# The Effectiveness of an Education Intervention based on Self-Care Model on Depressive Symptoms among adolescents with Type 1 Diabetes Mellitus

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## Abstract

**INTRODUCTION**

**Over the past years, evidence has shown a high prevalence of depression among Type 1 Diabetes Mellitus (T1DM) patients. This interventional study was performed to decrease depressive symptoms using education based on the self-care model in Kiambu County, Kenya.**

**METHODOLOGY**

**The study was conducted from January to August 2021 at diabetic clinics of Thika Level 5 Hospital (TL5H) and Kiambu Level 5 Hospital (KL5H). The study employed a pre-test post-test non-equivalent quasi-experimental study design. There were 96 adolescents with T1DM obtained by stratified random sampling, and assigned into experimental (48 respondents) and control group (48 respondents). Depressive symptoms were evaluated in the first and seventh months using the Center for Epidemiology Studies Short Depression (CES-D) scale. Paired sample T-test and Independent sample T-test were used to analyze data.**

**RESULTS**

**The results of the Independent sample T-test showed that there was a statistically significant difference in the mean score difference of depressive symptoms at post-intervention (t = -2.968, df = 94, p = 0.004), but no statistically significant difference in the mean score difference of depressive symptoms at baseline (t = -1.100, df = 86, p =0.274). The result of the paired sample T-test revealed that there was a statistically significant difference in the mean score difference of depressive symptoms in the intervention group (t = -4.374, df = 47, p = <0.001), but no statistically significant difference in the mean score difference of depressive symptoms in the control group (t= -1.304, df = 47, p =0.199).**

**CONCLUSIONS**

**Education intervention based on the self-care model is an effective program that can improve depressive symptoms. In addition, the education intervention based on the self-care model needs to be implemented continuously to prevent diabetes-related complications and improve depressive symptoms among diabetic patients.**

***Keywords:*** *Adolescents; Education; Depressive Symptoms; Self-Care Model; Type 1 Diabetes Mellitus*

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## Introduction

Depression is an important public health issue because it's associated with outcomes of diabetes (1). Type 1 Diabetes Mellitus (T1DM) increases the risk of depression, with its prevalence rates ranging from 15 to 40% (2). Depression remains unrecognised and untreated in the majority of cases, despite its specific relevance to diabetes (3). Most estimates suggest that only about one-third of people with diabetes and major depression are recognised and treated (2). Depression among people with diabetes has been studied using the following scales: Beck Depression Inventory, Zung Self-Rating Depression Scale and Center for

Epidemiological Studies Depression Scale (CES-D) (3).

A study done in India adopted the Beck Depression Inventory in surveying depression among diabetic patients and found that about 13% of 172 diabetic patients had depression (4). Similarly, a study in Ghana among individuals with diabetes found that 28.8% of the subjects had depression (5). A study done in Tanzania found that rates of depression (31%) and anxiety (29%) among diabetic patients were higher than in the general population (6). Consistently, a study done in Uganda, found that the rate of depression among diabetic patients was 25% higher than for healthy individuals (7). Similarly, a study done in Western rural Kenya noted that among 253 diabetic patients, 20.9% screened positive for depression (8). These findings suggest that depression is common among people with diabetes, which may profoundly impact diabetes control and treatment adherence.

A study done in India reported that diabetic patients with depression had inadequate self-care (9). Other researchers have indicated poor diabetes self-management among diabetic patients with a diagnosis of depression (10, 11, 12). Similarly, a study done in Rwanda stated that diabetic patients who were depressed were more likely to have inadequate self-care and required specialist interventions (13). This was in line with a study done in Kenya, which reported that patients with diabetes who had depression were labelled as noncompliant with self-care regimens (14). From the findings, co-morbid depression has consistently been found to impact diabetes self-management adherence. The main objective of the study was to evaluate the effectiveness of an Education Intervention based on the Self-Care Model on Depressive Symptoms among adolescents with T1DM.

## Materials and methods

### Study design, setting, and period

A pre-test post-test non-equivalent quasi-experimental study design was adopted. The study was carried out at the diabetic clinics of Thika Level 5 Hospital (TL5H) and Kiambu Level 5 Hospital (KL5H). Thika Level 5 Hospital began its operations in 1941 and it is strategically located at the heart of Thika Town of Kiambu County. It provides health services to an average of 20,000 inpatients and 350,000 outpatients annually. The diabetic clinic is located in the outpatient department and runs on a Thursday every week. Kiambu Level 5 Hospital is a government health centre. It is located in Kiambaa Constituency, Kiambu County. The hospital used to be a level 4 facility until it was upgraded to level 5 status in 2017. The hospital serves over 5 million people on average. The diabetic clinic is in the outpatient department and runs on a Tuesday every week. The two hospitals provide comprehensive medical and surgical services. The two hospitals were selected because they had most of their adolescents with T1DM. A baseline survey was conducted from March to May 2021. Education intervention based on the self-care model was initiated in June 2021 and ended in November 2021. Finally, the end-line survey was conducted from December 2021 to February 2022.

