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# *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.*

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***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

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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



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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



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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



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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.

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## 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.

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