REVIEW ARTICLE

The Prevalence of Iron Deficiency Anemia Among High School Students in Iran: A Systematic Review

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ABSTRACT

Iron is one of the most important elements forming the body and an essential metal for many biological processes in mammals. According to studies, anemia can cause numerous side effects in the body. Because of the effectiveness of iron in myelinated nerves, this illness can cause hearing loss and vision problems as well, and in students, it can even cause academic failure and learning problems and intensify behavioral disorders. Therefore, to collect the statistics of the prevalence of the disorder to inform parents, the present study was conducted to assess the prevalence of iron deficiency anemia in high school students in Iran using meta-analysis method. This study was continued in review form using the keywords anemia, iron deficiency anemia, and anemia prevalence with a consideration of the articles in Pubmed, Iranmedex databases and Scientific Information Database of SID in related topics with 89 articles. Time domain for searching articles and related books and was mainly from 1991 onwards. Studies on the prevalence of iron deficiency anemia in high school students show different results. Recent statistics based on published articles at home and abroad demonstrate the prevalence of iron deficiency anemia equal to 10.6%, (with a 95% confidence interval: 9.7 to 11.5) until 2014. The disease can cause hearing and vision disorders in adolescents. Moreover, it can cause academic failure and learning problems and intensify behavioral disorders in students. Given that children's health is an indicator of health planning of family for them, attention to the factors preventing iron deficiency anemia and its treatment is essential for students. Following this study, it is suggested that by correcting diet as the first step of prevention of catching this diseases, we take a step towards preventing it.

INTRODUCTION

Iron is one of the most important elements forming the body and an essential metal for many biological processes in mammals. Iron has vital functions in the body, some of which are transferring oxygen from the lungs to the organs of the body, electron transport in internal reactions of the cell in the body, and participating in the building of various enzymes in body tissues (1,2). Unfavorable reception of iron is the most important cause of iron deficiency anemia (IDA) that can be prevented by modifying nutritional and dietary diet (3,4). Iron deficiency is the most common nutritional problem in the world that about 4 to 5 billion people in the world suffer from and two billion people (more than 30 percent) of the world population has iron deficiency anemia (5).

According to studies, anemia can cause chronic fatigue, behavioral disorders, palpitations, exercise intolerance, general pallor of the skin, fade of conjunctival tissue, nail beds and palms, swelling of the tongue and sores in the corner of the lips, spoon nails and in severe cases, chronic heart failure (6). Also, the disease due to the effectiveness of iron in myelinated nerves can cause hearing loss and vision as well it can even cause academic failure and learning problems and intensify behavioral disorders (7,8).

Puberty and growth spurt, as well as the start of menarche and the menstrual cycle in females, increase their need for energy and nutrients, especially to micronutrients such as

iron (9,10). Increased consumption of junk food as snacks and fast food among children and adolescents leads to increased reduction of the content of dietary vitamins and minerals, especially vitamin A (11-15). Moreover, the unwanted status of receiving micronutrients such as vitamins B1 and B2, folic acid, calcium, and iron can cause iron deficiency anemia (16-20).

Since the awareness of mental health in educational levels is an indicator of the good health of family planning for children, several studies have been conducted in Iran on the prevalence of iron deficiency anemia in high school students, the results of which have reported different outbreaks. In assessing the prevalence of IDA, sample size and characteristics of the participants are of particular importance. Since the objectives of the meta-analysis are a systematic and normative review of documents, quantitative summing up of results of each study, combining the results of different studies, and providing a general interpretation of the results, this study was conducted in meta-analysis aimed to investigate the prevalence of IDA among high school students in Iran.

METHODS

This study is a systematic review and meta-analysis of IDA among high school students in Iran. The results of this study are based on studies and articles published in journals in our country and international databases of SID, Scopus, and magiran. Databases PubMed and Web of Science were searched to achieve articles published in journals of level 1. Search was done using Persian keys words and English keywords of "IDA (prevalence)," "anemia" and possible combination with the search strategy in titles.

Study Selection and Data Extraction

First of all, the researcher collected studies and research papers related to the prevalence of iron deficiency in Iran and upon completion of the search prepared a list of abstracts. At this stage, all articles with titles "prevalence," "IDA "and" students" entered the initial list, and other papers about the causes of anemia in different cases or simply risk factors associated with the disorder were excluded. Then a checklist of the information required by the study such as investigator

name, title, year and place of study, sampling methods, sample size, type of study, and measuring tool for the prevalence of IDA in the sub-group were prepared. The researchers looked at the final checklist list, and finally, articles related to the study entered meta-analysis. Following these steps and in the initial search, 34 articles entered the list of the abstracts sing the keywords available that was 21 related articles.

Quality and final assessment of the articles was performed using the checklist and criteria of interest to the researcher for the final evaluation (include criteria for sample selection and sample size, style and design of methodology, time of implementation, and the type of measurement instrument used for the estimate, prevalence of IDA, and overall incidence and prevalence in subgroups). The articles whose titles contained title the prevalence of IDA among high school students in different parts of Iran were confirmed. Finally, 9 relevant articles entered meta-analysis. The full text of articles was examined for analysis and entered the list of abstracts.

