Correlation Between Hba1c Levels, Emotional Stress And Dm Distress In Type 2 Diabetes Mellitus Patients

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Abstract.

This study aimed to examine the correlation between HbA1c levels, emotional distress, and diabetes-related distress (DM distress) among patients with type 2 diabetes mellitus (T2DM). Poor diabetes control and life stressors often lead to increased emotional and DM distress, which may elevate blood glucose through activation of the hypothalamic–pituitary–adrenal (HPA) axis. An analytical observational method with a cross-sectional design was used. Participants were outpatients with T2DM at PKU Muhammadiyah Gamping Hospital, selected using purposive sampling based on inclusion and exclusion criteria. HbA1c levels were analyzed using the boronate affinity method. Emotional distress was measured using the Depression Anxiety Stress Scale (DASS-42), and DM distress was assessed using the Diabetes Distress Scale (DDS-17). Statistical analysis employed the Shapiro–Wilk test for normality and the Spearman correlation test, with a significance level of $\alpha = 0.05$. A total of 45 subjects participated (23 males and 22 females). The mean HbA1c level was 9.2 ± 2.6%, the mean emotional distress score was 80.2 ± 19, and the mean DM distress score was 2.49 ± 0.93. The results revealed significant positive correlations between HbA1c levels and emotional distress ($r = 0.46$, $p = 0.001$), HbA1c levels and DM distress ($r = 0.52$, $p = 0.000$), and between emotional distress and DM distress ($r = 0.62$, $p = 0.000$). These findings indicate that higher emotional and DM distress are associated with poorer glycemic control. Integrating psychosocial evaluation and emotional support into diabetes care is essential to improve metabolic and psychological outcomes in T2DM patients.

Keywords: *Type 2 diabetes mellitus; HbA1c; emotional distress; diabetes distress and correlation.*

I. INTRODUCTION

Haemoglobin with glucose attached to it is scientifically referred to as haemoglobin A1c (HbA1c). This molecule forms when glucose in the bloodstream binds irreversibly to haemoglobin within red blood cells. Because red blood cells typically have a lifespan of about 120 days, the HbA1c test reflects the average blood glucose concentration over the preceding two to three months. Therefore, HbA1c serves as a reliable biochemical marker for assessing long-term glycemic control in individuals with diabetes mellitus. The higher the proportion of glycated haemoglobin, the poorer the blood glucose regulation has been during that time frame (Jayakrishnan et al., 2019; American Diabetes Association, 2020; Almutairi et al., 2022).For patients diagnosed with Type 2 Diabetes Mellitus (T2DM), it is generally recommended to maintain HbA1c levels below 7% as an optimal therapeutic target. Achieving and maintaining such levels have been associated with a substantial reduction in the risk of both microvascular and macrovascular complications, such as diabetic nephropathy, retinopathy, neuropathy, and cardiovascular events. More stringent glycemic control, when appropriately individualized, contributes to improved clinical outcomes, although excessive lowering of HbA1c in frail individuals may pose a risk of hypoglycemia. Nonetheless, elevated HbA1c levels are consistently associated with an increased probability of diabetic complications and poorer quality of life (Jayakrishnan et al., 2019).Stress is a physiological and psychological reaction that occurs in response to internal or external stimuli, often referred to as stressors. In its adaptive form, stress serves as a natural mechanism that prepares the body to respond to challenges or threats, mobilizing energy and enhancing alertness.

However, when stress becomes chronic or unmanageable, it transitions from being adaptive to maladaptive, resulting in what is known as distress. Distress represents a harmful form of stress that can have detrimental effects on both physical and mental health (Ingrosso et al., 2023).Among individuals with chronic illnesses such as diabetes mellitus, persistent exposure to stressors often leads to chronic emotional

stress. This condition has a profound impact on self-care behavior, emotional well-being, and metabolic regulation. Emotional stress affects not only the patient's ability to adhere to treatment regimens but also directly influences physiological processes, including hormonal secretion and glucose metabolism (Irfan and Wibowo, 2015; Hendrieckx et al., 2019).Numerous studies have demonstrated that emotional distress among individuals with Type 2 DM is significantly correlated with suboptimal self-management, higher HbA1c levels, and overall reduced emotional well-being. Classic diabetic symptoms such as polyuria (frequent urination), polydipsia (excessive thirst), polyphagia (increased appetite), and weight loss contribute to discomfort and fatigue, which in turn exacerbate psychological strain. Additionally, sleep disturbances, including increased nighttime awakenings, difficulty resuming sleep, and overall dissatisfaction with sleep quality, further aggravate the patient's emotional burden (Ningsih and Thahura, 2022).Diabetes distress (DM distress) refers specifically to the emotional pressure and psychological burden resulting from living with diabetes and coping with the relentless demands of self-management (Irfan and Wibowo, 2015).

