

Estimation of Radiological Effects and Modeling Radionuclide Transfer to Milk and Fish in Kisoro District, South-western Uganda

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ABSTRACT

Activity concentrations of Naturally Occurring Radionuclides (NORMS); ^{238}U , ^{232}Th , and ^{40}K in pasture, milk, water and fish were determined using sodium iodide detector in order to estimate the radiological effects and model radionuclide transfer to milk and fish in volcanic areas of Kisoro District, South-western Uganda. The radiological effects that were determined were radium equivalent, annual effective dose equivalent, and excess lifetime cancer risk. Seventy nine (79) pasture samples were collected from cattle farms in seven sub-counties where geological formation was volcanic eruption. The same was done for milk on the same farms. In milk and fish, average radium equivalent was 4.531 and 39.24 Bq l^{-1} , the annual effective dose equivalent was 0.014 and 0.126 mSv y^{-1} and the excess lifetime cancer Risk was 0.041×10^{-3} and 0.378×10^{-3} , respectively. These radiological effects from the consumption of milk were close to the safe values, hence the quantity of milk to be consumed was estimated to be 0.105 litres per day (0.74 litres per week) in order to keep the radiological effects low. The radiological effects from the consumption of fish were about 10 times higher than the safe values and the safe consumption rate was estimated to be 0.02 kg (fresh weight) per day or 0.14 kg (fresh weight) per week. Contribution to radium equivalent (Bq l^{-1}), annual effective dose equivalent (mSv y^{-1}), and excess lifetime cancer risk due to the radionuclide transfer from pasture to milk were estimated as 0.074, 0.002, and 6.1×10^{-6} , respectively. These contributions of radiological effects account for about 1.5 percent to the safe limit, hence causes a minimal radiation hazard. In fish, accumulation of radionuclide ^{210}Po , a daughter of ^{238}U , from water to fish remained constant after two years, the transfer does not contribute to radiological effects. Therefore, for poverty reduction and improving food security, animal rearing and stocking of the lakes need to be encouraged. A similar study where the chemistry of the soils and water is considered, on foodstuffs like vegetables, beans, potatoes, maize, yams, bananas and drinking water, should be carried out.