

Self-Care Behaviors of Mothers with Gestational Diabetes Treated with Insulin Based on the Theory of Planned Behavior

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ABSTRACT

Background & aim: The prevalence of gestational diabetes during pregnancy is one of the major maternal and fetal complications. Self-care behavior could be an effective method to control gestational diabetes induced by pregnancy. The theory of planned behavior (TPB) is one of the popular conceptual frameworks for the study of human action and the prediction and understanding of particular behaviors, including self-care behavior. With this background in mind, this study was performed to evaluate the predictive factors for self-care behaviors based on TPB in patients with gestational diabetes treated with insulin.

Methods: This descriptive and analytical study was performed on 60 women with gestational diabetes treated with insulin referring to diabetes clinic of Ommolbanin Hospital in Mashhad, Iran in 2014. The samples were randomly selected and evaluated based on a researcher-made questionnaire of awareness, gestational diabetes self-care behaviors, the variables of the theory of planned behavior theory (TPB) (attitude, subjective norm, perceived behavioral control, and behavioral intention), and fasting blood glucose and two-hour postprandial blood glucose tests. Data analysis was performed in SPSS V.16 using descriptive and inferential statistics (correlation, multiple regression analysis, ANOVA, Kruskal-Wallis, and independent t-tests).

Results: A direct relationship was observed between intention and perceived behavioral control indices and self-care behaviors. Moreover, attitude affected self-care behaviors through both intention and perceived behavioral control. With regard to total effects of the variables, perceived behavioral control was the second predictive factor for self-care after behavioral intention.

Conclusion: TPB emphasizes on behavioral intention and perceived behavioral control, which could be used as a framework to design educational interventions for promotion of gestational diabetes self-care behaviors in mothers.

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Introduction

Gestational diabetes is the most common metabolic disorder in pregnant women, associated with serious maternal and neonatal complications (1). This phenomenon is initially diagnosed during late pregnancy (2). It is predicted that the number

of diabetic patients is projected to double by 2030, which will also affect pregnant women (3). The incidence of gestational diabetes is calculated at 1-14% worldwide (4). In a study by Khoshniat et al. (2008), the prevalence of gestational diabetes was

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estimated at 1.3-9.8% in 11 provinces of Iran, while this rate was 4.4% in women without the risk factors in Tehran, Iran (5).

Some of the most important maternal complications of gestational diabetes include increased risk of developing preeclampsia and eclampsia, birth canal injury caused by macrosomia, polyhydramnios, premature delivery, spontaneous abortion, and cesarean section (6, 7). Women with gestational diabetes are also faced with increased risk of permanent diabetes in the future (5).

Perinatal complications include fetal mortality, macrosomia caused by injuries during birth, shoulder dystocia, neonatal hypoglycemia, hyperbilirubinemia, and respiratory distress syndrome. The major risk factors for gestational diabetes include women aged ≥ 25 years, family history of type II diabetes, obesity, history of gestational diabetes, birth weight of >4 kg, history of stillbirth, and congenital defects (4).

In general, control and regulation of maternal blood glucose level could lead to the prevention of complications caused by gestational diabetes (8). In this regard, self-care plays a pivotal role in the maintenance of blood glucose level within the normal range, which could promote to fetal and maternal health (9). In addition, self-care behaviors are inherent to the monitoring of blood glucose level in patients with gestational diabetes (10), which include diet, physical activity, monitoring of blood glucose level, and use of prescribed drugs (11).

The results obtained by Glasgow et al. (1997) and Northam et al. (2006) revealed that self-care promotion was associated with better blood glucose monitoring (12, 13). It should be emphasized that adherence to self-care behaviors leads to reduced prevalence of diabetes complications in patients. Therefore, the identification of influential factors for self-care is essential in this regard (14). Meanwhile, there are a few confounding factors for self-care behaviors, including poor efficacy, economic status, and psychosocial issues of the patients, as well as lack of awareness and motivation regarding the results of these behaviors (15).

In a previous study by Heisler et al. (2002), it was demonstrated that adherence to self-care programs was accompanied by a reduction in the complications of diseases up to 50% (11).

The results by Azadbakht et al. (2014) recognized the factors affecting self-care behaviors; such examples are diabetes, age, family history of type II diabetes, education level, social support, perceived barriers, economic status, knowledge, subjective norms, and attitude (16). However, in one study by Baghaei et al. (2008), it was concluded that illiterate patients with type II diabetes had better self-care behaviors compared to literate subjects. In addition, individuals who lived alone and had no social support were reported to have better self-care abilities compared to those who lived with their families and children (17).

In a study by Khoshtarash et al. (2013), in which self-care behaviors and their factors were evaluated in patients with heart failure, no statistically significant relationship was observed between self-care behaviors and demographics of the participants (18).

Self-care behaviors are less common in women with gestational diabetes (19), which could be indicative of inadequate educational programs offered at the public health centers and diabetes clinics. One constant reason of this failure is lack of attention to the etiological studies and their foundation regardless of social cognitive theories, known as conceptual framework, in educational planning (20).

In order to change or maintain healthcare behaviors, such as self-care, medical teams should have sufficient information about influential factors of the learning process, which leads to behavioral modifications. The related theories could enhance the knowledge of healthcare professionals in this regard (21).

The behavioral change theories, including TPB, could be applied to familiarize patients with their diseases and reduce the incidence rate of subsequent complications (22). The theory of planned behavior (TPB) was created by Fishbein and Ajzen in 1980. This theory claims that individual's behavioral intentions could be predicted by the attitude towards behavior, subjective norms, and perceived behavioral control (23).

Attitude towards behavior is a person's sense of overall desire or hatred toward any specific behavior. Subjective norm is the perceived social pressure on a person's belief towards performing the intended behavior. Perceived behavioral control denotes the extent to which

an individual perceives their behavior to be in accordance with the established norm (24)

(Figure 1).

