



Osteoporosis preventive behaviors in adolescent girls: the educational program based on BASNEF model

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Received: 12 February 2019 / Accepted: 17 June 2019

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Abstract

Summary Osteoporosis is a progressive and preventable metabolic disease. This study aimed to assess the short-term effect of the educational program based on the Beliefs, Attitude, Subjective Norms, Enabling Factors (BASNEF) model on the osteoporosis preventive behaviors in adolescent girls. It was found that the BASNEF model improved the osteoporosis preventive behaviors in adolescent girls.

Purpose Osteoporosis is a progressive and preventable metabolic disease. This study aimed to investigate the short-term effect of the education program based on the BASNEF model on the osteoporosis preventive behaviors in adolescent girls.

Methods This randomized clinical trial was conducted on adolescent girls from January to August 2018 in an urban area of Iran. Subjects were 120 adolescent girls aged 13–14 years studying in the girls' high school that were randomly assigned to intervention and control groups. The data collection tool was the demographic questionnaire and the researcher-made questionnaire consisting of six domains based on the BASNEF model. Validity and reliability of the questionnaires were confirmed before data collections. The educational program was developed based on the BASNEF model in four sessions lasting from 30 to 45 min. Data was collected before, immediately and 1 month after the educational program and was analyzed via the SPSS software v.18.

Results No statistically significant differences were reported between the groups in terms of knowledge ($p = 0.48$), attitude ($p = 0.94$), subjective norms ($p = 0.17$), behavioral intention ($p = 0.82$), enabling factors ($p = 0.62$), and osteoporosis preventive behaviors ($p = 0.32$). Meanwhile, immediately and 1 month after the educational program, differences were reported between the two groups in knowledge ($p < 0.001$), attitude ($p = 0.002$, $p < 0.001$), subjective norms ($p = 0.024$, $p = 0.001$), behavioral intention ($p < 0.001$, $p = 0.001$), enabling factors ($p < 0.001$), and osteoporosis preventive behaviors ($p < 0.001$).

Conclusion It is suggested that educational program based on the BASNEF model is used to strengthen the osteoporosis preventive behaviors among adolescent girls.

Keywords Prevention · BASNEF · Girl · Adolescent · Education · Osteoporosis

Introduction

Osteoporosis is an important metabolic disease characterized by the reduction of bone density [1]. In 2014, the National Osteoporosis Foundation announced that a total of 54 million adults aged more than 50 years in the USA suffer from osteoporosis [2]. As women grow older, women are more likely to experience bone loss compared to men [3] and they are four times more likely to suffer from osteoporosis than men [4, 5]. The results of a meta-analysis indicated that osteoporosis is a common problem among the Iranian people with an age older than 30 years [6].

The highest bone mineral density is developed during adolescence [7–9]. During adolescence, the adult bone mass increases at a high speed by 39%. Subsequently, the development of bone mass decreases late in puberty [10]. A rapid

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growth and increase of the bone mineral density during adolescence is a good opportunity to optimize bone strength and reduce the risk of osteoporosis through lifestyle modifications and environmental factors [7, 9, 11]. Studies have shown that in adolescence, genetic factors, endocrine function, nutrition, physical activity, body weight, and daily solar radiation are associated with the increased bone mass and prevent osteoporosis [7, 12].

Provision of recommendations for the prevention of osteoporosis is important for the development of an effective public health program [13]. One of the most important goals of the WHO is to increase the number of women educated about osteoporosis [3]. The health care system needs to focus on the increase of the knowledge of osteoporosis through appropriate education to change the adolescents' lifestyle and prevent osteoporosis [14]. For the prevention of osteoporosis, the focus of attention is girls, because of the higher risk of osteoporosis in women [4].

The selection of appropriate and target-oriented theory is required to guide health-related interventions [15]. The Beliefs, Attitudes, Subjective Norms and Enabling Factors (BASNEF) model was developed by John Hubley in 1988, based on the PRECEDE model and Value Expectancy Theory to fit the special needs of health education in developing countries [16]. The BASNEF model is a comprehensive model to study behaviors and change them, and define factors affecting individuals' decision making [17]. Accordingly, once individuals develop a new beneficial behavior, an attitude toward the behavior is developed. Key individuals can influence individual's decision for regarding the behavior and act as the facilitator or inhibitor. The combination of attitudes and subjective norms leads to the formation of the intention of behavior to perform a new behavior. Enablers such as skills and financial support help transform intent into the behavior [18].

