Variations in hair mineral measurements and statistical models: Studying associations between hair minerals and intractable diseases

T. Nakamura [1], T.Yamada [2], S. Goto[3], K. Sera[4], Todd Saunders[5], T. Takatsuji[2], T. Makie[6] and Y. Nose[7]

[1]Nagasaki University Graduate School of Environmental Studies
1-14 Bunkyomachi, Nagasaki 852-8521, Japan

[2]Center for Translational and Clinical Research, Osaka University Hospital
2-2 Ymadaoka, Suita, Osaka 65-0871

[3]Nishina Memorial Cyclotron Center, Japan Radioisotope Association
348-58 Tomegamori, Takizawa, Iwate 020-0603, Japan

[4]Cyclotron Research Center, Iwate Medical University
348-58 Tomegamori, Takizawa, Iwate 020-0603, Japan

[5]Nagasaki University Graduate School of Medicine
1-12-4 Sakamoto, Nagasaki 852-8523, Japan

[6]Clinical Research Center, Suzuka Hospital
3-2-1 Ksato, Suzuka, Mie 513-8501, Japan

[7]Kyushu University Graduate School of Medicine
3-1-1 Maidashi, Higashiku, Fukuoka, 812-8582, Japan

Abstract

In vivo measurements of trace elements are considered to be key biomarkers for better understanding of the cause and treatments of intractable diseases. In performing association studies between trace elements and intractable diseases, it is essential to clarify the characteristics of the variations, or fluctuations in the measurements of trace elements and to develop statistical methods that take into account the influence these fluctuations have on results. This clarification along with new statistical methods will lead to more reliable and accurate findings. Results obtained from this study describe the decomposition of the variations in the measurements of the trace elements into intra-individual variations and inter-individual variations. In addition, we will describe multivariate regression models, case control methods, and mechanistic models as examples of generally applicable

statistical methods that can easily make full use of the characteristics of hair minerals, and provide more evidence of relationships between hair mineral concentrations and intractable diseases.

Currently, the cause and treatment of atopic dermatitis are unknown. To examine associations between atopic dermatitis and hair mineral content, we conducted a cohort study with approximately 1,000 babies in Fukuoka City. After adjusting for family history of the disease, the results suggest that Se and Sr concentrations in the mothers and children were significantly associated with atopic dermatitis. This was the first published report to predict the relative risk of the onset of atopic dermatitis. In addition to applications in the medical sciences, PIXE-statistical analysis has been proven effective for distinguishing the origin of materials, including down feathers, vegetables, meats, and wood.