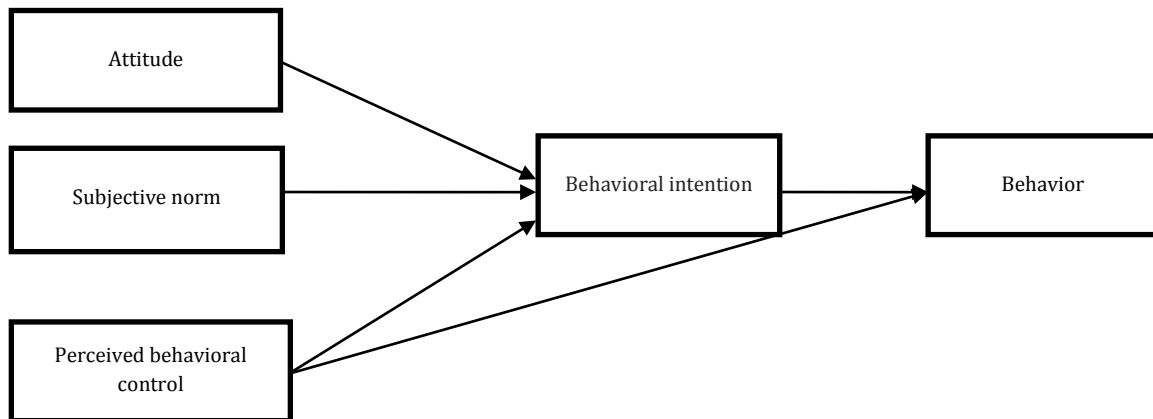


Figure 1. The theory of planned behavior (PBT)

TPB is widely applied for patient education and health promotion; such examples are healthy dietary behavior, exercise behavior, use of oral contraceptives, and participation in health screening programs. This theory can potentially explain 40% of the relationships between healthcare behaviors and intention. As a result, it could be argued that this model has a considerable ability to design educational interventions in order to change and promote the patients' behaviors (25, 26).

In this regard, a relationship was demonstrated between nutritional health behavior and behavioral intention in a study by Fila et al. (2006). In this study, behavioral health nutrition was independently related to attitude, subjective norm, and perceived behavioral control of the subjects (27). In a previous study by Didarloo et al. (2011), it was indicated that the extended theory of reasoned action predicted variances of behavioral intention and self-care behaviors in women with type II diabetes to be 41.6% and 26.2%, respectively. Moreover, among the factors with highest abilities to predict self-care behaviors were structures of attitude, subjective norm, and awareness of self-efficacy (28).

The increased prevalence of gestational diabetes and its complications, especially in mothers treated with insulin, has been developing serious concerns for healthcare systems around the world (19). The importance of factors affecting self-care of complicated mothers has given rise to the designation of appropriate and effective

educational interventions to prevent the maternal and neonatal complications of such diseases.

Given the lack of research in this area in Iran, this study aimed to evaluate the predictive factors for self-care behaviors based on TPB in mothers with gestational diabetes treated with insulin referring to the diabetes clinic of Ommolbanin Hospital in Mashhad, Iran in 2014.

Materials and Methods

This descriptive and analytical study was conducted on 60 pregnant women with gestational age of 24-30 weeks referring to the diabetes clinic of Ommolbanin Hospital in Mashhad in 2014. The participants were selected by convenience sampling method. Due to the lack of similar studies in this area, the sample size was determined based on the results of a pilot study performed on 20 mothers with gestational diabetes treated with insulin.

Furthermore, the correlation coefficient of the sample size was calculated with the confidence interval of 95% ($\alpha=5\%$) and test power of 80% ($\beta=20\%$). Given the correlation between perceived behavioral control and self-care behaviors ($r=0.190$), the sample size was calculated at 60 subjects based on the pilot study.

In the presence of the following factors, pregnant women referring to the selected healthcare center were invited to participate in the study: 1) fasting blood glucose level of ≥ 92 mg/dl based on the two-hour oral glucose tolerance test (OGTT) (dose: 75 g); 2) one-hour blood glucose

level of ≥ 180 mg/dl; 3) two-hour blood glucose level of ≥ 153 mg/dl; 4) diagnosis of gestational diabetes and 5) need for insulin treatment.

The research setting was selected so that the mothers with gestational diabetes treated with insulin could be easily contacted. In addition, all of the subjects were referred to the laboratory of this clinic from healthcare centers located at different areas of Mashhad.

The inclusion criteria of this study were as follows: 1) Iranian nationality; 2) basic literacy (primary education level); 3) gestational diabetes according to the results of a two-hour OGTT with 75 g dose of glucose and required treatment with insulin at the start of the research; 4) gestational age of 24-30 weeks (based on accurate data of the first day of the last menstrual period or the first trimester of pregnancy ultrasound); 5) lack of continuous use of glucocorticoids (due to underlying diseases); 6) lack of high-risk pregnancy (e.g., preeclampsia, erythroblastosis fetalis [fetal abnormalities], abnormal quantities of amniotic fluid, abnormal bleeding, placenta previa, and multiple pregnancy); 7) lack of unknown chronic diseases (e.g., diabetes, cardiac respiratory, and renal diseases, thyroid disorders, epilepsy, hyper-tension, anemia, and orthopedic limitations).

The exclusion criteria of this study were unwillingness to participate in the research and occurrence of major stressful events during the study period, such as death of a loved one, and serious diseases of the subjects, their child, or spouse.

Data collection tools included the questionnaire of demographic characteristics (e.g., age, gestational age, education, body mass index [BMI], and income status) and midwifery, researcher-made questionnaire of awareness about gestational diabetes, a TPB questionnaire, including attitude, subjective norm, perceived behavioral control, and behavioral intention variables, and the questionnaire of gestational diabetes self-care behaviors. In addition, blood glucose examination included fasting blood glucose and two-hour postprandial (2hpp) blood glucose tests. The awareness questionnaire evaluated gestational diabetes and contained 10 multiple-choice questions with minimum and maximum scores of one for correct answers and zero for wrong answers.

The TPB questionnaire assess each of the theory's major constructs, including questions about attitude (14 items), subjective norms (48 items), perceived behavioral control (28 items), and behavioral intention (18 items). In total, this questionnaire was consisted of 108 questions scored within the score range of 0-5 (very low, low, medium, high, and very high) based on a five-point Likert scale. The minimum and maximum obtainable scores of attitude were zero and 56, respectively. These values were zero and 112 for perceived behavioral control, and zero and 72 for behavioral intention. In addition, the minimum and maximum scores of subjective norm section were zero and four, respectively.

The samples were categorized into three groups in terms of attitude level: undesirable (0-18.6), relatively favorable (18.6-37.2), and favorable (37.2-56). In addition, they were classified into three groups regarding subjective norm level: undesirable (0-1.3), relatively favorable (1.3-2.6), and favorable (2.6-4). In terms of the level of perceived behavioral control, samples were categorized into three groups of undesirable (0-37.3), relatively favorable (37.3-74.6), and favorable (74.6-112). Finally, the subjects were classified into three groups of undesirable (0-24), relatively favorable (24-48), and favorable (48-72) in terms of the level of behavioral intention.