The use of this model on the continuation of exclusive breastfeeding to premature infants has been studied in Iran [19]. Also, this model has been used on the use of hookah by college students [20], selection of contraceptive methods [18], reduction of the rate of cesarean selection in women [17], development of self-management and healthy behaviors in young adults [21], and hypertension [22]. This study aimed at investigating the short-term effect of the educational program based on the BASNEF model on osteoporosis preventive behaviors in adolescent girls in urban areas of Iran.

Methods

Design

This randomized controlled trial was conducted between January and August 2018. The intervention was an

educational program based on the BASNEF model regarding the osteoporosis preventive behaviors in adolescent girls.

Participants

The sample size was estimated 56 girls using the following power formula. Given 10% possibility of dropout, the sample size for each group was 60 girls with not one declining to participate.

$$N = \frac{2(Z_{\alpha} + Z_{\beta})^2 \left(1 + (n-1)p\right)}{n[(\mu_1 - \mu_2)/\sigma]^2}$$

($\alpha = 0.05$, $Z_{\alpha} = 1.96$, power = 0.9, $Z_{\beta} = 1.28$), $(\mu_1 - \mu_2)/\sigma = 0.5$ (the effect size), $n = 3$ time points, and $p = 0.05$).

$$N = \frac{2(1.96 + 1.28)^2 \left(1 + (3-1)0.5\right)}{3(0.5)^2} \approx 56$$

Inclusion criteria were studying in the first grade of girls' high school and the absence of diseases, such as fractures, diabetes, and asthma, according to participants' self-reports. Exclusion criteria included failure to attend education sessions (at least two sessions) and a reluctance to continue participating in the study. It should be noted that the research participants were matched in the intervention and control groups in terms of their field of study. The participants were chosen using the multistage cluster sampling method. At first, a list of girls' high schools was prepared and two girls' high schools were selected using the table of random numbers. Through flipping the coin, a girl's high school was selected as an intervention group and the other as a control group. An intervention and control group from each of the 10th grade classrooms was selected randomly in the study fields of mathematics, physics, and humanities. On average, 30 students were enrolled in each classroom and each participant was given a code. After the pre-test, education sessions were held in the intervention group for each classroom separately. After the education sessions, data was collected using the questionnaires. Finally, data analysis was performed on 60 matched questionnaires using descriptive and inferential statistics. There were no statistically significant differences between the two groups in terms of demographic variables before the study.

Educational program

The educational program was developed based on the BASNEF model, and its validity was confirmed by two faculty members of the School of Nursing and Midwifery affiliated with Shahid Beheshti University of Medical Sciences

(SBMU). The educational program based on the BASNEF model in the intervention group consisted of four group education sessions lasting for 30–40 min. The educational program based on the BASNEF model was presented in Table 1. To avoid changes in the classrooms order, separate education sessions were held for each classroom. The process of the study is shown in Fig. 1.

Instruments

The demographic data questionnaire and a researcher-made questionnaire based on the BASNEF model for the prevention of osteoporosis were developed. The demographic data questionnaire consisted of 12 questions of age, field of study, living condition of parents, number of family members, birth rank, parental education, parents' job, history of osteoporosis in the family, and body mass index (BMI). It should be noted that height and weight of the participants were measured using a meter and an accurate scale, respectively, and the BMI was calculated by the first author.

