

# **Assessment of Heavy Metal Concentrations and their Associated Health Risks in Selected**

## **Vegetables and Soils from Minjingu Village, Tanzania using WDXRF Technique**

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Samples of soil and selected species of vegetables (cowpea leaves, spinach, sweet potato leaves, Ethiopian mustard and Chinese cabbages) were randomly collected from four sites which are Idara ya maji, Nkaiti, Mbulungu and Mkwajuni of Minjingu village of Manyara in Tanzania. The samples were analyzed using the wavelength dispersive x-ray fluorescence (WDXRF) spectrometry to determine the heavy metal concentrations in soils and vegetables. The concentrations were used to assess the health risk index (HRI) of vegetable consumption. The results indicate that soils have concentration range (in mg/kg) of 142-1547 for Ca, 737-2515 for K, 23964748 for Si, 0-121 for P, 0-181 for Mg, 0-36 for S, 0-68 for Na, 561-942 for Al, 1214748 for Fe, 0-80 for Mn, 0-53 for Sr, 0-37 for Cs and 0-11 for Ni which was above the MTLs. On the other hand, elements detected in vegetables were found in the range (in mg/kg) of 2123-6122 for ca, 747-8005 for K, 65-996 for Si, 40-348 for Mg, for Mn, 85-584 for P, 22-705 for S, 0-218 for Na, 70-835 for Fe, 23-286 for Al, 0-98 for Cs, 84-1076 for Cl and 0-13 for Ni. The highest heavy metal retention capabilities were exhibited in cowpea leaves, spinach and Chinese cabbages but sweet potato leaves and Ethiopian mustard contained lower concentration levels. Control site have the least concentration values. In some cases, essential elements in the control site surpassed the field study but heavy metals (Sr, Ni, Fe, Al, Cl, Mn and Cs) were in abundance in Minjingu village beyond acceptable limits set by FAO/WHO. The origin of heavy metals was attributed to Minjingu phosphate mine as the main anthropogenic polluting source. The correlation coefficient determined the primary sources of the heavy metals in vegetables. The accumulations of heavy metal in soils were significantly correlated with those in vegetables at 99% and 95% with anthropogenic activities. The HRI values for Sr ( $15.41 \times 10^{-00}$ ), Ni ( $1.105 \times 10^{-00}$ ) and Fe ( $1.466 \times 10^{-00}$ ) exceeded the maximum threshold limits ( $HRI > 1$ ) set by USEPA 2002. Furthermore, findings of this work indicate that soils and vegetables grown, particularly cowpea leaves, spinach and

Chinese cabbages were mostly contaminated with Sr, Ni and Feat levels able to pose detrimental health effects to the consumers.