



PREVALENCE AND DETERMINANT FACTORS AFFECTING THE MENTAL HEALTH OF DIABETES MELLITUS PATIENTS IN LAMONGAN REGENCY, INDONESIA

Abdul Rokhman¹, Nur Hidayati^{1*}, Dadang Kusbiantoro²

¹Department of Nursing, Faculty of Health Sciences, Universitas Muhammadiyah Lamongan, Jl. Raya Plalangan Plosowahyu KM 2 Lamongan, East Java 62218, Indonesia

²Department of Health Administration, Faculty of Health Sciences, Universitas Muhammadiyah Lamongan, Jl. Raya Plalangan Plosowahyu KM 2 Lamongan, East Java 62218, Indonesia

*nur_hidayati@umla.ac.id

ABSTRACT

Diabetes mellitus is one of the most prevalent chronic diseases worldwide, who are at a higher risk of developing psychological issues instead of physical complications. Objective to analyze the prevalence and determinant factors associated with mental health issues among diabetes patients. This cross-sectional study involving 71 diabetes mellitus patients in Lamongan Regency between May and August 2023. Data were analyzed using Spearman's test and logistic regression ($\alpha \leq 0.05$). Among the participants, 71.8% were female, 47.9% were aged 55–65 years, and 83.1% were non-smokers. Spearman's test results indicated no significant association between diabetes type, history of heart disease, history of hypertension, and health insurance status with mental health issues ($p = 0.057$, $p = 0.693$, $p = 0.925$, $p = 0.544$). However, a significant association was found between physical activity and mental health issues in diabetes patients ($p = 0.045$). Physical activity was identified as the dominant factor influencing the risk of mental health issues among diabetes patients ($p = 0.028$, 95% CI = 8.812 [1.267–61.317]). Diabetes patients who engage in strenuous physical activity are eight times more likely to experience mental health issues compared to those engaging in light physical activity.

Keywords: diabetes mellitus; lamongan regency; mental health

How to cite (in APA style)

Rokhman, A., Hidayati, N., & Kusbiantoro, D. (2025). Prevalence and Determinant Factors Affecting the Mental Health of Diabetes Mellitus Patients in Lamongan Regency, Indonesia. *Indonesian Journal of Global Health Research*, 7(4), 1053-1062. <https://doi.org/10.37287/ijghr.v7i4.5754>.

INTRODUCTION

Type 2 diabetes has become a major global health concern due to its rapidly increasing prevalence and the long-term complications and functional limitations it causes. As one of the most rapidly expanding chronic diseases worldwide, diabetes contributes to both microvascular and macrovascular issues, ultimately decreasing life expectancy. (Heald et al., 2020). Individuals with type 2 diabetes frequently experience unipolar depression and anxiety, with prevalence rates at least double those found in people without diabetes (Golden, et al., 2017; Semenkovich et al., 2015).

Individuals with diabetes are also at a higher risk of developing various physical (Einarson et al., 2018) (Harding et al., 2019) and psychological complications (Chireh et al., 2019). Psychological issues such as depression, anxiety, and stress related to illness are recognized as significant concerns for diabetes patients. Individuals diagnosed with diabetes are twice as likely to experience concerning levels of depression, as studies have shown that those with both diabetes and depressive symptoms have poorer survival rates compared to those without depressive symptoms (McCoy & Theeke, 2019). Additionally, the prevalence of anxiety is higher among individuals with type 2 diabetes compared to those without the condition (Smith et al., 2015). Although distinct from anxiety, stress is equally important, as it is closely

linked to diabetes (Burns et al., 2016) and represents a psychological burden associated with a type 2 diabetes diagnosis.