Gestational diabetes self-care behavior questionnaire contained 18 questions (five items related to physical activity, 11 items about diet compliance, one item related to the monitoring of blood glucose level, and one item about drug regimen compliance). The mean score of this questionnaire was the total score of four dimensions of diet compliance, physical activity, drug regimen compliance, and blood glucose monitoring. It is noteworthy to affirm that the mentioned mean score was calculated based on a five-point Likert scale, within the score range of 0-4 (very low, low, medium, high, and very high). In addition, the minimum and maximum scores were zero and 72, respectively.

In terms of the level of diet compliance, the participants were categorized into three groups of undesirable (0-14.6), relatively favorable (14.6-29.2), and favorable (29.2-44). In addition, they were divided into three groups regarding the level

of physical activity: undesirable (0-6.6), relatively favorable (6.6-13.2), and favorable (13.2-20). Furthermore, the subjects were classified into three groups in terms of the level of drug regimen compliance and blood glucose monitoring: undesirable (0-1.3), relatively favorable (1.3-2.6), and favorable (2.6-4), while they were divided into three groups regarding total self-care behavior: undesirable (0-24), relatively favorable (24-48), and favorable (48-72).

Content validity method was used to verify the validity of the article. In this regard, the questions were designed based on learning objectives and under the supervision of relevant experts. Afterwards, the questions were answered by 10 experts and professors of Mashhad University of Medical Sciences for assessment, followed by necessary suggestions and revisions to improve and provide the final tool.

Reliability of the questionnaire of awareness about gestational diabetes was calculated by split-half reliability method. Split-half reliability, a subtype of internal consistency reliability, was assessed through the calculation of the Guttman split-half coefficient, which was ($r=0.76$). To determine the reliability of the questionnaires in this study, the self-care behavior and TPB questionnaires were completed by 20 subjects. As for the reliability of the subcategories of the TPB questionnaire, the Cronbach's alpha for attitude, subjective norm, perceived behavioral control, behavioral intention, and self-care behavior were determined at 0.86, 0.92, 0.88, 0.85, and 0.84, respectively.

In order to comply with ethical issues, the objectives of the study were explained to the subjects, and they were assured of confidentiality terms regarding the privacy of information. In addition, participation in the study was voluntarily. In the next stage, the subjects completed demographics questionnaire, the questionnaire of awareness about gestational diabetes, the TPB questionnaire, and the questionnaire of gestational diabetes self-care behaviors in the presence of the researcher. Afterwards, an introduction referring letter was given to the samples in order to visit a clinic for fasting blood glucose and two-hour (after breakfast) postprandial glucose tests. Finally, blood glucose tests were performed on participants a week after completing the ques-

tionnaire at the laboratory of Ommolbanin Hospital in Mashhad.

According to the instructions of National Committee of Gestational Diabetes Mellitus in 2013 (29) and American College of Obstetricians and Gynaecologists (2013), fasting blood glucose level of ≥ 92 mg/dl and two-hour postprandial glucose level of ≥ 120 mg/dl were considered abnormal (30). Glucose oxidase method (Pars test blood glucose kit) was used to analyze fasting blood glucose and two-hour postprandial glucose tests. In this process, the biochemistry auto analyzer 3500 BT device was used by a fixed laboratory medicine personnel in the laboratory of Ommolbanin Hospital in Mashhad. Afterwards, in order to check the reliability of the results, the obtained blood samples were sent to another certified laboratory and were examined with similar devices in the same settings.

In this study, the Kolmogorov-Smirnov test was used to evaluate the normal distribution of data. Data analysis was performed in SPSS V.16 using multiple regression analysis, Pearson and Spearman's correlation coefficient, ANOVA, Tukey, Kruskal-Wallis, and independent t-tests. P-value of less than 0.5 was considered statistically significant in all the tests.

To determine the pattern of the factors for self-care behaviors of the samples, a regression-based path analysis was used with the constructs of TPB. Today, a more accurate statistical technique, recognized as multiple regression path analysis, is used to determine a causal model (especially if it is proposed to design an optimal model to design proper interventions).

In the path analysis, a variable or a number of variables were considered as the independent or dependent variables in the model. Path analysis in this study was conducted, using SPSS. In the early stage, by using multiple regression analysis, the effects of self-care behavior intention and perceived behavioral control were considered as the independent variables, while self-care behavior was regarded as the dependent variable. Since self-care behavior intention with a beta coefficient of 0.520 had the most significant effect on self-care behaviors, in the following stages, the significant effects of attitude and perceived behavior control were considered as the independent variables, while self-care

behavior intention was regarded as the dependent variable. In this study, the beta coefficient of subjective norm was not significant at an error level of < 0.05 ; therefore, this variable was excluded from the model.

The standard beta of multiple regression path analysis was considered as the coefficient of the path, which estimates the effects of independent variables on dependent variables. To determine the indirect effect of independent variables on dependent variables, the beta values of indirect effects were multiplied together. The total effect of independent variables on dependent variables was calculated based on the sum of direct and indirect effects.

Results

According to the results of this study, the mean age of the subjects was 31.9 ± 4.9 years, while the mean gestational age and BMI were 27.1 ± 1.4

weeks and 26.3 ± 2.0 kg/m², respectively. In addition, the mean disease duration in first-degree family members, diagnosed with type II diabetes, was 7.9 ± 6.0 years. Moreover, the mean fasting blood glucose level of the subjects was 96.35 ± 9.64 mg/dl, and the mean two-hour postprandial glucose level was 137.6 ± 12.2 mg/dl.

Meanwhile, the mean insulin intake of the samples was 9.40 ± 3.2 U/day. In total, 21.7% (n=13) of the participants reported gestational diabetes in their previous pregnancies, and 50% (n=30) had first-degree family members diagnosed with type II diabetes. The majority of the participants in this study had 0-3 children. The income status of 70% (n=42) of the participants was at a normal level. The education level of 35% of mothers (n=21) and 36.7% of spouses (n=22) was high-school diploma, and 63.3% (n=38) of the spouses were self-employed.

