Relationship between Type 2 Diabetes and Depression: A Systematic Review

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Abstract

Introduction: Type 2 diabetes is a metabolic disease that results in reduced quality of life, increased healthcare costs, and reduced life expectancy. Depression in diabetic patients reduces self-care and their performance abilities. The aim of this study was to investigate the relationship between type 2 diabetes and depression and the factors influencing them in studies in Iran and other parts of the world.

Materials and Methods: This research was a secondary systematic review study. The statistical population consisted of all the studies that examined type 2 diabetes and depression and the factors affecting them.

Results: After searching, screening and a qualitative evaluation of studies during the systematic review, the final synthesis was performed on 10 articles. The examination of the studies on the prevalence of depression showed that, on average, 42.13% of patients with diabetes are facing depression. The most important factors associated with depression in diabetes include high age and complications of diabetes, female gender, low income, and receiving oral or injectable diabetes drug.

Conclusion: Raising diabetic patients' awareness regarding control and prevention of complications and making appropriate treatment and care interventions can prevent depression in patients. Screening diabetic patients for depression and factors affecting its incidence, as well as screening older patients with depression for diabetes, is also recommended in this regard.

Keywords: Type 2 Diabetes, Depression, Relationship

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Introduction

The type 2 diabetes is a form of metabolic disease challenging governments and societies seriously. Type 2 diabetes decreases the life quality, increases costs of treatment, and reduces life expectancy (1). The World Health Organization represented diabetes as one of the most significant threats to human health in the 21st century. It is said that 346 million people in the world suffer from diabetes these days. The number of patients will double at least during the 15 years (2).

Diabetes is one of the most common diseases in Iran with the prevalence rate ranging from 7.8 to 15.5 in different racial groups (3). About 4 million people were suffering from diabetes in Iran in 2008. Experts predict that the number of people with diabetes will be tripled over the next 15 years. This means more than 12 million people will be diagnosed with diabetes by 1400 in solar years (4).

Evidence suggests that behavioral and environmental effects play a more significant role in emerging and maintaining chronic diseases such as diabetes, compared to biological changes.

The most common disorders which can be diagnosed with diabetes are anxiety and depression (5). Depression, as a chronic psychological stress, occurs with increasing secondary blood cortisol to adrenal- pituitary-hypothalamus activity which is not detectable in clinical checkups. Cortisol leads to visceral obesity, insulin resistance, Dyslipidemia, and high blood pressure (hypertension). This hormone stimulates the sympathetic nervous system, leads to an increase in the inflammation, and responds to platelet aggregation and decreased sensitivity to insulin.

This shows that an increase in cortisol in diabetes can be a risk factor for depression and anxiety (6).

Major depression is a common, chronic and recurring disease which is related to death and reduces the quality of life.

The World Health Organization recognizes major depression as the fourth reason for disability in the world and predicts that it will be the second reason by 2020.

Depression is a common cause for morbidity in diabetic patients as well as other chronic diseases. The existence of depression in patients with diabetes decreases the patient's self-protection and functional abilities, and affects the patient's health negatively (7). Besides, the symptoms of depression and anxiety often remain unknown and therefore, it will not be treated appropriately (2).

Since diabetes and depression is associated with a reduced quality of the patients' life, these two disorders increases the patients' disability and problems at the same time.

Therefore, understanding the association between diabetes with depression and the factors affecting them is important, and it is effective in screening and in the treatment of depression in diabetic patients or screening and in the treatment of diabetes in depressed patients, and improving the disease prognosis and patients' quality of life. Therefore, the present systematic review was conducted in order to study the relationship between type 2 diabetes and depression.

Methodology

In this study, the relationship between type 2 diabetes mellitus and depression has been investigated in 2011 to

2016, using a systematic review.

This study was designed based on Cochran's seven-step model and includes the year allocation, setting input criteria, and selection of the studies, reviewing the quality of the studies, information extraction, information analysis and presentation. Keywords including diabetes, depression and relationship were used in order to find articles. The keywords were searched in information databases such as Google Scholar, PubMed, Science Direct, and Sid.

