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The frequency of iron deficiency anemia and beta thalassemia carriers in volunteers of marriage.

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Abstract

Introduction: Thalassemia is one of the most important diseases associated with mild microcytic anemia, beta-thalassemia minor. This anemia usually does not require treatment, but it is important to screen for this anemia, especially before marriage, to prevent the birth of a newborn with thalassemia major in parents with β-thalassemia minor. Therefore, the aim of this study was to evaluate the prevalence of thalassemia and iron deficiency anemia in married couples of Ahwaz.

Methods: This study is a cross-sectional and descriptive study. 5 cc of blood were prepared in two tubes containing EDTA and Hemoglobin, MCV, MCH, RDW were determined by the System KX21 solenoid and the amount of ferritin, iron, and TIBC was also found in the serum sample. Blood samples from the MCV, MCH low electrophoresis and HbA2 measurements are measured.

Results: In this study 16281 couples (32,562) marriage volunteers who were referred to health centers in east and west of Ahwaz were studied. The results showed that the mean of ferritin, MCV and MCH hemoglobin was higher in males than in females. Of the 32,562 people surveyed (5.86%), 1908 had thalassemia minor, of which 966 (5.93%) and 942 (5.79%) were female. In addition, (30.44%), 3041 (10.69%) were 1741 males and (99.7%) were 1,300 women with alpha thalassemia. Of the 32,562 patients (55.1%), 504 had an anemia. Of these, were 284 (74.1%) men and 220 (1.25%) women.

Conclusion: The results of this study showed that the prevalence of iron deficiency anemia, thalassemia minor and sickle cell anemia in β-thalassemia carriers were higher among those referring to Ahwaz health center than other cases. On the other hand, in the case of thalassemia continued beta-thalassemia screening of couples in this city can effectively prevent the birth of a newborn with thalassemia major and impose unwanted treatment costs.

Keywords: Sickle cell anemia, Minor thalassemia, Marriage, Sickle cell anemia, Ferritin.

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Introduction

Iron deficiency anemia is an important health problem in developing countries. The most common reason of iron deficiency anemia is iron malnutrition [1]. Prevention of iron deficiency anemia is essential because iron deficiency anemia has much effect on psychological and physical activities. Conducted surveys in various countries have shown that iron administration leads hemoglobin rate to increase and mortality to decrease [2-4]. Beta-thalassemia syndromes are a group of congenital anemias determined by decrease or lack of synthesis of one hemoglobin beta globulin chain or more. The hematologic signs depend on heterozygote or homozygote form. In heterozygote or minor form, the hematologic signs are as microcytic and hypochromic and in homozygote or major form hematopoiesis is ineffective because of lack of beta-hemoglobin chain [5,6]. The molecular basis of thalassemia disorders is complex. Briefly, it is related to gene deletion, abnormality of mRNA or ribosomes, defect in synthesis, tRNA, which all above cases lead to lack of synthesis or no synthesis of polypeptide chain which leads to imbalance in globin chain synthesis. The interference of thalassemia syndrome with variant hemoglobin increases the complexity of disease [7,8].

The prevalence rate of Iron deficiency anemia is decreased during last decade in developed countries, but a little alteration has occurred in its global outbreak. Inadequate iron intake, iron malnutrition, digestive hemorrhage, and parasitic infections are among the common reasons of iron deficiency anemia [9,10]. Iron deficiency anemia has various complications such as: growth decline, activity intolerance, behavioral alterations, bad temper, carelessness, irritability, and alteration in host immune response. Epidemiologic studies have shown that iron

deficiency anemia is one of the most important women problems at fertility ages which are able to peril mother and fetus health [11,12]. On the other hand, minor beta-thalassemia is one of the most important diseases which are along with mild microcytic anemia. This anemia usually does not need any treatment, but screening of this anemia especially before marriage is essential in order to prevention of birth of infants with major thalassemia in parents with minor-beta-thalassemia [13,14]. Since people carrying the defective gene are lack of clinical signs, recognition of thalassemia carriers before marriage especially in Khoozestan province in which has a rather high prevalence in Iran can prevent birth of children with major thalassemia-which leads to numerous social-economical injuries- via training and education. Therefore, the aim of the present study was to evaluate the incidence rate of thalassemia and iron deficiency anemia in marriage volunteers of Ahvaz city.