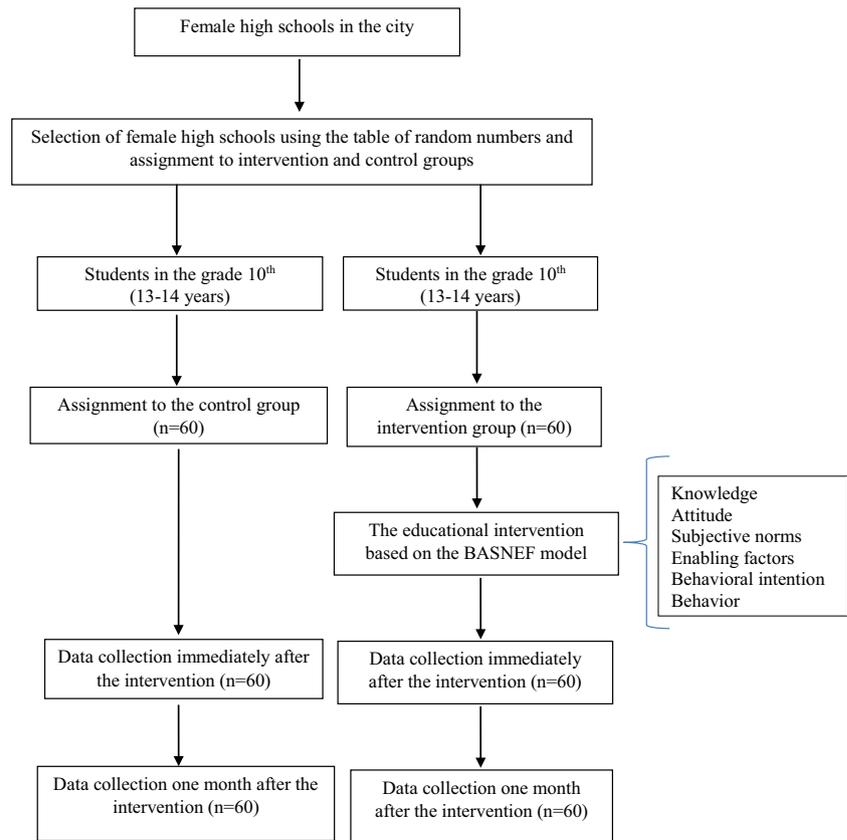
The researcher-made questionnaire based on the BASNEF model was developed through a review of literature [23]. Given that knowledge brings a commitment to perform health-related behaviors [24], knowledge was measured as a predictor of behavioral changes. In the different parts of the questionnaire, a number of items and their scoring were as follows: knowledge about prevention of osteoporosis including, 15 items; attitudes about the prevention of osteoporosis, 6

items; subjective norms (beliefs and pressures from the family, friends and relatives) on the prevention of osteoporosis, 7 items; behavioral intention (desire to behave) of the prevention of osteoporosis, 7 items; enabling factors (personal/family enabling resources and external/environmental enabling resources) on the prevention of osteoporosis, 9 items; and self-reported osteoporosis preventive behaviors (physical activity, calcium-rich food and appropriate to the body weight, use of sunlight and vitamin D supplementation), 7 items. Responses of the knowledge section were wrong (score 1) and correct (score 2). Attitudes, subjective norms, and enabling factors had a five-point Likert score from zero to 5 and osteoporosis preventive behaviors had a five-point Likert scale from 0 to 5.

Validity of the BASNEF model questionnaire was assessed using the Content Validity Ratio (CVR) and Content Validity Index (CVI). According to Lawshe (1975), CVR provides a measurement based on an agreement by experts on the essentiality of items [25]. In this study, to assess CVR, 10 nursing faculty members were asked to rate each question based on three criteria of “essential” (score 3), “useful, but not essential,” (score 2) and “not necessary” (score 1). The formula $CVR = (ne - n/2)/n/2$ was used, where “*ne*” was the number of experts who approved the essentiality of items and “*n*” was the total number of experts. The value was compared with a minimum value proposed by the Lawshe table. The minimum value in the table depends on the number of experts who contributed the rating of items, and the acceptance value for 10 expert was 0.62 [25]. The CVR value for all items was

Table 1 The educational program based on BASNEF model

Session	Objectives	Content	Assignment
1th and 2nd	Increase of knowledge and change of attitude	Introduction to researcher and study objectives, anatomy and physiology of bone and the role of bones in health and importance of education for preventing osteoporosis from adolescence. Definition, prevalence, symptoms, and cause of the disease, osteoporosis preventive behaviors such as healthy diet, physical activity, vitamin D, and avoiding alcohol and cigarette	Question and answer, group discussion
3rd	Encouraging subjective norms and enabling factors	The role of family and friends in preventing osteoporosis; introduction enabling factors for the prevention of osteoporosis 1. Personal/family resources including the Internet, books, calculations of BMI, exercise schedules, calcium-based foods based on household economic conditions, use of sun light, sports equipment, and at appropriate environment for exercise at home; Informing family members of osteoporosis 2. External/environmental enabling resources such as vitamin D tablets distributed in schools; sport facilities in schools and the presence of a school nurse; how to calculate BMI	Transfer of all education contents to families and especially mothers and provision of educational pamphlet to them; setting up a daily physical activity plan; calculation of BMI by the participants
4th		Studying how to calculate BMI; Checking out the fitness program Reviewing the contents of previous sessions	Question and answer, group discussion

Fig. 1 The process of study

higher than 0.8, and therefore, they remained in the questionnaire.