The input criteria included English and Farsi research articles which measured the prevalence or the relationship of type 2 diabetes mellitus with depression. The output criteria included qualitative studies, review, case studies, seminars, and also the studies presenting the relationship of other types of diabetes with depression.

After searching, 25 articles were found in which 2 articles were excluded because of being repetitive and 13 articles considering the output criteria (5 review articles, 1case study and 7 articles measured the relationship of other types of diabetes with depression). Finally, 10 articles were chosen based on the input criteria and the main required information were extracted from the articles. Chart 1 shows the primary process of studies input and output to the final synthesis.

Findings

After searching, screening, and qualitative studies during the systematic reviewing, ultimate synthesis was conducted on 10 articles (2 national articles and 8 international articles). The findings are represented in 3 sections: the prevalence of depression in type 2 diabetes, the prevalence of type 2 diabetes in depression and associated factors.

Among 10 articles, 8 articles focused on the prevalence of depression in diabetes and its related factors, one special article considered the factors associated with depression, and another one showed the density of the occurrence of depression in diabetic patients or the density of diabetes occurrence in patients with depression and the factors associated with them. The information and the results related to these studies are summarized in table 1.

Reviewing the studies related to the prevalence of depression showed that on average, about 42.13% of patients with diabetes suffer from depression. The range of the changes in these studies varied from 16.9 % in Balhara & Sagar's study to 70.37% in Parham et al.'s study. According to table 2, totally, 13 factors associated with depression in diabetes were shown in 7 international studies. This is while no factor was found associated with depression in 1 international study and 2 Iranian studies. The factors associated with depression in diabetes include: body mass index, blood glucose level, diabetes effects, sex, age, duration of diabetes affection, income status, receiving oral or injection medication for diabetes, smoking, marital status, education level, symptoms of anxiety and sleep quality.

The frequency of the factors associated with depression in diabetes include the effects of diabetes (4studies), age increasing (3 studies),low income, female sex, receiving oral or injection medication for diabetes , marital status (2 studies), body mass index, blood glucose levels, duration of diabetes affection, smoking, low education, the symptoms of anxiety and sleeping quality (1 studies), respectively.

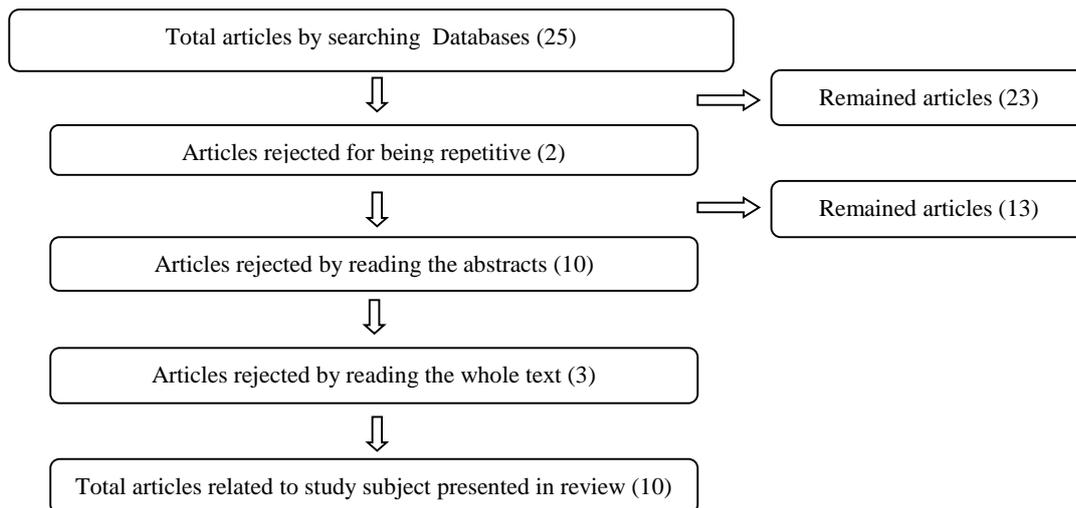**Chart 1.** input & output diagram of primary studies to final synthesis

| Total articles by searching Databases (25) |
| Articles rejected for being repetitive (2) | → Remained articles (23) |
| Articles rejected by reading the abstracts (10) | → Remained articles (13) |
| Articles rejected by reading the whole text (3) |
| Total articles related to study subject presented in review (10) |

