Original Article
Effect of comprehensive nursing on blood glucose level, unhealthy emotion, and pregnancy outcome of patients with gestational diabetes mellitus

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Abstract: Objective: To determine the effect of comprehensive nursing on blood glucose level, unhealthy emotion, and pregnancy outcome of patients with gestational diabetes mellitus (GDM). Methods: A total of 159 patients with GDM admitted to our hospital were enrolled and divided into two groups according to different nursing intervention methods. Patients under routine nursing mode were assigned to a control group (n=70; con group), and those under routine nursing mode combined with comprehensive nursing mode were assigned to an observation group (n=89; obs group). The following items of the two groups were evaluated and compared: Blood glucose level, adverse pregnancy outcome, postpartum complications, trait anxiety inventory (T-AI) score, state anxiety inventory (S-AI) score, Edinburgh postnatal depression scale (EPDS) score, breastfeeding self-efficacy scale (BSES) score, clinical compliance, MOS 36-item short-form health survey (SF-36) score, as well as nursing satisfaction. Results: After intervention, the blood glucose level of the obs group was significantly lower than that of the con group, and adverse pregnancy outcomes and postpartum complications in the obs group were significantly less than those in the con group. In addition, after intervention, the T-AI, S-AI, and EPDS scores of the obs group were significantly lower than those of the con group, and the BSES score, clinical compliance, SF-36 score, and nursing satisfaction of the obs group were all significantly higher than those of the con group. Conclusion: For patients with GDM, comprehensive nursing can improve the blood glucose level and self-care ability, alleviate postpartum depression, and reduce adverse pregnancy outcomes.

Keywords: Comprehensive nursing, gestational diabetes mellitus, blood glucose level, unhealthy emotion, pregnancy outcome

Introduction

Gestational diabetes mellitus (GDM) is a common complication during pregnancy, characterized by normal glucose metabolism before pregnancy and impaired glucose tolerance during pregnancy [1]. Relevant data show that the incidence of GDM in China is approximate 5%, and due to the influence of environmental and dietary factors, the incidence is still increasing annually [2, 3]. GDM will not only increase the incidence of various complications, but also pose a severe threat to the life and health of mothers and infants [4, 5]. Therefore, it is of great significance to intervene with GDM at an early stage [6].

As the medicine and society develops continuously, the conventional disease-centered nursing mode has been gradually replaced by various modern all-round nursing modes [7]. Comprehensive nursing is an all-round nursing method applied in recent years. One study by Ni et al. has demonstrated that comprehensive nursing can improve the nursing effect on patients with breast cancer and improve their life quality [8]. Comprehensive nursing is a nursing mode giving all-round nursing to patients from regular exercise, reasonable diet, blood glucose monitoring, and psychological recovery, which comprehensively focuses on internal and external influencing factors, so as to effectively reduce the sensitivity and discom-

fort of patients in treatment. It can effectively improve the quality of nursing services, increase patients' satisfaction, and lift the quality of nursing [10]. One study by Vambergue et al. [11] has revealed that the influence of abnormal glucose metabolism during pregnancy on the prognosis of mothers and infants depends on the condition and blood glucose control of the pregnant women with GDM. The prognosis of those with poor blood glucose control and severe illness is correspondingly poor, and they face higher rates of complications including polyhydramnios, cesarean delivery, premature delivery, postpartum hemorrhage, infection, diabetic ketoacidosis, as well as gestational hypertension. Previous studies have shown that early active nursing intervention contributes to better control of the blood glucose level in patients with GDM and improvement of their pregnancy outcomes [12, 13], but the application effect of comprehensive nursing in patients with GDM is still under investigation.

Therefore, this study selected 159 patients with GDM in our hospital, and applied routine nursing to patients in the control group (con group) and comprehensive nursing combined with routine nursing to patients in the observation group (obs group). Then the study compared the blood glucose level, unhealthy emotion, and pregnancy outcomes of the two groups, and analyzed the clinical effect of comprehensive nursing.