### Study population and sample size calculation

The study population comprised adolescents aged 10 to 19 years with T1DM attending diabetic clinics at TL5H and KL5H. According to 2018/2019 diabetics statistics, an average of 60 and 55 adolescents with T1DM visited monthly diabetic clinics at TL5H and KL5H respectively. The study sample size was determined based on the formula indicated below for comparing two proportions (15).

$$n = \frac{[(Z_{\alpha/2}+Z_{\beta})^2 \times (p_1(1-p_1) + p_2(1-p_2)]}{(p_1-p_2)^2}$$

$Z\alpha/2$ = the critical value of the Normal distribution at $\alpha/2$ (for a confidence level of 95%, $\alpha$ is 0.05) =1.96

$Z\beta$ = the critical value of the Normal distribution at $\beta$ (for a power of 80%, $\beta$ is 0.2) = 0.84

p1 = the expected sample proportion of adolescents with T1DM with poor glycaemic control in the control group = 20% = 0.2 (10)

p2 = the expected sample proportion of adolescents with T1DM with poor glycaemic control in the intervention group = 40% = 0.4 (12)

$$n = \frac{(1.96+0.84)^2 \times (0.2(1-0.2) + 0.4(1-0.4)}{(0.2 - 0.4)^2}$$

n= 37

To cater for attrition, 30% was added to the minimum sample size. A total of 96 adolescents with T1DM were included in the study; 48 adolescents with T1DM in the intervention arm and 48 in the control arm.

## Recruitment of participants and sampling

The selected diabetic clinics were visited and lists of all eligible adolescents aged 10 to 19 years diagnosed with T1DM attending TL5H and KL5H diabetic clinics were obtained from the computerized patients' record system after permission was granted. Adolescents with T1DM who met the inclusion criteria were issued with invitation letters containing information about the study. Researchers/research assistants approached eligible adolescents with T1DM in diabetes clinic waiting rooms. The eligible adolescents with T1DM were informed about the study objectives and were invited to participate in the study. Participants were pair-matched by age and education level to eliminate confounding factors. Stratified random sampling was used to sample participants from each study site to ensure equal representation.

## Inclusion and exclusion criteria

The inclusion criteria were: adolescents aged 10 to 19 years with T1DM living in Kiambu county and attending diabetic clinics of Thika Level 5 Hospital (TL5H) and Kiambu Level 5 Hospital (KL5H); adolescents who were diagnosed with T1DM at least three (3) months before recruitment to the study; and adolescents with T1DM who agreed to participate in a follow-up survey after six months. The exclusion criteria were: adolescents with T1DM with mental, visual, communication or learning disabilities and adolescents with T1DM with major medical illnesses that preclude them from participating in diabetic self-management education since they had difficulty understanding what was taught.

## Intervention

The education intervention package consisted of illustrative teaching fliers, collaborative and interactive teaching, peer support, motivational counselling and specific take-home activities. For better usage of interactive educational techniques, the intervention group was divided into four subgroups (each subgroup included at least 12 participants). The intervention group attended four diabetes self-management education (DSME) based on self-care model sessions, each lasting for approximately 90 minutes. The four DSME based on self-care model sessions were provided over four months. Each subgroup was instructed by the principal investigator. They were trained based on the self-care model AADE7 self-care behaviours: healthy eating, being physically active, monitoring blood glucose, compliance with medications, foot care, stress management and problem-solving skills. In instructional sessions, collaborative and interactive teaching methods (group discussion, brainstorming, and question and response techniques) were used. To promote participants' self-efficacy, the researcher also utilized specific training approaches such as verbal encouragement and persuasion, interactive discussion of experience sharing, role plays, educational video playbacks, peer support and performance accomplishments. The principal investigator concluded the diabetes self-management education sessions by providing take-home activities. Motivational counselling was provided to participants who had HbA1c > 9. This was followed by monthly follow-ups for the next two months. The participants in the control group continued their usual care,

including having their blood pressure and weight checked, consulting with physicians, and collecting medicines.

### Data collection

Data were collected using an interviewer-administered structured questionnaire which had two sections namely: section A: socio-demographic and diabetic specific characteristics; section B: depressive symptoms assessed using the Center for Epidemiology Studies Short Depression (CES-D) scale (16). The CES-D contained 10 items. Respondents were asked how often they experienced symptoms of depression during the previous week using a 4-point Likert scale (0, 1, 2, and 3), anchored on 0 “rarely or none of the time” (less than one day) to 3 “all the time” (5–7 days). Their responses to each item were then added to create a single composite score, ranging from 0 to 30. A score of 0–15, 16–23, and ≥ 23 was classified as no/ minimal, mild and moderate/severe depressive symptoms. The threshold score used to identify depression was ≥16 (16).

