

Original Article

Progressive muscle relaxation for reducing diabetes distress in adults with type 2 diabetes mellitus: A quasi-experimental study in primary care

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Abstract

Background: Diabetes distress is a common psychological burden among adults with type 2 diabetes mellitus and may interfere with self-management in primary care. Although Progressive Muscle Relaxation has been widely used as a simple non-pharmacological relaxation technique, evidence regarding its effect on diabetes-specific distress in primary care settings remains limited.

Objective: This study aimed to evaluate the effect of Progressive Muscle Relaxation on diabetes distress among adults with type 2 diabetes mellitus receiving care in a primary care setting.

Methods: A controlled quasi-experimental study with a pretest-posttest control group design was conducted among 46 adults with type 2 diabetes mellitus at Tulehu Public Health Center, Central Maluku Regency, Indonesia. Participants were recruited using purposive sampling based on predefined eligibility criteria and allocated to intervention and control groups. Eligible participants were adults with T2DM who were able to communicate effectively and perform Progressive Muscle Relaxation. The intervention group received PMR for 14 days, while the control group received usual care. Diabetes distress was assessed before and after the intervention using the Diabetes Distress Scale. Data were analyzed using paired-sample t-tests and independent-samples t-tests.

Results: The mean diabetes distress score in the intervention group decreased from 3.439 at baseline to 1.913 after the intervention, with a mean reduction of 1.526 points. This reduction was statistically significant ($p < 0.001$). The control group showed no significant change in diabetes distress scores ($p = 0.714$). Between-group analysis showed that the reduction in diabetes distress was significantly greater in the intervention group than in the control group ($p < 0.001$), with a large effect size (Cohen's $d = 0.85$).

Conclusion: Progressive Muscle Relaxation was associated with a significant reduction in diabetes distress among adults with type 2 diabetes mellitus in a primary care setting. This intervention may be integrated into nursing-led diabetes care as a feasible non-pharmacological strategy to support psychological well-being.

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Background

Type 2 diabetes mellitus (T2DM) is a major global health problem and one of the fastest-growing non-communicable diseases worldwide. In 2024, approximately 589 million adults aged 20–79 years were living with diabetes, and this number is projected to increase to 853 million by 2050 (IDF, 2025). Beyond its metabolic and vascular complications, T2DM imposes substantial psychological demands related to lifelong disease management.

The management of T2DM requires lifelong self-care, including dietary regulation, medication adherence, physical activity, blood glucose monitoring, and regular health service utilization (Conrad & Roth, 2007; Hedstr et al., 2026; Naja et al., 2017). These continuous demands may create emotional pressure, frustration, fear of complications, and feelings of being overwhelmed. This condition is known as diabetes distress, a

diabetes-specific emotional burden related to living with and managing diabetes (Hedstr et al., 2026; Ibrahim et al., 2023; Özyiğit & Sukut, 2025). Diabetes distress differs from general stress, anxiety, or depression because it is directly linked to treatment demands, self-management difficulties, and concerns about diabetes progression.

Diabetes distress is clinically important because it may reduce motivation, weaken treatment adherence, disrupt self-care behavior, and negatively affect glycemic control. Previous evidence has shown that diabetes distress is associated with poorer self-care activities and higher HbA1c levels among adults with T2DM (Alanazi et al., 2024; Çapacı & As, 2022; Care & Suppl, 2025b). Therefore, addressing diabetes distress should be considered an essential component of comprehensive diabetes management.

Despite its relevance, diabetes distress is often under-recognized in primary care. Routine diabetes services tend to focus on biomedical indicators such as blood glucose levels, medication use, dietary counseling, and complication prevention, while psychosocial needs are less frequently assessed. The American Diabetes Association recommends routine psychosocial screening, including screening for diabetes distress, depression, anxiety, fear of hypoglycemia, and disordered eating behaviors, as part of diabetes care (Kwon et al., 2026; Weng et al., 2026; Yao et al., 2025). However, implementation remains challenging in primary care settings, particularly where access to mental health professionals is limited.

Progressive Muscle Relaxation (PMR) is a simple, low-cost, non-invasive relaxation technique that involves systematic tension and relaxation of selected muscle groups. This technique can reduce physiological arousal, promote relaxation, and help patients manage psychological tension. PMR is particularly relevant for primary care because it can be taught by nurses, practiced independently by patients, and implemented without specialized equipment. Previous studies have reported that PMR may reduce stress, anxiety, diabetes distress, and improve selected clinical outcomes among patients with T2DM (S. Abbas et al., 2026; Dennick et al., 2017; Kurian et al., 2022).

