



HEMATOLOGICAL INDICES IN A POPULATION SAMPLE IN TIMIȘOARA, ROMÂNIA

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SUMMARY

The aim of this study was to investigate and to correlate the presumptive diagnostic with the hematological indices from a private medical laboratory from Timisoara. It was a retrospective study regarding 384 patients which present to that laboratory in 2009. The investigated hematological parameters are hemoglobin (HGB), hematocrit (HCT), mean corpuscular volume of erythrocyte (MCV), mean corpuscular hemoglobin concentration (MCHC), mean corpuscular hemoglobin (MCH), leukocytes (WBC) and platelets (PCT).

Keywords: hematological parameters; hemoglobin (HGB); hematocrit (HCT); leukocytes (WBC); platelets (PCT).

INTRODUCTION

Laboratory supports are used extensively in the diagnosis of diseases, in preventive medicine, and as management tools. The blood is an important medium in assessing the health status of patients. Both the physiological and pathological conditions of humans can

be assessed by the evaluation of hematological and biochemical analyses of the blood.

The hemoglobin (HGB) value helps to diagnose the anemia. The normal values for HGB are between 12-16 g /dL in women and 13-17 g /dL in men. There may be physiological fluctuations by 1-2 g /dL without pathological implications [1].

A hemoglobin level below 12 g /dL can mean anemia, especially if it is accompanied by low hematocrit and MCV. The HGB levels between 10-12 g /dL indicate mild anemia, while HGB levels between 8-10 g /dL moderate anemia and < 8 g /dL severe anemia. For values smaller than 6 g /dL blood transfusion is indicated [2].

The analysis of erythrocytes index is realized when is necessary the diagnosis of certain types of anemia. The anemia is defined according to cell size (MCV) and to amount of hemoglobin (HEM) as presented in Table I [3].

Table I. The anemia types by level of MCV and HEM

Type of anemia	The level of MCV and HEM	Normal values
microcytic anemia	MCV < minimum limit considered normal	MCV = 80-100 fentoliters (fL) /cell
normocytic anemia	MCV level is normal	
macrocytic anemia	MCV > maximum limit considered normal	
hypochromic anemia	HEM < minimum limit considered normal	HEM = 27-31 picograms /cell
normocytic anemia	HEM level is normal	
hiperchromic anemia	HEM > maximum limit considered normal	

The decrease in red blood cells (RBC) number under normal values (4.000.000 - 6.000.000 /mm³) indicates anemia. Results may be false for those patients who drink liquids before blood sampling, so having a larger volume of fluid, red blood cells were diluted in blood volume and seems less than normal, although in reality it is possible that their number to be normal [1].

The hematocrit (HCT) represents the percentage of RBC in blood volume. Normal values are 40-48% in men and 36-42% in female. The decrease in HCT values appears in case of anemia, in recent bleeding and hyperhydration [3].

The increase in RBC number and HCT are found in the case of dehydration or the persons suffering from a rare disease called poliglobulia. The dehydration leads to a false increase in RBC because it decreases blood volume and practical they concentrate, resulting more at numbered [4].

The hematocrit may be normal or slightly increased, but the number of RBC can be

below normal. Young RBC are larger than mature one, so their volume will be higher than the number of mature RBC, in the case of equal number for both types of cells. For example, in anemia caused by blood loss, the bone marrow produce newer and larger RBC to compensate the lack, but their effectiveness will be maximized when they reach maturity [4].

The normal values for leukocytes also called white blood cells (WBC) are in the range of 4.000-8.000 /mm³ in adults and 4.000-10.000 /mm³ in children (1-6 years). The decrease of WBC number below normal values occurs in cases of severe infections, viral infections, for patients who make immunosuppressants treatment, in cases of anemia or diseases of the bone marrow that produces these cells and which in the case of some disease, may produce fewer WBC than normal [5].

The increase in WBC number, generally occurs when the body faces an infection representing a mechanism of defending for the body. However there are other cases where these cells are more numerous than normal, such is the case of bone marrow disease or leukemia, when marrow produces too much WBC. Serious level of infection, sepsis, peritonitis produce also an increase in the number of WBC.

