Consumption of Iron Supplements, based on the Structures of the Health Belief Model, in Children Aged 6 to 24 Months in the Southeast of Iran

Consumo de suplementos de hierro, basado en las estructuras del modelo de creencias de salud, en niños de 6 a 24 meses en el sureste de Irán
Consumo de suplementos de ferro, com base nas estruturas do modelo de crença em saúde, em crianças de 6 a 24 meses no sul do Irã

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ABSTRACT

Objective: Iron deficiency is one of the common problems during infancy. The purpose of this study is to investigate the status of iron supplement consumption and the factors affecting it based on the constructs of the health belief model. **Methodology**: In this descriptive study, 402 mothers of children aged 6-12 months were selected using multi-stage random sampling. The status of mothers' performance regarding the provision of iron supplements and the status of health belief model constructs were evaluated using a questionnaire whose validity and reliability have been confirmed. The data were analyzed using analysis of variance, Pearson correlation coefficient and linear regression tests. **Results**: the present study showed that despite the state of proper awareness, the score of Consumption of iron supplements behavior was not favorable. So that 62.7% had reported a low performance. Pearson correlation test showed that only the perceived susceptibility score did not show significant relationship with the behavior ($p = 0.174$) The regression results showed that the variables included in the regression model, explained a total of 24.1% of the variance of the change in the behavior score (Adjusted $R^2 = 0.241$). **Conclusion**: Considering the unfavorable situation of iron supplementation behavior in infants, the use of health belief theory constructs can be effective in persuading mothers. Community health nurses can be more successful in improving this index by providing

educational intervention based on the structures of this model, especially helping to remove the barriers perceived by mothers.

Keywords
iron-deficiency; health belief model; infant; mothers.

RESUMEN

Objetivo: La deficiencia de hierro es uno de los problemas comunes durante la infancia. El propósito de este estudio fue explorar el consumo de suplementos de hierro y los factores que lo afectan, según constructos del modelo de creencias sobre la salud. **Metodología:** En este estudio descriptivo se seleccionaron 402 madres de niños de 6 a 12 meses mediante un muestreo aleatorio polietápico. Se evaluaron mediante un cuestionario tanto el desempeño de las madres con respecto a la provisión de suplementos de hierro como el estado de las construcciones del modelo de creencias de salud. Los datos se analizaron mediante análisis de varianza, coeficiente de correlación de Pearson y pruebas de regresión lineal. **Resultados:** El estudio evidenció que, a pesar de una conciencia adecuada de las madres sobre la provisión de suplementos, fue desfavorable el consumo de suplementos de hierro (62,7% había reportado un desempeño bajo). La prueba de correlación de Pearson mostró que solo el puntaje de susceptibilidad percibida no mostró una relación significativa con el comportamiento (p = 0,174). Los resultados de la regresión mostraron que las variables incluidas en el modelo explicaron un total de 24,1% de la varianza del cambio en la puntuación de comportamiento (R² ajustado = 0,241). **Conclusión:** Dada la situación desfavorable con respecto al consumo de suplementos de hierro dados a los bebés, el uso la teoría de creencias sobre la salud puede ser efectivo para persuadir a las madres. Las enfermeras de salud comunitaria pueden tener más éxito en mejorar este índice, proporcionando una intervención educativa basada en las estructuras de este modelo, especialmente porque ayudaría a eliminar las barreras percibidas por las madres.

Palabras clave
deficiencia de hierro; modelo de creencias sobre salud; bebé; madres.