However, several gaps remain in the existing evidence. Although recent studies have examined the effects of PMR on diabetes distress among adults with T2DM, evidence remains limited regarding its implementation in routine primary care, particularly in Indonesia (Setyowati et al., 2025). In addition, few studies have evaluated a brief, structured PMR intervention specifically targeting diabetes distress rather than general psychological stress or physiological outcomes. The present study addresses these gaps by evaluating a 14-day PMR intervention among Indonesian adults with T2DM in a real-world primary care setting, using diabetes distress as the primary outcome. Its novelty lies in the combination of the target population, Indonesian primary care context, brief intervention duration, diabetes-specific outcome measurement, and the feasibility of PMR as a nurse-deliverable intervention.

Therefore, this study aimed to evaluate the effect of Progressive Muscle Relaxation on diabetes distress among adults with type 2 diabetes mellitus in a primary care setting using a controlled quasi-experimental pretest-posttest

design. This study hypothesized that adults receiving PMR would experience a greater reduction in diabetes distress than those receiving usual care. The findings are expected to support the integration of simple nurse-led relaxation interventions into holistic diabetes care in primary care settings.

Methods

Study Design

This study used a non-randomized controlled quasi-experimental design with a pretest-posttest control group approach. This design was used to evaluate changes in diabetes distress before and after Progressive Muscle Relaxation among adults with type 2 diabetes mellitus and to compare these changes with participants receiving usual care. The independent variable was Progressive Muscle Relaxation, and the dependent variable was diabetes distress. Because random allocation was not applied, baseline measurement was conducted in both groups to assess initial diabetes distress before the intervention.

Sampling

The study was conducted in the working area of Tulehu Public Health Center, Central Maluku Regency, Indonesia. The target population comprised 51 adults with type 2 diabetes mellitus registered in the public health center service area. Participants were recruited using purposive sampling based on predefined eligibility criteria. The sample size was determined using the Slovin formula with a population of 51 patients and a 5% margin of error. The calculation yielded a minimum sample of 45.23 participants, which was rounded to 46. No a priori effect-size-based power analysis or additional adjustment for anticipated attrition was performed.

Participants were allocated non-randomly in a 1:1 ratio, resulting in 23 participants in the PMR intervention group and 23 in the usual-care control group. No random allocation sequence was used. Because group assignment was non-random, the possibility of selection bias and residual baseline differences between groups cannot be excluded and was considered when interpreting the findings.

The inclusion criteria were adults diagnosed with type 2 diabetes mellitus, registered as patients at Tulehu Public Health Center, willing to participate,

able to communicate effectively, and able to follow the Progressive Muscle Relaxation procedure. The exclusion criteria were physical limitations that prevented participants from performing relaxation exercises, acute illness during data collection, incomplete questionnaire data, withdrawal from the study, or unwillingness to complete the intervention procedures.

Instruments

Diabetes distress was measured using the Diabetes Distress Scale-17 (DDS-17). The DDS-17 consists of 17 items assessing four domains: emotional burden, physician-related distress, regimen-related distress, and interpersonal distress. The Indonesian version of the DDS-17, originally developed by (Setyowati et al., 2025) and culturally adapted and validated by (Çapacı & As, 2022), was used in this study. Validation of the Indonesian version among 324 patients with diabetes demonstrated a four-factor structure, with factor loadings ranging from 0.41 to 0.98 and inter-factor correlations ranging from 0.40 to 0.67. Internal consistency was satisfactory across all domains, with Cronbach's alpha coefficients of 0.83 for interpersonal distress, 0.83 for physician-related distress, 0.81 for emotional burden, and 0.78 for regimen-related distress (Çapacı & As, 2022).

Each item is rated on a six-point Likert scale ranging from 1 (not a problem) to 6 (a very serious problem). The overall DDS-17 score was calculated by summing all item scores and dividing by 17, with higher mean scores indicating greater diabetes distress. Scores were interpreted as no distress (<2.0), mild distress (2.0–2.9), moderate distress (3.0–3.9), and severe distress (≥4.0) (Anita et al., 2025). The DDS-17 was administered before and after the intervention to assess changes in diabetes distress.

Participant characteristics were collected using a demographic questionnaire, including age, sex, education level, occupation, duration of diabetes, and other relevant clinical characteristics. These data were used to describe the study sample and support interpretation of the intervention outcomes.

Intervention

The intervention group received Progressive Muscle Relaxation for 14 days. The intervention was delivered using a structured procedure based

on a Progressive Muscle Relaxation standard operating procedure. Participants performed PMR once daily for approximately 15–20 minutes per session. During the initial session, the researcher explained the purpose and procedure, demonstrated the technique, and guided participants through the sequential tensing and relaxing of selected muscle groups. Participants were instructed to tense and relax the muscle groups systematically to promote physical and psychological relaxation.