The platelets (PCT) are the smallest of the cells that make up blood, playing a key role in the clotting process. When an injury occurs in the body, PCT swell, bind and form a sticky coating that stops bleeding. The normal values for PCT are between 150.000 - 450.000 /mm³. If the number of PCT is below normal value, appears the risk of uncontrolled bleeding. Contrary if the number of PCT exceeds normal values it is possible to form blood clots in the arteries. Also, platelets are one of the most frequent factors of developing atherosclerosis [6].

The aim of this study is to investigate the hematological parameters of 348 laboratory patients in 2009.

METHODOLOGY

In this paper were analyzed the biological samples for a batch of people who addressed to medical analysis laboratory SC DERMATOMED SRL, located in Timișoara, between 01.01.2009 and 31.12.2009. The study subjects were 348 patients aged between 8 and 89 years with an average of 56.003 ± 17.41 years. Of these were 259 female and 88 male, 269 were living in urban areas, specifically in Timișoara and 78 in rural areas (localities within a radius of 30 km from Timișoara).

The diagnostic concordance index (DCI) was calculated using the formula:

$$DCI = \frac{CP}{CR}$$

where CP - total number of weighted cases and CR - total number of resolved cases.

DCI it is used to hospital management to assess how many of discharge diagnoses confirmed the presumptive diagnosis. The formula has been adapted and tried to identify how many of presumptive diagnoses were explained by the result of biological samples.

The data were selected and introduced in the computer using Microsoft Excel 2007 data tables and afterwards processed into statistics, with Stata software, version 5.0. Graphical representation of results was done with Excel. Frequencies were calculated based on theoretical considerations of each biological indicator examined.

The blood samples have been collected at rest via the median antebranchial vein into vacutainer tubes containing the anticoagulant EDTA. The hematological parameters (HGB, HCT, MCV, MCH, MCHC, PCT, WBC) were analyzed in automated equipment (which is checked daily by internal quality protocol and monthly by an external protocol as the Romanian law requires) approximately 2 hours after blood drawing. Then, all the investigated hematological parameters were compared to the standard values presented in literature and being the subject of a statistical analysis.

RESULTS AND DISCUSSIONS

The measurement and description of population by age groups presents interest to the health system because morbidity and mortality picture varies from one age group to another. The laboratory patients were divided into five age groups (Table I.):

Table II. Presumptive diagnosis according to age group

Age (years) Presumptive diagnosis	under 18 years	18 – 25 years	25 – 50 years	50 – 60 years	over 60 years
<i>Anemia</i>	33,33 %	33,33 %	29,11 %	4,93 %	1,23 %
<i>Dermatological diseases</i>	33,33 %	55,55 %	30,38 %	-	3,73 %
<i>Chronic pharyngitis</i>	33,33 %	-	-	-	-
<i>Gastritis</i>	-	11,11 %	6,33 %	-	-
<i>Asthenic syndrome</i>	-	5,55 %	10,12 %	-	-
<i>Chronic hepatitis</i>	-	-	3,79 %	2,46 %	0,062 %
<i>High blood pressure</i>	-	-	9,65	39,5 %;	69,135
<i>Ischemic heart disease</i>	-	-	5,53	25,92 %;	10,49 %;
<i>Diabetes</i>	-	-	5,06	8,64 %;	1,85 %;
<i>Hypercholesterolemia or</i>	-	-	-	16,06 %.	5,55 %

HEMATOLOGICAL INDICES

Presumptive diagnosis	Age (years)				
	under 18 years	18 – 25 years	25 – 50 years	50 – 60 years	over 60 years
<i>dyslipidemia</i>					
<i>Neoplasm</i>	-	-	-	-	1,85 %
<i>Collagen diseases</i> (rheumatoid arthritis, lupus erythematosus)	-	-	-	-	1,85 %;
<i>Asthma</i>	-	-	-	-	0,062 %
<i>Other disease</i>	-	-	-	-	3,73 %

It is observed that at the age group 25-50 years was encountered the pathology dedicated to deficiency diseases, occupational diseases and some early chronic diseases. At the age group 50-60 years it is notices that chronic pathology begins to make more and more felt, while at the age group over 60 the pathology represents largely chronic diseases and acute flare. Associated pathology was also met in 47 people represented by the association of hypertension with ischemic heart disease or dyslipidemia.