This concept differs from clinical depression; rather than a psychiatric disorder, it represents a disease-specific emotional response to the daily challenges of diabetes care. Patients with diabetes must constantly monitor their blood glucose, adhere to medication regimens, follow dietary restrictions, and manage physical activity—all of which can become emotionally exhausting over time.According to Tareen and Tareen (2017), several factors contribute to diabetes distress, including the psychological burden of chronic illness, discouragement, fear of complications, feelings of failure in disease management, perceived lack of support from healthcare professionals, and inadequate social or community support. These elements collectively erode the individual's quality of life and hinder their motivation to maintain proper glycemic control. Moreover, unresolved distress may evolve into anxiety or depression, further complicating diabetes management.Distress is not only a consequence of diabetes but also recognized as a potential risk factor in the development of Type 2 DM itself. Research by Virtanen et al. (2014) indicated that individuals who experience chronic distress, whether due to occupational stress, personal trauma, or social pressures, have a higher likelihood of developing metabolic disorders, including insulin resistance and diabetes mellitus. This is due to the activation of the hypothalamic-pituitary-adrenal (HPA) axis during stress, leading to increased cortisol secretion, which interferes with insulin sensitivity.Once diabetes is diagnosed, the state of ongoing distress often persists or worsens. Empirical evidence suggests that more than half of diabetic patients experience anxiety, and over one-third report significant distress or depressive symptoms (Soudagar and Rambod, 2018). The chronic nature of diabetes, coupled with the fear of complications, financial burden, and social stigma, perpetuates a cycle of emotional strain and physiological imbalance.

Sidhu and Tang (2017) further revealed that 52.5% of patients with Type 2 diabetes mellitus suffer from diabetes distress that is accompanied by elevated HbA1c levels, highlighting the intricate link between psychological well-being and glycemic control.The relationship between stress and glycemic control can be explained through neuroendocrine pathways. During stressful conditions, the sympathetic nervous system and HPA axis are activated, leading to the secretion of stress hormones such as cortisol, adrenaline, and noradrenaline. Cortisol, in particular, stimulates gluconeogenesis—the production of glucose from non-carbohydrate substrates in the liver—and inhibits insulin sensitivity in peripheral tissues. These mechanisms collectively result in increased blood glucose levels (Thau et al., 2023).Consequently, individuals with diabetes mellitus who are exposed to prolonged or repeated stress tend to experience persistent hyperglycemia, which further aggravates metabolic dysregulation. Elevated cortisol not only raises blood sugar but also promotes fat accumulation, particularly visceral fat, and worsens insulin resistance—thereby creating a vicious metabolic cycle.Several studies have confirmed that patients with diabetes mellitus exhibit higher anxiety levels compared to individuals without diabetes. Anxiety disorders show a close relationship with hyperglycemia in diabetic populations (Fitri et al., 2021; Maswiyah et al., 2023). High blood glucose concentrations and the constant fear of developing complications, such as blindness, renal failure, or amputation, significantly contribute to heightened anxiety among diabetic patients.The interaction between emotional stress and diabetes management is complex and bidirectional. On one hand, psychological stress can cause poor glycemic control through hormonal pathways that elevate glucose levels.

On the other hand, poor metabolic control—as reflected by high HbA1c—can intensify feelings of frustration and hopelessness, creating a feedback loop between emotional distress and physical health deterioration. Ingrosso et al. (2023) emphasized that the higher the level of stress, the worse the glycemic outcomes. Chronic stress alters the functioning of the HPA axis and disrupts insulin metabolism, leading to increased glucose variability and reduced treatment adherence. Stress-induced behaviors, such as overeating, decreased physical activity, smoking, or neglecting medication schedules, further contribute to the deterioration of metabolic control. Similarly, Irfan and Wibowo (2015) found that most Type 2 diabetes patients experience severe distress, with nearly half of them demonstrating poor blood glucose regulation. Such findings suggest that managing emotional and psychological aspects of diabetes is just as crucial as pharmacological interventions in achieving optimal health outcomes.Understanding the association between HbA1c levels, emotional stress, and diabetes distress has profound clinical implications. Routine monitoring of HbA1c provides clinicians with a quantitative measure of glycemic control, but this should be complemented by psychological screening tools to identify patients experiencing emotional distress. Instruments such as the Diabetes Distress Scale (DDS) and the Patient Health Questionnaire (PHQ-9) can be used to assess the emotional state and depression risk among diabetic patients.Integrating mental health evaluation into diabetes care allows healthcare providers to implement holistic management strategies, addressing both physical and emotional dimensions of the disease.

Psychosocial support interventions—such as cognitive-behavioral therapy (CBT), stress management programs, support groups, and patient education—have shown promise in reducing distress and improving self-management behaviors. When distress is effectively managed, patients exhibit better treatment adherence, dietary control, and physical activity, ultimately leading to improved HbA1c outcomes.Based on the aforementioned discussion, it is evident that HbA1c, emotional stress, and diabetes distress are deeply interrelated. HbA1c serves as an objective biochemical indicator of blood glucose control, while emotional stress and diabetes distress represent subjective psychological responses that influence metabolic stability. The interdependence between these variables forms a multidimensional network encompassing physiological, behavioral, and psychosocial factors.Given the high prevalence of distress and emotional stress among patients with Type 2 diabetes mellitus, empirical research is required to quantitatively assess the correlation between these psychological constructs and HbA1c levels. Such research would contribute to a deeper understanding of how psychological states influence physiological outcomes, providing valuable insights for designing comprehensive diabetes management programs.

