The Relationship of depression, anxiety, and stress with self-care behaviors in women with gestational diabetes

Masoumeh Kordi (MSc)[1], Mahsima Banaei Heravan (MSc)[2,3*]

[1] Assistant Professor; Nursing and Midwifery Care Research Center, Mashhad University of Medical Sciences, Mashhad, Iran
[2] Lecturer, Department of Midwifery, Faculty of Nursing and Midwifery, Pregnancy Health Research Center, Zahedan University of Medical Sciences, Zahedan, Iran
[3] MSc in Midwifery, Master in Midwifery, Faculty of Nursing and Midwifery, Mashhad University of Medical Sciences, Mashhad, Iran

A R T I C L E I N F O	A B S T R A C T
Article type: Original article *Article History:* Received: 29-Jun-2019 Accepted: 05-Nov-2019 *Key words:* Anxiety Depression Stress Self-care Gestational diabetes	***Background & aim:*** Gestational diabetes is the most common metabolic disorder in pregnancy, and lack of self-care is one of the important reasons for mortality in diabetic patients. Considering that glycemic control is controlled by physiological and psychological mechanisms, it seems that depression, anxiety, and stress could affect the performance of pregnant women towards their own self-care. This study aimed to determine the relationship of depression, anxiety, and stress with self-care behaviors in women with gestational diabetes. ***Methods:*** This descriptive correlational study was conducted on 400 females with gestational diabetes who referred to health-care centers and clinics of hospitals affiliated to Mashhad University of Medical Sciences, Mashhad, Iran, in 2015. Data were collected using a demographic questionnaire, a self-care scale retrieved from the Summary of Diabetes Self-Care Activities as well as Depression, Anxiety, and Stress Scale-21. The data were analyzed in SPSS software (version 22) through the Spearman correlation coefficient and multiple linear regression. ***Results:*** The results of the Spearman correlation coefficient revealed that depression, anxiety, and stress had no significant correlation with self-care (P>0.05). According to the linear regression model, none of the main variables under study obtained a significant level of less than 0.05; therefore, they were not considered as predictors of self-care (P>0.05). ***Conclusion:*** Since the results revealed that depression, anxiety, and stress had no correlation with self-care in females with gestational diabetes, further studies are recommended to be conducted in this regard with a larger sample size and in different settings.

Introduction

The prevalence and incidence of diabetes continue to increase in most countries without stopping, and it is expected that the number of people with diabetes will reach 300 million by 2025 (1). The World Health Organization has predicted that diabetes will affect about 6.8% of the population in Iran by 2025 (2). Gestational diabetes is defined as varying degrees of carbohydrate intolerance which is first started or diagnosed during pregnancy (3), and its prevalence is increasing worldwide (4). According to the estimation of the World Health Organization, the prevalence of this disease in 2035 will be about 1.5 times higher than that in 2000 (5).

In a review study conducted by Khoshniyat et al. (2008), the prevalence of diabetes was estimated at 4.4% among risk-free females in Tehran, Iran (6). Factors contributing to insulin resistance before pregnancy seem to be more damaging during pregnancy and are among the risk factors for gestational diabetes (7). About 70% of gestational diabetes cases are without clinical symptoms (8, 9). Complications of

* *Corresponding author:* Mahsima Banaei Heravan, Lecturer, Department of Midwifery, Faculty of Nursing and Midwifery, Pregnancy Health Research Center, Zahedan University of Medical Sciences, Zahedan, Iran. Tel: 00989127298776; Email: banaeihm@yahoo.com

gestational diabetes include increased incidence of polyhydramnios and preeclampsia, need for labor induction and cesarean section (10, 11), shoulder dystocia, hypoglycemia, neonatal jaundice, and hyper bilirubinemia(10). Born children are also susceptible to future obesity and diabetes (12). Approximately, 20% of the patients also maintain glucose tolerance disorder in the postpartum period (13).

These issues confirm the necessity of providing appropriate therapeutic facilities for the more optimal control of diabetes mellitus, which also has psychological benefits for the patient (1). In females with gestational diabetes mellitus (GDM), nutrition therapy and low carbohydrate-controlled diet are the main intervention strategies in order to control blood glucose levels and reduce complications of this disease (14). In this regard, walking is also recommended at least three times a week for 30 min (14). In a systematic review conducted by Tobias et al. (2011) in the United States, it was shown that the risk of gestational diabetes in women with high physical activity was 24% lower than that in women with low physical activity (15). Furthermore, the results of the study performed by Chasan et al. (2008) in the United States indicated that the physical activity even to a lesser extent than that given in the current guidelines may be associated with a reduced risk of gestational diabetes in American women (16).

Females with severe hyperglycemia and those who cannot regulate their blood sugar by diet and physical activity need insulin to control their blood sugar (17, 18). The American Diabetes Association recommends self-monitoring of blood sugar three or more times a day in diabetic pregnant women who use insulin (19, 20).

Finally, success in the treatment of diabetes depends on the individuals' ability to adopt effective self-care behaviors, such as adherence to medication, diet, exercise, and self-monitoring glycemia (21). One of the most comprehensive theories of self-care is Orem's self-care theory (22). In this theory, self-care is considered as a regulative function of human species; moreover, it is required for providing necessary equipment in order to sustain life and maintain its physical and mental performance and development of the individual within the natural and appropriate

limits for life and comprehensiveness (23). Support for self-care includes improved health and quality of life, increased patient satisfaction, rational use of services, and reduced health costs (24). A study conducted by Heisler et al. (2002) in the United States indicated that adherence to self-care programs reduced the incidence of diabetes complications by more than 50% (25). The results of the studies carried out by Glasgow et al. (1997) in the United States and Northam et al. (2006) in Australia have shown that self-care promotion is associated with improved metabolic control, self-efficacy, and better control of blood sugar in diabetic patients (26, 27).