Table 1. Self-care behavior and the variables of planned behavior theory (TPB) based on demographic characteristics of subjects

Characteristics	N (%)	Self-care behavior	Variables of TPB				
			Attitude	Subjective norm	Perceived behavioral control	Behavioral intention	
		$\bar{X} \pm SD$	$\bar{X} \pm SD$	$\bar{X} \pm SD$	$\bar{X} \pm SD$	$\bar{X} \pm SD$	
Maternal education level	Primary education	10 (16.7%)	36.8±4.5	49.2±3.4	0.5±3.04	47.2±10.4	45.7±9.1
	Secondary education	18 (30.0%)	37.3±8.2	48.7±2.1	3.02±0.6	54.2±13.3	45.1±8.4
	High-school diploma	21 (35.0%)	37.9±10.3	51.0±3.9	3.2±0.5	57.0±16.1	45.1±9.1
	University	11 (18.3%)	42.7±0.9	50.3±3.2	3.2±0.2	67.3±8.2	51.9±12.4
	P-value		0.34	0.35	0.51	0.009	0.24
Education level of the spouse	Illiterate	3 (5.0%)	35.0±1.7	49.1±3.2	3.2±0.4	44.0±7.2	46.6±15.1
	Primary education	9 (15.0%)	38.4±5.6	49.6±4.6	2.9±0.7	52.7±9.5	48.5±5.9
	High school diploma	16 (26.7%)	38.2±10.1	49.1±6.6	3.4±0.4	53.9±14.5	44.7±12.2
	University	22 (36.7%)	37.6±7.4	48.9±4.5	3.0±0.5	57.5±13.9	44.5±7.6
	P-value		0.82	0.49	0.12	0.12	0.36
Income status	Insufficient	18 (30.0%)	38.5±7.1	49.3±4.4	3.0±0.6	48.2±12.03	43.4±8.7
	Sufficient	42 (70.0%)	38.4±9.5	49.9±5.2	3.1±0.4	59.9±13.9	47.7±9.9
	P-value		0.87	0.65	0.41	0.003	0.11
Occupational status of the spouse	Office clerk	9 (15.0%)	44.2±1.0	50.4±4.9	3.1±0.3	71.1±1.2	50.7±4.2
	Self-employed	13 (21.7%)	37.9±6.4	49.3±5.0	3.1±0.5	47.6±1.05	42.6±9.6
	Self-employed	38 (63.3%)	37.2±8.8	49.7±5.0	3.1±0.5	56.0±1.3	46.7±10.4
	P-value		0.24	0.89	0.95	<0.001	0.15

Kruskal-Wallis test indicated no statistically significant difference between self-care scores and demographics of the samples, including maternal

education level (P=0.34), education level of the spouse (P=0.82), occupational status of the spouse

(P=0.24), and income status (P=0.87). In addition, the results of one-way ANOVA test affirmed a significant difference between self-care scores and demographics of the participants, such as maternal education level (P=0.35), education level of the

spouse (P=0.49), occupational status of the spouse (P=0.89), and income status (P=0.65).

Moreover, no statistically significant difference was observed between the subjective norm and

Table 2. Distribution of subjects based on performing self-care behaviors

Self-care behaviors	Unfavorable	Relatively favorable	Favorable
	N (%)	N (%)	N (%)
Compliance with dietary	3 (5.0%)	45 (75.0)	12 (20.0%)
Physical activity performance	28 (46.7%)	27 (45.0%)	5 (8.3%)
Blood glucose monitoring	39 (65.0%)	7 (11.7%)	14 (23.3%)
Compliance with drug dietary	2 (3.3%)	5 (8.3%)	53 (88.3%)
Total self-care behavior	2 (3.3%)	52 (86.7%)	6 (10.0%)

demographics of the samples, including maternal education level (P=0.51), education level of spouse (P=0.21), occupational status of spouse (P=0.95), and income status (P=0.41). Similarly, no significant relationship was found between the behavioral intention score and demographic variables, such as maternal education level (P=0.24), education level of spouse (P=0.36), occupational status of spouse (P=0.15), and income status (P=0.11).

On the other hand, the results obtained by independent t-test revealed that the score of

perceived behavioral control was higher in women with sufficient income (59.9±13.9) compared to those with lower income status (48.2±12.03) (P=0.003).

The results of One-way ANOVA and Tukey tests marked that the score of perceived behavioral control was significantly higher in mothers with academic education (67.3±8.2) compared to those with primary education level (47.2±10.4) (P=0.009). On the contrary, no significant difference was observed between the other groups.

Table 3. Correlation coefficient between the variables of TPB, self-care behavior, awareness, and blood glucose level

Variables	Attitude	Subjective norm	Perceived behavioral control	Behavioral intention	Self-care behavior	Fasting blood glucose level	Two-hour postprandial blood glucose level	Awareness
Attitude	1	*r=0.38 P=0.02	*r=0.26 P=0.04	*r=0.34 P=0.001	r=0.11 P=0.3	r=-0.15 P=0.2	r=-0.08 P=0.5	r=0.18 P=0.1
Subjective norm		1	r=0.21 P=0.09	r=0.02 P=0.8	r=0.02 P=0.7	r=0.4 P=0.7	r=-0.02 P=0.8	r=0.005 P=0.9
Perceived behavioral control			1	*r=0.45 P<0.001	**r=0.42 P=0.001	r=-0.03 P=0.7	r=-0.23 P=0.07	**r=0.25 P=0.04
Behavioral intention				1	**r=0.64 P<0.001	r=0.22 P=0.09	r=-0.07 P=0.5	r=0.16 P=0.2
Self-care behavior					1	**r=-0.25 P=0.04	r=-0.09 P=0.4	**r=0.267 P=0.04
Fasting blood glucose level						1	r=0.21 P=0.1	r=-0.041 P=0.9
Two-hour Postprandial blood glucose level							1	r=-0.12 P=0.3
Awareness								1

*Pearson correlation coefficient

**Spearman correlation coefficient

Moreover, these tests indicated that the score of perceived behavioral control was

significantly lower in mothers, whose spouses were workers, (56.0±1.3) compared to those

with office clerks (71.1±1.2) or self-employed (56.0±1.3) spouses ($P<0.001$). The difference between other groups was not significant (Table 1).

According to Table 2, 65% and 46.7% of complicated mothers had an unfavorable attitude towards blood glucose monitoring behavior and physical activity, respectively, while compliance with drug regimen was at a satisfactory level in

88.3% of the cases. On the other hand, self-care behavior was at a favorable level in only 10% of the samples.