### Data analysis

Quantitative data entry, cleaning and coding was done to enhance data quality. The questionnaires were assessed by the principal investigator upon receipt for completeness and legibility. They were then cross-checked for errors, coded and entered into Statistical Package of Social Sciences (SPSS) version 26 (SPSS Armonk, NY: IBM Corp) software for data analysis. Both descriptive and inferential statistics were used for data analysis. The study subjects were classified into two groups: the intervention and control groups. A T-test was used to analyze differences in continuous data between the mean scores of the intervention and control arms. Paired sample T-Test was used to determine whether there were statistically significant differences before and after the intervention, while Independent T-test was done to find the significant difference between the groups of study. A P-value of $< 0.05$ at a 95% confidence interval was considered significant in the study.

### Ethical consideration

Ethical clearance to carry out the research was sought from the JKUAT Institutional Ethics Review Committee (reference number: JKU/IERC/02316/0015). Permission to carry out the study was sought from the National Commission for Science Technology and Innovation (reference number: NACOSTI/P/20/7746/779807). Permission to carry out the study was also sought from Kiambu County Health Research Department, TL5H and KL5H administration. This study was conducted in compliance with the principles of the Declaration of Helsinki. Participant's autonomy and privacy were maintained and any information shared with them was confidential.

## Results

### Socio-demographic characteristics of respondents

Most of the respondents in both groups were aged between 10-13 years old, female, at the primary level of education, and living together with two parents. The majority of respondents had the primary caregiver as a mother and most of their primary caregivers had reached tertiary-level education (Table 1).

### Diabetes-specific characteristics of respondents

Most of the respondents in both groups had T1DM between 1-5 years, a normal body mass index (18.5 -25.0 kg/m$^2$), and a positive history of diabetes in the family. Regarding the insulin regime, the majority of the respondents were using 2 daily injections (Table 2).

### Depressive symptoms in the intervention and control arms of the study

At baseline, the scores of depressive symptoms of the respondents ranged from 8.0 to 25.0 and 9.0 to 29.0 in the intervention and control arms respectively. At post-intervention, the scores of depressive symptoms of the respondents ranged from 8.0 to 25.0 and 9.0 to 25.0 in the intervention and control arms respectively.

The proportion of participants who had a score of 0–15 increased from 41.7% (n=20) at baseline to 58.3% (n=28) at post-intervention in the intervention group while decreasing from 39.6% (n=19) at baseline to 37.5% (n=18) at post-intervention in the control group. The proportion of participants who had a score of ≥ 23 decreased from 8.3% (n=4) and 18.7% (n=9) at baseline to 2.1% (n=1) and 2.1% (n=1) at post-intervention in the intervention and control groups respectively. The proportion of participants with depression as defined by CES (D) score of ≥ 16 decreased from 58.3% (n=28) at baseline to 41.7% (n=20) at post-intervention in the intervention group while increased from 60.4% (n=29) at baseline to 62.5% (n=30) at post-intervention in the control group (Figure 1).

Table 3 presents the results of the independent-sample t-test performed for the mean scores of depressive symptoms of two independent groups of respondents in the intervention and control groups at baseline and post-intervention. To test whether the mean score differences of depressive symptoms between the intervention and control groups at baseline and post-intervention were statistically significant, the independent-sample t-test was performed.

***Table 1:***
Socio-demographic characteristics of respondents

| Variable | Category | Control n (%) | Intervention n (%) | Total n (%) |
|---|---|---|---|---|
| Age in years | 10 -13 | 25 (52.1%) | 18 (37.5%) | 43 (44.8%) |
| | 14-17 | 16 (33.3%) | 17 (35.4%) | 33 (34.4%) |
| | ≥ 18 | 7 (14.6%) | 13 (27.1%) | 20 (20.8%) |
| Gender | Male | 23 (47.9%) | 20 (41.7%) | 43 (44.8%) |
| | Female | 25 (52.1%) | 28 (58.3%) | 53 (55.2%) |
| Education level | None | 1 (2.1%) | 2 (4.1%) | 3 (3.1%) |
| | Primary | 24 (50.0%) | 20 (41.7%) | 44 (45.8%) |
| | Secondary | 18 (37.5%) | 20 (41.7%) | 38 (39.6%) |
| | Tertiary | 5 (10.4%) | 6 (12.5%) | 11 (11.5%) |
| Family structure | 2 parents living together | 35 (72.9%) | 33 (68.7%) | 68 (70.8%) |
| | Single parent | 10 (20.8%) | 12 (25.0%) | 22 (22.9%) |
| | Not living with parents | 3 (6.3%) | 3 (6.3%) | 6 (6.3%) |
| Primary caregiver | Mother | 38 (79.2%) | 38 (79.2%) | 76 (79.2%) |
| | Father | 7 (14.5%) | 8 (16.7%) | 15 (15.6%) |
| | Others (relatives, friends) | 3 (6.3%) | 2 (4.1%) | 5 (5.2%) |
| Primary caregiver | None | 3 (6.3%) | 2 (4.1%) | 5 (5.2%) |
| education level | Primary | 3 (6.3%) | 5 (10.5%) | 8 (8.3%) |
| | Secondary | 18 (37.4%) | 24 (50.0%) | 42 (43.8%) |
| | Tertiary | 24 (50.0%) | 17 (35.4%) | 41 (42.7%) |

