

The effect of maternal education on preventive behaviors of iron deficiency anemia in children: A randomized controlled trial

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Abstract

Background

Iron deficiency anemia (IDA) is the most common hematological disease in infancy and childhood. Therefore, it is necessary to provide maternal education using models that identify factors affecting behavior. Hence, this study was conducted to evaluate the effect of maternal education based on the health belief model (HBM) on preventive behaviors of IDA in children aged 1–6 years in rural health centers of Babol, Mazandaran Province, Iran in 2015.

Methods

In this quasi-experimental study, 119 mothers were selected through multi-stage random sampling and divided into two groups of intervention and control. The data collection tool was a researcher-made questionnaire whose validity and reliability were studied and confirmed. A pretest was conducted in both groups. Need assessment was done according to the pretest results, and educational intervention was performed in four educational sessions in the intervention group. The same questionnaire was applied for posttest three months after the intervention. SPSS version 20 was used for data analysis.

Results

There was no significant difference in the mean scores of awareness, HBM constructs, and performance of the mothers between the two groups before the intervention ($P < 0.05$) while the difference was significant after the intervention ($P < 0.001$). The mean score of performance, increased significantly from 80.84 to 88.68 in the intervention group after the intervention ($P < 0.001$).

Conclusion

Educational intervention, according to the HBM based on a primary needs assessment effectively improves maternal performance about IDA prevention in children. Therefore, it is suggested that these interventions replace conventional educational programs.

Trial registration: This trial has been registered at IRCT, IRCT2014082118892N1. Registered on 2014-11-23, <https://en.irct.ir/trial/17015>

Background

Iron Deficiency Anemia (IDA) is the most prevalent nutritional problem and common cause of anemia. It is estimated that about 18–38% of children below 5 years in Iran are anemic (1). Different studies in various parts of Iran like Jahrom (2), Rafsanjan(3), Birjand(4), Babol (5)and Qom(6), as well as a study by Sayari(7) have reported unfavorable results of IDA in children below and above 5 years. Iron is an essential nutrient for blood production that should be supplied through diet. If enough iron is not available for red blood cell production, the body first uses its own reserves. Then, if iron deficiency

continues, iron reserves decrease gradually leading to depletion of iron stores, eventually resulting in IDA(7, 8). According to Tatala et al, half of school-age children suffer from anemia(9). Researchers believe that IDA in school-age children indicates iron deficiency at earlier ages. Childhood anemia continues in later ages and due to the high growth speed of children, especially below 2 years of age, iron deficiency is associated with irreversible and irrecoverable sequelae in these children (6).

It is now clear that mild to moderate iron deficiency, even without anemia, had adverse effects on the cognitive function, physical growth, behavior, and immunity, and is associated with complications of infectious diseases in nursery and school age children(10).

The leading cause of anemia in developing countries is low iron intake and low bioavailability of the dietary iron. Eating habits like vegetarian diets and insufficient intake of animal products also contribute to IDA. Increased bioavailability of iron has an important effect on enhancing the quality of dietary iron(11); therefore, proper nutritional education to use a balanced and diverse diet is one of the most important measures to prevent IDA. Nutritional education for IDA prevention is based on using enhancers of iron absorption or avoiding co-administration of iron and iron absorption inhibitors. Education of preventive behaviors include intake of iron supplements, iron-rich foods(12), environmental health and control of parasitic diseases, immunization and treatment of infections (12);(11);(12);(13), avoiding use of bread made of non fermented dough, and modification of dietary patterns can help to prevent IDA. Therefore, health education programs aiming at IDA prevention should be presented to mothers as the major caregivers of children who are responsible for their health and well-being.

Research has shown that model-based structured education is more successful than conventional education(14). One of these models, the Health Belief Model (HBM), is a psychological model that suggests the person's knowledge and attitude predict behavior. This model is used to determine the relationship between health beliefs and engagement in health-promoting behavior(15). A review of the literature showed that no similar study used this model. Researcher used this model to promote IDA and some other health-related behaviors and its promising results have indicated the success of HBM-based education in promoting health behaviors of learners((16), (17), (18)). It seems that the HBM is effective in prevention of IDA in children because it can enhance the mothers' perceived susceptibility and severity regarding IDA preventive behaviors in children; therefore, the mothers perceive that their children are susceptible to IDA and learn about the severity and complications of IDA following not adopting preventive behaviors. A combination of these two, i.e. perceived susceptibility and perceived severity, produces perceived threat about IDA. Then, with regards to the perceived benefits of preventive behaviors and analysis of potential barriers, and through promoting self-efficacy (i.e. developing self-confidence in the person) and use of external and internal cues to action and stimuli affecting the person, e.g. the physician, health care personnel, other mothers, books, and media, a feeling of responsibility, fear of the complications, etc., the person is driven towards adopting IDA preventive behaviors.