The results provided in Table 3 revealed a correlation among the structures of TPB, self-care behaviors, fasting and two-hour postprandial blood glucose level, and awareness indices.

According to the findings of Pearson test,

Table 4. Distribution of the variables of TPB in the studied population

variables	Unfavorable	Relatively favorable	Favorable
	N (%)	N (%)	N (%)
Attitude	0	2 (3.3%)	58 (96.7%)
Subjective norm	0	9 (15.0%)	51 (85.0%)
Perceived behavioral control	6 (10.0%)	45 (75.0%)	9 (15.0%)
Behavioral intention	0	26 (43.3%)	34 (56.7%)

Table 5. Results of regression analysis for evaluation of the predictors of self-care behavior based on TPB

Predictors variables	B	R2	P
Behavioral intention	0.520	%0.511	<0.001
Perceived behavioral control	0.323	-	0.003
Perceived behavioral control	0.374	***0.274	0.002
Attitude	0.313	-	0.009
Attitude	0.259	***0.051	0.046

* Dependent variable: self-care behavior, ** dependent variable: intention of self-care behavior, *** dependent variable: perceived behavioral control

subjective norm ($P=0.02$, $r=0.38$), perceived behavioral control ($P=0.04$, $r=0.26$), and behavioral intention ($P=0.001$, $r=0.34$) had a statistically significant direct relationship with attitude.

Moreover, Pearson test confirmed a direct and significant linear correlation between perceived behavioral control and behavioral intention ($P<0.001$, $r=0.45$). The results of Spearman test revealed that awareness ($P=0.04$, $r=0.267$), behavioral intention ($P<0.001$, $r=0.64$), and perceived behavioral control ($P=0.001$, $r=0.42$) had a statistically significant direct relationship with self-care behaviors.

Our findings were also indicative of a significant direct relationship between awareness and perceived behavioral control ($P=0.04$, $r=0.25$), as well as a significant inverse relationship between fasting blood glucose level and self-care behaviors ($P=0.04$, $r=-0.25$). The Spearman test suggested a significant inverse relationship between perceived behavioral control and number of children ($P=0.01$, $r=-0.364$).

The information of Table 4 indicated that attitude, subjective norm, and behavioral intention were at a favorable level in 96.7%, 85%, and 56.7% of the subjects, respectively. However, perceived behavioral control was satisfactory in only 15% of the samples, which represented low perceived behavioral control of mothers with gestational diabetes in the performance of self-care behaviors.

The results of the second phase of multiple regression path analysis, which was performed to determine the beta coefficients of predictive variables, are provided in Table 5. According to these findings, intention and perceived behavioral control predicted 51% of the changes in self-care behaviors. In addition, perceived behavioral control and attitude explained 27% of changes in self-care behavior intention. Table 6 demonstrated direct, indirect, and overall effects of predictive variables of self-care behavior. Evidently, among the variables affecting gestational diabetes self-care behaviors, the effect of behavioral intention was stronger compared to

the other factors, with attitude having the minimum impact on self-care behavior.

The schema of TPB obtained by multiple regression path analysis is summarized in

Table 6 Direct, indirect, and total effects of predictive variables of self-care behaviors based on regression-based path analysis

Dependent variable	Total effect	Indirect effect	Direct effect	Dependent variables
	-	-	-	Subjective norm
Self-care behavior	0.295	$(0.313 \times 0.520) + (0.259 \times 0.323) + (0.374 \times 0.520 \times 0.259) = 0.295$	-	Attitude
	0.520	-	0.520	Behavioral intention
	0.490	$(0.520 \times 0.323) = 0.167$	0.323	Perceived behavioral control

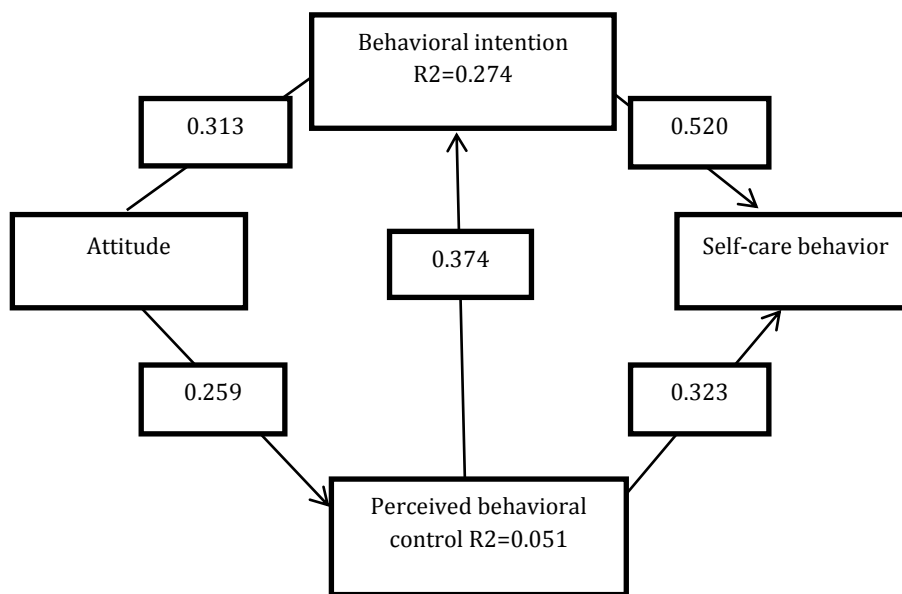


Figure 2. Predictors of self-care of mothers with gestational diabetes based on the results of the variables of PBT

Figure 2. According to this figure, behavioral intention and perceived behavioral control directly influenced self-care behaviors, while the effect of behavior intention was more significant in this regard. In addition, perceived behavioral control and attitude had an indirect effect on self-care behaviors. However, the subjective norm had no effect on behavioral intention and self-care behaviors.

Discussion

In this study, we aimed to evaluate the self-care predictors based on TPB in mothers with gestational diabetes treated with insulin

referring to diabetes clinic of Ommolbanin Hospital in Mashhad in 2014.

In total, the mean age of the subjects was 31.9±4.9 years, and their mean BMI was 26.3±2.0 Kg/m2. It was reported that 50% of the first-degree family members of the subjects had a history of type II diabetes. In a study by Akinsi et al. (2008), the mean age of 81 women with gestational diabetes treated with insulin was 31.4±5.1 years and their BMI was 26.2±4.5 Kg/m2. In addition, 44.4% of the subjects of the aforementioned study reported a history of type II diabetes in their first-degree family members

(31), which was consistent with the results of the present study.