***Table 2:***
Diabetic-specific characteristics of the respondents

| Variable | Category | Control n (%) | Intervention n (%) | Total n (%) |
|---|---|---|---|---|
| Duration of T1DM in | 1-5 | 37 (77.1%) | 39 (81.2%) | 76 (79.2%) |
| Years | 6-10 | 11 (22.9%) | 9 (18.8%) | 20 (20.8%) |
| Body mass index | Underweight (< 18.5) | 7 (14.6%) | 6 (12.5%) | 13 (13.5%) |
| (kg/m$^2$) | Normal (18.5 -25.0) | 37 (77.1%) | 39 (81.2%) | 76 (79.2%) |
| | Overweight (> 25.0) | 4 (8.3%) | 3 (6.3%) | 7 (7.3%) |
| Family history of | None | 4 (8.3%) | 5 (10.4%) | 9 (9.4%) |
| Diabetes | Present | 44 (91.7%) | 43 (89.6%) | 87 (90.6%) |
| Insulin regime | 2 daily injections | 33 (68.8%) | 32 (66.7%) | 65 (67.7%) |
| | Multiple daily injections | 15 (31.2%) | 16 (33.3%) | 31 (32.3%) |

There was a statistically significant difference in the mean score difference of depressive symptoms at post-intervention (t = -2.968, df = 94, p = 0.004), but no statistically significant difference in the mean score difference of depressive symptoms at baseline (t = -1.100, df = 86, p =0.274) (Table 3). The findings of this study suggest that educational intervention based on a self-care model significantly decreased depressive symptoms in the intervention group at post-intervention unlike in the control group.

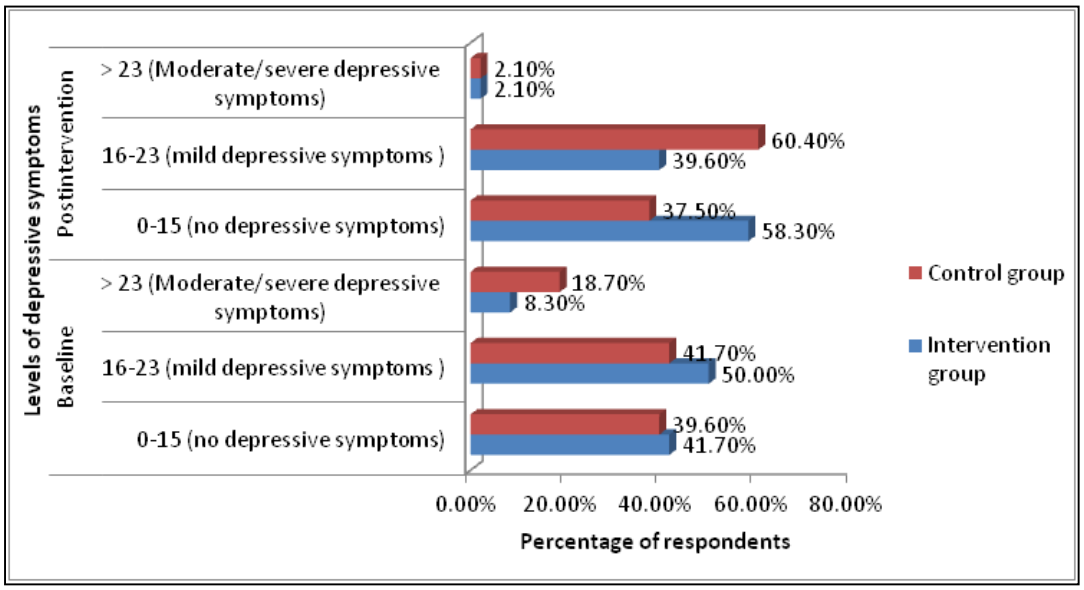


***Figure 1*:**
Percentage of respondents according to levels of depressive symptoms in the intervention and control groups of the study at baseline and post-intervention

