

DETERMINATION OF IRON IN BLOOD: AN ALTERNATIVE FOR SPORT MEDICINE

C.B.Zamboni¹, S.Metairon¹, L.Kovacs¹, D.Vaz de Macedo², M.A.Rizzutto³

¹Instituto de Pesquisas Energéticas e Nucleares, IPEN - CNEN/São Paulo, Brasil

²UNICAMP - São Paulo, Brasil

³Instituto de Física - Universidade de São Paulo, IFUSP/São Paulo, Brasil



Ministério da Ciência e Tecnologia



In this study is presented the details of an alternative methodology for iron blood evaluation using a portable X-Ray Fluorescence Spectrometry (PXRF). The main advantage for using this portable instrument is the fast procedure for iron analysis in blood (few minutes) combined with the viability to use small quantities of blood (10 times less, at least) compared with the conventional clinical tests. Our data can be useful to a well-planned nutritional proposition that could contribute to performance of endurance athletes.

INTRODUCTION

MOTIVATIONS

Clinical Tests

High aerobic activity and dietary habits may result in depletion of body iron stores, which could decrease the aerobic performance increasing the risks of fatigue and immune disorders. Athletes, particularly those involved in endurance sports, are commonly diagnosed with iron deficiency.

Economic Viability

According to the last Program External Quality Assessment of clinical laboratories (Brazil, 2014), 1.4 billion clinical tests have been done (~ 4% are biochemical test, mainly for Fe, Na, Ca and K); moreover, it is estimated an increase of ~2% of clinical examinations in 2015.

OBJECTIVE

In this study, the iron status was determined in whole blood of amateur athlete's using the X-Ray Portable X-Ray Spectrometer (PXRF).

These results were compared with the Control Group (subjects of same age but not involved with sports).

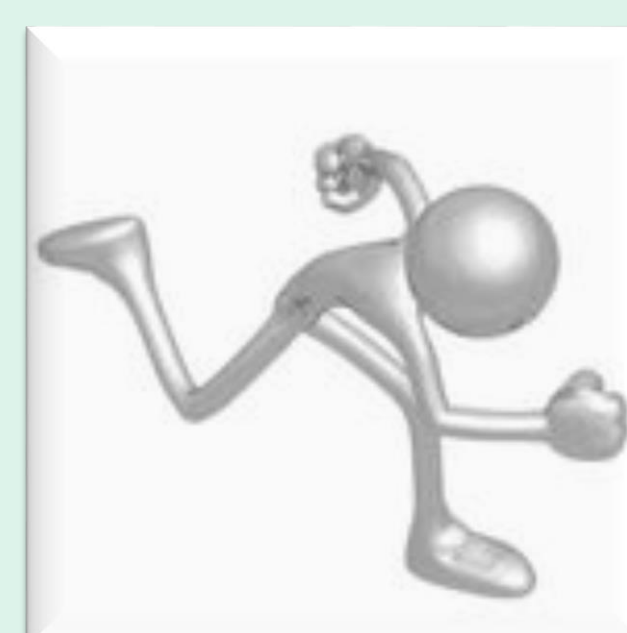
MATERIAL AND METHODS

Runners:

18 male amateur athletes participated. These athletes have balanced diet, without multivitamin or mineral supplements

Control Group (CG):

46 male healthy donors with the same age and not involved with physical activities



Sample Collection

Runner: The blood samples were collected at Laboratório de Bioquímica do Exercício (LABEX/UNICAMP - Brazil).

Control Group: Samples were collected at Paulista Blood Bank

All the samples were collected through digital puncture with micro capillary (at rest), in the morning.

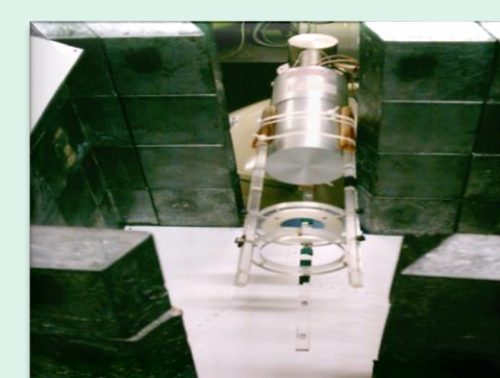
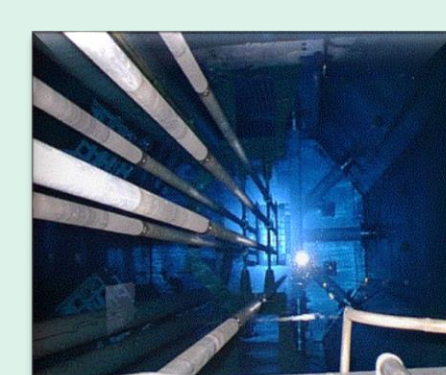
Quality control

