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Using of information–motivation–behavioral skills model on nutritional behaviors in controlling anemia among girl students

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Abstract

High prevalence of iron deficiency anemia is the most common nutritional problem worldwide, which also is reported among Iranian adolescent girls. This problem results from the inadequate intake of dietary iron or low iron intake in diet. Regarding the application of health education models, the aim of this study was to determine the effect of educational program based on Information–Motivation–Behavioral skills (IMB) model in relation to preventive nutritional behaviors against iron deficiency anemia. In this study, 120 participants were selected among Iranian high school girls. The participants were equally allocated to experimental and control groups. The educational intervention was performed as a four-hour workshop designed based on the IMB model constructs for the experimental group. The data were collected using a standard questionnaire based on the IMB constructs, measuring body mass index, and determining average heme iron consumption. The data were gathered before and 3 months after the intervention. The experimental group after the intervention showed a significant increase compared to the control group in the mean scores of IMB with regard to nutritional iron deficiency anemia. In the experimental group, the average daily intake of dietary heme iron increased by 0.10±0.52 mg. Regarding the positive effect of education in promoting iron-rich diets in high school girls, workshops based on the IMB model are suggested to be held in schools aiming at preventing iron deficiency anemia.

Keywords: Anemia, Behaviors, Iron-Deficiency, Student

Introduction

Healthy nutrition is a main pillar of public health and economic development that has also been emphasized in the primary health care. It is also taken into account as an important indicator to achieve the strategy of health for all [1]. Iron deficiency anemia, as the most common nutritional disorder in developing countries and the leading cause of anemia in children and women of childbearing age [2,3], can affect the mental and physical development, behavior, and ability to involve in jobs. Since its effect on work efficiency, power output, and ultimately on the development process in society has been proven, taking approaches to

prevent anemia is necessary especially in the age group of teenage girls due to rapid growth, puberty, and menstruation [4]. The world health organization estimates that more than a third of the world's population suffers from anemia [5]. Studies in Iran have reported that 30 to 50 percent of women across the country suffer from iron deficiency anemia [3]. It seems improving women's nutritional status before marriage and pregnancy, as a way to control and prevent anemia, can reduce the prevalence of anemia in pregnancy and decrease fetal complications [6]. According to a literature review, several attempts worldwide have been accomplished to identify the patterns and eating habits effective in the prevention of iron deficiency anemia among women of childbearing age [7,8].

Strategies for declining anemia include dietary supplementation, iron fortification, and dietary patterns modification. Improving the bioavailability of iron can have a significant role in the quality of iron intake by food [9]. Iron deficiency is related to the actual amount of iron in food and iron bioavailability. The bioavailability is affected by both dietary factors and biological factors of host. Reforming dietary regime is an approach to improve the amount of iron ingested and its bioavailability as well [10]. Studies have shown that an increase in awareness of community about iron sources, factors affecting iron absorption in body, and iron deficiency anemia can result in modifying the pattern of food consumption, increasing iron intake, and eventually reducing the prevalence of iron deficiency anemia [11]. Nutrition education is referred to any educational strategy designed to facilitate decision-making in food choices and behave healthily in nutrition that result in health and welfare [4]. Nutrition education program in school is a way to raise awareness, attitudes, and modify the wrong behaviors in nutrition [12,13].

The students should be provided by training, knowledge, and skills to be able to select appropriate nutrition leading to the improved health [14]. Consultants expect a rising awareness leading to the improved performance, however some studies have shown that despite the high level of knowledge, good practice have not been always observed [15-17].

It is worth noting that the use of theory and models can increase the likelihood of behavior change as a result of educational interventions and helps to identify individual features and surrounding environment that are effective in behavior. Therefore, theories and models of behavior change can play a crucial role in the design and evaluation of comprehensive educational programs [18]. One way to change dietary habits in people is change of their attitude [19]. The theories are nicely able to determine the characteristics, beliefs, and personal values that are associated with various health behaviors and may help participant to change an unhealthy behavior. Investigators have utilized the Information–Motivation–Behavioral Skills (IMB) model as a theoretical foundation for behavior change [20]. Similar to other behavior change models, IMB incorporates three major constructs that theoretically interact with each other, leading to the behavioral outcome. Each construct of IMB (information, motivation, and behavioral skills) includes subcontracts as the basis for tailoring the model to an individual health-related behavior.

In explaining the nutritional behavior of iron-deficiency anemia prevention, the information construct includes detailed information about preventive nutrition against iron deficiency anemia (e.g. iron intake is necessary to prevent iron-deficiency anemia), information about how to do the desired behavior (e.g. knowledge on iron-rich foods) as well as assumptions and misconceptions about the behavior (e.g. consumption of iron and tea at the same time) and ultimately effective information about behavior (e.g. consumption of iron and vitamin C at the same time).