Following the initial guided session, participants continued the exercises independently for the remainder of the 14-day intervention period. Adherence to the intervention was monitored using a daily observation sheet, and the researcher verified participants' performance through direct monitoring. The control group received usual care from the public health center and did not receive PMR during the study period. Usual care included routine diabetes management, health education, medication management, and follow-up services according to the standard practice of the public health center.

Data Collection

Data collection was conducted in several stages. First, eligible participants were identified from the public health center service area and screened based on inclusion and exclusion criteria. Second, participants who met the criteria received information about the study and provided written informed consent. Third, baseline data were collected from both groups, including participant characteristics and diabetes distress scores using the DDS-17. Fourth, the intervention group received Progressive Muscle Relaxation for 14 days, while the control group continued usual care. Finally, posttest diabetes distress scores were measured in both groups using the same instrument.

To minimize measurement bias, the same questionnaire and data collection procedure were used for both pretest and posttest measurements. Participants were asked to complete the questionnaire independently, with assistance provided only when clarification was needed. Data completeness was checked after questionnaire completion to reduce missing data.

Data Analysis

Data were analyzed using descriptive and inferential statistics. Categorical variables were summarized using frequencies and percentages, while continuous variables were presented as means and standard deviations. DDS-17 scores were calculated as the mean of the 17 items and interpreted according to the predefined categories described in the Instruments section. Normality was assessed using the Shapiro-Wilk test.

Given the non-randomized controlled pretest-posttest design, the primary between-group analysis was performed using analysis of covariance (ANCOVA), with the posttest DDS-17 score as the dependent variable, study group as the fixed factor, and baseline DDS-17 score as the covariate. This approach was selected to account for potential baseline differences in diabetes distress between the intervention and control groups. The homogeneity of regression slopes assumption was assessed by testing the interaction between study group and baseline DDS-17 score. Because this interaction was statistically significant, the group $\times$ baseline interaction term was retained in the final model. Adjusted group estimates and 95% confidence intervals were reported.

Paired-sample t-tests were additionally used as secondary analyses to describe within-group changes from pretest to posttest. Statistical significance was set at $p < 0.05$.

Ethical Consideration

This study obtained ethical approval from the Health Research Ethics Committee of STIKes Maluku Husada with approval number PM.420.2/STIK-MH/I/2026. All participants received clear information regarding the study objectives, procedures, potential benefits, minimal risks, confidentiality, and their right to withdraw from the study at any time without consequences. Written informed consent was obtained from each participant before data collection. Participant anonymity was maintained by using identification codes rather than personal names. All data were kept confidential and used only for research purposes. The control group received usual care and did not receive Progressive Muscle Relaxation during the study period. The study protocol did not include provision of PMR to the control group after completion of the final posttest.

Results

A total of 46 adults with type 2 diabetes mellitus were included in the final analysis, consisting of 23 participants in the Progressive Muscle Relaxation (PMR) group and 23 participants in the usual care group. All participants completed baseline and post-intervention measurements, with no dropout reported.

As shown in Table 1, the two groups were relatively comparable in age, sex, education level, occupation, and duration of diabetes, with no statistically significant differences at baseline.

Table 1. Baseline Characteristics of Participants by Group

Characteristics	PMR group (n=23)	Usual care group (n=23)	p-value
Age, mean $\pm$ SD	51.61 $\pm$ 7.11	51.22 $\pm$ 5.88	0.840
Age group, n (%)			0.809
30–39 years	2 (8.7)	1 (4.3)	
40–49 years	5 (21.7)	6 (26.1)	
50–59 years	16 (69.6)	16 (69.6)	
Sex, n (%)			1.000
Female	13 (56.5)	14 (60.9)	
Male	10 (43.5)	9 (39.1)	
Education level, n (%)			0.848
Elementary school	2 (8.7)	4 (17.4)	
Junior high school	6 (26.1)	5 (21.7)	
Senior high school	11 (47.8)	10 (43.5)	
Bachelor degree	4 (17.4)	4 (17.4)	
Occupation, n (%)			0.773

Characteristics	PMR group (n=23)	Usual care group (n=23)	p-value
Farmer	5 (21.7)	4 (17.4)	
Fisherman	3 (13.0)	4 (17.4)	
Entrepreneur	2 (8.7)	3 (13.0)	
Laborer	2 (8.7)	0 (0.0)	
Civil servant	4 (17.4)	4 (17.4)	
Housewife	7 (30.4)	8 (34.8)	
Duration of diabetes, mean $\pm$ SD	7.39 $\pm$ 2.90	6.91 $\pm$ 3.64	0.625