In 2017, the global prevalence of diabetes among individuals aged 18–99 years was around 451 million, and it is projected to rise to 693 million by 2045 (Cho et al., 2018). Diabetes is known to have a strong link with mental health disorders, particularly depression, which greatly impacts the quality of life of those living with the condition (Albekairy et al., 2018). Mental health disorders are a common comorbidity in diabetes mellitus (DM), with a global prevalence of 28%; women are more affected than men, with rates of 34% and 23%, respectively (Khaledi et al., 2019); (Khan et al., 2019); (Robinson et al., 2013); (Roy & Lloyd, 2012). Mental disorders such as anxiety disorders, depression, bipolar disorder, and eating disorders frequently occur in DM patients (Bernstein et al., 2013); (Lodha & De Sousa, 2018); (Sivertsen et al., 2014); (Sunny et al., 2019). Mental health issues in individuals with diabetes can reduce their quality of life (Eren et al., 2008) lead to poor self-care management (Smith et al., 2015), and increase disability (Bruce et al., 2016), cardiovascular mortality risk (Hendriks et al., 2014) and overall disease-related mortality (Naicker et al., 2017). Furthermore, diabetes itself is considered a risk factor for mental health disorders (Yu et al., 2015). Studies on the general population suggest that younger individuals with diabetes are more likely to develop mental health issues (Khaledi et al., 2019). However, other research indicates that older adults with diabetes are more prone to mental health disorders, with additional risk factors contributing to this association (Sunny et al., 2019). Previous studies have also concluded that mental health disorders are more likely to occur in women without formal education, alcohol consumers, individuals with type 1 diabetes, those with older age, longer diabetes duration, chronic diabetes complications, and other comorbidities commonly observed in elderly diabetes patients (Tiki, 2017). Additionally, research has shown a link between diabetes comorbidities and mental health disorders with genetic predisposition and family history (Barnes et al., 2017); (Köhler et al., 2018); (Hurst et al., 2022)(Park et al., 2023); (Tsang et al., 2017) and obesity (Brayne et al., 2005); (Mannan et al., 2016); (Zimmermann et al., 2003).

Mental health conditions that commonly coexist with diabetes in older adults should be a significant concern (Alagiakrishnan & Sclater, 2012). The development of psychiatric disorders in the elderly may be influenced by mechanisms related to diabetes mellitus (DM), including brain-derived neurotrophic factors, insulin resistance, and cytokine-induced inflammation (Alagiakrishnan & Sclater, 2012). Additionally, physical and psychosocial changes play a significant role in affecting both mental health and diabetes in older adults (Trief, 2007). Complications of diabetes, such as retinopathy, nephropathy, neuropathy, coronary artery disease, and cerebrovascular disease, have been associated with poor mental health in elderly individuals with diabetes (Bansal et al., 2019). Furthermore, research indicates that factors like being overweight, reduced physical ability, low activity levels, and diabetes-related complications increase the risk of depression in older adults living with diabetes (Chen et al., 2019). Despite the growing concern, data on the risk factors for mental health problems among elderly diabetes patients in Indonesia is still scarce. The most recent national survey addressing this issue is the 2023 National Basic Health Research, conducted by the Health Research and Development Agency. This study aims to identify the prevalence and risk factors related to mental health issues in diabetes patients specifically in Lamongan Regency.

METHOD

This study employed a cross-sectional design to analyze factors influencing mental health among diabetes mellitus patients in Lamongan Regency, specifically focusing on depression, anxiety, and stress. The independent variables in this study included demographic data (age, gender, marital status, education, occupation, health insurance, selection of a Family Welfare

Card), diabetes mellitus, heart disease, hypertension, smoking behavior, consumption of high-risk foods, dietary patterns, and physical activity. The dependent variables consisted of depression, anxiety, and stress. The study was conducted over one month in August 2024. The study population included all diabetes mellitus patients in Lamongan Regency, totaling 71 individuals. The research sample consisted of 71 diabetes mellitus patients, including those with type 1, type 2, and other types of diabetes. Diabetes mellitus diagnosis was established based on patient medical history and random blood glucose testing. The sampling technique used was total sampling, ensuring that all collected sample data were analyzed.

The research data were sourced from the 2023 Indonesian Health Survey (SKI), conducted by the Ministry of Health of the Republic of Indonesia (Badan Penelitian Dan Pengembangan Kesehatan Republik Indonesia, 2018) from May to August 2023. Data were collected and analyzed using Spearman's test and Logistic Regression to identify the factors influencing mental health in diabetes mellitus patients, with a significance level set at $\alpha \leq 0.05$. The assessment of mental health in this study was carried out using the Patient Health Questionnaire-9 (PHQ-9) in Indonesian version, a tool designed to measure levels of stress, depression, and anxiety. The reliability has been confirmed by the Cronbach's alpha value which was accounted for 0.885, and the correlation coefficient was 0.527, with with sensitivity of 90.7% and 86.5% of specificity (Dian et al., 2022). Prior to the study, the research proposal was deemed ETHICALLY APPROVED by the Health Research Ethics Committee of Muhammadiyah University of Lamongan on June 14, 2024, with approval number 300/EC/KEPK-S2/06/2024.