On the other hand, psychological factors appear to be involved in controlling the disease (28). In a study conducted by Peyrot et al. (1997) on 578 diabetic outpatients, diabetes was found to be associated with an increased risk of psychological disorders and symptoms (29). Dietary restrictions, drug treatment, blood glucose control, poor clinical outcomes, economic decline caused by illness, and inadequate compatibility styles are the causes of depression in diabetics (30). Depression is the fourth leading cause of disability in the world and is predicted to become the second leading cause of disability by 2020 (31). Lee Rowe et al. (2008) and Kogan et al. (2007) reported that type 2 diabetic patients suffered from high levels of depression (32, 33). The first symptom of depression is a decrease in motivation and interest followed by a decrease in activity, efficiency, life expectancy, and self-care, as well as a tendency to die (34). Depression is undiagnosed and untreated in two-thirds of diabetic patients (30). Prenatal depression is an important and significant issue that affects 12-20% of mothers (31). Depression in pregnancy can lead to inattention, lack of prenatal care, lack of self-care, inadequate nutrition, smoking, medication, low birth weight, and preterm delivery (35).

Birami quotes McKay et al. (2011) that depressed and high-stress pregnant women have lower levels of performance than non-depressed women (36). Furthermore, depressed patients with diabetes are likely to be less adherent to drug and dietary treatments, which in turn will lead to poorer glycemic control (28).

Anxiety is another common mental disorder in people with diabetes. Anxiety rates have been

reported to be between 7% and 15% in the Iranian population (37), and it is more common in diabetic patients than the general population (38). Studies have shown that the risk of anxiety doubles in those suffering from diabetes (39). Anxiety is defined as a feeling of stressed, anxious, and frightened with common signs and symptoms of sweating, heartthrob, headaches, and restlessness (40). This disorder is one of the most common symptoms in pregnant mothers (41). Babies of stressful and anxious mothers are at an increased risk of restlessness and low birth weight (42). On the other hand, insulin therapy is an invasive procedure that requires daily repetition and is difficult to follow (43). Anxiety induced by injection is the first psychological barrier to adherence to daily insulin injection in patients with diabetes (44). Evidence suggests that improving psychological conditions can lead to positive therapeutic outcomes (28).

On the other hand, psychological factors are potentially a mediator for the relationship between stress and diabetes control, especially in the youth community (45). Stress is the adverse reaction of individuals to severe pressures or other types of cases that are imposed on them (46). Moreover, it is the most prominent symptom in the clinical behaviors and symptoms of pregnant women. Pregnancy stress can have consequences for the fetus, including low birth weight, preterm labor (41), mental retardation at the age of two (36), delay in walking and speaking, sleep and emotional disturbances, and motor disorders (47). Stress can indirectly affect blood sugar levels by intensifying behavioral changes and patients' non-adherence to health-care regimes (48).

Undoubtedly, the diagnosis of diabetes is a major source of stress for the family and may change the family's normal life course. These changes begin shortly after diagnosis. Therefore, by identifying the level of anxiety, interventions can be made to reduce anxiety and prevent its associated consequences (44). There is a dearth of research investigating gestational diabetes during pregnancy (49); moreover, a limited number of studies have been conducted in this regard in Iran. Therefore, the present study aimed to determine the relationship of depression, anxiety, and stress with self-care among women with gestational diabetes who referred to the midwifery clinics and public hospitals (i.e., Omolbanin, Imam Reza, and Ghaem) affiliated to Mashhad University of Medical Sciences, Mashhad, Iran, in 2015.

Materials and Methods

This descriptive-predictive correlational study was performed on 400 females with gestational diabetes in Mashhad, Iran, from June to November 2015. The study population consisted of all women with gestational diabetes who were admitted to the healthcare centers and midwifery clinics of public hospitals (i.e., Omolbanin, Imam Reza, and Ghaem) affiliated to Mashhad University of Medical Sciences, Mashhad, Iran. A multistage sampling method was utilized to perform the sampling. Initially, all centers in Mashhad were selected through a stratified sampling method and a number of centers under categories (proportional to all centers covered by each center) were randomly selected as cluster. Subsequently, a number of health centers were selected for sampling from each cluster through sortition according to the covered population (proportional to size).

The participants were selected from those who referred to the clinics and health centers. A total of 15 health centers were selected. The study protocol was approved by the Ethics Committee of Mashhad University of Medical Sciences, Mashhad, Iran (IR.MUMS.REC.1394.137). It should be noted that all participants were informed of the research objectives and procedures, and written informed consent was obtained from them.

The sample size was obtained at 398 people based on the results of a preliminary study on 30 females with gestational diabetes with a 95% confidence level and 80% test power. Accordingly, 418 people were included in the study considering the sample attrition. The inclusion criteria were: 1) Iranian nationality, 2) residency in Mashhad, 3) minimum level of education (i.e., fifth grade at elementary school), 4) singleton pregnancy, 5) gestational diabetes diagnosed by a physician based on an oral glucose tolerance test, 6) elapsed time of at least a week since diagnosis because self-care questionnaire measures self-care activities for the past seven days, 7) lack of speech and hearing disorders that prevent communication with the researcher, 8) lack of drug addiction, 9)

no record or current medical or mental illnesses, 10) no occurrence of stressful accidents during six months prior to the study and during the study, 11) no record of infertility, 12) no history of abnormal newborn or fetus, 13) lack of education in medical sciences, and 14) access to telephone to make or receive telephone calls.

On the other hand, the females who terminated their pregnancy before the completion of follow-up and hospitalization were excluded from the study. The data were collected using demographic characteristics forms, midwifery questionnaires, and a self-care questionnaire obtained from the Summary of Diabetes Self-Care Activities (SDSCA) developed by Toobert and Glasgow (50), as well as Depression, Anxiety, and Stress Scale (DASS-21) (51).