RESUMO

Objetivo: A deficiência de ferro é um dos problemas comuns durante a infância. O objetivo deste estudo é investigar o status do consumo de suplementos de ferro e os fatores que o afetam com base nas construções do modelo de crença em saúde. **Metodologia:** Neste estudo descritivo, 402 mães de crianças de 6 a 12 meses foram selecionadas por meio de amostragem aleatória em vários estágios. O estado do desempenho das mães em relação ao fornecimento de suplementos de ferro e o estado dos construtos do modelo de crença em saúde foram avaliados por meio de um questionário cuja validade e confiabilidade foram confirmadas. Os dados foram analisados por meio de análise de variância, coeficiente de correlação de Pearson e testes de regressão linear. **Resultados:** o presente estudo mostrou que apesar do estado de consciência adequado, o escore do comportamento Consumo de suplementos de ferro não foi favorável. Assim que 62,7% relataram um baixo desempenho. O teste de correlação de Pearson mostrou que apenas o escore de suscetibilidade percebida não apresentou relação significativa com o comportamento (p = 0,174). Os resultados da regressão mostraram que as variáveis incluídas no modelo de regressão explicaram um total de 24,1% da variância da mudança no escore de comportamento (R² ajustado = 0,241). **Conclusão:** Considerando a situação desfavorável do comportamento de suplementação de ferro em lactentes, o uso de construtos da teoria das crenças em saúde pode ser eficaz para persuadir as mães. Os enfermeiros de saúde comunitária podem ter mais sucesso na melhoria desse índice, fornecendo intervenção educativa com base nas estruturas desse modelo, ajudando especialmente a remover as barreiras percebidas pelas mães.

Palavras-chave
deficiência de ferro; modelo de crenças em saúde; bebê; mães.

Introduction

Iron deficiency is the most common micronutrient deficiency in children (1). Iron deficiency is the most common cause of anemia, so iron deficiency anemia (IDA) accounts for approximately 50% of all anemia cases in the world (2). Children under 10 years of age endure the largest burden of anemia across the world (3). In general, it is estimated that 72% of children aged 6 to 59 months are anemic (4) the prevalence of anemia in developing countries is 3-4 times that of developed countries (5) and in these countries between 40 and 50% of children under 5 years of age have iron deficiency (6). Infants aged 6 to 12 months are at risk of anemia due to their high growth rate (7). In various studies in different parts of Iran, unfavorable results have been reported (8).

Iron deficiency leads to complications such as reduced immune cell function, behavioral changes, scoliosis, irritability, dysfunction of neurotransmitters, reduced IQ, and learning disorders (9). At least half of the anemias worldwide are due to iron deficiency and the rest due to folate deficiency, vitamin B12 deficiency, chronic inflammation and parasitic

infections (10). In addition, social determinants of health such as food taboos, cultural beliefs, knowledge and socio-economic status contribute to the disease burden associated with anemia (11). The economic and social damages of the consequences of anemia have made dealing with and preventing it a big challenge for health systems (12).

Suggested methods to control iron deficiency anemia include: iron supplementation, food fortification and activities to improve food diversity, nutrition education and control of infectious and parasitic diseases (13). To prevent anemia and iron deficiency in children aged 6 to 23 months, the World Health Organization has recommended the daily consumption of iron supplements in the amount of 10 to 12.5 mg for three months (14). In Iran, the daily consumption of 2 mg per kilogram of body weight of Ferro sulfate in children aged 6-24 months is included in the child care program (15). At present, supplemental support in health care centers for infants is established as a national policy, but one of the problems of receiving iron supplements in children is their incomplete compliance. A number of mothers also refuse to give iron drops to their infants despite the availability of iron drops in all health centers. Therefore, it seems necessary to investigate the causes and factors affecting the use of iron drops in children (16). One of the duties of community health nurses and children's ward nurses is to encourage mothers to regularly and adequately provide iron supplements to children. Using appropriate theories of behavior change can help in motivating mothers for preventive behaviors (17).

One of the models of behavior change in health education is health belief model. The health belief model is one of the comprehensive and predictive models for health-promoting behaviors (18). Some studies have shown that the structures of the health belief model have the ability to predict anemia in in female students (19). However, the studies conducted to determine the factors affecting the intake of oral iron drops in children from 6 months to 24 years old are limited (16). According to Adham

et al, only 53.1% of mothers followed the regular intake of iron drops for their children's (5).

Considering the pivotal role of mothers, it is important to identify the factors affecting iron intake in infants based on a well-known model of health education, from the mothers' point of view. The present study was conducted with the aim of determining the amount of iron supplements received by children and the status of health belief model constructs regarding iron supplement consumption behavior in children aged 6 to 24 months in Rafsanjan city. By identifying the most important factors related to behavior, effective interventions can be suggested in order to improve the health level of children and prevent iron deficiency in infants.