With regard to fasting blood glucose level, the mean score of the subjects of the present study was 96.35 ± 9.64 mg/dl, and the mean of two-hour postprandial blood glucose level was 137.6 ± 12.2 mg/dl, which was indicative of a lack of suitable control of glucose by most of the research units. In a previous study by Reader et al. (2006), the mean fasting blood glucose level in 192 women with gestational diabetes treated with insulin was 96.6 ± 15.9 mg/dl (32), which was in line with our findings. In another study by El Lithy et al. (2014), the mean fasting blood glucose level of 80 women with gestational diabetes treated with insulin was 94.05 ± 14.33 mg/dl (33), which was less than the mean fasting blood glucose level observed in the current study.

However, our findings revealed no statistically significant difference between demographic variables and self-care behavior, attitude, subjective norm, and behavioral intention indices. Nevertheless, perceived behavioral control had a significant relationship with education level, income status, occupational status of spouse, and the number of children of the samples.

A previous study was conducted by Khoshtarash et al. (2013) to evaluate self-care behaviors and its contributing factors of patients with heart failure. The results were indicative of no statistically significant relationship between self-care behaviors and demographics of the subjects (18), which was in congruence with our findings.

Meanwhile, in a study by Tol et al. (2012), performed to assess the influential factors for self-management in patients with type II diabetes based on empowerment theory, all the demographics of the participants were significantly associated with diabetes self-management (34); this result was inconsistent with the findings of the present study. This contradiction might be due to demographic differences between mothers with gestational diabetes and mothers with type II diabetes. Moreover, perceived behavioral control was the only construct of TPB with a mean score of less than the obtainable mean value.

Perceived behavioral control consisted of the viewpoints of the participants toward the

contributing factors and barriers of behavioral performance and perceived power of individuals toward each of these factors (35, 36). The degree of perceived behavioral control is formed based on self-efficacy and the presence of resources and factors that might facilitate or impede performance of the behavior (37). Patients with high self-efficacy can more efficiently overcome the barriers to self-care, resulting in the higher level of self-care activities (38).

Although personal beliefs (attitude) and social pressure play a pivotal role in healthcare behavior changes, they might have less significant effects on behaviors with specific natures. Patients may believe in the effectiveness of self-care behaviors and their positive effects on the overall health. Also, they may be under pressure by family members and their acquaintances to adopt health-promoting behaviors. However, lack of skill, ability, confidence, and self-esteem of the patients might lead to inadequate performance of a specific self-care behavior recommended by the physician (28). Therefore, by creation, preservation, and progression of the perceived behavioral control in patients, we can increase the adherence of people to treatment recommendations and self-care behavior performance.

The results of the present study indicated that the mean perceived behavioral control was higher in the samples with sufficient income compared to those with unsatisfactory salaries. In a study by Amireault et al. (2008), conducted to evaluate the factors affecting physical activity, behavioral intention, and perceived behavioral control of people (aged 18-55 years), the total score of perceived behavioral control was higher in people with better income, compared to less economically privileged samples (39); this finding was in accordance with the current study.

Meanwhile, in a previous study by Pourvakhshoori et al. (2011), self-efficacy of healthcare behavior performance, including dietary habits, stress management, and physical activity was more observed in employees with low income, which was inconsistent with the present study. This issue could be due to the small number of samples with higher income than the determined limit (40).

In the present study, the mean perceived behavioral control of the participants with academic education was higher compared to those with primary education level. In one study by Bastani et al. (2011), the samples with academic education level had higher self-efficacy (9), which was in line with our results. Nevertheless, in another study by Rezasefat et al. (2014), no statistically significant relationship was found between self-efficacy and the education level among adolescents aged 11-20 years with type I diabetes (41), which was not in congruence with our findings. This difference could be due to the fact that the majority of the adolescents in the mentioned study had secondary and high school education.

Patients' positive attitude towards self-efficacy could be improved by promoting their education level and encouraging their active role and responsibilities in the society. The more they believe in their efficiency and ability to perform self-care behaviors, the more desirably they perform self-care behaviors (42).

The results of the present study revealed that the mean perceived behavioral control of the samples with employed spouses was higher compared to those with worker spouses. In a study by Abootalebi et al. (2012), it was determined that desirable occupational status of the samples was indicative of their higher education level and better income (43). The results offered by Pour vakhshoori et al. (2011) suggested a statistically significant relationship between healthcare behaviors and mean of monthly income and self-efficacy (40), which was consistent with the results of the present study.

In this study, there was a significant and reverse relationship between perceived behavioral control and the number of children. This could be indicative of a reduction in the mean score of perceived behavioral control by increased number of children. A previous study by Solhi et al. (2014) was performed to determine the health responsibility, spiritual health, and interpersonal relations based on TPB. According to the results, a significant and reverse relationship was found between perceived behavioral control and the number of children (44), which was in congruence with the results of the current study.

Nevertheless, in a study by Pour Vakhshoori et al. (2011), employed samples with more children had higher levels of self-efficacy to perform healthcare behaviors, which was inconsistent with our obtained results. However, this inconsistency in the results could be due a higher number of employees with more children in the mentioned study (40).

One of the perceived barriers to self-care behavior is high costs of self-care. With increased household size, per capita income of family members is reduced among urban households (8). The results obtained by Najafianzadeh et al. (2015) demonstrated that the number of children, income status, and household economic status were significantly associated with food insecurity (45). This also could be due to the fact that mothers spend the majority of their time caring for their children and have inadequate time for themselves. It was concluded in a study by Carolan et al. (2012) that one of the barriers to self-care behaviors was lack of time, due to family commitments, such as performing household chores and childcare (46). The results of this study indicated that only 10% of the participants had favorable status in terms of self-care behaviors. It seems that evaluation of the influential factors of self-care performance is of paramount importance.

According to the results of the current study, the majority of the subjects had unfavorable status regarding blood glucose monitoring behavior and physical activity, while they had favorable status in terms of drug regimen compliance. In a previous study by Baji et al. (2015), the maximum behavior score was related to the correct use of drugs in patients with type II diabetes, while the minimum behavior score was associated with blood glucose monitoring and physical activity (47). These results were consistent with our findings.