IAEA-A13 Blood Animal was used for an analytical quality control

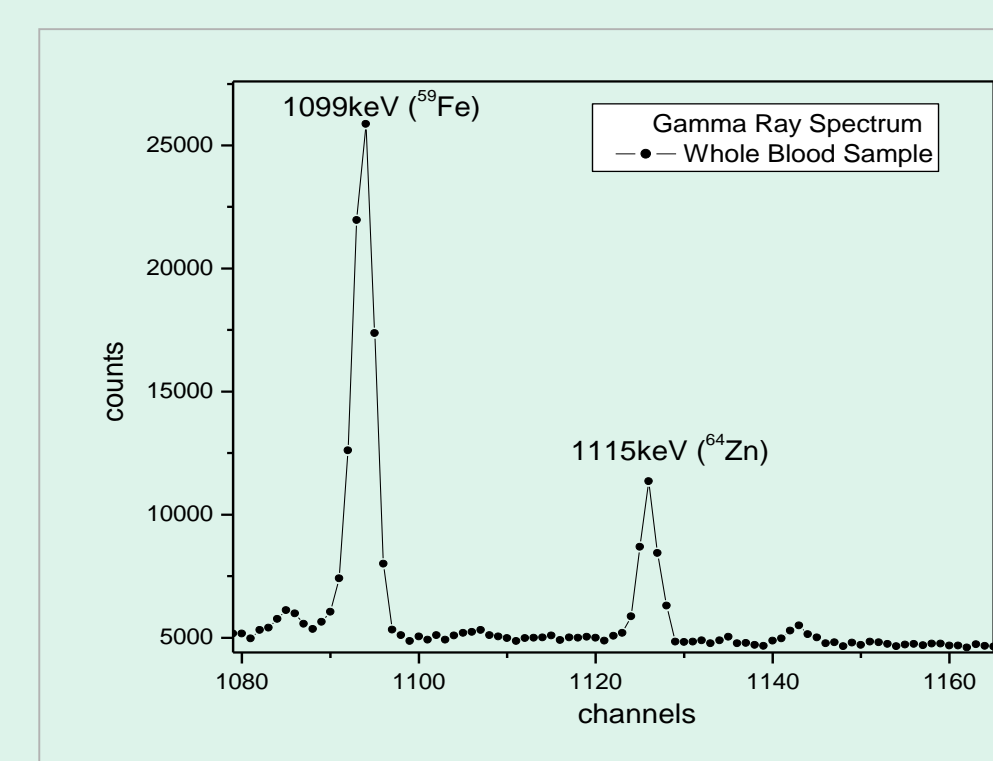
EXPERIMENTAL PROCEDURE

Neutron Activation Analysis

- Aliquots of 500 μ L blood were transferred to plastic bag;
- Sample and Certified Reference Material (AIEA-A-13) were irradiated (4hs) in the IEA-R1 nuclear reactor;
- Gamma-ray (1099 keV) was counted for 6hs using HPGe detector (FWHM=1.92 keV);
- Iron concentration was determined using the *Activation* software.

