# Arsenic and cadmium concentrations in legumes and cereals grown in the North Central Province, Sri Lanka and assessment of their health risk

**Article** · February 2019

DOI: 10.1186/s40550-019-0073-x



**2 authors:**

B.K. Kolita Kamal Jinadasa
National Aquatic Resources Research and Development Agency
**102** PUBLICATIONS **112** CITATIONS

SEE PROFILE

Ranjith Edirisinghe
Rajarata University of Sri Lanka
**46** PUBLICATIONS **183** CITATIONS

SEE PROFILE

International Journal of Food Contamination

DATA ARTICLE Open Access

# Arsenic and cadmium concentrations in legumes and cereals grown in the North Central Province, Sri Lanka and assessment of their health risk

E. M. R. K. B. Edirisinghe[1*] and B. K. K. K. Jinadasa[2]

## Abstract

**Background:** A total of 181 samples of cereals and legumes, including mustard, maize, finger millet, sesame, cowpea/black-eyed pea, Urad dal /split bean, foxtail millet, long bean and green gram from the North Central Province of Sri Lanka were analysed for arsenic (As) and cadmium (Cd) levels using atomic absorption spectrophotometry (AAS).

**Findings:** The As and Cd level in each sample was not significantly different. The mean level was found to be 48.90 ± 34.63 μg/kg for As and 19.39 ± 9.508 μg/kg for Cd on weight basis.

**Conclusion:** None of the foodstuffs studied contained As and Cd in levels exceeding the maximum permissible levels currently in force. Human health risk assessment of As and Cd in the foodstuffs was conducted and computed values indicated that there is no health risk due to consumption of the varieties studied. Nevertheless, the values, especially Total Hazard Quotient (THQ) emphasize the requirement of a comprehensive total diet study.

**Keywords:** Cereals, Legumes, Cadmium, Arsenic, Non-carcinogenic health risk, Carcinogenic effects, Dietary exposure, THQ

## Introduction

The Agency for Toxic Substances and Disease Registry (ATSDR), 2017 ranked arsenic (As) and cadmium (Cd) at number one and seven, respectively, in the hazardous substances list (ATSDR, 2017). Most As and Cd exposure of humans happens directly or indirectly by ingestion - through drinking water or contaminated food. As and Cd contaminated plant crops are mostly those that grow in contaminated soil (Zhao et al., 2010). After accumulation of these non-essential trace elements (NETEs) into the crops, transfer occurs via the food chain and finally reaches the apex consumer in the food chain such as humans. In the mid 1950s in Japan, the "Itai-Itai disease" was recorded after consumption of Cd contaminated soybean and rice (Huang et al., 2009). Consumption of Cd resulted in stomach irritation, vomiting and diarrhea, while long-term exposure caused kidney disease, cancer and fragility at birth. Arsenic exposure may cause skin lesions, neuropathy, gastrointestinal diseases, cardiovascular diseases, cancer, and other ailments (Corguinha et al., 2015).

Air, water, and soil contamination are the sources of NETEs in agricultural areas. Agricultural land inputs such as fertilizers and pesticides are responsible for high NETE contamination of soil (Gunatilake et al., 2014). The NETEs in soil are transferred through the agricultural crops as they are deposited in the edible parts. The transfer rate depends on many different factors such as climatic, plant species, and genotypes (Corguinha et al., 2015).

North Central Province is the largest province in Sri Lanka, and the majority of the people (65%) belong to the agricultural sector. Rice, the main crop of this area is cultivated by using the highly sophisticated ancient irrigation system from the Mahaweli River (Gunatilake et al., 2014).

* Correspondence: ranjith_e@hotmail.com
[1]Department of Physical Sciences, Faculty of Applied Sciences, Rajarata University of Sri Lanka, Mihintale, Sri Lanka
Full list of author information is available at the end of the article