For the CVI, the expert panel was asked to assess the “relevance” of each question and give a score from 1 to 4. The CVI of the questionnaire was reported between 88.5 and 100. Since the mean score of the questionnaire was higher than 0.7 [26], the relevance of all questions was confirmed. For reliability, the test-retest method was used. The questionnaires were completed by 30 students who were not the study participants within a 2-week interval, and the correlation coefficient was calculated using the intraclass correlation coefficient (ICC). The value of this indicator was reported between 0.75 and 0.9. The Cronbach’s alpha coefficient increased from 0.71 to 0.82, indicating the consistency of the questionnaire.

Data collection

Data was collected before, immediately and 1 month after the educational program by the groups. Data collection was conducted at the girls’ high school. Data was analyzed via the SPSS software v.18 using descriptive statistics (mean and standard deviation) and inferential statistics (Mann-Whitney, independent *t* test, and Fisher’s exact test). The normality distribution of data was evaluated using the Kolmogorov-Smirnov test. The significance level was considered $P < 0.05$.

Ethical considerations

Before data collection, permissions were granted by authorities to enter the research zone, and the participants of both groups were informed of the aim and data collection process. They were informed of voluntary nature of participation in this study and possibility of withdrawal from the study at any time. The questionnaires were filled out without mentioning their names and through registering codes. At the end of the study, the control group was also offered the education content and pamphlets.

Results

The mean age of the participants in the intervention and control groups was 16 ± 0.42 and 15.85 ± 0.55 , respectively. There was no statistically significant difference between the two groups in terms of age. No statistically significant differences were reported between the groups in terms of the academic discipline. Other demographic data was presented in Table 2. According to Table 3, no statistically significant difference was found between the groups before the educational program in the knowledge structure ($p = 0.48$), although immediately and 1 month

Table 2 Demographic variables of the participants in the intervention and control groups and their statistical comparison

Variable	Intervention group	Control group	<i>P</i> value
Age (M ± SD)	16 ± 0.42	15.85 ± 0.55	<i>P</i> = 0.82 *
Parents' living condition			<i>P</i> = 0.061 **
Yes	53 (88.3%)	59 (98.3%)	
No	1 (1.7%)	7 (11.7%)	
Number of family members			<i>P</i> = 0.617 ***
≤ 3	3 (10%)	3 (1.7%)	
4	14 (23.3%)	13 (30%)	
5	30 (50%)	22 (36.7%)	
≥ 6	13 (16.7%)	19 (31.7%)	
Father's education level			<i>P</i> = 0.075 **
Lower than elementary	16 (26.7%)	12 (20%)	
Guidance school and diploma	38 (63.3%)	47 (78.3%)	
Academic	6 (10%)	1 (1.7%)	
Mother's education level			<i>P</i> = 0.63 ***
Lower than elementary	25 (41.7%)	26 (43.3%)	
Guidance school and diploma	33 (55%)	34 (56.7%)	
Academic	2 (3.3%)	0 (0%)	
Father's job			<i>P</i> = 0.735 **
Employee	11 (18.3%)	13 (21.7%)	
Self-employed	36 (60%)	35 (58.3%)	
Unemployed	6 (10%)	3 (5%)	
Retired	7 (11.7%)	9 (15%)	
Mother's job			<i>P</i> = 0.287 **
Employee	3 (5%)	5 (8.3%)	
Self-employed	2 (3.3%)	0 (0%)	
Housewife	55 (91.7%)	55 (91.7%)	
History of osteoporosis in the family			<i>P</i> = 0.845 **
Yes	6 (10%)	7 (11.7%)	
No	29 (48.3%)	30 (50%)	
Unknown	25 (41.7%)	23 (38.3%)	
BMI	20.91 ± 3.95	19.93 ± 3.53	<i>P</i> = 0.459 *

P ≤ 0.05

*Mann-Whitney

**Fisher's exact test

***Chi-square

after it, the difference in knowledge scores between the groups was reported ($p < 0.001$). Also, no statistically significant difference between the groups in terms of attitude before the educational program was reported ($p = 0.49$), but immediately and 1 month after the educational program, the difference in attitude scores between the groups was statistically significant ($p = 0.002$, $p < 0.001$). The independent *t* test showed no statistically significant difference between the groups before the educational program ($p = 0.17$), but immediately and 1 month after it, there was a statistically significant difference between the two groups ($p = 0.024$ and $p = 0.001$, respectively). No statistically significant difference in the mean score of behavioral intention between the groups before the educational program was observed ($p = 0.82$), but immediately and 1 month

after it, the difference was statistically significant ($p < 0.001$ and $p = 0.001$).