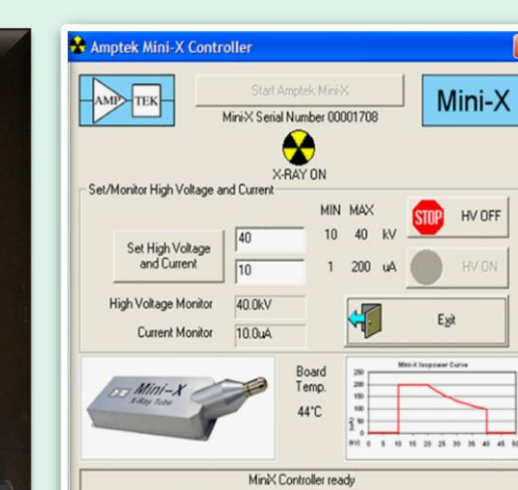


Whole blood spectra using HPGe detector

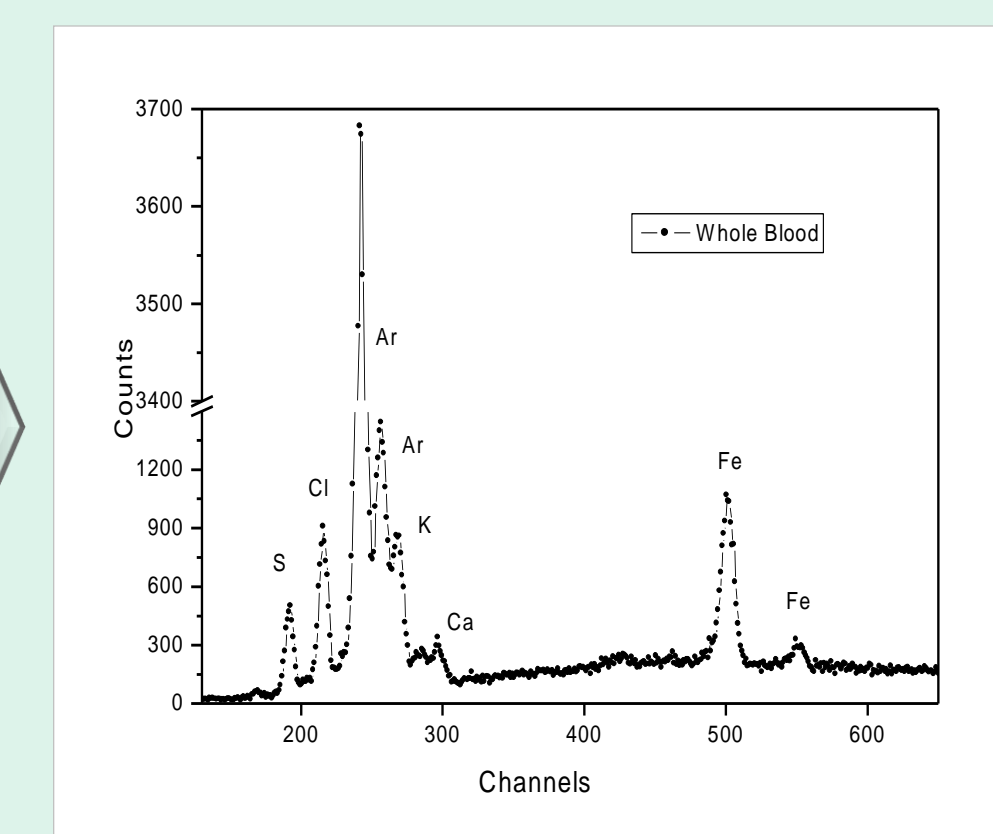


X-Ray Fluorescence

- Aliquots of 50 μ L (duplicate) was then transferred to the filter paper and dried for few minutes using an infrared lamp.
 - ✓ aliquots of Fe standard solutions was also transferred to filter paper and prepared in the same manner as the biological samples.
- Si Drift detector (25 mm² x 500 μ m / 0.5 mil) with Be window;
 - ✓ X-ray characteristics intensities (K α lines) measured with 30kV and 5 μ A excitation;
 - ✓ each samples was irradiated for 300s using 30 kV and 5 μ A excitation;
 - ✓ the quantitative analysis (was performed using WinQxas software).



