JNK

JURNAL NERS DAN KEBIDANAN
(JOURNAL OF NERS AND MIDWIFERY)
https://ojs.phb.ac.id/index.php/jnk

Description of Stress Level of Diabetes Mellitus Patients with Hyperglycemia

Yeyen, [CA]Dewi Rachmawati, Tri Cahyo Sepdianto
Poltekkes Kemenkes Malang, Indonesia
[CA]Corresponding Author dewi_rachmawati@poltekkes-malang.ac.id

Article Information

History Article:
Received, 08/08/2024
Accepted, 20/04/2026
Published, 28/04/2026

Keyword:
DASS-42, Diabetes Mellitus, Hyperglycemia, Stress

Abstract

Uncontrolled diabetes mellitus will cause short-term and long-term complications. This study aimed to describe the stress levels in diabetes mellitus patients experiencing hyperglycemia. A quantitative descriptive study design was used with a purposive sampling technique with inclusion criteria of blood glucose levels ≥250 mg/dL accompanied by comorbid diseases such as stroke, chronic kidney disease (CKD), or acute coronary syndrome with a sample size of 39. The instrument used the Depression Anxiety Stress Scale (DASS-42). The results showed that 48.72% of respondents experienced moderate stress, 33.33% mild stress, 12.82% excessive stress, and 5.13% normal stress. These findings indicate that moderate stress is the dominant stress level among patients with hyperglycemia. This condition may be due to the long duration of diabetes experienced by most patients, which increases their awareness of potential complications and leads to regular involvement in treatment to prevent disease progression. Therefore, it is hoped that diabetes patients can independently monitor blood glucose levels to prevent complications, which ultimately can reduce stress and anxiety.mkasih mas

✉Correspondence Address:
Poltekkes Kemenkes Malang – East Java, Indonesia
Email: direktorat@poltekkes-malang.ac.id
P-ISSN : 2355-052X
E-ISSN : 2548-3811
DOI: https://doi.org/10.26699/jnk..v13i1.ART.p028-039

INTRODUCTION

Non-communicable diseases are a major problem that determines the health status of a region (Shahid et al., 2025). Non-communicable diseases such as diabetes mellitus and cardiovascular disease are increasing every year (Huang et al., 2025; Shahid et al., 2025). Indonesia ranks 4th largest in the number of people with diabetes in the world after India, China, and the United States (Wahidin et al., 2024; Soeatmadji et al., 2023). Prevalence is 8.6% of the total population, estimated in 1995 there were 4.5 million people and about 12.4 million people in 2025 (Chen et al., 2025; Shahid et al., 2025). The estimated number of people with diabetes mellitus in East Java is 2.6% of the population aged 15 years and above. The highest number of cases of diabetes mellitus is in Mojokerto City with 6,258 people (123.7%) (Dinas Kesehatan Provinsi Jawa Timur, 2022 ;Trisnadewi et al., 2020 ; Oktora & Butar, 2022).

Diabetes mellitus is a long-term disease characterized by high blood sugar levels. Common symptoms include polyuria, polyphagia, and polydipsia (Banday et al., 2020). Complications of hyperglycemia include short-term and long-term complications. Short-term complications include ketoacidosis and long-term complications include a double risk of cardiovascular disease and kidney failure (Mezil & Abed, 2021; Rehman & Akash, 2017). The main causes of hyperglycemia are stress, medication, and food intake. Stress and diabetes mellitus are closely related (Alfianto et al., 2021; Andoko et al., 2021; Vedantam et al., 2022). Lack of stress control and high levels of stress make it difficult to control blood sugar levels (Hidayat et al., 2022; Farmaki et al., 2021; Tomic et al., 2022).

According to research conducted by Lusiana & Mansyur (2019) at the West City Health Center in Gorontalo City to 52 people, 38 respondents (73.1%) experienced moderate stress and as many as 32 respondents (61.5%) experienced an increase in blood sugar levels with a bad category. This is supported by Susanti & Bistara, 2022 which stated that there is a relationship between stress levels and blood glucose levels, indicating that the higher the blood glucose level, the higher the patient's stress level. The presence of stress triggers the release of catecholamines and glucocorticoids. Over a prolonged period, these hormones influence gluconeogenesis and lipolysis, which ultimately lead to hyperglycemia (Arunima, 2019; Ingrosso et al., 2023; Nurhidayati et al., 2025). Additionally, glucocorticoids interfere with glucose uptake into the cells, causing glucose to remain in the bloodstream and resulting in hyperglycemia. These hormones also affect pancreatic beta cells in insulin secretion and contribute to increased insulin resistance (Sharma et al., 2022; Vedantam et al., 2022).