RESULT

Table 1.
Respondents' Characteristics (n=71)

Variables	Characteristics	f	%
Age	26-44 years	5	7
	45-54 years	19	26.8
	55-65 years	34	47.9
	66-74 years	10	14.1
	75-90 years	3	4.2
Gender	Male	20	28.2
	Female	51	71.8
Marital Status	Married	47	66.2
	Divorced	2	2.8
	Widowed	22	31
Education	No schooling	4	5.6
	Did not complete Elementary School	6	8.5
	Elementary School	26	36.6
	Junior High School	24	33.8
	Senior High School	10	14.1
	Higher Education	1	1.4
Occupation	Not Working	20	28.2
	Student	3	4.2
	Self-employed	21	29.6
	Farmer	24	33.8
	Fisherman	1	1.4
	Others	2	2.8
Smoking Intake	Smoking everyday	7	9.9
	Smoking not everyday	5	7
	Not smoking	59	83.1

The majority of diabetes mellitus patients are female (71.8%), with 47.9% of respondents aged 55–65 years. Additionally, 66.2% are married, 36.6% have completed elementary school, 33.8% work as farmers, and 83.1% do not smoke (Table 1). Table 2 shows that 50.7%

of diabetes patients have BPJS PBI health insurance, 63.4% have type 2 diabetes, 97.2% do not have heart disease, and 62% do not have hypertension. Furthermore, 69% engage in moderate physical activity, and 92.9% are not at risk of mental health issues.

Table 2.
Frequency Distribution of Research Variables (n=71)

Variable	f	%
Health Insurance		
BPJS PBI	36	50.7
BPJS Non PBI	16	22.5
JAMKESDA	1	1.4
No health insurance	18	25.4
DM Types		
Type 1	6	8.5
Type 2	45	63.4
DM with pregnancy	1	1.4
Unknown	19	26.8
Heart Disease		
Yes	2	2.8
No	69	97.2
Hypertension		
Yes	27	38
No	44	62
Physical Activities		
Light	11	15.5
Moderate	49	69
Vigorous	11	15.5
Mental Disorder Risks		
Normal	66	92.9
Risky	5	7.04

Table 3.

Analysis of the Relationship Between Diabetes Mellitus Type, Medical History, Physical Activity, and Health Insurance with Mental Health Issues in Diabetes Mellitus Patients (n=71)

Variable	Category	Normal		Mental Disorder Risks		p
		f	%	f	%	
DM Types	Type 1	6	9.1	0	0	0.057
	Type 2	40	60.6	5	100	
	DM with pregnancy	1	1.5	0	0	
	Unknown	19	28.8	0	0	
History of Heart Disease	Yes	2	3	0	0	0.693
	No	64	97	5	100	
History of Hypertension	Yes	25	37.9	2	40	0.925
	No	41	62.1	3	60	
Physical Activities	Light	11	16.7	0	0	0.045
	Moderate	47	71.2	2	40	
	Vigorous	8	12.1	3	60	
Health Insurance	BPJS PBI	34	51.5	2	40	0.544
	BPJS Non PBI	15	22.7	1	20	
	JAMKESDA	1	1.5	0	0	
	No health insurance	16	24.2	2	40	
	BPJS PBI	34	51.5	2	40	

Noted:

BPJS PBI: Badan Penyelenggara Jaminan Nasional - Penerima Bantuan Iuran
(National Insurance Provider Agency - Contribution Assistance Recipients)

BPJS Non PBI: Badan Penyelenggara Jaminan Nasional – Non Penerima Bantuan Iuran (National Insurance Provider Agency - Non-recipients of Contribution Assistance)

JAMKESDA: Jaminan Kesehatan Daerah (Regional Health Insurance)