Table 1. given information from 10 articles related to type 2 diabetes and depression

No	author	year	Study subject	country	population	Study type	instrument	results
1	Mirghani & Elbadawi	2016	Depression, anxiety & sleepiness in type 2 diabetics and its relationship with diabetes control	Saudi Arabia	178 patient and 100 control	Case- Control	Beck Depression Inventory (BDI)	The prevalence of depression in diabetic patients was 61.8 % and 30% in control group (p <0/001). There was no difference between diabetic patients with depression and those without this disorder in terms of control diabetes (P <0/293) and body mass index (p <0/ 481).
2	Rajput et al	2016	Studying the prevalence and diagnosis of the factors affecting the Depression, anxiety	India	410 patients and 410 controls	Cross- Sectional Case- Control	Hamilton Depression Rating Scale Hamilton Anxiety Rating Scale	A high proportion of the diabetic patients suffered from depression (26.3 % vs 11.2 %, p=0.001%) or depression and anxiety at the same time (21% vs 7.3%, p = 0.001), compared to control group. The predicted factors to intensify depression and anxiety in type 2 diabetic patients include age (P = 0.005) and the confidence intervals 0.238-3.784), the female sex (p = 0.002) and confidence intervals(0.310-2.770), insulin therapy (p=0.001) and confidence intervals (2.781-6.994), retinopathy (p=0.001) and confidence intervals (2.775-15.53), nephropathy (p = 0.001) and confidence intervals (2.781-6.994) and ischemic heart disease (p = 0.001) and confidence intervals (0.183-2.453).
3	Sun et al	2016	prevalence and factors determining depression & anxiety symptoms in adults with type 2 diabetes	China	893	Cross- Sectional	Zung Self- Rating Anxiety and Depression Scale	The prevalence of depression symptoms was 56.1 %. The symptoms of depression related with the female sex (P =0 and confidence intervals (1.186-2.401), high age(P =0.02) ,and confidence intervals (1.104-2.257) , low level of education (P = 0.04) , and confidence intervals (1.063- 6.940), Non-married (P = 0.05) and confidence intervals,(1.005-2.721), complications of diabetes (P = 0) and confidence intervals (1.301-2.423), symptoms of anxiety (P = 0 and confidence intervals (2.621-4.988) and low quality of sleeping (P = 0, confidence intervals (1.449-4.424).
4	Park et al	2015	anxiety in adult patients with type 2 diabetes mellitus	Korea	753	epidemiologic	Beck Depression Inventory (BDI)	The prevalence of depression in the samples was 28.8% that in depressed group, jobless people 2.40 times (confidence intervals (1.21-4.76), people with low income 2 .57 times (confidence intervals 1.52-4.35), smokers 2.03 times (confidence interval 1.10-3.73), people without a regular exercise program 1.91 times (confidence intervals 1.17-3.14) and people who took oral or insulin 2.03 times (confidence intervals 1.25-3.32) are more than those without depression.
5	Mikaliukstie stain et al	2014	prevalence and determining depression & anxiety symptoms in patients with type 2 diabetes	Lithuania	1500	epidemiologic	The Hospital Anxiety and Depression Scale (HADS)	The prevalence of depression with minor to severe degree was 28.5 % (confidence intervals 25.7- 31.4) and high age (P < 0.001) , confidence intervals 35.4-46.3 ,and the time of affecting to diabetes (P < 0.001) and confidence intervals (40.2-58.3) associated with higher depression symptoms. 72.2 % of participants suffered from diabetes effects and there was a significant relationship between diabetes symptoms and depression scores. (P < 0.001, and confidence intervals (30.1- 37.0).
6	Chen et al	2013	Kouhort study based on population about bilateral relationship between type 2 diabetes and depression	Taiwan	16957	Kouhort based on population	Taiwan's national health insurance database	The first Cohort analysis showed the density of occurrence of depression in 7.03 in 1000 people in a year for the group with diabetes and 5.04 in 1000 people in a year for non-diabetic, stating the range of the risk 1.43, (confidence intervals 1.16-1.77). The second Cohort analysis showed the density of the occurrence of diabetes 27.59 in 1000 people in a year for the group with depression and 9.22 in 1000 people a year for the group without depression ,stating that the risk (2.02) was high ,(Confidence intervals1.80-2.27).