The latest data from the website of RSUD dr. Soedono Madiun from January to March 2023 patients with diabetes mellitus who were in the inpatient room were 56 cases, worth (25%) or 14 cases who experienced diabetes mellitus with hyperglycemia. Based on the description above, researchers are interested in conducting research on the description of stress levels in patients with diabetes mellitus with hyperglycemia at RSUD dr. Soedono Madiun to identify the level of stress experienced by patients with diabetes mellitus with hyperglycemia conditions that can be life-threatening.

METHODS

The research design was descriptive quantitative. The population of this study consisted of all hospitalized patients with diabetes mellitus and hyperglycemia, totaling 56 patients. The sample size was determined using the Taro Yamane and Slovin formulas with a 10% significance level, resulting in a minimum sample of 39 respondents. Samples were selected using purposive sampling.

In the implementation phase, a screening process was conducted based on the inclusion criteria, namely patients diagnosed with diabetes mellitus with hyperglycemia with blood glucose levels ≥250 mg/dL and having comorbidities such as stroke, hypertension, chronic kidney disease (CKD), and heart disease (acute coronary syndrome/ACS). Based on this screening, 39 respondents met the inclusion criteria, while 17 patients did not meet the inclusion criteria and were

therefore excluded from the study. Thus, the final number of respondents included in the analysis was 39 patients.

The study was conducted in Wijayakusuma C, D, and E wards of RSUD Dr. Soedono Madiun from February 1 to March 10, 2024, and had obtained ethical clearance with the approval number 400.14.5.4/4128/102.9/2024. The research variable was the stress level of patients with diabetes mellitus and hyperglycemia, which was measured using the DASS-42 (Depression Anxiety Stress Scale) questionnaire, adapted from the study by Kusumadewi et al., (2020). From the total 42 items, 14 stress-related questions were selected, namely items 1, 6, 8, 11, 12, 14, 18, 22, 27, 29, 32, 33, 35, and 39. Scoring was conducted as follows: a score of 0 for "never," 1 for "sometimes," and 3 for "always." The total score was calculated and categorized into five levels of stress: normal stress (0–14), mild stress (15–18), moderate stress (19–25), overload (26–33), and burnout (>34).

RESULTS

Table 1. General Data of respondents in the study of stress level of diabetes mellitus patients with hyperglycemia at IRNA Wijayakusuma C, D, and E RSUD dr. Soedono in Madiun on 01 February – 10 March 2024.

No	Variable		Frequency	Percent (%)
1	Age	50−54 years	12	30,8
		55─59 years	10	25,6
		60─64 years	6	15,4
		65─69 years	8	20,5
		70─74 years	2	5,1
		75─79 years	1	2,6
2	Gender	Male	12	30,8
		Female	27	69,2
3	Education	Primary School	14	35,9
		Junior High School	8	20,5
		Senior High School	8	20,5
		University	9	23,1
4	Employment	Housewife	15	38,5
		Farmer	8	20,5
		Merchant	1	2,6
		Teacher	4	10,3
		Self-employed	5	12,8
		Retired	6	15,4
5.	History of diabetes	0−1 years	2	5,1
	melitus	1─5 years	36	92,3
		6─10 years	1	2,6
6.	History of treatment	Regular	10	25,6
		Irregular	29	74,4
7.	Therapy	NR (NovoRapid)	21	53,8
		Lantus	6	15,4
		Oral	9	23,1
		Lantus & NR	3	7,7
8.	Microangiopathy	Yes	7	17,9
		No	32	82,1

9.	Diabetes Symptoms	Polydipsia	13	33,3
		Polyphagia	18	46,2
		Polyuria	3	7,7
		Easily tired	5	12,8
10.	Blood Pressure	<120, <80	7	17,9
		120─139, 80─89	9	23,1
		140─159, 90─99	9	23,1
		>160, >100	14	35,9
11.	HbA1c	0−6,5%	14	35,9
		>6,5%	25	64,1
12.	Blood Sugar	250-300 mg/dl	28	71,8
		301-350 mg/dl	10	25,6
		351-400 mg/dl	1	2,6
13.	Disease Comorbidities	CKD	16	41
		ACS	7	17,9
		Hypertension	16	41
14.	Duration Disease History	0-1 years	10	25,6
		1-5 years	24	61,5
		6-10 years	5	12,8

Source: *Primary Data (2024), n=39*

Based on Table 1 above, 30.8% of the patients were aged between 50 and 58 years, and 69.2% were female. Regarding educational background, 35.9% had completed primary school. In terms of occupation, 38.5% were housewives. A majority of 92.3% had a history of diabetes for 1 to 5 years, and 74.4% reported irregular treatment adherence. NovoRapid therapy was administered to 53.8% of the patients. Additionally, 17.9% experienced microangiopathy, while 46.2% exhibited classic diabetic symptoms such as polyphagia. Blood pressure readings exceeding 160/>100 mmHg were observed in 35.9% of patients. Furthermore, 64.1% had HbA1c levels greater than 6.5%. Comorbid conditions were noted, with 41% of patients diagnosed with chronic kidney disease (CKD) and another 41% with hypertension. Overall, 61.5% of patients had been living with diabetes for a duration of 1 to 5 years.