***Table 3*:**
Independent samples T-test for depressive symptoms in the intervention and control arms of the study at baseline and post-intervention

| | | | Depressive symptoms scores | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Group | N | Mean | SD | Mean difference | T-test value | Df | P-value | 95% C.I Lower | 95% C.I Upper |
| Baseline | Intervention | 48 | 16.48 | 4.13 | -1.10 | -1. 100 | 86 | 0.274 | -3.099 | 0.891 |
| | Control | 48 | 17.58 | 5.60 | | | | | | |
| Post-intervention | Intervention | 48 | 14.67 | 3.92 | -2.33 | -2.968 | 94 | 0.004 | -3.894 | -0.772 |
| | Control | 48 | 17.00 | 3.78 | | | | | | |

***Table 4:***
Paired samples T-test on post- and pre-test scores for depressive symptoms in the intervention and control arms of the study

| | | | Depressive symptoms scores | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Group** | **N** | **Mean** | **SD** | **Mean difference** | **T-test value** | **Df** | **P-value** | **95% C.I Lower** | **95% C.I Upper** |
| Intervention | After | 48 | 14.67 | 3.92 | -1.81 | -4.374 | 47 | <0.001 | -2.646 | -0.979 |
| | Before | 48 | 16.48 | 4.13 | | | | | | |
| Control | After | 48 | 17.00 | 3.78 | -0.58 | -1.304 | 47 | 0.199 | -1.483 | 0.317 |
| | Before | 48 | 17.58 | 5.60 | | | | | | |

Table 4 presents the results of the paired-sample t-test performed on the post and pre-test mean scores of depressive symptoms in the intervention group (with intervention) and control group (without any intervention). To test whether the mean score differences of depressive symptoms post and pre-test in the intervention and control groups were statistically significant, a paired samples t-test was conducted. The result of this test revealed that there was a statistically significant difference in the mean score difference of depressive symptoms in the intervention group ($t = -4.374$, $df = 47$, $p = <0.001$), but no statistically significant difference in the mean score difference of depressive symptoms in the control group ($t = -1.304$, $df = 47$, $p = 0.199$) (Table 4). These findings indicate that educational intervention based on the self-care model significantly decreased depressive symptoms in the intervention group.

## Discussion

Depression affects approximately one in every five diabetic patients compared to the general population (17). Comorbid depressive symptoms have consistently remained high among diabetic patients, especially in Sub-Saharan Africa (3). At baseline, the frequency of depression as defined by CES (D) scores ≥ 16 was 59.4%. Similarly, a study done in Pakistan observed depression among 59.7% of diabetic patients aged 7-15 years (18). In contrast, a higher prevalence of depression was noted in another study done in Pakistan and Mexico based on the Patient Health Questionnaire-9 (PHQ-9) (19, 20). A systematic review conducted in Ethiopia showed that the prevalence of depression among diabetic patients was 80.7% (21). Other studies also found the rate of depression was high at 83.5% and 92.9% (22, 23). The variation can be explained by the different environmental, cultural, ethnic, and social backgrounds. It is important to screen diabetic patients for depression at least once a year, and more frequently if recommended by their medical provider.

The majority of participants had mild depressive symptoms followed by no/minimal depressive symptoms. Studies done in India and Tanzania found similar findings (24, 25). The rate of moderate/severe depression was comparable to those found in studies done in Nigeria, Ethiopia and Malawi (26, 27, 28, 29). In contrast, studies done in Morocco and Egypt found that diabetic patients had a higher prevalence of moderate/severe depression (30, 26). Lifestyle modifications, cognitive and emotional reactions to unstable blood sugar levels, parental stress and the wish of not being different from peers, caused frustration and increased risk of depressive symptoms among diabetic patients (31).

There was a statistically significant decrease in the mean score of depressive symptoms in the intervention arm after the education intervention. This finding was similar to studies done in the United Kingdom where group-based education and diabetes education delivered by telephone coaching significantly decreased depressive symptoms in the intervention groups (32, 33). A reduction in depressive symptoms linked to group education was attributed to participants sharing experiences. This helped participants to learn potential strategies from their peers to help comprehend and control diabetes-related symptoms. There was evidence that coping skills training done in Yale Children's diabetes clinic led to a decrease in depressive symptoms among children with T1DM in the intervention group (34). Another study reported that 2–9 motivational interviewing sessions delivered by nurses in Central Pennsylvania significantly reduced diabetes depressive symptoms in the intervention group ($p = 0.02$) (35). Similarly, an education intervention involving cognitive behaviour therapy (CBT) delivered over 6 sessions among Asian and Pacific diabetic patients significantly improved symptoms of depression ($p = 0.03$) (36). Further, a study done among diabetic Latinos showed that eight community health worker-led sessions of integrated care intervention involving techniques of dual therapy of CBT and

mindfulness as well as diabetes education were effective in reducing depressive symptoms ($p = 0.002$) (37). To alleviate the psychological health problems, diabetes education needs to be contextualized to resource-limited areas.

