

## ORIGINAL

# The study of gestational diabetes as a silent disease

*El estudio de la diabetes gestacional como enfermedad silenciosa*

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**Abstract**

Many of the deaths associated with diabetes are due to cardiovascular complications. Deaths from diabetes are premature and occur when patients are economically active in society. Gestational diabetes is a silent condition that affects both the mother and the foetus throughout pregnancy. Gestational diabetes is a silent condition that affects both the mother and the foetus throughout pregnancy. This study examines the gestational diabetes as a silent disease. In women with a history of gestational diabetes, diabetes prevention to early detection and control of diabetes, need to be given training on follow ups the after delivery. The follow ups, are including postpartum diabetes screening and lifestyle changes (exercise and diet compliance).

**Key words:** Self-regulation model, gestational diabetes, silent diabetes.

**Resumen**

Muchas de las muertes asociadas con la diabetes se deben a complicaciones cardiovasculares. Las muertes por diabetes son prematuras y ocurren cuando los pacientes son económicamente activos en la sociedad. La diabetes gestacional es una condición silenciosa que afecta tanto a la madre como al feto durante el embarazo. La diabetes gestacional es una condición silenciosa que afecta tanto a la madre como al feto durante el embarazo. Este estudio examina la diabetes gestacional como una enfermedad silenciosa. En las mujeres con antecedentes de diabetes gestacional, es necesario capacitar desde la prevención de la diabetes hasta la detección temprana y el control de la diabetes sobre el barbecho después del parto. Los barbechos incluyen exámenes de detección de diabetes posparto y cambios en el estilo de vida (ejercicio y cumplimiento de la dieta).

**Palabras clave:** Modelo de autorregulación, diabetes gestacional, diabetes silenciosa.

**Introduction**

During the study of deaths due to diabetes in four provinces of the country (East Azerbaijan, Bushehr, Chaharmahal Bakhtiari and Semnan) in 1999, 272 people per ten thousand people were estimated. In other words, diabetes was the 16th leading cause of death in men and the 9th leading cause of death in women<sup>1</sup>. Decreased insulin secretion, decreased glucose uptake due to insulin resistance, and increased glucose uptake to varying degrees are involved in each type of diabetes. Diabetes causes premature and late changes that result in disability, cost of treatment, and ultimately increase mortality. Diabetes is the fifth leading cause of death in the world and the number one cause of chronic renal failure, non-traumatic amputation and blindness in many societies<sup>2</sup>.

According to studies in India, if an adult low-income family lives with an adult with diabetes, 25% of the total family income is earmarked for diabetes care. In an American family with one child with diabetes, 10% of family income is allocated to diabetes control<sup>3</sup>. The total cost of health care for a person with diabetes in the United States is two to three times higher than for those without the disease. In 1997, for example, the cost of treating diabetes in the United States was estimated at \$ 44 billion<sup>4</sup>. A recent analysis of health care costs in the Pacific West and at the World Health Organization shows that 16% of hospital expenditures were for people with diabetes<sup>5</sup>. The cost of diabetes affects everyone and everywhere. These costs are not just financial expenses. Imperceptible costs such as pain, anxiety, discomfort, headache and, in general, a

decrease in quality of life, which generally affect the lives of patients and their families, are almost incalculable. The direct costs of patients and their families are: medical care, medicines, insulin and other necessities. Patients may also incur certain other costs, such as an increase in car insurance, life, and medical services. In most countries, the most expensive forms of diabetes treatment are hospital expenses, late complications of diabetes such as heart attacks and kidney failure, and problems with diabetic foot<sup>6&7</sup>. In general, the direct costs of diabetes account for 15% - 2.5% of the total health budget<sup>8</sup>. The quality of people's daily work activities decreases with diabetes, and some of them even lose the ability to work. Illness, absenteeism, disability, premature retirement, or premature death cause a decline in productivity and a loss of productivity<sup>9</sup>. Estimating the costs of declining productivity in society is not easy, although in many cases these costs are estimated to be equal to or even higher than the direct costs of diabetes care. Indirect costs of diabetes in the United States, for example, were \$ 54 billion in 1997, while direct costs of the disease were \$ 44 billion in the same year<sup>10</sup>. The total estimated indirect costs of diabetes in 25 Latin American countries indicate that these costs are five times the direct costs of diabetes health care. This situation may be due to limited access to high quality care services, high incidence of complications, disability and premature death. In the same way, the problems caused by the decrease of household income will be more due<sup>10</sup>. Pain, anxiety, discomfort, and other factors that reduce the quality of life are called intangible costs, which are very high.