Material and Methods

Study design

This study was a cross-sectional descriptive one during which the marriage volunteers of Ahvaz city during 2016-2017 were studied, after filling out the consent form of participating in study, 5 mililiter blood was taken from each case in two tubes one containing EDTA and another one as blot. The hemoglobin, RDW, MCH, MCV of samples was measured using cell counter model Sysmex KX21 and ferritin, iron and TIBC rates of serum samples were also determined. Blood samples with low MCH and MCV were electrophorized and HbA2 rate was measured. With considering the amounts of HbA2, beta-thalassemia and iron deficiency anemia were specified. If iron deficiency is persistent after treatment for one month, HbA2 was repeated again.

Data analysis

In quantitative variables, average and standard deviations were used in order to data description, and in qualitative variables, frequency and percentage were used. In order to data analysis Chi-Square test was used and T-test, ANOVA test and regression methods such as logistic regression were used if needed. All analysis was performed using SPSS software version 20.

Results

Demographic characteristics

In the present study 16281 couples (32562 individuals) of marriage volunteers referring to health centers of east and west Ahvaz were studied, the average age of total patients was 25.92 ± 8.09 years, the mean age of studied women was 24.60 ± 16.66 years and the average age of men was 27.75 ± 4.23 years, there was no significant correlation for age between the two genders (P>0.05).

Iron deficiency anemia

From 32,562 evaluated individuals, 10513 patients (32.28%) had iron deficiency anemia, among them, 2962 cases (18.19%) were men and 7551 patients (46.38%) were women, therefore, the prevalence rate of iron deficiency anemia was significantly higher in women comparing to men in the evaluated population (Table 1).

Table 1. *Prevalence of iron deficiency anemia between marriage volunteers separately for genders.*

Population	Without iron deficiency anemia	With iron deficiency anemia
Women	8730 (53.62%)	7551 (48.38%)
Men	13319 (83.46%)	2962 (16.54%)
Whole population	22049 (67.72%)	10513 (32.28%)

Hematological indices in patients with iron deficiency anemia

From all patients with iron deficiency anemia, 1621 individuals (10.10%), accomplished iron deficiency follow up, the results of hematological examinations in iron deficiency anemia patients showed that the mean rates of ferritin, hemoglobin, MCV and MCH had been higher in men comparing to women (Table 2).

Table 2. *Mean rates of ferritin, hemoglobin, MCV and MCH in evaluated patients for gender separately.*

Parameter	Women	Men
Ferritin (ng/ml)	11.2 ± 3.21	19.4 ± 5.23
Hemoglobin (g/dl)	10.16 ± 1.38	10.95 ± 2.02
MCV (FL)	70.63 ± 6.81	74.22 ± 8.13
MCH (pg)	22.15 ± 7.24	24.67 ± 4.98

Thalassemia prevalence evaluation

From 32562 evaluated patients, 1908 cases (5.86%) had minor thalassemia, among whom 966 cases (5.93%) were men and 942 cases (5.79%) were women. Therefore, no significant difference was observed among the two genders for thalassemia prevalence in the evaluated population. Also, the mean rates of MCV and MCH were 61.08 ± 8.30 fl and 19.53 ± 2.54 Pg, respectively. Furthermore, 3041 individuals (9.34%) including 1741 men (10.69%) and 1300 women (7.99%) had alpha-thalassemia.

The prevalence of sickle cell anemia

From 32562 evaluated cases, 504 patients (1.55%) including 284 men (0.87%) and 220 women (0.68%) had sickle cell

anemia, on the other hand, 6 patients (0.02%) had trait and 498 cases (1.53%) showed non-trait sickle cell anemia (Table 3).

Table 3. *Prevalence of sickle cell anemia according to gender and hemoglobin S percentage.*

Variables		Non Trait	Trait
Gender	Man	4(66.67%)	280(56.22%)
	Woman	2(33.33%)	218(43.78%)
Lowest percentage of hemoglobin S		81.3%	28.5%
Highest percentage of hemoglobin S		69.6%	47.8%
Mean percentage of hemoglobin S		75.91%	41.4%
Major sickle cell		3 patients (2 men and 1 woman)	0

