Evidence Based Care Journal
http://ebcj.mums.ac.ir/

Effect of an Educational Intervention Program Based on Bandura's Self-efficacy Theory on Self-care, Self-efficacy, and Blood Sugar Levels in Mothers with Pre-diabetes during Pregnancy

Atefeh Eshghi Motlagh, Raheleh Babazadeh, Farideh Akhlaghi, Habibollah Esmaily

The online version of this article can be found at
http://ebcj.mums.ac.ir/article_13310.html

Evidence Based Care Journal 2019 09:53 originally published online 01 July 2019
DOI: 10.22038/ebcj.2019.37173.1959

Online ISSN: 2008-370X

Address: Mashhad Nursing and Midwifery School, Ebn-e-Sina St., Mashhad, Iran
P.O.Box: 9137913199
Tel.: (098 51) 38591511-294
Fax: (098 51) 38539775
Email: EBCJ@mums.ac.ir

Evidence Based Care Journal

Original Article

OPEN ACCESS JOURNALS

Effect of an Educational Intervention Program Based on Bandura's Self-efficacy Theory on Self-care, Self-efficacy, and Blood Sugar Levels in Mothers with Pre-diabetes during Pregnancy

Atefeh Eshghi Motlagh[1], Raheleh Babazadeh[2*], Farideh Akhlaghi[3], Habibollah Esmaily[4]

Received: 02/01/2019
Accepted: 15/06/2019

Evidence Based Care Journal, 9 (2): 53-64

Abstract

Background: Sense of self-efficacy prepares an appropriate framework for self-care behaviors.

Aim: This study aimed at investigating the effect of an educational intervention program based on Bandura's Self-Efficacy Theory (SET) on self-care, self-efficacy, and blood sugar levels in mothers with pre-diabetes during pregnancy.

Method: This randomized two-group clinical trial was conducted on 100 pregnant women with pre-diabetes in Shirvan, Iran, during 2018. The intervention group received educational training according to the constructs of Bandura's SET. On the other hand, the control group was provided with routine care. The data were collected using Diabetes Self-Care Activities and the standardized and adjusted Diabetes Self-Efficacy Questionnaires, as well as an automatic biochemistry analyzer, and a blood glucose monitoring device. The data were analyzed in SPSS software (version 22) through paired sample t-test, Mann-Whitney U test, and Wilcoxon signed-rank test.

Results: The mean ages of the participants in the intervention and control groups were 28.9±7.1 and 29.3±6.2 years, respectively. According to the Mann-Whitney U test results, the intervention group obtained higher scores regarding self-care behaviors and sense of self-efficacy (41.8±13.5, 99.3±16.2), compared to the control group (22.8±5.0, 99.3±16.2, $P<0.001$). The mean fasting blood sugar level in the intervention group (75.8±6.7) was significantly lower than that in the control group (85.4±9.7, $P<0.001$).

Implications for Practice: The promotion of self-care behaviors and self-efficacy strategies in mothers with pre-diabetes during pregnancy could prevent gestational diabetes and reduce the severity of its complications.

Keywords: Blood sugar level, Pre-diabetes self-efficacy, Pregnant women, Self-care

1. MSc Student of Midwifery Counseling, School of Nursing and Midwifery, Mashhad University of Medical Sciences, Mashhad, Iran
2. Assistant Professor, Nursing and Midwifery Care Research Center, Mashhad University of Medical Sciences, Mashhad, Iran
3. Professor of Obstetrics and Gynecology, School of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran
4. Professor of Biostatistics, School of Health, Mashhad University of Medical Sciences, Mashhad, Iran

* Corresponding author, Email: babazadehr@mums.ac.ir

Introduction

Gestational diabetes, which is a disorder in carbohydrate tolerance occurs during pregnancy and can be initially diagnosed in this period (1). It is one of the biggest health-related challenges in the 21st century (2). Gestational diabetes as a silent disease is also considered as one of the common complications of pregnancy which can have detrimental effects on mothers and infants leading to undesirable consequences during pregnancy and delivery (3).

According to the national instructions for screening and detection of gestational diabetes in Iran, a mother is diagnosed with pre-diabetes if her fasting blood sugar (FBS) level in her first gestational care visits is estimated at 93-125 mg/dl (4). Based on the estimates by the International Diabetes Federation, 7.7% of the Iranian general population is affected with pre-diabetes status. Each year, the normal blood sugar level in 4% of the total adult population in Tehran is transformed into pre-diabetes status (5). Therefore, the target population of research studies should include individuals with pre-diabetes to avoid the occurrence of this disorder (6).

Moreover, there is no accurate statistics in Iran on the prevalence rate of gestational diabetes as well as the percentage of pregnant women with pre-diabetes. The pre-diabetes status can also increase the risks of complications, such as cardiovascular diseases before being converted into diabetes. Clinical studies have also reported that complications associated with diabetes often occur before clinical diagnosis of this disorder.

