

Evaluation of the trace elements concentrations in blood serum of a healthy elderly population by neutron activation analysis

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Trace elements play an important vital role in human metabolism as well as to provide important information about environmental and occupational exposure to toxic elements. The aim of this study was to evaluate trace elements concentrations in blood serum samples from elderly people without clinical evidence of serious chronic diseases, seen at the clinical geriatric discipline of Clínica Hospital of Medicine School of São Paulo University. The selection of the individuals was based on the SENIEUR protocol. The samples of 52 elderly people (14 men and 38 women), aging 73 ± 6 years, without significant chronic diseases, were analyzed. The blood, after 12 hours fast, was collected by venipuncture using sterile standard metallic needles. The blood was collected in the evacuated tube (Vacutainer Systems - Becton Dickinson), without heparin, specific for trace elements analyses. An aliquot of serum (3.0 mL) was transferred to a flask (Nalgene) using a micropipet. Neutron activation analysis (NAA) was performed using about 200 mg of sample weighed in clean polyethylene bags, and irradiated at the IEA-R1 research nuclear reactor together with elemental standards. Short irradiations of 30s for Cl, and Na determinations were carried out by using a pneumatic transfer system facility under a thermal neutron flux of $1.4 \times 10^{12} \text{ n cm}^{-2} \text{ s}^{-1}$. Longer irradiations of 16 hours under a thermal neutron flux of about $5 \times 10^{12} \text{ n cm}^{-2} \text{ s}^{-1}$ were performed for Br, Ca, Fe, Rb, Se and Zn determinations. After adequate decay times, the irradiated samples and standards were measured using a Hyperpure Ge detector Model GX2020 coupled to Model 1510 Integrated Signal Processor, both equipments from Canberra, Australia. Each sample and standards were measured at least twice for different decay times. Counting times from 200 to 50 000 seconds were used, depending on the half-lives or activities of the radioisotopes considered. The radioisotopes measured were identified according to their half-lives and gamma-ray energies. Element concentrations were calculated by comparative method. The certified reference material, NIST 1566b Oyster Tissue was analyzed to evaluate the accuracy and precision of the results. Determinations of Ca, Fe and Mg were also carried out by colorimetric method and of Na and K by ion-selective electrode (ISE) method using Roche/Hitachi MODULAR ANALYTICS PP (Roche Diagnostics GmbH, Mannheim, Germany). The mean concentration values obtained by NAA were: Br: $3.46 \pm 0.02 \text{ mg/L}$, Ca: $9.52 \pm 0.48 \text{ mg dL}$, Cl: $86.94 \pm 1.50 \text{ Meq/L}$, Fe: $158.58 \pm 5.72 \text{ } \mu\text{g/L}$, Na: $129.76 \pm 1.71 \text{ Meq L}$, Rb: $335.30 \pm 5.19 \text{ } \mu\text{g/L}$, Se: $73.30 \pm 1.85 \text{ } \mu\text{g/L}$ and Zn $98.66 \pm 0.96 \text{ } \mu\text{g/L}$. Results by Roche Hitachi MODULAR ANALYTICS chemistry analyzer were: Ca: $8.8 \pm 2.7 \text{ mg dL}$, Fe: $108 \pm 35 \text{ } \mu\text{g/dL}$, Mg: $1.84 \pm 0.22 \text{ Meq/L}$, Na: $139.6 \pm 2.3 \text{ Meq/L}$, K: $4.6 \pm 0.4 \text{ Meq L}$. From the results obtained it can be conclude the selected elderly group did not present deficiency or excess of trace elements in blood serum samples. Trace elements concentrations obtained were within the reference values used in clinical laboratories. The mean concentration for Na obtained by NAA was slightly lower than that by ISE method.

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