Whole Blood spectra using Portable X-Ray Spectrometer



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RESULTS

The concentration results in blood for CG

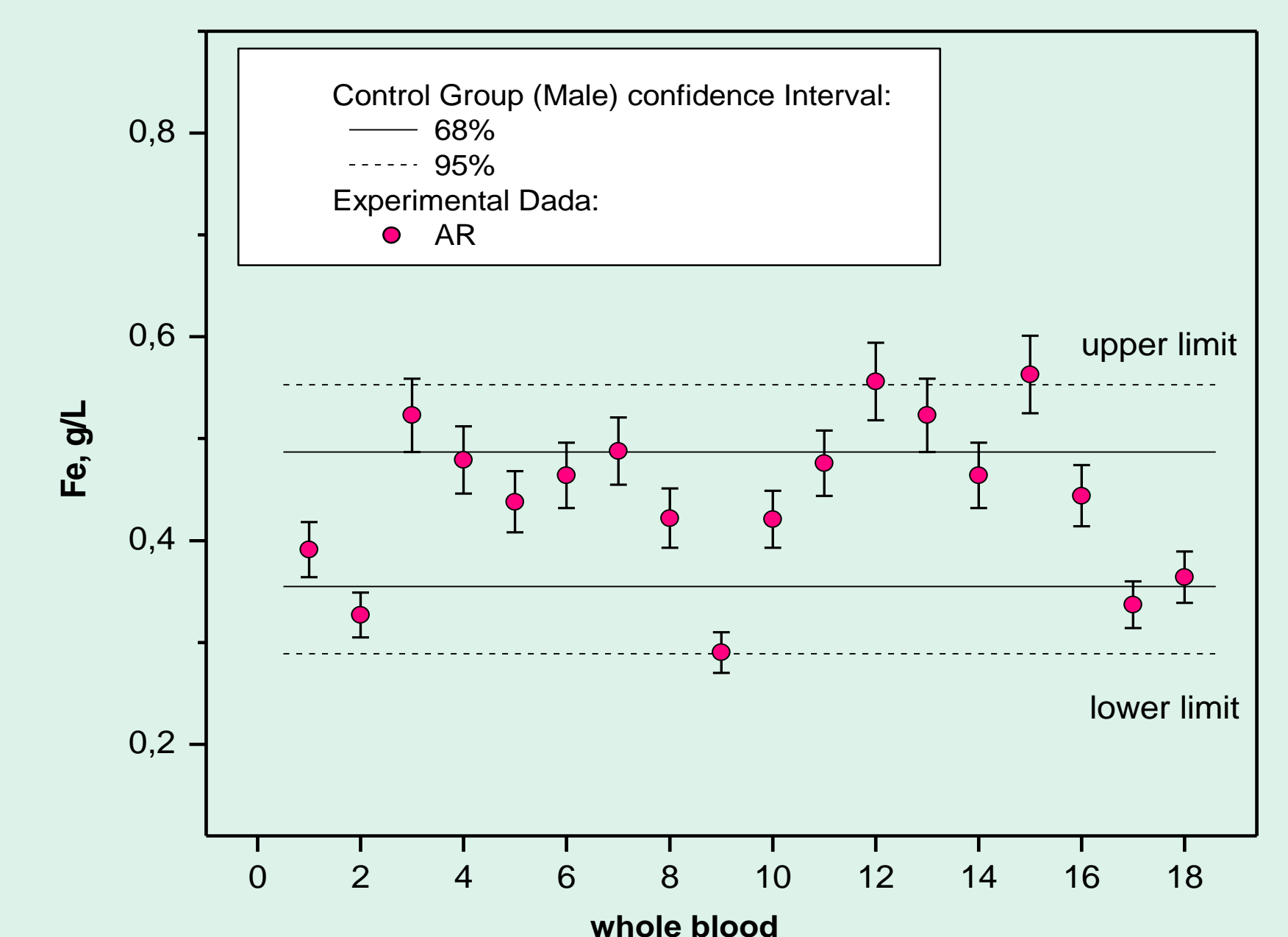
Fe, mgL ⁻¹	NAA	XRF
Mean value	409	354
± 1SD	60	54
Range	289 - 553	246 - 462
Median	407	343
Mode	420	343
Minimum	315	267
Maximum	495	482

NAA & XRF:

According to Student's *t*-test ($p < 0.05$) the NAA and XRF analysis showed agreement for Fe.

Comparison

Individual concentrations of Fe in blood of Runners with the indicate interval of Control Group



CONCLUSIONS

• We presented a new clinical methodology for iron evaluation in blood with the respective confidence interval;

• These data can be considered for evaluating the performance of the athletes during the period of competition preparation, for preparation of balanced diet as well as to contribute for proposing new protocols of clinical evaluation.

Moreover,

This alternative procedure can also be used in sports medicine for different modalities...