## Literature of Review

The articles reviewed in this study include two Persian articles and one English article. By searching for terms such as: postpartum diabetes, self-regulation, postponement, in Iran Doc, Magiran, SID databases and searching for terms such as, screening, diabetes, type 2 diabetes, follow up, postpartum, procrastination, Gestational diabetes was obtained in PubMed, science direct, ProQuest, ISI databases in the period 2016-2005. The following studies are sorted by the closest time. Coppola et al. (2013) conducted a cross-sectional study of 6770 pregnant women at Pugliese-Ciaccio Hospital in Caucasian, southern Italy. The statistical population of this study included women who participated in gestational diabetes screening from January 2004 to December 2011. The aim of this study was to "accurately determine the predictive factors in performing postpartum glucose tolerance test in women with a history of gestational diabetes". Out of 6770 pregnant women, 1159 (17.1%) were diagnosed as gestational diabetes. All of these women were included in the study, except those who, according to the American Diabetes Association, had pre-pregnancy diabetes. Demographic characteristics included age, level of education, number of deliveries,

history of gestational diabetes, family history of diabetes, pre-pregnancy weight, and previous diagnosis of polycystic ovary syndrome based on Rotterdam criteria. After January 2011, women at the hospital were given verbal and written counseling on the importance of follow-up at 35 to 40 weeks of gestation. In this study, the rate of women's participation in postpartum glucose tolerance test was reported on the two dates mentioned above (2011-2011 and 2011 onwards) and also in this study, predictive factors in performing this test were determined. Out of 1159 women diagnosed with gestational diabetes, 374 (32.3%) participated in postpartum screening. There was a significant increase in referral rate following counseling. Also, interestingly, the previous diagnosis of polycystic ovary syndrome was determined as the most important predictor of postpartum follow-up. Explain that these women may be more eager to seek medical advice because they often experience undesirable clinical problems such as irregular menstruation, infertility, and hirsutism. In addition, these women are often treated with metformin and antidiabetic drugs and may be more aware of the risk of type 2 diabetes or more closely associated with the health care system. Other prognostic factors included a previous history of gestational diabetes, higher education, and insulin therapy during pregnancy. Also, there was no significant difference between body mass index, family history of type 2 diabetes and number of deliveries with the rate of participation<sup>11</sup>.

Overall, the data of this study showed that the intervention as a counseling is an effective, inexpensive, and simple tool in increasing the rate of oral glucose tolerance test for women with a history of gestational diabetes. However, despite counseling, some women still do not participate. Polycystic ovary syndrome was also a strong predictor of women's participation in the postpartum diabetes test. Finally, the authors of this article write that further studies are needed to determine whether their findings are common in other populations<sup>12</sup>. Butorn et al. (2014) in a cohort study examined the relationship between education level and gestational diabetes. In this study, 7511 pregnant women were studied and the prevalence of gestational diabetes at 4 educational levels was analyzed. Odds Ratio was calculated for better interpretation and analysis. The results of this study showed that people with the lowest level of education (elementary) compared to people with higher education are three times more likely to develop gestational diabetes (OR = 3.07). And there is a significant and direct relationship between education level and the incidence of gestational diabetes<sup>13</sup>.

Lubner et al. (2006) conducted a study to determine the predictors of postpartum diabetes in women with gestational diabetes. The aim of this study was to identify the risk factors for postpartum diabetes and women with a history of gestational diabetes from 1989 to 1999 were followed up. In this study, 302 subjects were present in the study and their glucose tolerance

was assessed at 9 months, 2 years, 5 years, 8 years and 11 years after delivery. The results showed that the risk of postpartum diabetes in women with BMI = 30 is significantly higher risk so that the risk in this group is 1.5 times lower than people with BMI (P = 0.04). Smith et al. (2005) examined the extent of physical activity and postpartum psychosocial activity in women with a history of gestational diabetes. This study was performed on 226 subjects living in Sydney with a mean age of 33.4 years. The results showed that only 33.6% of women had adequate physical activity and exercise after childbirth. Among physical activities, walking was the most rewarding activity. On the other hand, the most important barriers to postpartum sports activities were caring for the baby or infant (49.1% of the subjects) and not having enough time (37.6% of the subjects). In addition, women's self-efficacy for physical activity was low. Among the psychological-social support, verbal support was also reported as the most common support received by women (39% of the subjects). More than half of the women stated that they had not received any support in the field of housework<sup>14</sup>.