Accordingly, it is of utmost importance to diagnose diabetes within the early stages, examine pre-diabetes stages, and identify factors affecting this disease (7). In this respect, self-care behaviors are among the protective factors affecting the prevention of the transition from pre-diabetes to diabetes (6). The theme of World Health Day in 2012 was "Good health adds life to years" which highlighted the necessity of promoting capabilities and strategies in individuals to practice self-care behaviors (8). Studies on individuals with pre-diabetes have further demonstrated that blood sugar levels could be reduced through improving self-care behaviors, including adherence to dietary regimens and practice of physical activities (9). In this regard, Dodson in an investigation entitled “Pre-diabetes: Factors related to self-care management among adults at risk for type-2 diabetes” reported that changes in dietary regimens and increased physical activities could lead to weight loss and decrease risk factors of this disorder (10).

Accordingly, one of the factors influencing self-care promotion is expanding knowledge and awareness among patients using a variety of educational intervention programs (11). Moreover, researchers believe that the sense of self-efficacy is a good framework for understanding and predicting patients’ commitments to practice self-care behaviors (12). In fact, there is a direct correlation between self-efficacy and self-care (13). In other words, a person with a low sense of self-efficacy is less likely to make efforts in practicing new health-related behaviors or make changes in routine behaviors (12).

As reported by behavioral science research, it is critical to utilize the learning theories to create effective behavioral intervention programs (14). Bandura’s Self-efficacy Theory (SET) is among the prominent theories of learning in the health education domain (15). It has been assumed in this theory that individuals avoid activities they think they will fail in (16). Bandura has also recommended numerous sources of information for promoting self-efficacy; therefore, the establishment of educational intervention programs based on this theory can contribute to the promotion of a sense of self-efficacy.

These sources include skillfully successful experiences, role-model experiences about the observation of performance, success, and failure in others, social persuasion (i.e. verbal persuasion by fellow members, colleagues, and relatives), as well as emotional and physiological states (15). Studies in this domain have further revealed that successful interventions are accompanied by a promoted sense of self-efficacy in diabetic patients, thereby improving hemoglobin A1C levels and increasing self-care

behaviors.

With this background in mind, it seems that the sense of self-efficacy is an important and effective prerequisite to practice successful self-care behaviors (17). Chen et al. conducted a study on the predictive effects of self-care behaviors on individuals affected with pre-diabetes. According to the results, the utilization of this theory was confirmed due to the improved sense of self-efficacy in individuals and importance of self-efficacy in self-care behaviors as an appropriate educational option for self-care and prevention of diabetes in mothers during pregnancy (6).

However, this theory has not been so far utilized in examining self-care behaviors in people with pre-diabetes, especially mothers during pregnancy. Currently, teaching routine gestational care in Iran is not generally theory-driven. Therefore, this type of education only broadens levels of awareness in individuals and it is less likely to make them change their behaviors.

Given the importance of this issue as well as the priority of prevention over treatment, this study aimed to examine the effect of an educational intervention based on Bandura's SET on self-care, self-efficacy, and blood sugar levels in mothers with pre-diabetes during pregnancy.

Methods

This randomized clinical trial with intervention and control groups was conducted on 100 pregnant women. After taking the approval of Ethics Committee of Mashhad University of Medical Sciences, Mashhad, Iran, the participants were selected out of 180,000 patients with pre-diabetes referred to community health centers in Shirvan, Iran, during 2017-2018 using convenience sampling method.

In total, six community health centers were assigned into intervention (n=3) and control groups (n=3) via drawing. For this purpose, the names of the given six centers were written on pieces of paper, sealed, and then placed in a bag, and subsequently, the drawing was conducted. Finally, the first three centers were nominated as the intervention and the rest were selected as the control group. The sample size was estimated considering the formula of sample size calculation for comparing groups at 95% confidence and 80% test power by 42 individuals. Given the 20% attrition, 50 individuals were included in each group in this study.

The inclusion criteria were: 1) gestational age of 10-14 weeks, 2) Iranian nationality, 3) residency in Shirvan, 4) minimum educational level of fifth grade, 5) FBS levels of 93-125 mg/dl, 6) ability to communicate verbally, 7) singleton pregnancy, 8) non-smoking and no addiction, 9) absence of mental disorders, 10) no medication use or hospitalization due to mental illnesses, 11) no history of medical illnesses, such as underlying diseases of diabetes, cardiovascular diseases, hypertension, epilepsy, migraine, history of head trauma, thyroid disease, connective tissue disease, asthma, respiratory disorders, kidney failure, anemia, and stroke, 12) lack of high-risk pregnancy, 13) no continuous use of glucocorticoid drugs (this criterion was determined through completing a demographic characteristics form using an interview), 14) no use of medications to lower blood sugar level, including metformin, 15) and easy access by a contact phone number.