The self-care questionnaire is a 14-item short self-report instrument measuring the dietary self-care activities (n=6), physical activity (n=2), blood glucose level monitoring (n=3), insulin injections (n=1), oral medication (n=1), and smoking (n=1) of the patients during the past 7 days. The participants were asked to report their self-care behaviors related to diabetes, except smoking, on a continuum from 0 (i.e., I did not do it at all in the last week) to 7 (I did it every day in the last week). In addition, the question related to smoking was given a score of either 0 (i.e., smoking) or 1 (i.e., not smoking). Considering the fact that merely diet, physical activity, implementation of blood glucose levels monitoring, insulin injections or metformin consumption, or any of these cases together were recommended to the individuals, they responded to the questionnaire based on the type of treatment.

Since the individuals were subjected to different treatments, there were variations in the number of answered questions and their scores. For homogenization of the total score of the questionnaire, the total score of each individual from the questionnaire was divided by the number of questions answered, and the final score of self-care was determined on the basis of 0-6.57.

The DASS-21 has been introduced by Lovibond and Lovibond (1995) in the form of a 21-item scale measuring depression (questions 21, 17, 16, 13, 10, 5, and 3), anxiety (questions 20, 19, 15, 9, 7, 4, and 2), and stress (questions 18, 14, 12, 11, 8, 6, and 1). The scoring is based on a 4-point Likert scale from 0 (none) to 3 (very high). Moreover, depression, anxiety, and stress scores range from 0 to 21. Therefore, the scores of 5-6, 4-5, 8-9 indicate mild depression, anxiety, and stress. The scores of 7-10, 6-7, and 10-12 signify moderate depression, anxiety, and stress. In addition, severe depression, anxiety, and stress are denoted by the scores of 11-13, 8-9, and 13-16, respectively. Moreover, the scores equal to 14 or greater, 10 or greater, and 17 or greater present extremely severe depression, anxiety, and stress, respectively.

The self-care questionnaire and DASS-21 obtained good content validity. Furthermore, Mollahadi (2010) and Mahmoudi (2010) confirmed the validity of DASS-21 in Iran (52, 53). Additionally, the reliability of the DASS-21 and self-care questionnaire were obtained through Cronbach's alpha coefficient at $\alpha=0.70$ and $\alpha=0.83$, respectively. Furthermore, the reliability coefficients of the depression, anxiety, and stress were estimated at $\alpha=0.66$, $\alpha=0.62$, and $\alpha=0.61$, respectively.

At the beginning of the study, people who were eligible based on the inclusion and exclusion criteria were requested to complete the demographic form, self-care questionnaire, and DASS-21 in 30 min. The self-care questionnaire was completed three times. After the completion of the first version, two versions of the self-care questionnaires were given to the participants to complete at the end of each week during the next 2 weeks. At the end of 2 weeks, they were asked to refer to the health center or clinic to deliver them. One or two days before the visit, a phone call was made as a reminder. The final score obtained from the self-care questionnaire was the mean of these three measurements. After a 2-week follow-up, fasting blood glucose and 2 h postprandial glucose level were also recorded. The data were analyzed using SPSS software (version 22) through the Spearman correlation coefficient and multiple linear regression. A P-value less than 0.05 was considered statistically significant.

Results

In total, 18 participants were excluded from the study due to not delivering the questionnaires after follow-up (n=12),

pregnancy termination before the end of the follow-up (n=1), hospitalization (n=3), and unwillingness to continue the study (n=2). Accordingly, the final analysis was performed on 400 individuals.

The mean age of the participants was 31.34±5.6 years, and the mean body mass index was 27.59±4.8 kg/m^2. In addition, 159 (39.8%) cases had high school degrees, and 363 (90.8%) females with GDM were housewives. Regarding the socioeconomic status, 224 (56%) participants were included in the average socioeconomic status group. Moreover, 331

participants (82.8%) had wanted pregnancies, and 85 ones (21.2%) had a history of gestational diabetes. All 400 participants (100%) were under recommended diet, physical activity, and blood glucose levels monitoring; in addition, 124 (31%) and 11 (2.75%) individuals were asked to use insulin and metformin, respectively. Furthermore, 11 (2.75%) females were recommended to use metformin and insulin. Totally, 371(92.8%) participants were interested in learning self-care activities (Table 1).

Table 1: Frequency distribution of females with gestational diabetes regarding the level of education, occupation, socioeconomic status, type of pregnancy, history of gestational diabetes, and interest in learning self-care activities

Variable	Number (percentage)
Level of education	
Elementary school	85 (21.2)
Middle school	57 (14.2)
High school	159 (39.8)
University degree	99 (24.8)
Job	
Housewife	363 (90.8)
Employed	28 (7.0)
Student	9 (2.2)
Socio-economic status*	
First class	11 (2.8)
Second class	115 (28.7)
Third class	224 (56.0)
Fourth class	47 (11.7)
Fifth class	3 (0.8)
Type of pregnancy	
Wanted	331 (82.8)
Unwanted	69 (17.2)
History of gestational diabetes	
Yes	85 (21.2)
No	315 (78.8)
Interest in learning self-care activities	
Yes	371 (92.8)
No	29 (7.2)
Total	400 (100.0)

*Classification of the participants is based on their spouses' type of occupation (the first and fifth classes are considered the lowest and highest regarding the socio-economic status, respectively.

The mean±SD values of depression, anxiety, stress, and self-care were obtained at 4.62±3.8, 5.19±3.7, 6.56±4.2, and 3.99±0.8, respectively. Table 2 tabulates the frequency distribution of females with gestational diabetes in terms of

severity of depression, anxiety, and stress (Table 2).

Moreover, the mean±SD values of fasting blood glucose and 2 h postprandial glucose at the beginning of the study and after 2 weeks are shown in Table 3 (Table 3).