## Discussion

### 1. Complications of Diabetes

Symptoms of diabetes are due to high blood sugar levels above 180 mg, which cause glucose to enter the urine. Increased volume and frequency of urination, thirst, weakness and fatigue, overeating, blurred vision and itchy skin and vagina are the most common early symptoms of diabetes. Chronic complications of diabetes fall into three main categories: large vessel complications, small vessel complications, and neurological complications. Complications of large vessels (macrovascular) are seen in the form of atherosclerosis of the coronary arteries, cerebrovascular disease and peripheral vascular disease. Complications of small vessels (microangiopathy) include diabetic nephropathy and retinopathy, which are the most common and major late complications. Neuromuscular complications of diabetes are mostly manifested in the form of mononeuropathy of one or more nerve trunks, symmetrical peripheral polyneuropathy, diabetic neuropathy of the autonomic nerves and diabetic myopathy. According to a study conducted at the Endocrinology Research Center in Isfahan in 1996, the prevalence of complications among people with diabetes was as follows:

- 34% of ischemic heart disease
- 50% hypertension
- 12% heart failure
- 44% retinopathy
- 5% cataract
- 27% bacteriuria
- 10% nephropathy (Statistics of 1379 Dialysis and Kidney Transplant Center in Iran show that 22.4%

- of cases have led to dialysis due to diabetes)
- 72% neuropathy
- 60% depression
- 2.5% diabetic foot
- 37% hypercholesterolemia
- 37% hypertriglyceridemia<sup>14</sup>

### 2. Incidence and prevalence of diabetes

The prevalence of diabetes has increased significantly in the last two decades. Although the prevalence is seen in both types of diabetes, the increase in the prevalence of type 2 diabetes has been far greater than in type 1 diabetes. In the 21st century, the prevalence of type 2 diabetes and impaired glucose tolerance (IGT) has become epidemic due to decreased physical activity and weight gain and obesity<sup>15</sup>.

The incidence of type 1 diabetes is lower than that of type 2 diabetes, and is generally between 3 and 35 per 100,000 people per year. The incidence of type 1 diabetes in Canada and the United States is reported to be between 8 and 20 per 100,000 people. In general, type 1 diabetes is rare and more common in residents of Japan, China, the Philippines, as well as Asian Indians, African blacks, and Eskimos. Type 1 diabetes is difficult to diagnose per 100,000 people in a year, and therefore many studies are incomplete in terms of defining indicators and their results should be considered with caution.

The prevalence of type 2 diabetes in the general population is between 1 to 4% and in people over 40 years between 5 to 10%. Given the growing prevalence of type 2 diabetes in the world, the World Health Organization declared it a latent epidemic and since 1993 has called on all countries to fight diabetes<sup>15</sup>.

A study conducted by the Endocrine Research Center of Shahid Beheshti University of Medical Sciences showed that the prevalence of type 2 diabetes in people over 30 years of age is about 7.6% in women and 7.1% in men. The results of this study also showed that the prevalence of renal glucose intolerance is 14.6% and 8.9% in men.

In a study in Tehran, the prevalence of gestational diabetes was reported to be 4.7%, and in another study in villages around Tehran, the results showed that 12.7% of pregnant women after consuming 50 g of oral glucose, serum sugar above 140 Mg / dL.

### 3. Classification of types of diabetes

The types of diabetes are divided according to its pathological process. The most common types of diabetes are types 1 and 2, which differ in etiology, epidemiology and many other dimensions. In addition to type 1 and type 2 diabetes, diabetes may appear for other reasons such as genetic disorders, some diseases, etc. Gestational diabetes is different from type 1 and type 2 diabetes because it is diagnosed for the first time in a

pregnant woman. The effects on the mother and fetus are similar to those who already have diabetes and then become pregnant, and may become completely normal after termination of pregnancy. There are three ways to diagnose type 2 diabetes today:

1. The venous plasma glucose concentration is equal to or greater than 200 mg/dL two hours after ingestion of 75 g of glucose.
2. Venous plasma glucose concentration in a random sample equal to or greater than 200 mg / dL with a clear sign of diabetes
3. Intravenous plasma glucose concentration in two fasting sessions equal to or greater than 126 mg/dL.

