

## DYNAMICS OF SOME ERYTHROCYTIC INDICES IN MEGALOBlastic ANEMIA

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### INTRODUCTION

Increasing knowledge of the mechanism of anemia production has stimulated a series of particularly important research on their treatment, which has allowed, in our century, the discovery of liver extracts and, more recently, vitamin B12 and folic acid, very useful in combating certain forms of anemia.

Anemia is defined in current practice by decreasing the values of parameters that assess the amount of erythrocytes in circulation; their number, volume (hematocrit) and hemoglobin content. That is why the blood count is the mandatory primary investigation in all situations where the presence of anemia is presumed.

Erythrocyte parameters and quantitative evaluation of circulating erythrocytes allows a first assessment of the degree of anemia and subsequently serves for the dynamic follow-up of post-therapeutic evolution.

### MATERIAL AND METHODS

The biological material for determining erythrocyte parameters was peripheral blood collected from 34 patients. The study was conducted over a period of 2 years, between 2017-2019. The complete blood count (venous blood, pink vacutainer / purple-K3-EDTA) was used to study erythrocyte parameters. The method used for the hemogram was flow cytometry (flow cytometry) on the SYSMEX XN-3000 automatic analyzer (Fig. 1). The hemogram was also accompanied by a peripheral blood smear, which involves microscopic analysis of the cellular elements of the blood.

### RESULTS AND DISCUSSIONS

Of the 34 patients investigated, 24 were women and 10 men (Fig. 2), so women are more affected by this disease than men. 19 patients (63%) come from urban areas and 15 patients (37%) come from rural areas (Fig. 3).

On the age criterion, the most affected by megaloblastic anemia are patients aged between 61-70 years in a percentage of 38.2%, followed by the age category of 51-60 with a percentage of 17.64% (Fig. 4).

The age categories less affected in our case are 30-40 years, with a percentage of 5.9% followed by the category of those over 80 years with a percentage below 3% (Fig. 4).

**The average erythrocyte volume (VEM)** is calculated according to the following erythrocyte formula:  $VEM = Hct (\%) \cdot 10 / Nr.Ert (\cdot 10^6 / ql)$  and is expressed in femtoliters.

Medium erythrocyte volume (VEM) is the erythrocyte index that differentiates between microcytic (low volume), normocytic (normal volume) and macrocyte (high volume) anemias. Normal values are 80-94 fL ( $\mu m^3$ ). In the morphological analysis on the smear, normal erythrocytes have an average diameter of 7-8  $\mu m$ : those with small dimensions (microcytes) correspond to a low VEM, and those with large dimensions (macrocytes, up to 12  $\mu m$ , or megalocytes, over 12  $\mu m$ ) correspond to an increased FEV. An increased VEM value may also occur in chronic alcohol consumption, hypothyroidism or in hemolytic anemias (due to the presence of reticulocytes, which have a larger volume than mature red blood cells).

In the case of the 24 women investigated, 4 of them (16.7%) have normal values, while a number of 20 patients registered pathological values representing a percentage of 83.3%. The highest value is recorded in the case of a 79-year-old patient and is 142.7 fl (Fig. 5).

Out of the total of the 10 male patients studied, 3 of them have normal FEV values representing a percentage of 30%, and in the remaining 7 patients (70%) we encounter pathological values. The highest value was found in a 59-year-old patient with a value of 141.4 fl (Fig. 6).

**Mean erythrocyte hemoglobin (HEM) and mean erythrocyte hemoglobin concentration (CHEM)** are useful erythrocyte parameters in the differential diagnosis of the cause of anemia. Normal values are 27-33 pg for HEM and 32-36% for

CHEM. Low values of CHEM (hypochromia) are found in microcytic anemias, normal values (normochromia) in macrocytic anemias (due to the large volume of red blood cells, although the amount of hemoglobin = HEM is increased, the concentration remains normal) and high values (hyperchromia) in hereditary spherocytosis, sickle cell disease and HbC. Low values of HEM occur in hypochromic microcytic anemias.