However, a study done in India reported that diabetic patients who received 3–6 sessions of education intervention delivered by dieticians and diabetes nurses, did not significantly reduce symptoms of depression ($p = 0.01$) (38). Similarly, a home-based diabetes self-management coaching delivered by paraprofessionals in a community care access centre in Ontario, Canada, reported no significant reduction in depressive symptoms (39). The findings were consistent with a study carried out in an outpatient clinic of a municipal hospital in Taipei, where diabetes education provided by nutritionists and diabetes nurse educators supported by counselling and telephone calls did not significantly reduce depressive symptoms (40). Similarly, a study done in Ethiopia on the effects of locally contextualised nurse-led diabetes self-management education on psychosocial health and quality of life showed no statistically significant difference between and within groups in depressive symptoms scores (41). The variation can be explained by the different environmental, cultural, ethnic, and social backgrounds.

## Conclusion

The educational intervention utilizing the self-care model significantly reduced depressive symptoms in adolescents with T1DM, as evidenced by a decrease in mean scores from 16.48±4.13 to 14.67±3.92 in the intervention group compared to 17.58±5.60 to 17.00±3.78 in the control group. The post-intervention analysis confirmed a significant decrease in mean depressive symptoms within the intervention group ($p<0.05$). Continuous implementation of education interventions based on the self-care model is recommended to consistently alleviate depressive symptoms among adolescents with T1DM.

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**Competing interest;** The authors declare no competing interests.

## References

1. **Anderson, R. M., Funnell, M. M., Butler, P. M. Arnold, M. S., Fitzgerald, J. T., & Feste, C. C.** Patient empowerment: Results of a randomized controlled trial. *J Diabetes Care;* 2015; 18(9), 934–949. https://doi.org/10.2337/diacare.18.7.943
2. **Harris, M. D.** Psychosocial aspects of diabetes with an emphasis on depression. *J Current Diabetes Reports*; 2015; 3(1), 49–55. https://doi.org/10.1007/s11892-003-0053-6
3. **Lustman, P. J., Anderson, R. J., Freedland, K. E., ed Groot, M., Carney, R. M., & Clouse, R. E.** Depression and poor glycaemic control : A meta-analytic review of the literature. *Diabetes Care*; 2016; 23(5), 934–942. https://doi.org/10.2337/diacare.23.7.934
4. **DeRekeneier, N., Resnick, H. E., & Schwartz, A. V.** Diabetes is associated with subclinical functional limitations in nondisabled older individuals. The health, ageing, and body composition study. *Diabetes Care;* 2013; 26(12), 3257–3263. https://doi.org/10.2337/diacare.26.12.3257
5. **Hanninen, J. A., Takala, J. K., & Keinanen-Kiukaanniemi, S. N.** Depression in subjects with diabetes: Predictive factors and relation to quality of life. *Diabetes Care*; 2014; 22(6), 997–998. https://doi.org/10.2337/diacare.22.6.997
6. **Rubin, R., & Peyrot, M.** Men and diabetes: psychosocial and behavioral issues. *Diabetes Care;* 2018; 11(5), 81–7.
7. **Egede, L. E., Zheng, D., & Simpson, K.** Comorbid depression is associated with increased healthcare use and expenditures in individuals with diabetes. *Diabetes Care*; 2015; 25(3), 464–470. https://doi.org/10.2337/diacare.25.3.464
8. **Shirey, K., Simon M. Manyara, D.E., & L. A.** Symptoms of depression among patients attending a diabetes care clinic in rural western Kenya. *Journal of Clinical & Translational Endocrinology;* 2015 2(2), 51–54. https://doi.org/10.1016/j.jcte.2015.02.002