Normal plasma glucose levels in the fasting state and 2 hours after eating 75 g of glucose are 100 and 140 mg/dL, respectively. The American Diabetes Association prefers fasting plasma glucose levels because it is more practical, more proportionate, and more reproducible. If fasting plasma is between 100. 125 It is called "fasting diabetes disorder". If the glucose concentration is between 140 and 200 two hours after glucose consumption, it is called "glucose tolerance disorder". In these two groups, the incidence of diabetes is higher. Although two-thirds of them may not always have the symptoms of diabetes, they are more likely to have cardiovascular complications. Lifestyle changes can reduce the risk of developing diabetes in these groups<sup>15</sup>. Hemoglobin A1C is closely related to blood sugar levels, but is not currently used as a diagnostic test for diabetes because its normal nature cannot rule out impaired glucose tolerance or mild diabetes.

#### 4. Epidemiology and etiology of diabetes

The etiology and epidemiology of the two types of diabetes are quite different. **Table I** lists some of these differences<sup>16&17</sup>.

#### 5. Type 1 diabetes

Type 1 diabetes is divided into two types, types A1 and B1. Type A1 results from immunological destruction of beta cells, leading to insulin deficiency. People with type B1 do not have immunological characteristics, but for unknown reasons have insulin deficiency and are highly

susceptible to diabetic ketoacidosis. It seems that in type 1 diabetes, genetics is a contributing factor that plays an important role in causing the disease along with environmental factors. The predisposing gene in this type of diabetes is located on chromosome<sup>18</sup>.

Due to the fact that most new cases (incidence rates) of type 1 diabetes are seen in spring and autumn, and its prevalence has increased with the change of school and exposure to new viruses, and also due to the fact that in some epidemics Viral cases of type 1 diabetes have also increased. It seems that special attention has been paid to the role of viral agents in the etiology of this type of diabetes. An increase in cases of type 1 diabetes has been reported in epidemics of coxsackie, mumps, hepatitis and rubella<sup>19&20</sup>.

Some sources have suggested that the pathogens of type 1 diabetes are immunoglobulin antibodies that act against the islets of Langerhans. These antibodies are present in 60 to 90% of patients' blood at the beginning of the disease, but are seen in only 10% of patients after ten years<sup>21</sup>. In general, the etiological factors of type 1 diabetes can be expressed as the fact that in most patients with insulin-dependent diabetes there is a genetic predisposing factor that predisposes the pancreatic beta cells to a virus or chemical or immunological factors. Favorable. After beta cell damage, antigens bleed into the bloodstream, producing antibodies that invade the cell and cause further cell damage<sup>21</sup>.

#### 6. Type 2 diabetes

It is the most common type of diabetes that develops slowly and gradually in old age and does not tend to cause ketoacidosis. Genetic and control factors are involved in causing this disease. The disease typically begins in a person with a normal carbohydrate metabolism and progresses to glucose intolerance with increased insulin compensation. This finding suggests that the major disorder in type 2 diabetes may not be due to decreased beta cell activity, but in this type of diabetes, the disturbance of peripheral tissue responses to the effects of insulin and glucose is of particular importance<sup>22</sup>.

**Table I:** Comparison of type 1 and type 2 diabetes.

	Type 1 diabetes	Type 2 diabetes
The genetic locus	chromosome 6	probably chromosome 11
The onset of the disease	rapid	acute
Disease age	less than 40 years	more than 40
Weight	Normal	low
Ketoacidosis	common/uncommon	low
Plasma insulin	normal decrease	normal
plasma glucagon	high suppressive	resistant to suppression
insulin resistance	Rare	available
Common anti-beta	antibodies Common	not available
Acute complications	hyperosmolar	coma ketoacidosis
Insulin therapy	Insulin therapy responds	resistant
Treatment with sulfonyl urea	does not work	It works

