Journal of Nutrition and Food Security
Shahid Sadoughi University of Medical Sciences
School of Public Health
Department of Nutrition
Nutrition & Food Security Research Center

eISSN: 2476-7425 pISSN: 2476-7417 JNFS 2019; 4(4): 243-248 Website: jnfs.ssu.ac.ir

Prevalence of Anemia According to Some Hematological Parameters among Reproductive-Age Females in Kermanshah, Western Iran

Behnaz Abiri; PhD[1], Mohammadreza Vafa; PhD[*2] & Fatemeh Azizi-Soleiman; PhD[3]

[1] *Department of Nutrition, School of Paramedicine, Ahvaz Jundishapur University Medical Sciences, Ahvaz, Iran.*
[2] *Department of Nutrition, School of Public Health, Iran University of Medical Sciences, Tehran, Iran.*
[3] *Department of Clinical Nutrition, School of Nutrition & Food Science, Isfahan University of Medical Sciences, Isfahan, Iran.*

ARTICLE INFO

ORIGINAL ARTICLE

Article history:
Received: 30 May 2018
Revised: 4 Jul 2018
Accepted: 27 Sep 2018

Corresponding author:
Vafa.m@iums.ac.ir
Department of Nutrition, School of Public Health, Iran University of Medical Sciences, Tehran, Iran.

Postal code: 1449614535
Tel: +982186704734

ABSTRACT

Background: Iron deficiency anemia is a major public health problem in the developing countries. Anemia decreases physical capacity and adversely affects performance in women. The aim of this study was to evaluate the prevalence of anemia based on some hematological parameters among women of reproductive age in Kermanshah, Western Iran. **Methods:** We conducted a cross-sectional study in Kermanshah in May 2015. A total of 515 females aged 15-45 years agreed to participate in the study. Blood samples were collected from all participants. The analyzed hematological parameters from the participants' blood samples included the hemoglobin (Hb) concentration, hematocrit, mean cell volume (MCV), mean hemoglobin concentration (MCH), and mean corpuscular hemoglobin concentration (MCHC). **Results:** The total prevalence of anemia was 15.1%. Mean concentration of Hb was 13.86 ± 1.08 mg/dL in ages 15 to 25 years, 13.83 ± 1.08 mg/dl in 26 to 35 years, and 13.58 ± 1.27 mg/dl in the age range of 36-45 years. These results showed that the mean concentration of Hb decreased with increase of age. The prevalence of microcytosis and hypochromia were higher in women aged 36-45 years. The hypochromic-microcytic anemia was observed in 81.3% of those with Hb < 12.7 mg/dl. **Conclusions:** The prevalence of anemia in women of reproductive age is not a health concern in Kermanshah City. However, this does not mean that the importance of prevention programs should be neglected.

Keywords: *Iron deficiency anemia; Anemia; Hematological parameters; Prevalence; Women; Western Iran*

Introduction

Iron deficiency anemia (IDA) is diagnosed by detection of small red blood cells (microcytosis) deficiency in hemoglobin (hypochromia), which results in decreased oxygen-carrying capacity of blood to meet the physiological needs (Hennek *et al.*, 2016). Anemia can cause severe complications such as impaired cognitive ability and intellectual performance, weakened immune system, reduced

This paper should be cited as: Abiri B, Vafa MR, Azizi-Soleiman F. ***Prevalence of Anemia according to some Hematological Parameters among Reproductive-Age Females in Kermanshah, Western Iran.*** *Journal of Nutrition and Food Security (JNFS)*, 2019; 4 (4): 243-248.

[Downloaded from jnfs.ssu.ac.ir on 2026-11-08]
[DOR: 20.1001.1.24767417.2019.4.4.1.5]
[DOI: 10.18502/jnfs.v4i4.1721]

working capacity, higher mortality rate in pregnant women, and low birth weight (Allen, 2000). Anemia has multiple underlying causes including nutritional deficiencies, infections, and hemoglobin disorders (Kassebaum *et al.*, 2014).

According to the World Health Organization (WHO), the worldwide prevalence of anemia in 1993–2005 demonstrated that anemia was more prevalent in Africa and South-East Asia (Stevens *et al.*, 2013a). Systematic analysis of Global Anemia Burden from 1990-2010 introduced anemia as the reason for 8.8% of years lived with disability (YLD) in 2010 (Kassebaum *et al.*, 2014).

Anemia is a global public health problem that is considered as severe, when its prevalence is equal to or greater than 40% in a vulnerable group (Karaoglu *et al.*, 2010). Accordingly, in nearly all developing countries anemia is of major importance.