9. **DeGoot, M., Anderson, R., Freedland, K. E., Clouse, R. E., & Lustman, P. J.** Association of depression and diabetes complications: A meta-analysis. *Psychosom Medicine*; 2015 63(4), 619–630. https://doi.org/10.1097/00006842-200107000-00015
10. **Anderson, B., Ho, J., Brackett, J., Finkelstein, D., & Laffel, L.** Parental involvement in diabetes management tasks: relationships to blood glucose monitoring adherence and metabolic control in young adolescents with insulin-dependent diabetes mellitus. *J Pediatr;* 2013; 130(2), 257–65. https://doi.org/10.1016/s0022-3476(97)70352-4
11. **Fu, D., Fu, H., McGowan, P., Shen, Y., Zhu, L., Yang, H., Mao, J., Zhu, S., Ding, Y., & Wei, Z.** Implementation and quantitative evaluation of chronic disease self-management program in Shanghai, China: Randomised controlled trial. *Bulletin of the World Health Organization;* 2013; 18, 174–182.
12. **Talbot, F., & Nouwen, A.** A review of the relationship between depression and diabetes: Is there a link? *Diabetes Care*; 2013; 23(10), 1556–1562. https://doi.org/10.2337/diacare.23.10.1556
13. **Ciechanowski, P., Katon, W., & Russo, W**. Impact of depressive symptoms on adherence, function and costs. *Archives of Internal Medicine*; 2015; 160(26), 3278–3285. https://doi.org/10.1001/archinte.160.21.3278
14. **Guthrie, D. W., & Guthrie, R. A.** Nursing management of diabetes mellitus: A guide to the pattern approach. New York: *Springer* publishing company; 2012.
15. **Wang, H., & Chow, S. C.** Sample Size Calculation for Comparing Proportions. *Wiley Encyclopedia of Clinical Trials*; 2007. https://doi.org/10.1002/9780471462422.eoct005
16. **Kibourne, A. M., Justice, A. C., Rollman, B. L., Kathleen, A., Rabeneck, L., Weissman, S., Smola, S., Schultz, R., Whittle, J., & Rodriguez-Barradas, M.** Clinical importance of HIV and depression symptoms among veterans with HIV infection. *Journal of General Internal Medicine*; 2012; 17(5), 512–520. https://doi.org/10.1046/j.1525-1497.2002.10803.x
17. **Shoib, S., Mushtaq, R., Tasleem, A., & Hayat, B. M.** Depression and diabetes : common link and challenges of developing epidemic. *Africa Journal of Psychiatry*; 2015; *18*(2), 160–164. https://doi.org/10.4172/Psychiatry.1000231
18. **Khan, W.I., Rabbani, M.W., Afzal, E., & Adnan, M.** Psychological screening in children with diabetes mellitus type-I at the children's hospital and the Institute of Child Health, Multan. *J Pak Med Assoc;* 2013; 63(12), 1520–1522.
19. **Fisher, L., Skaf, M.M., & Mullan, J. T.** Clinical depression versus distress among patients with diabetes: not just a question of semantics. *Diabetes Care;* 2017; 30(3), 542–548. https://doi.org/10.2337/dc06-1614
20. **Rubin, R.R., Wadden, T.A., & Bahnson, J. L.** Impact of Intensive Lifestyle Intervention on Depression and Health Related Quality of Life among Diabetes Patients: The Look AHEAD Trial. *Diabetes Care;* 2014; 37(6), 1544–1553. https://doi.org/10.2337/dc13-1928
21. **Teshome, H.M., Ayalew, G.D., Shiferaw, F.W., Leshargie, C.T., & Boneya, D. J.** The prevalence of depression among diabetic patients in Ethiopia: a systematic review and meta-analysis. *Depress Res Treat J;* 2018; 27(7), 112–117. https://doi.org/10.1155/2018/6135460
22. **Dever, M.** Screening for Depression in Adolescents With Diabetes. *Journal of Pediatric Nursing;* 2016; 31(1), 117–119. https://doi.org/10.1016/j.pedn.2015.11.004
23. **Lawrence, J.M., Standiford, D.A., Loots, B., Klingensmith, G.J., Williams, D.E., & Ruggiero, A.** Prevalence and correlates of depressed mood among youth with diabetes: the SEARCH for Diabetes in Youth study. *J Am Acad Child Adolesc Psychiatry;* 2016; 117(4), 1348–1358. https://doi.org/10.1542/peds.2005-1398
24. **Majaliwa, E.S., Munubhi, E., Ramaiya, K., Mpembeni, R., Sanyiwa, A., & Mohn, A.** Survey on acute and chronic complications in children and adolescents with type 1 diabetes at Muhimbili National Hospital in Dar es Salaam, Tanzania. *J Diabetes Care;* 2014; 30(9), 2187–2192. **https://doi.org/10.2337/dc07-0594**
25. **Mathew, C., Dominic, M., Isaac, R., & Jacob, J.** Prevalence of depression in consecutive patients with type 1 diabetes mellitus of 5-year duration and its impact on glycemic control. *Indian J Endocrinol Metab;* 2012; 16(5), 764–768. https://doi.org/10.4103/2230-8210.100671
26. **Mendenhall, E., Norris, S.A., Shidhaye, R., & Prabhakaran, D.** Depression and type 1

diabetes in low- and middle-income countries: A systematic review. *Diabetes Res Clin Pract*; 2014; 103(2), 276–85. https://doi.org/10.1016/j.diabres.2014.01.001