Genetic predisposing factors play a much stronger role in type 2 diabetes than in type 1 diabetes. If one of the monozygotic twins develops type 2 diabetes, the chance of becoming infected is almost 100%. While the same condition in type 1 diabetes has a 50% chance of developing<sup>23</sup>. Long-term studies have shown that about 50% of first-degree relatives of patients with type 2 diabetes develop diabetes by the age of 80<sup>24</sup>. Despite the role of genetic factors, the most important risk factors for type 2 diabetes are overweight and obesity. In a society, there is a strong and direct relationship between obesity and the prevalence of diabetes. Sedentary lifestyle also appears to play an independent role in increasing the risk of type 2 diabetes. Numerous studies have shown that the prevalence of type 2 diabetes is higher in rural communities than in urban communities, one of the main reasons being inactivity in urban communities.

## 7. Prevention and screening in diabetes

Diabetes is a debilitating disease with chronic and costly complications that affects most organs of the body. The need for measures to diagnose, prevent and closely monitor diabetes in order to prevent or delay acute and chronic complications has been proven by numerous studies.

### 7.1. Type 1 diabetes

The cause of this disease is autoimmune and screening and early detection of this type of diabetes is not recommended and performed except in some communities for the following reasons:

1. Uncertainty of a specific limit of any antibody (standard titer specified) that causes the disease.
2. If antibodies can be identified by testing and finding antibodies, a solution to prevent and delay the clinical onset of type 1 diabetes has not been found to date; Because such measures must focus on the immune system, these studies are still in the early stages of the world.
3. Due to the very low prevalence of type 1 diabetes, screening it will not be cost effective (10% -5% of all diabetics).
4. In type 1 diabetes, the symptoms appear quickly and clearly. Therefore, severe symptoms of the disease are the reason for the patient to see a doctor who therefore does not need screening<sup>25</sup>.

### 7.2. Type 2 diabetes

Early prevention and cognition and timely and correct treatment of type 2 diabetes are important in the world for the following reasons:

In this type of diabetes, hyperglycemia develops gradually. These people are often asymptomatic or have no severe symptoms, and as a result, in many cases, the disease is not diagnosed (at any given time, at least 50% of people with diabetes are unaware of

their disease. Undiagnosed). During this period, there is asymptomatic and metabolic disorders due to high plasma glucose. These people are at risk for macro and microvascular complications and usually see a doctor when they become aware of a chronic complication of diabetes such as diabetic foot, gangrene of the foot, heart attack or stroke, or kidney failure. Diagnosing glucose intolerance before diabetes and taking steps to control risk factors, including weight loss (through diet modification and increased physical activity), can prevent or at least delay the onset of diabetes. Proper control of blood sugar after early diagnosis of diabetes prevents the occurrence or progression of complications. On the other hand, detection of impaired glucose tolerance or diabetes is possible by performing a simple and non-invasive test such as measuring fasting glucose (twice) or oral glucose tolerance test (OGTT). Considering the progressive and latent course of diabetes, the existence of a cheap and efficient diagnostic method for early diagnosis of the disease and finally the possibility of controlling and preventing the progression of the disease with its early diagnosis, generally confirm the need for screening<sup>26</sup>.

## 8. Gestational Diabetes

Any amount of glucose intolerance that first develops or manifests during pregnancy is called gestational diabetes. Gestational diabetes is the most important medical complication and common metabolic disorder in pregnant women. Gestational diabetes is defined as the varying severity of carbohydrate intolerance that first begins or is diagnosed during pregnancy. This definition applies to treatment regardless of whether or not insulin is used (27, 28). As the pregnancy progresses, the increased tissue resistance to insulin increases the demand for insulin. In most pregnancies, this requirement is met, resulting in a balance between insulin resistance and insulin production. But if resistance overcomes, the pregnant woman becomes hyperglycemic, and in these conditions, blood glucose levels rise during pregnancy, and the symptoms of diabetes become apparent in a pregnant woman who has not had diabetes. This condition often occurs in the last half of pregnancy; Insulin resistance progressively increases until delivery. The prevalence of gestational diabetes is reported to be between 1-14% in different parts of the world. A review article conducted in 2014 in 12 provinces of Iran has estimated the prevalence of gestational diabetes at 5.88%<sup>27&28</sup>.