Nevertheless, a study by Jordan et al. (2010) was conducted to evaluate American-Filipina women with type II diabetes. The results were indicative of the weakest performance of the participants regarding proper use of drugs (48), which was incompatible with the results of the present study. This lack of consistency might be due to different cultural, social, and economic factors affecting the behavior of patients (49) in different societies. Patients' belief about the

effects of medications could justify higher self-efficacy in terms of drug regimen compliance in women with gestational diabetes treated with insulin (18).

Inadequate blood glucose monitoring in women with gestational diabetes might be due to the need for enhanced knowledge and skills in the regulation process of blood glucose monitoring, as well as the provision of facilities, such as glucometers and blood glucose test strips. Other factors involved in insufficient blood glucose monitoring were high costs of required equipment and tests for measuring the level of blood glucose, lack of skills in blood glucose monitoring, and lack of training sessions for patients (47). Among the main causes of the unwillingness of gestational diabetic patients to perform regular physical activities were lack of belief in the effectiveness of such activities, fear of fetal damage, inadequate training in this regard, and unavailability of appropriate facilities (50, 51).

The results of the current study affirmed that attitude, subjective norm, and behavioral intentions were favorable in the majority of the participants. However, perceived behavioral control was only observed in 15% of the subjects. A previous study by Hausenblas et al. (2008) aimed to predict physical activity intention and behavior in pregnant women using TPB. The obtained results indicated that the highest scores were related to attitude, subjective norm, and behavioral intention, while the lowest score was only associated with perceived behavioral control (52), which was consistent with our findings.

On the other hand, in a previous study by Agh Atabay et al. (2015), entitled as "the use of TPB to predict the behavior of salt consumption in rural women", the lowest scores were related to attitude and subjective norms; however, perceived behavioral control had the highest score among the variables of TPB (53). These results were not in line with the findings of the current study.

According to the literature, enhanced education could lead to an increased attitude score (54, 55). In this study, the low level of education (primary and secondary education levels) in the majority of women could be a factor of insufficient score of attitude in this regard (56%). In a

previous study, the subjects were residence of the villages of Sistan and Baluchestan. The obtained results were indicative of low education level of rural people living in deprived areas (56).

High education level is associated with the proper recognition of the significance of health issues and tendency toward positive healthcare behaviors in order to improve overall health (57). On the other hand, the healthy diet of family members, friends, and relatives encourages an individual to adhere to a healthy dietary regimen (14).

Studies have shown that low education level of effective subjective norms, such as parents, has a significant influence on adoption of unhealthy nutritional behaviors (58, 59). Similarly, low score of subjective norms associated with reduced salt consumption could be due to low education level of effective subjective norms, such as family members, and their inadequate awareness of the dangers of salt intake. Therefore, it is recommended that broad training programs be conducted for patient companions to improve their subjective norm (60).

Since perceived behavioral control depends on the presence or absence of facilitators and barriers to perform an act, the study subjects felt that they lack full authority over performing self-care behaviors due to the presence of these obstacles. One of the determining factors for performing self-care behaviors of diabetes was the barrier a patient is faced with during the performance of these behaviors. On the contrary, the abilities to overcome the barriers to perform diabetes self-care behaviors had a significant direct relationship with increased self-care behaviors (61). In addition, self-care behavior had a direct relationship with adequate skills to control diabetes (15), social support, good economic status, and sufficient motivation and knowledge induced by self-care programs (8).

If people believe that they do not have the resources or opportunities to perform the desired behavior, the possibility of performing the desired behavior will be less regardless of a positive attitude towards performing the desired behavior and a strong belief toward the confirmation of the performed behavior by other people (35, 36). In general, people perform healthcare behaviors, such as self-care, in an appropriate manner when

they believe they have control over these types of attitudes (62).

In this study, a significant direct relationship was observed between awareness and variables of self-care behaviors and perceived behavioral control. A previous study by Yarmohammadi et al. (2011) was conducted to evaluate the predictive factors for fast food consumption in high school students based on TPB. According to the obtained results, a significant relationship was found among knowledge, perceived behavior control, and fast food consumption behavior (63), which was in line with the results of the present study.

On the other hand, in another study by Morowati et al. (2009), no significant correlation was observed between the variables of awareness and self-efficacy and self-care behaviors in patients with rheumatoid arthritis (64); however, this result was inconsistent with our findings. In the present study, the level of knowledge of the participants about self-care behaviors was higher than moderate, which could be indicative of no significant relationship between self-efficacy and self-care. Similarly, perceived behavioral control might have the same correlation with self-efficacy. In other words, the variables of perceived behavioral control and self-efficacy are conceptually overlapped (65).

The relationship between awareness and variables of perceived behavioral control and self-care indicated that increased awareness of the subjects led to a greater possibility of adopting self-care behaviors. American Diabetes Association (ADA) suggested that awareness of diet and physical activities is crucial to implement necessary gestational diabetes self-care behaviors (66). In a previous study by Langer et al. (2005), it was demonstrated that lack of awareness resulted in feeble commitment toward self-care, followed by maternal and fetal complications (67).

The results of the present study indicated that women with better self-care had low fasting glucose levels. In the studies conducted by Baji et al. (2015) and Jafarian et al. (2010), a significant reverse relationship was observed between the mean scores of self-care and fasting glucose levels in patients with type II diabetes (47,68). These results were in line with the findings obtained in the current study. However,

it should be noted that these two studies had different sample population and research tools.

In the present study, two variables of intention and perceived behavioral control predicted 51% of self-care behaviors. In a study by Barati et al. (2014), intention and perceived behavioral control variables predicted 50% of smoking behaviors of the samples (69), which was consistent with the results of this study.

Meanwhile, in a study by Yarmohammadi et al. (2011), which was conducted to evaluate the predictive factors affecting fast food consumption in high school students, these two variables predicted only 6% of the behaviors (63). These conflicting research results might be due to the presence of several factors, such as individual factors (attitude, beliefs, and desires) socio-economic factors, sociocultural norms, and family characteristics (70).

The results of path analysis indicated that self-care behaviors were directly influenced by behavioral intention and perceived behavioral control; however, the impact of behavioral intention was more prominent. In line with our findings, behavioral intention had a greater impact on the power of prediction compared to other structures of this model in a study by Didarloo et al. (2012) entitled as "physical activity among women with type II diabetes: prediction by the extended theory of reasoned action" (57).