Materials and methods

General materials

A total of 159 patients with GDM admitted to our hospital between October 2017 and November 2019 were enrolled and divided into two groups according to different nursing intervention methods. Patients nursed under the routine nursing mode were assigned to a con group (n=70), and those nursed under the routine nursing mode combined with the comprehensive nursing mode were assigned to an obs group (n=89). The con group consisted of patients between 23 and 38 years old, with a mean age of (30.54±8.26) years, gestational age of 34-40 weeks, and average gestational age of (36.57±2.15) years, while the obs group consisted of patients between 21 and 39 years old, with an average age of (31.43± 7.66) years, gestational age of 36-41 weeks, and average gestational age of (37.24±1.83)

years. There was no significant difference between the two groups in basic data such as age, gestational age, and disease state (all $P>0.05$). All participants enrolled in this study were diagnosed as GDM according to the clinical diagnostic criteria of GDM, and they all voluntarily signed informed consent forms after understanding the study. The study was approved by the Ethics Committee of our hospital. The inclusion criteria of the study: Patients diagnosed as GDM according to clinical examination. The exclusion criteria of the study: Patients with comorbid hematological diseases, patients with diabetes mellitus before pregnancy, patients with cognitive impairment and unable to communicate normally, patients with comorbid mental disease, abnormal genital tract, or personality disorder, and those who received induced labour or abortion during pregnancy.

Methods

The 24-h blood glucose of each patient in the two groups was dynamically monitored. Patients in the con group were given routine nursing as follows: Nursing staff were arranged to inform patients with GDM about disease-related knowledge to increase their awareness of the disease, and the staff were also arranged to intervene with the diet of each patient according to her blood glucose monitoring results. In the midtrimester, each patient was required to intake moderately increased calorie (3%-4%), fat (30%-40%), and carbohydrate (40%-50%) each week. The nursing staff were arranged to provide scientific diet to each patient according to her maternal weight to ensure balanced nutrition. If the blood glucose was out of effective control, the staff should help the patient receive insulin treatment according to doctor's advice. Patients in the obs group were given comprehensive nursing based on the nursing to the con group, and the specific nursing measures were as follows: (1) Psychological nursing: GDM is a high-risk disease during pregnancy. Some patients with it are prone to anxiety and fear due to worry about pregnancy outcome. Therefore, nursing staff were arranged to actively contact with patients and their families, inform them of inducing factors of GDM, importance of blood glucose monitoring, blood glucose control methods, and possible complications, so that the patients can make apsychological preparation

in advance. The nursing staff were also arranged to tell the patients the relationship between negative emotions such as anxiety and adverse pregnancy outcomes, provide examples that effective control of blood glucose contributed to good pregnancy outcome, so as to improve the patients' confidence. (2) Dietary guidance: In order to control the blood glucose of each patient, the nursing staff were arranged to provide comprehensive dietary guidance to each patient, and adjust the dietary structure of each patient while ensuring the total calorie of the patient. First of all, high-fiber foods should be consumed. Each patient was asked to take healthy whole grains as the staple food and eat beans, fruits, and vegetables properly and adequately every day. Secondly, foods rich in vitamins and proteins should be consumed. Each patient was required to each fish, milk, and eggs every day, eat less high-fat foods, and avoid fried foods. In addition, the hazards of overeating should be emphasized. Each patient was required to eat foods on time every day under the principle of frequent small meals to ensure stable blood glucose. (3) Exercise intervention: The nursing staff were arranged to develop an exercise plan for each patient according to her blood glucose, weight, and heath, and inform the patient of the benefit of moderate light physical exercise to blood glucose reduction. The nursing staff were also arranged to help each patient go out for a 30-min walk at 1 h after each meal every day, and the patient was required to rest once feeling tired to control exercise intensity and avoid accidents such as falls. In addition, the patient was required to go to sleep and get up on time every day and keep good living habits. (4) Life intervention: Each patient was required to do well in personal hygiene, change and clean clothes and related articles regularly, and cultivate good living habits. In addition, the patient was also required to strengthen skin and oral hygiene management to lower the risk of infection in the urinary system, oral cavity, and respiratory tract.

Evaluation indexes

The glucose oxidase method was adopted to determine the fasting blood glucose (FBG) and 2 hour postprandial blood glucose (2hPG) of each patient, and the high-performance liquid chromatography was adopted to determine the