Nutritional anemia is the most prevalent type of anemia worldwide that can be related to iron, vitamin B12, and folic acid deficiencies (Kotecha, 2011). Among types of deficiency, IDA is more common, which mostly has no specific signs/symptoms. Based on WHO report, approximately two billion anemic persons live worldwide and nearly 50% of them have iron deficiency (Miller, 2013). Iron is an essential nutrient involved in oxygen transport, electron transfer reactions, gene expression, and cell differentiation. The risk factors of IDA include low iron intake, poor iron absorption because of high phytate or phenolic compounds in diets, or higher requirement in some periods of life (Crichton, 2016). Low mean cell volume (MCV), low mean corpuscular hemoglobin (MCH), high red cell distribution width (RDW), and increased platelet count may predicate IDA (Longo and Camaschella, 2015).

In 1993-2005, the WHO database on the prevalence of anemia in Iran revealed that 40.5% of the pregnant women and 33% of the non-pregnant women were anemic (Stevens *et al.*, 2013b).

Anemia is screened on the basis of hemoglobin (Hb) concentration at the population level. The WHO definition of anemia is as follows: A Hb value below 13 g/dl in men >15 years of age, below 12 g/dl in non-pregnant women >15 years, and below 11 g/dl in pregnant women (World Health Organization, 2015). Some recent studies indicated high prevalence of anemia in different provinces of Iran (Eftekharzadeh-Mashhadi *et al.*, 2015, Payandeh *et al.*, 2014).

As women's health in childbearing age matters to families and communities, screening for anemia in this group can prevent the probability of adverse pregnancy outcomes and preterm births (Bora *et al.*, 2014). Therefore, the present study was conducted to determine the prevalence of anemia in reproductive age women in Kermanshah, a western city in Iran.

Materials and Methods

Study Area and Population: This cross-sectional study was carried out in Kermanshah city, the capital of Kermanshah province, Iran in 2015. This province is in Western Iran and Kurds are its prominent ethnic group. A total of 515 randomly-selected reproductive-age females aged 15-45 years were investigated for anemia. The participants were randomly selected from four health centers in Kermanshah. The required sample size was estimated as 504 individuals using the formula $\frac{Z^2P(1-P)}{d^2}$ after assuming 16% prevalence for anemia in child-bearing age females, with a precision of 0.032 (Eftekharzadeh-Mashhadi *et al.*, 2015). Finally, a total of 515 women participated in the study. The study was approved by the Ethics Committee of the Isfahan University of Medical Sciences and all participants signed written consent forms. Only 15-45 year-old non-pregnant premenopausal females, who had not been transfused nor had major surgery within the previous four months, were included in the study. Women with chronic diseases such as liver, kidney disorders, thalassemia, or cancer were excluded from the study.

Data collection: Participants were invited to participate in the study through public

[Downloaded from jnfs.ssu.ac.ir on 2026-11-08]
[DOR: 20.1001.1.24767417.2019.4.4.1.5]
[DOI: 10.18502/jnfs.v4i4.1721]

announcement. The blood samples were drawn from the median cubital vein and were collected in ethylenediaminetetraacetic acid (EDTA) tubes. The Hb concentration and RBC indices (MCV, MCH and MCHC) were defined using the Symex NE 9100 automated hematology analyzer (Symex, Kobe, Japan).

A total of 515 women were included in the analysis. Anemia was defined in accordance with the WHO standard for non-pregnant women (serum Hb <12 g/dl); however, based on the Center for Disease Control (CDC) correction proposed in 1989, the cut-off point of Hb in Kermanshah at an altitude of 1350 m was considered about 12.7 g/dl for screening anemia in our study (Ruiz-Arguelles, 2006).

Data analysis: The Statistical Package for Social Sciences, version 22.0, was used for all statistical analyses (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Cor).

Results

The mean age of women was 34.9±8.60 years. From this population, 270 individuals (52.4%) were in the age range of 36-45 years. The total prevalence of anemia was 15.1%. The mean concentration of Hb was 13.86 ± 1.08 mg/dL in ages of 15 to 25 years, 13.83 ± 1.08 mg/dL for the age range of 26 to 35 years, and 13.58 ± 1.27 mg/dL for the individuals within the age range of 36-45 years. Based on the results, the mean concentration of Hb decreased with increase of age. The prevalence of anemia based on hemoglobin was 12% in the first age tertile, 11.1% in the second age tertile, and 18.5% in the third age tertile (**Table 1**). The prevalence rates of microcytosis and hypochromia were higher in women within the age range of 36-45 years. **Table 2** shows the anemia sub-types based on MCV, MCHC, and Hb. The hypochromic-microcytic anemia was observed in 81.3% of those with Hb < 12.7 mg/dl.

