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DETERMINATION OF BLOOD IRON BY EDXRF IN THE FEMALE POPULATION OVER 60 YEARS OF AGE

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1. Introduction

In recent decades, the Brazilian population has undergone a rapid aging process, and current estimates based on household-based research carried out by the Brazilian Institute of Geography and Statistics (IBGE) indicate that the number of elderly people in Brazil will quadruple by the year 2060 [1]. This new demographic reality, with an increasing number of elderly people, also requires the health system to be able to respond to current and future demands. In Brazil, iron deficiency anemia is a nutritional problem of great magnitude and affects children and pregnant women (3 million cases), but it is also a health problem in the elderly population [2, 3].

Current estimates in Brazil indicate that the number of elderly people who should receive more care should increase between 30% and 50%: while men spend, on average, 4.2 years needing long-term care, women spend up to 4.7 years. Furthermore, men die earlier than women do. Therefore, in geriatric medicine, the aging of the Brazilian population is considered a gender issue [1]. This study aimed to evaluate iron in the blood tissue of women over 60 years of age due to the high prevalence of iron deficiency anemia in this age group. We intend to use the Energy Dispersive X-Ray Fluorescence technique (EDXRF) to perform Fe dosage in blood. There are some motivations for this clinical application, but the major advantage is the viability to use whole blood samples comparatively to conventional analyses performed in serum or plasma samples [4]. In addition, its execution is faster (minutes), has a lower cost (eliminates the use of reagents and glassware) and the sample can be storage (for years) without the need for refrigeration (non-destructive analysis).

2. Methodology

Forty healthy female, ages 72 ± 6 years participated in the study (CAAE 45889915.0.0000.5659). The whole blood samples (~ 2 ml) were collected in the morning in the EEFERP-USP (Escola de Educação Física e Esporte da Universidade de São Paulo - Ribeirão Preto). Two types of samples were prepared: 50 µL (in duplicate) were dropped onto filter paper Whatmann–41 and aliquots of 1.5 ml were lyophilized, compacted into tablets and placed in a circular support with a thin film base (4µm). The EDXRF analysis was performed using X-Ray Spectrometer (X-123 SDD model - Amptek®), with Ag target. The characteristic fluorescent X-rays emitted from the samples (K_α line) was measured with a Si Drift detector (25 mm^2 x 500 µm) with Be window (12.5 µm). The excitation conditions were optimized in 30 kV and 5 µA and counting time of 200 s. The spectra analysis was performed using WinQAXIL software program [5].

3. Results and Discussion

The Fe concentrations determined using freeze-dried samples is presented in **Table 1** and **Figure 1** shows a comparison performed using liquid and freeze-dried samples.

Table I: Fe concentrations by EDXRF technique

Fe, mg/l K_α = 6.40 keV	Whole blood	
n	40	10
Sample preparation	freeze-dried samples	samples deposited on paper
Mean Value	294	301
±1 SD	68	63
Median	274	271
Minimum	176	171
Maximum	398	364
Range *	158 - 430	157 - 427

n: number of samples analyzed in duplicate

*confidence interval of 95% usually adopted for clinical practices

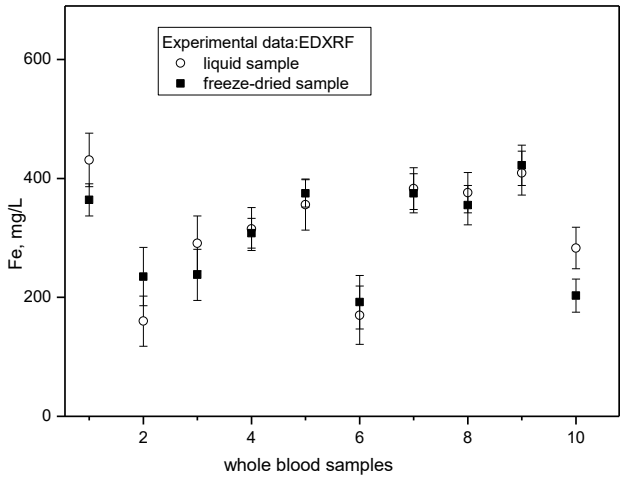

Figure. 1 Fe blood concentration results for liquid and freeze-dried samples.

According to the *t- test*, Fe in whole blood samples (**Figure 1**) show non-significant differences when a comparison is performed using liquid and freeze-dried sample ($p > 0.05$).

4. Conclusions

These results are the first estimates of blood iron in this age group, however greater investment in measurements is needed (higher statistics). Another aspect to highlight is the feasibility of determining iron from small amounts of whole blood (a few drops deposited on paper), a very efficient alternative, especially when the material is scarce.

Acknowledgements

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