The present study was conducted in mothers of 1–6 year-old children to evaluate The effect of maternal education on preventive behaviors of iron deficiency anemia in children. The results of this study can be

used in designing theory-based preventive policies and educational programs to promote pediatric IDA preventive behaviors.

Methods

Study design

An educational intervention was applied in this quasi-experimental study. The Ethics Committee of Arak University of Medical Sciences (ethics code: 93-169-4) and Ethic Committee of Babol County approved the study protocol.

Sample sizing estimation

The sample size was calculated 132 mothers (66 in the test group and 66 in the control group) with regards to a similar previous study (17), standard deviation of 25.33, mean difference of 15, confidence interval of 95%, statistical power of 90%, and attrition of 10%. Finally, the data of 59 cases and 60 controls were analyzed. Multi-stage random sampling was applied to select the participants. All rural health centers of Babol were considered as strata. In each region, one rural health center, and in each rural health center, two rural health houses were randomly selected. One health house was used as the case center and the other was used as the control center. In total, four health houses were used as case centers and four were used as control centers. Seventeen children were randomly selected in each health house using the infant care register and their mothers were contacted. The objectives of the study were explained to mothers and their informed consent was obtained if they agreed to participate in the study. The inclusion criteria were having a 1–6 year-old child, being selected in random sampling, and no history of anemia or other related diseases like Gastro Intestinal diseases in the child according to medical records and mother's statement. The exclusion criteria were lack of interest in participation in the study, loss of motivation during the study, and missing more than one educational session. First, the case and control groups were selected. Then, the level of awareness, perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, behavior, and self-efficacy regarding IDA preventive behaviors was assessed in both groups using a pretest questionnaire.

Measures

The data collection tool before and after the intervention was a researcher-made questionnaire containing demographic data and an IDA questionnaire according to the HBM. This questionnaire contained 16 questions on awareness. Moreover, perceived susceptibility (7 questions), perceived severity (4 questions), perceived benefits (7 questions), perceived barriers (9 questions), perceived self-efficacy (6 questions), external and internal cues to action (10 questions), and performance of the mothers regarding IDA preventive behaviors in their 1–6 year-old children were assessed using a checklist (20 questions) with a 5-point Likert scale. As for scoring, in the awareness section, a correct answer scored one and a wrong answer scored zero, and the total score of this section was calculated out of 100 through dividing the number of correct answer by the total number of questions multiplied by 100. For perceived

susceptibility, severity, benefits, and barriers, the score of each question ranged from 1 to 5 (I completely disagree = 1, I disagree = 2, I have no idea = 3, I agree = 4, I completely agree = 5). The score of these sections was also calculated out of 100. In the performance section, a correct behavior scored one and a wrong behavior scored zero. The score of this section was also calculated out of 100.

The content validity of the instrument was evaluated and confirmed by experts. To assess the reliability of the questionnaire, it was administered to 30 mothers of children aged 1–6 years who were demographically similar to the study population. The Cronbach's alpha of awareness, perceived susceptibility, perceived severity, perceived benefits, perceived barriers, perceived self-efficacy, cues to action, and performance was 0.62, 0.69, 0.80, 0.9, 0.83, 0.72, 0.73, and 0.74, respectively. The Cronbach's alpha of the instrument was 0.85.

Educational Intervention

The educational intervention was performed in the case group (based on the pretest results as an educational needs assessment) after determining awareness and other components of the HBM and preparing the educational content accordingly. The educational intervention was presented in four educational sessions, each lasting 40 minutes, using lecture, group discussion, and Role playing. Moreover, the pamphlets, booklets, and video CDs were used for a more effective content delivery. Finally, three months after the educational intervention, the same questionnaire was used in both groups for pretest.

in the first session that was designed to promote knowledge of mothers ,they became familiar with IDA and its signs and symptoms as well as the causes and preventive factors. In the second session, the participants were provided with HBM-based education to enhance their perceived susceptibility and severity regarding IDA in order to improve the mothers' attitude towards the complications, causes, and preventive factors of this disease in their children. In the third session, the researcher discussed the benefits and barriers of IDA preventive behaviors in children and tried to underline the perceived benefits (to downplay the barriers). The fourth session was spent on perceived self-efficacy, cues to action, empowering of mothers regarding IDA preventive behaviors in their children, familiarizing mothers with different information sources about IDA preventive behaviors, and enhancing their performance using internal and external cues to action. Since acquiring information from "health centers staff" received the highest score in cues to action on the pretest, education was provided by the researcher as a health care provider in the health house, or upon agreement of mothers, in a nearby large mosque. In these sessions, PowerPoint slides, pamphlets, booklets, and videos were employed to achieve educational objectives (cognitive, emotional, and psychological).

