

# A Study on Identification and Improvement of Anemia Using Effective Interventions

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## Abstract

**Introduction:** Anemia is the most common blood condition among primary school students, presenting lifelong health problems to them. Iran is a country with a young population most of which study in schools. This study aimed to survey students' anemia status and its improvement through using effective and efficient interventions in primary students in Paveh City.

**Methods and Materials:** In this interventional study, students were randomly selected, and after a primary screening, the suspected ones were recognized and referred to physicians and laboratory tests. After final approval by physicians, short and long-term interventions were carried out to address the problem of anemia. The process was repeated after one year to compare the intervention result. Then data analyzes was carried out using STATA10 software at a significance level of 0.05.

**Results:** The results of the study revealed that 37.8% of female and 24.1% of male students had problems due to anemia, which comprised 31.1% of the total number of students. The results showed that the intervention was effective for girls in their 3rd, 4th, and 5th grades leading to the reduction of the condition to 61%, 88% and 90%, respectively. This reduction in boys at 4th and 5th grade were 76% and 83% (P<0.05).

**Conclusions:** The study results showed that the rate of anemia significantly declined among the students and applying interventions were effective.

**Keywords:** Anemia, students, intervention.

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► Please cite this paper as:

Esmailnasab N, Gharibi F, Asghari Jafarabadi M, Gharib AR. A Study on Identification and Improvement of Anemia Using Effective Interventions. *Jundishapur J Health Sci* 2014;6(2):299-306

Received: 2013/7/20

Revised: 2013/10/22

Accepted: 2013/11/30

## Introduction

A society's success depends largely on a healthy population and this requires attention to the needs of different ages, genders, and social groups. One of these groups is students who are the parents of the future and pillars of a strong future society. Due to an increasing young population, the health of this great and vulnerable portion of the society in Iran is getting increasingly important. Anemia is one of the main problems in a society in general, and in students in particular. It can cause present and future problems as well as serious consequences and implications in the community.

Anemia refers to a condition in which hemoglobin found in red blood cells decreases and consequently gas transmission power drops. Anemia is usually due to poor nutrition and lack of materials such as iron, copper, vitamin B12, and folic acid. However, bleeding, infection, diarrheal, and genetic diseases may be among other contributing factors. But most conditions of anemia especially during school period are due to iron deficiency anemia which is due to a poor nutrition and lack of an iron-rich diet (1). Generally, the main cause can simply be attributed to poor nutrition, which is associated with poverty, lack of nutritional knowledge and commitment among public health experts to provide adequate training and monitoring of the nutritional status during the control and treatment program of anemia (2-4).

Anemia can cause symptoms such as fatigue, shortness of breath, dizziness, headache, chest pain, depression, numbness, weakness, inability to exercise, and poor quality of life (1,5). Also, the disease reduces academic performance, physical and intellectual growth, mental and physical growth and IQ, and may also cause difficulty in speech, conceptual and practical problems and ultimately loss of investment in education and health, higher mortality rate and reduced production in the community (6-8).

World Health Organization reported that more than 1.62 billion people suffer from varying degrees of anemia worldwide (4). In other words, it can be said that almost a quarter of the world's population is anemic but the rates vary in different population groups and different parts of the world. More than 50% of anemia is due to iron deficiency which causes 0.8 million deaths annually (1.5% of all deaths in the world) (9).

A study reported students in general and female students in particular are among the groups that suffer from higher prevalence rate of anemia. In other words, 25.4% of students around the world are anemic especially in developing countries (1). Iranian population-based studies show that about 30 to 50% of women and children suffer from iron deficiency anemia (10).

The aim of the study was to examine the prevalence of anemia in primary school children of Paveh in Iran and compare it with the national and international rates in order to take a positive step toward solving potential problems using effective training based interventions.

## Methods and Materials

This is a quasi-experimental interventional study with the participation of 574 male and female students (sample size obtained based on Morgan Table) conducted in 14 primary schools in 2012 and 2013 (11). In this study, students were selected randomly from 14 primary schools across the city according to the ratio of male to female students. The number of female students were 296 and the rest of samples (278) were male students.

The Method of primary diagnosis of anemia in students was based on signs and symptoms of the disease. This included early fatigue and weakness only after strenuous activity or exercise, restlessness and irritability, decreased functional ability, headache especially in the morning, dizziness especially when standing up quickly, nausea, tingling hands

and feet, dryness of the eye and pale eyelid, pale skin, and slow blood return in capillary nail and palm refill test. In case of presence of one or more of these symptoms, the students were referred to a physician for follow-up tests and other diagnosis and treatment processes.

