

Hematological reference ranges among healthy adults of Curitiba, PR, Brazil

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The development of this work focused on the establishment of new reference values for the complete blood count (CBC) in the city of Curitiba as this was last studied back in the 1980s.^(1,2) With the improvement in cell counting and analysis technologies, the need to update hematologic reference values is evident with the inclusion of the new parameters provided by the most up-to-date equipment. Besides the methodological aspect, the updating of hematologic indices is also important in respect to the new socio-economic conditions of the Brazilian population, as well as the new lifestyle in our society.

Venous blood samples were obtained from 1000 individuals (500 women and 500 men) for routine hematological examinations. Blood collection was made in several healthcare clinics throughout the city and transported under controlled conditions to the Laboratorio Municipal de Curitiba where all analyzes were carried out. Hematology analyses were performed in an ABX Pentra 120 - Horiba cell counter. Participants for this study were randomly selected between June and October 2007 from the data base according to the following criteria: (i) age between 12 to 60 years old of both genders; (ii) exams

identified as solely routine; (iii) cross file examinations to discard suspected pathologies.⁽³⁻⁵⁾

Reference ranges were obtained from 2.5 and 97.5 accumulated percentiles in normal distributions. When normality could not be achieved, the 95% reference interval was obtained with the help of non-parametric ordinal descriptive statistics. Analyses were carried out using an Excel spreadsheet (Microsoft) and the statistical package Statistica 8.0 (StatSoft). Statistical significance was set for a p-value < 0.05.

There were statistically significant differences (p-value < 0.05) between men and women for most hematology parameters. Men had higher red blood cell, hemoglobin, eosinophil, basophil and monocyte counts and higher hematocrit, mean cell hemoglobin, mean cell hemoglobin concentration and red cell distribution width values compared to women. Women had higher neutrophil and platelet counts than men.

The red cell distribution width for both men and women was higher than the values commonly found in the literature.^(6,7) The maximum limits of 16% found in our work are generally above the limit cited by the manufacturers of automated cell counters

Table 1 - Mean and reference ranges for hematology laboratory values in the Municipal Laboratory of Curitiba, PR

	Mean (range)		p-value t-test
	Women	Men	
Red blood cells ($\times 10^{12}/L$)	4.7 (4.0 - 5.4)	5.2 (4.3 - 6.1)	<0.05*
Hemoglobin (g/L)	136.2 (118 - 154)	152.8 (127 - 177)	<0.05*
Hematocrit (L/L)	0.41 (0.35 - 0.46)	0.45 (0.38 - 0.52)	<0.05*
Mean cell volume (fL)	87.3 (78.0 - 95.1)	87.9 (78.0 - 97.2)	
Mean cell hemoglobin (pg)	29.3 (25.6 - 32.1)	29.6 (26.1 - 32.7)	<0.05
Mean cell hemoglobin concentration (g/L)	335.8 (319 - 354)	336.9 (322 - 354)	<0.05
Red cell distribution width (%)	13.7 (11.8 - 16.7)	13.8 (12.0 - 16.3)	<0.05
White blood cells ($\times 10^9/L$)	6.7 (3.84 - 10.4)	6.7 (3.9 - 10.9)	**
Eosinophils (%)	3.5 (0 - 11)	4.3 (1 - 13)	<0.05
Eosinophils ($\times 10^6/L$)	228.5 (56 - 682)	284.6 (65 - 940)	<0.05
Basophils (%)	0.5 (0 - 1)	0.6 (0 - 2)	<0.05
Basophils ($\times 10^6/L$)	29.6 (0 - 99)	41.7 (0 - 125)	<0.05
Lymphocytes (%)	33.2 (21 - 48)	33.8 (19 - 49)	
Lymphocytes ($\times 10^6/L$)	2175.3 (1157 - 3500)	2223.2 (1265 - 3648)	**
Monocytes (%)	6.9 (4 - 11)	7.5 (3 - 12)	<0.05
Monocytes ($\times 10^6/L$)	455.1 (208 - 807)	503.2 (192 - 968)	
Neutrophils (%)	56 (40 - 70)	53.8 (35 - 69)	
Neutrophils ($\times 10^6/L$)	3777.3 (1804 - 6460)	3762.7 (1728 - 6820)	
Platelets ($\times 10^9/L$)	284.1 (175 - 421)	258.6 (163 - 399)	<0.05**

* - normal; ** - log-normal distribution evaluated by the Shapiro-Wilks test

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(14.5%). These differences may be explained by the different types of equipment on the market today where the cell measurement methods may be different.

Regarding erythrogram and leukogram parameters, the values found for both women and men did not show significant differences compared to values reported in the literature.^(1,2,8) Reference values, stratified by gender, are described in Table 1.

An important factor to be noted is the characteristic of the population involved in the current study. The Municipal Laboratory receives blood samples from about 100 government healthcare clinics scattered around the city of Curitiba that attend the city's most needy populations. Therefore, our results must be analyzed cautiously to avoid erroneous comparisons.

In summary, our results showed that despite the improved technology of cell counting and analysis, the hematological parameters of the adult population of the city of Curitiba suffered no major changes compared to studies performed in the 1980s. However, our work incorporates one new parameter (red cell distribution width), and provides values that better reflect the current conditions of the majority of the adult population of the city of Curitiba, thereby allowing greater accuracy in the interpretation of the data provided by the complete blood count.

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