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Normal Hemoglobin and Hematological Indices in Southwest of Iran

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Abstract

Background: Anemia is common throughout the world, remarkably in developing countries. Our aim is to calculate normal hemoglobin and other hematological indices in southwest of Iran.

Materials and Methods: A random selection of 500 healthy males and 500 healthy females was done in the age group of 13 to 65 years. A complete blood count (CBC) was performed in all participants.

Results: Hemoglobin (Hb) level ranged from 13.80 to 18.40 g/dL with a mean value of 15.96 g/dL in males, and 12 to 15.90 g/dL with a mean value of 13.79 g/dL in females. Mean cell volume (MCV) ranged from 80 to 100.10 fL with a mean value of 86.63 fL in males, and 80 to 95.40 fL with a mean value of 86.80 fL in females. Red blood cell (RBC) count ranged from 4.5 to $7.07\times10^6/mm^3$ with a mean value of $5.57\times10^6/mm^3$ in males, and 4.17 to $6.84\times10^6/mm^3$ with a mean value of $4.88\times10^6/mm^3$ in females.

Conclusion: Although the normal range of various hematological indices of our study nearly were equal to that presented in the literature, some parameters differed such as maximum value of Hb in males, maximum value of hematocrit (HCT) in both sexes, range of MCV in females, and range of mean cell hemoglobin concentration (MCHC) in both sexes. The most prominent feature was the higher maximum value of RBC count in both sexes.

Keywords: Reference value, Erythrocyte count, Hemoglobin, Erythrocyte indices

Introduction

Anemia is defined as reduction in total red blood cell (RBC) mass.[1] It refers to a state in which the level of hemoglobin (Hb) in the blood is below the normal range appropriate for age and sex.[2] Anemia is common all around the world, remarkably in developing countries. It can be the cause and result of many other disorders. Mostly it is found in individuals with underprivileged low socioeconomic level but this is not always true.[1-3] Anemia leads to impaired oxygen transport to tissues. Many factors can cause anemia. It can either be a manifestation of an underlying disease or may itself be the cause. Anemia is classified in three major classes; hypoproliferative, infective erythropoiesis, and decreased red cell survival. Iron deficiency anemia, a subclass of hypoproliferative anemia, is the most common form worldwide.[3] Others include thalassemia, glucose-6-phosphate dehydrogenase deficiency (G6PD), folate and cobalamin (B_{12}) deficiency, aplastic anemia, and sickle cell anemia.[3] Anemia is most often recognized by abnormal laboratory tests.[1] The Hb level and other RBC indices differ with age, altitude, and sex. In order to find the normal values of RBC count, Hb, mean cell hemoglobin (MCH), hematocrit (HCT), mean cell volume (MCV), and mean cell hemoglobin concentration (MCHC), which are helpful in diagnosis of anemia, this study was conducted in Fars Province in southwest of Iran.

Materials and Methods

In a cross-sectional study in southwest of Iran from August 2004 to August 2005, 500 healthy males and 500 healthy females in the age group 13-65 years were randomly selected and entered our

Table 1. *The table shows the total number of cases with maximum and minimum values for each of the following parapeters: age, MCV, RBC count, Hb, HCT, MCH, and MCHC. It also shows the valid number of cases.*

Sex		Number	Minimum	Maximum
Male	AGE (years old)	381	16.00	57.00
	MCV (fl)	381	80.00	100.10
	RBC Count (10^6/mm^3)	381	4.52	7.07
	Hb (g/dl)	381	13.80	18.40
	HCT(%)	381	40.50	56.80
	MCH (pg)	381	27.00	33.00
	MCHC (g/l)	381	30.30	38.70
	Valid N	381		
Female	AGE (years old)	282	13.00	65.00
	MCV (fL)	282	80.00	95.40
	RBC Count (10^6/mm^3)	282	4.17	6.84
	Hb (g/dL)	282	12.00	15.90
	HCT (%)	282	36.40	48.70
	MCH (pg)	282	27.00	32.10
	MCHC (g/L)	282	28.90	36.80
	Valid N	282		

study, and underwent a complete blood count (CBC), by Technic on H_1 system laser (French). Individuals having Hb<12 g/dL, or MCV<80 fl, or MCH<27 pg were excluded from the study. Therefore, data of 381 males and 282 females were used for final analysis. For each sex, a minimum and a maximum value and a mean value were calculated for each index. All data were analyzed using SPSS software, version 13 for data analysis.

Results

The range and the mean value of MCV, RBC count, Hb, and MCHC for males and females are shown in tables 1 and 2.

