

Trace Element Assessment in Fingernails of Adult Females

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ABSTRACT

Trace elements play a significant role in giving nutritional benefits to the body because they act as essential cofactors for all physiological processes. However, there are some trace elements which may bring more harm than good when entering the human body. Due to its ability to incorporate trace elements in an amount that is proportional to an individual's dietary intake and environmental exposure, human fingernails are suitable biomarkers in assessing the health status of an individual as they reflect on the trace element concentration present in the body. This study has analysed fingernail samples of 23 adult females residing in Kuching and Kota Samarahan, Sarawak, Malaysia for four elements, namely Cd, Cu, Pb and Zn. By using flame atomic absorption spectroscopy (FAAS), the mean elemental concentrations found in fingernail samples of research participants were $171.8 \pm 33.8 \mu\text{g/g}$ for Zn, $27.8 \pm 14.8 \mu\text{g/g}$ for Cu and $2.64 \pm 0.94 \mu\text{g/g}$ for Pb. Cd concentrations were not able to be detected as they were below the detection limits. A standard reference material, NIST 1568b Rice Flour was used to verify the methods used in elemental analysis using FAAS. Independent t-test which was used to compare the means of Zn and Cu between vegetarians and non-vegetarians showed no significant differences for both elements. Moreover, correlation analysis showed negative correlations between Cu/Zn pair and Pb/Zn pair, whereas significant positive correlation was obtained for Cu/Pb pair. The overall data from this study showed good agreements with data obtained from studies in other countries. Therefore, the current data in this study represents the latest background elemental concentrations in fingernails of the residents in Kuching and Kota Samarahan, Sarawak.

Keywords: Adult females, fingernails, flame atomic absorption spectroscopy (FAAS), trace elements

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INTRODUCTION

Trace elements are known as dietary minerals which are needed in small quantities for ensuring normal physiological functions in the body of living organisms (Strachan, 2010). Trace elements are those which constitutes less than 0.01% of body mass. Being structural constituents of enzymes or cofactors, they play vital roles in the prevention of nutritional deficiencies, antioxidant defence, immune functions, regulation of gene expression and in the prevention of chronic diseases. Although most trace elements present in human bodies are essential elements produced naturally by the body itself, it is also possible for these elements to be taken in from the external environment. This leads to the increase in trace element concentrations in the body. Other than that, the uptake of environmental elements, such as heavy metals, into the human body is possible by three main routes, namely dermal absorption, inhalation and ingestion. Thus, upon high exposure to possible sources of environmental elements and heavy metals, the human body may contain high concentrations of trace elements which can be toxic and lead to negative health effects to the exposed individual (Esteban & Castano, 2008; Parizanganeh, Zamani, Bijnavand & Taghilou, 2014). Human biomonitoring (HBM) is defined as a scientific technique that allows researchers to investigate how much of environmental substances have entered the human body, besides looking at how these exposures vary over a certain period of time. The biological samples, such as blood, breastmilk, saliva, urine and nails, are collected, analysed and are then compared with suitable reference values in order to assess exposure and health risk of the exposed subjects (Angerer, Aylward, Hays, Heinzow & Wilhelm, 2011; Esteban & Castano, 2008; Waseem & Arshad, 2016). In this study, fingernail samples were chosen mainly due to its easy sample collection and storage, besides having the advantage of reflecting elemental concentrations in the body from a period of 12 to 28 months (Li *et al.*, 2012).

To the best of current knowledge, there has yet to be any published research on the proposed study area, namely Kuching and Kota Samarahan, Sarawak, Malaysia. As mentioned in Li *et al.* (2012), the scientific data for elemental nail concentrations are still limited even with the findings obtained from previous studies throughout