Methods

In this descriptive analytical study, 402 mothers with children aged 6 to 24 months were selected using multi-stage random sampling. Due to the demographic distribution of Rafsanjan city, it was determined that eight urban health centers are not significantly different in terms of social and economic factors. Therefore, out of eight urban health centers, four centers (centers 1, 3, 6, and 7) were randomly selected for sampling and then again based on the maternal care file number; about 100 people from each center were randomly selected and included in the study. The sample size was estimated to be 384 individuals using $p = 0.5$ and $\alpha = 0.05$ and the sample size formula $(n = \frac{z^2 p(1-p)}{d^2})$, finally 402 people were included in the study for more assurance.

After explaining the objectives of the plan and obtaining verbal consent of the parents, the questionnaire was given to the mothers. Children aged 6-12 whose mothers had expressed their consent to participate in the project were included in the study, and the exclusion criteria were incomplete answers to the questions (more than 20% of the questions were answered incompletely), and children who had a known disease of iron deficiency or were under medical treatment. A researcher-made questionnaire was used to determine the status of the constructs

of the health belief model. The validity and reliability of this tool has been examined and confirmed. Cronbach's alpha for the constructs of this tool has been reported from 0.72 to 0.84 (16). This questionnaire includes 5 questions related to demographic information (child's age, number of family members, parents' education level, occupation, income level and birth order). Awareness assessed with 10 questions and the status of theoretical structures. (Perceived Susceptibility, Perceived severity, Perceived benefits and barrier) was evaluated with 20 questions. The feeding behavior with iron supplement was also evaluated with 5 questions. In order to score the knowledge questions, a correct answer is given a score of two, a wrong answer is given a score of zero, and the answer I don't know is given a score of one, so the total score for the awareness section can vary from 0 to 20, for the questions of the health belief model, which is on a five-point Likert scale. (From completely agree to completely disagree) were considered to be scored from 0 to 4 and the range of scores for each construct of the health belief model was evaluated numerically between 0 and 20. For performance questions scoring was considered from 0 to 3, so the lowest score of the performance section is 0 and the highest score is 15. The scores of the constructs were converted into percentages, and scores from 0 to 34 were considered as low scores, scores from 35 to 67 as average scores, and scores from 68 to 100 as high scores. Due to the self-report nature of the data and in order to prevent recall bias, mothers were given enough time to answer and memory aids were used. The SPSS version 20 software was used to analyze the data ($\alpha = 0.05$). Frequency, percentage, mean and standard deviation were used to describe the sample characteristics and score status of health belief model constructs. The normality of the data was checked and confirmed. The Kolmogorov-Smirnov test was used to ensure that the data were normal. Due to the quantitative nature of the variables, the Pearson correlation coefficient was used to check their relationship. Multiple linear regression analysis was run to determine the predicting effects of the health belief model structures on feeding behavior with iron supplementation in mothers.

Ethic consideration

The current study fully complies with the ethical principles outlined in the Declaration of Helsinki. This study approved by the Research Council of Rafsanjan University of Medical Sciences with the ethics code of IR.RUMS.REC.1400.2224

Results

In this study, the factors affecting the consumption of iron supplements in 402 children aged 6 to 12 months were investigated. The average age of the children was 7.14 ± 4.4 months. The majority of the participants were families with average population. Most of the children were the first or second child of the family (42%). 83.1% of the mothers were housewives and reported a medium income level. The results of analysis of variance (ANOVA) indicated that there was no significant relationship between the education level of parents and the number of children with behavior. There was a significant relationship between the level of income and Feeding behavior with iron supplementation (Table 1). The results of post hoc Tukey's HSD test showed that mothers with good income had a higher performance score than people with low and moderate income.

Table 1

Comparison of the average score of feeding behavior with iron supplements according to the demographic characteristics of the studied population