Table 1. Frequency distribution of red blood cell changes (Hb, Hct, MCV, MCH, and MCHC) in age categories

Variables	15-25 y N (%)	26-35 y N (%)	36-45 y N (%)
Hb < 12.7 mg/dl	11 (12)	17 (11.1)	50 (18.5)
Hct < 37.0%	3 (3.3)	4 (2.6)	17 (6.3)
MCV < 80.0 fl	8 (8.7)	14 (9.2)	33 (12.0)
MCH < 27.0 pg	13 (14.1)	30 (19.6)	68 (25.2)
MCHC < 32 g/dl	16 (17.4)	41 (26.8)	86 (31.9)

Table 2. The prevalence of hypochromia, microcytosis, and anemia

	Hb < 12.7 mg/dl (n =78)		Hb ≥ 12.7 mg/dl (n=437)	
	N	%	N	%
Hypochromia	39	81.3	9	18.8
Microcytosis	18	18.9	77	81.1
Normocytosis				
Normochromia	3	42.9	4	57.1
Microcytosis	18	4.9	347	95.1
Normocytosis				

Discussion

In this study, 515 non-pregnant women in the age range of 15-45 years from Kermanshah were investigated. Among them, 15.1% had anemia. Based on WHO criteria for evaluating the significance of anemia as a public health problem, anemia prevalence in the current study is in the range of mild public health significance. In pregnant

[Downloaded from jnfs.ssu.ac.ir on 2026-11-08]
[DOR: 20.1001.1.24767417.2019.4.4.1.5]
[DOI: 10.18502/jnfs.v4i4.1721]

women, IDA is the most common type of anemia (McLean *et al.*, 2009), which contributes to poor iron absorption, chronic blood loss, malabsorption, hemolysis, or a combination of these factors (Levy *et al.*, 2005).

The prevalence of anemia in other cities of Iran was very similar to our results. We applied Hb and found that the prevalence of anemia among reproductive age females was estimated as 13.8% in Tabas (Azami *et al.*, 2016), 16.0% in Mashhad (Eftekharzadeh-Mashhadi *et al.*, 2015), and 11.8% in Kerman (Rahmati *et al.*, 2017). It seems that the prevalence of anemia decreased in previous years in Iran. For example, in one meta-analysis conducted by Barooti et al. the prevalence of anemia in reproductive age women was 12.4% (Esmat *et al.*, 2010). In 2006, the data reported by Bateni and Shoghli indicated that 23.6% of 15-45 year-old non-pregnant females were anemic (Shahi *et al.*, 2016). The discrepancy between the findings of our research and other studies can be related to geographical, social, cultural, and economic differences. Socioeconomic factors were also related to anemia (Ismail *et al.*, 2017). Unfortunately, we did not evaluate the risk factors for anemia. A possible reason for this decline can be attributed to increased knowledge and fortification programs. To the best of our knowledge, no study has ever evaluated the effectiveness of these strategies in Iran. The "WHO global database on anemia 1993-2005" estimated that Africa, South-East Asia, and Eastern Mediterranean had the highest prevalence rates of anemia among non-pregnant women (47.5%, 45.7%, and 32.4%, respectively) (World Health Organization, 2014). The prevalence of anemia among women of reproductive age in Iran's neighboring countries such as Turkey was reported as 27.8% and the overall prevalence of anemia was 44.3% in Kazakhstan (Saydam *et al.*, 2017, Tazhibayev *et al.*, 2014). These are comparable to the data of a systematic analysis over global prevalence of anemia during 1995 to 2011, which showed a 4.0% global decline in anemia (Stevens *et al.*, 2013b). This result shows that the prevalence of anemia among non-pregnant women has improved in this period of time. For example, it has decreased from 34% to 28% in Iran. However, the prevalence of anemia has increased slightly in high-income countries (from 14% to 16% in non-pregnant women aged 15–49 years).

In the present study, women with 36-45 years old had the highest prevalence of anemia (18.5%). In another study conducted in Iran, the prevalence of anemia was 22.22% in 35-44 year-old women (Eftekharzadeh-Mashhadi *et al.*, 2015). Similarly, the prevalence of anemia was higher in women aged 40-44 years compared to the other age groups (Sadeghian *et al.*, 2013). This finding can be attributed to multiple pregnancies and lack of enough supply of dietary requirements, which may result in anemia in this age range.