In males, HCT ranged from 40.50% to 56.80% with a mean value of 48.23%, and MCHC ranged from 30.30 to 38.70 g/L with a mean value of 33.12 g/L. In females, HCT ranged from 36.40% to 48.70% with a mean value of 42.28%, and MCHC ranged from 28.90 to 36.80 g/L with a mean value of 32.63 g/L.

Discussion

The hematological indices differ among various regions due to change in altitude and other geographic factors. Shiraz, the capital of Fars province is situated 1800 meters above the sea level. We predicted hematological parameter levels to be higher than values quoted in references. It should be mentioned that Iran is a country having high prevalence (5-10%) of β-thalassemia trait.[4] Prevalence of Cooley's anemia is about 7.2 in 10,000 people.[4] Prevalence of Iron deficiency anemia (IDA) is 28.5%, compared to 5-8% in industrialized nations.[5] Most references consider Hb concentration of 14 and 12 g/dl as the lower limits, 18 and 16 g/dl as the upper limits, and 16 and 14 g/dl as mean values of for males and females, respectively.[6,7] A study conducted on healthy elderly people (age>65years) in Australia showed that the range of hemoglobin was 12.5 to 16.9 g/dl with a mean value of 14.7 g/dl in males, and 11.6 to 14.8 g/dl with a mean value of 13.7 g/dl in females.[5] Our study also revealed the same results except for maximum value of Hb in males which are higher (18.4 g/dl).

The normal hematocrit range is from 41.0% to 53.0% in adult males in references.[1] Our study showed a maximum value of 56.8% in males which is quite higher. In adult females, hematocrit varies

Table 2. *The table shows the mean value, standard deviation, and variance for each of the following parapeters: age, MCV, RBC count, Hb, HCT, MCH, MCHC, RDW, and HDW.*

Sex		Mean	Std. Error	Std.	Variance
Male	AGE (years old)	25.8373	0.3044	5.94225	35.310
	MCV (fL)	86.6310	0.1645	3.21008	10.305
	RBC Count ($10^6/mm^3$)	5.5769	0.0177	0.34533	0.119
	Hb (g/dL)	15.9606	0.0463	0.90293	0.815
	HCT (%)	48.2328	0.1352	2.63993	6.969
	MCH (pg)	28.6722	0.0549	1.07074	1.146
	MCHC (g/L)	33.1215	0.0478	0.93346	0.871
	RDW	12.8570	0.0290	0.56511	0.319
	HDW	2.7479	0.0117	0.22756	0.052
Female	AGE (years old)	21.3298	0.3135	5.26397	27.709
	MCV (fL)	86.8067	0.1891	3.17475	10.079
	RBC Count ($10^6/mm^3$)	4.8861	0.0197	0.33035	0.109
	Hb (g/dL)	13.7961	0.0477	0.80166	0.643
	HCT (%)	42.2801	0.1354	2.27348	5.169
	MCH (pg)	28.3436	0.0593	0.99603	0.992
	MCHC (g/L)	32.6372	0.0625	1.04969	1.102
	RDW	12.9390	0.0363	0.60980	0.372
	HDW	2.7139	0.0152	0.25493	0.650

from 36.0% to 46.0% as depicted in literature.[1] Our study revealed a maximum value of 48.7% which is again quite high. References quote normal values of MCH to be from 27.0 to 34 pg,[1] which is nearly similar to our results. MCV, given in references, ranges from 78 to 100 fl in both males and females.[1] In our study, females had lower maximum value of MCV (95.4 fl). Normal MCHC is between 32.0 to 36.0 g/dL for both males and females.[8,9] Our study showed higher maximum value of MCHC (38.7 g/dL). RBC count varies from 4.50 to $5.90\times10^6/mm^3$. Our study showed a prominent increase in RBC count in this geographic area (4.5 to $7.07\times10^6/mm^3$). In females RBC count ranged from 4.0 to $5.2\times10^6/mm^3$,[1] whereas our study showed much greater values (4.17 to $6.84\times10^6/mm^3$).

Conclusion

Although the normal range of various hematological indices in our study were nearly equal to that presented in the literature, some parameters differed such as maximum value of Hb in males which was higher compared to other references probably due to differences in altitude. Maximum value of hematocrit in both sexes was also higher than other places, whereas MCH values were similar to other studies. MCV in females had a quite lower range. Maximum value of MCHC was also higher in both sexes. The most prominent feature was the higher maximum range of RBC count in both males and females in our study compared to references. Therefore, this geographical part (southwest of Iran) had higher values of hematological indices to the normal range of other parts.

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