd and Pb. This is due to smelting and other industrial activities, where vegetables can be exposed to fine particles of Pb from PbSO₄, PbO and PbCO₃.
- The elevated levels of As was found in rice, which can be due to the higher transfer of As from soil to grain in the anaerobic paddy soil systems for rice production and excessive use of ground water for irrigation containing As.
- The elevated levels of Pb in fish due to the ingestion of Pb contaminated sediment from the surrounding rivers.

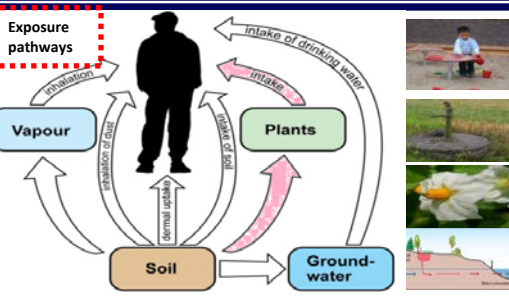
Table 2. Estimated daily intake (EDI) of metals due to foods consumption

Foodstuffs	Estimated daily intake (EDI) (mg/day)					
	Cr	Ni	Cu	As	Cd	Pb
Rice	0.38	0.41	2.6	0.076	0.023	0.028
Maize	0.047	0.032	0.06	0.015	0.0019	0.004
Pulse	0.033	0.022	0.054	0.0013	0.0001	0.005
Vegetable	0.13	0.49	2.2	0.01	0.018	0.126
Fruit	0.063	0.049	0.28	0.018	0.0011	0.024
Fish	0.20	0.12	0.33	0.022	0.0024	0.086
Meat	0.032	0.0033	0.03	0.0006	0.0002	0.0022
Egg	0.016	0.02	0.036	0.0007	0.0002	0.0015
Milk	0.066	0.023	0.096	0.0026	0.0012	0.0044
Intake from soil	0.024	0.021	0.027	0.006	0.002	0.019
Total intake (food+soil)	0.99	1.2	5.7	0.15	0.05	0.30
MTDI (JECFA, 2004)	0.20	0.3	30.0	0.13	0.046	0.21

$$EDI = \frac{FIR \times C}{BW}$$

➢ Where, EDI is the estimated daily intake, FIR is the food ingestion rate (g/day), C is the metal concentration (mg/kg fw) in foods and BW is the body weight (60 kg for adult)

➢ Dietary intake of metals were higher than the Maximum tolerable daily intake (MTDI), indicating the potential risk through consumption of foods



Conclusion: This study showed that the intensive uncontrolled operation of various industries has resulted in the release of metals in the local environment and caused elevated concentrations in the surrounding soil. Foods grown in the nearby sites were also contaminated by metals, especially Cr, As, Cd and Pb, which could be a potential health concern to the local residents.

Reference: Joint FAO/WHO Expert Committee on Food Additives (JECFA), 2004. Safety evaluation of certain food additives and contaminants. WHO Food Additives Series No. 52. World Health Organization, Geneva.