JRH
Jrh.gmu.ac.ir

The effect of PRECEDE model in preventing iron deficiency anemia in high school students

Hassan Eftekhar Ardebili[1], Fahimeh Bagheri[1], Hossein Shahnazi[2]

Journal of Research & Health
Social Development & Health Promotion Research Center
Early View 30 May 2017
Original Article

1. Department of Health Education and Promotion, School of Health, Tehran University of Medical Sciences, Tehran, Iran
2. Department of Health Education and Promotion, School of Health, Isfahan University of Medical Sciences, Isfahan, Iran
Correspondence to: Fahimeh Bagheri, Department of Health Education and Promotion, School of Health, Tehran University of Medical Sciences, Tehran, Iran
Email: f_bagherikho@yahoo.com

Received: 22 Dec 2013
Accepted: 3 Dec 2014

How to cite this article: Eftekhar Ardebili H, Bagheri F, Shahnazi H. The effect of PRECEDE model in preventing iron deficiency anemia in high school students. *J Research & Health 30 May 2017; Early View.*

Abstract

Iron deficiency anemia is the most common nutritional deficiency throughout the world, and young girls are among the most vulnerable groups. The quasi-experimental study was conducted on randomly selected 190 junior high school girls to determine the effect of PRECEDE-based health education program in prevention of iron deficiency anemia. The intervention was carried out in three 90-minute sessions, and data were collected immediately and three months after the intervention using PRECEDE–based questionnaires. A significant improvement was observed in the case group compared to the control after the intervention in mean scores of predisposing factors (knowledge and attitude), empowering factors (holding and participation in educational classes and use of educational resources), reinforcing factors (peers' and teachers' encouragement) and iron deficiency preventing behaviors. The present study showed the positive effect of PRECEDE-based educational intervention in increasing iron deficiency anemia preventing behaviors.

Keywords: Anemia, Health Education, Students

Introduction

Today, as a common public health problem, anemia has spread throughout developing and developed countries [1]. The World Health Organization estimates that two billion (40% or more than a third of the world population) suffer from anemia [2], of whom, 19 million are in the Eastern Mediterranean region [1]. Prevalence of anemia among 15-59 year-old women is 10.3% in industrial countries and 42.3% in non-industrial countries [3].

In the third world countries, iron deficiency is the most common cause of anemia, and the most common blood disorder (iron deficiency is responsible for 75% of anemia cases). Iron deficiency anemia is among the most common chronic diseases in humans, and affects about 30% of the world population [2]. In Iran, 30% to 50% of women and children (especially in low income families) suffer from iron deficiency, and 45% of 15-45 year-old women and up to 30% of young girls suffer from anemia [4].

Iron deficiency anemia is most prevalent among children younger than 2 years, young girls, pregnant women and older adults [5], among these, adolescence that is identified with rapid development and gaining adult phenotype and biological rhythm, is a

prominent period affected by iron deficiency anemia. In this period, the need for iron in boys and girls increases due to the increase in the amount of blood and body mass [6], but greater attention is focused on girls due to their rapid physical growth and loss of blood through menstruation [7,8].

In a study conducted to assess anemia and iron deficiency among female students, mean loss of blood through menstruation was 62.6 ml, and mean loss of iron per month was 12.5 ml. 25% of girls had blood loss more than 80 ml per month [9].

Results of a nationwide survey in 1985 on women of reproductive age (15-49) in rural and urban areas showed that 34.5% of women had severe iron deficiency (based on serum ferritin indicator), and 16.6% of women and 38.7% of young girls had severe iron deficiency anemia [10]. Results of a nationwide survey of micro-nutrients in spring 2001 showed that 22.8% of young girls had severe iron deficiency [11]. Another study showed iron deficiency and iron deficiency anemia in girls (18.3% and 11.5% respectively) was 10 times greater than in boys (1.5% and 1.4% respectively) [12].

There are many factors involved in iron deficiency anemia; the most important being nutrition and lack of iron intake [13-15].

The disease initially appears in the form of mild chronic fatigue and pale skin, gradually extending to pale gums, nails, palms, conjunctiva and lips. Exacerbation of anemia leads to intolerance of activity, palpitations, and cracks in the corner of lips and… [16]. Iron deficiency anemia reduces IQ of school age children by 5 to 10 points [17], and thus it is highly important in students due to its huge effect on learning [18]. Prevalence of anemia is 40% in students, and 9% in students in industrial countries, and in 53% in students in non-industrial countries [19]. Quantitative calculation of socioeconomic consequences of iron deficiency anemia shows that 10% reduction in concentration of hemoglobin causes 10% to 20% reduction in performance [20].