The highest prevalence of anemia in countries such as Ethiopia and India was observed in 25-39 and 41-45 years old populations, respectively (Anand *et al.*, 2014, Assefa *et al.*, 2014). The consistent results were reported from studies conducted in African countries (Bekele *et al.*, 2016, Dim and Onah, 2007, Melku *et al.*, 2014, Okunade and Adegbesan-Omilabu, 2014). This finding might be due to the postpartum hemorrhage, which increases using medications and incidence of diseases.

Our study has some limitations. Initially, access to other hematologic markers such as ferritin, total iron binding capacity (TIBC), and serum iron was impossible. Therefore, defining sub-types of anemia was not feasible. Additionally, other risk factors of anemia including micronutrients deficiency, parasites, and haemoglobinopathies were not investigated, which should be defined in future studies. Second, we did not evaluate the related risk factors of anemia. Socio-economic status, dietary habits, and knowledge of women can affect the anemia prevalence. Therefore, it is recommended to conduct further studies to address the above-mentioned limitations.

The prevalence of anemia in women of reproductive age was not a health concern in Kermanshah. However, this does not mean that the

[Downloaded from jnfs.ssu.ac.ir on 2026-11-08]

[DOR: 20.1001.1.24767417.2019.4.4.1.5]
[DOI: 10.18502/jnfs.v4i4.1721]

importance of prevention programs should be neglected. Regarding the detrimental long-term effects of iron deficiency anemia in Kermanshah, its prevention should be a high priority in health programs of health system in Iran. Moreover, iron supplementation is recommended.

Conclusion

In conclusion, the prevalence of anemia in women of reproductive age is not a health concern in Kermanshah City. However, this does not mean that the importance of prevention programs should be neglected. Therefore, it is recommended to identify determinant factors of anemia in women of reproductive age.

Conflict of interest

The authors clarify that there is no conflict of interest in this study.

Acknowledgements

The authors are grateful to thank the volunteers who participated in the study.

Authors' contribution

Abriri B, Vafa M and Aziz-Soleiman F designed this study. Abriri B and Aziz-Soleiman F participated in the conduct of the study. Abriri B and Aziz-Soleiman F drafted the manuscript. Vafa M critically revised the manuscript. All authors read and approved the final manuscript.

References

Allen LH 2000. Anemia and iron deficiency: effects on pregnancy outcome. *American journal of clinical nutrition.* **71 (5)**: 1280s-1284s.

Anand T, Rahi M, Sharma P & Ingle GK 2014. Issues in prevention of iron deficiency anemia in India. *Nutrition.* **30 (7)**: 764-770.

Assefa S, Mossie A & Hamza L 2014. Prevalence and severity of anemia among school children in Jimma Town, Southwest Ethiopia. *BMC hematology.* **14 (1)**: 3.

Azami M, Darvishi Z, Borji M & Sayehmiri K 2016. The Prevalence of Anemia Among Pregnant Women in Iran (2005-2016): A Systematic Review and Meta-Analysis Study. *Journal of School of Public Health and Institute of Public Health Research.* **14 (1)**: 15-30.

Bekele A, Tilahun M & Mekuria A 2016. Prevalence of anemia and its associated factors among pregnant women attending antenatal care in health institutions of Arba Minch Town, Gamo Gofa Zone, Ethiopia: a cross-sectional study. *Anemia.* **2016**: 1073192.

Bora R, Sable C, Wolfson J, Boro K & Rao R 2014. Prevalence of anemia in pregnant women and its effect on neonatal outcomes in Northeast India. *Journal of maternal-fetal & neonatal medicine.* **27 (9)**: 887-891.

Crichton R 2016. Iron metabolism: from molecular mechanisms to clinical consequences. John Wiley & Sons.

Dim CC & Onah HE 2007. The prevalence of anemia among pregnant women at booking in Enugu, South Eastern Nigeria. *Medscape general medicine.* **9 (3)**: 11.

Eftekharzadeh-Mashhadi I, Hedayati-Moghaddam MR, Fathimoghadam F, Bidkhori HR & Shamsian SK 2015. Anemia as a public health issue in Mashhad, Iran: evidence from the first population-based study. *Acta Medica Iranica.* **53 (3)**: 186-190.

Esmat B, et al. 2010. Prevalence of Iron Deficiency Anemia among Iranian Pregnant Women; a Systematic Review and Meta-analysis. *Journal of reproduction & infertility.* **11 (1)**: 17-24.

Hennek JW, et al. 2016. Diagnosis of iron deficiency anemia using density-based fractionation of red blood cells. *Lab on a Chip.* **16 (20)**: 3929-3939.