In this study, after final physician approval, large-scale short and long-term interventions were carried out to address the anemia's underlying cause. Short-term interventions included students' referral in order to perform tests to determine the level and cause of anemia, ruling out other effective problems such as parasitic diseases, prescription of nutritional supplements and appetizers, and application of medications. Long-term intervention included nutrition knowledge of the students and their parents with an emphasis on the role of anemia in the students' health and their growth. After one year, students were examined in the same way and suspected cases were referred for a follow-up process.

Data were gathered and arranged to show frequency and percentages. Logistic regression analysis was used to investigate the effect of interventions for each grade and gender separately. A multiple logistic regression model was performed to investigate the effect of interventions with applying educational grades and gender variables in the analysis. For all the analysis, odds ratio and 95% confidence intervals were reported. Data were analyzed using STATA 10 software at a significance level of 0.05.

### Results

A total number of 574 students participated in this study, of which 296 (51.5%) were female and 278 (48.5%) were male. Samples were assigned to different grades based on their ratio. Table 1 shows frequency of students participating in the study by gender and grade.

Of the total participants, 181 students had one or more signs and symptoms of

anemia. Later all of them were referred to Physician, and after the physician's visit and diagnostic tests, 179 (98.9%) of them showed varying degrees of anemia. Later necessary interventions were performed on them.

In this study, it was found that 31.1% of the students, 37.8% female and 24.1% male, had anemia problems. The study revealed that the number of anemic cases was significantly more in the higher grades (the 4th and 5th grades) than the 1st grades ( $P < 0.05$ ), which seems to be due to an increasing number of students in the higher grades leading to nutritional imbalance because of the parents' nutritional neglect toward their children.

Furthermore, Results showed that the prevalence of disease is in between male and female students, therefore, the number of female students suffering from anemia was significantly more than male students ( $P < 0.05$ ). This is probably due to the rapid growth rate of female students compared to male students or lack of proper nutrition. In Table 2, the rate of anemia in pre- and post-test steps is given based on gender and educational grade. Table 3 and 4 show the significance of applied interventions considering gender and grade variables.

The results showed that the intervention was effective for girls in 3rd, 4th, and 5th grades ( $P < 0.05$  for all of them) and led to the reduction of the disease 61%, 88% and 90% respectively. Also, for the 1st and 2nd grade students, although the effect was not statistically significant, it was considerable from the health point of view and the disease reduced 61% and 58% respectively ( $P < 0.1$ ). The results showed that the intervention was effective for boys in grades 4 and 5 and the disease decreased 76% and 83% respectively ( $P < 0.05$  for both of them).

The results show that through applying gender and grade variables, the intervention was highly effective; therefore, the disease decreased 73%. The overall effect was different among males

and females; males had 48% less anemic problems than females ( $P < 0.05$ ). The overall effect was different for different educational grades and in comparison with the students at 1st grade, those at grades 2, 3, 4 had more problems (7%, 57%, 77%,

and 88% respectively) furthermore, these differences were more significant for grades 4 and 5 ( $P < 0.05$ ).

The considerable effect of the intervention is illustrated clearly in charts below:

**Table 1: Frequency of students participating in the study according to gender and grade**

		Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
Females	Frequency	57	60	55	67	57
	Percentage	9.9	10.4	9.6	11.7	10.0
Males	Frequency	55	56	52	62	53
	Percentage	9.6	9.8	9.0	10.8	9.2
Total	Frequency	112	116	107	129	110
	Percentage	19.5	20.2	18.6	22.5	19.2

**Table 2: Frequency (percentage) of anemic students according to gender and grade**

			Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
Pre-test	Females	Frequency	15	14	22	31	34
		Percentage	26.3	23.3	40.0	46.2	59.6
	Males	Frequency	7	9	12	16	17
		Percentage	12.7	16.1	23.1	25.8	32.1
	Total	Frequency	22	23	34	47	51
		Percentage	19.6	21.5	31.7	36.4	46.3
Post-test	Females	Frequency	6	6	9	4	4
		Percentage	10.5	10.0	16.4	6.0	7.0
	Females	Frequency	4	5	6	4	3
		Percentage	7.2	8.9	11.5	6.5	5.6
	Males	Frequency	10	11	15	8	7
		Percentage	8.9	9.4	14.0	6.2	6.3

**Table 3: Frequency (percentage) of anemic students according to gender and grade and results of simple logistic regression analysis**

