

# Metal Concentration in Commonly Used Medicinal Herbs and Infusion by Lebanese Population: Health Impact

Samira I. Korfali<sup>1</sup>, Mohamad Mroueh<sup>2</sup>, Mohammad Al-Zein<sup>3</sup> & Rosin Salem<sup>4</sup>

<sup>1</sup>Natural Science Department, Lebanese American University, E-mail: [skorfali@lau.du.lb](mailto:skorfali@lau.du.lb)

<sup>2</sup>School of Pharmacy, Lebanese American University, E-mail: [mmroueh@lau.edu.lb](mailto:mmroueh@lau.edu.lb)

<sup>3</sup> Biology Departments, American University of Beirut, Email: [msalzein@gmail.com](mailto:msalzein@gmail.com)

<sup>4</sup>Natural Science Department, Lebanese American University, E-mail: [salemrosine@gmail.com](mailto:salemrosine@gmail.com)

The use of plants as medicine predates recorded history despite medical and pharmaceutical advancements. The use of medicinal plants in primary healthcare intervention is more common in developing countries, where commercial drugs are mostly unaffordable or unavailable. The effectiveness of medicinal plants for therapeutic purposes is often accounted for by their chemical constituents. Minerals and trace metals are partially responsible for their medicinal and nutritional properties, as well as their toxic ones. The levels of essential elements in plants vary according to the geographical region, geochemical soil characteristics, and the ability of plants to selectively accumulate some of these elements. Some metals are essential nutrients (zinc, iron, copper, and chromium), yet become toxic at high concentrations, while others (lead, mercury, arsenic and cadmium) have no known beneficial properties and are toxic. Accumulation of heavy metals in plants is one of the most serious environmental concerns because they transfer heavy metal pollutants from soil into the food chain, and cause adverse health effects in humans. There are a number of factors which contribute to heavy metal contamination in agricultural soils including waste and industrial water discharge, irrigation with contaminated water, fertilizers and pesticides. In Lebanon, research on medicinal plants has mainly focused on the identification and characterization of their essential oils and pharmacologically important secondary metabolites. However, no studies on metal levels in commonly used medicinal herbs in Lebanon have been conducted yet. Therefore, the objective of this study is to assess the major and toxic metal levels in sixteen commonly used medicinal herbs, local and imported, and their infusions by the Lebanese population. In this study we used the common practice of herb infusions, and were prepared by either boiling the herb with boiling water or soaking the herb in boiled water to simulate its traditional usage. Sixteen medicinal herbs or blends were purchased from one of the oldest and major herbalists in Beirut. The concentrations of metals (Ca, K, Fe, Mn, Zn, Cu, Co, Ni, Cr, Pb, Cd, As) in the dried herbs was determined using EDXRF. Two types of herbal infusions were prepared based on the common methods used by Lebanese (boiling the herbs with water or by soaking the herbs in hot water). The concentration of metals in infusion (boiled and soaked) was determined by using thermal AAS. Statistical analyses were performed using SPSS, and SigmaStat statistical packages. Results revealed the order of metal contents in the herbs was found to be: K (6990-19850 µg/g) > Ca(1630-14450 µg/g) > Fe(80-3650 µg/g) > Mn (28-458 µg/g) > Zn (23-108 µg/g) > Cu (5-71 µg/g) > Cr (3.1-55 µg/g) Pb> (1.1-10.3 µg/g) > As (nd-10.8 µg/g) > Cd (nd-1.7 µg/g). The mean levels of toxic metals in herbs Pb, As and Cd were below WHO permissible levels. Cluster analysis indicated metals are most probably in plants due to wastes disposal and irrigation with contaminated wastes and/or from atmospheric waste particulates. The levels of Mn, Cr, Pb and As in herbal infusions were found to be higher in soaked than boiled preparations and correlated with Fe, while Zn and Cu levels were higher in boiled infusions. The highest weekly intake from herbal infusions of toxic metals Cr (492.8µg), As (77.0 µg), Pb (291.2 µg) and Cd (19.0 µg) were below the recommended permissible tolerable weekly intake respectively 1260 µg, 900 µg, 1500 µg, and 150 µg. Therefore, the consumption of these traditional medicinal herbs does not pose any health risk provided full compliance with recommended daily doses.