The motivation construct is divided into two sub-units: personal motivation including attitude toward personal performance, assessment, and consequences of doing a behavior (e.g. daily consumption of iron tablet is inconvenient) and social motivation

known as social protection (e.g. regarding the share of iron-rich food in the family food basket) [21].

The constructs of behavioral skills includes the ability to engage in the behavior (e.g. the ability to identify and select iron sources) and the effect of self-confidence (the ability to understand the behavior) [22] (Figure 1).

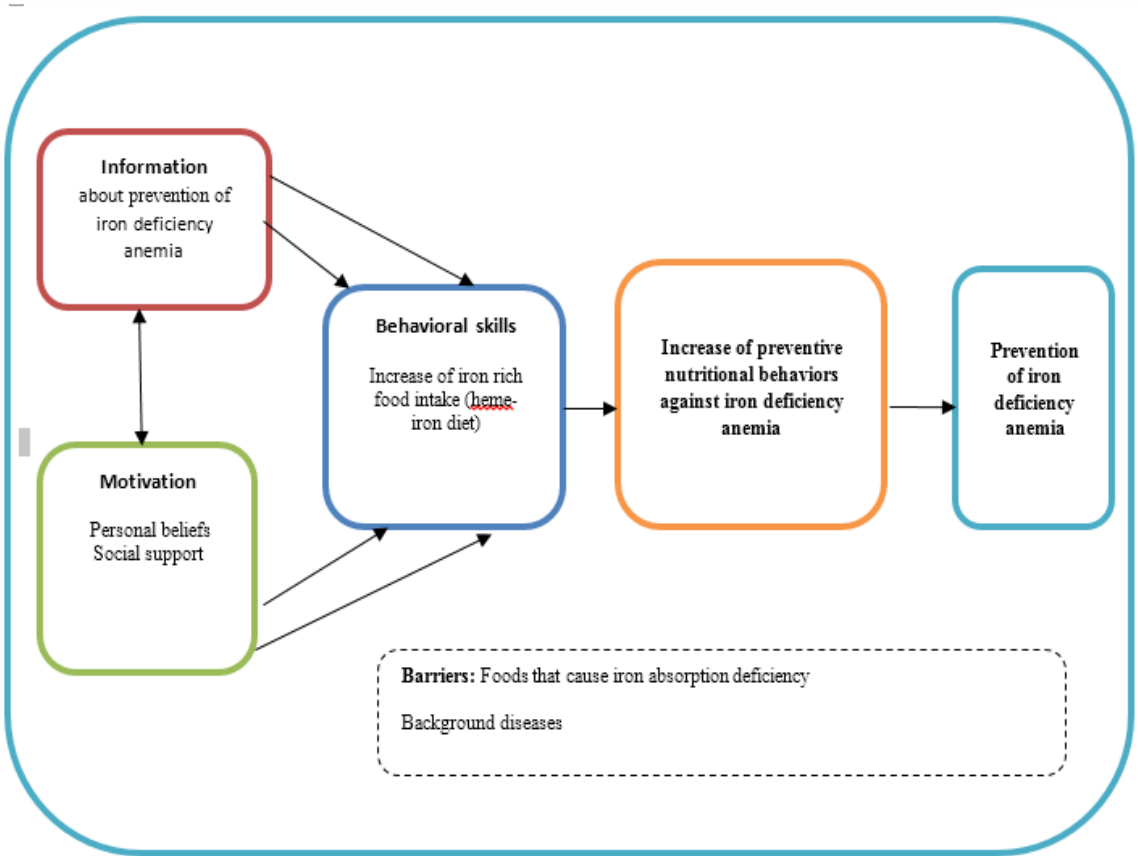

Figure 1 *Compliance of information, motivation, and behavioral skills model constructs with preventive nutritional behaviors against anemia in students*

Due to unsatisfactory practice among students in regard to nutrition and the effect of nutrition education using educational models. The aim of this study was to determine the effect of educational program based on IMB model in relation to preventive nutritional behaviors against iron deficiency anemia among Iranian female high school students.

Method

In this quasi-experimental research, according to a pilot study, a sample size of 120 was calculated at the confidence level of 95%. The participants were equally allocated to the experimental and control groups. The inclusion criteria composed of Iranian female students being studied in high schools of Mashhad, Iran in 2013-14, agreed to participate in the study, and not having congenital anemia and/or minor thalassemia. The exclusion criteria included students with unfinished questionnaire, absent in the training session, or moved the high school.

The multi-stage cluster sampling was used to select the participants. Initially, one health center was selected randomly among the city health centers in Mashhad. Then, two female high schools were randomly selected among the high schools under the cover of Samen health center. Finally, several first-grade classes were selected randomly in each school. After coordination with school officials, 60 students from one school were enrolled as the experimental group and 60 from another school as the control group. The participants involved in the study provided that they signed the consent form. They also were assured

about confidentiality of information. Then, the questionnaires were distributed among the experimental and control groups and data on weight, height, and average heme iron intake were recorded.