The data in table 3 show that 60.6% of patients with type 2 diabetes have normal mental health, with 5 individuals at risk of mental health issues. Among diabetes patients with no history of heart disease, 97% have normal mental health, and 5 individuals without a history of heart disease are at risk of mental health problems. 62.1% of those without a history of hypertension have normal mental health, and 3 diabetes patients with no history of hypertension are at risk of mental health issues. Diabetes patients with moderate physical activity have normal mental health in 71.2% of cases, while those with vigorous physical activity are at a 60% risk of mental health problems. Diabetes patients with BPJS PBI health insurance have normal mental health in 51.5% of cases, and 40% of patients with BPJS PBI insurance or no insurance are at risk of mental health issues. Spearman's test results indicate no significant relationship between diabetes type, heart disease history, hypertension history, and health insurance status with mental health issues ($p=0.057$; $p=0.693$; $p=0.925$; $p=0.544$). However, there is a significant relationship between physical activity and mental health issues in diabetes patients ($p=0.045$).

Table 4.
Multivariate Analysis of the Relationship of DM Type and Physical Activity with Mental Health Problems in Patients with DM (n=71)

	Variable	Coefficient	p	PR (95% CI)
Step 1	Type 1	-0.229	1	0.795 (0-0)
	Type 2	-18.555	0.998	0.00 (0-0)
	Moderate Physical Activity	19.731	0.999	370899.1 (0-0)
	Vigorous Physical Activity	1.946	0.056	7 (0.952-51.448)
Step 2	Moderate Physical Activity	20.222	0.999	605803066.1 (0-0)
	Vigorous Physical Activity	2.176	0.028	8.812 (1.267-61.317)

Factors eligible for logistic regression analysis are diabetes mellitus type and physical activity. The vigorous physical activity factor has a p-value of 0.028 with a prevalence ratio (95% CI) = 8.812 (1.267-61.317), meaning that physical activity is a dominant factor in the risk of mental health issues in diabetes mellitus patients in Lamongan Regency. Patients with diabetes who engage in vigorous physical activity are at an 8-fold increased risk of mental health issues compared to those engaging in light physical activity. Diabetes type is a confounding factor for the risk of mental health issues in diabetes patients in Lamongan, meaning that if a diabetes patient engages in vigorous physical activity and also has type 2 diabetes, the risk of mental health issues becomes significantly higher (Table 5).

DISCUSSION

The study results indicate that vigorous physical activity combined with type 2 diabetes increases the risk of mental health issues in diabetes patients. Additionally, the vigorous physical activity in College students were less likely to report poor mental health and received stress (Vankim & Nelson, 2013). Mental health problems that can occur in diabetes patients include depression, anxiety, eating disorder, stress, ADHD, and others (Ducat et al., 2014; Tomic et al., 2022). When mental health comorbidities of diabetes are not recognized and treated, the financial cost to society and health care systems, as well as the morbidity and health effects for patients, are significant (Ducat et al., 2014).

In various countries, the incidence of depression among diabetes patients varies significantly based on research findings. According to (Majumdar et al., 2021) several significant predictors contribute to the occurrence of depression in type 2 diabetes patients in Eastern India, including younger age, female gender, low economic status, low adherence to treatment, hypoglycemia, and difficulty managing daily activities. Additionally, patients who experience hypoglycemia more than once a month have a 22% higher risk of suicidal ideation. Mental disorders (depression, anxiety, and ADHD) in diabetes patients in the United States are more common in younger patients and those with type 2 diabetes (Ismail et al., 2023) also reported that 20.1% of type 2 diabetes patients in Qatar experience depression, measured using the PHQ-9, with 70.8% of these patients experiencing mild depression (Park et al., 2023).

The psychological and physical conditions in diabetes mellitus patients are interconnected. This study's findings indicate that vigorous physical activity combined with type 2 diabetes increases the risk of mental health issues. On the other hand, mental health issues can also influence the rise in blood glucose levels. Therefore, managing diabetes mellitus should not focus solely on physical conditions such as blood glucose control and the prevention of microvascular and macrovascular complications but also address psychological conditions. The study results show that stress and depression levels have a significant relationship with blood glucose levels in diabetes mellitus patients, meaning that as stress and depression levels increase, blood glucose levels will rise (Ludiana et al., 2022).

In addition to physical and psychological factors, external factors also play a crucial role in the recovery and resilience of diabetes mellitus (DM) patients. The results of the study indicate that social support and self-esteem can prevent depression in DM patients. The higher the level of social support, the more optimistic and resilient the patient becomes. The higher the self-esteem in type 2 DM patients, the lower their depression levels (Donsu et al., 2014). One form of social support is family support. The study found a significant relationship between family support and blood glucose levels. Family support not only reduces stress but also significantly influences self-management of diabetes at home (Isworu & Saryono, 2010).

