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TRACE ELEMENTS AT WHOLE BLOOD OF *GOLDEN HAMSTER* USING SEMI PARAMETRIC NAA TECHNIQUE

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ABSTRACT

In the present study Neutron Activation Analysis technique has been used to determine, simultaneously, some element concentrations in whole blood samples of *Golden Hamster*. Using these data will be possible to check the similarities with the human being as well as to use them as reference value to performed clinical investigation using whole blood.

1. INTRODUCTION

Animal experimentation is an useful tool in many research areas mainly those related to life sciences. Particularly, in the veterinary medicine, small-sized animals are frequently used for testing new medicines and vaccines as well as for medical diagnostic studies, before to being tested in human being. One of the most used animals is the *Golden Hamster* due to the low cost and also to the facilities related to medico-legal implications. In this study the semi-parametric Neutron Activation Analysis technique [1] was used to determine the element concentrations, such as, Br, Cl, K and Na, in whole blood samples of *Golden Hamster*. These elements were selected because they are very useful for clinical practical. The basic principle of this technique is the irradiation of the biological material with neutrons followed by the measurement of the γ-ray activities induced in the biological sample, where the elements can be identified by the nuclear properties of γ-rays. As this nuclear procedure has been successfully used in the public health field for the investigation of elements in urine, bones and organs of small and medium-sized animals [1-5] it was extended to analyze whole blood. The relevancy of this study is that blood represents the most important biological referential to the circulatory system then its biochemistry analyses give indication for a great number of anomalies.

2. EXPERIMENTAL PROCEDURE

To determine the concentration of the elements in the biological samples the Cd Ratio Technique was used for the measurement of thermal flux distribution [3]. In this technique,

Au foils (~1mg), both bare and Cd covered (1mm thick), are irradiated together with the biological sample in the IEA-R1 nuclear reactor at IPEN/SP (IEA-R1, 2-4MW, pool type), for few minutes, allowing the simultaneous activation of these materials under the exact same irradiation conditions. Using this procedure the γ-ray activities induced in the Au foils by both the thermal and epithermal neutrons were obtained as well as the activation of biological samples. A γ spectrometer system with a semiconductor detector connected to an ADCAM multichannel analyzer and to a PC computer were then used to measure the induced gamma-ray activity. The detector was a HGPe of high resolution (FWHM=1.87 keV) calibrated for energy and efficiency through the measurements of standard sources of Co^{56} and Eu^{152}.

For this study were collected whole blood samples from 7 female adult and 13 male adult *Golden Hamsters* (Mesocricetus Auratus). These biological samples were from Centro de Pesquisas Aggeu Magalhães in Recife. Less than 0.1 ml of whole blood was collect of each animal and aliquots of 100 μl (in duplicate) were immediately transferred to the filter paper and dried for few minutes using an infrared lamp. Each sample was sealed into an individual polyethylene bag and irradiated together with the Au foils at the IEA -R1 nuclear reactor. Using this experimental procedure it was possible to activate simultaneously the following radioactive nuclides: ^{80}Br($T_{1/2}$=17.68 min, Eγ =616.3 keV),^{38}Cl ($T_{1/2}$=37 min, Eγ =1642 keV), ^{42}K ($T_{1/2}$=12h, Eγ =1525 keV) and ^{24}Na ($T_{1/2}$=15h, Eγ =1368 keV). The concentration of each element was then obtained by using in- house software [6].

3. RESULTS

The indicative interval and arithmetic mean value, taken at ±1 standard deviations (SD) are shown in Table I for the elements Br, Cl, K and Na. All the results are a mean of duplicate analyses. In addition, the indicative intervals for human been whole blood estimation were presented for comparison.

For an illustrative visualization in figure 1 the potassium concentration's behavior in whole blood samples from the *Golden Hamster* are shown. The human been whole blood estimation were also included.

Table 1. Indicative interval for the reference values of the elements Br, Cl, K and Na (in gl^{-1}) in whole blood samples of *Golden Hamster* using NAA with Au as flux monitor.

Elements	Mean	SD (68%)	Minimum Value	Maximum Value	Indicative Interval
Br, gl^{-1}	0.026	0.007	0.016	0.035	0.019 – 0.033 [0.0048 – 0.0072]*
Cl, gl^{-1}	3.12	0.4	2.37	3.73	2.72 – 3.52 [2.34 – 3.00]*
K, gl^{-1}	1.92	0.24	1.55	2.25	1.68 – 2.16 [1.09 – 1.53]*
Na, gl^{-1}	2.04	0.37	1.57	2.75	1.67 – 2.41 [1.24 – 1.60]*

* Human whole blood estimation from ref [7].

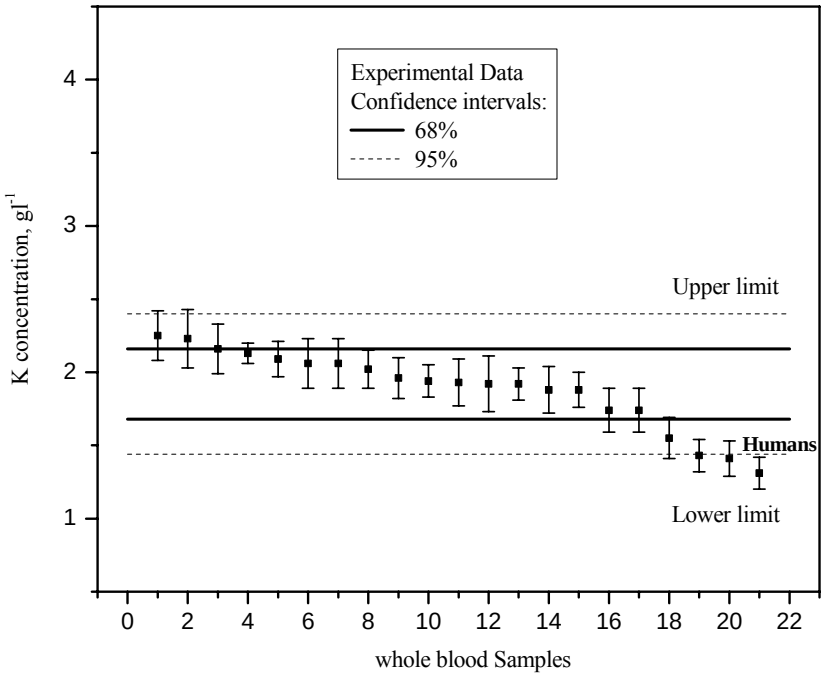

Figure 1. Potassium concentration in whole blood samples of *Golden Hamster*. The values are arranged by decreasing concentration.

4. DISCUSSION

The use of this nuclear procedure to quantify elements in whole blood for clinical practical presents some advantages, when compared with the conventional clinical analysis, that could be emphasized: it is an economic and agile alternative to perform biochemistry's analysis, it gives information about the clinical condition during the animal experimentation and, considering that these investigations usually involves a lot of samples, specially when sample quantities are restricted (small-size animals), this procedure is preferred because it requires small qualities of biological material reducing the stress of them. In addition, the knowledge of the biochemical values for Br, Cl, K and Na and their comparison with the results from human being whole blood estimation permit to check the similarities or physiologic differences, an important data for animal experimentation.

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