27. **Mossie, T.B., Berhe, G.H., Kahsay, G.H., & Tareke, M.** Prevalence of depression and associated factors among diabetic patients at Mekelle City, North Ethiopia. Indian J Psychol Med; 2017; 39(1), 52–8. https://doi.org/10.4103/0253-7176.198947
28. **Kauye, F., Jenkins, R., & Rahman, A.** Training primary health care workers in mental health and its impact on diagnoses of common mental disorders in primary care of a developing country, Malawi: a cluster-randomized controlled trial. *Psychol Med;* 2014; 44(3), 657–66. https://doi.org/10.1017/S0033291713001141
29. **Bensbaa, S., Agerd, L., Boujraf, S., Araab, C., Aalouane, R., & Rammouz, I.** Clinical assessment of depression and type 1 diabetes in Morocco: economical and social components. *J Neurosc Rural Pract;* 2014; 5(3), 250–253. https://doi.org/10.4103/0976-3147.133576
30. **Wysocki, T., Greco, P., Harris, M.A., Bubb, J., & White, N. H.** Behavior therapy for families of adolescents with diabetes. *Diabetes Care;* 2017; 24(3), 441–446. https://doi.org/10.2337/diacare.24.3.441
31. **Davies, M. J., Heller, S., Skinner, T. C., Campbell, M. J., Carey, M. E., Cradock, S., & Khunti, K.** Effectiveness of the diabetes education and self management for ongoing and newly diagnosed (DESMOND) programme for people with newly diagnosed type 2 diabetes: Cluster randomised controlled trial. *BMJ*; 2016; 336(7642), 491–495. https://doi.org/10.1136/bmj.39474.922025.BE
32. **Khunti L.J., Gray T., Skinner M.E., Carey K., Realf H., & D. M. J.** Effectiveness of a diabetes education and self management programme (DESMOND) for people with newly diagnosed type 2 diabetes mellitus: Three year follow-up of a cluster randomised controlled trial in primary care. *BMJ*; 2012; 13(7), 122–127. https://doi.org/10.1136/bmj.e2333
33. **Grey, M., Boland, E.A., Davidson, M., Yu, C., Sullivan-Bolyai, S., & Tamborlane, W. V.** Short-term effects of coping skills training as adjunct to intensive therapy in adolescents. *Diabetes Care;* 2017; 21(6), 902–908. https://doi.org/10.2337/diacare.21.6.902
34. **Gabbay, R.A., Añel-Tiangco, R.M., Dellasega, C., Mauger, D.T., Adelman, A., & Van, D. H.** Diabetes nurse case management and motivational interviewing for change (DYNAMIC): results of a 2-year randomized controlled pragmatic trial. *J Diabetes*; 2013; 5(3), 349–57. https://doi.org/10.1111/1753-0407.12030
35. **Inouye, J., Li, D., Davis, J., & Arakaki, R.** Psychosocial and clinical outcomes of a cognitive behavioral therapy for Asians and pacific islanders with type 1 diabetes: a randomized clinical trial. *Hawai'i J Med Public Health;* 2015; 74(11), 360–368.
36. **Wagner, J.A., Bermudez-Millan, A., Damio, G., Segura-Perez, S., Chhabra, J., Vergara, C., Feinn, R., & Perez-Escamilla, R.** A randomized, controlled trial of a stress management intervention for Latinos with diabetes delivered by community health workers: outcomes for psychological wellbeing, glycemic control, and cortisol. *Diabetes Res Clin Pract;* 2016; 120(15), 162–70. https://doi.org/10.1016/j.diabres.2016.07.022
37. **Welschen, L.M, van Oppen, P., Bot, S.D., Kostense, P.J., Dekker, J.M., & Nijpels, G.** Effects of a cognitive behavioural treatment in patients with type 2 diabetes when added to managed care; a randomised controlled trial. *J Behav Med*; 2013; 36(6), 556–66. https://doi.org/10.1007/s10865-012-9451-z
38. **Pauley, T., Gargaro, J., Chenard, G., Cavanagh, H., & McKay, S. M.** Home-based diabetes self-management coaching delivered by paraprofessionals: A randomized controlled trial. *Home Health Care Services Quarterly; 2016; 35(4), 137–154.* https://doi.org/10.1080/01621424.2016.1264339
39. **Wu, S. F., Liang, S. Y., Wang, T. J., Chen, M. H., Jian, Y. M., & Cheng, K. C.** A self management intervention to improve quality of life and psychosocial impact for people with type 1 and 2 diabetes. *Journal of Clinical Nursing*; 2013; 20(17), 2655–2665. https://doi.org/10.1111/j.1365-2702.2010.03694.x
40. **Fikadu B. H., Per H., &, & M., A.** Effect of locally-contextualized nurse-led diabetes self-management education on psychosocial health and quality of life: A controlled before-after study. *International Journal of Africa Nursing Sciences*; 2021; 15(1), 30–35. https://doi.org/10.1016/j.ijans.2021.100325