Table 2. Stress levels of diabetes mellitus patients with hyperglycemia at IRNA Wijayakusuma C, D, and E RSUD dr. Soedono in Madiun.

No	Stress Levels	Frequency	Percent (%)
1	Moderate	19	48,72
2	Mild	13	33,33
3	Excessive	5	12,82
4	Normal	2	5,13

Source: *Primary Data (2024), n=39*

Based on Table 2, it was found that less than half of patients with diabetes mellitus and hyperglycemia had moderate stress levels (48.72%), while 33.33% experienced mild stress, 1 2.82% were categorized as having severe stress, and only 5.13% were in the normal category.

Table 3. Stress levels of diabetes mellitus patients with hyperglycemia by age, gender, presence of microangiopathy, comorbidities and duration disease history.

Characteristics	Stress Levels							
	Normal		Mild		Moderate		Excessive	
	F	%	F	%	F	%	F	%
Age								
50−54	1	2,5	4	10,25	6	15,38	1	2,5
55−59	0	0,0	1	2,5	7	17,94	2	5
60−64	0	0,0	3	7,5	2	5	1	2,5
65−69	1	2,5	3	7,5	3	7,5	1	2,5
70−74	0	0,0	1	2.5	1	2,5	0	0,0
75−79	0	0,0	1	2,5	0	0,0	0	0,0
Gender								
Male	0	0	7	17,94	5	12,82	0	0
Female	2	5	6	15	14	35,89	5	12,82
Microangiopathy								
Yes	1	2,5	3	7,5	3	7,5	0	0
No	1	2,5	10	25	16	41,03	5	12,5
Disease Comorbidities								
CKD	1	2,5	5	12,5	7	17,5	3	7,5
ACS	0	0	3	7,5	3	7,5	1	2,5
Hypertension	1	2,5	5	12,5	9	22,5	1	2,5
Duration disease history								
0-1 years	1	2,5	2	5	6	15	1	2,5
1-5 years	0	0	9	22,5	11	27,5	4	10
6-10 years	1	2,5	2	5	2	5	0	0

Source: *Primary Data (2024), n=39*

Based on Table 3, the age group analysis showed that 15.38% of respondents aged 50–54 years were categorized as having moderate stress, 10.25% had mild stress, and 2.5% each were classified as experiencing excessive stress and no stress (normal). Among respondents aged 55–59 years, 17.94% experienced moderate stress, while 5% were categorized as having excessive stress. In terms of gender, female respondents demonstrated higher stress levels, with 35.89% classified as having moderate stress, 15% with mild stress, and 12.82% experiencing stress. Regarding the microangiopathy group, the findings indicated that 41.03% of patients without microangiopathy experienced moderate stress, while among those with microangiopathy, 7.5% each were found to experience moderate stress and mild stress. Based on patients' comorbid conditions, 22.5% of patients with hypertension experienced moderate stress, 12.5% had mild stress, and 2.5% each experienced excessive stress and were categorized as normal. Meanwhile, among patients with a history of CKD, 17.5% experienced moderate stress, and 7.5% experienced excessive stress.

DISCUSSION

Moderate Stress Levels

The findings of this study indicate that 27.5% of respondents who experienced moderate stress had been living with diabetes mellitus (DM) for 1–5 years. This result suggests that disease duration plays an important role in increasing stress levels

among patients with diabetes mellitus, particularly during the early to intermediate stages of the disease trajectory. This finding is consistent with the study conducted by Siregar et al., (2023), which reported a significant relationship between the duration of diabetes mellitus and stress levels, indicating that longer disease duration is associated with higher stress. During the first 1–5 years after diagnosis, patients often begin to fully realize that diabetes mellitus is a chronic condition requiring lifelong management. This realization is frequently accompanied by a substantial psychological burden, including fatigue related to continuous medication use, lifestyle modifications, dietary restrictions, and regular monitoring of blood glucose levels. Such ongoing demands may lead to persistent emotional pressure, placing patients within the category of moderate stress, where they are still able to function but experience noticeable psychological distress.