Ismail IM, Kahkashan A, Antony A & Sobhith V 2017. Role of socio-demographic and cultural factors on anemia in a tribal population of North Kerala, India. *International journal of community medicine and public health.* **3 (5)**: 1183-1188.

Karaoglu L, et al. 2010. The prevalence of nutritional anemia in pregnancy in an east

[Downloaded from jnfs.ssu.ac.ir on 2026-11-08]

[DOR: 20.1001.1.24767417.2019.4.4.1.5]
[DOI: 10.18502/jnfs.v4i4.1721]

Anatolian province, Turkey. *BMC public health.* **10**: 329.

Kassebaum NJ, et al. 2014. A systematic analysis of global anemia burden from 1990 to 2010. *Blood.* **123 (5)**: 615-624.

Kotecha PV 2011. Nutritional anemia in young children with focus on Asia and India. *Indian journal of community medicine.* **36 (1)**: 8-16.

Levy A, Fraser D, Katz M, Mazor M & Sheiner E 2005. Maternal anemia during pregnancy is an independent risk factor for low birthweight and preterm delivery. *European journal of obstetrics & gynecology and reproductive biology.* **122 (2)**: 182-186.

Longo DL & Camaschella C 2015. Iron-deficiency anemia. *New England journal of medicine.* **372 (19)**: 1832-1843.

McLean E, Cogswell M, Egli I, Wojdyla D & De Benoist B 2009. Worldwide prevalence of anaemia, WHO vitamin and mineral nutrition information system, 1993-2005. *Public health nutrition.* **12 (4)**: 444.

Melku M, Addis Z, Alem M & Enawgaw B 2014. Prevalence and predictors of maternal anemia during pregnancy in Gondar, Northwest Ethiopia: an institutional based cross-sectional study. *Anemia.* **2014**.

Miller JL 2013. Iron deficiency anemia: a common and curable disease. *Cold spring harb rerspect medicine.* **3 (7)**.

Okunade K & Adegbesan-Omilabu M 2014. Anaemia among pregnant women at the booking clinic of a teaching hospital in south-western Nigeria. *International journal of medicine and biomedical research.* **3 (2)**: 114-120.

Payandeh M, et al. 2014. The prevalence of anemia and hemoglobinopathies in the hematologic clinics of the kermanshah province, Western iran. *International journal of hematology-oncology and stem cell research.* **8 (2)**: 33.

Rahmati S, Delpishe A, Azami M, Ahmadi MRH & Sayehmiri K 2017. Maternal Anemia during pregnancy and infant low birth weight: A systematic review and Meta-analysis. *International journal of reproductive biomedicine.* **15 (3)**: 125.

Ruiz-Arguelles GJ 2006. Altitude above sea level as a variable for definition of anemia. *Blood.* **108 (6)**: 2131; author reply 2131-2132.

Sadeghian M, Fatourechi A, Lesanpezeshki M & Ahmadnezhad E 2013. Prevalence of anemia and correlated factors in the reproductive age women in rural areas of tabas. *Journal of family and reproductive health.* **7 (3)**: 139-144.

Saydam BK, Genc RE, Sarac F & Turfan EC 2017. Prevalence of anemia and related factors among women in Turkey. *Pakistan journal of medical sciences.* **33 (2)**: 433.

Shahi A, Abedini S & Aghamolaei T 2016. Prevalence of anemia and Iron deficiency anemia in high school girls of Bandar Abbas in 2013. *Journal of preventive medicine.* **3 (1)**: 37-43.

Stevens GA, et al. 2013a. Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and non-pregnant women for 1995-2011: a systematic analysis of population-representative data. *Lancet global health.* **1 (1)**: e16-25.

Stevens GA, et al. 2013b. Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and non-pregnant women for 1995–2011: a systematic analysis of population-representative data. *Lancet global health.* **1 (1)**: e16-e25.

Tazhibayev S, et al. 2014. Prevalence of anaemia in non-pregnant women of reproductive age in three counties of Kazakhstan: a cross-sectional study: Andrej Grjibovski. *European journal of public health.* **24 (suppl_2)**: cku151-004.

World Health Organization 2014. Worldwide prevalence of anaemia 1993-2005: WHO global database on anaemia. Geneva: WHO, 2008.

World Health Organization 2015. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity. 2011. *Geneva: WHO.*

[Downloaded from jnfs.ssu.ac.ir on 2026-11-08]

[DOR: 20.1001.1.24767417.2019.4.4.1.5]

[DOI: 10.18502/jnfs.v4i4.1721]