Demographic variables		n (%)	Mean ± SD	p-value
Mother's education level	Elementary	4 (1.0)	24.75 ± 25.49	0.054
	Middle	23 (5.7)	34.72 ± 19.82	
	Diploma	131 (32.6)	27.96 ± 19.33	
	Academic education	244 (60.7)	33.18 ± 18.52	
Mother's job	Housewife	334 (83.1)	30.54 ± 18.79	0.028
	Employee	68 (16.9)	36.10 ± 19.70	
Family monthly income	Poor	34 (8.5)	23.68 ± 19.36	<0.001
	Moderate	248 (61.7)	29.96 ± 17.65	
	Good	108 (26.9)	37.95 ± 20.05	
	Excellent	12 (3.0)	26.95 ± 22.41	
Father's education level	Elementary	12 (3.0)	33.00 ± 23.20	0.35
	Middle	48 (11.9)	32.86 ± 19.79	
	Diploma	144 (35.8)	29.19 ± 17.39	
	Academic education	198 (49.3)	32.73 ± 19.71	
Child's age	6-12	159 (39.6)	33.49 ± 19.44	0.23
	13-18	148 (36.8)	30.05 ± 17.52	
	19-24	93 (23.1)	30.30 ± 20.48	
Number of children	1-2	6 (1.5)	31.90 ± 28.13	0.66
	3-4	320 (79.6)	31.06 ± 18.79	
	More than 4 children	76 (18.9)	33.26 ± 19.47	

The mean behavior score, based on a score of 100, is 31.5 ± 19. The score of the constructs of health belief model about the behavior of receiving iron supplements by children and their categories is shown in the Table 2. The results showed that the score of health belief model structures in most of the mothers was average, while the majority of mothers reported high awareness score. The score of children's feeding behavior in the majority of the studied population, 252 people (62.7%) was in the range of low scores.

Table 2

The mean and standard deviation of the constructs of the health belief model regarding the feeding behavior with iron supplements in mothers

Variable	Mean ± SD	Low n (%)	Moderate n (%)	High n (%)
Perceived Susceptibility	63.33 ± 11.98	2 (0.5)	247 (61.4)	153 (38.1)
Perceived severity	70.29 ± 19.90	17 (4.2)	156 (38.8)	229 (57.0)
Perceived barriers	55.29 ± 22.61	71 (17.7)	201 (50.0)	130 (32.3)
Perceived benefits	65.57 ± 21.33	25 (6.2)	183 (45.5)	194 (48.3)
Awareness	77.47 ± 12.64	0 (0)	79 (19.7)	323 (80.3)
Behaviour	31.48 ± 19.03	252 (62.7)	137 (34.1)	13 (3.2)

The results of the correlation between health belief model constructs and iron supplementation behavior showed that there is a negative relationship between perceived barriers and behavior, and a positive and significant relationship between constructs of severity, perceived benefits and awareness score with behavior. However, perceived susceptibility did not show a significant relationship (Table 3).

Table 3

Correlation coefficient matrix between health belief theory constructs and iron supplementation behavior in the studied population

Construct	1	2	3	4	5	6
Perceived susceptibility	1					
Perceived severity	0.393**	1				
Perceived barriers	−0.009	−0.102*	1			
Perceived benefits	0.318**	0.599**	0.102*	1		
Awareness	0.180**	0.395**	0.023	0.334**	1	
Behaviour	0.068	0.333**	−0.272**	0.341**	0.305**	1

* Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed).

In the linear regression analysis, the effects of health belief theory constructs in the presence of demographic variables on the prediction of iron feeding behavior were examined (Table 4). The constructs of perceived benefits, perceived barriers, perceived severity and awareness significantly predicted behavior. According to the beta coefficients, it can be said that the perceived barriers play the most important role in predicting the score of feeding behavior with iron supplements. The variables included in the regression model explain a total of 24.1% of the variance of the change in the behavior score (adjusted $R^2 = 0.241$).

Table 4
The results of multiple linear regression of the effect of the constructs of the health belief model on the consumption of iron supplements in children from 6 to 24 months

Variable	Un standard β	Standard β	T-value	*p*-value
Perceived benefits	0.164	0.164	2.928	0.004
Perceived susceptibility	−0.136	−0.086	−1.792	0.074
Perceived severity	0.160	0.167	2.828	0.005
Perceived barriers	−0.204	−0.242	−5.148	<0.001
Awareness	0.303	0.198	4.105	<0.001
Mother's education level	−1.228	−0.042	−0.816	0.415
Father's education level	−1.268	−0.053	−1.062	0.289
Mother's job	3.113	0.061	1.333	0.183
Family monthly income	4.071	0.138	2.983	0.003

Discussion

The present study was conducted in order to investigate the behavior and performance of mothers with children from 6-24 months, about giving iron supplements to their children and the influencing factors based on the constructs of the health belief model.