There was no statistically significant difference between the groups in enabling factors before the educational program ($p = 0.62$), but immediately and 1 month after it, the difference between the groups was statistically significant ($p < 0.001$). The independent *t* test showed no statistically significant difference between the groups before the educational program in self-reported osteoporosis preventive behaviors ($p = 0.32$), but immediately and 1 month after the educational program, the difference was statistically significant ($p < 0.001$). It indicated the continuation of osteoporosis preventive behavior in the post-education stage in the intervention group.

Table 3 Comparison of the elements of the BASNEF model before, after, and 1 month after the educational program in the intervention and control groups

Elements	Stage	Intervention M ± SD	Control M ± SD	<i>P</i> value
Knowledge	Before educational program	35.14 ± 2.31	35.30 ± 3.34	<i>P</i> = 0.48**
	Immediately after educational program	42.50 ± 2.90	35.35 ± 3.32	<i>P</i> < 0.001**
	One month after educational program	41.84 ± 2.97	37.07 ± 3.29	<i>P</i> < 0.001**
Attitude	Before educational program	25.02 ± 3.09	24.82 ± 3.71	<i>P</i> = 0.94**
	Immediately after educational program	26.72 ± 3.35	24.77 ± 3.70	<i>P</i> = 0.002**
	One month after educational program	26.75 ± 3.74	24.77 ± 3.71	<i>P</i> < 0.001**
Subjective norms	Before educational program	25.50 ± 3.77	24.49 ± 4.37	<i>P</i> = 0.17*
	Immediately after educational program	26.35 ± 4.31	24.54 ± 4.39	<i>P</i> = 0.024*
	One month after educational program	26.94 ± 3.67	24.49 ± 4.34	<i>P</i> = 0.001*
Behavior intention	Before educational program	32.44 ± 4.85	32.74 ± 4.54	<i>P</i> = 0.82**
	Immediately after educational program	36.24 ± 3.64	32.75 ± 4.47	<i>P</i> < 0.001**
	One month after educational program	35.24 ± 3.73	32.69 ± 4.58	<i>P</i> = 0.001**
Enabling factors	Before educational program	30.84 ± 4.47	31.47 ± 5.09	<i>P</i> = 0.62**
	Immediately after educational program	35.34 ± 4.64	31.32 ± 5.03	<i>P</i> < 0.001*
	One month after educational program	34.82 ± 4.30	31.55 ± 5.12	<i>P</i> < 0.001**
Osteoporosis preventive behaviors	Before educational program	23.30 ± 4.50	24.17 ± 4.99	<i>P</i> = 0.32*
	Immediately after educational program	28.25 ± 4.23	24.10 ± 4.95	<i>P</i> < 0.001*
	One month after educational program	30.17 ± 2.88	24.14 ± 4.96	<i>P</i> < 0.001**

P ≤ 0.05**t* test

**Mann-Whitney test

Discussion

The aim of this study was to examine the short-term effect of an educational program based on the BASNEF model on the knowledge, attitude, subjective norms, behavioral intention, and enabling factors, and self-reported osteoporosis preventive behaviors in adolescent girls in an urban area of Iran. Examining the short-term effect of an educational program allows an analysis in a shorter time period on the effectiveness of the program [27].

Changing behaviors related to osteoporosis prevention in adolescent girls is important, because it is a major public health concern, especially in elderly women. Given the increase in life expectancy and the mean age of the population, osteoporosis is increasingly common in the society. The bone mass reaches its full density in the first three decades of life, which has a decisive role in osteoporosis. Puberty and adolescence are considered important life stages for the prevention of osteoporosis [28].

Also, the BASNEF model helped examine factors influencing osteoporosis preventive behaviors [29]. The use of a model like BASNEF helps develop educational programs that are effective with measureable outcomes [24]. In this regard, the study used the multidimensional instrument matched using the BASNEF model consisting of elements of knowledge, attitude, subjective norms, behavioral intention, enabling factors and self-reported osteoporosis preventive behavior.