**Mean erythrocyte hemoglobin (HEM)** has the following formula  $HEM = Hb (g / d L) / No.Ert (* 106 / ql)$  and is expressed in picograms (pg).

In the case of the 24 patients, 20 patients registered increased values (83.3%), the highest value being registered in a 79-year-old patient with 48.1 pg 16.7% of the total women registered normal values HEM, the lowest value being 29.4 pg in a 47-year-old patient (Fig. 7).

Out of the total of the 10 studied male patients, 9 patients, respectively a percentage of 90% registered pathological values, the highest value was found in a 59-year-old patient, a value of 49pg, and a percentage of 10% had normal values (Fig. 8).

**The average erythrocyte hemoglobin concentration (CHEM=Mean erythrocyte hemoglobin concentration)** is the average hemoglobin concentration in a given volume of erythrocytes. CHEM is expressed in g / dL.

In the case of patients (Fig. 9) a percentage of 20.1% and 5 women respectively had abnormal values and a number of 19 women, ie a percentage of 79.1% had normal values.

From the sample of 10 men, a percentage of 20% with abnormal values and a percentage of 80% normal values were registered (Fig. 10).



Fig. 1. Sysmex XN-3000 Analyzer

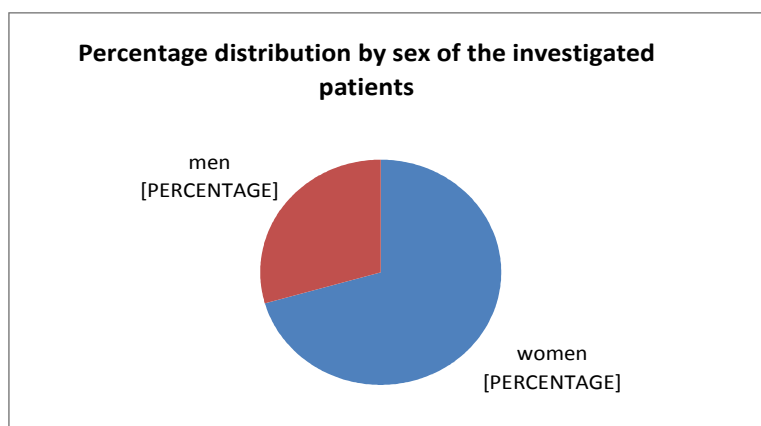


Fig. 2. Percentage distribution by sex of the investigated patients  
men women

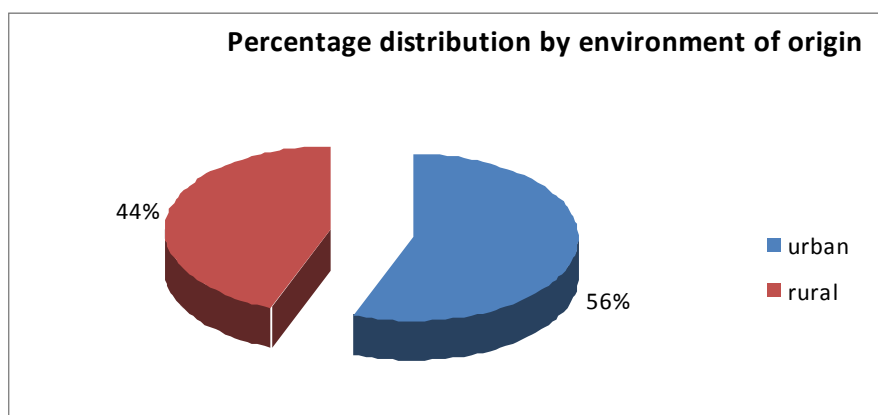


Fig. 3. Percentage distribution of patients investigated by place of origin

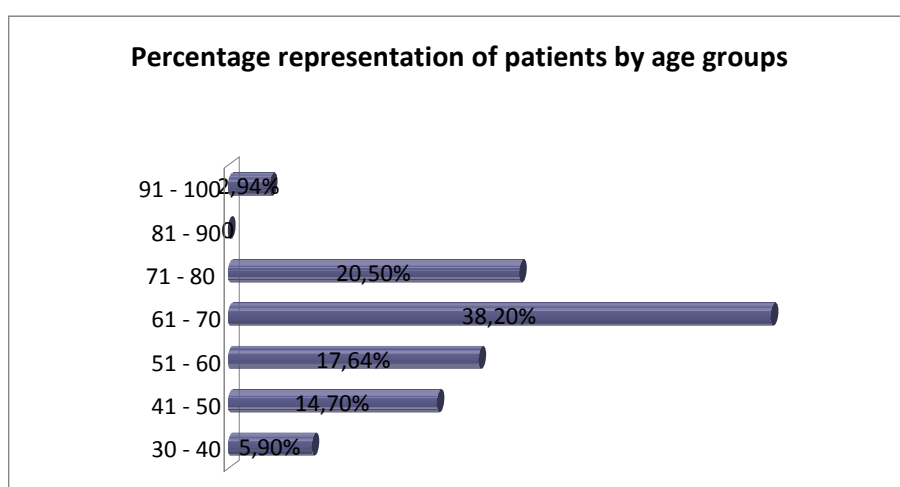


Fig. 4. Percentage representation of patients by age groups

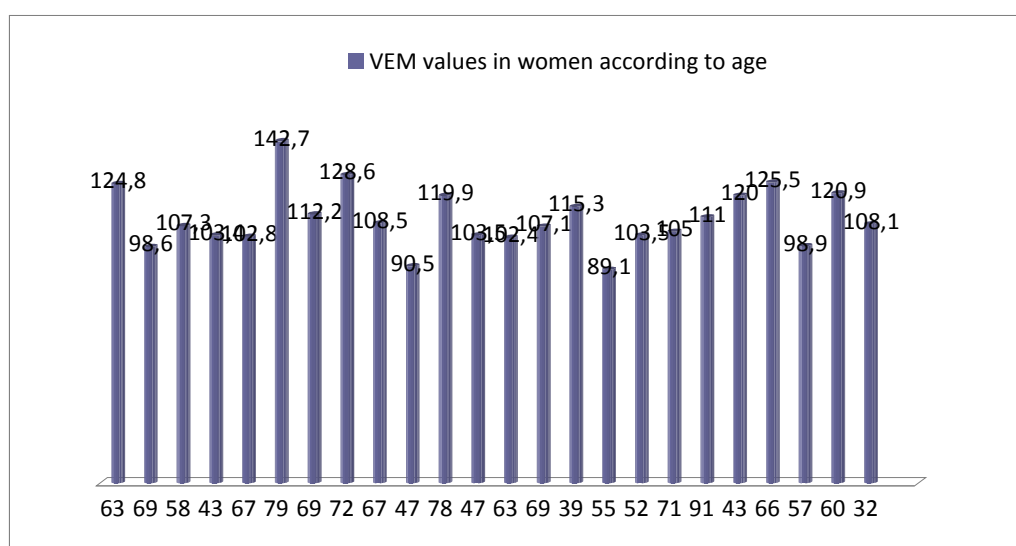


Fig. 5. Graphical representation of VEM in women according to age

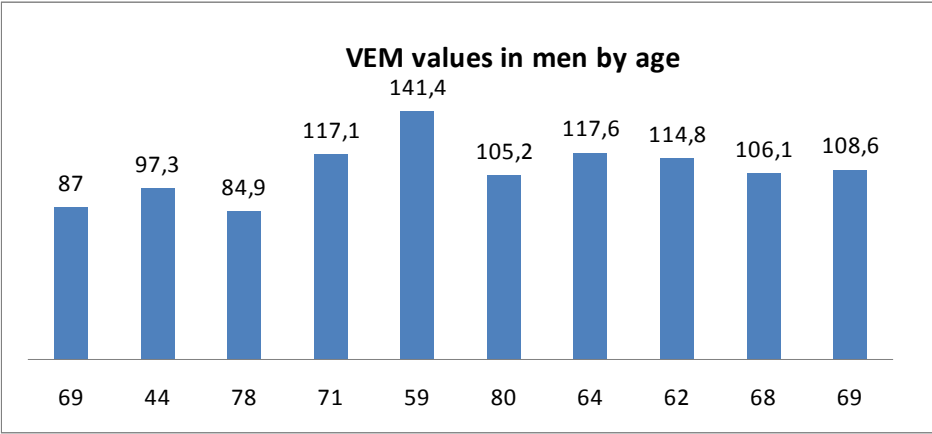


Fig. 6. Graphical representation of VEM in men by age

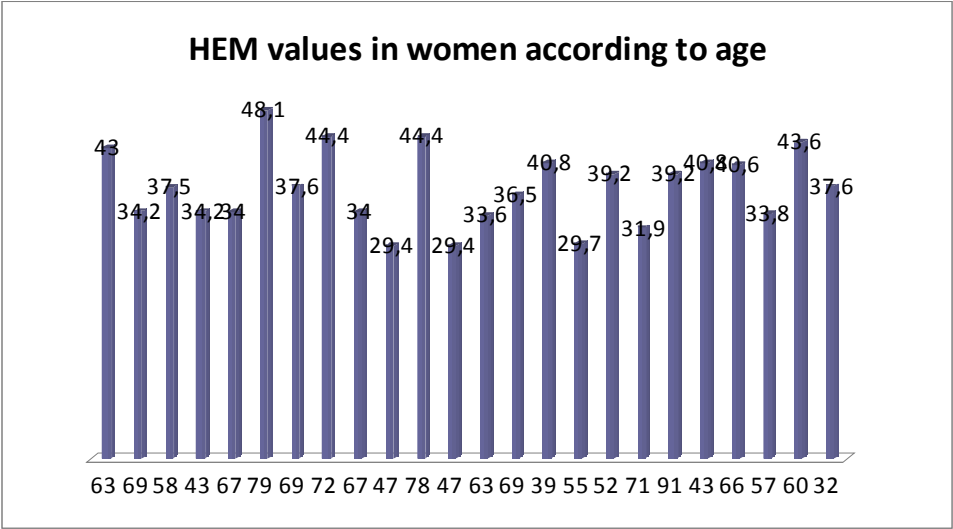


Fig. 7. Graphical representation of HEM in women according to age

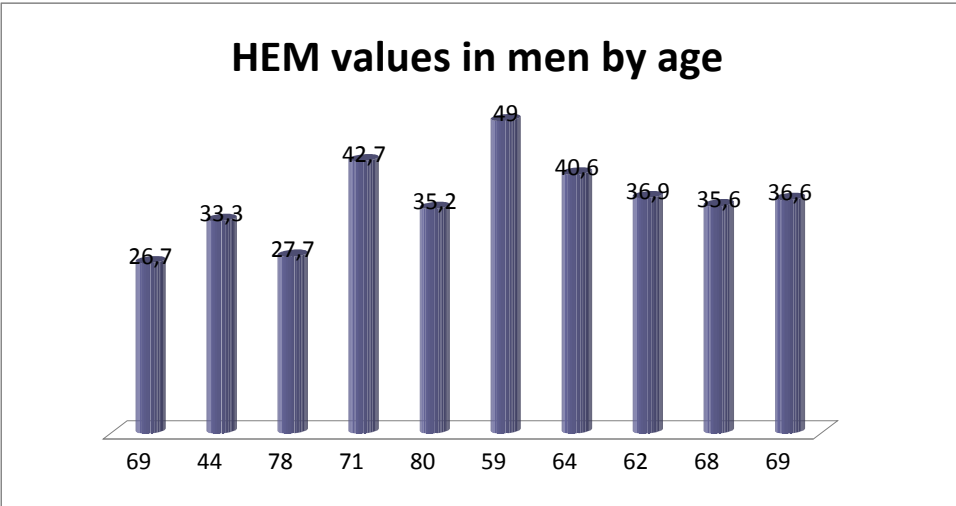


Fig. 8. Graphical representation of HEM in men by age

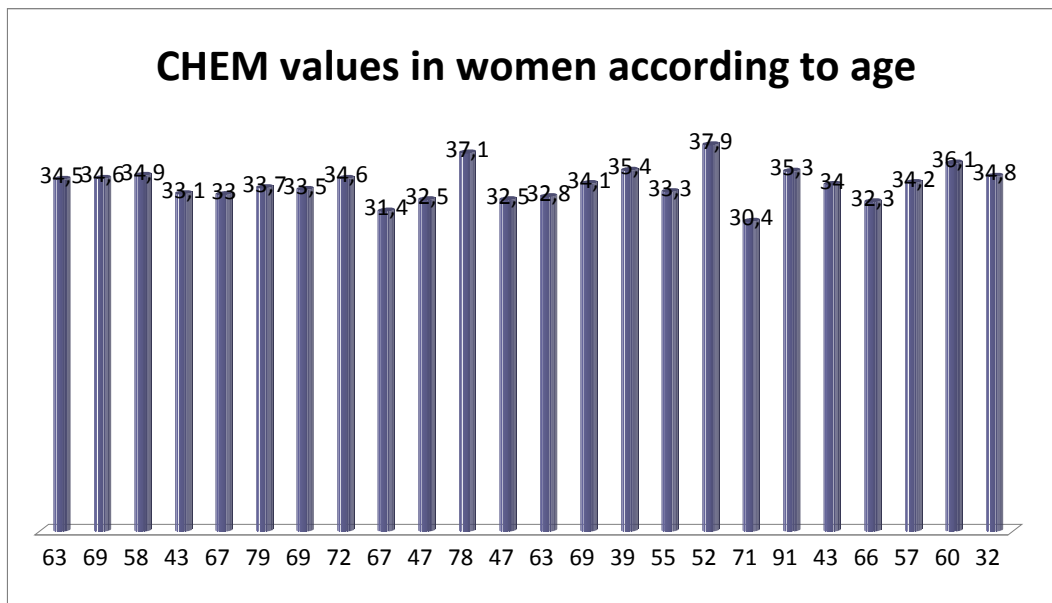


Fig. 9. Graphical representation of CHEM in women according to age

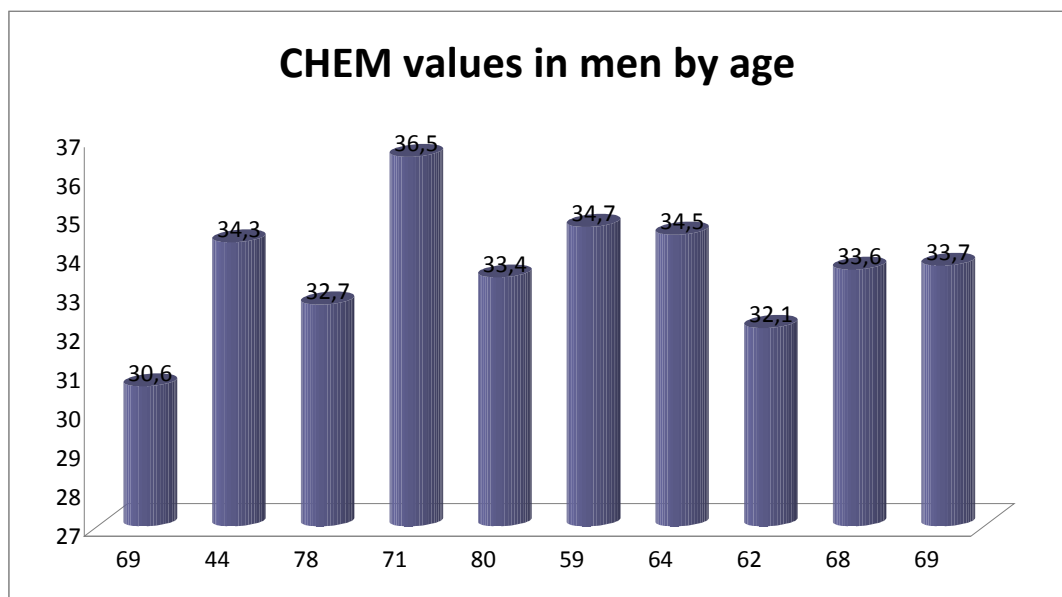


