# CADMIUM CONTAMINATION LEVELS OF RICE GROWN IN NORTH CENTRAL PROVINCE, SRI LANKA

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## Introduction

Rice is the seed of the monocot plants Oryza sativa (Asian rice) or Oryzaglaberrima (African rice). As a cereal grain, it is the most widely consumed staple food for a large part of the world's human population, especially in Asia. [1] Rice is grown mainly on irrigated land in Sri Lanka's "dry zone" that spans most of the country's north-central and northeastern regions, and secondarily on rain-fed (non-irrigated lands) by smallholder farmers across the country. [2] Some debate exists as to exactly what constitutes a "heavy metal" and which elements should properly be classified as such. Most recently, the term "heavy metal" has been used as a general term for those metals and semimetals with potential human or environmental toxicity where Cd is well included. [3,4] Experiments carried out by the Bathalagoda Rice Research and Development Institute (RRDI Sri Lanka) have revealed that soil samples taken from all paddy fields contain a certain amount of Cadmium. Issuing a Press release, RRDI said by adding organic and inorganic fertilizers to paddy fields, the Cadmium rate of the soil increases. Although by adding organic ingredients to the soil, the Cadmium absorption rate of a paddy plant can be significantly reduced. . It indicates that Cadmium absorption rate can be greatly reduced by adding organic ingredients to the field. Since each and every farm family eats their own rice which they have cultivated in the season there should be a proper way of confirming whether food they eat is safe or not and whether they exceed the maximum contamination level of Cd knowing there is a risk of Cd contamination over this part of the country. In recent years, there are some claims that rice consumed in Sri Lanka is contaminated with some toxic heavy metals including Cd due to excessive use of contaminated fertilizers and pesticides. So our main objectives include comparison of the toxic levels of traditional rice varieties verses new breeds which are highly popular among farmers and to have a general idea of the relative toxic levels with rice which uses organic fertilizer and chemical fertilizer.

## Materials & Methods

Thirty six rice varieties including varieties of Nadu rice (BG varieties),

samba, Sri Lankan red rice, Keeri samba, and traditional varieties including Suwandel, Kalu-Heenati, Goiya-goda, Pachchaperumal and Al-wee were collected from 5 distant sampling locationsfrom North Central Province, Sri Lankain August-October 2013. Samples includes par boiled sample and an organic fertilized samples as well. Collected rices amples were packed into Polyethylene bagsand carried out for the analysis.Rice samples were treated with concentrated $HNO_3$and then digested using Microwave sample digester (Mars CEM XP-1500, Matthews, USA). Then the Cd levels were measured with Atomic Absorption Spectrophotometer (Varian AA 240 FS). Blank and spiked samples were also analyzed and standard quality control material (T/0774, Fapas, UK) was used to validate the results. All statistical analysis was conducted using Microsoft Excel 2009 version.

**Results and Discussion**

The mean concentrations of Cd in rice collected from Bulankulama, Pandukabhayapura, Medawachchiya, Mahakanadarawa and Galenbindunuwewa are given in table-01. Further, the mean Cd levels of rice samples are given in figure-01.

Table 1. Mean concentration levels of Cd in rice

| Area | Cd Concentration Mean, (µg/kg) |
|---|---|
| Bulankulama | 19.85 |
| Pandukabhayapura | 22.77 |
| Medawachchiya | 22.39 |
| Mahakanadarawa | 17.02 |
| Galenbindunuwewa | 22.98 |