As summarized from previous studies (Jayakrishnan et al., 2019; American Diabetes Association, 2020; Virtanen et al., 2014; Ingrosso et al., 2023; Irfan and Wibowo, 2015; Sidhu and Tang, 2017), stress-induced hyperglycemia and distress-related behavioral changes can jointly deteriorate metabolic outcomes. Therefore, the integration of psychological well-being into diabetes care protocols is crucial in breaking the cycle of poor glycemic control and emotional strain.In conclusion, chronic emotional stress and diabetes distress are not merely byproducts of living with diabetes but significant determinants of disease progression and glycemic regulation. Effective management requires a multidisciplinary approach that combines medical, psychological, and social interventions. Future studies should aim to explore the causal pathways linking stress hormones, emotional distress, and HbA1c variability through longitudinal and experimental designs. From this background, it becomes clear that comprehensive research is essential to demonstrate and quantify the correlation between HbA1c levels, emotional stress, and diabetes distress among patients with Type 2 Diabetes Mellitus. By understanding these interconnections, healthcare professionals can better tailor interventions that enhance both psychological resilience and metabolic stability, ultimately improving the quality of life and health outcomes of diabetic populations worldwide.

II. METHODS

This study employed an analytical observational research design using a cross-sectional approach, which allowed the observation of the relationship between multiple variables at a single point in time, particularly to examine the association between HbA1c levels, emotional stress, and diabetes distress among patients with Type 2 Diabetes Mellitus (T2DM). The research subjects consisted of outpatients diagnosed

with Type 2 Diabetes Mellitus who were receiving treatment at the Polyclinic of PKU Muhammadiyah Gamping Hospital, Sleman, Yogyakarta, Indonesia. This hospital was selected because it serves as a referral center for diabetic patients, ensuring the availability of representative subjects for the study. The sample size was determined using the Slovin formula, resulting in a minimum requirement of 39 subjects to achieve statistical adequacy and representativeness. The sampling technique applied was non-probability sampling with a purposive sampling method, where participants were deliberately selected based on specific inclusion criteria relevant to the study's objectives. Data collection was conducted from January to May 2024. All participants were informed about the purpose and procedures of the research, and written informed consent was obtained prior to participation.The inclusion criteria for participants were individuals who had a confirmed medical diagnosis of Type 2 Diabetes Mellitus and were between 25 and 65 years of age.

Meanwhile, the exclusion criteria included individuals with dementia or cognitive impairment, those suffering from severe psychiatric disorders such as schizophrenia or major depressive disorder, and patients currently dealing with acute medical emergencies or critical health conditions that could interfere with the study variables. These criteria ensured that the study population represented typical T2DM patients while minimizing confounding factors that could bias the results.The variables examined in this study included HbA1c levels, emotional distress, and diabetes distress. To measure HbA1c levels, 1 cc of venous blood was drawn from each participant using aseptic procedures. The HbA1c concentration was analyzed using the boronate affinity chromatography method, which is a highly accurate and standardized laboratory technique for determining the percentage of glycated hemoglobin, thereby reflecting the average blood glucose levels over the previous two to three months. Based on the laboratory findings, HbA1c results were categorized into three groups: well controlled (<7%), moderately controlled (7–8%), and poorly controlled (>8%), following the clinical guidelines of the American Diabetes Association (2020).Emotional distress was measured using the Depression Anxiety Stress Scale (DASS-42) questionnaire, which assesses emotional well-being through 42 items encompassing depression, anxiety, and stress subscales. Each item was rated on a four-point Likert scale according to the frequency and severity of symptoms experienced during the past week. Based on the total scores, emotional distress was classified into five levels: normal, mild, moderate, severe, and very severe.

This tool provided a quantitative representation of each participant's emotional state, allowing for statistical comparison with physiological parameters such as HbA1c.The level of diabetes distress was assessed using the Diabetes Distress Scale (DDS-17), a 17-item instrument specifically designed to measure distress related to the burden of diabetes self-management. The DDS-17 evaluates four domains: emotional burden, physician-related distress, regimen-related distress, and interpersonal distress. Each item was scored on a six-point Likert scale ranging from "not a problem" to "a very serious problem." Based on the total score, diabetes distress was categorized into three levels: mild (score <2.0), moderate (2.0–2.9), and severe (≥3.0). The DDS-17 provided an accurate measure of the psychological burden that arises from daily management of diabetes, complementing the physiological measures obtained from the HbA1c analysis. Prior to hypothesis testing, data normality was assessed using the Shapiro–Wilk test, which is suitable for small to medium-sized samples. Since most data did not follow a normal distribution, the Spearman rank correlation test was used to analyze the relationships between HbA1c levels, emotional distress, and diabetes distress. The Spearman correlation test was selected because it is a non-parametric method that does not require normal distribution and is appropriate for ordinal and ranked data. The level of statistical significance was set at $\alpha = 0.05$, meaning that p-values below 0.05 were considered statistically significant. Correlation strength was interpreted according to conventional standards, where values between 0.00–0.19 indicated a very weak correlation, 0.20–0.39 weak, 0.40–0.59 moderate, 0.60–0.79 strong, and 0.80–1.00 very strong.

Through this analytical approach, the study aimed to determine whether there was a statistically meaningful correlation between high HbA1c levels and increased emotional or diabetes distress among patients with Type 2 Diabetes Mellitus.Ethical approval for this research was obtained from the Ethics Committee of PKU Muhammadiyah Gamping Hospital, with registration number 023/KEP-PKU/1/2024. The study adhered to the ethical standards outlined in the Declaration of Helsinki for research involving human participants. All participants received complete information about the study's aims, benefits,

procedures, and possible risks, and each provided written informed consent before data collection. Participants were also informed of their right to withdraw from the study at any time without any negative consequences for their medical care. The research was carried out under strict ethical and procedural standards to ensure the validity, reliability, and integrity of the findings. The combination of biochemical, psychological, and behavioral data collection methods allowed for a comprehensive analysis of the interplay between metabolic control, emotional stress, and diabetes-specific distress among Type 2 diabetic patients. By integrating laboratory assessments with validated psychometric instruments, the study sought to present a holistic understanding of how physiological and emotional factors interact in chronic disease management. This approach underscores the importance of addressing both mental and physical aspects of diabetes care, highlighting that optimal glycemic control cannot be achieved without considering the psychological well-being of patients. Overall, this research methodology ensured that the investigation was systematically designed, ethically executed, and analytically robust, providing reliable evidence on the correlation between HbA1c levels, emotional distress, and diabetes distress among patients with Type 2 Diabetes Mellitus.