In addition, poorly controlled hyperglycemia contributes significantly to increased stress levels (Hamdiana et al., 2025). Fluctuating or persistently elevated blood glucose levels may heighten patients' concerns about the risk of developing both acute and chronic complications. Diabetes mellitus complications can affect multiple body systems, including the cardiovascular, neurological, and renal systems. The perceived threat of these complications often generates continuous fear and worry, which can significantly elevate stress levels among patients with diabetes mellitus (Rif'at et al., 2023). Emphasized that diabetes mellitus and its associated complications impose a considerable economic burden due to long-term medical costs (Irman & Saridewi, 2024). Financial stress related to ongoing treatment, hospitalization, and medication may further exacerbate psychological stress, particularly among patients experiencing hyperglycemia that requires intensive management (Hidayat et al., 2022).

Evidence also indicates that comorbidities or complications in patients with diabetes mellitus can lead to a decline in physical functioning, thereby limiting daily activities (Shoji et al., 2024). Reported that among older adults, the presence of complications and comorbidities significantly increases the complexity of care, reduces physical functioning, and worsens the quality of life of patients with T2DM. A decline in physical function and quality of life may limit patients' ability to perform daily activities independently, leading to feelings of frustration, helplessness, and emotional strain (Merabet et al., 2022). However, as patients are still able to adapt to their condition and maintain partial functional capacity, these psychological challenges are more likely to manifest as moderate rather than overload stress (Yen et al., 2023).

From the researchers' perspective, moderate stress among patients with diabetes mellitus and hyperglycemia arises from a complex interaction between disease duration, fear of complications, physical limitations, and the demands of long-term treatment. Adherence to routine treatment and effective glycemic control are essential to maintaining physiological stability (Walker et al., 2020). Poor adherence may worsen hyperglycemia and increase the risk of complications, which in turn may intensify psychological stress. Therefore, a holistic approach to diabetes care is required, one that not only focuses on glycemic control but also emphasizes psychological support and stress management interventions, particularly for patients with a disease duration of 1–5 years who are at increased risk of experiencing moderate stress. The results of this study indicate that age is also one of the factors causing respondents to experience moderate stress. the risk factor that affects the incidence of type 2 diabetes mellitus is age ≥50 years. Age increase is a risk factor for the incidence of type 2 of diabetes. The elderly will experience a decrease in body function, one of which is the endocrine system and a decrease in pancreatic beta cell function (Sari et al., 2020). Pancreatic beta cells will increase glucose intolerance. According to the researchers, it is very necessary to control blood sugar levels to avoid complications due to too high blood sugar levels. Blood sugar monitoring can be done independently with a glucometer. If respondents routinely check their blood sugar, their

condition will not worsen (Nursucita & Handayani, 2021).

Mild Stress Levels

The findings of this study showed that 33.33% of patients experienced mild stress. Further analysis revealed that 11 out of 13 patients with mild stress had a history of irregular treatment adherence and had been living with diabetes mellitus for 1–5 years. This finding indicates that inconsistent disease management during the early to intermediate phase of diabetes contributes to psychological stress, although it has not yet progressed to a severe level. Patients with mild stress often demonstrate ambivalence toward disease management, particularly regarding routine blood glucose monitoring and medication adherence. Regular and consistent treatment plays a critical role in preventing disease progression and improving clinical outcomes. Conversely, irregular treatment may lead to uncertainty regarding disease control, which contributes to psychological discomfort and mild stress (Laksono et al.,2023).

In this study, respondents who did not routinely monitor their health condition expressed fear of knowing their actual health status, particularly concerning uncontrolled hyperglycemia and potential complications. This avoidance behavior may temporarily reduce anxiety but paradoxically increases psychological stress due to uncertainty. In contrast, respondents who regularly checked their health condition reported better preparedness in anticipating complications, thereby reducing stress severity.

The 1–5-year duration of diabetes mellitus represents a transitional period in which patients are still adjusting to long-term disease management. patients in this duration range frequently experience stress due to lifestyle changes, dietary restrictions, and the need for continuous treatment. However, when complications are not yet severe and physical functioning remains relatively intact, stress tends to manifest at a mild level (Siregar et al., 2023). Furthermore, data from East Java Health Service indicate that many patients with chronic diseases demonstrate suboptimal adherence to treatment regimens. Inadequate scheduling and lack of structured follow-up may hinder the development of effective coping strategies, emphasizing the importance of structured treatment schedules and adherence support programs to prevent stress escalation (Dinas Kesehatan Jatim, 2024).