Discussion

In the present study, 16281 couples (32562 individuals) of married volunteers referring to health centers of East and west Ahvaz were evaluated; from 32562 evaluated persons, 10513 patients (32.28%) had iron deficiency anemia, among these 2962 cases were men (18.19%) and 7551 cases were women (46.38%), therefore, in the evaluated population, the incidence rate of iron deficiency anemia was significantly higher in women comparing to men (about three folds higher). Various studies in Iran have reported the total prevalence of iron deficiency and also its rate in both genders. Shaianmehr et al. [15] reported that the incidence rate of iron deficiency anemia in marriage volunteers of Orumiye City is 4.52%. also in their study the occurrence rate of iron deficiency anemia was observed 6 folds higher in women. also, in study of Sadr et al. (1378) the incidence rate of iron deficiency anemia among the marriage volunteers of Kashan city was 10.97%, also, the incidence rate of this type of anemia was about three folds higher in women comparing to men. On the other hand, Keikhaei et al. [16] reported the incidence rate of iron deficiency anemia among children of Ahvaz city as 29.1%. Zendedel et al. [17] in their study in Lorestan indicated that the incidence rate of iron deficiency anemia in women 15 to 49 years old was about 69%. Similar to our study, this study reported high prevalence of iron deficiency anemia between women, and was parallel with our study. Shams et al. [18] evaluated the prevalence of iron deficiency anemia in girl students of Tehran with average age of 20 years. They study showed that around 41 percent of evaluated population had nearly 4% iron deficiency anemia. Veghari et al. [19] evaluated women in age range of 18 to 35 years in 20 villages of northern Iran; their study showed that the rate of iron deficiency in these women who are in fertility age is about 13.5%, although the total rate of iron deficiency and anemia were reported 35.6% and 26.8% respectively.

In the present study the mean hemoglobin of patients with iron deficiency anemia was 10.16 ± 1.38gram per dl in women and 10.95 ± 2.2 gr/dl in men, the mean rates of ferritin in women and men with iron deficiency were 11.2 ± 3.21 and 19.4 ± 5.23 ng/dl, respectively, and also MCV was 74.22 ± 8.13 in men and 70.63 ± 6.81 in women and MCH for men and women was 24.67 ± 4.98 and 22.15 ± 7.24 pg. Although there were no significant differences for these indices between the two genders, but all of them were lower than normal range. In study of Keikhaei et al. [16], the mean hemoglobin, MCV and MCH in individuals with anemia in age range of 10 to 55 years old in Ahvaz were 10.25 ± 1.30, 71.64 ± 8.56 and 22.16 ± 3.47, respectively which were consistent with our study. Shams et al. [18] reported the indices of hemoglobin, ferritin and MCV in women with iron deficiency anemia 11/00 ± 0.9, 3.4 ± 1.3 and 67.2 ± 6, respectively. These findings were consistent with our results. As it was seen, the prevalence of anemia and evaluated indices were different in various studies and in some cases the results are contradictory. However, various agents including sample size, geographical area, nutritional regime and habits, consuming iron supplementary and physiological status especially among women could be effective on occurrence of this type of anemia.

Patra et al. [20] showed that iron deficiency anemia effects on pregnancy result and also mother's health and leads to birth of preterm infants (69.3%), post-parturition hemorrhage (26%), myocardial infarction (18%), pre-eclapsia (17%) and eclampsia (14%). Shaianmehr et al. [15] in a systematic review study with studies conducted in Iran imparted that the rate of iron deficiency anemia is 14.2% among Iranian pregnant women on average. They also stated that anemia is higher in rural women (20%) comparing to urban women (13.4%). According to the statistics of world health organization also, more than half of pregnant women and one third of non-pregnant women in fertility ages suffer from anemia. The prevalence of anemia in fertility ages is because of menstruation and more pregnancy and especially in developing countries has higher prevalence because of inaccurate nutrition and lack of supplementary iron consumption. Therefore, the awareness of couples of iron deficiency anemia status and its effect on mother and infant's health especially in women at fertility ages is very important.

From the 32562 evaluated individuals, 1908 cases had minor thalassemia (5.86%), among these, 966 cases (5.93%) were men and 942 cases (5.79%) were women. therefore, there was no significant difference observed in the evaluated population about the rate of thalassemia prevalence in both genders. Also, the averages of MCV and MCH in these people were 61.08 ± 8.30 fl and 19.53 ± 2.54 pg respectively. Furthermore, 3041 cases (9.34%) including 1741 (10.69%) men and 1600 (9.83%) women had alpha-thalassemia. Keikhaei et al. [16] with studying of children, reported the occurrence of minor thalassemia as 3.4% in Ahvaz, which is lower than prevalence rate in our study, one of the reasons for this difference can be sample size of evaluated population, the sample size of present study was higher comparing to their study. However, in study of Shaianmehr et al. [15] in Urumia, the occurrence rate of minor thalassemia and alpha-thalassemia were reported 0.09%