In this study, PRECEDE model was used, which has been proposed as a successful model in many clinical and field trials, and many studies on iron deficiency anemia have also used PRECEDE as an educational model [19-25]. This model provides a framework for determining predisposing factors (attitude and knowledge), reinforcing factors (encouragement from family, teachers and peers), and empowering factors (holding and participating in educational classes) [25].

Accordingly, this study was conducted to assess the effect of PRECEDE-based education on prevention of iron deficiency anemia among junior high school female students in Lenjan township.

Method

This quasi-experimental study with a control group and before/after design recruited a group of junior high school female students from Lenjan town, Iran. Study inclusion criteria were: studying at junior high school level, with known and accessible address and telephone number for follow-up, and no hereditary anemia. Those unwilling to take part, absent, or transferred were excluded from study.

The sample size with a confidence coefficient of 0.95, a test power factor of 0.84, and standard deviation of the score of each factor in the two groups of 0.4 were calculated 75 participants in each group. Students were selected in a multi-stage sampling process. Given homogeneity of various districts of the town in terms of socioeconomic factors, schools were not much different from one another. The researcher presented a letter of introduction from Tehran University of Medical Sciences to the education authorities of Isfahan province, and traveled to Lenjan town, where he randomly selected 4 out of 34 female high schools, and randomly assigned two as case group and two as control group schools. Prior to commencement, explanations about study objectives and method were provided and written consents were obtained from parents of students willing to take part. Ninety-five students were selected as the case group from the first two schools, and 95 as the

control from the second two schools. Data were collected using a questionnaire prepared by Shahnazi et al. to study the effect of PRECEDE-based health education on knowledge, attitude, and nutritional behaviors associated with iron deficiency anemia among second year junior high female students in Isfahan [25]. According to PRECEDE model, this questionnaire contains five parts, including knowledge (15 questions), attitude (10 questions), empowering factors (3 questions), reinforcing factors (2 questions), and finally behavior (10 questions). In the present study, Cronbach's alpha was found 0.73 for knowledge, 0.75 for attitude, and 0.93 for behaviors.

Questions in knowledge section were answered according to a 4-option format, where correct answers scored one point, and wrong ones scored zero. Questions in attitude and behavior sections were answered according to 5-point Likert scale, where in attitude section, scoring ranged from 0 to 4 (totally agree=4, agree=3, no comment=2, disagree=1, and totally disagree=0), and in behavior section, from 0 to 4 (always=4, often=3, occasionally=2, rarely=1, never=0). For ease of comparison, scores in all three parts were scaled to 100 points. Empowering factors included three questions on holding education classes about prevention of iron deficiency anemia in school, participation in these classes, and receiving relevant written educational topics. Reinforcing factors also included three questions on encouragement by family, friends and peers to eat iron-rich foods, and teachers encouraging students to take part in these classes. Empowering and reinforcing questions were designed according to a yes or no answer, and relative frequency was calculated for these sections.

Before intervention, the questionnaire was completed by students in both groups. Then, three 90-minute educational sessions were held for students in case group. Education program was designed with the help from four health education experts. In the first session, students were introduced to iron deficiency anemia, vulnerable groups, and causes of iron deficiency anemia among young girls, and symptoms and ways to detect iron deficiency. In the second session, a nutritionist was also present, and students learnt about iron deficiency causes and factors, complications and consequences of iron deficiency anemia, and iron-rich sources, and had a group discussion about their food habits, and nutritionist provided education about right and wrong habits. In the third session, students were introduced to strategies for prevention of iron deficiency anemia. Students were asked to convey to their families what they had learnt in each session. An education session for teachers and one for mothers were also held. Students were also given educational notes and pamphlets.

Lectures, group discussions, and questions and answers techniques were used in educational sessions, and whiteboard, slides, and power-point were used for greater efficacy. Questionnaire was completed by both groups immediately and three months after intervention. In terms of ethical considerations, An education session was held for control group at the end of study. Data were analyzed in SPSS-18 using independent t-test, paired t-test, repeated measures ANOVA, Chi-square, and Cochrane-McNemar tests.

Results

The study participants were a group of junior high school female students. The education level of parents in most of participants in intervention and control groups was under diploma. Father's job in most of participants was self-employed and their mather's job was housewife.

Independent t-test before the intervention showed no significant difference between students in mean score of knowledge, attitude and behavior toward iron deficiency anemia, but mean score of knowledge, attitude and behavior was significantly greater in the case group immediately and three months after the intervention compared to the control group ($p<0.001$).