Table 2: Frequency distribution of females with gestational diabetes regarding the severity of anxiety, depression, and stress

Severity of anxiety, depression, and stress	Depression Number (percentage)	Anxiety Number (percentage)	Stress Number (percentage)
No symptoms	233 (58.2)	160 (40.0)	252 (63.0)
Mild	64 (16.0)	68 (17.0)	59 (14.8)
Moderate	66 (16.5)	76 (19.0)	48 (12.0)
Sever	22 (5.5)	41 (10.2)	32 (8.0)
Extremely sever	15 (3.8)	55 (13.8)	9 (2.2)
Total	400 (100.0)	400 (100.0)	400 (100.0)

Table 3: Mean±SD values of fasting blood glucose and 2 h postprandial glucose at the beginning of the study and after 2 weeks in females with gestational diabetes

Variable	Mean±*SD	
	At the beginning of the study	2 weeks after the study
Fasting blood glucose (mg/dl)	107.93±34.7	95.67±22.3
2 h postprandial glucose (mg/dl)	154.38±43.6	129.55±38.1

*SD=Standard Deviation

Spearman test results showed no significant linear relationship of depression, anxiety, and stress with self-care (Table4).

Table 4: Spearman correlation coefficient results regarding the relationship of depression, anxiety, and stress with self-care

	Test Result	
Variable	*r*	*P*
Depression	-0.03	0.517
Anxiety	-0.03	0.485
Stress	-0.04	0.415

Finally, depression, anxiety, and stress as independent variables and self-care as a dependent variable were entered into the multiple linear regression model. The results showed that none of the variables (i.e., depression, anxiety, and stress) obtained a significant level less than 0.05; therefore, they were not considered as predictors of self-care (Table 5).

Table 5: Linear regression test results regarding the relationship of depression, anxiety, and stress with self-care

Variable	β	df	*R*	*F*	Test result (*P*)
Depression	0.004	1	0.017	0.114	0.736
Anxiety	0.004	1	0.019	0.145	0.703
Stress	-0.004	1	0.018	0.134	0.714

Meanwhile, there was no significant linear relationship between self-care and fasting blood glucose level after a 2-week follow-up (P=0.373, r=0.04); however, after a 2-week follow-up, a significant linear relationship was observed between self-care and 2 h postprandial glucose level (P=0.016, r=0.12).

It should be noted that the simultaneous effects of intervening variables were investigated on the relationship of depression, anxiety, and stress with self-care using a multiple regression model in this study. According to the results, there were significant multiple correlations between the studied variables and self-care, except for occupation (i.e., employed) that was removed from the regression model (R=0.212, P=0.040, F=1.520, df=12). However, out of variables in the regression model, age (P=0.024, β=0.019) and history of gestational diabetes (P=0.042, β=0.223) correlated separately and significantly with self-care (Table 6).

Table 6. Multiple correlation test results regarding the effect of demographic and midwifery variables on the relationship of depression, anxiety, and stress with self-care in females with gestational diabetes

Variable	β	P	$Exp.\beta$
History of gestational diabetes	0.223	0.042	0.104
Age	0.019	0.024	0.119
Occupation (housewife)	0.147	0.404	0.049
Interest in learning self-care activities	0.134	0.431	0.040
Type of pregnancy	0.050	0.679	0.022
Anxiety	0.012	0.535	0.051
Depression	0.007	0.706	0.030
Body mass index	-0.009	0.316	-0.052
Education	-0.019	0.676	-0.023
Stress	-0.019	0.272	-0.094
Socio-economic status	-0.029	0.661	-0.023
Occupation (i.e., student)	-0.261	0.440	-0.044

Discussion

This study aimed to determine the relationship of depression, anxiety, and stress with self-care behaviors in females with gestational diabetes. The results showed that 58.2%, 40%, and 63% of the women with GDM had no depression, anxiety, and stress, respectively. These results may be due to the short duration of gestational diabetes since some factors (i.e., duration of illness) have greater impacts on strengthening the association between depression and diabetes. In fact, increased duration of illness leads to the onset of disease complications and the hopelessness to recover from the disease that appears in the form of depression (30).

However, there is a significant correlation between the severity of depression and the duration of diabetes in a study conducted in Semnan, Iran. Moreover, the increased rate of diabetic complications increases the rate and severity of depression in patients (54). Zahiruddin et al. (2003) conducted a study to assess depression in 100 patients with type 1 and type 2 diabetes. They employed a simple method to diagnose depression and remind the need for more attention to this disease and its timely treatment. The results obtained from the Beck Depression Inventory showed that 67.6% and 84.1% of the patients with type 1 and type 2 diabetes had depression, respectively. Moreover, 91% and 30.4% of the patients with and without diabetic complications were depressed, respectively.

Additionally, the participants were compared in terms of duration of illness (i.e., at least five years in one group and more than five years in another group) and its association with depression. The results revealed significant differences between the two groups in this regard (P<0.05) (55).

Furthermore, in a study conducted by Dowlatabadi et al. (2010), the severity of depression was evaluated in 383 type 2 diabetic patients regarding the contextual characteristics using the Beck Depression Inventory. According to the results, 72% of the diabetic patients had depression, and the depression rate increased with increasing duration of illness (56). Based on a study performed by Taziki et al. (2001), there was a relationship between depression symptoms and diabetes in 150 insulin- and non-insulin dependent diabetic patients using the Beck Depression Inventory. The results of the aforementioned study showed that 61.3% of the participants were depressed; moreover, 40.6% of the diabetic patients had moderate to severe depression. There was also a significant statistical relationship between the duration of diabetes and depression (57).