On the other hand, the participants whose FBS levels and blood sugar levels two hours after eating were above or equal to 93 and 120 mg/dl, respectively, (two weeks after the onset of the intervention), those who experienced the occurrence of major stressful events during the study and pregnancy-related complications, including bleeding, hypertension, early delivery, and surgery or hospitalization for current pregnancy, as well as delivery or abortion during the study, and individuals who did not attend any of the educational intervention program sessions and were unwilling to continue the research were excluded from the study.

The data were collected using a participant selection form, a demographic and midwifery characteristics form, the researcher-made Diabetes Self-Care Activities Questionnaire (DSCAQ), the standardized and adjusted Diabetes Self-Efficacy Questionnaires (DSEQ) , an automatic biochemistry analyzer, and a blood glucose monitoring device. The DSCAQ was designed to assess self-care

behaviors in mothers with pre-diabetes during pregnancy, including adherence to dietary regimens and practice of physical activities. This research instrument includes 16 items measuring physical activities (5 items) and adherence to dietary regimens (11 items). The participants in both groups were then required to complete the questionnaire at the onset of the study and at the gestational age of 24-28 weeks. The results were compared in both groups.

This questionnaire is scored based on a 5-point Likert-type scale from very low (0) to low, medium, high, and very high (4). The minimum and maximum scores were zero and 64, respectively. Face validity and content validity were used in this study to determine the validity of this questionnaire. To this end, the questionnaire was developed after reviewing textbooks and articles and consulting with professors and experts involved in gestational diabetes. Afterward, it was submitted to seven faculty members specialized in this domain, and the necessary revisions were made after receiving their suggestions.

The DSEQ is the adjusted version of the Self-efficacy for Diabetes Questionnaire (18) developed by the American Stanford University Research Center and consists of 12 items that are adapted to the constructs of Bandura's SET. Each item in this questionnaire is scored on a Likert-type scale from 1 (Totally unsure) to 10 (Totally sure). If more than two items are unanswered, the questionnaire is not assessed in this study. The range of the total score for this questionnaire is from 12-120 in which the maximum score indicated the highest sense of self-efficacy.

This questionnaire was completed at the onset of the study (at the gestational age of 10-14 weeks) and then on 24-28th weeks (three months after the intervention) by the intervention and control groups. The validity of this research instrument was determined using content validity. To this end, the implemented and translated version of the questionnaire in the study by Kordi et al. (2016) (19) was submitted to seven faculty members of Mashhad University of Medical Sciences, Mashhad, Iran, for further evaluation. After reviewing and considering the suggestions and necessary corrections, the final instrument was used in this study.

The reliability of these research instruments was determined utilizing Cronbach's alpha coefficient. Doing so, the questionnaires were given to a total number of 20 members of the research community and then Cronbach's alpha coefficient was calculated. The reliability of the DSCAQ and DSEQ were estimated at 89% and 92%, respectively.

The reliability of the automatic biochemistry analyzer and blood glucose monitoring device were also calculated via equivalence reliability method. To this end, firstly, 10 blood samples were sent to another trusted laboratory and reexamined using the same devices with similar settings, and it was found that the results were equal and they were confirmed with r=0.7. Therefore, all the tests were conducted with the same methods and devices by a laboratory technician in the laboratory of the community health center No.3 in Shirvan.

The study protocol was approved by the Ethics Committee of Mashhad University of Medical Sciences, Mashhad, Iran. After obtaining permission from the School of Nursing and Midwifery, authorities, and heads working at the community health centers in Shirvan, the researcher referred to these centers and conducted the blood sampling lasting for 8 months. First, FBS levels were measured within the first visits for prenatal care on weeks 10-14 of pregnancy by automatic biochemistry analyzer and blood glucose monitoring device at the laboratory of the community health center No. 3 in Shirvan.

If the given levels were at the range of 93-125 mg/dl, the participants could be included in the study. Subsequently, all participants were informed of the research objectives and procedures as well as the confidentiality of data. Following that, the written consent was obtained, and the questionnaires were distributed among the eligible participants.

At the time of completing the questionnaires, the researcher also responded to the questions raised by mothers and resolved ambiguities. The questionnaires were distributed when the participants were

waiting for physicians' visits. The mean completion time of the questionnaires was 30 min, and they were collected by the researcher upon being completed.

The researcher also provided a contact number for more coordination with the control group. Moreover, a contact number was received from the participants in the intervention group for further referrals and completion of the questionnaires. In addition to routine care services, the intervention group attended three 90-minute educational face-to-face sessions every other day according to the constructs of Bandura's SET in the community health center No. 1. Accordingly, three educational intervention sessions were arranged according to various studies that had already employed this theory (20, 21). In addition, considering the specific characteristics of the target group (pregnant mothers), and due to the time constraints of the study, the organization of more educational intervention sessions was not possible since face-to-face education as the teaching method required much more time.