Fig. 10. Graphical representation of CHEM in men by age

## CONCLUSIONS

- Megaloblastic anemia is a macrocytic anemia (VEM> 100 FL) and normochrome (normal CHEM). It is due to folic acid or vitamin B12 deficiency.
- The most modified erythrocyte indices are the mean erythrocyte volume (VEM) which has pathological values in 83.3% of women and 70% of the men investigated and the average erythrocyte hemoglobin (HEM) which records pathological values in 83.3% of women and in 90% of men.
- The average concentration of erythrocyte hemoglobin (CHEM) has a high percentage of normal values (80% women and men), megaloblastic anemia being a macrocytic anemia (erythrocytes decrease much more than hemoglobin or hematocrit).
- Women have more frequent megaloblastic anemia (70.58%) than men, and the most affected age group is between 61-70 years (38.2%).

## ABSTRACT

Over a period of 2 years, between 2017-2019, a study of erythrocyte parameters was performed in 34 patients with megaloblastic anemia. The complete hemoleukogram accompanied by the peripheral blood smear was used as working methods for the study of erythrocyte parameters. Peripheral blood smear investigations Mean erythrocyte volume (VEM) and mean erythrocyte hemoglobin (HEM) are the most pathologically altered erythrocyte indices. The average erythrocyte hemoglobin concentration (CHEM) is an index within relatively normal limits.

## REFERENCES

1. ANTONESCU MONICA și col., 1977 - Clinical Hematology, Medical Publishing House, Bucharest (Hematologie clinică, Editura Medicală, București).
2. HOSSU T., 1974 - Contributions to the study of folic deficit in pregnancy, Doctoral thesis, I.M.F Publishing House, Bucharest (Contribuții la studiul deficitului folic în sarcină, Teză de doctorat, Editura I.M.F, București).
3. NICOLAU C.T, NICOARĂ ST., 1966 - Advances in the usual hematological techniques, Medical Publishing House, Bucharest (Progrese în tehnicile hematologice uzuale, Editura Medicală, București).
4. PĂUN RADU, COLITĂ DAN, 1997 - Treatise on Internal Medicine - Hematology, Part o I, Medical Publishing House, Bucharest (Tratat de Medicină Internă- Hematologie, Partea I, Editura Medicală, București).
5. VENGHEL KONDI, 1981 - Hematology, Medical Publishing House, Bucharest, (Hematologie, Editura medicală, București).
6. PRISECARU MARIA, CRISTEA TINA OANA, STOICA IONUȚ, 2011 -Animal Histology, "Alma Mater" Publishing House, Bacau, ISBN: 978-606-527-115-9 (Histologie animală, Editura „Alma Mater”, Bacău).
7. PRISECARU MARIA, CRISTEA TINA OANA, VOICU ROXANA, 2011- Cellular and molecular biology, "Alma Mater" Publishing House, Bacau, ISBN: 978-606-527-116-6. (Biologie celulară și moleculară, Editura „Alma Mater”, Bacău).
8. PRISECARU MARIA, IONUȚ STOICA, 2017 - General and clinical immunology, Ed. Alma Mater Bacau, 2017, ISBN 978-606-527-572-0 (Imunologie generală și clinică, Ed. Alma Mater Bacău).
9. WALLACH JACQUES, 2001 - Blood tests. In Interpretation of diagnostic tests. Medical Sciences Publishing House, Bucharest, Romania, 7th Edition (Analizele de sange. In Interpretarea testelor de diagnostic. Editura Stiintelor Medicale, București, Romania, 7 Ed.).

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