A study carried out by Garduno et al. (1998) on type 2 diabetic patients in Mexico concluded that 46% of them were depressed, and the duration of diabetes was a risk factor for depression (58). Similarly, Mahmoudi et al. (2004) conducted a study on 227 diabetic and 151 non-diabetic patients using a 21-item Beck Depression Inventory. According to the results, 77% of diabetic patients had depression (59). Gilden et al. (2003) also found that 75% of the patients with type 2 diabetes suffered from depression (60). In the same line, Nejati Safa et

al. (2007) conducted a study to determine the correlation between depression and glycemic control with quality of life in 100 patients with type 1 and type 2 diabetes using Hospital Anxiety and Depression Scale. The results indicated that 66% and 59% of the participants had depression and anxiety disorders, respectively (61).

The results of a study performed by Momeni Javid et al. (2014) on 100 pregnant women with a definite diagnosis of gestational diabetes and 100 healthy pregnant women using Cohen's Perceived Stress Scale showed that perceived stress in gestational diabetes group was 82% (49). The inconsistencies between the results of the present study and the aforementioned studies can be attributed to the differences in the studied population and the method of measurement. Moreover, the DASS-21 scale was used in the present study; however, the mentioned studies applied other questionnaires to measure depression, anxiety, and stress. Additionally, the present study was conducted on females with gestational diabetes, whereas Mahmoodi et al. (2004), Gulden et al. (2003), Zahir al-Din et al. (2003), and Nejati Safa et al. (2007) performed their studies on males and females with type 1 and type 2 diabetes. According to the results, the prevalence of depression in those with diabetes was affected by the type of disease and the place of residence (i.e., advanced developing countries) (30). On the other hand, as noted in some studies (54-58), the duration of the illness and its complications played effective roles in the development of depression.

In the present study, the mean±SD of self-care among females with gestational diabetes was obtained at 3.99±0.8, and the scores obtained from the self-care questionnaire ranged from 0 to 6.57; therefore, they obtained average self-care scores. However, Momeni Javid et al. (2014) performed a study in Tehran, Iran, using a questionnaire related to self-care during pregnancy and a 13-item researcher-made questionnaire with scores ranged from 0 to 100. The mean score of self-care among women with gestational diabetes was 71.9 which was at a favorable level (4).

In the same line, Hamadzadeh et al. (2013) conducted a study on 285 type 1 and type 2 diabetic patients in Tehran, Iran, to determine the correlation between the coping styles and self-care behaviors using a 15-item SDSCA measure with scores ranged from 0 to 99. The self-care mean score of participants was 51.4 which was an average score, and the majority of the individuals obtained poor and average self-care scores (62). It seems that the discrepancies in the self-care activities of participants in the current study, compared to those in the studies by Momeni Javid et al. (4) and Hamadzadeh et al. (62) was due to differences in sample size, the way the patients measured self-care, and the research site. On the other hand, the studied population in the present study were also different from those in the study conducted by Hamadzadeh et al. (62). In this study, the self-care questionnaire retrieved from SDSCA, and the individuals were followed up for 2 weeks for self-care; in addition, the final score of self-care was the mean score of the three measurements; therefore, the likelihood of forgetting self-care activities was reduced in this study.

On the other hand, Momeni Javid et al. (4) utilized a researcher-made pregnancy self-care questionnaire, and the SDSCA measure was used by Hamadzadeh et al. (62). It should be noted that these questionnaires were merely completed at the beginning of the study through interviews in both studies. In addition, age is one of the factors affecting self-care. Since the mean age of the participants in the current study was higher than that in a study carried out by Momeni Javid et al. (4), it can be considered as another reason for the inconsistencies between the present study and the study performed by Momeni Javid et al.

In the present study, depression, anxiety, and stress had no significant correlation with self-care behaviors that can be resulted from the short duration of gestational diabetes, as well as short-term treatment and follow-up (i.e., two weeks).

Taziki et al. (2001) conducted a study on 150 insulin- and non-insulin-dependent diabetic patients to determine the relationship between depression and diabetes. The results showed no statistically significant relationship between depression and control of diabetes according to glycated hemoglobin values (57). Similarly, Rezaeian et al. (2017) investigated the effect of

stress, anxiety, and depression on prenatal self-care behaviors in females at the risk of preterm labor. The results showed no significant linear relationship between anxiety and self-care; however, self-care correlated significantly and inversely with pregnancy stress and depression (63).

In a study conducted by Sajjadi et al. (2008) on the relationship between self-care and depression in patients who underwent maintenance hemodialysis, there was a strong and negative relationship between self-care and depression (64). A study was conducted by Weng et al. (2008) to investigate the effect of self-efficacy and self-care behaviors on the depression symptoms in kidney transplant recipients in Taiwan. The results indicated a strong negative relationship between depression and self-care (65).

Gonzales et al. (2007) performed a study to determine the relationship between depression and self-care behaviors in type 2 diabetic patients. They reported an inverse relationship between depression and self-care behaviors (66). In the same line, Park et al. (2004) investigated the association between depression and self-care behaviors in type 2 diabetic patients. According to the results, a significant negative relationship was observed between depression and self-care behaviors (67). Similarly, Dehghani et al. (2014) evaluated the effect of patients' familiarity with cardiac surgery on their anxiety level before undergoing coronary artery bypass graft surgery (68). The results of the aforementioned study were inconsistent with the findings of a study performed by Ezati (2012) in which the effect of awareness about self-care behaviors was investigated on the level of fear and anxiety among patients suffering from cardiovascular diseases (69).

The inconsistencies in the results could be attributed to the differences in the study population, data collection tools, and the employed approaches. Other causes for discrepancies between the present study and the studies conducted by Wang et al. (2008), Gonzales et al. (2007), and Park et al. (2004) include cultural, psychological, and social differences that can affect the results of the studies.