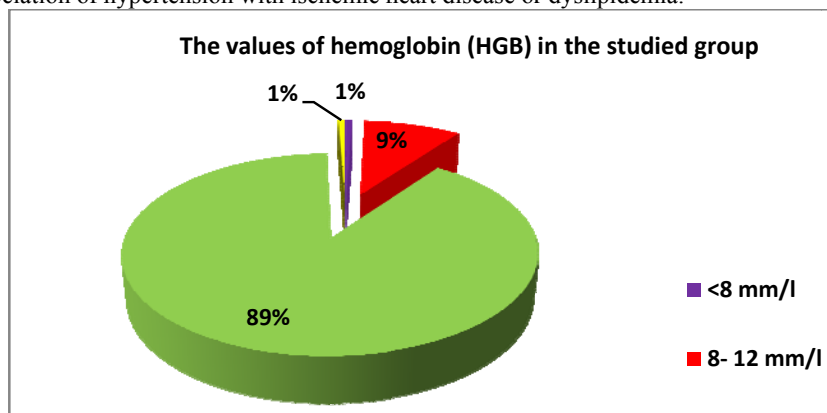


Figure 1. The values of hemoglobin in the studied group

With regard to HGB in the case of 89% of investigated subjects, the hemoglobin values determined were within the range of normal, whereas at 10% of the subjects the values were below the lower limit of normal values and at 1% were situated even under the value of 8 g /dL, showing a moderate to severe anemia.

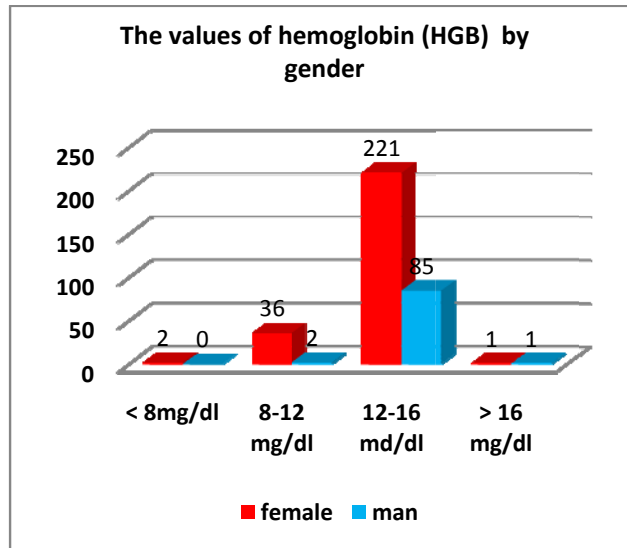


Figure 2. The values of hemoglobin by gender
We can see from Fig. 2 that the female subjects more often have anemia than men.

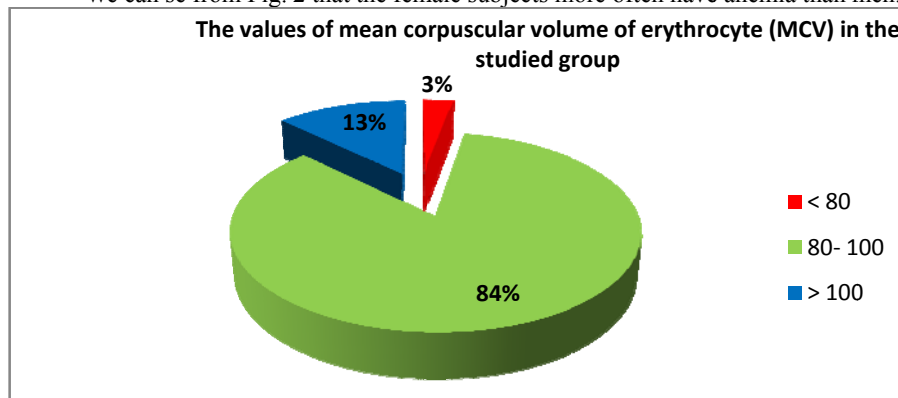


Figure 3. The values of mean corpuscular volume of erythrocyte in the studied group
The results of biological samples at MCV's value shows that most subjects had normal values, only 3% having values below the normal, representing microcytic anemia and 13% above normal values, representing macrocytic anemia.