Table 2 showed at baseline, the PMR group had a higher proportion of participants with moderate and severe diabetes distress than the usual care group. In the PMR group, 9 participants (39.1%) had moderate distress and 8 (34.8%) had severe distress, whereas in the usual care group, 6 participants (26.1%) had moderate distress and 7 (30.4%) had severe distress. Because several expected cell frequencies were below five, the baseline categorical distributions were compared

using the Fisher-Freeman-Halton exact test. The difference in baseline diabetes distress categories between groups was not statistically significant ($p = 0.524$). Similarly, the mean baseline DDS-17 scores did not differ significantly between the PMR and usual care groups (3.439 ± 0.8167 vs. 3.313 ± 0.9221 ; $p = 0.626$). Nevertheless, baseline DDS-17 score was included as a covariate in the primary adjusted analysis because of the non-randomized study design.

Table 2. Baseline Diabetes Distress Categories by Group

Group	No distress n (%)	Mild n (%)	Moderate n (%)	Severe n (%)	p-value
PMR group	0 (0.0)	6 (26.1)	9 (39.1)	8 (34.8)	0.524
Usual care group	2 (8.7)	8 (34.8)	6 (26.1)	7 (30.4)	

Table 3 showed PMR group showed a substantial reduction in diabetes distress after the 14-day intervention. The mean DDS-17 score decreased from 3.439 ± 0.8167 at baseline to 1.913 ± 0.4985 after the intervention, corresponding to a mean change of -1.526 points. A paired-sample t-test showed that this within-group reduction was statistically significant ($p < 0.001$). In contrast, the usual care group showed little change, from 3.313 ± 0.9221 at baseline to 3.335 ± 0.8472 at posttest (mean change = $+0.022$), with no statistically significant within-group difference on the paired-sample t-test ($p = 0.714$).

The unadjusted difference in mean change between groups was -1.548 points and was

statistically significant on the independent-samples t-test ($p < 0.001$). However, because group allocation was non-randomized, the primary between-group analysis was further evaluated using baseline-adjusted ANCOVA. The group $\times$ baseline DDS-17 interaction was statistically significant ($p < 0.001$), indicating that the homogeneity-of-regression-slopes assumption was not met; therefore, the interaction term was retained in the final model. At the overall mean baseline DDS-17 score of 3.376, the adjusted posttest mean was 1.881 (95% CI: 1.765–1.997) in the PMR group and 3.390 (95% CI: 3.274–3.506) in the usual care group. The adjusted between-group difference was -1.509 points (95% CI: -1.673 to -1.345 ; $p < 0.001$), favoring the PMR group.

Table 3. Change in Diabetes Distress Scores by Group

Group	Baseline Mean $\pm$ SD	Post-intervention Mean $\pm$ SD	Mean Change	Within-group p-value
PMR group	3.439 ± 0.8167	1.913 ± 0.4985	-1.526	<0.001
Usual care group	3.313 ± 0.9221	3.335 ± 0.8472	$+0.022$	0.714
Unadjusted between-group difference in change			-1.548	<0.001

Table 4 showed after the 14-day intervention, the PMR group showed a marked shift toward lower diabetes distress categories. No participants in the PMR group remained in the moderate or severe distress categories. Eleven participants (47.8%) were categorized as having no distress and 12 (52.2%) as having mild distress. In contrast, most participants in the usual care

group remained in the moderate or severe distress categories.

Because several post-intervention cells contained zero counts, the posttest categorical distributions were compared using the Fisher–Freeman–Halton exact test. The distribution of diabetes distress categories differed significantly between groups ($p < 0.001$).

Table 4. Post-Intervention Diabetes Distress Categories by Group

Group	No distress n (%)	Mild n (%)	Moderate n (%)	Severe n (%)	p-value
PMR group	11 (47.8)	12 (52.2)	0 (0.0)	0 (0.0)	<0.001
Usual care group	0 (0.0)	6 (26.1)	11 (47.8)	6 (26.1)	

Table 5 showed baseline random blood glucose was comparable between the PMR group and usual care group. The mean baseline blood glucose level was 248.65 ± 82.83 mg/dL in the PMR group and 258.87 ± 94.71 mg/dL in the

usual care group ($p=0.699$). After the intervention period, the mean blood glucose level was 189.17 ± 51.78 mg/dL in the PMR group and 199.35 ± 62.89 mg/dL in the usual care group ($p=0.552$).

Table 5. Random Blood Glucose by Group

Group	No distress n (%)	Mild n (%)	Moderate n (%)	Severe n (%)	p-value
PMR group	11 (47.8)	12 (52.2)	0 (0.0)	0 (0.0)	<0.001
Usual care group	0 (0.0)	6 (26.1)	11 (47.8)	6 (26.1)	

All participants in the PMR group completed the 14-day intervention period and were included in the post-intervention assessment. No adverse events related to Progressive Muscle Relaxation were reported during the study period. Overall, the PMR group demonstrated a greater reduction in diabetes distress scores and a more favorable shift in distress categories compared with the usual care group.

