

Impact of Exercise Training on Depression among People with Type 2 Diabetes Mellitus: A Narrative Review

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ABSTRACT

Purpose: *The prevalence of clinically relevant depressive symptoms among clients with Type 2 diabetes mellitus is in the range of 30%. Since these conditions are often under-diagnosed and under-treated in clinical practice, they negatively affect functional recovery, adherence to treatment, and the quality of life. Despite the large body of evidence regarding the effects of exercise training on different aspects of diabetes, no updated conclusive article that reviews depression is available. This article aims to review the current literature on exercise training and its effect on depression in people with Type 2 diabetes mellitus.*

Method: *An electronic search of literature from 2010, highlighting the effects of exercise on depression among Type 2 diabetes mellitus clients, was conducted using Google Scholar and PubMed. Relevant articles were utilised for this review. The selected studies are based on relational and rehabilitative exercise training approaches.*

Results: *While most of the studies support the efficacy of exercise training, study settings and described models are not conclusive. No single clearly defined model exists for exercise training for depression among people with diabetes. There is evidence for the efficacy of supervised aerobic exercise in the treatment of depression, when undertaken three times weekly at moderate intensity, for a minimum of eight weeks. Further research is required to develop specific exercise training models that can be tested in experimental studies for this client group.*

Conclusion: *The current review showed that exercise training can be used to alleviate depression among people with diabetes. Future studies should adopt rigorous methodological criteria to back up the present findings.*

Key words: *Exercise training, Type 2 diabetes, depression, aerobics.*

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INTRODUCTION

The prevalence of diabetes is steadily increasing globally, most markedly in the world's middle-income countries. In 2016, diabetes was the direct cause of 1.6 million deaths (World Health Organisation, 2018). Diabetes and its complications bring about substantial economic loss to people with diabetes and their families, and to health systems and national economies, through direct medical costs and loss of work and wages. Among chronic diseases, diabetes is unique because treatment largely depends on self-management. It is therefore a priority to investigate integrative approaches to treatment that offer added benefit to clients engaged in diabetes self-management training. Training provides diabetics with knowledge about diet and exercise, as well as how to cope with stress levels.

Type 2 diabetes mellitus (T2DM) is the most common form of diabetes, affecting approximately 95% of individuals with the disease. It is widely known that clients with T2DM are at high risk of decreased psychological well-being (Gask et al, 2012; Stuckey et al, 2014). This is due to strained coping with changed life routine (such as relationships, work-related and financial issues) right from the time of diagnosis of diabetes mellitus (Walker et al, 2012). An international survey, the 'Diabetes Attitudes, Wishes and Needs second study (DAWN2)', that included over 16000 individuals (comprising clients, family members and healthcare providers) in 17 countries across four continents, reported that the proportion of the people with T2DM who were likely to have depression and diabetes-related distress was 13.8% and 44.6% respectively, with overall poor quality of life at 12.2% (Nicolucci et al, 2013).

Individuals with T2DM and a mental health condition are at increased risk for hyperglycemia (Brieler et al, 2016), coronary heart disease (Kinder et al, 2002), poor quality of life (de Groot et al, 2006) and increased health care costs when compared to those with diabetes alone. Positive emotional health may sustain long-term coping efforts and protect clients from the negative consequences of prolonged emotional disorders and illness perception, thus facilitating diabetes self-management behaviour and better physical health. Although the interaction between emotional health and diabetes physiology are becoming clearer, there is still a paucity of structured exercise training programmes that incorporate human psychology and intervene effectively in clients with T2DM for improved clinical outcomes. To date, a wide variety of programme combinations have been utilised in random controlled trials, making it challenging for the practitioner to prescribe effective exercises for clients with depression. Thus, the purpose of this

review is to analyse the studies published since 2010, which report the effect of exercise for treatment of T2DM with depression, and to examine the programme variables which may lead to successful treatment. Researchers and practitioners may draw upon the resultant recommendations to design exercise interventions for the treatment of diabetes clients with depression.

METHOD

An electronic search of literature from 2010, highlighting the effects of exercise on depression among T2DM clients, was conducted using Google Scholar and PubMed. Relevant articles were utilised for this review. The keywords used for literature search included 'type 2 diabetes mellitus', 'aerobics', 'exercise training' and 'depression'. Randomised controlled trials or RCTs published in English between 2010 and 2018 were included. A broad research approach was chosen to minimise the chances of missing relevant articles. Articles that assessed variables reflecting diabetes mellitus and the effect of exercise training provided to T2DM clients independently or in combination with other strategies were included. The studies were double checked and only full text articles were used for the review. The abstracts and articles published in languages other than English and with incomplete data were excluded. Totally 4 studies were selected to emphasise the effect of exercise training on depression in T2DM clients. The main findings are summarised in Tables 1 - 4.