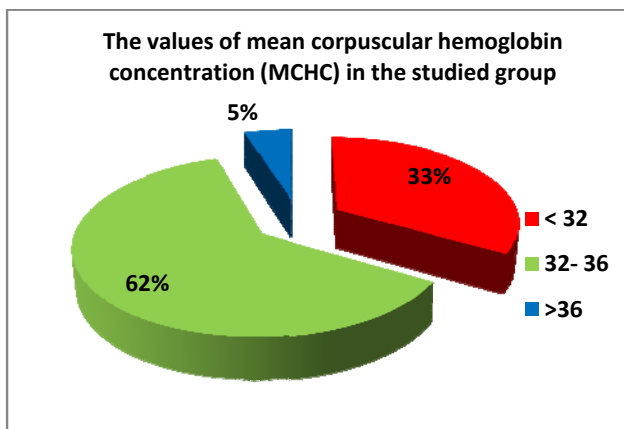


Figure 4. The values of mean corpuscular hemoglobin concentration in the studied group

More than half of the subjects investigated had values of mean corpuscular hemoglobin concentration (MCHC) located within the range of normal values, between 32-36 g/dL (see Figure 5).

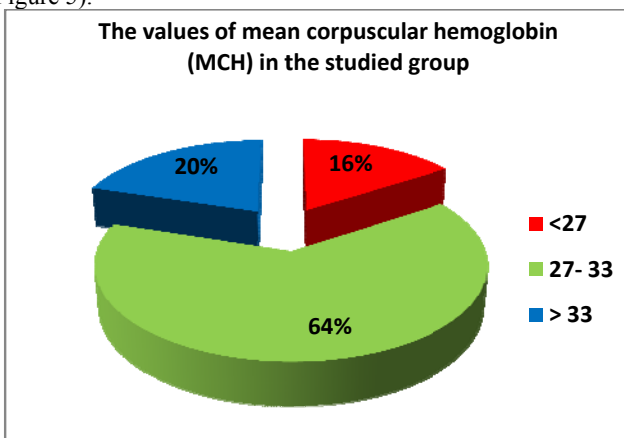


Figure 5. The values of mean corpuscular hemoglobin in the studied group

Mean corpuscular hemoglobin (MCH) has the normal values between 27-33 pg/cell. As in MCV is can be observed that 64% of subjects at which determinations were made had MCH values located within the range of values considered normal. 16% of subjects had MCH values below the normal range and 20% had values above normal. So we could say that 3% of subjects describe hypochromic and microcytic anemia as in iron deficiency anemia.

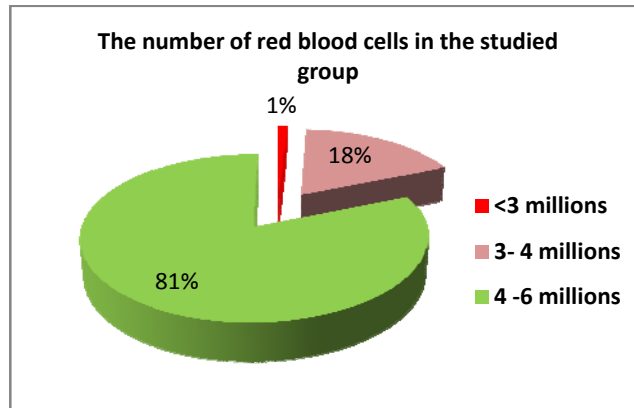


Figure 6. The number of red blood cells in the studied group

Cellular red line investigation results showed that the number of RBC are within the range of normal values, in the case of the vast majority of subjects investigated. 19% of subjects had the number of RBC below normal values, representing 68.42% in the case of women and 31.57% in the case of men.