glycosylated hemoglobin (HbA1c) of each patient. In addition, the pregnancy outcomes and complications of the two groups were evaluated and compared. The Spielberger state-trait anxiety inventory (STAI) was adopted to evaluate the psychological state of each patient [14, 15], mainly including trait anxiety inventory (T-AI) and state anxiety inventory (S-AI) scores. Higher scores indicated more severe anxiety and poorer psychological stress ability. The Edinburgh postnatal depression scale (EPDS) was adopted to score each patient before and after nursing intervention [16]. The EPDS score was given in strict accordance with the modified EPDS. In addition, the breastfeeding self-efficacy scale (BSES) was adopted to score each patient in the two groups at admission and before delivery [17]. With a total score of 30-15 points, the BSES covers 30 items and adopts the 5-grading system. A higher score indicates higher self-efficacy. Moreover, the incidences of cesarean delivery, neonatal asphyxia, fetal distress, postpartum hemorrhage, premature delivery, and abnormal weight of the two groups were evaluated. The treatment compliance of the two groups was also analyzed, and the MOS 36-item short-form health survey (SF-36) was used to evaluate the life quality of each patient before and after intervention mainly from role physical, role emotional, mental health, as well as social functioning. The total score was directly proportional to the quality of life [18]. Compliance evaluation criteria: (1) Complete compliance: The patient strictly followed the doctor's advice and adhered to the standard treatment during clinical treatment. (2) Moderate compliance: The patient basically followed the doctor's advice and occasionally showed irregularities during clinical treatment. (3) Non-compliance: The patient often failed to follow doctor's advice, could not insist on treatment or failed to receive treatment continuously during clinical treatment. Finally, the nursing satisfaction of the two groups was also analyzed.

Statistical analyses

Data in this study were analyzed statistically by SPSS22.0. Measurement data were expressed as (x ± s) and analyzed using the t test. Enumeration data were expressed by n (%) and analyzed using the χ^2 test. *P*<0.05 implies a significant difference.

Table 1. Comparison between the two groups in general data

Item	The observation group (n=89)	The control group (n=70)	t-value	*P*-value
Age (Y)	31.43±7.66	30.54±8.26	0.703	0.483
Gestational week	37.24±1.83	36.87±2.15	1.171	0.243
Times of pregnancy			2.890	0.089
Primipara	65 (73.03)	59 (84.29)		
Multipara	24 (26.97)	11 (15.71)		
Education level			0.018	0.893
With senior high school diploma or below	41 (46.07)	33 (47.14)		
With junior high school diploma or above	48 (53.93)	37 (52.86)		
Weight at delivery (kg)	70.52±2.44	71.03±2.11	1.388	0.167
Height (cm)	160.43±7.56	161.12±8.24	0.549	0.584

Table 2. Changes of blood glucose and HbA1c in the two groups

Group	FPG (mmol/L)		2hPG (mmol/L)		HbAc (%)	
	Before intervention	After intervention	Before intervention	After intervention	Before intervention	After intervention
The observation group (n=89)	8.41±0.66	5.13±0.71	9.75±1.12	6.12±0.79	6.73±0.71	5.24±0.51
The control group (n=70)	8.39±0.58	6.9±0.88	9.73±1.41	7.34±1.13	6.82±0.64	6.19±0.51
t-value	0.200	14.040	0.100	8.001	0.828	11.660
P-value	0.842	<0.01	0.921	<0.01	0.409	<0.01

Table 3. Complications and pregnancy outcome of the two groups

Item	Cesarean delivery	Premature delivery	Fetal distress	Neonatal asphyxia
The observation group (n=89)	7 (7.87)	3 (3.37)	5 (5.62)	4 (4.49)
The control group (n=70)	32 (45.71)	9 (12.86)	13 (18.57)	8 (11.43)
χ^2-value	30.320	5.053	6.549	2.700
P-value	<0.01	0.025	0.011	0.100

Results

General data of the two groups

There was no significant difference between the two groups in age, gestational weeks, times of pregnancy, educational level, weight at delivery, and height (all *P*>0.05). **Table 1**.

Changes of blood glucose and HbA1c in the two groups

Comparison of the changes in blood glucose and HbA1c between the two groups showed that before intervention, there was no significant difference in the levels of FPG, 2hPG, and HbA1c between the two groups (all *P*>0.05), while after intervention, the levels of them in both groups decreased (all *P*<0.05), and the levels of them in the obs group were significantly lower than those in the con group (all *P*<0.05). **Table 2**.

Complications and pregnancy outcomes of the two groups

Comparison of complications and pregnancy outcomes between the two groups showed that the incidences of cesarean delivery, premature delivery, and fetal distress in the obs group were significantly lower than those in the con group (all *P*<0.05), and there was no significant difference between the two groups in the incidence of neonatal asphyxia (*P*>0.05). **Table 3**.