Sex	Grade	Pre-test		Post-test		OR	L	U	P value
		Frequency	Percentage	Frequency	Percentage				
Females	Grade 1	15	26.3	6	10.5	0.39	0.15	1.01	0.053
	Grade 2	14	23.3	6	10.0	0.42	0.16	1.10	0.077
	Grade 3	22	40.0	9	16.4	0.39	0.18	86	0.020
	Grade 4	31	46.2	4	6.0	0.12	0.04	0.33	<0.001
	Grade 5	34	59.6	4	7.0	0.10	0.04	0.30	<0.001
Males	Grade 1	7	12.7	4	7.2	0.57	0.16	1.95	0.368
	Grade 2	9	16.1	5	8.9	0.55	0.18	1.66	0.286
	Grade 3	12	23.1	6	11.5	0.49	0.18	1.32	0.159
	Grade 4	16	25.8	4	6.5	0.24	0.08	0.73	0.012
	Grade 5	17	32.1	3	5.6	0.17	0.05	0.58	0.005

OR: Odds Ratio

L: Lower limit of 95% confidence interval

U: Upper limit of 95% confidence interval

**Table 4: Results of multiple logistic regression analysis for assessing intervention effect considering gender and grade variables**

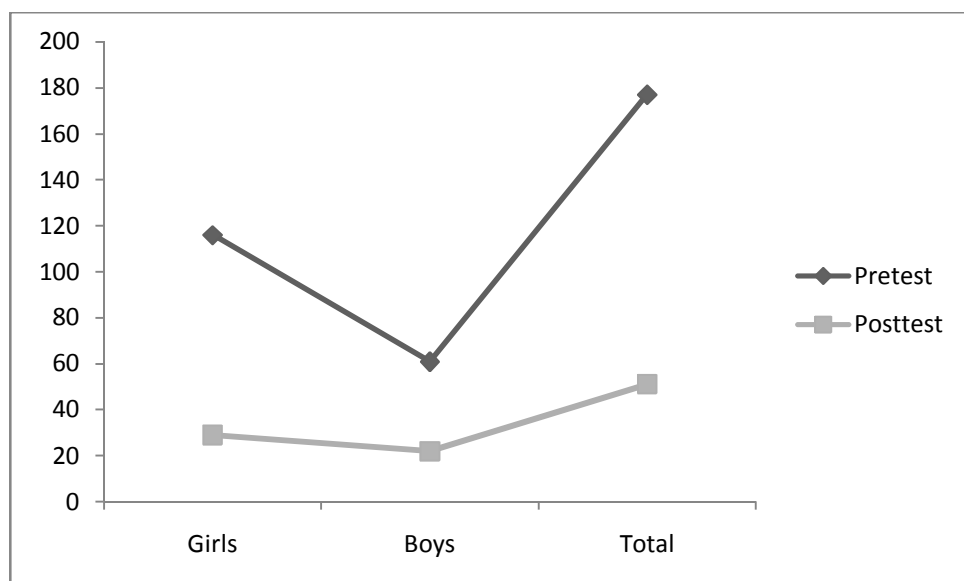
Variable	OR	L Intervention	U	P value
Pre-test	Reference group	---	---	---
Post-test	0.27	0.20	0.38	<0.001
		Gender		
Females	Reference group	---	---	---
Males	0.52	0.39	0.68	<0.001
		Grade		
Grade	1.19	1.08	1.31	<0.001#
Grade 1	Reference group	---	---	---
Grade 2	1.07	0.65	1.75	0.802
Grade 3	1.57	0.99	2.48	0.055
Grade 4	1.77	1.13	2.77	0.012
Grade 5	1.88	1.20	2.92	0.005

OR: Odds Ratio

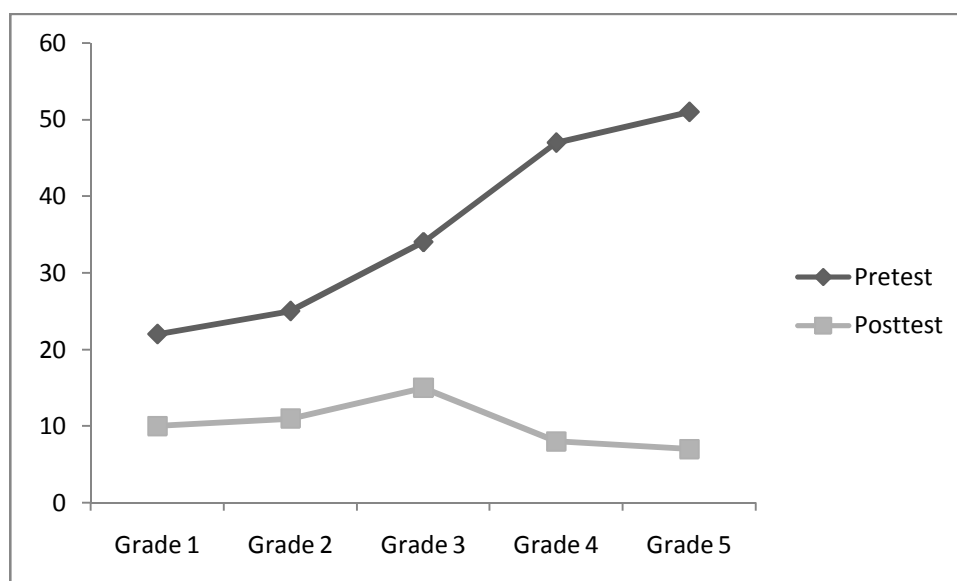
L: Lower limit of 95% confidence interval