Table 1: Risk Factors for developing Depression in Individuals with Diabetes

Risk factors for developing depression in individuals with diabetes include:

- Female gender
- Adolescents /young adults and older adults
- Poverty
- Few social supports
- Stressful life events
- Poor glycaemic control (particularly with recurrent hypoglycemia)
- Longer duration of diabetes
- Presence of long-term complications

Table 2: Symptoms of Depression**Symptoms of depression can be mild to severe, and include:**

- Feeling sad or empty
- Losing interest in favourite activities
- Overeating or not wanting to eat at all
- Not being able to sleep or sleeping too much
- Having trouble concentrating or making decisions
- Feeling very tired
- Feeling hopeless, irritable, anxious, or guilty
- Having aches or pains, headaches, cramps, or digestive problems
- Having thoughts of suicide or death

Table 3: Standardised Outcome Measures used for Assessment of Depression in People with Diabetes**Standardised outcome measures for assessment of depression in people with diabetes**

- Beck Depression Inventory (BDI-II)
- Geriatric Depression Scale (GDS)
- Hospital Anxiety and Depression Scale (HADS)
- Short Depression Screening Tool
- Primary Care Health Questionnaire (PHQ-9)

Table 4: Symptoms of Depression- Results

Source	Interval	Evaluation Test	Results
Kaka et al, 2018	8 weeks	Beck Depression Inventory	Significant between-group difference
Lin et al, 2017	12 weeks	Beck Depression Inventory	Significant between-group difference
Lincoln et al, 2011	16 weeks	Geriatric Depression Scale	Significant between-group difference
Sardar et al, 2014	8 weeks	Geriatric Depression Scale	No significant between-group difference

RESULTS AND DISCUSSION

Diabetes and Mental Health

It is well recognised that many individuals with chronic illnesses also have co-morbid unrecognised mental health disorders (Diabetes UK, 2018). The International Federation of Diabetes has stressed the importance of integrating psychological care in the management of diabetes. Three in five people with diabetes experience emotional or mental health problems. New research from Diabetes UK finds that one in five people living with diabetes use counselling from a trained professional to help them manage their ailment. It has been estimated that the risk of getting depression in the general population is 10-25% in females and 5-12% in males. Systematic reviews have shown that diabetics have a higher prevalence of depression than non-diabetic populations (Nouwen et al, 2010).

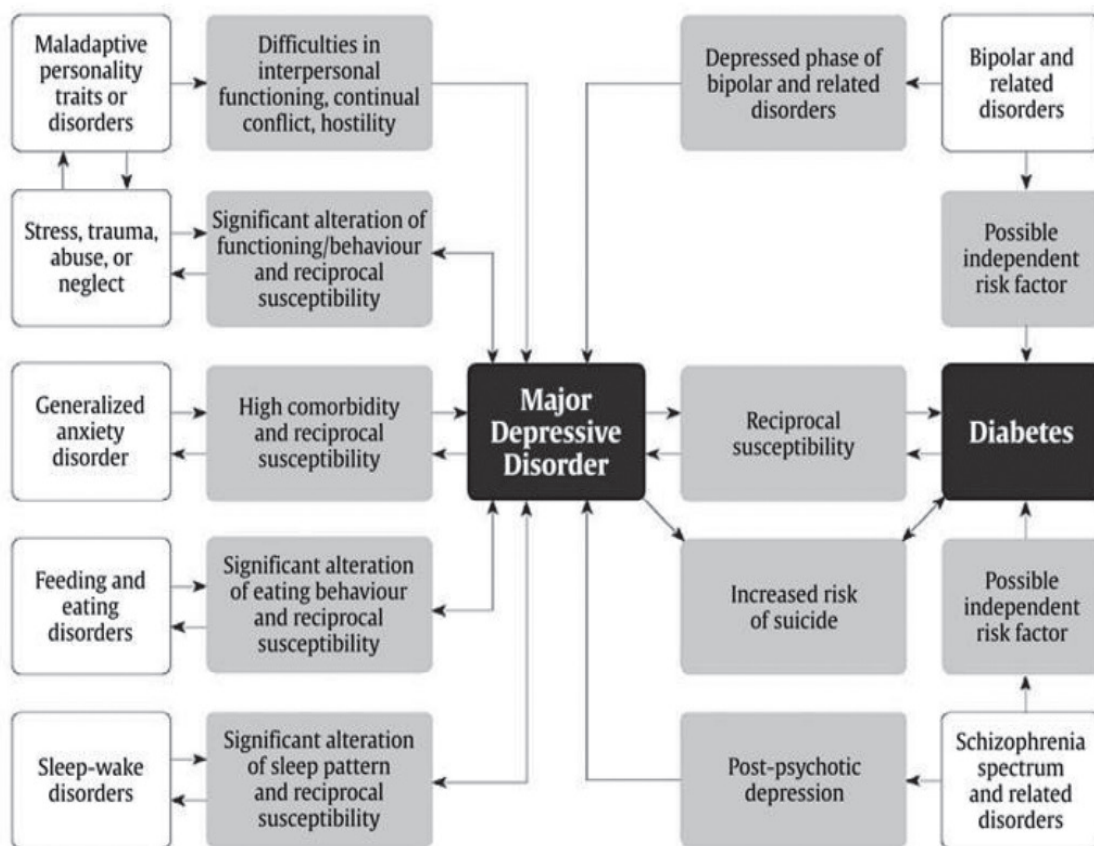
The prevalence of clinically relevant depressive symptoms among clients with diabetes is in the range of 30%. The prevalence of major depressive disorder (MDD) is approximately 10%, which is double the overall prevalence in people without a chronic medical illness. Depression in clients with diabetes amplifies symptom burden by a factor of about 4. Researchers have identified the risk factors for developing depression in individuals with diabetes, as listed in Table 1.