Based on the various references mentioned above, DM management can be approached from physical, psychological, and social aspects. These three factors are essential and interconnected. Therefore, managing type 2 diabetes requires a comprehensive and continuous approach, involving the family in diabetes management. This study utilized secondary data with a sample size of fewer than 100, which reduces the generalizability of the data to the broader population. Moreover, the mental health issues faced by diabetes patients were not analyzed in detail, such as the number of patients experiencing stress, depression, and/or anxiety, so an appropriate intervention method to address the mental health issues of DM patients has not yet been established.

CONCLUSION

Diabetes mellitus is a disease that not only causes physical health issues but also impacts the mental health of patients, leading to stress, depression, and anxiety. The study results indicate a relationship between physical activity and mental health issues, where the more vigorous the physical activity, the higher the risk of experiencing mental health problems. Furthermore, the test results show that factors such as diabetes type, history of heart disease, history of hypertension, and health insurance were found to be unrelated to mental health issues. Further research is needed to specifically investigate the mental health problems experienced by

diabetes patients in Lamongan Regency.

ACKNOWLEDGEMENTS

This research is funded by Universitas Muhammadiyah Lamongan through the 2024 Internal Research Grant Program. We would like to appreciate the Ministry of Health Republic Indonesia for providing the data from the Indonesian Health Survey (SKI) 2023.

REFERENCES

- Alagiakrishnan, K., & Sclater, A. (2012). Psychiatric disorders presenting in the elderly with type 2 diabetes mellitus. *American Journal of Geriatric Psychiatry*, 20(8), 645–652. <https://doi.org/10.1097/JGP.0b013e31823038db>
- Albekairy, A., Aburuz, S., Alsabani, B., Alshehri, A., Aldebasi, T., Alkatheri, A., & Almodaimegh, H. (2018). Exploring factors associated with depression and anxiety among hospitalized patients with type 2 diabetes mellitus. *Medical Principles and Practice*, 26(6), 547–553. <https://doi.org/10.1159/000484929>
- Badan Penelitian Dan Pengembangan Kesehatan Republik Indonesia. (2018). Laporan Riskesdas 2018 Nasional.pdf. In *Lembaga Penerbit Balitbangkes* (p. hal 156).
- Bansal, R., Singhal, S., Dewangan, G., Kumar, P., Satpathy, S., Kumar, N., Dwivedi, S., & Dey, A. (2019). Diabetic complications and poor mental health in the aging population. *Journal of Geriatric Mental Health*, 6(2), 78. https://doi.org/10.4103/jgmh.jgmh_22_19
- Barnes, J., Mondelli, V., & Pariante, C. M. (2017). Genetic Contributions of Inflammation to Depression. *Neuropsychopharmacology*, 42(1), 81–98. <https://doi.org/10.1038/npp.2016.169>
- Bernstein, C. M., Stockwell, M. S., Gallagher, M. P., Rosenthal, S. L., & Soren, K. (2013). Mental health issues in adolescents and young adults with type 1 diabetes: Prevalence and impact on glycemic control. *Clinical Pediatrics*, 52(1), 10–15. <https://doi.org/10.1177/0009922812459950>
- Brayne, C., Gao, L., & Matthews, F. (2005). Challenges in the epidemiological investigation of the relationships between physical activity, obesity, diabetes, dementia and depression. *Neurobiology of Aging*, 26(SUPPL.), 6–10. <https://doi.org/10.1016/j.neurobiolaging.2005.09.030>
- Bruce, D. G., Davis, W. A., Dragovic, M., Davis, T. M. E., & Starkstein, S. E. (2016). Comorbid Anxiety and Depression and Their Impact on Cardiovascular Disease in Type 2 Diabetes: The Fremantle Diabetes Study Phase II. *Depression and Anxiety*, 33(10), 960–966. <https://doi.org/10.1002/da.22523>
- Burns, R. J., Deschênes, S. S., & Schmitz, N. (2016). Associations between coping strategies and mental health in individuals with type 2 diabetes: Prospective analyses. *Health Psychology*, 35(1), 78–86. <https://doi.org/10.1037/hea0000250>
- Chen, F., Wei, G., Wang, Y., Liu, T., Huang, T., Wei, Q., Ma, G., & Wang, D. (2019). Risk factors for depression in elderly diabetic patients and the effect of metformin on the condition. *BMC Public Health*, 19(1), 1–9. <https://doi.org/10.1186/s12889-019-7392-y>
- Chireh, B., Li, M., & D'Arcy, C. (2019). Diabetes increases the risk of depression: A systematic review, meta-analysis and estimates of population attributable fractions based on prospective studies. *Preventive Medicine Reports*, 14(January), 100822. <https://doi.org/10.1016/j.pmedr.2019.100822>