III. RESULTS AND DISCUSSION

Result

In this study, 45 patients suffering from type 2 DM aged between 25-65 years were found, consisting of 23 men and 22 women. Detailed characteristics of the subjects can be seen in table 1.

Table 1. Subject Characteristics

Respondents' characteristic	Respondents				Total
	Male		Female		
	Frequency	Percentage	Frequency	Percentage	
Gender	23	51.10%	22	48.90%	45
Age					
25-30 year	1	4.35%	0	0%	1
31-35 year	1	4.35%	0	0%	1
36-40 year	1	4.35%	2	9.10%	3
41-45 year	1	4.35%	3	13.63%	4
46-50 year	7	30.43%	5	22.72%	12
51-55 year	8	34.78%	8	36.37%	16
56-60 year	4	17.39%	3	13.63%	7
61-65 year	0	0%	1	4.55%	1

Source:

The total number of respondents in this study was 45 individuals, consisting of 23 males (51.1%) and 22 females (48.9%). This relatively balanced gender distribution indicates that both male and female patients were almost equally represented, allowing for a more objective assessment of emotional and diabetes-related distress across genders. The slight predominance of male respondents (51.1%) suggests that men may be more likely to seek or receive outpatient treatment for type 2 diabetes mellitus at PKU Muhammadiyah Gamping Hospital, although the difference is not substantial.Regarding age distribution, participants ranged from 25 to 65 years old, representing a broad adult population affected by type 2 diabetes mellitus. The highest proportion of respondents fell within the 51–55 year and 56–60 year age groups, accounting for 34.78% and 36.37% among males and females, respectively. This finding aligns with epidemiological data indicating that type 2 diabetes is more prevalent among middle-aged and older adults, likely due to cumulative lifestyle factors, decreased insulin sensitivity, and metabolic changes associated with aging.Among male respondents, the 46–55 year age range represented the largest group (65.21%), while among females, the 46–60 year age range dominated (72.72%). These patterns suggest that the onset and diagnosis of diabetes in this study population predominantly occur during middle adulthood, a stage often characterized by increased occupational stress, dietary irregularities, and sedentary lifestyles—all of

which can exacerbate diabetes risk.Younger respondents aged 25–40 years accounted for only a small portion of the sample (less than 10%), both in men and women. This limited representation may indicate that early-onset type 2 diabetes is relatively rare in this population or that younger individuals are less likely to undergo routine medical screening. Meanwhile, the lowest participation was observed in the 61–65 year age group (4.55% of females and none of the males), possibly reflecting reduced outpatient attendance among older adults due to mobility limitations or comorbid conditions.Overall, the demographic profile demonstrates that type 2 diabetes mellitus in this study primarily affects individuals in their fifth and sixth decades of life, with near-equal gender distribution. These findings emphasize the need for targeted diabetes education and psychological support programs for middle-aged adults, particularly focusing on stress management, emotional well-being, and glycemic control to prevent further complications.

Table 2. Categories Based on HbA1c Levels

HbA1c Level	Control category	Frequency	Percentage
<7%	Good	9	20%
7-8%	Fair	7	15.56%
>8%	Poor	29	64.44%

Source:

The distribution of HbA1c levels among the 45 respondents shows that the majority of patients had suboptimal glycemic control. Specifically, **9 respondents (20%)** achieved good control with HbA1c levels below 7%, which aligns with the American Diabetes Association (ADA) recommendation for optimal diabetes management. This group represents individuals who have likely maintained consistent adherence to medication, diet, and lifestyle modifications.Meanwhile, **7 respondents (15.56%)** fell into the fair control category, with HbA1c levels between 7% and 8%. These individuals may experience occasional fluctuations in blood glucose levels, possibly due to inconsistent dietary habits, irregular physical activity, or emotional stress affecting self-management behaviors. Although their control is relatively better than the poor category, it still poses a risk for long-term complications if not improved. The largest proportion of respondents, **29 individuals (64.44%)**, were classified as having poor glycemic control, with HbA1c levels above 8%. This high percentage indicates that most patients in the study struggled to maintain target glucose levels. Poor control may result from inadequate diabetes education, medication non-adherence, emotional or diabetes-related distress, or limited access to healthcare support. Overall, these results highlight a concerning trend in glycemic management among type 2 diabetes mellitus patients, where nearly two-thirds exhibit uncontrolled blood glucose levels. This finding underscores the importance of integrating both medical and psychosocial interventions—such as stress reduction programs, counseling, and continuous diabetes education—to help patients achieve better metabolic outcomes and prevent complications associated with chronic hyperglycemia. (see table 2)