Repeated measures ANOVA test showed no significant difference in mean score of knowledge, attitude and behavior toward

iron deficiency anemia before, immediately and three months after the intervention in the control group, but in the case group, the difference in mean score of knowledge, attitude and behavior on these three occasions was significant (p<0.001) (Table 1).

Table 1 *Mean and standard deviation of knowledge, attitude and behavior of participants about iron deficiency anemia*

Variable	Time	Case group	Control group	*p-value
Awareness	Before intervention	59.1±15.1	57.4±14.6	00.402
	Immediately after intervention	87.6±12.7	62.2±16.4	<0.001
	Three months after intervention	79.5±16.04	61.06±17.6	<0.001
	**p-value	<0.001	0.08	-
Attitude	Before intervention	65.2±13.6	67.06±12.5	0.312
	Immediately after intervention	76.5±13.6	67.7±11.3	<0.001
	Three months after intervention	77.8±10.7	66.09±12.9	<0.001
	**p-value	<0.001	0.62	-
Behavior	Before intervention	67.7±18.25	67.6±15.2	0.952
	Immediately after intervention	74.4±21.07	67.2±18.02	<0.01
	Three months after intervention	73.2±18.5	63.6±16.3	<0.001
	**p-value	<0.03	0.14``	-

*independent t-test
** Repeat measure ANOVA

Cochrane test showed no significant difference in frequency of empowering factors of holding educational classes about iron deficiency anemia, participation in classes, and receiving educational topics in the control group on the three occasions (p=0.723), but in the case group the difference was significant (p<0.001). McNemar test showed a significant increase in distribution frequency of empowering factors of holding educational classes about iron deficiency anemia, participation in classes, and receiving educational topics immediately and three months after the intervention compared to before the intervention (Table 2).

Table 2 *Relative frequency distribution of empowering factors in participants about iron deficiency anemia*

	Case group (%)				Control group (%)			
Empowering factors	Before intervention	Immediately after intervention	Three months after intervention	p*	Before intervention	Immediately after intervention	Three months after intervention	p*
Iron deficiency anemia classes in school	13.1	100	100	<0.001	14.3	16.2	15.3	0.59
Participation in Iron deficiency anemia classes	38.6	100	100	<0.001	42.3	41.2	43.7	0.72
Educational sources of iron deficiency anemia	38.4	100	100	0.033	42.3	38.5	44	0.823

*Cochrane test

Cochrane test showed no significant difference between the two groups in frequency of reinforcing factors of family encouragement to eat iron-rich foods (p=0.64). This was the same in the control group in teacher's encouragement to participate in educational classes (p=0.62) and peers' encouragement to eat iron-rich foods (p=0.99) on the three occasions. But, in the case group, a significant increase was observed immediately and three months after the intervention in encouraging factors of teachers and peers compared to before the intervention (Table 3).

Table 3 *Relative frequency distribution of reinforcing factors in participants about iron deficiency anemia*

	Case group (%)				Control group (%)			
Reinforcing factors	Before intervention	Immediately after intervention	Three months after intervention	p*	Before intervention	Immediately after intervention	Three months after intervention	p*
Family encouragement to eat iron-rich foods	91.9	93.9	97	0.298	98.2	98.2	98.2	1
Teachers encouragement to take part in iron deficiency anemia classes	35.2	56.1	66	<0.001	30	26.2	23.4	0.62
Peers encouragement to eat iron-rich foods	30.2	43.4	48	<0.001	38.4	39	38.7	0.99

*Cochrane test

Discussion

PRECEDE is among health education models used in promotion of health and in identifying requirements [26], and has the following constructs:

1) Predisposing factors: This deals with motivational forces needed to adopt the right behavior such as knowledge and attitude, which act as underlying factors in affecting behavior [25]. The present study results showed a significant increase in mean knowledge and attitude scores after the intervention, suggesting the effect of educational interventions. Other studies have also confirmed the effectiveness of PRECEDE model in increasing knowledge and attitude, including studies by Shahnazi et al. [25] on increasing knowledge and attitude toward nutritional behaviors associated with iron deficiency anemia, Shakori et al. [19]on increasing students' knowledge and attitude in control of iron deficiency anemia, Jalili et al. [21] on increasing knowledge and attitude of mothers about iron deficiency anemia in 1-5 year-old children, and Fallahi [20] on increasing nutritional knowledge and positive attitude of female students about iron deficiency anemia.

2) Empowering factors: This includes facilitation and skills required to change behavior [25]. In this study empowering factors included holding education classes, participation in classes, and receiving educational topics. Results showed a significant difference between case and control groups after the intervention. Other studies have also shown improved behavior due to empowering factors, including Jalili et al. [21] that showed use of this model had a direct and significant effect on behaviors preventing iron deficiency in 1-5 year-old children, and empowering factors as a construct of this model predicted iron deficiency prevention behaviors. Results obtained by Shahnazi et al. [25], and Shakori et al.[19] agree with the present study results.