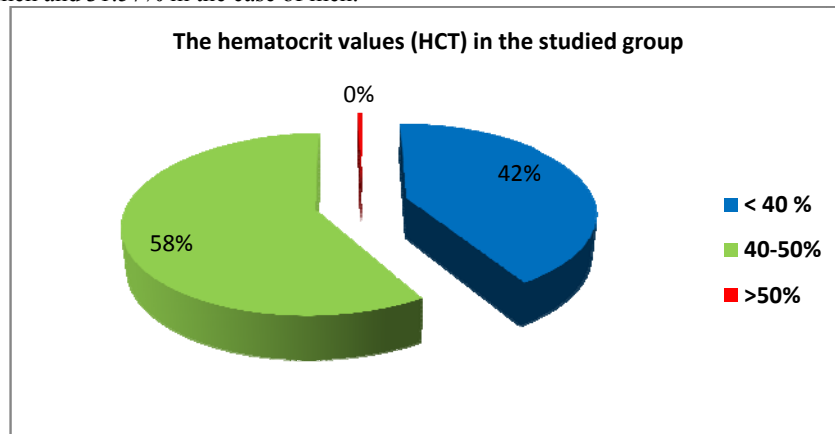


Figure 7. The hematocrit values in the studied group

With regard to hematocrit in female subjects at 128 persons the HCT values were below normal, and 131 in the range of normal values, whereas in the male subjects, HCT values were located within the range of normal values at 81.81% of the investigated subjects, and 18.18% were below the lower limit of normal range.

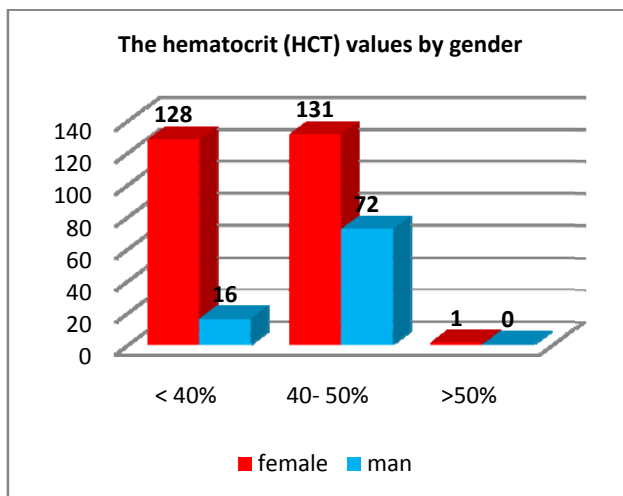


Figure 8. The hematocrit values by gender

As seen in the figure 9 most of the subjects presented measured value of leukocytes are within the normal range, yet 22% had higher values, between 8.200 and 13.500 leukocytes /dL, presenting possible infections. At one person was determined the value of 24.700 leukocytes /dL, requaiering that deailed investigation should be further made, this value revealing a possible leukemia.

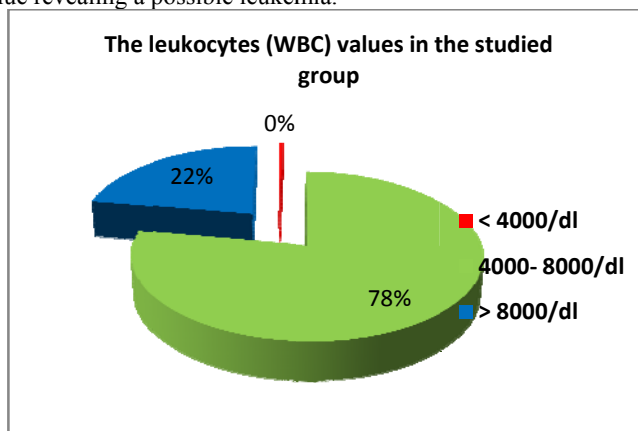


Figure 9. The leukocytes values in the studied group

The figure 10 shows that the number of PCT in 97% of the investigated subjects were in the range of values considered normal, 150.000 – 450.000 /mm³, while 2% of

values determined were below the lower limit of normal values and 1% were above the upper limit of normal values.