Table 3. Categories Based on DASS-42 Total Score

DASS-42 score	Category	Frequency	Percentage
0-32	Normal	0	0%
33-39	Light	0	0%
40-49	Medium	3	6.70%
50-57	Heavy	3	6.70%
>57	Incredibly heavy	39	86.60%

Source:

The results of the DASS-42 assessment reveal a striking prevalence of severe emotional distress among respondents with type 2 diabetes mellitus. None of the participants fell into the normal (0–32) or light (33–39) categories, indicating that all individuals in the study experienced some degree of psychological distress. This finding suggests that emotional strain is a pervasive issue among diabetic patients, likely influenced by the chronic nature of the disease, treatment burden, and lifestyle adjustments required for diabetes management. A small portion of respondents, 3 individuals (6.7%), exhibited moderate emotional distress (40–49), while another 3 respondents (6.7%) reported severe emotional distress (50–57). Although

these two categories represent a minority, they still indicate a notable psychological impact that may interfere with daily self-care behaviors and glycemic control.The overwhelming majority of participants, 39 individuals (86.6%), scored in the extremely severe (>57) category, demonstrating a high level of emotional burden. This condition may stem from multiple factors, including persistent anxiety about disease complications, financial strain from long-term treatment, and reduced quality of life. Additionally, elevated emotional distress can activate the hypothalamic–pituitary–adrenal (HPA) axis, increasing cortisol secretion and subsequently raising blood glucose levels—thereby worsening diabetes outcomes. Overall, these findings indicate that emotional distress is highly prevalent and severe among patients with type 2 diabetes mellitus in this study population.

This highlights the urgent need for integrated psychosocial interventions, including counseling, stress management therapy, and emotional support programs, as essential components of diabetes care. Addressing emotional distress is critical not only for improving mental well-being but also for enhancing self-management behaviors and achieving better metabolic control. (see table 3) The results of the Diabetes Distress Scale (DDS-17) assessment demonstrate that a significant proportion of respondents experienced varying degrees of diabetes-related distress. Based on the categorization, 18 respondents (40%) were classified as having low or mild distress (DDS < 2). This group likely represents individuals who have developed adequate coping mechanisms and maintain consistent diabetes self-management practices, supported by stable emotional and social conditions. Their relatively lower distress levels may contribute positively to better adherence to treatment and glycemic control.Meanwhile, 14 respondents (31%) reported moderate distress (DDS 2.0–2.9), indicating a considerable psychological burden associated with living with diabetes. Patients in this group may struggle with issues such as fatigue from continuous self-care, worry about long-term complications, or frustration with treatment demands. Moderate distress can negatively affect motivation and self-efficacy, potentially leading to irregular blood glucose monitoring or medication non-compliance if not properly addressed.

Table 4. Categories Based on DDS-17 Scores

DDS-17 SCORE	Category	Frequency	Percentage
<2	Light	18	40%
2-2,9	Medium	14	31%
≥3,0	Heavy	13	29%

Source:

Furthermore, 13 respondents (29%) experienced high or severe distress (DDS ≥ 3.0), reflecting significant emotional strain in managing their condition. Individuals in this category may feel overwhelmed by the demands of diabetes management, perceive a lack of social or medical support, or experience anxiety about disease progression and complications. Such high distress levels are often associated with poor glycemic control, elevated HbA1c levels, and reduced overall quality of life. In summary, more than half of the respondents (60%) experienced moderate to severe diabetes distress, indicating that emotional and psychological challenges are prevalent among patients with type 2 diabetes mellitus. This emphasizes the importance of incorporating routine psychological screening and supportive counseling into diabetes care. Addressing diabetes distress through patient education, stress reduction techniques, and family involvement may enhance treatment adherence and improve both emotional well-being and metabolic outcomes. (see table 4)

Table 5. Correlation between HbA1c Levels, Emotional Distress Scores and DM Distress

Correlation	*r*	*p*	Power
HbA1c–Skor Emotional distress level	0,46	0,001	Medium
HbA1c–Skor Distress DM level	0,52,	0,000	Medium
DM Emotional Distress-Distress Score	0,62	0,000	Medium

The correlation analysis demonstrates a significant positive relationship between HbA1c levels, emotional distress, and diabetes distress among patients with type 2 diabetes mellitus.First, the correlation between HbA1c levels and emotional distress shows a moderate positive relationship (r = 0.46, p = 0.001). This indicates that higher emotional distress is associated with higher HbA1c levels, suggesting poorer

glycemic control. Emotional distress, which may include anxiety, tension, or depression, can interfere with patients' ability to manage their condition effectively—leading to irregular medication use, unhealthy eating patterns, and reduced physical activity. Physiologically, stress also activates the hypothalamic–pituitary–adrenal (HPA) axis, resulting in increased cortisol production that elevates blood glucose levels.Second, the relationship between HbA1c levels and diabetes distress shows a moderate positive correlation ($r = 0.52$, $p = 0.000$). This finding indicates that patients who experience greater diabetes-related distress—stemming from the emotional burden of managing their disease, self-care fatigue, or fear of complications—tend to have higher HbA1c levels.

