LABORATORY ELEMENTS FOR ACCURATE DETECTION OF IRON DEFICIENCY IN RESOURCE-LIMITED SETTINGS OF AFRICA.

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I- INTRODUCTION

Iron deficiency is a frequent nutritional problem that predominantly affects children and pregnant women. The World Health Organisation (WHO) criteria for the diagnosis of iron deficiency is a serum ferritin < 12 µg/L, and/or a transferrin saturation < 10% [1]. Unfortunately, these assays remain quite inaccessible in many African countries where iron deficiency remains a public health problem. The objective of this study was to find a simple method of evaluating iron deficiency with a strong predictive value.

II- METHODOLOGY

Our study was approved by the Gabonese Ministry of Public Health. The prevalence of iron deficiency in children aged 6 months to 5 years was determined in Libreville using a random sample of 275 children, in a population estimated at 80,000, who appeared to be healthy in kinder garden and public health center. A blood sample of 3 mL was taken from the children in the morning prior to eating, for a complete blood count (CBC). Using micro method assay, by Coulter STKS of Beckham Coulter Gen. S. System™, the following was measured: haemoglobin (Hb; g/dL), mean corpuscular volume (MCV; fl), mean corpuscular haemoglobin (MCH; pg), mean corpuscular haemoglobin concentration (MCHC; %), and anisocytosis indicator (Rdw; %),. The serum ferritin (µg/L) per immuno-enzymatic assay was taken with IM-X™ (Abbott), the serum iron (Fe; µg/dL) with the Alcyon 300/300i™ (Abbott), and the total iron binding capacity (TIBC; µg/dL), then the calculation of the percent transferrin saturation = (Fe/TIBC)×100. On the basis of serum ferritin < 12µg/L, and by using Bayes theorem, we were able to evaluate positive predictive value (PPV) as well as the specificity and sensitivity of erythrocyte parameters analysed in our series.

III- RESULTS

Table I gives the values of sensitivity, specificity and PPV for the various erythrocyte parameters. The association by pairs of erythrocyte parameters, as evaluated using Pearson's coefficient, showed a strong correlation between microcytosis and anemia (r = 0,90; p<0,001) as well as between a decrease of MCH and a rate of Rdw ≥ 15 % (r=0,67; p<0,001). No other significant correlations were seen between anemia and Rdw ≥ 15%, or between anemia and MCH < 25 pg.

Table I- Sensitivity, specificity, and positive predictive value (PPV) of erythrocyte parameters.

	Sensitivity (%)	Specificity (%)	PPV (%)
MCH < 25 pg	87.0	62.0	79.0
MCHC < 30%	30.0	90.0	81.0
RDW ≥ 15%	90.0	34.0	66.0
MCV < 70 fl	39.0	88.0	80.0
MCH < 25 pg and RDW ≥ 15%	60.0	88.0	93.0
Hb < 11 g/dL and MCV < 70 fl	20.0	90.0	96.0

Hb: Haemoglobin; MCH: Mean Corpuscular Haemoglobin; MCHC: Mean Corpuscular Haemoglobin Concentration; MCV: Mean Corpuscular Volume; RDW: Red cell Distribution Width;

IV- DISCUSSION

The MCH and the RDW could be used in combination to evaluate iron deficiency of an individual, in the presence of a normal haemoglobin rate. The weak sensitivity of the CMV in our study raises the issue of it's effectiveness as the only source of early detection of iron deficiency in the tropics. These results differ from that of OSKI et al, who were quite confident in this test for the early detection of iron deficiency [2]. The 90% and 87% sensitivity of the RDW ≥15% and MCH < 25 pg, respectively, are similar to the results of Das Gupta

et al. in India [3] who found a 96% sensitivity for the RDW ≥15% and a 69% sensitivity for the MCH < 25pg). VISWANATH et al, have reported 82% to 100% sensitivity for the RDW ≥15% [4]. These two parameters that are present on a simple CBC, would allow for the early discovery of iron deficiency. Therefore KNIGHT et al, affirm that the correlation between RDW ≥15% and MCH <25pg found again in their series, would allow for their use to detect iron deficiency up to 90% [5]. Kim et al. have found a positive prediction value of 98% for the association of CMV <70 fl and RDW ≥15% with a specificity of CMV<70 fl up to 97.8% for children [6].

V- CONCLUSION

Although the ferritin test remains the method of reference for evaluating the iron deficiency status of an individual, it is not practical to generalize its use in poor African countries, because of the high cost and technical exigencies of its execution. In clinical practice, the evaluation of iron deficiency without interaction from an inflammatory pathology, prevents the occurrence of the pernicious effects of iron deficiency, and guarantees an overall and optimal coverage of this any deficiencies.
Our study has permitted us to address these two concerns by reading a simple blood count ■

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