During the study, the researcher attempted to create diversity in education (practical along with theoretical) and not to make the 90-minute sessions boring for pregnant mothers. The educational intervention sessions lasted from early March 2017 to August 30, 2018, and totally about 200 h of education was presented to the participants.

Table 1 presents the layout of the educational intervention program sessions as well as educational objectives, methodology, and contents of the sessions. At the gestational age of 24-28 weeks (three months after the intervention), a post-test was administered to measure the sense of self-efficacy and self-care behaviors. The FBS levels were also measured in the laboratory of community health center No. 3 in Shirvan. The control group only received routine care services, including education in terms of the adherence to dietary regimens and practice of physical activities for 5-10 minutes along with routine blood tests.

All ethical considerations related to intervention-based research using human samples, such as presenting a written letter of introduction from the officials of the School of Nursing and Midwifery to the authorities in community health centers and obtaining written informed consent from the participants were observed in this study. During the study, the exclusion criteria form was also completed by the researcher. In total, 2 and 5 mothers in the intervention and control groups, respectively, were removed due to delivery or abortion before the final evaluation, and other participants were replaced in this study. Moreover, 3 and 7 mothers in the intervention and control

Table 1. Layout of educational intervention sessions

Sessions	Objectives	Educational content and method
First	Increasing awareness about diabetes and pre-diabetes and modeling a successful person with proper self-care behaviors	1. Teaching pre-diabetes, diabetes, and its complications, as well as self-care behaviors and their benefits through lectures and video clips 2. Conducting interviews with a person who had been able to properly control her blood sugar levels via self-care behaviors
Second	Teaching how to practice self-care behaviors, perform some of the self-care items, increase the sense of self-efficacy by doing these exercises, and recording self-care measures	1. Teaching adherence to dietary regimens and practice of physical activities through educational video clips, pamphlets, and lectures 2. Practicing physical activities 3. Providing a registration form for adherence to dietary regimens and physical activities (Construct of skillfully successful experiences)
Third	Reducing stress and anxiety and encouraging self-care behaviors	1. Teaching stress-coping techniques and strategies 2. Providing verbal persuasion for individuals after reviewing the registration form for adherence to dietary regimens and practice of physical activities 3. Giving gifts (Constructs of physiological and emotional states and verbal persuasion)

groups, respectively, were referred to endocrinologists two weeks after the onset of the intervention due to FBS levels greater than 93 mg/dl or blood sugar levels more than 120 mg/dl two hours later, and they were crossed out of the study.

The final analysis was performed on 90 patients in the intervention (n=47) and control (n=43) groups. Furthermore, blood sugar levels were measured three times during the study. The FBS levels were measured at the onset of the study (at the gestational age of 10-14 weeks). Two weeks later, FBS levels and blood sugar levels two hours after eating were measured, and eventually, FBS levels of participants were measured at the gestational age of 24-28 weeks (post-test).

The data were analyzed in SPSS software (version 22) through Kolmogorov-Smirnov and Shapiro-Wilk tests to determine the normality of the quantitative variables. In case of normality, parametric statistics were employed; otherwise, equivalent non-parametric ones were utilized in this study. Independent-sample t-test was employed to evaluate the homogeneity of the quantitative intervening variables with a normal distribution in both groups. Quantitative variables with a non-normal distribution were also analyzed via the Mann-Whitney U test. To compare normal variables before and after the intervention in each group, paired-sample t-test was used, whereas Wilcoxon signed-rank test was utilized for non-normal data, and Mann-Whitney U test was employed for intra-group comparison before and after the intervention. Furthermore, ANCOVA was performed to control self-care and self-efficacy variables before and after the intervention. P-value less than 0.05 was considered statistically significant.

Results

The mean ages of the study participants in the intervention and control groups were 28.9±7.1 and 29.3±6.2 years, respectively. The results of Mann Whitney U test did not show a significant difference between the two groups in this respect (P=0.69), and both groups were reported homogenous in terms of age. According to Table 1, there were no significant differences between the two groups considering all intervening variables, including pre-pregnancy body mass index , number of pregnancies, gestational age at the onset of the study, levels of education, history of gestational diabetes, history of high blood sugar levels during pregnancy, family history of diabetes, a history of giving birth to babies weighing more than 4500 g, a history of polycystic ovary, and information about gestational diabetes.

The mean±SD values of self-care behaviors at the pre-intervention stage were 25.4±9.9 and 24.8±5.4 in the intervention and control groups, respectively. The results of the independent-sample t-test did not show a significant difference in this regard (P=0.74). Additionally, the mean±SD of self-care behaviors at the post-intervention stage were 42.3±13.3 and 22.9±4.8 in the intervention and control groups, respectively. The results of the Mann Whitney U test revealed a significant difference in this respect (P<0.001).

Based on the results of Wilcoxon signed-rank, a significant difference was observed before and after the intervention regarding self-care behaviors in the intervention group (P<0.001). Moreover, there was a significant difference before and after the intervention in the control group based on the results of paired-sample t-test in terms of self-care behaviors (P<0.001, Table 2).