- Cho, N. H., Shaw, J. E., Karuranga, S., Huang, Y., da Rocha Fernandes, J. D., Ohlrogge, A. W., & Malanda, B. (2018). IDF Diabetes Atlas: Global estimates of diabetes prevalence for 2017 and projections for 2045. *Diabetes Research and Clinical Practice*, 138, 271–281. <https://doi.org/10.1016/j.diabres.2018.02.023>
- Dian, C. N., Effendy, E., & Amin, M. M. (2022). The Validation of Indonesian Version of Patient Health Questionnaire-9. *Open Access Macedonian Journal of Medical Sciences*, 10(T7), 193–198. <https://doi.org/10.3889/oamjms.2022.9293>
- Donsu, J. D., Hadjam, M. N. R., Asdie, A. H., & Hidayat, R. (2014). Peran Faktor-faktor Psikologis terhadap Depresi pada Pasien Diabetes Mellitus Tipe 2. *Jurnal Psikologi*, 41(2), 241. <https://doi.org/10.22146/jpsi.6953>
- Ducat, L., Philipson, L. H., & Anderson, B. J. (2014). The mental health comorbidities of diabetes. *Jama*, 312(7), 691–692. <https://doi.org/10.1001/jama.2014.8040>
- Einarson, T. R., Acs, A., Ludwig, C., & Panton, U. H. (2018). Prevalence of cardiovascular disease in type 2 diabetes: A systematic literature review of scientific evidence from across the world in 2007-2017. *Cardiovascular Diabetology*, 17(1), 1–19. <https://doi.org/10.1186/s12933-018-0728-6>
- Eren, I., Erdi, Ö., & Şahin, M. (2008). The effect of depression on quality of life of patients with type II diabetes mellitus. *Depression and Anxiety*, 25(2), 98–106. <https://doi.org/10.1002/da.20288>
- Harding, J. L., Pavkov, M. E., Magliano, D. J., Shaw, J. E., & Gregg, E. W. (2019). Global trends in diabetes complications: a review of current evidence. *Diabetologia*, 62(1), 3–16. <https://doi.org/10.1007/s00125-018-4711-2>
- Heald, A. H., Stedman, M., Davies, M., Livingston, M., Alshames, R., Lunt, M., Rayman, G., & Gadsby, R. (2020). Estimating life years lost to diabetes: outcomes from analysis of National Diabetes Audit and Office of National Statistics data. *Cardiovascular Endocrinology and Metabolism*, 9(4), 183–185. <https://doi.org/10.1097/XCE.0000000000000210>
- Hendriks, S. M., Spijker, J., Licht, C. M. M., Beekman, A. T. F., Hardeveld, F., De Graaf, R., Batelaan, N. M., & Penninx, B. W. J. H. (2014). Disability in anxiety disorders. *Journal of Affective Disorders*, 166, 227–233. <https://doi.org/10.1016/j.jad.2014.05.006>
- Hurst, K. T., Ballard, E. D., Anderson, G. E., Greenstein, D. K., Cavanaugh, G. W., Dwyer, E., Swartz, K., Zarate, C. A., Chung, J. Y., & Park, L. T. (2022). The mental health impact of contact with COVID-19 patients on healthcare workers in the United States. *Psychiatry Research*, 308(December 2021), 114359. <https://doi.org/10.1016/j.psychres.2021.114359>
- Ismail, M., Seif, M. H., Metwally, N., Neshnash, M., Joudeh, A. I., Alsaadi, M., Al-Abdulla, S., & Selim, N. (2023). Prevalence and determinants of depression among patients with Type 2 diabetes mellitus attending family medicine clinics in Qatar. *American Journal of Medicine Open*, 9(September 2021), 100014. <https://doi.org/10.1016/j.ajmo.2022.100014>
- Isworo, A., & Saryono. (2010). Hubungan Depresi Dan Dukungan Keluarga Terhadap Kadar Gula Darah Pada Pasien Diabetes Melitus Tipe 2 Di Rsud Sragen. *Jurnal Keperawatan Soedirman*, 5(1), 37–46.
- Khaledi, M., Haghighatdoost, F., Feizi, A., & Aminorroaya, A. (2019). The prevalence of