A previous study by Barati et al. (2014) was conducted to predict the cigarette smoking behavior in adolescents. While it was concluded that perceived behavioral control had a greater influence on the power of prediction compared to behavioral intention, the obtained results were not in congruence with the findings of the present study. This was probably due to the fact that behaviors, such as smoking, are sometimes performed unintentionally.

Peer-pressure and inability to say "no" were some of the factors for smoking among teenagers with no prior intention (69). It could be affirmed that occurrence of behavior is significantly increased by a strong relationship between intention and behavior. According to this theory, intention is the superior determinant of behavior (71).

The results of path analysis also indicated that self-care behavior performance was not

only affected by intention, but was also influenced by perceived behavioral control. Nevertheless, the results obtained by Rahaei et al. (2012) revealed that attitude of the subjects towards the behavior of self-monitoring blood pressure was only influenced by intention, which was inconsistent with our findings (72).

In the current study, subjective norms had no effect on intention and self-care behaviors. Similarly, no relationship was observed between subjective norms and citizen's behavior of fruit and vegetable consumption in a study by Gholami et al. (2014) (73).

Furthermore, a previous study by Esperat et al. (2007) was performed to evaluate the factors for health promotion behaviors. The results revealed that social protection was not a significant predictor of health promotion behaviors (74). This could be due to the special condition of the participants (pregnancy), who were in need of other facilitating factors for healthcare behaviors (75). Inconsistent with our findings, a significant relationship was found between subjective norms and the behavior of self-monitoring of blood pressure of patients with hypertension in the results obtained by Rahaei et al. (2012) (72).

People under peer-pressure are more encouraged to perform self-care behaviors compared to those with no social pressure (76). According to the literature, social protection is one of the most fundamental factors for improving the overall health of the patients with chronic diseases (77, 78). The majority of chronic diseases are properly managed under the influence of family and friends.

According to the results of the present study, most of the participants had primary level education. Lack of high-level education was associated with perceived social support from family, since family members with a low education level believed that their patient was incapable of overcoming the challenges associated with the disease. Therefore, the family mainly focuses on the patient's activities, such as adherence to the treatment regimen and expert opinion (79). This could justify the discrepancy between the present findings and the results reported in the mentioned research.

In the current study, perceived behavioral control was a stronger predictor of behavioral

intention compared to attitude. In a study by Mazloomi et al. (2008), a significant relationship was observed between perceived behavioral control and behavioral intention to use safety helmet compared to attitude (80), which was in line with our obtained results. However, in one study by Yarmohammadi et al. (2011), attitude was a stronger predictor of intention for fast food consumption in high school students compared to subjective norm and perceived behavioral control variables (63); this finding was incompatible with the results of the present study.

In this regard, Ajzen and Fishbein (1975) declared that the relative importance of subjective norms, attitudes, and perceived behavioral control for prediction of intentions of people might be different in various types of behaviors and societies (81).

The results of the present study were indicative of a direct linear relationship between attitude and variables of subjective norm, perceived behavioral control, and behavioral intention. Moreover, a significant relationship was found between perceived behavioral control, behavioral intention, and self-care behaviors.

In a study by Yekaninejad et al. (2012), a significant and direct linear relationship between was observed between attitude and variables of subjective norm, perceived behavioral control, and behavioral intention. In addition, a significant correlation was found between behavior of physical activity in high school students and the variables of perceived behavioral control and behavioral intention (65). These results were consistent with the findings obtained in the present study.

On the other hand, no statistically significant relationship was observed between salt consumption behavior of the participants and the variables of attitude, subjective norm, perceived behavioral control, and behavioral intention in a study by Agh Atabi et al. (2015). However, a significantly direct relationship was found between the attitude of the subjects and behavioral intention, subjective norm, and perceived behavioral control variables (53).

The direct and significant associations between the constructs of TPB affirmed that influential factors, such as beliefs and attitudes towards self-care behavior and perceived behavioral control, play a pivotal role in these

behaviors and intentions (71). In the present study, a significant relationship was observed between self-care behaviors and theoretical variables of subjective norms, perceived behavioral control, and behavioral intention.

In a previous study by Ashoogh et al. (2013) entitled as "utilizing TPB to predict the safe driving behaviors in truck drivers", no significant and direct relationship was found between driving behavior of the samples and variables of subjective norms and behavioral intention (82). These findings were in line with the results of the current study. Incompatible with our findings, no significant and direct linear relationship was observed between subjective norms and variables of behavioral intention and perceived behavioral control in one study by Yekaninejad et al. (2012) entitled as "determination of the predictive value of TPB for physical activity in adolescents" (65).

Studies have shown that parents and peers (subjective norms) play a pivotal role in the performance of physical activity behaviors by young adults. In other words, peer and social pressure are associated with the increased level of self-confidence to perform physical activities. These factors are also known as the most important influential indices for the participation of individuals in physical activities in the majority of cases (83).

Conclusion

In this study, a significant association was observed between self-care behaviors and the variables of TPB, especially the indices of perceived behavioral control and behavioral intention. Therefore, it is recommended that this theory be used to design educational interventions, which could lead to enhanced self-care behaviors in women with gestational diabetes. According to the results of the present study, it is crucial to highlight the role of intention and perceived behavioral control variables.

Moreover, factors for promotion of self-care behaviors in the patients with gestational diabetes included maternal education, income status, occupational status of spouse, and the number of children in the family. Therefore, it is suggested that further research be carried out in order to evaluate the subjective norms, attitudes, and other influential factors for self-care behaviors.

Given the significance of perceived behavioral control as the major determinant of self-care behaviors of mothers with gestational diabetes treated with insulin, it is necessary to improve this factor among mothers who are less capable in this area. These people should realize that in spite of the barriers of gestational diabetes, they still have the ability to perform self-care behaviors to control this disease.

Providing healthcare facilities for patients with gestational diabetes could help overcome some of the barriers of self-care behaviors. Therefore, it is recommended that educational programs be designed and conducted to so that mothers with gestational diabetes could overcome the healthcare barriers and perform self-care behaviors to control this disease.

The major drawback of this study was the fact that it relied on subjective reports of the participants that might lead to biased results. In addition, only some of the influential factors for self-care behaviors and effective components of blood glucose level were evaluated in the present study. Clearly, further research will be needed to examine other factors affecting self-care behaviors of mothers with gestational diabetes.

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Conflicts of Interest

The authors declare no conflicts of interest.

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