3) Reinforcing factors: These factors probably increase continuity of recommended behavior [25]. In this study, family encouragement to eat iron-rich foods was considered the first reinforcing factor. Results showed no significant difference between the two groups after intervention, which was probably due to its high score before the intervention

(91.9), which shows knowledge and sensitivity of families to children's nutrition and their encouragement to eat iron-rich foods.

However, a significant difference was found between the two groups after the intervention due to teachers' encouragement of students to take part in training classes and peers' encouragement to eat iron-rich foods, which indicates the significant role of teachers and peers in student education. The results obtained by Shahnazi et al. [25] Shakori et al. [19], Jalili et al. [21] also show a significant increase in PRECEDE model constructs, of which reinforcing factors are one. Strong points in the present study included follow-up of students three months after the intervention, which was carried out to assess sustainability of the intervention. In terms of behavior, results showed a significant increase in mean score immediately and three months after the intervention in the case group compared to the control. In the case group, mean score of behavior also showed a significant increase immediately and three months after the intervention compared to before. These results suggest the effectiveness of PRECED model in changing behavior.

In Jalili et al. [21] study, in the intervention group, mothers' behavior showed an improvement in prevention of iron deficiency anemia in under-five children and a significant difference was found between their behaviors before and after the intervention. In a study by Kashfi et al. [27], the performance score of mothers about growth monitoring and prevention of children's developmental disorder was significantly increased 4 months after intervention compared to before intervention. Other studies, including a study by Lesan [28] showed an increase in anxiety-reducing health behaviors among fire department personnel, and a study by Taghizadeh [29] showing increased self-help behavior for controlling premenstrual syndrome.

it is recommended that health planners and authorities use this model as a theoretical framework of interventions in their macro and national plans to control iron deficiency anemia. The results obtained also emphasize the need for implementation of education programs for all junior high school girls.

Conclusion

Young girls are highly exposed to the risk of iron deficiency, and their knowledge as future mothers is associated with community health. This study showed that PRECEDE-based educational planning can have positive effects on every aspect of behavior. Combination of predisposing, empowering and reinforcing factors increases efficacy of education. Given the significant increase in knowledge, attitude, and behavior in the case group compared to the control, empowering and reinforcing factors appear to a decisive role in behavior change.

Acknowledgements

This article was derived from an MSC thesis in health education. We thank Tehran University of Medical Sciences for funding this research. We also thank all education authorities, heads, teachers, and students of high schools in Lenjan for their cooperation.

Contribution

Study design: HEA, HSH, FB
Data collection and analysis: FB
Manuscript preparation: HEA, HSH, FB

Conflict of Interest

"The authors declare that they have no competing interests."

References

1- EL-Sahn F, Sallan S, Mandi A, Galal O. Anemia among Egyptian adolescents: prevalence and determinants. *East Mediterr Health J*2000; 6(5-6): 1017-25.

2- Sarbandy Zaboly F. Survey health education in order to decrease iron deficiency anemia. [dissertation]. MSC Health Education, Tehran: Tarbiat Modarres University; 2004.

3- World Health Organization (2001) Iron deficiency anaemia: assessment, prevention, and control. A guide for programme managers. WHO/NHD/01.3. Available at URL: http://www.who. int/nutrition/publications/ en/ida_assessment_prevention_ control.pdf. Accessed April, 2007.

4- Mosaiy R. Survey effect of education in decrease iron deficiency anemia girls student at Tehran. [dissertation]. MSC Health Education. Tehran: Tarbiat Modrres University; 2002.