Discussion

This study evaluated changes in diabetes distress among adults with type 2 diabetes mellitus receiving Progressive Muscle Relaxation (PMR) compared with usual care in a primary care setting. The main finding was that the reduction in diabetes distress was significantly greater in the PMR group than in the usual care group, with an unadjusted between-group difference in mean change of -1.548 points ($p < 0.001$). This between-group comparison provides stronger evidence than interpreting the significance of within-group changes separately. Participants receiving PMR showed a reduction in diabetes distress over the

14-day intervention period, accompanied by a shift from moderate and severe distress toward mild or no distress categories, whereas the usual care group showed comparatively little change. These findings suggest that participation in the PMR intervention was associated with lower diabetes distress over the study period. However, because participants were not randomly allocated, residual confounding and selection bias cannot be excluded, and the observed association should not be interpreted as definitive evidence of a causal intervention effect.

The significant reduction in diabetes distress observed in this study is particularly important because diabetes distress represents one of the most common psychosocial challenges experienced by individuals living with diabetes. Unlike depression or generalized anxiety, diabetes distress is directly related to the daily demands of diabetes management, including medication adherence, dietary restrictions, blood glucose monitoring, fear of complications, and concerns regarding future health outcomes (Rasmussen et al., 2025; Sorrell, 2025; Zhang et al., 2026; Zu et al., 2024). Consequently, reducing diabetes distress

may improve patients' emotional well-being and enhance their capacity to engage in effective self-management behaviors. The observed reduction of 1.526 points in the PMR group suggests that participants experienced meaningful improvements in their ability to cope with diabetes-related emotional challenges.

Several physiological and psychological mechanisms may explain the effectiveness of PMR in reducing diabetes distress. Progressive Muscle Relaxation works by systematically alternating muscle tension and relaxation, which activates the parasympathetic nervous system and suppresses excessive sympathetic nervous system activity (Arunraj et al., 2025; Feleke & Ashager, 2025; Hannan et al., 2022; Kunhi et al., 2026). This physiological response contributes to reductions in muscle tension, heart rate, psychological arousal, and perceived stress. Individuals who experience relaxation may become less preoccupied with negative thoughts and worries associated with diabetes management. Through repeated practice, PMR may improve emotional regulation and reduce the psychological burden associated with chronic disease management. This mechanism is consistent with the psychophysiological theory of relaxation, which suggests that relaxation responses can counteract stress-related physiological activation and promote psychological well-being.

The findings of this study are consistent with previous evidence demonstrating the beneficial effects of PMR on psychological outcomes among patients with chronic diseases. Several studies have reported that PMR can reduce anxiety, perceived stress, emotional distress, and fatigue while improving psychological adaptation among individuals living with chronic conditions (Cardon et al., 2026; Giuseppe, 2021; Özyiğit & Sukut, 2025; Weerasinghe et al., 2025). Research conducted among patients with diabetes has similarly shown that relaxation-based interventions may improve emotional well-being and support better disease management. However, many previous studies primarily focused on general stress, anxiety, or physiological indicators such as blood glucose levels. The present study extends the existing literature by specifically examining diabetes distress as the primary outcome. This distinction is important because diabetes distress reflects a unique emotional burden that is directly related to

diabetes self-management rather than general psychological symptoms.

An interesting finding of this study is that participants in the PMR group showed substantial improvement despite presenting with relatively higher levels of distress at baseline. The PMR group contained a greater proportion of participants with moderate and severe diabetes distress compared with the usual care group. Nevertheless, after the intervention, no participant in the PMR group remained in the moderate or severe distress categories. This finding suggests that PMR may be particularly beneficial for individuals experiencing elevated levels of diabetes-related emotional burden. However, because the study used a non-randomized quasi-experimental design, the possibility of regression to the mean should be considered. Participants with higher baseline distress scores may naturally experience some degree of improvement over time. Despite this possibility, the absence of significant change in the usual care group strengthens the interpretation that the observed improvement was associated with the PMR intervention.

The categorical improvement observed after the intervention further supports the clinical relevance of the findings. Statistical significance alone does not necessarily indicate meaningful clinical change. However, the movement of participants from moderate and severe distress categories into mild distress and no distress categories suggests that PMR contributed to tangible improvements in psychological status. This finding is particularly relevant for primary care settings, where interventions must not only demonstrate statistical effectiveness but also produce meaningful improvements in patients' daily experiences and functioning.

