

## Blood Pb and Cd levels – Human biomonitoring study in Serbia: DecodExpo project

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### Introduction

Lead (Pb) and Cd (cadmium) are toxic metals whose low-level exposure affects human health. Both metals are known to cause adverse effects on multiple organs (Wu et al., 2016). Cadmium is an established human and animal carcinogen and is usually associated with lung, prostate, and kidney cancers, and more recently, pancreatic cancer (Buha et al., 2017; Djordjevic et al., 2019). Lead is a highly potent neurotoxic metal and its exposure primarily affects the central nervous system (Javorac et al., 2022). Furthermore, some researchers postulate that there is no safe blood Pb level (Vorvolakos et al., 2016).

Measurements of the concentration of metals in the human blood provide direct information about the exposures to these metals. Therefore, these measurements may serve as biomarkers to heavy metal exposure (Satarug et al., 2020). In our preliminary human biomonitoring study, the aim was to measure the levels of Cd and Pb in the whole blood of the Serbian population.

### Materials and methods

The study population was chosen to represent the general population of Serbia and included 435 participants, 218 women and 217 men from five cohorts:

prostate and testes cancer patients (104), breast cancer and benign breast dysplasia patients (96), pancreatic cancer patients (22), thyroid and metabolic disorders patients (77) and healthy volunteers (136).

Pb and Cd levels were determined by graphite furnace method using AAS GTA 120 graphite tube atomizer, 200 series AA, Agilent Technologies, Santa Clara, CA, USA. The accuracy of AAS analyses was verified using certified reference material (CRM) Seronorm Trace Elements Whole Blood L-2 (SeronormTM, Sero, Billingstad, Norway). Metal analyses were carried out following the manufacturer's specifications, with a low probability of contamination. All chemicals for metal analyses were purchased from Fisher Scientific (Germany) and were of pure analytical grade.

All data were analyzed using SPSS 23.0 (IBM, Armonk, NY, USA) and Graph Pad Prism8 software (GraphPad Software Inc., San Diego, USA).

### Results and discussion

Humans are exposed to a pollutant when they inhale it, drink it, eat it, or absorb it through their skin. To evaluate the impact on health and develop suitable control techniques, it is essential to know the level of exposure. In

the presented study, the mean Cd blood level was 1.800 µg/L (5%: 0.030, 95%: 5.801) and the mean Pb blood level was 4.303 µg/L (5%: 0.332, 95%: 131.825). In females, the mean Cd concentration was 1.962 µg/L (5%: 0.030, 95%: 6.448) while in males, a statistically significant lower ( $P < 0.001$ ) Cd concentration was detected at 1.476 µg/L (5%: 0.032, 95%: 4.280). Lead levels did not significantly differ between gender groups, with females at 2.65 µg/dL (5%: 0.209, 95%: 14.01) and males at 3.11 µg/dL (5%: 0.57, 95%: 14.44).

Exposure to toxic metals including Cd and Pb may occur from polluted air, food or water. Measured levels of Cd and Pb indicate that exposure to those metals exists in the Serbian population. In the case of Cd smoking habits and diet probably had an impact on the blood Cd levels (Repić et al., 2020). Lead exposure is primarily from man-made sources due to its extensive usage. For Pb the acceptable blood concentration is 50 µg/L, therefore the observed mean level is within the safe range (Abadin et al., 2007). Cadmium is naturally present in the environment, but it is also released during mining and smelting processes, as well as from companies in plastics and batteries production. All tobacco products generate Cd, which has been classified as a carcinogen, with active and passive smoking being the main sources of exposure to humans (Wu et al., 2016).

## Conclusion

The presented study provides existing exposure to Cd and Pb in the Serbian population and represents the first phase of the DecodExpo project founded by Science Found of Serbia. Given that those metals are harmful at low doses, it is essential to promote the assessment of human toxic metal exposures as a basis for creating environmental control strategies to safeguard public health.

## Ethics approval

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Scientific and Ethical Committee of the Clinical Hospital Centre, Bezanijska kosa (Ethical License No. 9740/3), Clinical Centre of Serbia (License No. 526/9, 579/19, 31/8) and University of Belgrade – Faculty of Pharmacy (License No. 650/2, 288/2).

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