U: Upper limit of 95% confidence interval

#: series test results



**Chart 1: Comparison of the number of anemic students before and after the intervention based on gender**



**Chart 2: Comparison of the number of anemic students before and after the intervention based on educational grade**

### Discussion

This was a quasi-experimental interventional study assessing the effects of efficient and effective interventions, which lasted over two years of continuous work in order to solve the underlying problem of anemia among the primary school students in Paveh City. In this study, the researchers conducted a precise, scientific, and effective process, which could result in considerable outcomes after proper implementing and monitoring and could be helpful for researchers and school health administrators.

As observed, rate of anemia among studied students declined significantly, suggesting the effectiveness of the interventions. This study showed that the application of logical and scientific processes could improve poor conditions leading to a health promotion in the society. In addition, the study highlighted the needs for further attention to the nutritional status of female primary students without overlooking the higher graders' nutritional needs.

In the present study, it was shown that the rate of anemia in studied sample was about 31.1%, 24.1% in males and 37.8% in female students, considering the fact that

the disease rate in females is more than in males and this rate raises with an increase in school grades.

In a study in 2009 with the aim of assessing the effectiveness of a health educational program on anemia control, it was found that the rate of anemia in females was about 30 to 50%, in which the upper bound is related to lower-income families (10). In another study in Iran, it was shown that the rate of anemia among female students was significantly higher than in male students (8). Both findings were consistent with the results of the present study. However, the rate of anemia in this study was in the lower limit of the reported range.

In another study in 2007 in Gaza aiming to investigate the relationship between social-demographic factors and nutritional status of students (with some components, such as anemia), anemia rate was 49.6%, and the rate in the girls was more than in the boys. The study also revealed that the incidence of the disease was different in various age groups with an increase rate in the elders (12). The prevalence of anemia in that study was quite higher than the findings of our study; however, other

findings were consistent with the results of this study.

Prevalence of anemia in Indonesia, Sri Lanka, and Shanghai, China showed rates of 21.8%, 58.1% and 46.8%, respectively (13,14). Interestingly, in most of the studies, higher rates of the disease are related to females.

In another study in Iran in 2010 with the aim of investigating the effect of nutrition education on iron deficiency anemia in high school girls, it was shown that nutrition education could significantly reduce the incidence of anemia; therefore, the complications of the disease could be eliminated. These results correspond with the findings of our study (15).

In a study done in 2004, the effect of nutrition education on anemia improvement and children growth was shown in people with low economic status (16). Also, in another study in 2005, it was revealed that providing nutrition education and subsequently the change in eating habits can lead to improvement of iron deficiency anemia (17). Findings of those studies are consistent with the results of this study.

The following suggestions could be provided from the findings of this study: 1) an accurate and timely treatment of the mentioned problem in schools and health care centers due to the extent of the disease and its deep impact on the present and future students' health, 2) providing appropriate training on the importance of anemia and its treatment and nutrition education to students and their families, 3) continued follow-up until complete treatment of anemia, 4) application of this study results by health administrators and doing the similar interventions in order to cure the disease, 5) attention to health education and literacy promotion in the society by health experts and managers. 6) using active learning styles in health education in order to deepen the learning, and 7) conducting similar studies with larger sample size and populations and publication of results in a timely fashion.

## Conclusions

The results of the study showed that studying simultaneous interventions could be more effective than pure therapeutic intervention, since nutritional education to students and their families could be an important action toward underlying management (and not just the symptomatic treatment) of this widespread problem. The results of this and other similar studies undoubtedly could be of assistance to health and nutritional experts as well as health managers and policy makers in macro-level, in their attempt to curb this pervasive problem.

## Acknowledgements

The researchers would like to appreciate kind cooperation of the personnel in the studied schools, as well as physical education and health experts of the department of education in Paveh, Iran.

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