and 0.32% in men, respectively, which is very lower than the present study results, but the averages of MCV and MCH in their study, were consistent with our results. Rahmani et al. [21] reported the prevalence rate of minor thalassemia in Kordestan as 0.02% with evaluation of 4966 marriage volunteers. The evaluation of 17768 persons in southern Iran, reported the incidence rate of minor thalassemia as 7.4%. They also reported MCV and MCH in these patients as below 80 and lower than 27 picograms respectively, which was consistent with our study. However, the studies out of Iran also have reported various prevalence of thalassemia. Lai et al. [22] in a systematic review study reported the incidence rate of beta-thalassemia, minor alpha-thalassemia, and concurrent involvement of beta and alpha-thalassemia in China as 2.21%, 7.88% and 0.48% respectively. Also, the occurrence rates of minor thalassemia are different in other studies somehow that its prevalence in Turkey, Saudi Arabia, and Egypt is 2.1%, 3.22% and 5-15% respectively.

The evaluation of internal and foreign studies shows that the prevalence rates of thalassemia gene in various areas of world and also Iran, somehow that in Iran the highest prevalence of beta-thalassemia is around Caspian Sea and Persian Golf with rates of higher than 10%. Its prevalence in Isfahan has reported about 8% and in North-west Iran about 1%. Various factors can be effective in prevalence of this gene. In previous studies, the high incidence of this gene in Khoozestan is attributed to factors such as race (Arab and Bakhtiari), weather conditions and proximity to persian gulf, the existence of malaria epidemic in past and familial marriages and its consequences on gene pool, which have increased the high rate of this disease in Khoozestan.

From 32562 evaluated individuals, 504 cases (1.55%) had sickle cell anemia, from these, 284 patients (1.74%) were men and 220 cases (1.35%) were women. on the other hand, 6 patients (0.02%) had trait sickle cell anemia and 498 patients (1.53%) had non-trait sickle cell anemia. The evaluation of 500 couples referring to Isfahan health center showed that the incidence rate of these gene was zero in their evaluated population. Keikhaei et al. [16] with evaluation of sickle cell anemia gene, reported its occurrence in marriage volunteers (Arab race) in Dashte Azadegan and Khorramshahr cities as 3.63% and 10.57%, respectively, which this rate was higher than our results. One of the reasons for this difference can be race variable, although sample size and geographical conditions also can be effective on this difference. Lervolino et al. [23] showed in their study that the prevalence of trait sickle cell anemia is between 1.1 and 9.8% in Brazil and 0.8 to 60 patients with sickle cell anemia are observed per each 100 thousand births. Dormandy et al. [24] reported the incidence rate of sickle cell anemia gene 1 in 4600 cases in UK.

Conclusion

The results of the present study showed that the incidence rate of iron deficiency anemia, minor thalassemia and sickle cell anemia? is patients referring to Ahvaz health center is higher than other regions. Given that iron deficiency can induce destructive effects on mother and fetus, therefore awareness of couples especially women from their body iron status and consumption of appropriate nutritional regimes and receiving iron supplementary can prevent these complications. On the other hand, in case of thalassemia, implementation and continuity of screening program of couple's beta-thalassemia in this city can effectively prevent from birth of infants with beta-thalassemia and imposing of unwanted treatment costs. Finally, with regards to weather conditions which are predisposing of sickle cell anemia gene maintenance, screening of this gene can be effective in decreasing of this type of anemia incidence.

Authors' Contribution

All the authors contributed the same.

Financial Disclosure

There is no conflict of interest.