Statistical analysis

Data analyses were performed using IBM SPSS Statistics for Windows, Version 20 through descriptive and inferential statistics (including independent t-test, paired t-test, Chi-square). The significance level was considered at 0.05. To investigate the normality of the data, Kolmogorov-Smirnov test was used and normal distribution of the data was obtained.

Ethical considerations

The Ethics Committee of Arak University of Medical Sciences (ethics code: 93-169-4) and Ethic Committee of Babol County approved the study protocol. This trial has been registered at IRCT, IRCT2014082118892N1. Written informed consent was obtained from all the participants. educational material was shared with the control group at the end of the study.

Data Analysis

The data was analyzed with SPSS software version 20, using correlation coefficient, paired t test, chi square, independent t test, and ANOVA.

Results

Sample characteristics

The mean age of the mothers was 31.07 ± 5.80 and 29.85 ± 5.06 years in the intervention and control group, respectively. Other demographic characteristics are presented in Tables 1 and 2. The results of independent t test and chi square showed no significant difference in qualitative and quantitative variables between the intervention and control group.

Table 1
Comparison of quantitative demographic variables of the mothers and children between intervention and control groups

Variable- group	Control	Intervtion	Level of significance
	Mean SD	Mean SD	
Age, mothers (year)	31/07 5/80	29/85 5/06	0/22
Age, Children (Year)	3/84 1/58	3/91 1/76	0/80
Spouse's education	9/56 3/52	9/37 3/60	0/80
Number of children	1/64 0/71	1/85 0/75	0/12

Table 2
Comparison of qualitative demographic variables of the mothers and children
between intervention and control groups

Group-variable	Intervention	Control	Level of significance
Mother's occupational status	Number %	Number %	0/317
working	1 1/7	3 5	
Housewife	58 93/3	57 95	
Housing status			0/976
owned	53 89/8	54 90	
rented	6 10/2	6 10	
First child			0/169
Yes	29 49/2	22 36/7	
No	30 50/8	38 63/3	
Maternal education			0/091
Primary school	6 10/2	11 18/3	
Middle School	11 18//6	20 33/3	
High school	35 59/3	24 40	

Evaluation of intervention

The independent t test was also applied to compare the mean score of HBM constructs between the two groups before the intervention. The results showed no significant difference in the variables of awareness, perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, cues to action, and performance were similar between the two groups before the intervention.

The results of independent t test showed no significant difference in the mean scores of awareness and performance regarding pediatric IDA preventive behaviors between the two groups before the intervention ($P > 0.05$), while the difference between the two groups was significant 12 weeks after the intervention ($P < 0.0001$). Paired t test showed a significant difference in the mean score of awareness and performance before and after the education in the intervention ($P < 0.001$) and control group ($P < 0.05$).

Independent t test showed no significant difference in the mean scores of HBM constructs regarding pediatric IDA preventive behaviors between the two groups before the intervention ($P > 0.05$), while the difference between the two groups was significant in all constructs ($P < 0.001$) except for cues to action ($P = 0.17$) three months after the intervention. The results of paired t test showed a significant improvement in the mean scores of all HBM constructs in the intervention group after the education ($P <$

0.001), while no significant difference was observed in the HBM constructs except for cues to action before and after the intervention in the control group ($P > 0.05$) (Table 3) .

Discussion

The score of awareness was low in case and control groups before educational intervention; however, this even low level of awareness is most probably acquired from health care providers, TV, physicians, newspapers and books, other mothers, and radio. The significant increase in the mean score of awareness after the intervention can be due to receiving education about IDA preventive behaviors. These sessions improved awareness about IDA prevention by 47 scores (91.3%) in the case group. This finding was similar to the results of studies by Hassan et al. (18) in mothers of children suffering from IDA in the UAE, Mansourian et al. (16) about IDA prevention in children, Ghafari et al. (19) on enhancing nutritional behaviors of osteoporosis prevention in female students, Shamsi & Sjadi, (20) on preventive behaviors of febrile convulsion in children. However, Tavasoli et al. (21) evaluated the knowledge and attitude of female teachers regarding osteoporosis prevention and reported different results. It should be noted that teachers are a special group of the society with a rather similar socioeconomic status, while our study population included subjects from different classes of the society, and this difference should be considered in designing and delivering the educational material.