In the present study, fasting blood glucose and 2 h postprandial glucose levels reduced after a 2-week follow-up. Furthermore, there was a significant linear relationship between self-care and 2 h postprandial glucose level after a 2-week follow-up. Studies have also confirmed that maintaining the optimal blood glucose levels post-meal is preferred to that before meals in gestational diabetes (3). In this study, the participants were advised by health-care providers, such as midwives to follow self-care behaviors, including following a diet and physical activity, monitoring blood glucose, having timely and accurate insulin injection, or taking oral medication to lower blood glucose. As a result, the individuals in this study were aware of self-care behaviors.

On the other hand, early-stage diagnosis of gestational diabetes along with a balanced diet and regular exercise caused 80% of women to achieve good control of blood glucose (14). In addition, physical activity can lower fasting blood glucose and postprandial glucose (70), and in some females with GDM, it is likely to eliminate the need for insulin injections (14). In this regard, the results of a study carried out by Davenport et al. (2008) on 30 females with GDM in Canada showed that nutrition therapy with insulin therapy plus walking program reduced blood glucose levels as well as the need for insulin injections (13).

One of the limitations of this study was the utilization of a self-report questionnaire for assessing self-care activities. The patients' responses were trusted, and fasting blood glucose and 2 h postprandial glucose level were also recorded after a 2-week follow-up. There are also a number of strengths in this study. The individuals were followed up for 2 weeks regarding self-care, and the participants were requested to complete the self-care questionnaires once at the beginning of the study and twice within 2 weeks after the inclusion in the study. The final score of the self-care was the mean of these three measurements, and as a result, the possibility of forgetting self-care activities was reduced in this study. Further studies are recommended to investigate the effects of Orem's self-care model-based training on depression, anxiety, and stress in females with gestational diabetes and larger sample size.

Conclusion

According to the results of the present According to the results of this study, females with gestational diabetes are experienced fewer self-care behaviors, depression, anxiety, and stress. This finding indicates the need for more attention to self-care behaviors during pregnancy. Accordingly, the incidence of diabetes can be prevented during pregnancy by educating and increasing the awareness of pregnant women about having a proper lifestyle and implementing any intervention that can lead to a better lifestyle in this period.

Acknowledgements

Conflicts of interest

Authors declared no conflicts of interest.

References

1. Esmaili A, Asadnia S, Easazadeh A, Amirsardari L, Issazadeghan A, Ansari B. Evaluation of the effectiveness of cognitive behavioral therapy on decreasing depression levels and improving the lifestyle of patients with type 2 diabetes. Journal of Urmia University of Medical Sciences. 2013;24(10):812-22.(Persian).

2. Namazi N, Esfanjani A, Avari M, Heshmati J. Dioica fruit extract hydrocarbons and some indicators of insulin sensitivity in patients with type 2 diabetes Alhtaby. Hamedan Med J. 2011;18(2):1-10.(Persian).

3. Cunningham F, Leveno KJ, Bloom S, Hauth J, Rouse D, Spong C. Volume three of Williams Obstetrics. 24nd ed. New York: Mc Graw Hill; 2018. P. 322-3.

4. Momeni javid F, Simbar M, Dolatian M, Alavi Majd H. Comparison of pregnancy self-care, perceived social support and perceived stress of women with gestational diabetes and healthy pregnant women. Iranian Journal of Endocrinology and Metabolism. 2014;16(3):156-64.(Persian).

5. Almasi Z, Salehiniya H. The prevalence of gestational diabetes mellitus in Iran(1993-2013): a systematic review. J Isfahan Med Sch. 2014;32(299):1-17.(Persian).

6. Khoshniyat Nikoo M, Abbaszadeh Ahar Najani S, Larijani B. Studies examining the prevalence of gestational diabetes mellitus in diffrent parts of Iran. Iranian Journal of Diabet and Lypid. 2008;8(1):1-10.(Persian).

7. Zhang C, Schulze M, Solomon C, Hu F. Prospective study of dietary patterns, meat intake and the risk of gestational diabetes mellitus. Journal of Diabetologia. 2006;49(11):2604-13.

8. Delavari A, Mahdavi Hazaveh A, Norouzinejad A, Yarahmadi S. The doctor and diabetes. The ministry of health and medical education: Sidra publisher; 2004. P. 15-6. (Persian).

9. Ghasem zadeh S, Dadmanesh M, Safari A, Ebrahimi S. The study on the knowledge ,attitude and function of gestated mother's about gestational diabetes that referred to army khanvadeh hospital from 2005 to 2006. JAUMS 2007;5(3):1325-30. (Persian).

10. Ju H, Rumbold AR, Willson KJ, Crowther CA. Borderline gestational diabetes mellitus and pregnancy outcomes. BMC pregnancy and childbirth. 2008;8(31):1-7.

11. Kaveh M, Kiani A, Salehi M, Amooei S. The effect of nutrition and exercise, the level of knowledge and indicators of metabolic control in patients with gestational diabetes. Journal of Iran Endocrinology and Metabolism. 2012;13(5):441-8.(Persian).

12. Symons Downs D, Ulbrecht J. Understanding exercise beliefs and behaviors in women with gestational diabetes mellitus. Journal of Diabetes Care. 2006;29(2):236-40.

13. Davenport M ,Mottla M, McManus R, Gratton R. A Walking Intervention Improves Capillary Glucose Control In Women With Gestational Diabetes Mellitus: A Pilot Study. Appl Physiol Nutr Metab. 2008;33(3):511-7.

14. Hosseinzadeh M. "The effect of multiple teaching methodsto preventive behavior of postpartum type 2 diabetes in gestational diabetic women attendance to Mashhad health centers"(dissertion) , Iran University; 2015.(Persian).

15. Tobias D, Zhang C, Van Dam R. Physical activity before and during pregnancy andrisk of gestational diabetes mellitus: a meta-analysis. Diabetes Care Journal. 2011;34(1):223-9.