According to the attainable score, the average behavior score in the current study was unfavorable, which is consistent with the findings of other studies in this field. According to studies by Safari et al. (15) And Adham et al. (5), about half of the mothers did not give iron supplements to their children regularly. A review study by Turawa et al. (19) showed that the prevalence of iron deficiency anemia is high in the age group of 6 to 12 months, and one of the reasons for that is the lack of proper and sufficient iron supplementation.

In the present study, there was no association between education level and the use of iron supplements. The results of the current study do not agree with those of several other studies that have been done in this field, such as the intervention of Abdinia et al. (20) and the study of Saeedi et al. (21), perhaps, to justify this difference, we can point to the difference in the level of education in different studies. As in the present study, the majority of the participants had a university level of education.

In the present study, there was a significant relationship between income level and receiving iron supplements. So that people with high income level had a higher performance score. In line with the results of a recent study, some studies conducted on iron supplementation programs have shown that low socioeconomic status is associated with fewer adherences to iron supplementation recommendations (22). In some studies, economic factors have been introduced as one of the determining factors of iron deficiency anemia in children (23). However, since in Iran iron supplements are available to mothers at a low cost or in some cases at no cost, perhaps other factors such as cultural factors and the quality of recommended iron supplements are effective in this regard.

In recent study, there was a relationship between iron supplementation and the employment status of mothers. Thus, the performance of working mothers was better. This is consistent with the findings of the studies by Arastov et al. (24) and Fesharkinia et al. (25). In this case, it may be pointed out that working women are more successful in this field due to their more active presence in the community and obtaining more information about the methods to overcome the obstacles of giving iron supplements to children.

In the present study, the score of health belief theory constructs was average and the women's knowledge score has an acceptable status, which is consistent with some similar studies (16) that show the appropriate knowledge status in mothers, Which can be justified due to the high level of education of the group and easy access to information. It seems that considering the problems faced by mothers in giving oral iron supplements, in addition to raising awareness, other factors affecting behavior based on theories predicting behavior should be taken into consideration by community health nurses. Some studies state that in order to encourage mothers to feed their children with supplements, instead of focusing on increasing awareness, it is necessary to emphasize on increasing motivation by expressing the benefits of regular consumption of supplements (26).

According to the high score of the perceived barriers in the present study, it seems that in order to motivate the behavior, it is necessary to help to overcome the perceived obstacles in mothers regarding the use of iron supplements. The relationship between the theoretical constructs and the regular use of iron drops showed that the relationship of all constructs except perceived susceptibility was significant. The results of our study are somewhat consistent with the study of Mekonnen et al. (10).

In the recent study, perceived barriers had the highest predictive power. While in the study by Powers and et al. (26) the structures of perceived benefits and self-efficacy were able to explain the behavior of iron supplementation. In order to justify this difference, we can point to the difference in the nature of behavior in different groups. Some studies show that one-third of the cases of failure to properly implement iron supplementation in children are related to obstacles such as child refusal/spitting, digestive discomfort, teeth staining and parents' lack of preparation to deal with these barriers (27). Therefore, it is essential to help mothers in learning how to overcome these barriers. The results of the regression analysis also showed that the theoretical constructs are able to predict the feeding behavior with iron supplements in children during infancy. Some studies, in line with the present study, confirm that health belief theory can have a positive effect on iron deficiency prevention behaviors (28).

The current study is one of the few studies that investigate the status of iron supplement consumption during the covid-19 pandemic based on the attitudes derived from the constructs of the health belief theory in mothers with children aged 6 to 12 months in a relatively high population. However, our study was accompanied by limitations such as self-reported behavior measurement. It seems that conducting the study with objective measurements such as serum iron level will provide more accurate results. On the other hand, self-efficacy as one of the factors affecting The incidence of behavior is discussed, which has not been evaluated in this study, considering the importance of this construct, it is recommended to investigate it in future studies.

Conclusion

The results of our study showed that despite the relatively good knowledge about iron supplementation in mothers of children aged 6 to 12 months, the condition of receiving complete iron in children was not appropriate. According to the present study, the constructs of health belief theory can predict the reception of iron supplements in this group. It seems that in addition to routine education based on awareness, the use of effective factors on the occurrence of behavior, such as reducing perceived barriers in mothers, should be included in programs providing health services to mothers and children.

Conflict of interest

None declared.

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