The mean±SD scores of the sense of self-efficacy at the pre-intervention stage were obtained at 76.7±15.3 and 58.9±23.7 in the intervention and control groups, respectively. The results of independent-sample t-test similarly showed a significant difference between the two groups in this regard (P<0.001). Moreover, the mean±SD scores of sense of self-efficiency at the post-intervention stage were 100.3±15.7 and 57.9±23.6 in the intervention and control groups, respectively.

The results of the Mann-Whitney U test also revealed such a significant difference between the two groups regarding the sense of self-efficiency (P<0.001). Moreover, the results of the Wilcoxon signed-rank test for the intervention group showed a significant difference before and after the

Table 2. Demographic characteristics of participants in the control and intervention groups

Variables	Groups		Test results
	Intervention (n=50) Mean±SD	Control (n=50) Mean±SD	
Age (year)	28.9±7.1	29.3±6.2	P*=0.69
Pre-pregnancy body mass index (kg/m^2)	27.0±4.7	26.7±5.6	P*=0.55
Gestational age (week)	11.7±1.4	12.0±1.5	P*=0.27
	Frequency (percentage)	Frequency (percentage)	
Levels of education			P***=-0.47
Elementary school	4 (80.0)	8 (16.0)	
Middle School	8 (16.0)	8 (16.0)	
High School	4 (80.0)	6 (12.0)	
High School diploma	17 (34.0)	10 (20.0)	
Associate's degree and higher	17 (34.0)	18 (36.0)	
Number of previous pregnancies			P***=0.35
One	16 (32.0)	14 (28.0)	
Two	14 (28.0)	12 (24.0)	
Three	18 (36.0)	16 (32.0)	
Four	2 (40.0)	6 (12.0)	
Five	0 (0.0)	2 (40.0)	
History of gestational diabetes			P***=0.24
Yes	2 (40.0)	5 (10.0)	
No	48 (96.0)	45 (90.0)	
History of high blood sugar levels during pregnancy			P***=0.56
Yes	8 (16.0)	6 (12.0)	
No	42 (84.0)	44 (88.0)	
Family history of diabetes			P***=0.40
Yes	16 (32.0)	22 (44.0)	
No	34 (68.0)	28 (56.0)	
History of giving birth to babies over 4500 g or higher			P**=0.26
Yes	2 (40.0)	6 (12.0)	
No	48 (96.0)	44 (88.0)	
Information about gestational diabetes			P***=0.40
Yes	20 (40.0)	16 (32.0)	
No	30 (60.0)	34 (68.0)	

*Mann-Whitney U test **Fisher's exact test ***Chi-square test

intervention in terms of self-efficacy in the intervention group (P<0.001). A significant difference was also observed in the control group regarding the sense of self-efficacy at the pre- and post-intervention stages based on the results of paired-sample t-test (P<0.001, Table 3).

Furthermore, ANCOVA was employed to evaluate the levels of self-care and self-efficacy before and after the intervention. The results indicated an improvement by 18.85±1.95 in the intervention group regarding self-care behaviors, compared to the control group (P<0.001). Moreover, the intervention group obtained higher scores by 30.57±3.8 in terms of a sense of self-efficacy, compared to control group (P<0.001, Table 4).

The FBS levels in mothers with pre-diabetes during pregnancy were also compared between two study groups. At the onset of the study, the FBS levels were 97.7±6.0 and 96.6±4.3 in the intervention and control groups, respectively. The results of Mann-Whitney U did not show a significant difference between the two groups in this respect (P=0.894).

Additionally, the FBS levels at the gestational age of 24-28 weeks were obtained at 75.8±6.7 and

Table 3. Mean ±SD of self-care, self-efficacy, and blood sugar levels in mother with pre-diabetes before and after intervention in both groups

Variables		Groups		Inter-group test results
		Intervention (n=50)	Control (n=50)	
		Mean±SD	Mean±SD	
Self-care behaviors	Before intervention	25.4±9.9	24.8±5.4	P*=0.74
	After intervention	42.3±13.3	22.9±4.8	P*<0.001
	Intra-group test results	P***<0.001	P****<0.001	
Sense of self-efficacy	Before intervention	76.6±15.3	58.9±23.7	P*<0.001
	After intervention	100.3±15.7	57.9±23.6	P**<0.001
	Intra-group test results	P***<0.001	P****<0.001	
Fasting blood sugar level	Before intervention	97.7±60.0	96.6±4.3	P**=0.89
	After intervention	75.8±6.7	85.4±9.7	P**<0.001
	Intra-group test results	P***<0.001	P***<0.001	

*Independent-sample t-test **Mann Whitney U test ***Wilcoxon signed-rank test ****Paired-sample t-test

Table 4. ANCOVA results on the effect of education based on Bandura's SET on self-care and self-efficacy in mothers with pre-diabetes during pregnancy

