Analysis of Essential Trace Elements by EDXRF in Selected Medicinal Plants Used in Kenya

Wilson W. Njue  
Professor, Department of Chemistry, Kenyatta University, Kenya  
Ruth Wanjau  
Associate Professor, Department of Chemistry, Kenyatta University, Kenya  
Njenga I. Kariuki  
M.Sc. Student and Lecturer, Kiambu Institute of Science and Technology, Kenya

Abstract: 
Kenya is endowed with nature where hundreds of medicinal plants are available. During photosynthesis in plants, and respiration in animals and other organisms, metal elements play a major role with a few of the elements being essential to the body as nutrients. Trace elements for example Zn, Cr, V and Se with known immunological response and healing properties were analysed in selected medicinal plants available in Kenya. These plants were: Prunus africana, Urtica massaica (stinging nettle), Maytenus obscura, Maytenus putterlikiodes, Azadiracta indica (Neem), M. whytei, Zanthoxylum usambarense, Maerua edulis, Trigonella foenum-graecum (fenugreek) and Glycyrrhiza glabra (licorice). The concentrations of elements were determined using Energy Dispersive X-ray Fluorescence Spectrometer (EDXRF). The levels of zinc varied from 25.94±1.89 to 70.58±4.70 mg/kg (mean 45.94±12.42 mg/kg). Vanadium from 1.69±0.18 to 9.99±0.86 mg/kg with an average level of 5.89±2.09 mg/kg. Chromium from 1.44±0.30 to 6.94±0.59 mg/kg with a mean of 3.49±1.32 mg/kg. Selenium (53.21±5.45 to 124.01±4.41 µg/kg, mean of 90 ±19.17 µg/kg). The levels of the trace elements were compared with recommended dietary intake (RDI) and were found to provide these essential elements as part of therapeutic utility. The levels in different plant parts were found to vary significantly (P<0.05) in some plants and not significantly (P>0.05) in others for a given species. The plants can provide the elements as per required daily intake (RDI).

Keywords: Trace elements, EDXRF, Medicinal plants

1. Introduction 
The world population is experiencing an upsurge of diseases whose cure is becoming elusive. Among this disease are HIV/AIDS, tuberculosis, cardiovascular and a myriad of cancers. As a response to these challenges great effort is being expended in the study of herbal medication as a possible source of cure. Today, there is widespread interest in herbal drugs. This interest primarily stems from the belief that herbal medicines are safe, inexpensive and have no adverse effects (Kumar et al., 2012). World health organization estimates that 80% of the world population currently uses medicinal plants for some aspect of their primary healthcare (Obianjuwa et al., 2004). Trace elements such as selenium, chromium, zinc and vanadium play a major role in improving body immunity (Al Durttsch, 1999 & American Cancer Society, 2004). Available and reliable sources of these minerals are plant sources. Medicinal plants contain essential trace elements in amounts that are helpful to the body. Selenium is effective in cancer prevention, an antioxidant, slows aging process and stimulate the formation of antibodies in response to vaccines. (American Cancer Society, 2004 & Mahyar et al., 2010). Zinc is essential to human body growth and development of normal brain function (Rink & Gabriel, 2000). Zinc deficiency may affect bone metabolism and gonadal function (Nishi, 1996). Chromium is found in the body in tiny amounts and has the function of glucose metabolism. (Al Durttsch, 1999). Vanadium helps promote healthy glucose levels in people with lack of insulin sensitivity (Cohen et al., 1995).

Many conventional drugs and their precursors are derived from plants but there is a fundamental difference between administering a pure chemical and the same in a plant matrix. “There exist advantages of chemical complexity in herbal medicines that form a synergy with the human body” (Ron et al., 2000). Generally herbal formulations involve use of fresh or dried plant parts. Comprehensive knowledge of such crude drugs is a very important aspect in preparation, safety and efficacy of the herbal product. Trace elements with known immunological and curative properties are part of this chemical complexity. Though many metal complexes are used in medicine for example zinc antiseptic creams, magnesium drugs for treatment of ulcers and metal clusters as anti-HIV and cancer drugs (Kupka and Fawai, 2002; Mocchegiani and Muzzioli, 2000), there are side effects when they are excessively administered and without due care.

The objective of this study was to analyze the levels of trace elements in medicinal plants for their quality control (Arceusz et al., 2010) and bring awareness for their use in provision healthcare.