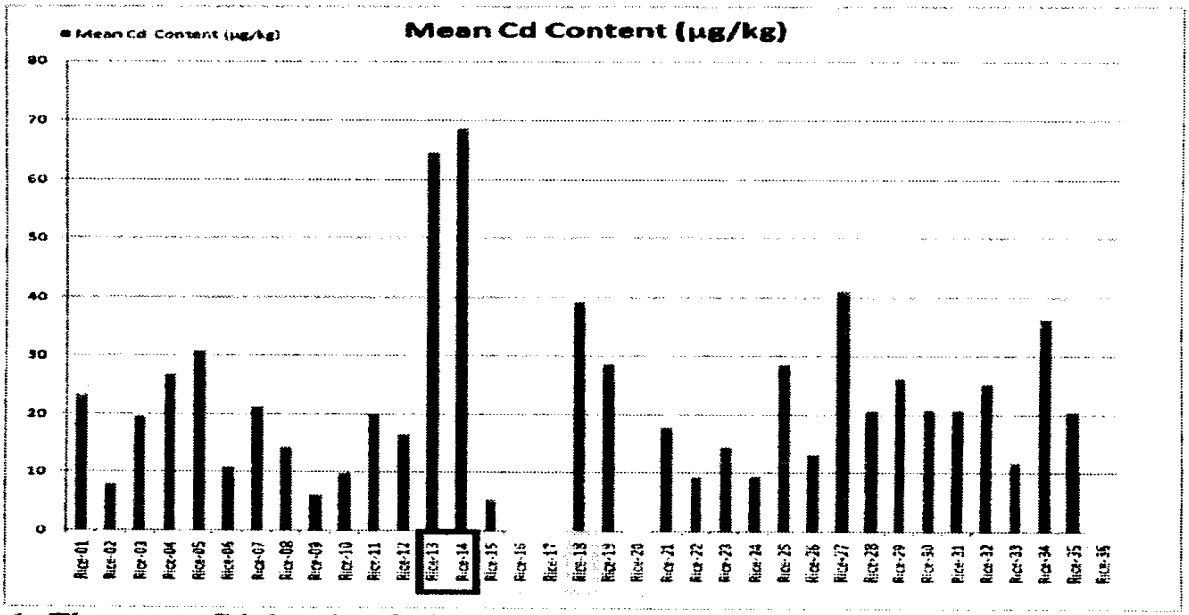


Figure 1. The mean Cd levels of rice samples

The Cadmium content in rice collected from home granaries and fields of NCP ranged from 0.00 to 68.72 µg/kg with a mean value of 20.35 µg/kg. All the samples collected were positive for Cd content except three traditional varieties which has not used any kind of a chemical fertilizer or a weedicide/pesticide. We observe that the background value for rice grain Cd in Sri Lanka was found to be 1 µg/kg.The maximum permissible level of cadmium in rice grain according to Codex committee (2002) is 0.2mg/kg. Thus the amounts of Cd in Rice grains harvested in subjected areas are not sufficient to cause acute toxicity.

The Provisional TolerableWeekly Intake of rice underdifferent body masses indicates the degree of chronicintake and Its potential impact on health of the people of these areas.Table-2 represent the weekly mean intake of cadmium through the staple rice based on body weight groups.Although the weekly intake of Cd from irrigated rice grains from Pandukabhayapura is below the Maximum allowable Contamination Level (MCL) 7 µg/kg Body weight (JEFCA-2003). But the children under 5 years are reaching critical level though it is little below the MCL. However, long –term dietary exposure over the years results in accumulation of Cd levels which can lead to Cadmium toxicity.

Table 2: Estimated weekly intake of Cd for the extremely contaminated rice sample collected from Pandukabhayapura.

| Age group | Body Weight (kg)[1] | Daily rice intake (kg)[2] | WI-Cd µg/kg BW[3] |
|---|---|---|---|
| 4-5 | 16.2 | 0.19 | 5.64 |
| 14 | 42.4 | 0.38 | 4.31 |
| 20-29 | 56.2 | 0.38 | 3.25 |
| 30-39 | 57.8 | 0.38 | 3.16 |
| 40-49 | 59.3 | 0.38 | 3.08 |

(1) Age group and body weight; Simmons et al. (2005)
(2) FAO (2006)
(3) Based on rice grain Cd, 0.06872 mg/kg

**References**

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