Although this study primarily focused on diabetes distress, changes in blood glucose levels were also observed. Participants in the PMR group demonstrated lower average blood glucose levels after the intervention period. Nevertheless, the between-group difference was not statistically significant. These findings should be interpreted cautiously because the study was not designed to evaluate glycemic control as a primary outcome. The relationship between psychological well-being and metabolic outcomes is complex and may involve multiple behavioral and physiological

pathways. Reduced distress may improve medication adherence, dietary behavior, physical activity, and self-monitoring practices, which could subsequently influence glycemic control. Future longitudinal studies are needed to investigate whether reductions in diabetes distress translate into sustained improvements in metabolic outcomes.

The findings have important implications for nursing practice and primary care services. Contemporary diabetes management increasingly recognizes the importance of integrating psychosocial care into routine clinical practice. The American Diabetes Association recommends routine psychosocial assessment, including screening for diabetes distress, as part of comprehensive diabetes care (Q. Abbas et al., 2023; Alanazi et al., 2024; Care & Suppl, 2025b, 2025a; Ibrahim et al., 2023; Mathiesen & Egerod, 2019). However, implementation remains limited in many primary care settings, particularly in resource-constrained environments where access to psychologists or mental health professionals is restricted. PMR offers a practical solution because it is inexpensive, easy to teach, requires minimal resources, and can be delivered by nurses as part of routine diabetes education. The intervention can also be practiced independently by patients, making it particularly suitable for community-based and primary care settings.

The relevance of PMR may be even greater in rural and island communities where specialized psychological services are often unavailable. In such settings, nurse-led interventions represent a feasible strategy for expanding psychosocial support. By integrating PMR into diabetes management programs, primary care providers may be able to address both the physical and psychological dimensions of diabetes care. This approach aligns with contemporary models of person-centered and holistic chronic disease management, which emphasize the interaction between physical health, psychological well-being, and self-management capacity.

Several limitations should be acknowledged. First, the study employed a non-randomized quasi-experimental design, which increases the potential for selection bias and limits causal inference. Second, the relatively small sample size and recruitment from a single primary care setting may restrict the generalizability of the findings.

Third, baseline demographic comparability between groups could not be fully evaluated because some participant characteristics were not available by group. Fourth, the intervention period was limited to 14 days, preventing assessment of long-term sustainability. Fifth, diabetes distress was assessed using self-reported responses, which may be influenced by recall bias or social desirability bias. Finally, the study did not evaluate adherence to diabetes self-management behaviors or long-term glycemic outcomes, which may mediate the relationship between diabetes distress and health outcomes.

Despite these limitations, this study contributes important evidence supporting the use of PMR as a feasible nursing intervention for reducing diabetes distress among adults with type 2 diabetes mellitus in primary care. The findings highlight the importance of integrating psychosocial support into diabetes management and suggest that simple relaxation-based interventions may enhance holistic diabetes care. Future studies should employ randomized controlled designs, larger sample sizes, longer follow-up periods, and comprehensive psychosocial and metabolic outcome measures to further evaluate the effectiveness and sustainability of PMR in diabetes management.

Conclusion and Recommendation

Progressive Muscle Relaxation was associated with a significant reduction in diabetes distress among adults with type 2 diabetes mellitus in a primary care setting. Participants who received the intervention showed improvement in diabetes distress scores and shifted toward lower distress categories after the 14-day intervention period, whereas the usual care group did not show comparable improvement.

These findings indicate that Progressive Muscle Relaxation may be a feasible non-pharmacological strategy to support psychosocial care in diabetes management. The intervention is simple, low-cost, and can be delivered by nurses as part of routine primary care services. Integrating relaxation-based interventions into diabetes care may help address the emotional burden of living with type 2 diabetes mellitus and strengthen a more holistic approach to chronic disease management.

Primary care providers, particularly nurses, are encouraged to integrate Progressive Muscle Relaxation into diabetes education and counseling programs for patients who experience diabetes-

related emotional distress. The intervention can be introduced during routine visits and continued independently by patients at home with appropriate guidance and monitoring.

Future studies should use randomized controlled trial designs with larger sample sizes, longer follow-up periods, and more diverse primary care settings. Further research should also examine whether reductions in diabetes distress are associated with improvements in self-management behaviors, treatment adherence, glycemic control, and quality of life.

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Declaration of conflict of interest

The authors declare no competing interests.

Declaration on the Use of AI

No AI tools were used in the preparation of this manuscript.

Data Availability Statement

Data sharing is not applicable to this article.

