

**Aluminium and Fluoride Levels in Soil, Water and Foods in Mwingi and Thika District**

**JOY KAGWIRIA OCHIENG**

**A thesis submitted in partial fulfillment for the Degree of Master of Science in Food  
Science and Post Harvest Technology at Jomo Kenyatta University of Agriculture and  
Technology**

**2007**

## ABSTRACT

Low amount of ingested fluoride is important for prevention of dental caries. However, ingestion of high levels of fluoride may lead to disease conditions that adversely affect the skeleton. Aluminium is not known to be any nutritional value to human beings. Ingestions of high amounts of aluminium in foods and water has been reported to cause aluminium toxicity, leading to development of disease conditions such as osteomalacia and Alzheimer' disease among others. Soils, foods and water vary in their contents of aluminium and fluoride, depending on geographical location and composition of underlying rock. The aluminium content in cooked food depends on handling, processing and preservation methods. However there is little information concerning the content of aluminium and fluoride in water, soils and foods commonly eaten in Kenya. The main objective of the study was to determine the levels of aluminium and fluoride in water, food and soil in Thika and Mwingi Districts.

Aluminium was determined using the AAS with a nitrous oxide/acetylene flame. Fluoride was determined using the SPADNS calorimetric method which is based on the reaction between fluoride and zirconium- Dye Lake. The mean fluoride content in 18 soil samples analyzed was 369 ppm. The highest fluoride content in soil was that from sample in Nuu location (469 ppm) in Mwingi district, the lowest was from chain location (126 ppm) Thika district. The highest fluoride content in water samples was from Jojo borehole in Kanzanzu location, Mwingi District (2.47 ppm). The lowest fluoride content was from river Thiririka in Juja location, Thika district (0.05 ppm). The mean fluoride content in the different sources of water was as follows: boreholes 1.21 ppm; shallow wells, 0.68 ppm; rivers springs, 0.21 ppm and tap water, 0.07 ppm. fluoride content in tap water, rivers and springs was below the recommended levels, in shallow

well some were within the recommended levels, while in boreholes some had higher levels than the maximum who permissible levels. The mean aluminium content in different sources of water was as follows: spring, 1.59 ppm; shallow wells, 1.29 ppm; boreholes, 0.82 ppm; rivers, 0.83 ppm and taps, 0.95 ppm; shallow aluminium content in all the water sources was above the maximum admissible levels of 0.2 ppm. The highest aluminium content in soil was from Kianguni in Chania location (1005 ppm), while the lowest was in Mwenga, Nuu where no aluminium was detected among the foods analyzed tea had the highest aluminium content (1189 ppm), while cow peas had the lowest (41 ppm) aluminium content. The aluminium content in beans from different locations ranged from 152 ppm in Chania to 40 ppm in Juja and Nuu. The greatest increase in aluminium content in foods cooked with aluminium pans as compared to stainless pans was in tomatoes where tomato cooked in aluminium pan had 266 ppm, while, in stainless it had 139 ppm. acidic de- ionized water boiled in aluminium pan had aluminium content increase from 0 ppm to 230 ppm after 30 minutes, 467 ppm after 40 minutes and 1298 ppm after one hour, while a control with stainless steel had only 3.6 ppm after one hour.

This study shows that exposure to fluoride content is varied, in different locations and populations. It is important to ensure the WHO limits are maintained to ensure the beneficial effects due to fluoride are realized, and the toxic effects are avoided, with time Kenya should set their own standards. Aluminium levels in water in this study are above the WHO set quality guidelines therefore studies need be done to relate the toxic effects of aluminium to the levels in different population in the country – Kenya.