5-Wu AC, Les Perance L, Bernstein H. Screening for

iron deficiency. *Pediatr Rev*2002; 23(5): 171-8.
6- Beard JL. Iron requirements in adolescent female. *J Nutrition*2000; 130(2S Suppl): 594-7.
7- Brown D. Link between iron and youth cognitive skills? *Journal of the Academy of Nutrition and Dietetics*2001; 101(11): 1308.
8-Lynch SR. The potential impact of iron supplementation during adolescence on iron status in pregnancy. *J Nutr*2000 ; 130(2S Suppl): 448-51.
9- Pimentel NZ, Torres GR, Garcia T, Esudero ME, Cabakkero SC. Anemia and iron deficiency anemia in adolescent student in lima, peru: causes, consequences and prevention. Institute Investigation Nutritional Lima, Peru. 1996.
10- Sheikholeslam R, Abdollahi Z, Jamshidbeigi A, Salehian P, Malekafzali H. Prevalence of iron deficiency, anemia and iron deficiency anemia in woman of reproductive age (15-49) in urban and rural areas of the country. *Journal Teb, Tazkieh*2002; 47: 37-44.
11- Ministry of Health and Medical Education, Micronutrient status – National survey; 2001.
12- Schaaf D, Scragg R, Metcalf P, Grant C, Buchanan J. Prevention of iron deficiency in Aukland high students. *N Z Med J*2000; 113(1116): 347-50.
13- Beinner MA, Lamounier JA. Recent experience with fortification of foods and beverage with iron for the control of iron- deficiency anemia in Brazilian children. *Food Nutr Bull*2003; 24(3): 268-74.
14- Slotkin SH, Christofides AL, Hyder SM, Schauer CS, Tondeur MC, Sharieff W. Controlling iron deficiency anemia through the use of home-fortified complementary foods. *Indian J Pediatr*2004; 71(11): 1015-19.
15- Buonomo E, Cenko F, Altan AM, Godo A, Marazzi MC, Palombi L. Iron deficiency anemia and feeding practices in Albanian children. *Ann Ig*2005; 17(1): 27- 33.
16- Khazaee T, Zardast M, Sadat Jou SAR. Prevalence of iron defiency anemia in Birjand high school students. *Journal of Birjand University of Medical Sciences*2003; 10(1): 9-15.
17- Pishgouei SAH, Khosh Sima S. The study of Iron deficiency anemia prevalence among aja nursing faculty students, Tehran, 2004-2005. *Annals of Military and Health Sciences Research*2006; 4(3): 931-4.
18- Amirkhani MA, Ziaedini SH, Dashti M, et al. The prevalence of Anemia among school students in a National screening program in Iran. *Journal Isfahan University of Medical Science*2009; 26(91): 381-6.
19- Shakouri S , Sharifirad G, Golshiri P, Hassanzadeh A, Shakouri M. Effect of health education program base on PRECEDE Model in controlling iron-deficiency anemia among high school girl students in Talesh. *Journal Arak University of Medical Science*2009; 12(3): 47-56.
20-Fallahi E, Rashidi M, Ebrahimzadeh F, Karbasi SH, Shokrollahi N. Effect of nutrition education on iron-deficiency anemia among high school girl student. *Journal Shahrekord University of Medical Science*2010; 12(1): 37-45.
21-Jalili Z, Faghihzadeh S, Heydarnia AR, Hazaveei MM, Sadat Hashemi SM. Using the PRECEDE Model for causal analysis of mothers' preventive behaviors in iron deficiency anemia of children aged 1-5 years old. *Journal Kerman University of Medical Science*2002; 9(2) : 93-101.
22- Moshki M, Ghofranipour F, Azadfallah P, Hajizadeh E. Implementation of participatory-educational program based on PRECEDE Model for self –esteem and psychological well-bing enhancement of university students. *Journal Hormozgan University of Medical Science*2010; 14(1): 22-31.
23- Salehi L, Heidari F. Efficacy of PRECEDE model in promoting nutritional behaviors in a rural society. *Iranian J Epidemiol*2011; 6(4): 21-7.
24- Chiang LC, Huang JL, Lu CM. Educational diagnosis of self-management behaviors of parents with asthmatic children by triangulation base on PRECEDE – PROCEED model in Taiwan. *Patient Educ Couns*2003; 49(1): 19-25.
25- Shahnazi H, Tabar Isfahani M, Azarbin S, Hassanzadeh A, Charkazi A, Moodi M. Impact of education base on PRECEDE model on knowledge, attitude and behavior of grade two guidance school girls regarding Iron Deficiency Anemia (IDA) in Isfahan. *Journal Diciplin Researchs*2012; 8(5): 773-81.
26- Naidoo J, wills J. Health promotion: Foundations for practice. Philadelphia, PA: Elsevior Health Sciences; 2000. pp: 361-3.
27- Kashfi SM, Jeyhouni AK. Mothers' educational program based on the precede model on the prevention of growth retardation in 6 to 12-month old children in the health centers of Shiraz city, Fars Province, Iran: An Interventional Study. *Journal of School of Public Health & Institute of Public Health Research*2012;9(3): 55-62.
28- Lesan SH. Decrease anxiety of fire officials by use of precede model integrated with educational theories in Tehran. [dissertation]. PHD Health Education. Tehran: Tarbiat Modarres university 2003.
29- Taghi zadeh M. Application of Precede model integrated into self-regulation theory premenstrual syndrome control. [dissertation]. PHD Health Education. Tehran: Tarbiat Modarres university 2003.