16. Chasan Tuber L, Schmidt M, Pekow P, Sternfeld B, Manson J, Solomon C. Physical activity and gestational diabetes mellitus among hispanic women. J Womens Health(Larchmt). 2008;17(6):999-1008.

17. Langer O, Conway D, Berkus M, Xenakis E, Gonzales O. A comparison of glyburide and insulin in women with gestational diabetes mellitus. The New England journal of medicine. 2000;343(16):1134-8.

18. Lee Parritz A. Contemporary management of gestational diabetes. Curr Opin Endocrinol Diabetes Obes. 2011;18(6):395-400.

19. Laird J, McFarland K. Fasting blood glucose levels and initiation of insulin therapy in gestational diabetes. Endocr Pract. 1996;2(5):330-2.

20. Statement P. Standard of medical care in diabetes. Diabetes Care Journal. 2004;27:15-34.

21. Parizad N, Hemmati Maslakpak M, Khalkhali H. Promoting self-care in patients with type 2 diabetes: tele-education. Hakim Res J. 2013;16(3):220-7.(Persian).

22. Habibzadeh H, Davarpanah M, Khalkhali H. The study of the effect of orem self care model on self efficacy in hemodialysis patients in Urmia medical science hospitals during 2011. J Urmia Nurs Midwifery Facul. 2012;10(2):190-9. (Persian).

23. Naji A, NaroieS, Abdeyazdan G, Dadkani E. Effect of applying self-care orem model on quality of life in the patient under hemodialysis. Zahedan J Res Med Sci 2012;14(1):8-12. (Persian).

24. Rafieefar S, Attarzadeh M, Ahmadzadeh Asl M. Comprehensive system of empowering people to take care of their health. 1st ed. Tehran: Mehrravash; 2005. P. 30-40, 57-84. (Persian).

25. Heisler M, Bouknight R, Hayward R, Smith D, Kerr E. The relative importance of physician communication, participatory decision making, and patient understanding in diabetes self-management. J Gen Intern Med. 2002;17(4):243-52.

26. Glasgow R, Hampson S, Strycker L, Raggiero L. Personal-model beliefs and social-environmental barriers related to diabetes self-management. Diabetes care. 1997;20(4):556-61.

27. Northam E, Todd S, Cameron F. Interventions to promot optimal health outcomes in children with type 1 diabete. Are They Effective Diabete Med. 2006;23(2):113-21.

28. Vala M, Razmandeh R, Rambol K, Nasli Esfahani E, Ghodsi Ghasemabadi R. Mindfulness-based stress reduction group training on depression, anxiety, stress, self-confidence and hemoglobin A1c in young women with Type 2 diabetes. Iranian Journal of Endocrinology and Metabolism. 2016;17(5):382-90.(Persian).

29. Peyrot M. Levels and risks of depression and anxiety symptoms among diabetic adults. Diabetes Care. 1997;20(4):585-90.

30. Ghaedi Heydari F, Toghian Chaharsoghi N. The effect of simultaneous incidence of diabetes and depression. Jorjani Biomed J. 2012;0(1):1-8.(Persian).

31. Baghi V, Ghanei R, Roohi M, Ghoreishi H, Moradi N. The Relationship between antenatal depression and sleep apnea. Iran J Obstet Gynecol Infertil 2013;16(52):18-24.(Persian).

32. Liro N, Bocanegra A, Dzhan S, Wang S, Stolz N, Acosta I, et al. Clinical depressive symptoms. Nurs Res. 2008;21(3):223-33.

33. Kogan M, brody C, Crawley P, Logan W. Correlates of elevated depressive symptoms among rulel African adults with type 2 diabetes. Affect Disorder. 2007;17(1):106-12.

34. Ghanei R, Golkar F, Aminpoor E. Foot carein depressed and non-depressed diabetic patients. Modern Cares J. 2013;10(2):124-31.(Persian).

35. Rezaeian S, Abedian Z, Latifnejad Roudsari R, Mazloum S, Dadgar S. The relationship of prenatal self-care behaviors with stress, anxiety and depression in women at risk of preterm delivery. IJOGI. 2017;20(3):68-76.(Persian).

36. Bayrami M, Zahmatyar H, Bahadori K. Prediction strategies to coping with stress in the pregnancy women with first experience on based factors hardiness and social support. Iran J Nurs Res. 2013;7(27):1-9.(Persian).

37. Ashoori J. The effects of Meta-cognitive therapy on generalized anxiety disorder and depression among patients with type 2 diabetes. Diabetes Nursing. 2015;3(2):19-29.(Persian).

38. Grigsby B, Anderson R, Freedland K, ClouseR, Lustman P. Prevalence of anxiety in adults with diabetes: a systemic review. J Psychosom Res. 2002;53(6):1053-60.

39. Collins M, Corcoran P, Perry I. Anxiety and depression symptoms in patients with diabetes. Diabetic medicine : a journal of the British Diabetic Association. 2009;26:153-61.

40. Tagharrobi Z. Effect of recitation of Quran on the anxiety of patients with myocardial infarction. Evidence Based Care. 2014;4(1):7-16.(Persian).

41. Jabbari Z, Hashemi H, Haghayegh S. Survey on effectivenessof cognitive behavioral stress management on the stress, anxiety and depression of pregnant women. J Health Syst Res. 2013;8(7):1341-7. (Persian).

42. Cuhadaroglu F. Observing depression and anxiety together in adolescents: a review. Turkish J Psyciatry. ١٩٩٣;١٨٣:٤-٨.

43. Mollema E, Snoek F, Ader H, Heine R, Van Der Ploes H. Insulin treated diabetes patients with fear of self injecting or fear of self testing psychological comorbidity and general well being. J Psychosom Res. 2001;51(5):665-72.

44. Ebrahim poor F, Sadeghi N, Ghaljaei F, Naderi nfar M. Insulin-induced anxiety in children with diabetes. Diabetes nursing. 2015;3(3):63-73.(Persian).