This reinforces the evidence that psychological distress directly impacts diabetes self-management and metabolic outcomes. Persistent distress can lead to reduced adherence to dietary restrictions, medication regimens, and glucose monitoring, which ultimately worsens glycemic control. Finally, there is a moderate positive correlation between emotional distress and diabetes distress ($r = 0.62$, $p = 0.000$). This suggests that emotional and diabetes-specific distress are closely interrelated; patients experiencing general emotional distress are more likely to report higher diabetes-related distress. The overlap between these two forms of distress highlights the importance of viewing diabetes management holistically—addressing not only the physical aspects of the disease but also its psychological consequences. Overall, the results confirm that emotional and diabetes distress significantly influence glycemic control in patients with type 2 diabetes mellitus. The moderate strength of all three correlations underscores that psychosocial factors play a meaningful role in diabetes outcomes. Therefore, comprehensive diabetes management programs should integrate psychological assessments, emotional support, and stress reduction strategies alongside medical treatment to improve both mental health and metabolic stability in diabetic patients.

Discussion

The HbA1c levels in this study were found by the majority (80%) of uncontrolled type 2 DM patients. This situation is no different from research in several hospitals in Indonesia (Amran and Rahman, 2018 ; Sarihati et al., 2019; Wulandari et al., 2020). Increased HBA1c levels are associated with an increased risk of DM complications (Sherwani 2016). High levels of HbA1c and the risk of complications make every DM sufferer experience a psychological burden (Fitri et al., 2021; Wibowo et al., 2022; Maswiyah et al., 2023) . This is an indication of the importance of interventions to manage emotional stress and DM distress (Hessler *et al*., 2021). All research subjects experienced emotional stress disorders. The majority had very severe emotional stress (86.6%). The emotional distress of type 2 DM patients is related to the duration of DM, level of knowledge, DM education and complications (Bener *et al.*, 2017; Laili, 2019). DM disease can cause a decrease in the quality of life of DM patients. After being diagnosed with DM, not all DM patients accept their condition openly. Treatment is routine and takes a long time to burden the mind and emotions (Livana Ph *et al*., 2018). Psychological support in the form of appreciation, emotional calm is very necessary (Bener *et al*., 2017). Management through religiosity and relaxation interventions has been proven to improve anxiety and cortisol levels in type 2 DM patients (Amir *et al*., 2018 ; Lenggogeni *et al*., 2023). Forty percent of the patients in this study had mild DM distress ratings. Up to 60% of participants reported having moderate (31%) or severe (29%) DM distress.

The study's findings show numbers that are largely consistent with those of Nurmaguphita and Sugiyanto, (2019) specifically, 45.5% of subjects reported moderate distress, 4.5% severe distress, and 50% of subjects reported low distress. Research conducted by Derek et al., (2017) found that DM distress was 50.7% in the severe category, 36.0% in the moderate category and 13.3% in the mild category. Research by Sidhu and Tang, (2017) discovered that moderate to severe diabetes distress was experienced by 52.5% of patients with type 2 diabetes mellitus. According to Fisher et al., (2019) DM discomfort is associated with the challenges of living with diabetes mellitus, such as managing the illness, worrying about potential complications, losing physical function, and having trouble accessing medical care. There is a positive correlation between HbA1c levels in type 2 DM patients and emotional distress scores. Emotional distress is a common consequence of living with diabetes that can interfere with patients' feelings and behavior (Derek *et al*., 2017; Na *et al*., 2019). The presence of DM causes negative emotional conditions such as depression, anxiety and distress(Bijayanti et al., 2021). Tareen and Tareen, (2017) said that chronicity of the condition,

a lack of control, hopelessness, a sense of being controlled by the disease, a lack of community and healthcare professional support, and other issues with life are associated with emotional stress and suffering related to diabetes mellitus. In this study, a positive correlation was found between HbA1c levels and DM distress.

According to Parsa et al., (2019) the main trigger for DM distress is uncontrolled blood glucose management. An increase in HbA1c as a reflection of failure in glucose control triggers increased anxiety (Adam and Tomayahu, 2019; Fatih *et al.*, 2023). On the other hand, when distress occurs, there is activation of the hypothalamus-pituitary-adrenal (HPA) which has an impact on the production of the hormones catecholamine and cortisol. Increased production of this hormone results in a decrease in insulin sensitivity resulting in an increase in blood sugar levels (Ebrahem and Masry, 2017). A systematic review research conducted by Wibowo *et al*., (2022) found a positive correlation between HbA1c levels and DM distress scores. In this study, a correlation was also found between emotional distress scores and DM distress, which reflects the adaptive harmony of type 2 DM patients in responding to life problems and their illness. DDS-17 screening can practically be used to predict emotional status (anxiety, depression or distress). This screening can even be used to estimate the psychosocial quality of life of diabetes mellitus patients (Batais et al., 2021). The clinical role of DDS-17 screening can clarify the problematic management of type 2 DM patients (Fayed et al., 2022). There are just a few temporal correlations between HbA1c levels, emotional stress, and DM distress in this cross-sectional investigation. Therefore, a cause-and-effect link cannot be guaranteed. Because the patients were chosen on purpose, the findings are not generalizable to the whole community. It is anticipated that future prospective research investigations will reduce the faults and limits of this study.

IV. CONCLUSION

This study demonstrates a significant relationship between HbA1c levels, emotional distress, and diabetes-related distress among patients with type 2 diabetes mellitus. The findings reveal that higher emotional and diabetes distress levels are moderately correlated with increased HbA1c values, indicating poorer glycemic control. This suggests that psychological well-being plays a critical role in diabetes management, as emotional stress and diabetes-specific distress can directly and indirectly influence blood glucose regulation through both behavioral and physiological mechanisms.The strong association between emotional distress and diabetes distress further highlights the interconnected nature of psychological factors affecting individuals with chronic illness. Patients who experience persistent emotional tension, anxiety, or fatigue from continuous disease management are more likely to struggle with treatment adherence, lifestyle modifications, and overall metabolic stability.Therefore, diabetes care should not only focus on pharmacological and lifestyle interventions but also incorporate regular psychological assessment and emotional support. Implementing stress management programs, counseling, and patient education can help mitigate distress, improve adherence to treatment, and ultimately enhance both psychological well-being and long-term metabolic outcomes for individuals living with type 2 diabetes mellitus.

