

# An investigation by Laser Ablation and Inductively Coupled Mass Spectrometry of the gradation and levels of metal contaminants in UK-grown fruits, vegetables and cereals in 2012/13

Area of research interest: [Chemical hazards in food and feed](#)

Study duration: 2012-10-01

Project code: FS102002

Conducted by: University of Aberdeen

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## Background

During growth, fruit, vegetables and cereals take up metal contaminants from the surrounding soil area. Arsenic, cadmium, lead and mercury have no known beneficial health effects, while trace amounts of other metals (chromium, copper, iron, aluminium, manganese and zinc, for example) can act as nutrients and are essential for health. However, all may be harmful if excessive amounts are consumed.

The European Food Safety Authority (EFSA) has previously concluded that dietary exposure to inorganic arsenic, cadmium, lead and mercury should be reduced. Additionally, the Joint Food and Agriculture Organization (FAO) and the World Health Organization (WHO) Expert Committee on Food Additives (JECFA) agree that it is not possible to set a tolerable lead intake and therefore minimisation of exposure to lead from all sources is desirable.

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## Research Approach

Field samples of UK-grown fruit, vegetable and cereal produce and accompanying soil were sampled from various growing regions of the British Isles to determine the levels of total arsenic, inorganic arsenic, cadmium, lead, mercury, chromium, copper, iron, aluminium, manganese and zinc.

A minimum of 300 samples of produce and soil were taken from late autumn 2012 to summer 2013. Types of produce sampled included apples, pears, carrots, parsnips, beetroots, turnips, swedes, courgettes, wheat, barley, oats and rye.

All produce samples collected were analysed for the distribution of arsenic, cadmium, lead, mercury, chromium, copper, iron, aluminium, manganese and zinc from the outer skin to the core of the selected produce using Laser Ablation-Inductively Coupled Mass Spectrometry (LA-ICP-MS). In addition, total elemental analyses were performed on the sampled produce and a subset of samples analysed for arsenic speciation.

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## Results

The results of the study confirm that concentrations of metals tend to be higher in the outer layer (skin/peel) of fruits and vegetables compared to the 'flesh'. Similarly concentrations of metals tend to be higher in the outer or bran layer of cereal grains compared to the middle or endosperm layer and also germ or core of the cereal grain.

The results indicated that:

- elevated amounts of heavy metals such as cadmium, mercury and lead and also other metals such as copper and zinc, in the skin/peel of fruit and vegetables, compared with the 'flesh'
- these metals were accumulated in less than 0.5mm thickness from the skin surface
- the relative concentration of metals at different points on the skin of vegetables and fruits varied, indicating a heterogeneous distribution
- in cereals, heavy metals such as lead and other metals such as copper and zinc, were elevated in bran and germ compared to the endosperm

The levels of metals reported in this study do not increase concern about risk to human health and do not support any changes to our advice to consumers, therefore our current advice on how to wash and peel fruits and vegetables remains the same.

Research report

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