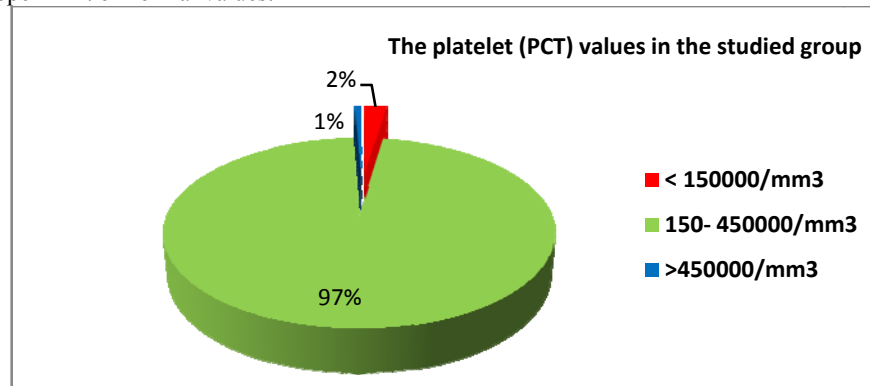


Figure 9. The platelet values in the studied group
In the year 2009 at SC DERMATOMED SRL Laboratory, DCI is 0.91.

$$DCI = \frac{NCR + NC}{TD}$$

where NCR = nr. of diagnoses that could not be confirm or refute, NC = nr. of confirmed diagnoses and TD = total diagnoses.

$$DCI = \frac{389 + 56}{348 + 152} = 0.91$$

Anemia was confirmed in 21 people, more than was indicated by the presumptive diagnosis. From the 19 presumptive diagnosis of anemia only 11 were confirmed by the results of blood tests, but the remaining 8 cases could be tested after a period of appropriate treatment and meanwhile the values could be normalized.

$$DCI_{anemia} = 40 / 19 = 2.1$$

From the possible 13 anemia resulting from investigations, 9 could be explained by the presumptive diagnosis of asthenic syndrome, the rest are new cases of diagnosed anemia.

CONCLUSION

In conclusion, our research showed that the vast majority of patients investigated were part of the age group over 60 years. Were discovered 13 new cases of anemia. The diagnosis of dermatological diseases could not be confirmed or refuted only through biological exploration, requiring also a physical examination of subjects. However were found elevated levels of leukocytes at 95.12 % of those subjects with a presumptive diagnosis of dermatological diseases. Also at the 2 cases of chronic pharyngitis were met

elevated leukocytes values. The remaining 36 of the patients with elevated levels of leukocytes, should continue investigating the cause of leukocytosis, one subject may present leukemia, the values of leukocytes being 24.700 leukocytes /dL.

91% from diagnostics can not be confirmed or infirmed just from the biological analyses, because the presumptive diagnostics which the patients present to the laboratory, can not be confirmed without more clinical and functional explorations.

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REFERENCES

1. Ioniță H., Mihăiescu R., Chevereșanu L., Isac A., "*Hematologie clinică*", Editura Lito, Timișoara, 2001.
 2. Mazza Chessells J.J., "*Medical of Clinical Hematology*", cap. 11, Philadelphia, 2002.
 3. Fauci A.S., Braunwald E., Isselbacher K.J., Wilson J.D., Martin J.B., Kasper D.L., Hauser S.L., Longo D.L., "*Harrison - Principiile Medicinii Interne*", vol.1, Ed. 14, 698 - 706, Editura Teora, București, 2003.
 4. American Society of Hematology, "*2011 Clinical Practice Guideline on the Evaluation and Management of Immune Thrombocytopenia (ITP)*", 2011.
 5. Nabili S.T., "*Anemia*", www.emedicinehealth.com; accesed in 02.06.2011.
 6. Mut Popescu D., "*Hematologie clinică*", Editura Medicală, București, 1994.
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