V. SUGGESTION

Patients with type 2 diabetes necessitate psychosocial evaluation and management. Living with DM generally results in emotional stress and DM misery. An essential component of treating people with diabetes mellitus should be the proactive monitoring of emotional state and DM discomfort. Interprofessional cooperation is necessary for type 2 DM patients to be successfully managed.

REFERENCES

[1] Adam, L., Tomayahu, M.B., 2019. Tingkat Stres Dengan Kadar Gula Darah Pada Pasien Diabetes Melitus. ***JHSJ*** 1, 1–5. https://doi.org/10.37311/jhsj.v1i1.2047

[2] Almutairi, J.S., Almigbal, T.H., Alruhaim, H.Y., Mujammami, M.H., AlMogbel, T.A., Alshahrani, A.M., Al Zahrani, A.M., Batais, M.A., Shaik, S.A., 2022. Self-awareness of HbA1c and its association with glycemic control among patients with type 2 diabetes: A multicenter study. ***SMJ*** 43, 291–300. https://doi.org/10.15537/smj.2022.43.3.20210536

[3] American Diabetes Association, 2020. *Standards of Medical Care in Diabetes—2020* Abridged for Primary Care Providers. Clinical Diabetes 38, 10–38. https://doi.org/10.2337/cd20-as01

[4] Amir, F., Mastutik, G., Hasinuddin, M., Putra, S.T., 2018. Dhikr (recitation) and relaxation improve stress perception and reduce blood cortisol level in type 2 diabetes mellitus patients with ADM 54.

[5] Amran, P., Rahman, R., 2018. Gambaran Hasil Pemeriksaan HbA1c Pada Penderita Diabetes Melitus Tipe II Di RSUD Labuang Baji Makassar. MAK 9. https://doi.org/10.32382/mak.v9i2.686

[6] Batais, M.A., Alfraiji, A.F., Alyahya, A.A., Aloofi, O.A., Almashouq, M.K., Alshehri, K.S., Almizel, A.M., Alotaibi, M.T., Alosaimi, F.D., 2021. Assessing the Prevalence of Diabetes Distress and Determining Its Psychosocial Predictors Among Saudi Adults With Type 2 Diabetes: A Cross-Sectional Study. Front. Psychol. 12, 759454. https://doi.org/10.3389/fpsyg.2021.759454

[7] Bener, A., Ozturk, M., Yildirim, E., 2017. Association between Depression, Anxiety and Stress Symptoms and Glycemic Control in Diabetes Mellitus Patients 1.

[8] Bijayanti, I.A.N.P., Primatanti, P.A., Ningrum, R.K., 2021. Emosi Negatif pada Pasien Diabetes Melitus di Puskesmas IV Denpasar Selatan. ***e-Journal AMJ (Aesculapius Medical Journal)*** 2, 150–154.

[9] Derek, M.I., Rottie, J.V., Kallo, V., 2017. Hubungan Tingkat Stres Dengan Kadar Gula Darah Pada Pasien Diabetes Melitus Tipe II Di Rumah Sakit Pancaran Kasih GMIM Manado 5.

[10] Ebrahem, S.M., Masry, S.E., 2017. Effect of Relaxation Therapy on Depression, Anxiety, Stress and Quality of Life Among Diabetic Patients. CNS 5, 35. https://doi.org/10.5430/cns.v5n1p35

[11] Fatih, H.A., Tania, M., Aprillia, D., 2023. Hubungan Tingkat Stres Dengan Kadar Gula Darah Penderita Diabetes Mellitus Di Kota Bandung 11.

[12] Fayed, A., AlRadini, F., Alzuhairi, R.M., Aljuhani, A.E., Alrashid, H.R., Alwazae, M.M., Alghamdi, N.R., 2022. Relation between diabetes related distress and glycemic control: The mediating effect of adherence to treatment. Primary Care Diabetes 16, 293–300. https://doi.org/10.1016/j.pcd.2021.12.004

[13] Fisher, L., Polonsky, W.H., Hessler, D., 2019. Addressing diabetes distress in clinical care: a practical guide. Diabet. Med. 36, 803–812. https://doi.org/10.1111/dme.13967

[14] Fitri, A., Jafar, N., Indriasari, R., Syam, A., Salam, A., 2021. Hubungan Tingkat Stress Dengan Kadar Gula Darah Pada Polisi Yang Mengalami Gizi Lebih Di Polresta Sidenreng Rappang 10.

[15] Hendrieckx, C., Halliday, J., Speight, J., 2019. Diabetes and emotional health A practical guide for healthcare professionals supporting adults with Type 1 and Type 2 diabetes, 2nd ed. Diabetes UK.