Globally, an estimated 43 million diabetics have symptoms of depression. Being diagnosed with diabetes is a life-stressor by itself. It requires a large number of physical and mental accommodations. Depression adds to the burden of managing diabetes. Furthermore, health care utilisation and costs (Egede et al, 2002; Subramaniam et al, 2009) increase with the coexistence of diabetes and major depression.

A growing body of literature has reported that clients with diabetes are almost twice as likely to suffer from anxiety and depression as the general population (Ghuloum et al, 2010). Such symptoms were associated with poor glycemic control, diabetes complications, worsened prognosis and quality of life as well (Lustman et al, 2000). It was reported that blood pressure, duration of diabetes, obesity and physical inactivity were significant risk factors for depression in clients with diabetes (Bener et al, 2011). Only 25% to 50% of people with diabetes who have depression get diagnosed and treated. The symptoms of depression are listed in Table 2 (Centres for Disease Control and Prevention, 2018).

Compared to those with diabetes alone, individuals with diabetes and mental health concerns have decreased participation in diabetes self-care, decreased quality of life, increased functional impairment, increased risk of complications associated with diabetes, and increased healthcare costs. Individuals with serious mental illnesses, particularly those with depressive symptoms or syndromes, and people with diabetes share reciprocal susceptibility and a high degree of comorbidity. The interplay between diabetes, major depressive disorder and other psychiatric conditions are depicted in Figure 1.

Figure 1: The Interplay between Diabetes, Major Depressive Disorder and other Psychiatric Conditions



Note: Figure is adapted from 2018 Clinical Practice Guidelines, Diabetes and Mental Health, Diabetes Canada Clinical Practice Guidelines Expert Committee (Robinson et al, 2018)

In a primary care setting, several validated tools are available to assist in the diagnosis of depression (Table 3). Four studies examined the effects of exercise training on symptoms of depression. The results are listed in Table 4. Most intervention programmes were performed three times a week and were of moderate exercise intensity. All included trials used aerobic exercise, either treadmill or rebound exercise, swimming or stationary cycle. Intervention duration ranged from eight to sixteen weeks. Exercise training was shown to be effective in lowering the symptoms of depression. Some level of supervision is recommended.

Exercise Training and Depression

Depression is prevalent among people with diabetes and is associated with significant morbidity, increased risk of mortality, and economic burden. Although effective treatments for depression exist (e.g., antidepressant medication, cognitive-behavioural therapy), the disorder remains inadequately treated for many clients. Recently, the use of exercise as a treatment for depression has received increased attention.

Based on the data from World Health Organisation, depression is ranked as the second largest healthcare problem globally, in terms of years lived with disability (Ustun et al, 2004). Depending on its severity, depression is often treated using psychotherapy, antidepressants or a combination of both. However, the clinical benefits of antidepressants (Turner et al, 2008; Jakobsen et al, 2017) and psychotherapy (Jakobsen et al, 2012) have been challenged. Both treatments are costly in terms of time and money and may also have adverse effects. Compliance with antidepressant treatment is poor; the dropout rate in clinical trials is reported to be between 12% and 40% within the initial 6–8 weeks of treatment (Cipriani et al, 2009). The weakness of evidence for the beneficial effect of current interventions, along with problems related to low compliance and harm, has resulted in interest in alternative interventions. The use of exercise as an intervention has attracted considerable attention, and various forms of exercise, varying in intensity, have been assessed in a number of randomised clinical trials to test their effectiveness as a treatment for clients with depression.