Excessive Stress Levels

In contrast, 12.82% of patients experienced excessive stress, indicating a more profound psychological burden. Excessive stress was more frequently observed among female patients, patients aged 55–59 years, and those with significant comorbidities, particularly chronic kidney disease (CKD) and hypertension. Excessive stress in patients with diabetes mellitus and hyperglycemia is strongly associated with advanced disease burden and increased perceived vulnerability (Harris et al., 2017; Schrems et al., 2025). Complications of type 2 diabetes mellitus, such as nephropathy and cardiovascular disorders, significantly impair physiological functioning and increase the complexity of disease management (Farmaki et al., 2021). The presence of comorbidities intensifies patients' fear of disability, dependency, and mortality, which may escalate stress to severe levels. This study also demonstrated that female patients had a higher proportion of moderate-to-severe stress (35.89%). This finding is consistent with , who reported that women with diabetes are more susceptible to psychological stress due to hormonal fluctuations, caregiving responsibilities, and higher emotional sensitivity toward illness-related stressors (Nursucita & Handayani, 2021). Additionally, prolonged hyperglycemia and the risk of dehydration and metabolic imbalance may contribute to physical discomfort and fatigue, which further exacerbate psychological stress. highlighted that dehydration and metabolic disturbances in diabetic patients can lead to systemic weakness and hemodynamic instability, indirectly increasing emotional distress (Leksana, 2015).

Economic burden also plays a significant role in severe stress. Emphasized that the direct medical

costs associated with diabetes mellitus and its complications impose substantial financial strain on patients and their families (Hidayat et al., 2022). This burden is particularly impactful for patients requiring intensive treatment or hospitalization due to uncontrolled hyperglycemia (Yohana et al., 2024) Furthermore, severe stress may worsen glycemic control through neuroendocrine mechanisms (Hamdiana et al., 2025). Demonstrated that stress-induced hormonal responses, such as elevated cortisol and catecholamines, contribute to increased blood glucose levels (Stanley, 2026). This bidirectional relationship creates a vicious cycle, where hyperglycemia increases stress and stress further exacerbates hyperglycemia (Sharma et al., 2022 ; Vedantam et al., 2022).

Normal Stress Levels

The results of this study revealed that 5.13% of patients with diabetes mellitus and hyperglycemia experienced normal stress levels. Although this proportion is relatively small, it indicates that a subset of patients is able to maintain psychological stability despite living with a chronic metabolic condition and experiencing hyperglycemia. Based on Table 3, patients with normal stress levels were identified in those with a shorter disease duration (0–1 year) as well as those with a longer disease duration (6–10 years). Patients in the early stage of diabetes may not yet experience significant disease-related burden or complications, allowing them to perceive diabetes as a manageable condition. This perception may reduce emotional distress and support normal stress levels. Conversely, patients with longer disease duration may have developed effective coping mechanisms and psychological adaptation, enabling them to manage the demands of chronic illness without experiencing excessive stress. Emphasized that stress levels in patients with diabetes mellitus are influenced not only by disease duration but also by individual coping strategies and illness perception (Siregar et al., 2023). Furthermore, Table 3 shows that patients with normal stress levels were present both among those with and without microangiopathy, suggesting that the absence of severe complications contributes to psychological well-being, but is not the sole determinant of stress levels. Patients without microvascular complications may feel reassured about their physical condition and future prognosis, thereby reducing fear and anxiety related to disease progression. Reported that patients without diabetes-related complications tend to have better physical functioning and psychological outcomes (Rif'at et al., 2023).

Another important factor associated with normal stress levels is good adherence to treatment and regular health monitoring (Savitri et al., 2025). Patients who routinely monitor blood glucose levels and adhere to prescribed treatment regimens tend to have a stronger sense of control over their illness., Consistent and regular treatment plays a crucial role in preventing disease progression and improving clinical stability. A heightened sense of control and predictability in disease management has been shown to reduce psychological stress and promote emotional resilience (Laksono et al., 2023). Economic and social support may also contribute to maintaining normal stress levels. Highlighted that the financial burden of diabetes mellitus and its complications can significantly increase psychological stress. Patients who receive adequate financial support, health insurance coverage, or family assistance may experience reduced anxiety related to treatment costs, thereby supporting emotional stability (Hidayat et al.,2022).

Additionally, the physiological relationship between stress and hyperglycemia should be considered. Stress activates neuroendocrine pathways that increase cortisol and catecholamine secretion, which subsequently elevate blood glucose levels. Studies, demonstrated that effective stress regulation may contribute to improved glycemic control. Patients who are able to manage stress effectively may avoid stress-induced hyperglycemia, creating a positive feedback loop that supports both metabolic and psychological stability (Sharma et al., 2022, Vedantam et al., 2022). From the researchers' perspective, normal stress levels among patients with diabetes mellitus and hyperglycemia reflect successful psychological

adaptation, effective self-management, and resilience. These patients likely possess adequate health literacy, positive illness perception, and sufficient social support, enabling them to cope with chronic disease demands without experiencing significant emotional distress.

CONCLUSION

The findings of this study indicate that stress levels among individuals with diabetes mellitus are influenced by various interconnected factors. Psychological stress often arises from prolonged illness, irregular treatment routines, and fear of confronting one's health condition. The presence of comorbidities such as chronic kidney disease, coronary artery disease, and hypertension further contributes to emotional burden, particularly when treatment is not consistently managed. Age also plays a significant role in the emergence of stress, especially among older adults who experience a natural decline in physical function and hormonal changes that may increase emotional sensitivity. Gender differences, particularly among women undergoing menopause, also appear to influence vulnerability to stress and diabetes-related complications.