45. Radahmadi M, Shadan T, Sadr S, Karimian S. The effect of psychical stress on cause and exacerbation of diabetes mellitus, serum glucose and cortisol levels, and body weight in rats. J Shahrekord Univ Med Sci. 2004;6(1):14-25.(Persian).

46. Gyllensten K, Palmer S. The relationship between coaching and workplace stress: A correlational study. International Journal of Health Promotion and Education. 2005;43(3):97-103.

47. Nikrahan G, Kajbaf M, Nouri A, Zarean E, Naghshineh E. Assessment of the relationship

between personality traits, coping styles with stress and stress level in pregnant women. Journal of Obstet Gynecol Infertil. 2011;14(5):49-57.(Persian).

48. Mehrabi A, Fata L, Davazdahemami M, Rajab A. The effectiveness of stress management training based on cognitive-behavioral theory on blood glucose control and etiological disorders in type 1 diabetic patients. Iranian Journal of Diabetes and Lipid Disorders. 2009;8(2):103-14.(Persian).

49. Momeni Javid F, Simbar M, Dolatian M, Alavi Majd H. Comparison od pregnancy slf-care, perceived social support and perceived stress of women with gestational diabetes and healthy pregnant women. IJEM. 2014;16(3):156-64.(Persian).

50. Toobert D, Hampson S, Glasgow R. The summary of diabetes self-care activities measure: results from 7 studies and a revised scale. Diabetes Care Journal. 2000;23(7):943-50.

51. Khoshnevisan Z, Afrooz G. Relationship of self-efficacy with depression, anexiety and stress. Thought and Behavior in Clinical Psychology Journal. 2011;5(20):73-80. (Persian).

52. Mollahadi M, Tayyebi A, Ebadi A, Daneshmandi M. Comprison between anexiety, depression and stress in hemodialysis and kidney transplantation patients. Iranian Journal of Critical Care Nursing. 2010;2(4):153-6. (Persian).

53. Mahmoudi H, Ebadi A, Salimi S, Najafi Mehri S, Mokhtari Noori J, Shokrollahi F. Effect of nurse communication with patients on anxiety, depression and stress level of emergency ward patients. Iranian Journal of Critical Care Nursing. 2010;3(1):7-12.(Persian).

54. Behnam B, Ghorbani R. Epidemiologic features of depression in non-insulin dependent diabetic patients in Semnan. Journal of the Faculty of Medicine. 2005;29(1):45-50.(Persian).

55. Zahiredin A, Sedighi G. Depression among 100 diabetics referring to university hospitals. Research in Medicine. 2003;27(3):203-7.(Persian).

56. Kasiri Dolatabadi N, Mortezapour S, Hosseini S. Depression in diabetes patients with type 2, Isfahan, Iran. Journal of Health Research 2010;6(2):308-14.(Persian).

57. Taziki S, Bazrafsan H, Behnampour N, Paviz M. Relationship between depressive's symptoms and diabetes. J GorganUniv Med Sci. 2001;3(2):59-64.(Persian).

58. Garduno-Espinosa J, Tellez-Zenteno J. Frequency of depression in patients with diabetes mellitus type 2. Rev Invest Clin. 1998;50(4):287-91.

59. Mahmodi A, Sharifi A. Comparison frequency and factors associatedwith depression in diabetics and non diabetics patients. J Urmia Nurs Midwifery Facul. 2008;6(2):88-93.(Persian).

60. Gilden G. Diabetes support groups improve health care of diabetic patients. Jags. 2003;40(20):145-50.

61. Nejati Safa A, Larijani B, Shariati B, Amini H, Rezagholizadeh A. Depression, quality of life and glycemic control in patients with diabetes. IJDLD. 2007;7(2):195-204.(Persian).

62. Hamadzadeh S, Ezatti Z, Abedsaeidi Z, Nasiri N. Coping styles and self-care behaviors among diabetic patients. Iran Nursing Journal. 2013;25(80):24-33.(Persian).

63. Rezaeian S, Abedian Z, Latifnejad Roudsari R, Mazloom S, Dadgar S. The relationship of prenatal self-care behaviors with stress ,anxiety and depression in women at risk of preterm delivery. IJOGI. 2017;20(3):68-76.(Persian).

64. Sajjadi M, Akbari A, Kianmehr M, Atarodi A. The relationship between self-care and depression in patients undergoing hemodialysis. Ofogh-E-Danesh. 2008;4(1):7-13.(Persian).

65. Weng L, Dai Y, Wang Y, Huang H, Chiang Y. Effect of self-efficacy, self-care behaviors on depressive symptom of Taiwanese kidney transplant recipients. J Clin Nurs. 2008;17(13):1786-94.

66. Gonzalez J, Safren S, Cagliero E, WexlerD, Delahanty L, Wittenberg E, et al. Depression, self-care, and medication adherence in type 2 diabetes: relationships across the full range of symptom severity. Diabetes Care. 2007;30(9):2222-7.

67. Park H, Hong Y, Lee H, Ha E, Sung Y. Individuals withtype 2 diabetes and depression symptoms exhibited lower adherence with self-care. J Clin Epidemiol. 2004;57(9):978-84.

68. Dehghani H, Dehghani K, Nasiriani K, Banaderakhshan H. The effect of familiarization with cardiac surgery process on the anxiety of patients undergoing coronary artery bypass graft surgery. Modern Care J. 2013;10(4):257-63.(Persian).

69. Ezati N. Effect of knowledge about self care behaviors on fear and anxiety in patients with coronary artery disease. Woman Stud Fam. 2012;5(17):29-107.(Persian).

70. Pedersen O, Beck Nielsen H, Heding L. Increased insulin receptors after exercise in patients with insulin-dependent diabetes mellitus. The New England Journal of Medicine. 1980;302(16):886-92.