No serious adverse events were reported in any of the trials that were analysed. Treadmill, stationary cycling, swimming and resistance training were the various exercise training used as intervention in the trials. Three of the four randomised controlled trials reported statistically significant difference in depression. All

outcomes for the primary analysis reflect depression severity; however, an in-depth discussion of the included assessment scales is beyond the scope of this review. To further elaborate on the current findings, it is recommended that future trials must include blinded outcome assessors.

Swimming training, three times a week for 8 consecutive weeks, was found effective in reducing depression among people with diabetes. The swimming training programme consisted of maximal crawl 30 minutes (2 min activity and 3 min rest) for 3 days a week in the first month, and 30 minutes (2 min activity and 1 min rest) for 4 days a week in the second month. During this study, subjects were encouraged to keep low to moderate intensity for accommodate conditioning. The reason for this effect probably related to an increase of endorphin in subjects, under the influence of physical exercise. Endorphins could generate happiness and be a feel-good factor. Beck Depression Inventory was used for measuring depression in this study (Saiariet al, 2011).

One of the most effective mechanisms in reducing depression through exercise training can be the increased levels of serotonin and norepinephrine, which result in endorphin release and reduced secretion of cortisol (Dery et al, 2013; Lee et al, 2013). Probably increased levels of endorphin, norepinephrine and serotonin, followed by a decrease in cortisol secretion, were some of the reasons for reduced depression. Rebound exercise and circuit training were also found effective in reducing depression in a trial involving a total of 70 participants for eight weeks (Kaka & Maharaj, 2018). Rebound exercise on the mini trampoline moves all parts of the body at once, so it is also called cellular exercise (Tobkin, 2018). It may be superior to any other type of exercise as it utilises gravity and forces of acceleration and deceleration, so that at the top of the bounce one experiences weightlessness, and at the bottom the weight doubles, pulling into the centre of the rebounder. It was reported that moderate-intensity exercise training improves insulin sensitivity, quality of life and depression status in T2DM clients particularly over time, within a 12-week exercise training course (Lin et al, 2017).

A study conducted among older adults with poorly controlled Type 2 diabetes, reported significant reduction in depression when participants were submitted to exercise training under supervision, three times per week for 16 weeks. Each session lasted approximately 45 minutes and included warm-up, progressive resistance exercise training and cool-down exercises. Geriatric Depression Scale was used by researchers to assess the level of depression. The findings of this study

demonstrated that participation in progressive resistance training had the added benefit of significantly improving mental health (Lincoln et al, 2011). In older individuals, progressive resistance exercise has been previously demonstrated to be safe and feasible (Fiatarone et al, 1994).

A recent study examined the effects of aerobic exercise training on psychosocial aspects (mental health, the aspects of physical symptoms, anxiety and insomnia, social functioning, and depression) in clients with T2DM. The eight-week moderate intensity aerobic exercise training, that lasted 45 to 60 minutes, had significant effects on mental health, subscales of physical symptoms, and anxiety and insomnia (Sardar et al, 2014). General Health Questionnaire (GHQ- 28) was used as the outcome measure in this study. However, aerobic exercise training had no effect on the subscales of social functioning disorder and depression, which was inconsistent with the findings of other studies. The reasons for these contrasting findings may be due to the duration, intensity, and type of exercise training (aerobic exercise in water), because exercise conducted in water is more pleasant than other aerobic exercises. Researchers argued that diabetics usually suffer from depression, which prevents them from participating in physical activities. Hence, it would appear that they need physical activities of longer duration, and they must be the ones to select the type of exercises.

CONCLUSION

Mental health and diabetes are intricately linked, making it necessary and appropriate to address them in tandem. Research on exercise training for the improvement of mental health in diabetes has been encouraging. There is strong evidence to support the use of exercise for the treatment of depression in people with T2DM. Interventions lasting 8-12 weeks, with the frequency of 3 sessions per week at moderate intensity, were found effective in majority of the studies analysed. Further research should be carried out with a larger sample size with adequate allocation concealment, using blinded outcome assessments and focused on ideal frequency, duration, intensity and type of exercise, exploring the mechanistic pathways.

This review concludes that exercise is an outstanding intervention in the treatment of clients who have a mix of mental and physical health problems, and exercise training is a holistic care option.

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