Overall, the study underscores the importance of regular medical care, adherence to treatment, and lifestyle management in reducing stress and preventing complications in patients with diabetes. Strengthening patients' understanding of their condition, encouraging consistent self-monitoring, and promoting supportive environments can help improve psychological well-being and treatment outcomes.

SUGGESTION

Evidence-based interventions should be prioritized by providing targeted stress management programs for patients with moderate and overload stress levels, including psychoeducation, relaxation techniques, and coping skills training. Integrating psychological support into routine diabetes care is essential to improve emotional well-being and prevent stress escalation.

ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to the management and healthcare staff of RSUD Dr. Soedono Madiun, particularly the Wijayakusuma C, D, and E wards, for their support and cooperation during the data collection process. Appreciation is also extended to all patients who willingly participated in this study.

FUNDING

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest related to this study.

AUTHOR CONTRIBUTIONS

All authors contributed substantially to this study. All authors were involved in the conceptualization and study design, data collection, data analysis and interpretation, manuscript drafting, critical revision of the manuscript, and final approval of the version to be published. All authors agree to be accountable for all aspects of the work and ensure the accuracy and integrity of the research.

REFERENCE

Alfianto, A. G., Ulfa, M., Kurniyanti, M. A., & Wicaksono, K. E. (2021). Tingkat Stres Penderita Diabetes Mellitus Tipe 2 di Wilayah Pedesaan Selama Pandemi Covid-19 Dalam Melakukan Manajemen Perawatan Diri. *Jurnal Kesehatan Komunitas*, *7*(3), 354–359. https://doi.org/10.25311/keskom.vol7.iss3.975

Andoko, A., Pangesti, D. N., & Asmawarni, N. (2021). Hubungan stres dengan kadar gula darah penderita diabetes mellitus. *Holistik Jurnal Kesehatan*, *14*(4), 573–580. https://doi.org/10.33024/hjk.v14i4.1583

Arunima. (2019). Pathophysiology of Stress A Review. *International Journal of Research and Review*, *6*(5), 199–213.

Banday, M. Z., Sameer, A. S., & Nissar, S. (2020). Pathophysiology of diabetes: An overview. *Avicenna Journal of Medicine*, *10*(04), 174–188. https://doi.org/10.4103/ajm.ajm_53_20

Chen, S., Cao, Z., Chen, W., Zhao, J., Jiao, L., Prettner, K., Kuhn, M., Pan, A., Bärnighausen, T. W., & Bloom, D. E. (2025). The global macroeconomic burden of diabetes mellitus. *Nature Medicine*, *32*(January). https://doi.org/10.1038/s41591-025-04027-5

Dinas Kesehatan Provinsi Jawa Timur. (2022). *Profil Kesehatan Provinsi Jawa Timur 2021*.

Farmaki, P., Damaskos, C., Garmpis, N., Garmpi, A., Savvanis, S., & Diamantis, E. (2021). Complications of the Type 2 Diabetes Mellitus. *Current Cardiology Reviews*, *16*(4), 249–251. https://doi.org/10.2174/1573403x16042012291155 31

Hamdiana, L., Wahyudi, I., Pa'ni, D. M. Q., & Amrullah, M. (2025). The Relationship of Stress Level to Blood Sugar Levels in Diabetic Mellitus Patients at UPTD Puskesmas Terara. *THRIVE Health Science Journal*, *2*(1), 29–36. https://doi.org/10.56566/thrive.v2i1.313

Harris, M. L., Oldmeadow, C., Hure, A., Luu, J., Loxton, D., & Attia, J. (2017). Stress increases the risk of type 2 diabetes onset in women: A 12-year longitudinal study using causal modelling. *PLOS ONE*, *12*(2), 1–13. https://doi.org/10.1371/journal.pone.0172126

Hidayat, B., Ramadani, R. V., Rudijanto, A., Soewondo, P., Suastika, K., & Siu Ng, J. Y. (2022). Direct Medical Cost of Type 2 Diabetes Mellitus and Its Associated Complications in Indonesia. *Value in Health Regional Issues*, *28*, 82–89. https://doi.org/https://doi.org/10.1016/j.vhri.2021.04.006

Huang, X., Wu, Y., Ni, Y., Xu, H., & He, Y. (2025). Global, regional, and national burden of type 2 diabetes mellitus caused by high BMI from 1990 to 2021, and forecasts to 2045: analysis from the global burden of disease study 2021. *Frontiers in Public Health*, *13*(January), 1–12. https://doi.org/10.3389/fpubh.2025.1515797

Ingrosso, D. M. F., Primavera, M., Samvelyan, S., Tagi, V. M., & Chiarelli, F. (2023). Stress and Diabetes Mellitus: Pathogenetic Mechanisms and Clinical Outcome. *Hormone Research in Paediatrics*, *96*(1), 34–43. https://doi.org/10.1159/000522431

Irman, V., & Saridewi, R. I. (2024). Relationship between Stress Levels and Blood Sugar Levels in Diabetes Mellitus Article information Abstract. *Frontiers in Healthcare Research*, *1*(1), 65–68.