Gestational diabetes as a silent disease affects the phenomenon of pregnancy, adversely affects the mother and fetus and leads to adverse pregnancy outcomes, the most common of which are fetal macrosomia, birth defects, cesarean section, poly Hydramnios, preeclampsia, and neonatal metabolic disorders (hypoglycemia, hyperglycemia, hyperbilirubinemia), respiratory distress syndrome, and late-onset complications include

maternal type 2 postpartum diabetes<sup>29</sup>. Although in most women with a history of gestational diabetes, glucose intolerance returns to normal within a few weeks after delivery, insulin resistance or impaired insulin secretion have been reported in these women<sup>30</sup>.

### 9. Risk factors for gestational diabetes

The most important risk factors for gestational diabetes are: Age over 30 years, obesity, family history of gestational or type 2 diabetes, history of macrosomic (large) childbirth, and history of stillbirth.

#### 9.1. Guidelines for diagnosing gestational diabetes

#### 9.2. Pregnancy tips

In 2013, the World Health Organization and the International Diabetes Association (IADPSG) officially recommended a two-hour GTT test with 75 g of glucose for screening and diagnosing gestational diabetes<sup>31&32</sup>. For all pregnant women, a fasting blood sugar test should be requested at the first pregnancy visit and its interpretation is as follows:

**Table II:** Interpretation of fasting blood sugar test at the first visit.

Fasting blood sugar mg/dl	≤92	Normal
Pre-diabetic	125-93 mg/dl	
Abnormal	≥126	

If fasting blood sugar is between 93 and 125 mg/dL, the person is considered pre-diabetic and proper diet and exercise are recommended. If the fasting blood sugar is 126 or more, the test is repeated, and if the second test is equal to more than 126, the person is diabetic and should be treated. For all non-diabetic pregnant women (normal and pre-diabetic) for screening for gestational diabetes, a two-hour oral glucose tolerance test with 75 g of glucose (OGTT) is required at 28-24 weeks of gestation and is interpreted according to the following guidelines:

**Table III:** Interpretation of oral glucose tolerance test at 24-48 weeks of gestation.

Fasting blood sugar	≥92	
Blood sugar 1 hour after consuming 75 grams of glucose (mg/dl)	≥180	abnormal
Blood sugar 2 hours after consuming 75 grams of glucose (mg /dl)	≥153	

If at least one of the above results is abnormal, definitive diagnosis of gestational diabetes and necessary action and follow-up are necessary.

#### 9.3. Recommendations after pregnancy

For all women with gestational diabetes, in order to detect stable diabetes, in the 6th to 12th week after delivery, oral glucose tolerance test with 75 g of glucose (fasting and two-hour sampling) should be requested and its interpretation is as follows<sup>31</sup>:

**Table IV:** Interpretation of oral glucose tolerance test, 6-12 weeks postpartum.

Fasting blood sugar (mg/dl)	99≥	normal
	-125 100	Pre-diabetic
	≥126	
Blood sugar 2 hours after glucose intake (mg/dl)	<140	Normal
	140-199 ≥200	Pre-diabetic Diabetic

#### 9.4. Importance of postpartum follow-up

After childbirth, glucose intolerance persists in about 30% of women with gestational diabetes. Also, women with gestational diabetes are seven times more likely to develop type 2 diabetes, even with mild glucose intolerance, than women with pregnancies with normal glucose tolerance<sup>31</sup>. The prevalence of type 2 diabetes following gestational diabetes has been reported from 3 to 70%. The incidence of this infection increases significantly in the first 5 years after delivery and at a slower rate up to 10 years after delivery<sup>32</sup>.

More than half of women with gestational diabetes develop type 2 diabetes within the next 20 years<sup>33</sup>. Overall, women with a history of gestational diabetes are 7 to 10 times more likely to develop type 2 diabetes<sup>34</sup>. In women with a history of gestational diabetes, in order to diagnose and control diabetes early or to prevent diabetes, it is necessary to provide training on postpartum follow-up. This includes screening for postpartum diabetes and lifestyle changes (exercise and diet)<sup>34</sup>.