In this study, the mean score of knowledge also increased significantly in the control group, which is in line with the results of a study by Shojaeizadeh et al(22). This finding can be attributed to the effect of pretest questionnaire which encouraged mothers to use different information sources to find answers to the questions during these 12 weeks, resulting in an increase in their score of knowledge (21 scores).

However, it should be noted that increased knowledge alone might not result in performance change. Therefore, to make a change in the performance, in addition to knowledge, interventions on the attitude are also required. In this regard, Kang conducted a study on the Korean students' knowledge and attitude about breast milk(23). Although education is associated with knowledge enhancement, an attitude change is necessary to improve reaction (24, 25).

In a study by Sharifirad et al, despite adequate awareness, the patients did not adhere to diet recommendations(26). The significant increase in the mean score of susceptibility after the education in the case group indicates the effectiveness of education in enhancing perceived susceptibility since after the intervention, most of the mothers in the case group believed that their children might be at risk of IDA. An increase in the mean score of perceived susceptibility was also reported in other studies(16), (20), (27), (28), (29), (19),(30). Our study also showed a significant difference in the perceived severity between the two groups after the intervention, which is in line with the results of studies by Ebadi & Solhi (27) Tol et t al.(28), Mansourian et al.(16), Hassan et al.(18), Razi et al.(29), Ghafari et al.(19), and Gilasi et al(30).

In our study, it seems that reminding mothers of the severe complications of IDA, especially delayed growth and development as well as economic burdens and cognitive disturbances, was an important factor in improving their perceived severity. Before the intervention, the subjects in both groups had a

good understanding of the benefits of IDA prevention that improved far more in the case group after the intervention (13.4 scores), causing a significant difference between the two groups. This finding was in line with studies conducted by Razi et al. (29) Gilasi et al. (30), Ghafari et al. (19), Ebadi & Solhi (27), although Mansourian et al. reported different results (16).

Mothers believed that their attempts to prevent diseases (like IDA, thyroid disorders through screening, etc.) in their children had more benefits compared to the children's attempts in this regard. There was no significant difference in the perceived barriers of IDA prevention between the two groups, while a significant difference in this construct between the two groups after the intervention indicates the effectiveness of the educational intervention in removing perceived barriers (a decrease of 14 scores in the perceived barriers) in the case group. Tol et al. (28), Ebadi & Solhi (27) Shamsi & Sajadi (20) Razi et al. (29) Ghafari (19) and Hassan et al. (18) reported similar and Mansourian et al. (16) and Gilasi et al. (30) reported different results in this regard. In the study by Gilasi et al. (30) removal of the barriers required preparation of infrastructures and provision of some facilities.

Sharifirad et al. (31) also reported that a decrease in perceived barriers was associated with a decrease in smoking in adolescents. In a study by Reisi et al. (32), mothers did not use iron supplements since they believed it had some side effects, like bad odor and taste, GI and dental side effects, and stool discoloration, resulting in lack or irregular use of iron by children. The findings of the study showed no significant difference in perceived self-efficacy between the two groups before the educational intervention; while a significant difference in this construct between the two groups after the intervention showed the effect of intervention on improved perceived self-efficacy (15 scores). This finding was consistent with the results of studies conducted by Hazavehi et al. (33) Ebadi & Solhi, (27) Tol et al. (28), and Razi et al. (29). Self-efficacy connecting factors between awareness and behavior, and is the belief in self to exhibit a behavior since mere knowledge of the reason of a behavior does not result in displaying it and the person should see himself capable of doing it. Perceived self-efficacy is an introduction to a behavior, and therefore requires a special attention (34). There was no significant difference in cues to action regarding IDA preventive behaviors between the two groups before the intervention. After the intervention, the mean score of cues to action increased in both groups, but the increase was more prominent in the case group. It seems that exposure to the pretest questionnaire created some questions in the mothers that motivated them to find their answers, resulting in an increase in the score of cues to action in the control group. This finding was in line with the results of studies conducted by Mansourian et al. (16), Gilasi et al. (30), Razi et al. (29), and Tol et al. (28). Shamsi et al. (20) also reported that the most important internal factor motivating mothers to display oral health behaviors was a feeling of responsibility towards the health of the fetus and infant.