Kusumadewi, S., Wahyuningsih, H., Informatika, T., Indonesia, U. I., Indonesia, U. I., & Korespondensi, P. (2020). *Model Sistem Pendukung Keputusan Kelompok Untuk Penilaian Gangguan Depresi , Kecemasan Dan Stress Berdasarkan Dass-42 Group Decision Support System Model For Assessment of Depression , Anxiety And Stress Disorders Based On DASS-42*. *7*(2), 219–228. https://doi.org/10.25126/jtiik.202071052

Laksono, H., Febriyanto, T., & Ningsih, L. (2023). Faktor Risiko Kejadian ESRD (End Stage Renal Disease) Pada Penderita Diabetes Melitus di RSHD Kota Bengkulu; Case Control Study. *Journal of Nursing and Public Health*, *11*(1), 178–188. https://doi.org/10.37676/jnph.v11i1.4116

Leksana, E. (2015). Dehidrasi dan Syok. *Cermin Dunia Kedokteran*, *42*(5), 391–394. https://www.academia.edu/33357048/Dehidrasi_dan_Syok

Merabet, N., Lucassen, P. J., Crielaard, L., Stronks, K., Quax, R., Sloot, P. M. A., la Fleur, S. E., & Nicolaou, M. (2022). How exposure to chronic stress contributes to the development of type 2 diabetes: A complexity science

approach. *Frontiers in Neuroendocrinology*, *65*(September 2021). https://doi.org/10.1016/j.yfrne.2021.100972

Mezil, S. A., & Abed, B. A. (2021). Complication of Diabetes Mellitus Complication of Diabetes Mellitus. *Annals of the Romanian Society for Cell Biology*, *25*(3), 1546–1556. http://annalsofrscb.ro

Nurhidayati, A., Nu'im Haiya, N., & Aspihan, M. (2025). Hubungan Tingkat Stres dengan Kadar Gula Darah pada Penderita Diabetes Melitus. *Jurnal Keperawatan Berbudaya Sehat*, *3*(2), 53–60. https://doi.org/10.35473/jkbs.v3i2.3877

Nursucita, A., & Handayani, L. (2021). Factors Causing Stress in Type 2 Diabetes Mellitus Patients. *Jambura Journal of Health Sciences and Research*, *3*(2), 304–313. https://doi.org/10.35971/jjhsr.v3i2.10505

Oktora, S. I., & Butar, D. B. (2022). Determinants of Diabetes Mellitus Prevalence in Indonesia. *Kemas*, *18*(2), 266–273. https://doi.org/10.15294/kemas.v18i2.31880

Rehman, K., & Akash, M. S. H. (2017). Mechanism of Generation of Oxidative Stress and Pathophysiology of Type 2 Diabetes Mellitus: How Are They Interlinked? *Journal of Cellular Biochemistry*, *118*(11), 3577–3585. https://doi.org/10.1002/jcb.26097

Rif'at, I. D., Hasneli N, Y., & Indriati, G. (2023). Gambaran Komplikasi Diabetes Melitus Pada Penderita Diabetes Melitus. *Jurnal Keperawatan Profesional*, *11*(1), 52–69. https://doi.org/10.33650/jkp.v11i1.5540

Sari, N. A., Nurhayati, C., & Rustini, S. A. (2020). Relationship Of Stress Levels And Diet With Blood Sugar Levels In Patients Of Type 2 Diabetes Mellitus. *STRADA Jurnal Ilmiah Kesehatan*, *9*(1), 241–247. https://doi.org/10.30994/sjik.v9i1.253

Savitri, L., Hilmi, M. H., Kasimo, E. R., Krissanjaya, R., & Ihsan, K. (2025). Academic Stress and Blood Glucose Levels: A Correlational Study Among Medical Laboratory Technology Students. *Biology, Medicine, & Natural Product Chemistry*, *14*(2), 977–981. https://doi.org/10.14421/biomedich.2025.142.977-981

Schrems, E., Gruber, J. R., Schiweck, C., Ruf, A., Reif, A., Goldbach, R., Edwin Thanarajah, S., & Matura, S. (2025). Daily life stress is linked to increased glucose levels in individuals with insulin resistance: a real-world assessment. *Diabetologia*, *68*(12), 2709–2718. https://doi.org/10.1007/s00125-025-06552-x