Variables		Mean	Standard deviation	t-statistic	P-value
Self-care behaviors	Intervention	18.85	1.95	9.62	P<0.001
	Control	0	-	-	
	Before intervention	0.357	0.124	2.88	
Sense of self-efficacy	Intervention	30.57	3.08	9.89	P<0.001
	Control	0	-	-	
	Before intervention	0.709	0.071	9.94	

85.4±9.7 in the intervention and control groups, respectively. This difference was significant according to Mann-Whitney U results (P<0.001). Moreover, the results of the Wilcoxon signed-rank test demonstrated that FBS levels had significantly reduced in the intervention and control groups (P<0.001). Comparing changes using the results of Mann-Whitney U test showed that blood sugar levels at the gestational age of 24-28 weeks had significantly decreased in the intervention group at the onset of the study (P<0.001).

Discussion

The purpose of the present study was to determine the effect of an educational intervention program based on Bandura's SET on self-care behaviors and sense of self-efficacy in mothers with pre-diabetes during pregnancy. The findings of this study revealed that the educational intervention program based on this theory had a significant impact on the improvement of the sense of self-efficacy in pregnant women with pre-diabetes. These results were consistent with the findings of the study conducted by Dehghan et al. (2015).

They examined the effect of education based on Social Cognitive Theory of Bandura on diabetes management self-efficacy in diabetic patients, and the results revealed that the given theory could increase the sense of self-efficacy regarding diabetes management. The findings of a study by Niknami et al. (21) on designing a self-efficacy educational program revealed the positive effect of self-efficacy on diabetic patients in terms of self-monitoring and reducing their blood sugar levels. The results of the above-mentioned study were consistent with the findings of this study (22).

The reason for the uniformity of the results of these studies was the use of Bandura's SET to improve the sense of self-efficacy. Moreover, the results of the present study were in line with the findings reported by Shi et al. (2010) and Ha et al. (2014). They found that educational strategies, such as behavioral patterns and verbal persuasion, among the constructs of Bandura's SET, improved the sense of self-efficacy in diabetic patients (23, 24). The reason for the consistency of the results in

these studies was the use of educational strategies, such as verbal persuasion as one of the constructs of Bandura's SET. In general, it was concluded that patients who had been verbally persuaded had specific abilities due to an increased sense of self-efficacy, and they could make more efforts to solve problems (15).

The findings of the present study indicated that educational intervention had a significant effect on the improvement of self-care behaviors in mothers with pre-diabetes during pregnancy. Accordingly, they had a greater sense of self-efficacy and much more abilities to understand the positive status of their health, and used diabetes self-care behaviors in their everyday life. These results were in agreement with the findings by Reisi et al. (2017). They investigated the effectiveness of an educational intervention program based on a self-efficacy model on the constructs of self-efficacy, waiting time, and outcomes to promote self-care behaviors and control blood sugar levels in patients with type-2 diabetes was. This study showed that the educational intervention based on the self-efficacy model had significant effects on the improvement of self-efficacy and consequently reduced blood sugar levels in diabetic patients; therefore, it was recommended to make use of such treatment and disease control programs for diabetic patients (25).

The reason behind the sameness of the results of these studies could be attributed to the use of Bandura's SET to enhance self-care behaviors. Since there is a close relationship between self-efficacy and self-care, individuals with higher levels of self-efficacy are more likely to have stronger motivations to practice some self-care behaviors in case of having some barriers. Accordingly, sense of self-efficacy is an important and effective prerequisite to successfully practice self-care behaviors (17).

In the same line, the results of a study by Kim et al. (2009) showed that the adherence to a physical activity program had not been improved after completing a phone-based distance learning program (26), which might be due to the higher age of the participants. It seemed that older patients suffering from disorders and chronic diseases were less likely to participate in such programs. Furthermore, the findings of the present study revealed a significant decrease in the mean blood sugar levels in the intervention and control groups three months after the onset of the study. However, reduced blood sugar levels were more significant in the intervention group, compared to those in the control group.

In this study, the control group only received routine care services, including verbal education by physicians and healthcare providers. It was assumed that such educational programs might not have the desired effectiveness and efficiency on patients' behaviors due to lack of attention to their attitudes as well as those of influential people and no concentration on reinforcing small achievements and a subsequently improved sense of self-efficacy.

However, the individuals in the intervention group not only received routine care services but also benefitted from a series of interactive and comprehensive educational sessions based on Bandura's SET. These findings demonstrated the effectiveness of educational programs based on theory-driven approaches rooted in behavior change models, compared to conventional ones (27). The results of this study were in harmony with the findings in the study by Cousins et al. (2003) entitled "21-day program of outpatient education and surveillance for patients diagnosed with gestational diabetes". This study focused on adherence to dietary regimens and practice of physical activities and how to monitor blood sugar levels on women with diabetes during pregnancy. To this end, this study included participants with a mean gestational age of 29 weeks at the onset of the study who had no need to inject insulin. Moreover, 79,526 blood samples were evaluated regarding sugar levels 4 times a day per patient. The results revealed that 64.8% and 74.1% of all blood sugar tests were in the target range (i.e., FBS levels below 90 mg/dl) at the end of the first and third weeks of education, respectively (28).