There was no significant difference in the mean score of performance between the two groups while the difference between the two groups was significant after the intervention, which could be attributed to the positive effect of education. Razi et al. (16), Hassan et al. (18), Mansourian et al. (16) and Ghafari et al. (19) reported similar results. In all the above studies, HBM-based education improved performance in various fields.

Limitation : The limitation of this study is reporting of anemia behavior prevention based on self-report.

Conclusion

The results of the present study showed that designing and implementing an educational program based on the health belief model can cause a significant change in the level of awareness, attitude, and performance of the others regarding IDA preventive behaviors, indicating the necessity of well-designed educational interventions for adoption of preventive behaviors. Therefore, it is recommended that this model of educational intervention be applied in the educational programs of other rural health centers instead of conventional educational methods. Moreover, this educational model can be also used in mass media like the TV and radio to promote preventive behaviors. One of the limitations of the present study, which also exists in most human studies, was lack of control on the samples and follow-up of their adherence to preventive behaviors at home. The data were collected based on self-reports, which could affect the data quality. The objectives and benefits of the research were discussed with mothers at the time of pretest to persuade them to join the study. Several educational sessions with a smaller number of mothers were held to overcome the issue of non-attendance.

Abbreviations

IDA
Iron deficiency anemia
HBM
health belief model
GI
gastro intestinal

Declarations

Ethics approval and consent to participate:

The present study was approved by Research Council of Arak University of Medical Sciences (Grant Number:4202). The ethics committee approval code number is (93-169-4). This study has been registered in Clinical Trial Registry with the code of IRCT2014082118892N1. Informed written consent was obtained from the mothers and all the procedures performed in the study involving human participants, were in accordance with the ethical standards.

Consent for publication:

Not applicable.

Availability of the data and materials:

Upon request, we can offer onsite access to external researchers to the data analyzed at Arak University of Medical Sciences, Arak, Iran.

Competing Interest:

The authors declare that they have no conflicts of interest.

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This study was based on the result of a master's degree thesis approved by Arak University of Medical Sciences in 2014 (project number: 4202), which was financially supported by the University, as well.

Authors' contributions

M N and KH M and SH M and RM designed the study, MN, implemented intervention, MN and KH M and RM analyzed data, M N and KH M and SH M RM prepared manuscript .All authors review manuscript.

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Table 3

Comparison of mean score of performance regarding IDA preventive behaviors and HBM constructs before and after the intervention in case and control groups and the mean score change in both groups

Group Variable		Case		Control		P-value*	Score change before and after education mean \pm SD	
		Mean	SD	Mean	SD		Case	Control
Awareness	Before	43/32	16/77	42/08	15/89	0/679	17/99 \pm 47/98	21/50 \pm 21/45
	After	91/31	8/37	63/54	16/11	0/001		
	P-value**	0/001		0/001			0/001	
Perceived Susceptibility	Before	74/09	7/94	75/90	10/73	0/298	9/33 \pm 14/81	13/44 \pm 0/19
	After	88/91	8/08	76/09	13/40	0/001		
	P-value**	0/001		0/91			0/001	
Perceived severity	Before	74/74	10/92	78/25	11/89	0/97	12/60 \pm 17/88	15/03 \pm 1/75
	After	92/62	8/11	76/50	11/39	0/001		
	P-value**	0/001		0/37			0/001	
Perceived benefits	Before	80/04	8/10	93/51	6/60	0/05	8/57 \pm 13/46	15/22 \pm 1/23
	After	83/38	10/42	82/14	11/68	0/001		
	P-value**	0/001		0/53			0/001	
Perceived barriers	Before	47/19	9/95	46/03	16/52	0/64	11 \pm 14/99	15/64 \pm 3/59
	After	32/20	10/12	42/44	16/80	0/001		
	P-value**	0/001		0/081			0/001	
Self-efficacy	Before	72/65	11/12	76/11	12/32	0/11	11/53 \pm 15/19	12/64 \pm 0/66
	After	87/85	9/34	75/44	15/51	0/001		
	P-value**	0/001		0/68			0/001	
Cues to action	Before	62/75	11/70	66/45	12/9	0/10	13/10 \pm 13/34	12/10 \pm 6/95
	After	76/10	10/25	73/41	11/06	0/17		
	P-	0/001		0/001			0/007	

	value**							
Performance	before	80/74	6/12	79/72	7/45	0/41	6/42 ± 7/94	7/35 ± 0/74
	After	88/68	5/66	80/47	8/64	0/001		
	P-value**	0/001		0/437			0/001	

* Independent t test
** Paired t test