Shahid, S., Ajeel, A. A., Marsool, A. D., Saifullah, M., Mukhtar, H., Sattar, M. U., Waseem, A., Shafqat, Z., Rehman, Z., Ahmed, R., & Farhan, D. M. (2025). Trends and regional disparities in the diabetes burden across Asia, 1990–2021: Insights from the global burden of disease study. *Diabetes Epidemiology and Management*, *19–20*(October), 100287. https://doi.org/10.1016/j.deman.2025.100287

Sharma, K., Akre, S., Chakole, S., & Wanjari, M. B. (2022). Stress-Induced Diabetes: A Review. *Cureus*, *14*(9), 1–6. https://doi.org/10.7759/cureus.29142

Shoji, T., Kogure, K., Toda, N., Hakoshima, M., Katsuyama, H., & Yanai, H. (2024). Association between comorbidities associated with diabetes and higher - level functional status in older patients with type 2 diabetes mellitus : a cross sectional study. *European Geriatric Medicine*, *15*(4), 1101–1110. https://doi.org/10.1007/s41999-024-00937-8

Siregar, L. M., Napitupulu, W. E., Syafitri, H., & Hutajulu, J. (2023). Hubungan Lama Menderita Dm Dengan Tingkat Stres Pada Penderita Dm Di Uptd Puskesmas Parlilitan. *Jurnal Health Reproductive*, *8*(2), 29–33. https://doi.org/10.51544/jrh.v8i2.4741

Soeatmadji, D. W., Rosandi, R., Saraswati, M. R., Sibarani, R. P., & Tarigan, W. O. (2023). Clinicodemographic Profile and Outcomes of Type 2 Diabetes Mellitus in the Indonesian Cohort of DISCOVER: A 3-Year Prospective Cohort Study. *Journal of the ASEAN*

Federation of Endocrine Societies, *38*(1), 68–74. https://doi.org/10.15605/jafes.038.01.10

Stanley, S. A. (2026). Neural regulation of blood glucose in acute stress: A report on research supported by pathway to stop diabetes. *Diabetes*, *75*(1), 5–16. https://doi.org/10.2337/dbi24-0051

Susanti, S., & Bistara, D. N. (2022). *Relationship Between Stress Level And Increased Blood Sugar Levels In Patients With Diabetes Mellitus*. *9*(September), 181–186. https://doi.org/10.35842/jkry.v9i3.692

Timur, D. K. J. (2024). *Profil Kesehatan Provinsi Jawa Timur 2023*. https://dinkes.jatimprov.go.id/userfile/dokumen/PROFIL KESEHATAN PROVINSI JAWA TIMUR TAHUN 2023.pdf

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

Trisnadewi, N. W., Adiputra, I. M. S., Putu, N., & Oktaviani, W. (2020). *Correlation between stress level and family support towards fasting and postprandial glucose level in type 2 diabetes mellitus*. *9*(3), 811–815. https://doi.org/10.15562/bmj.v9i3.2006

Vedantam, D., Poman, D. S., Motwani, L., Asif, N., Patel, A., & Anne, K. K. (2022). Stress-Induced Hyperglycemia: Consequences and Management. *Cureus*, *1*(7), 1–13. https://doi.org/10.7759/cureus.26714

Wahidin, M., Achadi, A., Besral, B., Kosen, S., Nadjib, M., Nurwahyuni, A., Ronoatmodjo, S., Rahajeng, E., Pane, M., & Kusuma, D. (2024). Projection of diabetes morbidity and mortality till 2045 in Indonesia based on risk factors and NCD prevention and control programs. *Scientific Reports*, *14*(1), 1–17. https://doi.org/10.1038/s41598-024-54563-2

Walker, R. J., Garacci, E., Campbell, J. A., & Egede, L. E. (2020). The influence of daily stress on glycemic control and mortality in adults with diabetes. *Journal of Behavioral Medicine*, *43*(5), 723–731. https://doi.org/10.1007/s10865-019-00109-1

Yen, H.-Y., Lee, S.-C., Lin, C.-F., Lee, T.-I., Yamaguchi, Y., & Lee, P.-H. (2023). Complications and comorbidities as influencing factors of health outcomes in older adults with type 2 diabetes mellitus. *Collegian*, *30*(2), 230–235. https://doi.org/10.1016/j.colegn.2022.08.010

Yohana, I., Waris, L., & Ikhlasiah, M. (2024). The Effects of Stress on Glucose Level of Hyperglicemic Sufferers. *Faletehan Health Journal*, *11*(01), 85–89. https://doi.org/10.33746/fhj.v11i01.651