- comorbid depression in patients with type 2 diabetes: an updated systematic review and meta-analysis on huge number of observational studies. *Acta Diabetologica*, 56(6), 631–650. <https://doi.org/10.1007/s00592-019-01295-9>
- Khan, P., Qayyum, N., Malik, F., Khan, T., Khan, M., & Tahir, A. (2019). Incidence of Anxiety and Depression Among Patients with Type 2 Diabetes and the Predicting Factors. *Cureus*, 11(3). <https://doi.org/10.7759/cureus.4254>
- Köhler, C. A., Evangelou, E., Stubbs, B., Solmi, M., Veronese, N., Belbasis, L., Bortolato, B., Melo, M. C. A., Coelho, C. A., Fernandes, B. S., Olfson, M., Ioannidis, J. P. A., & Carvalho, A. F. (2018). Mapping risk factors for depression across the lifespan: An umbrella review of evidence from meta-analyses and Mendelian randomization studies. *Journal of Psychiatric Research*, 103, 189–207. <https://doi.org/10.1016/j.jpsychires.2018.05.020>
- Lodha, P., & De Sousa, A. (2018). Geriatric mental health: The challenges for India. *Journal of Geriatric Mental Health*, 5(1), 16. https://doi.org/10.4103/jgmh.jgmh_34_17
- Ludiana, L., Hasanah, U., Sari, S. A., Fitri, N. L., & Nurhayati, S. (2022). Hubungan Faktor Psikologis (Stres dan Depresi) Dengan Kadar Gula Darah Penderita Diabetes Mellitus Tipe 2. *Jurnal Wacana Kesehatan*, 7(2), 61. <https://doi.org/10.52822/jwk.v7i2.413>
- Majumdar, S., Sinha, B., Dastidar, B. G., Gangopadhyay, K. K., Ghoshal, S., Mukherjee, J. J., Mazumdar, A., Ray, S., Dasgupta, S., & Bhattacharjee, K. (2021). Assessing prevalence and predictors of depression in Type 2 Diabetes Mellitus (DM) patients – The DEPDIAB study. *Diabetes Research and Clinical Practice*, 178, 108980. <https://doi.org/10.1016/j.diabres.2021.108980>
- Mannan, M., Mamun, A., Doi, S., & Clavarino, A. (2016). Prospective associations between depression and obesity for adolescent males and females - A systematic review and meta-analysis of longitudinal studies. *PLoS ONE*, 11(6), 1–18. <https://doi.org/10.1371/journal.pone.0157240>
- McCoy, M. A., & Theeke, L. A. (2019). A systematic review of the relationships among psychosocial factors and coping in adults with type 2 diabetes mellitus. *International Journal of Nursing Sciences*, 6(4), 468–477. <https://doi.org/10.1016/j.ijnss.2019.09.003>
- Naicker, K., Johnson, J. A., Skogen, J. C., Manuel, D., Øverland, S., Sivertsen, B., & Colman, I. (2017). Type 2 diabetes and comorbid symptoms of depression and anxiety: Longitudinal associations with mortality risk. *Diabetes Care*, 40(3), 352–358. <https://doi.org/10.2337/dc16-2018>
- Park, J., Tang, S., Mendez, I., Barrett, C., Danielson, M. L., Bitsko, R. H., Holliday, C., & Bullard, K. M. K. (2023). Prevalence of diagnosed depression, anxiety, and ADHD among youth with type 1 or type 2 diabetes mellitus. *Primary Care Diabetes*, 17(6), 658–660. <https://doi.org/10.1016/j.pcd.2023.09.004>
- Robinson, D. J., Luthra, M., & Vallis, M. (2013). Diabète et santé mentale. *Canadian Journal of Diabetes*, 37(SUPPL5), 459–465. <https://doi.org/10.1016/j.jcjd.2013.07.025>
- Roy, T., & Lloyd, C. E. (2012). Epidemiology of depression and diabetes: A systematic review. *Journal of Affective Disorders*, 142(SUPPL.), S8–S21. [https://doi.org/10.1016/S0165-0327\(12\)70004-6](https://doi.org/10.1016/S0165-0327(12)70004-6)
- Semenkovich, K., Brown, M. E., Svrakic, D. M., & Lustman, P. J. (2015). Depression in type 2 diabetes mellitus: Prevalence, impact, and treatment. *Drugs*, 75(6), 577–587.