No	author	year	Study subject	country	Sample population	Study kind	instrument	result
7	Zarate et al	2012	Prevalence of anxiety and depression in outpatients with type 2 diabetes	Mexico	820	epidemiologic	Hamilton Depression Rating Scale Hamilton Anxiety Rating Scale	The prevalence of depression was 48.27% (confidence intervals 44.48-52.06). There was a significant relationship between the blood glucose level (P = 0.009 and confidence intervals (0.40-0.87) and diabetes complications with depression (P = 0.01 and confidence intervals 1.06-1.97)
8	Balhara & Sagar	2011	Correlation of anxiety and depression in outpatients with type 2 diabetes mellitus	India	77	Cross- Sectional	Brief Patient Health Questionnaire (brief PHQ) Hospital Anxiety and Depression Scale (HADS)	The prevalence of depression in diabetic patients (n = 13) was 16.9 %, and there was a significant correlation between depression score and body mass index (correlation coefficient 0.36,P = 0.004). There was no significant correlation between depression and diabetes and the treatment of the disease.
9	Mazloum Baqraee et al	2014	Investigating the prevalence rate of depression and anxiety in diabetic patients	Iran	50 patients & 50 healthy one	Descriptive	21-question questionnaire of DASS and demographic data	There is no significant difference between male and female patients with diabetes in terms of depression and anxiety; there is no significant difference between normal people and diabetics in terms of the depression and anxiety. (P<0.05).
10	Parham et al	2013	The symptoms of depression and blood sugar control in patients with type 2 diabetes	Iran	116	Cross- Sectional	Beck Depression Inventory (BDI)	70.37% patients had symptoms of depression, and 29.3 % patients had no symptoms of depression. 17.6 % of patients with symptoms of depression and 35.3% of non-depressed patients, had FBS less than 130 mg/dl (P= 0.099), moreover, 17.1% of patients with symptoms of depression and 17.6% of non-depressed patients had HbA1c less than 7 % (P= 0.940). Depression, particularly in long-term, does not affect the blood sugar control on patients with diabetes.

Table 2. Specifications of the studies related to the factors affecting the depression

	Factors related to depression in patients with diabetes												author
Quality of sleeping	Anxiety symptom	Education level	Marital status	smoking	Receiving oral or injection medicine for diabetes	income status	duration of affected to diabetes	age	gender	diabetes effects	blood glucose level	body mass index	
*	*	*	*					*	*	*			San,et al
												*	Ball Hara & Segar
								*	*				Zerat, et al
							*						Chen , et al
						*		*		*			Mickalic Stein, et al
				*	*	*							Park,et al
			*		*	*		*	*	*			Rajpout , et al

The above factors can be classified in the following 3 main subgroups:
1. Demographic characteristics include: age, sex, economic status, and education level
2. Social support includes: emotional and psychological support by the spouse
3. The history of mental and physical problems include: the effects of diabetes, body mass index, blood glucose level, duration of diabetes affection, smoking, sleeping quality, anxiety symptoms and receiving oral or injection medication for diabetes.
Chen et al. showed that the rate of risk for diabetes in patients with depression (2.02) is more than the rate of the risk for depression in diabetic patients (1.43), and the risk of diabetes increases in depressed patients with an increase in age.