The findings of this study showed that the educational program based on the BASNEF model made changes in knowledge, attitude, subjective norms, behavioral intention, and enabling factors and improved the self-reported osteoporosis preventive behaviors in adolescent girls. Similarly, Sharifi and Majlessi found that education based on the Orem self-care model improved self-care behaviors related to the prevention of osteoporosis in adolescents [28]. Another study found that nutritional behaviors for preventing osteoporosis in girls promoted the use of the health belief model [30]. The results of the study by

Ahmadi et al. also indicated the effectiveness of an educational program on the BASNEF model on the mothers' breastfeeding behavior [31]. In another study, an improvement was reported in the self-monitoring behavior in patients with hypertension after the intervention based on the BASNEF model [22]. In a study by Shahnazi et al., self-administered healthy behaviors were improved after educational intervention based on the BASNEF model [21].

The results of this study showed that the educational program increased the knowledge of adolescent girls about the prevention of osteoporosis. In the study of Masoumi et al., the knowledge of participants in the intervention group regarding the feeding of premature infants with breast milk increased after the intervention based on the BASNEF model compared to the control group [19]. Another study showed an increase in the knowledge of students of the prevention of cutaneous leishmaniasis after education based on the BASNEF model [32].

This study showed that education based on this model could improve the attitude toward osteoporosis. Momenabadi et al. also found that education based on the BASNEF model improved students' attitudes toward the intention to change the hookah use [33]. Another study showed that education based on the BASNEF model helped significantly improved knowledge and attitudes regarding nutrition and participation in physical activities [21]. Knowledge and attitude are important aspects for changing behaviors, and individuals can change their behaviors through improvement of their knowledge and attitude [34].

Subjective norms as one of the structure of the BASNEF model, after the educational program, showed a higher score in the intervention group. Similarly, the educational intervention based on the BASNEF model improved students' subjective norms about leishmaniasis [32]. Shahnazi et al. also showed that, after education based on the BASNEF model, a significant increase in subjective norms regarding self-administered healthy behaviors was reported [21]. According to the authors, since subjective norms refer to the family and friends' role in health behaviors, the change in the scores of subjective norms in the intervention group can be attributed to the indirect participation of families in the study through sending educational pamphlets to them and strengthening their role in preventive behaviors for osteoporosis in adolescent girls.

The findings of this study indicated that education based on the BASNEF model led to changes in behaviors. Similarly, studies by Saghafipour et al. [32] and Shahnazi et al. [21] suggested that BASNEF-based education led to changes in the behavioral intention for preventing leishmaniasis and self-administered healthy behaviors. Behavioral intention is an important factor for accepting a behavior and modifying a behavior through changing the intention of a behavior [35]. On the other hand, due to the mutual effects of the theory elements in the BASNEF model, the increase in attitude and subjective norms can lead to changes in the behavioral intention.

Conclusions

Elements of the BASNEF model including knowledge, attitude, subjective norms, behavioral intention, and enabling factors can be used to design educational programs for the improvement of short-term osteoporosis preventive behaviors in adolescent girls. There is a need to two-group experimental designs to compare the effectiveness of the traditional education programs and the educational program based on BASNEF model.

This study was conducted in an urban area of Iran and the generalization of findings to other cities needs further research. The BASNEF model can be used to investigate preventive behaviors for osteoporosis in adolescent girls.

As a limitation of this study, the follow-up of the program effectiveness was carried out shortly after the completion of the students' academic year and there was a lack of access to all participants in the intervention and control groups in the ongoing academic year. Therefore, a longer follow-up time should be used in future studies. Also, fatigue and lack of interests by the girls to attend in the school and classroom might have affected their responses. Lack of direct access to families of the girls to assess the effect of the educational program based on the BASNEF was another limitation of this study. The self-report method of data collection could have affected the data collection.

Acknowledgments The authors express their gratitude and appreciation to the educational and research departments of SBMU and the girls for their collaboration in this study.

Compliance with ethical standards

This study was approved by the Ethics Committee of SBMU (decree code: IR.SBMU.PHNM.1395) and the Center for Registering Clinical Trials in Iran (decree code: IRCT20171019036883N3). The consent form was signed by the participants before the data collection.

Conflicts of interest None.

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