- Sherita Hill Golden, M.D., M.H.S., Nina Shah, M.S., Mohammad Naqibuddin, M. B. B. S., M.P.H., Jennifer L. Payne, M.D., Felicia Hill-Briggs, Ph.D., Gary S. Wand, M.D., N.-Y., & Wang, Ph.D., Susan Langan, M.S., M.P.H., and Constantine Lyketsos, M.D., M. H. S. (2017). The Prevalence and Specificity of Depression Diagnosis in a Clinic-Based Population of Adults With Type 2 Diabetes Mellitus. *Psychosomatics*, 58(1), 28–37. <https://doi.org/doi:10.1016/j.psych.2016.08.003>
- Sivertsen, B., Petrie, K. J., Wilhelmsen-Langeland, A., & Hysing, M. (2014). Mental health in adolescents with Type 1 diabetes: Results from a large population-based study. *BMC Endocrine Disorders*, 14(1), 1–8. <https://doi.org/10.1186/1472-6823-14-83>
- Smith, K. J., Pedneault, M., & Schmitz, N. (2015). Investigation of anxiety and depression symptom co-morbidity in a community sample with type 2 diabetes: Associations with indicators of self-care. *Canadian Journal of Public Health*, 106(8), e496–e501. <https://doi.org/10.17269/CJPH.106.5170>
- Sunny, A. K., Khanal, V. K., Sah, R. B., & Ghimire, A. (2019). Depression among people living with type 2 diabetes in an urbanizing community of Nepal. *PLoS ONE*, 14(6), 1–11. <https://doi.org/10.1371/journal.pone.0218119>
- Tiki, T. (2017). Prevalence and Associated Factors of Depression among Type 2 Diabetes Mellitus Patients on Follow up at Ambo General Hospital, Oromia Regional State, Ethiopia, Institutional Based Cross Sectional Study. *Journal of Depression and Anxiety*, 06(01), 1–5. <https://doi.org/10.4172/2167-1044.1000259>
- Tomic, D., Shaw, J. E., & Magliano, D. J. (2022). The burden and risks of emerging complications of diabetes mellitus. *Nature Reviews Endocrinology*, 18(9), 525–539. <https://doi.org/10.1038/s41574-022-00690-7>
- Trief, P. M. (2007). Depression in elderly diabetes patients. *Diabetes Spectrum*, 20(2). <https://doi.org/10.2337/diaspect.20.2.71>
- Tsang, R. S. M., Mather, K. A., Sachdev, P. S., & Reppermund, S. (2017). Systematic review and meta-analysis of genetic studies of late-life depression. *Neuroscience and Biobehavioral Reviews*, 75, 129–139. <https://doi.org/10.1016/j.neubiorev.2017.01.028>
- Vankim, N. A., & Nelson, T. F. (2013). Vigorous physical activity, mental health, perceived stress, and socializing among college students. *American Journal of Health Promotion*, 28(1), 7–15. <https://doi.org/10.4278/ajhp.111101-QUAN-395>
- Yu, M., Zhang, X., Lu, F., & Fang, L. (2015). Depression and Risk for Diabetes: A Meta-Analysis. *Canadian Journal of Diabetes*, 39(4), 266–272. <https://doi.org/10.1016/j.jcjd.2014.11.006>
- Zimmermann, U., Kraus, T., Himmerich, H., Schuld, A., & Pollmächer, T. (2003). Epidemiology, implications and mechanisms underlying drug-induced weight gain in psychiatric patients. *Journal of Psychiatric Research*, 37(3), 193–220. [https://doi.org/10.1016/S0022-3956\(03\)00018-9](https://doi.org/10.1016/S0022-3956(03)00018-9)