For data collection, a standard questionnaire was used, which was designed based on the IMB model in three parts. The first part included 16 questions related to the information construct with a minimum score of 16 and maximum of 80. The second part comprised 14 questions related to the motivation construct with a minimum score of 14 and maximum of 70. The third part consisted of 9 questions related to the behavioral skills construct with a minimum score of 9 and maximum of 45. A five-point Likert scale was used to score the questions. The questionnaire was evaluated by experts in the field of health education and their comments were applied to generate a valid survey. The reliability of questionnaire was confirmed in a pilot study by Cronbach's alpha values of 0.85 for the information construct, 0.77 for the motivation construct, and 0.80 for the behavioral skills construct. The data on the average heme iron intake were collected using food frequency questionnaire (FFQ) that has been confirmed in reliability and validity in previous studies [23].

A calibrated portable analog scale was used to measure the weight of participants. The height was measured in centimeter.

The intervention program, developed for preventive nutritional behavior against iron deficiency anemia, was held as a 4-hour workshop hosted by experts in health education. At the beginning of workshop, the instructors and educational objectives were introduced. For better communication, the students were organized in three roundtable groups and discussed about the definition of iron deficiency anemia, root causes, and consequences in adolescence. In conclusion of this stage, the instructor described the wrong beliefs about iron deficiency anemia. Next, the symptoms of diagnosis, different phases of iron deficiency, required amount of iron in body, iron sources and the factors that increase or decrease iron uptake in the body were explained.

The ways of having rich daily diet in iron and preventing iron deficiency anemia were enumerated in group discussion. In addition, educational leaflets and pamphlets prepared by the instructors were presented to the students. They were also asked to transfer the workshop trainings to their families. Meanwhile, iron tablets were delivered to the students while they had been learned practically how to use iron tablet (as a way to prevent iron deficiency). The students were encouraged to use iron tablets weekly by engaging in a purposeful play.

Three months later, the questionnaires were distributed to the experimental and control groups and the data were collected again. In this study, we tried to increase the effect of training by using educational aiding tools such as white boards, booklets, pamphlets, power point slides, and bright colors that stimulated the students to participate in the learning process. The educational pamphlets were distributed to the control group at the end of the study. Finally, the data were analyzed by SPSS-19 using statistical tests such as independent t-test and paired t-test at the significance level of $p<0.05$.

Results

The mean of Body Mass Index (BMI) in the experimental and control groups were 21.1±3.8 and 20.7±4.5, respectively. Approximately, 60% of students were in the normal range of weight and two groups were matched in terms of this variable ($p=0.98$). The mean score of information construct in regard to preventive nutritional behavior against iron deficiency anemia in the experimental group before and after the educational intervention was 60.7±7.67 and 65.33±7.51, respectively, representing a significant increase in the information construct three months after the intervention. Contrary, the mean score of information in the control group before and three months after the intervention showed no significant difference ($p=0.82$).

Before the intervention, the mean score of information between the two groups was not

significantly different. Three months after the intervention, however, the two groups were significantly different with respect to this construct (p<0.001).

The mean score of motivation construct between before and three months after the intervention was significantly different in the experimental group and significantly not different in the control group (p=0.9). The results of paired t-test showed that the experimental and control groups before the intervention were equal in terms of behavioral skills (p=0.45). The mean score of behavioral skills in the experimental group increased after the intervention and showed a significant difference from the mean score obtained in the control group (Table 1).

Table 1 *Comparison of mean score of information, motivation, and behavioral skills in female students in regard to the prevention of iron deficiency anemia before and after the educational intervention in the experimental and control groups*

Variable		Experimental group	Control group	Independent t-test
Information	Before intervention M±SD	60.7±7.67	60.33±6.97	p=0.785
	3 months after intervention M±SD	65.33±7.51	60.57±6.59	p<0.001
	p-value (Paired t-test)	<0.001	=0.821	
Motivation	Before intervention M±SD	45.28±9.18	45.18±8.29	p=0.95
	3 months after intervention M±SD	48.78±9.24	45.03±8.28	p<0. 01
	p-value (Paired t-test)	<0.001	=0.90	
Behavioral skills	Before intervention M±SD	24.85±7.94	24.38±5.39	p=0.696
	3 months after intervention M±SD	37.08±7.04	24.97±3.94	p<0.01
	p-value (Paired t-test)	<0.001	=0.453	

The daily average of iron required in adolescent girls aged 9-18 has been determined as 10 mg that 10 percent of total iron intake should be as heme-iron.