Comparison of psychological state between the two groups

Before intervention, there was no significant difference between the two groups in T-AI and

Table 4. Comparison of psychological state between the two groups

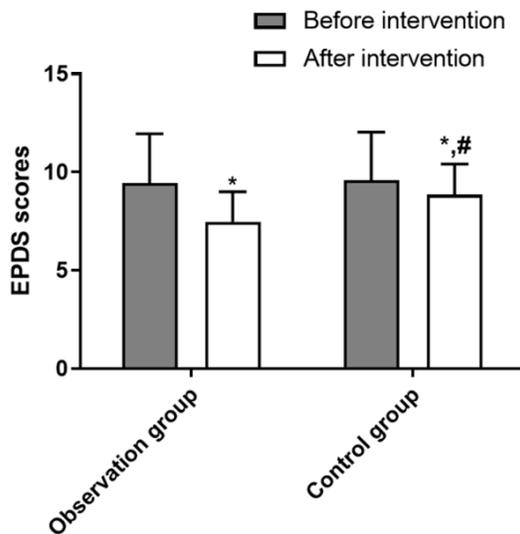| Item	T-AI score	S-AI score
The observation group (n=89)	42.31±4.23	44.56±6.34
The control group (n=70)	32.56±3.95	58.49±11.47
t-value	2.676	19.890
P-value	0.008	<0.01

Figure 1. Comparison of EPDS score between the observation group and the control group. Before intervention, there was no significant difference in EPDS score between the two groups ($P>0.05$), while after intervention, the EPDS scores of both groups decreased significantly (both $P<0.05$), and the EPDS score of the observation group was significantly lower than that of the control group ($P<0.05$). Note: *$P<0.05$ vs. the same group before intervention; #$P<0.05$ vs. the observation group after intervention.

S-AI scores (both $P>0.05$), while after intervention, the T-AI and S-AI scores of both groups decreased (both $P<0.05$), and the T-AI and S-AI scores of the obs group were both significantly lower than those of the con group (both $P<0.05$). **Table 4**.

Comparison of EPDS scores between the two groups

Comparison of EPDS scores between the two groups showed that before intervention, there was no significant difference in EPDS score between them ($P>0.05$), while after intervention, the EPDS scores of both groups decreased significantly (both $P<0.05$), and the EPDS score of the obs group was significantly lower than that of the con group ($P<0.05$). **Figure 1**.

Comparison of BSES scores between the two groups

Comparison of BSES scores between the two groups showed that before intervention, there was no significant difference in BSES score between them ($P>0.05$), while after intervention, the BSES scores of both groups increased significantly (both $P<0.05$), and the BSES score of the obs group was significantly higher than that of the con group ($P<0.05$). **Table 5**.

Comparison of treatment compliance between the two groups

Comparison of treatment compliance between the two groups showed that after intervention, the treatment compliance of both groups improved significantly, and the total treatment compliance rate of the obs group was higher than that of the con group. **Table 6**.

Comparison of life quality score between the two groups

Comparison of life quality scores showed that the scores of role physical, role emotional, mental health, social functioning, and general health of the obs group were also significantly higher than those of the con group (all $P<0.05$). **Figure 2**.

Comparison of nursing satisfaction between the two groups

The nursing satisfaction of the obs group was significantly higher than that of the con group (92.13% vs. 81.43%, $P<0.05$). **Table 7**.

Discussion

Due to stimulation by hormones during pregnancy, blood glucose of pregnant women shows an obvious upward trend, so if insulin secretion is insufficient, the pregnant women are prone to GDM [19]. GDM is a high-risk disease in pregnancy, which has a complex impact on pregnant women and fetuses [20]. A large number of studies show that continuous hyperglycemia may induce postpartum hemorrhage, puerperal infection, macrosomia, and neonatal respiratory distress syndrome [21, 22]. Therefore, it is necessary to pay attention to monitoring blood glucose of pregnant women and adopt targeted intervention as soon as possible [23].