The American Diabetes Association recommends that women diagnosed with gestational diabetes should be screened for type 2 diabetes 6-12 weeks postpartum and then repeated every three years. It is done to prevent the complications of diabetes. With the diagnosis of pre-diabetes, it is recommended to follow a diet, do more physical activity, to prevent type 2 diabetes, as well as periodic blood sugar tests. If the blood sugar level is normal, it is necessary that because of the high risk of developing diabetes due to a history of gestational diabetes, diet and physical activity, do not become obese and repeat diagnostic tests every three years<sup>35</sup>. In fact, the primary goal of treatment in women with a history of gestational diabetes is behavioral changes in lifestyle, including changes in diet and physical activity, which modulate the onset and severity of type 2 diabetes in later life<sup>36</sup>. However, the cooperation of women with a history of postpartum diabetes in timely referral for screening for

postpartum diabetes is weak and most of them do not refer for screening<sup>36,37</sup>. Studies in the United States and Canada have shown that women refer to postpartum glucose measurements in 45-20% of cases<sup>36</sup>.

### 10. Self-regulatory model

According to the results of a study in Iran, the participation rate of women with a history of gestational diabetes for postpartum screening for diabetes was 48.7%<sup>37</sup>. There are barriers to postnatal diabetes screening in women with a history of gestational diabetes, including stress, time pressure, problems adjusting to maternal role<sup>38&39</sup>, and chronic self-management deficits. Studies have shown that daily management of diabetes requires behavioral self-regulation and self-regulation is a significant predictor of physical activity and diet<sup>40&41</sup>.

Self-regulation is the process by which people set their goals, control their emotions and thoughts, and improve their strategies. In self-regulation, a person evaluates his behavior and if it fits his standards, his behavior is evaluated well and makes him happy, and if this behavior does not fit the standards, he tries to achieve the standards by changing the behavior. Then re-evaluates to see if it has been able to reduce or eliminate the behavior gap from the standards. When there is no gap between behavior and standards, then it stops the process or sends it out of its mind<sup>42&43</sup>. Miller, Brown, and Frederick designed a seven-step self-regulating model. In this model, self-regulatory behavior slips due to failure or defect in each of these stages, these seven stages include: acceptance, evaluation, commissioning, review, planning, implementation and measurement. For many people, taking action and maintaining a lifestyle change is the most difficult aspect of self-care programs and they delay it<sup>44</sup>. Procrastination is defined as a form of failure in self-regulation when a person voluntarily delays despite expecting a bad delay. In short, despite the expectation of a bad result, the relevant action is not performed. New research has shown that procrastination has been associated with negative physical health outcomes, in particular it has been shown that procrastination has been associated with less healthy behaviors, such as nutrition and healthy activity. Part of the poor health experience by procrastinators may be due to their tendency to delay their health problems<sup>45&46</sup>.

Due to the high prevalence of type 2 diabetes in women with a history of gestational diabetes, one of the midwives' duties is to inform women with gestational diabetes during pregnancy and after delivery and to encourage them to be screened for diabetes. In the postpartum period and to prevent the occurrence of type 2 diabetes or delay its onset, lead them to a healthier lifestyle (diet and physical activity)<sup>47</sup>. However, various studies have shown that women's participation in diabetes screening, diet and physical activity is not desirable and many studies have been conducted by women with a history of gestational diabetes to follow these postpartum follow-ups. Interventions are considered necessary because one of the reasons for the non-participation of these women in postpartum follow-up is lack of self-regulation and procrastination, and self-regulatory strategies provide the basis for purposeful action. This study aims to investigate the effect of self-regulatory model education on postpartum follow-up (including diabetes testing, exercise and physical activity, as well as diet) in women with a history of gestational diabetes. It is hoped that the results and achievements of this study will be a small step towards promoting the health of mothers in Iran.

### Conclusion

In conclusion, Gestational diabetes is a silent condition that affects both the mother and the foetus throughout pregnancy. After gestational diabetes, the prevalence of type 2 diabetes has been observed to range from 30 to 70%. Women with a history of gestational diabetes should receive instruction on follow ups after delivery to help with diabetes prevention, early detection, and control. The follow ups, are including postpartum diabetes screening and lifestyle changes (exercise and diet compliance. Training according to the self-regulatory model improves the physical activity and nutritional status of women with a history of gestational diabetes and it is recommended that this model in the programs of the Ministry of Health and at different levels of Use clinical centers and provide training packages based on this model to the health team, especially midwives, nurses, health workers and even doctors.

### Interests conflict

The researchers declare that they have no conflict of interest.

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