References

- Abbas, Q., Latif, S., Habib, H. A., Shahzad, S., Sarwar, U., & Shahzadi, M. (2023). Cognitive behavior therapy for diabetes distress, depression, health anxiety, quality of life and treatment adherence among patients with type - II diabetes mellitus: a randomized control trial. *BMC Psychiatry*, 1-14. <https://doi.org/10.1186/s12888-023-04546-w>
- Abbas, S., Ikram, S., Irfan, H., & Moazzam, A. (2026). Metabolism Diabetes distress: What a clinician needs to know – A South Asian perspective. *Best Practice & Research Clinical Endocrinology & Metabolism*, xxxx, 102116. <https://doi.org/10.1016/j.beem.2026.102116>
- Alanazi, S. M., Alasad, S. M., Mohammed, M., Alqabi, A., Mohammed, M., Alqabi, A., & Mohammed, A. (2024). Diabetes Mellitus: Pathophysiology, Insulin Resistance, Nutritional Care, and Nursing Implications. *Journal of International Crisis and Risk Communication Research*, 7.
- Arunraj, M., Vijay, V., Kumpatla, S., & Viswanathan, V. (2025). The effect of progressive muscle relaxation therapy on diabetes distress & anxiety among people with type 2 diabetes. *Indian J Med Res*, January, 72-80. <https://doi.org/10.25259/IJMR>
- Çapacı, S., & As, G. D. (2022). European Journal of Integrative Medicine Effect of progressive muscle relaxation on caregiver satisfaction, caregiver burden and depression levels of the caregivers of older patients: A randomized control trial. *European Journal of Integrative Medicine*, 50(February), 1-8. <https://doi.org/10.1016/j.eujim.2022.102114>
- Cardon, A., Andersen, T. H., Akerkar, A., Due-christensen, M., Honoré, O. B., Rasmussen, A., Rossing, P., & Cleal, B. (2026). Psychological and emotional aspects in people with diabetic foot disease: a systematic scoping review. Cardon et Al. *BMC Psychology*, 14(789).
- Care, D., & Suppl, S. S. (2025a). 1. Improving Care and Promoting Health in Populations: Standards of Care in Diabetes — 2025. *Diabetes*, 48(January), 14-26.
- Care, D., & Suppl, S. S. (2025b). Introduction and Methodology: Standards of Care in Diabetes — 2025. *Diabetes Care*, 48(January), 1-5.
- Conrad, A., & Roth, W. T. (2007). Muscle relaxation therapy for anxiety disorders: It works but how? *Journal of Anxiety Disorder*, 21, 243-264. <https://doi.org/10.1016/j.janxdis.2006.08.001>
- Dennick, K., Sturt, J., & Speight, J. (2017). Journal of Diabetes and Its Complications What is diabetes distress and how can we measure it? A narrative review and conceptual model. *Journal of Diabetes and Its Complications*, 31(5), 898-911. <https://doi.org/10.1016/j.jdiacomp.2016.12.018>
- Feleke, M. G., & Ashager, K. (2025). Prevalence and associated factors of diabetes-related distress among type 2 diabetic patients in Africa: a systematic review and meta-analysis. *BMC Public Health*, 25(3994).
- Giuseppe, M. Di. (2021). Assessing the Prevalence of Diabetes Distress and Determining Its Psychosocial Predictors Among Saudi Adults With Type 2 Diabetes: A Cross-Sectional Study. *Frontiers in Psychology*, 12(December), 1-12. <https://doi.org/10.3389/fpsyg.2021.759454>
- Hannan, M. A., Rahman, M. M., Alam, M. S., Amin, M. N., Kabir, M. R., & Chanda, P. K. (2022). Prevalence and predictors of diabetes distress among adults with type 2 diabetes mellitus: a facility-based cross-sectional study of Bangladesh. *BMC Endocrine Disorders*, 3(22), 1-9.
- Hedstr, M., Josefsson, C., & Ulrika, P. (2026). Primary Care Diabetes Diabetes distress and associated factors among adults with type 2 diabetes in Sweden – a cross-sectional study. *Primary Care Diabetes Journal*, 20(January), 357-364. <https://doi.org/10.1016/j.pcd.2026.04.009>
- Ibrahim, A., El, A., & Mohamed, H. S. (2023). Diabetes Distress and Self-Care Activities Among Patients With Diabetes Type II: A Correlation Study. *SAGE Open Nursing*, 9(1-9). <https://doi.org/10.1177/23779608231189944>
- IDF. (2025). Diabetes Atlas. International Diabetes Federation.
- Kunhi, A. A., Arlappa, N., & Jaleel, A. (2026). Diabetes self-care, psychological distress, and quality of life among

people with type 2 diabetes in low-income urban communities: An exploratory mixed-methods study in Hyderabad, India. *Archives of Gerontology and Geriatrics Plus*, 3(2), 100262. <https://doi.org/10.1016/j.aggp.2026.100262>