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References

1. Leblanc CP, Rioux FM. Iron deficiency anemia following prenatal nutrition interventions. Can J Diet Pract Res 2007; 68:222-225.
2. Ekiz C, Agaoglu L, Karakas Z, Gurel N, Yalcin I. The effect of iron deficiency anemia on the function of the immune system. Hematol J 2005; 5:579-583.
3. De Silva A, Atukorala S, Weerasinghe I, Ahluwalia N. Iron supplementation improves iron status and reduces morbidity in children with or without upper respiratory tract infections: a randomized controlled study in Colombo, Sri Lanka. Am J Clin Nutr 2003; 77:234-241.
4. Baker RD, Greer FR. Committee on Nutrition American Academy of Pediatrics. Diagnosis and prevention of iron deficiency and iron-deficiency anemia in infants and young children (0-3 years of age). Pediatrics 2010; 126:1040-1050.
5. Bandyopadhyay A, Bandyopadhyay S, Basak J, Mondal BC, Sarkar AA, Majumdar S, Das MK, Chandra S, Mukhopadhyay A, Sanghamita M, Ghosh K, Dasgupta UB. Profile of β-thalassemia in eastern India and its prenatal diagnosis. Prenat Diagn 2004; 24:992-996.
6. Cappellini MD, Musallam KM, Marcon A, Taher AT. Coagulopathy in beta-thalassemia: Current understanding and future perspectives. Mediterr J Hematol Infect Dis 2009; 1.
7. Tadmouri GO, Garguier N, Demont J, Perrin P, Başak AN. History and Origin of beta-thalassemia in turkey: Sequence haplotype diversity of beta-globin genes. Hum Biol 2001;73:661-674.

8. Galanello R, Origa R. Beta-thalassemia. Orphanet J Rare Dis 2010; 5:1-11.
9. Stoltzfus RJ. Defining iron-deficiency anemia in public health terms: A time for reflection. J Nutr 2001; 131:565-567.
10. Pasricha SR, Brown SC, Allen KJ, Gibson PR, McMahon LP, Olynyk JK, Roger SD, Savoia HF, Tampi R, Thomson AR, Wood EM, Robinson KL. Diagnosis and management of iron deficiency anaemia: a clinical update. Med J Aust 2010; 193:525-532.
11. Vichinsky EP. Changing patterns of thalassemia worldwide. Ann N Y Acad Sci 2005; 1054:18-24.
12. Siqueira CM, Giannetti JG. Poor school performance: An updated review. Rev Assoc Med Bras 2011; 57:78-86.
13. Campbell JS. Alpha and beta thalassemia. Am Fam Physician 2009; 80:339-344.
14. Ehsani M, Shahgholi E, Rahiminejad M, Seighali F, Rashidi A. A new index for discrimination between iron deficiency anemia and beta-thalassemia minor: results in 284 patients. Pak J Biol Sci 2009; 12:473-475.
15. Shaianmehr M, Abassi M, Zareipour M, Abassi M, Eftekar E. Premarital screening of beta thalassemia in Urmia country of Northwest Iran during 2014: A short report. J Rafsanjan Univ Med Sci 2016; 14:903-910.
16. Keikhaei B, Zandian K, Ghasemi A, Tabibi R. Iron-deficiency anemia among children in southwest Iran. Food Nutr Bull 2007; 28:406-411.
17. Zendedel A, Jahanmardi F, Anbari K, Gorji M. Frequency of iron deficiency anemia and its related factors in adult patients referred to the internal clinic of Shohada Ashayer from 6 March to 6 July 2011. Yafteh 2012; 14:31-37.
18. Shams S, Asheri H, Kianmehr A, Ziaee V, Koochakzadeh L, Monajemzadeh M, Nouri M, Irani H, Gholami N. The prevalence of iron deficiency anaemia in female medical students in Tehran. Singapore Med J 2010; 51:116-119.
19. Veghari G, Mansourian A, Marjani A. The comparison of the anemia in pregnant and non-pregnant women in the villages of the south-East of Caspian Sea-Gorgan-Iran. Am J Med Sci 2007; 7:303-306.
20. Patra S, Pasrija S, Trivedi S, Puri M. Maternal and perinatal outcome in patients with severe anemia in pregnancy. Int J Gynaecol Obstet 2005; 91:164-165.
21. Rahmani S, Moradi G, Rostami S, Arasteh S, Fatimeh B. The survey of thalasemia minor epidemological in volunteers of marrige refferrd to health centers of javanroud city. Zanco J Med Sci 2015; 16:19-25.
22. Lai K, Huang G, Su L, He Y. The prevalence of thalassemia in mainland China: Evidence from epidemiological surveys. Sci Rep 2017; 7:920.
23. Lervolino LG, Baldin PEA, Picado SM, Calil KB, Viel AA, Campos LA. Prevalence of sickle cell disease and sickle cell trait in national neonatal screening studies. Rev Bras Hematol Hemoter 2011; 33:49-54.
24. Dormandy E, James J, Inusa B, David R. How many people have sickle cell disease in the UK? Public Health Rep 2017; 40:e291-e295.

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