Table 5. Comparison of BSES score between the two groups

Item	Before intervention	After intervention
The observation group (n=89)	71.45±10.43	128.54±15.38
The control group (n=70)	72.34±10.54	102.68±12.44
t-value	27.830	16.640
P-value	<0.01	<0.01

The blood glucose of women with GDM changes complexly during pregnancy. If it is not detected timely, it may induce postprandial hyperglycemia. Dynamic monitoring to 24-h blood glucose can dynamically reflect the changes of blood glucose of the patient, on which the drug dosage can be adjusted to control the blood glucose of the patient at an ideal level [24]. Targeted nursing intervention based on fluctuation characteristics of blood glucose of patients with GDM can lower the incidence of adverse pregnancy outcomes [25]. In this study, we gave patients in the obs group with comprehensive nursing involving psychology, diet, exercise, and life based on routine nursing methods, and compared comprehensive nursing with routine nursing. It was found that after different nursing intervention, the levels of FPG, 2hPG, and HbA1c in the two groups decreased, and the levels of them in the obs group were significantly lower than those in the con group, which indicated that comprehensive nursing intervention effectively ameliorated the blood glucose level. In addition, the comparison of pregnancy outcomes showed that the incidences of cesarean delivery, premature delivery, and fetal distress in the obs group were significantly lower than those in the con group (all *P*<0.05), and there was no significant difference between the two groups in the incidence of neonatal asphyxia (*P*>0.05), which further suggested that comprehensive nursing can effectively improve the pregnancy outcomes. The environment of patients with GDM has changed significantly, and the blood glucose level of the patients is higher than that of normal individuals, which is easy to damage the physical and mental health, delivery, and the health of neonates. Therefore, it is necessary to carry out professional nursing to patients with GDM in the perinatal period to relieve their negative emotions including anxiety and fear and guarantee the health of them and their neonates [26]. One study by Yuan et al.

[27] has also revealed that comprehensive nursing can ameliorate the blood glucose level and weight gain, and improve the outcomes of pregnant women with GDM, which is similar to the results of our study. Comprehensive nursing is a nursing mode that mainly adopts prenatal education, comprehensive prenatal examination, and psychological counseling measures to enhance the cognition of patients to disease and positive emotion of the patients, reduce adverse effects of disease and delivery, help the patients build self-confidence in successful delivery, and maintain maternal and child health. In this study, the BSES score of the obs group was higher than that of the con group, and after nursing intervention, the T-AI, S-AI, and EPDS scores of both groups were improved (all P<0.05), and the improvement of the scores in the obs group was more significant than that in the con group, which suggested that comprehensive nursing intervention significantly ameliorated the emotion of patients. Therefore, compared with routine nursing, comprehensive nursing has obvious advantages in improving patients' self-efficacy and pregnancy outcome and reducing negative emotions. Due to adverse emotions such as mental stress and anxiety and complications, lying-in woman are prone to more severe psychological problems, which compromises their nursing compliance and cooperation, and thus harms their physiological conditions and may also induce uterine inertia and increase the risk of postpartum hemorrhage. Comprehensive nursing takes primiparas with high risk pregnancy as the nursing core and emphasizes that cognitive and psychological nursing can enhance patients' cognition of their own diseases, self-care awareness, reduce negative emotions, and improve their physical and mental state. Finally, we compared the nursing satisfaction and treatment compliance between the two groups, and found that the treatment compliance and nursing satisfaction of the obs group were both higher than those of the con group. It shows that comprehensive nursing can not only improve the treatment effect on patients in hospital, but also lift their nursing satisfaction and strengthen their self-monitoring ability after discharge, thus effectively improving their compliance during pregnancy.