There were also some investigations that were in contrast with the present study, including those conducted by Grant et al. (2011) and Kaveh et al. (2012). Grant et al. (2011) aimed to determine the effect of a low glycemic index diet on blood sugar levels in women with gestational hyperglycemia who did not require insulin at the onset of treatment. In this study, FBS levels were measured at the

onset of the study and four weeks after the intervention by the laboratory. The findings showed no significant differences between the onset of the study and one month after the intervention regarding the mean changes in FBS levels in the intervention group (29).

The study by Kaveh et al. (2012) investigated the impact of education on nutrition and exercise on the levels of knowledge and metabolic control indicators of patients with gestational diabetes. The educational intervention lasted 6 h in one week using focus group discussion and lectures along with providing educational pamphlets. According to the results, no significant difference was observed between the intervention and control groups regarding the mean changes in FBS levels at the onset of the educational program and four weeks later (30). The results of such studies indicated the insignificant effect of common educational methods for blood sugar level control in mothers with gestational diabetes, confirming further efficiency of theory-driven educational intervention programs.

Although the findings of this study confirmed the effect of theory-driven educational intervention programs, there were some limitations including time constraints, low number of educational intervention sessions, as well as long-time educational sessions (90 minutes) for pregnant women. Therefore, there were attempts to control this limitation through the theoretical layout of sessions beside their practical ones, and the participants were encouraged by gifts. Moreover, the degree of adherence in individuals to self-care behaviors presented in the educational intervention sessions was not precisely evaluated; however, this limitation was to some extent controlled by providing the individuals with a checklist to record their self-care behaviors. Ultimately, there was the possibility of delivery or abortion in participants before final evaluation; consequently, they were excluded from the study, which could make sampling much longer.

Implications for Practice

Based on the results of this study, education based on Bandura's SET could increase the sense of self-efficacy and improve self-care behaviors in mothers with pre-diabetes during pregnancy and also help them control their blood sugar levels. Given the time constraints of the present study and the importance of providing education to this group of pregnant women, it was suggested to conduct a study with added educational intervention sessions and larger sample size using Bandura's SET for the education of mothers with pre-diabetes during pregnancy. Therefore, the risks of gestational diabetes could be prevented and subsequently the severity of its complications could be reduced via promoting self-care behaviors and sense of self-efficacy in mothers with pre-diabetes during pregnancy.

Acknowledgments

This study was extracted from a Master Thesis in Midwife Consulting approved by Mashhad University of Medical Sciences, Mashhad, Iran, with the registration number of IRCT20180117038419N1. We would like to appreciate the Research Deputy of Mashhad University of Medical Sciences, Mashhad, Iran, for their financial support. Moreover, the authors express their gratitude to all authorities at community health centers in Shirvan as well as the participants for their collaboration in this study.

Conflicts of Interest

The authors declared no conflict of interest regarding the publication of this study.

References

1. Landon MB, Spong CY, Thom E, Carpenter MW, Ramin SM, Casey B, et al. A multicenter, randomized trial of treatment for mild gestational diabetes. N Engl J Med. 2009;361(14):1339-48.
2. Carolan M. Women's experiences of gestational diabetes self-management: a qualitative study. Midwifery. 2013;29(6):637-45.