Kurian, J., Mohanthi, S., & Mavathur, R. (2022). Journal of Bodywork & Movement Therapies Mechanism of action of yoga on prevention and management of type 2 diabetes mellitus: Narrative review. *Journal of Bodywork & Movement Therapies*, 29, 134–139. <https://doi.org/10.1016/j.jbmt.2021.10.003>

Kwon, C., Won, J., & Lee, B. (2026). Complementary Therapies in Medicine The health effects of diaphragmatic breathing: A systematic review. *Complementary Therapies in Medicine*, 96(December 2025), 103317. <https://doi.org/10.1016/j.ctim.2025.103317>

Mathiesen, A. S., & Egerod, I. (2019). Psychosocial interventions for reducing diabetes distress in vulnerable people with type 2 diabetes mellitus: a systematic review and meta-analysis. *Dovepress*, 19–33.

Naja, T., Kohandany, M., Oskouei, F. H., & Malek, M. (2017). The effect of progressive muscle relaxation on glycated hemoglobin and health-related quality of life in patients with type 2 diabetes mellitus. *Applied Nursing Research*, 33, 142–148. <https://doi.org/10.1016/j.apnr.2016.11.008>

Özyiğit, G., & Sukut, Ö. (2025). Progressive muscle relaxation to reduce anxiety before electroconvulsive therapy (ECT). *Özyiğit and Sukut BMC Nursing*, 24(1217).

Rasmussen, B., Mekonnen, A., Geller, G., Holton, S., Orellana, L., Nankervis, A., Houlihan, C., Hendrieckx, C., Steele, C., Mcnamara, C., Read, M., & Wynter, K. (2025). Sexual & Reproductive Healthcare Psychosocial well-being and diabetes distress in the transition to motherhood among women with type 1 or type 2 diabetes. *Sexual & Reproductive Healthcare*, 43(July 2024), 101048. <https://doi.org/10.1016/j.srhc.2024.101048>

Setyowati, R., Haroen, H., Yosep, I., Agustina, H. R., Setyowati, R., Haroen, H., & Yosep, I. (2025). A Scoping Review of Psychoeducational Interventions for Managing Type 2 Diabetes Mellitus in Asian Countries A Scoping Review of Psychoeducational Interventions for Managing Type 2 Diabetes Mellitus in Asian Countries. *Journal of Multidisciplinary Healthcare* ISSN:, 2390. <https://doi.org/10.2147/JMDH.S568155>

Sorrell, S. (2025). Digital technologies for the assessment, diagnosis, and treatment of diabetes distress: A review of current evidence. *Health Sciences Review*, 15(April), 100227. <https://doi.org/10.1016/j.hsr.2025.100227>

Weerasinghe, S. A., Wang, G., Izadikhah, Z., Goh, Y., Ireland, M. J., Wang, G., & Izadikhah, Z. (2025). Psychosocial interventions for diabetes distress in culturally diverse populations: a systematic scoping review. *BMJ Open*, 15(e102630). <https://doi.org/10.1136/bmjopen-2025-102630>

Weng, Y., Xu, X., Ruan, M., Zhu, L., Zhu, J., & Jin, X. (2026). Effects of diabetes distress on glycemic level and health-related quality of life among patients with type 2 diabetes mellitus: A cross-sectional study. *Journal of Psychosomatic Research*, 205(February), 112612. <https://doi.org/10.1016/j.jpsychores.2026.112612>

Yao, T., Sun, J., Jiang, Q., Wang, H., Zhang, J., Zhang, F., Cao, H., Li, D., Yan, J., & Yang, J. (2025). The mediating role of expectations regarding aging between diabetes distress and self-management behaviors in older adults with type 2 diabetes mellitus. *Geriatric Nursing*, 63, 362–369. <https://doi.org/10.1016/j.gerinurse.2025.03.033>

Zhang, F., Zhao, J., Zhang, Y., Tian, Z., Li, J., Lü, Q., Wang, W., Hong, T., Shan, Z., Yan, L., Peng, Y., & Tong, N. (2026). Clinical guidelines on physical activity and exercise therapy for Chinese adults with type 2 diabetes: A clinical practice guideline from the Chinese Society of Endocrinology. *Journal of Sport and Health Science*, 15, 101124. <https://doi.org/10.1016/j.jshs.2026.101124>

Zu, W., Li, F., Ma, X., Zhang, S., Nie, W., & Wang, L. (2024). Journal of Contextual Behavioral Science Exploring the interconnectedness of depression, anxiety, diabetes distress, and related psychosocial factors in adults with type 2 diabetes: A network analysis. *Journal of Contextual Behavioral Science*, 34(October), 100843. <https://doi.org/10.1016/j.jcbs.2024.100843>