The amount of iron in the diet of students between the experimental and control groups was not significantly different before the intervention. On the contrary, three months after the intervention, the amount of iron in the diet of the experimental group and the control group was drastically different (Table 2).

Table 2 *Comparison of the mean iron intake (mg/d) by female students before and after the educational intervention in the experimental and control groups*

Heme-iron in the diet	Experimental group M±SD	Control group M±SD	Results of independent t-test
Before intervention M±SD	0.9±0.72	0.9±0.72	p=0.98
3 months after intervention M±SD	1.42±0.82	0.9±0.72	p<0.001
Results of paired t-test	p<0.001	p=0.935	

Discussion

Promoting community nutritional awareness through nutrition education is a must in order to reduce malnutrition in developing countries such as our country, Iran. Nutrition

education as a part of health education depends on selecting an appropriate model in the first step of planning a training program [24].

Four behavioral models have been commonly used for nutrition education in previous studies including health belief model, stages of change model, theory of reasoned action, and social cognitive theory which have been used by Hassan et al. [25], sun et al. [26], Jalili et al. [1], Noronaha et al. [27], and Sharifirad et al. [28]. The information-motivation-behavioral skills (IMB) model theoretically has been developed to change behavior.

Overall, the IMB model takes a more cost-benefit and multi-factorial approach to change behavior than the other models. The most of models do not take into account specific relationships among key constructs, indicating no predictive validity with critical constructs, or are missing constructs that are central to understanding and eliciting health-related behavior change. Finally, the application of IMB leads educators to explicit points to target the desired changes in individuals.

The IMB behavior change theory has been successfully employed to practically educate health behaviors including human immunodeficiency virus and acquired immune deficiency syndrome (HIV/AIDS) prevention [29], adherence to medication [30], breast self-examination [31], self-care in diabetes [32], and beverage consumption in children [33].

The advantages of IMB over other behavior change models highlight the reasons behind choosing IMB for this research. The difference between this model and other behavior change models, commonly emerged in the nutrition education literature, is that IMB does not assume decision making a linear process. Instead, IMB postulates that behavioral influences are resulted from the interaction of constructs that some of them directly influence the behavior outcome [22].

In this study, a significant increase in the mean scores of information, motivation, and behavioral skills about nutrition was obtained after the intervention to prevent iron deficiency anemia in the experimental group, which reflects the effect of the educational intervention. Shell Duncan and McDate [34] showed that making a change in eating habits and using iron-rich foods are the perfect solution for improving related indices in anemia-suffered patients [34].

In the present study, three months after the intervention, the mean amount of heme-iron intake from food sources increased in the intervention group. The findings of other surveys based on the IMB model also indicate the effect of this model in improving behavior. For example, the results of Anderson et al [35] study on the use of condoms to prevent sexually transmitted diseases, Malek Gugan et al [36] on glycemic control in patients with type II diabetes, and Mita et al on the consumption of fruit and vegetables in pre-school [37] are in the same direction. In the study of Zhu et al on smoking tendency among 16,500 high school students based on the IMB model, a correlation between the constructs of the model was obtained, which is similar to the results of the present study [38].

The findings of present study suggested that nutritional behaviors in order to prevent iron deficiency anemia in adolescent girls were improved as a result of intervention based on the IMB model. Therefore, it is recommended to develop educational programs to prevent common diseases such as iron deficiency anemia in the national health system to be presented to the students in schools.

Although the current research showed the effect of the information, motivation, and behavioral skills model to change nutrition behavior, it encountered limitations. One limitation was related to the self-reporting questionnaires, which could undermine the quality of data gathered. Also, the final evaluation of the designed and implemented program (posttest) was performed 13 weeks after accomplishing the intervention. It is recommended for future studies to evaluate the behavior change in longer follow-up time.

Conclusion

An accumulation of evidence is needed to allow for the identification of critical targets for prevent iron deficiency anemia interventions for different populations.

Planning an education based on the information, motivation, and behavioral skills (IMB) model positively affected all the aspects required to create a healthy behavior. Future qualitative and quantitative research to determine the kinds of information and motivation that may be most influential to health behavior adoption is needed. In conclusion, this study shows that consistent with the IMB model, information, personal motivation, and social motivation are important critical prerequisites to performing nutritional behaviors in anemia.

The findings characterize the key elements for prevention anemia and indicate that in addition to knowledge, nutritional behaviors education programs should to target personal and social motivation effect behavior change.

Our results also lend support to the growing body of literature and recommendations of tailoring health promotion interventions to the knowledge and motivation needs of student. Based on the findings of this study and consistent with the IMB model, providers and educators need to first be aware of student' levels of knowledge and motivation and then tailor educational programs accordingly

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Contribution

Study design: NP, MA
Data collection and analysis: MA
Manuscript preparation: MA

Conflict of Interest

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

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