Table 6. Treatment compliance of the two groups

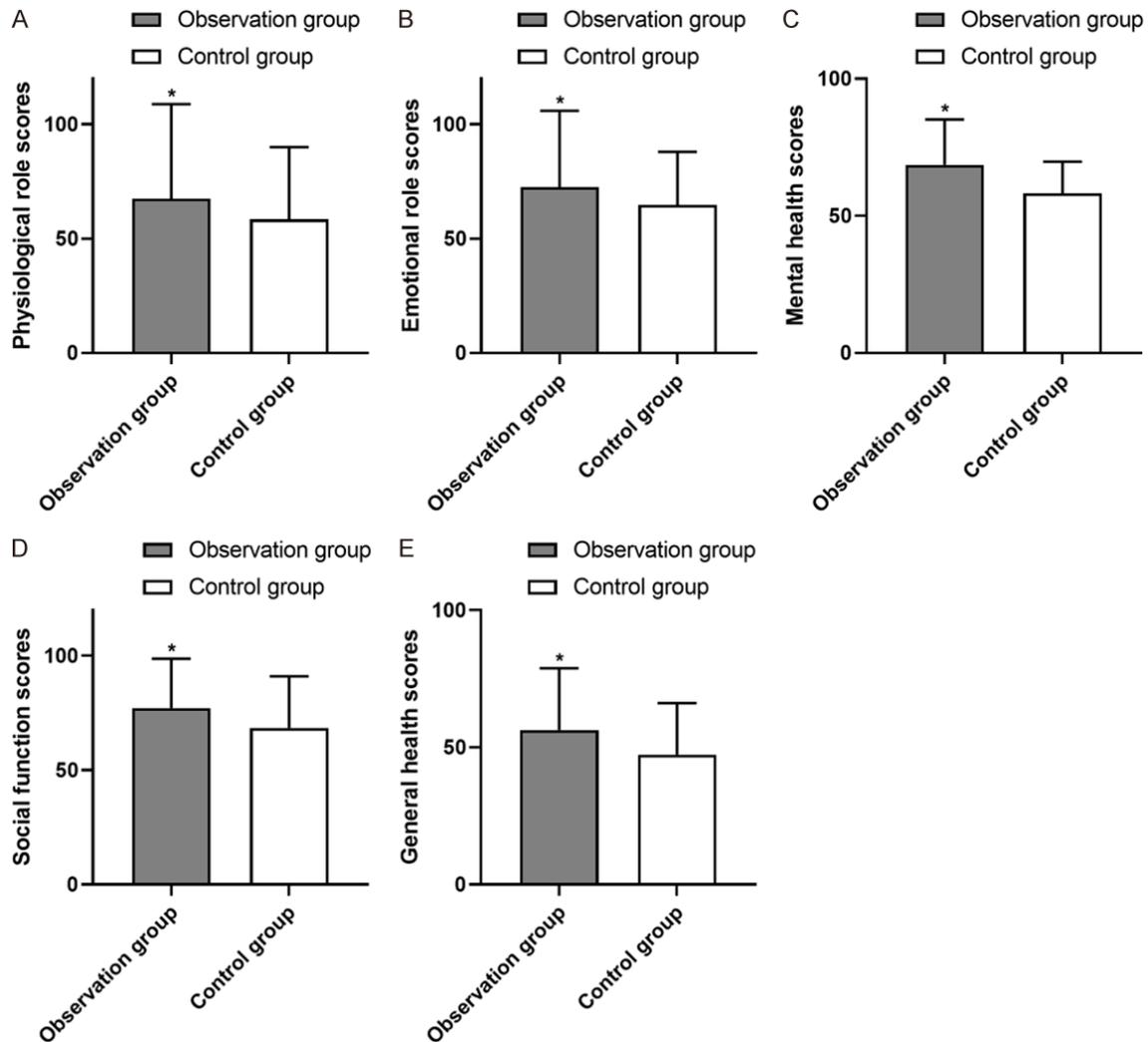| Item	Complete compliance	Moderate compliance	Non-compliance	Total compliance rate (%)
The observation group (n=89)	60 (67.42)	26 (29.21)	3 (3.37)	86 (96.63)
The control group (n=70)	41 (58.57)	15 (21.43)	14 (20)	56 (80)
χ^2-value				11.35
P-value				<0.01

Figure 2. Comparison of life quality score between the observation group and the control group. A. Comparison of role physical score between the two groups. The role physical score of the observation group was significantly higher than that of the control group ($P<0.05$). B. Comparison of role emotional score between the two groups. The role emotional score of the observation group was significantly higher than that of the control group ($P<0.05$). C. Comparison of mental health score between the two groups. The mental health score of the observation group was significantly higher than that of the control group ($P<0.05$). D. Comparison of social functioning score between the two groups. The social functioning score of the observation group was significantly higher than that of the control group. E. Comparison of general health score between the two groups. The general health score of the observation group was significantly higher than that of the control group ($P<0.05$). Note: *$P<0.05$ vs. the control group.

Although we have confirmed the application value of comprehensive nursing for patients with GDM in this study, we have not studied the influence of comprehensive nursing on

Table 7. Comparison of nursing satisfaction between the two groups

Item	High satisfaction	Moderate satisfaction	Dissatisfaction	Overall satisfaction
The observation group (n=89)	62 (69.66)	20 (22.47)	7 (7.87)	82 (92.13)
The control group (n=70)	24 (34.29)	33 (47.14)	13 (18.57)	57 (81.43)
χ^2-value				4.084
P-value				0.043

long-term blood glucose level, unhealthy emotion, and pregnancy outcome of these patients. We hope to supplement it in future research.

To sum up, for patients with GDM, comprehensive nursing can improve the blood glucose level and self-care ability, alleviate postpartum depression, and reduce adverse pregnancy outcomes.

Disclosure of conflict of interest

None.

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