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Transfer of Heavy Metals from Soils to Vegetables and Associated Human Health Risk in Selected Sites in Pakistan

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ABSTRACT

Contamination of food chain with heavy metals is considered as one of the major environmental pathways of human exposure leading to potential health risk. This study aimed to investigate the concentrations of heavy metals like copper (Cu), zinc (Zn), chromium (Cr), nickel (Ni), and manganese (Mn) in agricultural soils and food-crops (fruity, leafy and rooty vegetables), and their associated health risk in the local population in southern selected districts of Khyber Pakhtunkhwa, Province, Pakistan. The concentrations of the selected metals in soil varied over a wide range, in the following decreasing order Mn> Zn > Cr > Ni > Cu. The bioaccumulation of metals in vegetables was within the permissible risk limits, except for Cr which showed a higher contamination in all tested food-crops. The trend of metal transfer factors for different vegetables were in the order of Cu > Ni > Cr >Mn> Zn, while the calculated daily intake of metals (DIM) in adults and children through consumption of food-crops were in the decreasing order of Mn> Zn > Ni > Cr > Cu . The values of health risk index (HRI) for the heavy metals for both adults and children were less than 1, therefore, no significant health risk is anticipated for the local consumers through ingestion of these food-crops.

INTRODUCTION

Heavy metal (HM) contamination is considered as a dominant source of pollution and a potentially growing environmental and human health concern all over the world. These concerns have been given tremendous attention, especially in developing countries (Jarup, 2003; Atta *et al.*, 2009). The toxic metals enter the environment from both natural processes (volcanic eruptions, weathering, parent rock erosions, and atmospheric deposition etc.) and anthropogenic activities (use of agro-chemicals, sewage disposal, mining, manufacturing, combustion of fossil fuels and composts application and green manure) (Singh, 2001; Oti, 2015; Waqas *et al*., 2015). These sources can cause contamination of both soil and vegetables at high concentrations, leading to a number of potential impacts (Singh, 2001; Oti, 2015)

For example, HMs including both essential and non-essential elements have particular implications in eco-toxicology, since they all have the prospective to be lethal to living organisms (Storelli *et al*., 2005). Some HMs like Cu, Zn, and Mn are essential for metabolic activities of animals