3. Ju H, Rumbold AR, Willson KJ, Crowther CA. Borderline gestational diabetes mellitus and pregnancy outcomes. BMC Pregnancy Childbirth. 2008;8(1):31.
4. National screening guidelines for diabetes. Tehran: Ministry of Health and Medical Education; 2015.
5. Hadaegh F, Bozorgmanesh MR, Ghasemi A, Harati H, Saadat N, Azizi F. High prevalence of undiagnosed diabetes and abnormal glucose tolerance in the Iranian urban population: Tehran Lipid and Glucose Study. BMC Public Health. 2008;8(1):176.
6. Chen MF, Wang RH, Hung SL. Predicting health-promoting self-care behaviors in people with pre-diabetes by applying Bandura social learning theory. Appl Nurs Res. 2015;28(4):299-304.
7. Yazdani A, Mansourian M, Faghihimani E. The effects of macronutrient intake on the risk of pre-diabetes in first-degree relatives of patients with type 2 diabetes. J Isfahan Med Sch. 2014;32(301):1475-86.
8. Noroozi A, Tahmasebi R, Rekabpour SJ. Effective social support resources in self-management of diabetic patients in Bushehr (2011-12). Iran South Med J. 2013;16(3):250-9.
9. Chen M, Haung SY. The relationship of blood glucose levels high risk factors and health promotion life style in a community diabetes screening program. J Health Educ. 2008;24:1-24.
10. Dodson NC. Prediabetes: factors related to self-care management among adults at risk for type II diabetes. Winston Salem State Univ. 2015;2(3):10-20.
11. Mazlom S, Firooz M, Hasanzade F, Kimiaee S, Raoufsaeb A. The effect of group counseling on physiological aspect of self-care and HbA1C level of patients with diabetes type II. Evid Based Care. 2015;5(2):25-36.
12. Peyman N, Behzad F, Taghipour A, Esmaily H. Assessment of the effect of a health literacy educational program for health personnel on promoting self efficacy among patients with chronic diseases. Health Syst Res. 2016;12(3):350-7.
13. Masoompour M, Tirgari B, Ghazanfari Z. The relationship between health literacy, self-efficacy, and self-care behaviors in diabetic patients. Evid Based Care. 2017;7(3):17-25.
14. Jemmott JB 3rd, Heeren GA, Ngwane Z, Hewitt N, Jemmott LS, Shell R, et al. Theory of planned behaviour predictors of intention to use condoms among Xhosa adolescents in South Africa. AIDS Care. 2007;19(5):677-84.
15. Serap Kurbanoglu S. Self-efficacy: a concept closely linked to information literacy and lifelong learning. J Documentat. 2008;59(6):635-46.
16. Sheykholeslami A, Ramezani S. The effectiveness of group hope therapy based on the snyder's theory on self-efficacy of physical and mobility impairments men. Quart J Soc Work. 2017;6(1):5-12.
17. Rezasefat Balesbaneh A, Mirhaghjou N, Jafsri Asl M, Kohmanaee S, Kazemnejad Leili E, Monfared A. Correlation between self-care and self-efficacy in adolescents with type 1 diabetes. J Holist Nurs Midwifery. 2014;24(2):18-24.
18. Stanford patient education research center. Stanford medicine. Patient Education in the Department of Medicine. Available at: URL: http://patienteducation.stanford.edu; 2008.
19. Kordi M, Banaei M, Asgharipour N, Mazloum SR, Akhlaghi F. Prediction of self-care behaviors of women with gestational diabetes based on Belief of Person in own ability (self-efficacy). Iran J Obstet Gynecol Infertil. 2016;19(13):6-17.
20. Mirzaei A, Mohammadi S, Mazloomi SS, Jalilian M, Hatamzadeh N. Promotion of sun protection in children: an educational intervention based on social cognitive theory to skin cancer prevention via mother education. Sci J Ilam Univ Med Sci. 2011;19(4):38-45.
21. Davazdah Emamy MH, Roshan R, Mehrabi A, Attari A. The effectiveness of cognitive-behavioral stress management training on glycemic control and depression in patients with type 2 diabetes. Iran J Endocrinol Metab. 2009;11(4):385-92.
22. Zareban I, Niknami S, Rakhshani F. The effect of self efficacy education program on reducing blood sugar levels in patients with type 2 diabetes. Health Educ Health Promot. 2013;1(1):67-79.
23. Shi Q, Ostwald SK, Wang S. Improving glycaemic control self-efficacy and glycaemic control behaviour in Chinese patients with Type 2 diabetes mellitus: randomised controlled trial. J Clin Nurs. 2010;19(3-4):398-404.
24. Ha M, Hu J, Petrini MA, McCoy TP. The effects of an educational self-efficacy intervention on osteoporosis prevention and diabetes self-management among adults with type 2 diabetes mellitus.

Biol Res Nurs. 2014;16(4):357-67.
25. Reisi M, Javadzade H, Mostafavi F, Jalilian F, Mahaki B, Sharifirad G. Effect of theory based education on blood sugar control in type-2 diabetic patients. Iran J Endocrinol Metab. 2017;18(6):420-31.
26. Kim HS, Oh JA. Adherence to diabetes control recommendations: impact of nurse telephone calls. J Adv Nurs. 2009;44(3):256-61.
27. Country guide for midwifery and women services. Tehran: Ministry of Health and Medical Education Family and Family Health Office Mothers' Health Office; 2017.
28. Cousins L, Catanzarite V, Istwan N, Rhea D, Stanziano G. A 21-day program of outpatient education and surveillance for patients diagnosed with gestational diabetes. Am J Obstet Gynecol. 2008;189(6):S108.
29. Grant SM, Wolever TM, O'Connor DL, Nisenbaum R, Josse RG. Effect of a low glycaemic index diet on blood glucose in women with gestational hyperglycaemia. Diabetes Rese Clin Pract. 2011;91(1):15-22.
30. Kaveh MH, Kiani A, Salehi M, Amouei S. Impact of education on nutrition and exercise on the level of knowledge and metabolic control indicators (FBS & PPBS) of gestational diabetes mellitus (GDM) patients. Iran J Endocrinol Metab. 2012;13(5):441-8.