[16] Hessler, D., Strycker, L., Fisher, L., 2021. Reductions in Management Distress Following a Randomized Distress Intervention Are Associated With Improved Diabetes Behavioral and Glycemic Outcomes Over Time. Diabetes Care 44, 1472–1479. https://doi.org/10.2337/dc20-2724

[17] Ingrosso, D.M.F., Primavera, M., Samvelyan, S., Tagi, V.M., Chiarelli, F., 2023. Stress and Diabetes Mellitus: Pathogenetic Mechanisms and Clinical Outcome. Horm Res Paediatr 96, 34–43. https://doi.org/10.1159/000522431

[18] Irfan, M., Wibowo, H., 2015. Hubungan Tingkat Stres Dengan Kadar Guladarah Pada Penderita Diabetes Mellitus (DM) Dipuskesmas Peterongan Kabupaten Jombang. ***Jurnal Ilmiah Keperawatan 1.***

[19] Jayakrishnan, Sreeja, JayanthiBai, 2019. Glycated Hemoglobin (HbA1c) - A Predictor of Glycemic Control and Diabetes Mellitus. ***International Journal of Health Sciences & Research*** 9, 7–11.

[20] Laili, F., 2019. Hubungan Faktor Lama Menderita DM dan Tingkat Pengetahuan dengan Distres Diabetes pada Penderita Diabetes Mellitus Tipe 2 Tahun 2017 (Studi di Wilayah Kerja Puskesmas Rowosari, Kota Semarang). MKMI 18, 35–38. https://doi.org/10.14710/mkmi.18.2.35-38

[21] Lenggogeni, D.P., Gusty, R.P., Erwanto, R.P., 2023. Implementasi Terapi Progressive Muscle Relaxation (PMR) Untuk Menurunkan Kadar Glukosa Darah Dan Stres Pada Pasien Diabetes Mellitus Tipe 2. REAL in Nursing Journal (RNJ 6, 205–2012.

[22] Livana Ph, Sari, I.P., Hermanto, H., 2018. Gambaran Tingkat Stres Pasien Diabetes Mellitus. ***Jurnal Perawat Indonesia*** 2, 41. https://doi.org/10.32584/jpi.v2i1.40

[23] Maswiyah, Gea, N.Y.K., Meliyana, E., 2023. Hubungan Tingkat Stress Dengan Kadar Gula Darah Orang Tua Muda Penderita Diabetes Mellitus Di RT 007 RW 001 Desa Jayalaksana Kecamatan Cabangbungin Kabupaten Bekasi 5.

[24] Na, I., Hm, A., Cg, K., 2019. Study of the effect of glycemic control on the diabetes- related distress in a sample of Egyptian patients with diabetes mellitus. ***Jurnal Diabetes Updates 4***.

[25] Ningsih, N., Thahura, F., 2022. Kesehatan Mental Pasien Diabetes Melitus di Puskesmas Langsa Baro. ***Jurnal Kebidanan, Keperawatan Dan Kesehatan (Bikes)*** 2, 7–14. https://doi.org/10.51849/j-bikes.v2i1.20

[26] Nurmaguphita, D., Sugiyanto, S., 2019. GAMBARAN DISTRESS PADA PENDERITA DIABETES MELLITUS. ***Jkj 6***, 76. https://doi.org/10.26714/jkj.6.2.2018.76-82

[27] Parsa, S., Aghamohammadi, M., Abazari, M., 2019. Diabetes Distress and Its Clinical Determinants in Patients with Type II Diabetes. Diabetes & Metabolic Syndrome: Clinical Research & Reviews 13, 1275–1279. https://doi.org/10.1016/j.dsx.2019.02.007

[28] Sarihati, I.G.A.D., Karimah, H.N., Habibah, N., 2019. Gambaran Kadar HbA1c Pada Pasien Diabetes Melitus Tipe 2 Di RSUD Wangaya. M 6, 88–98. https://doi.org/10.33992/m.v6i2.442

[29] Sidhu, R., Tang, T.S., 2017. Diabetes Distress and Depression in South Asian Canadians with Type 2 Diabetes. ***Canadian Journal of Diabetes*** 41, 69–72. https://doi.org/10.1016/j.jcjd.2016.07.008

[30] Soudagar, S., Rambod, M., 2018. Prevalence of Stress, Anxiety and Depression and Their Associations with Spiritual Well-being in Patients with Diabetes. Sadra Med Sci J 6, 1–10.

[31] Tareen, R.S., Tareen, K., 2017. Psychosocial aspects of diabetes management: dilemma of diabetes distress. Transl. Pediatr 6, 383–396. https://doi.org/10.21037/tp.2017.10.04

[32] Thau, L., Gandhi, J., Sharma, S., 2023. Physiology, Cortisol. StatPearls Publishing LLC, Bradenton, Florida.

[33] Virtanen, M., Ferrie, J.E., Tabak, A.G., Akbaraly, T.N., Vahtera, J., Singh-Manoux, A., Kivimäki, M., 2014. Psychological Distress and Incidence of Type 2 Diabetes in High-Risk and Low-Risk Populations: The Whitehall II Cohort Study. Dia Care 37, 2091–2097. https://doi.org/10.2337/dc13-2725

[34] Wibowo, Z.K., Wibisono, S., Khairina, 2022. The relationship between diabetes distress and HbA1C level in type 2 diabetes mellitus therapy patients: a systematic review.

[35] Wulandari, I.A.T., Herawati, S., Wande, I.N., 2020. Gambaran Kadar HbA1c Pada Pasien Diabetes Melitus Tipe II Di RSUP Sanglah Periode Juli-Desember 2017 9, 71–75.