Discussion
According to the results of previous researches the rate of depression in patients with type 2 diabetes is more compared to the non- diabetes population. Also, the results of previous studies reveal that the occurrence of diabetes complications and age increasing are the most powerful predicting factors for depression (1, 2, 6, 8, 9). Since diabetes leads to social-economical limitations and disturbance in the individual independence, it can play a significant role in the occurrence of depression in diabetic patients. Moreover, increase in age leads to an increase in physical weakness, the severity of the disease and the risk of diabetes that can be a factor in the incidence of depression in these patients. This is while the study of Chen et al (8). showed that increase in age decreases the extent of the risk for depression.
The most common prevalence of depression was seen in a study conducted by Parham et al (3). in Iran, in which there was no significant relationship between blood sugar control, age, sex and depression. The less common prevalence of depression was in Balhara & Sagar studies (10) in India and there was a significant correlation between depression and body mass index. Rajpout et al (9). & Park et al (11). low income and receiving oral or injection medication for diabetes known to Cause of depression in diabetic patients. Low income limits the resources and facilities and leads to the incidence of diabetes and increases the risk of depression in these patients. In addition, in patients who are treated by receiving oral or injection medication for diabetes, the severity of the disease is high and using the drug continuously can cause fatigue and symptoms of depression in patients. While studies of Mikaliuk Stain et al (2). showed that there is no significant relationship between insulin consumption and depression. The study of Balhara & Sagar (10) associates the body mass index with the incidence of depression in diabetes. Its reason can be found in the relationship of obesity with reduced confidence, socio-economic, and psychological problems in individuals. This is while the study of Mirghani & Elbedawi (7) didn't show any significant relationship between depression and body mass index. Zarate et al (6). showed a significant relationship between blood glucose levels and the incidence of depression in diabetes. Its reason can be reported in the

relationship between blood glucose levels and diabetes effects. The study of Parham et al (3). didn't show a significant relationship between the frequency of the distribution of blood glucose control with depression. The study of Sun et al (1). suggests that the duration of diabetes is one of the factors associated with the incidence of depression which can be caused by the relationship between the duration of diabetes with the incidence of diabetes effects as a risk factor for depression. In a study conducted by Parham et al (3). there was no significant relationship between the duration of diabetes and the incidence of depression. Park et al (11). showed a significant relationship between depression and smoking which can be caused by the increasing probabilities of diabetes associated with smoking. Also, this is while Mikaliuk Stain et al.'s study (2) didn't show a relationship between smoking and depression. In a study conducted by Sun et al (1)., results showed a significant relationship between education level and anxiety symptoms, and the low quality of sleeping with depression. Those with higher education levels accept the importance of the recommended treatment and follow the principles of self-protection and preventive programs better. Moreover, anxiety symptoms and low quality of sleeping can pave the way to depression. This is while Mazloum et al (5). showed that the extent of the depression among different education groups in diabetics is equal. Sun et al (1). reported that depression in single people is more prevalent and can be associated with lack of emotional support by his spouse. This is while Rajpout et al (9). reported that depression in married people is more common which can be caused by the burden of responsibility and psychological pressures.
The limitation of this study is that according to its methodology, it doesn't investigate the available studies. It is suggested to review the previous researches which used the same case study in order to compare the results precisely.

Conclusion
The results of this study showed that the rate of prevalence of depression in patients with type 2 diabetes is more than the non-diabetic group. Also, the incidence rate of type 2 diabetes in patients with depression is more than the non-depressed group. The severity of diabetes and its effects in depression symptoms plays a significant role in these patients. Increasing age associated with physical weakness and patients' financial resources limitations lead to intensifying the effects of the disease, and eventually leads to depression. Increasing the diabetic patients' level of information and knowledge regarding to disease control, prevention of the effects, and proper intervening treatments can prevent depression in these patients. However, screening the diabetic patients in terms of depression and factors affecting their depression is suggested. Furthermore, according to an increase in the possibility of the occurrence of diabetes in patients with depression in older ages, screening the depressed patients with an increasing age in terms of diabetes is suggested.

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