As in every article, the prevalence of IDA and the number of participants in the study were extracted, a binomial distribution was used to calculate the variance of each study. The average weight was used to combine the prevalence rates of various studies. Each study was given a weight proportional to its inverse variance. The multi-regression was calculated to investigate the relationship between the prevalence of DA year. Data was analyzed using Comprehensive Meta-Analysis (CMA) software version 2.2.

RESULTS

In this systematic review based on searches conducted, 34 papers were identified and after checking the titles of articles, the abstracts of 21 articles were included in the list. After the final assessment, 9 articles were included in the checklist and full-text of the articles was given to the researcher. The final studies were conducted from 1996 to 2014, and 5017 people participated in these studies. The features of the studies carried out on the prevalence of IDA are presented in Table 1 and Figure 1.

DISCUSSION

In this study, the prevalence of IDA among high school girls in the different regions of Iran was studied. This study is the

Table 1. Profile of studies of IDA among high school students in Iran

Study name	Year	Sample size	Place	Prevalence (%)	CI
Dizegi et al.(21)	1997	1350	Ilam	8.1	6.8–9.7
Pourghasem et al. (22)	1997	625	Jolfa	11.3	9–14
Vahidi et al. (23)	1999	450	Yazd	4.5	2.9–6.9
Nezhde Amir et al. (24)	1999	799	Varamin	7.6	6–9.7
Fakhr Movahedi et al. (25)	2002	402	Semnan	5.4	3.6–8.1
Khazaie et al. (26)	2003	480	Birjand	24.1	20.5–28.1
Mozaffari et al. (27)	2007	200	Yazd	3.9	1.9–7.7
Korourian et al. (28)	2009	325	Baft	8.4	5.8–11.9
Akramipour et al. (29)	2013	386	Kermanshah	12.2	9.3–15.9
Total		5017		10.6	9.7–11.5

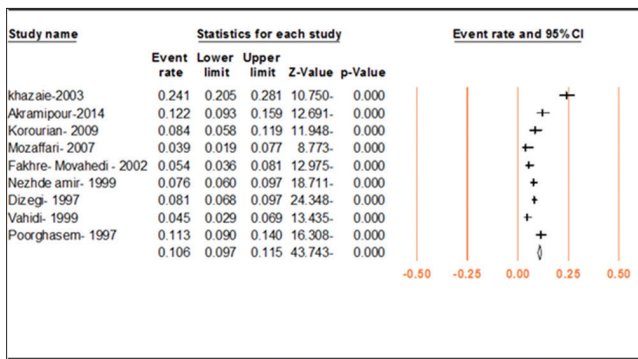| Study name	Statistics for each study					Event rate and 95% CI
	Event rate	Lower limit	Upper limit	Z-Value	p-Value	
khazaie-2003	0.241	0.205	0.281	10.750-	0.000	
Akramipour-2014	0.122	0.093	0.159	12.691-	0.000	
Korourian- 2009	0.084	0.058	0.119	11.948-	0.000	
Mozaffari- 2007	0.039	0.019	0.077	8.773-	0.000	
Fakhre- Movahedi - 2002	0.054	0.036	0.081	12.975-	0.000	
Nezhde amir- 1999	0.076	0.060	0.097	18.711-	0.000	
Dizegi- 1997	0.081	0.068	0.097	24.348-	0.000	
Vahidi- 1999	0.045	0.029	0.069	13.435-	0.000	
Poorghasem- 1997	0.113	0.090	0.140	16.308-	0.000	
	0.106	0.097	0.115	43.743-	0.000	

Figure 1: Prevalence of IDA among high school students according to the researcher, years, prevalence and 95% confidence intervals in Iran.Each segment shows the confidence interval. Mark Diamond is the result of combining all studies, with 95% confidence intervals

first systematic review of IDA among high school girls in Iran. According to the searches performed in prestigious scientific databases, so far, using meta-analysis, the researcher examined the effect of some factors on anemia, but in none of these studies, the frequency of anemia in this age period has been reported.

In the present study, the overall prevalence of anemia in female high school students in Iran was reported 10.6% (with 95% CI: 9.7-11.5). In the surveys by Akramipour *et al.* conducted in Kermanshah (29), IDA was estimated 12.2 %. Moreover, in the studies done in other parts of the world, different statistics are seen. In a survey carried out in Morocco to evaluate anemia in students with IDA, it has been reported at a rate of 16.2% (30). As observed, on the prevalence of IDA in this age group, various statistics are seen. The difference may be due to nutritional causes.

CONCLUSION

As the objective of systematic review studies is a regular and systematic review of the evidence of each study, quantitative summary of some results of the survey, combining the results of different studies, and providing a general interpretation of the results, giving an overall result of national studies are the strengths of this study. Failure to determine the qualitative value of each of the studies used is of the weaknesses of the current study.

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AUTHORS CONTRIBUTION

Reza Alipoor, Mohammad Saeed Gholami, Reza Heidari-Soureshjani, Reza Rajabi, Mohammad Javad Anari, Mohammd Sadegh Vaziri1, Saghar Vajdi, Amir Shamshiriyan gathering data and Reza Alipoor Analyzed Data, wrote primary draft, revised and submitted it.

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