

## Potential impact of music interventions in managing diabetic conditions

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### Abstract

Diabetes is one of the most prevalent diseases, characterized by an insufficiency in insulin secretion as well as chronic hyperglycemia and disturbances in carbohydrate, lipid, and protein metabolism. The major aim of this study was to conduct a literature review on the impact of music intervention on the management of diabetic conditions among patients. Available studies on the impact of music interventions on the management of diabetic conditions were reviewed and analysed using descriptive literature review approach. This review showed that music intervention plays a dual role in managing patients' diabetic conditions. First, music intervention is impactful in managing the health condition of diabetic patients through enhancing the patient's compliance with exercise, improving lower limb blood circulation, and enhancing health parameters that increase autonomous balance among diabetic patients. Second, music therapy is impactful in the management of diabetic conditions through lowering blood sugar, heart rate, glucose levels, and stress among patients. However, with the number of empirical studies available in this regard, the impact of music intervention is still growing, and longer-term studies and randomised controlled trials with robust sample size are recommended to reach a more valid conclusion.

**Key Words:** Diabetes; Management of diabetes; Music intervention; Music therapy

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**Core Tip:** The use of music intervention has been found effective in treating a wide range of health issues. This study demonstrates that music intervention is impactful in the management of diabetic conditions through reduction in blood sugar, heart rate, glucose level, and stress. These symptoms have been widely associated with diabetic conditions among patients. It is imperative to further examine the significant effects of music intervention in curtailing these symptoms through the selection of specific music that reduces these specific symptoms in diabetics.

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## INTRODUCTION

Music therapy is a non-drug-assisted intervention that has a significant impact on diabetic patients' management, comfort, and recovery. Music intervention has been perceived as a resolute musical exercise in which music listening and singing are central. Music intervention is the clinical and evidence-based application of music in a therapeutic intervention by a certified professional who has completed a recognized music therapy programme[1]. Additionally, music interventions are delivered by licensed music therapists and are distinguished by the utilization of personalized musical experiences and the inclusion of a therapeutic approach[2]. In music therapy history, music intervention may include listening to music, playing music, or writing songs[3]. Music features have been shown to have a significant impact on the management and reduction of stress experienced by patients with illnesses[4].

Music of different types, such as high and low tempos, with and without lyrics, live or recorded, has a different degree of impact on managing the health conditions of patients. In the context of music, the tempo of a piece is regarded as one of the most significant moderators of arousal and relaxation. Meditative music with a slow tempo of 60-80 beats per minute is commonly linked with decreases in heart rate, resulting in greater relaxation[5,6]. When instrumental music is used, it is found to have a more profound impact on reducing stress as music that includes lyrics is more distracting and stimulating rather than calming[7]. As a result of the possible comforting effects of lyrics, music with lyrics may enhance the positive impact of music interventions when managing stress associated with ailments[8]. Additionally, the manner in which music is played (on stage or recorded) has a significant impact on patients. Since live music therapists tailor their programmes in order to capture patients' specific needs, live music has been revealed to be more impactful than "music as medicine" in lessening patient pain[9]. There is evidence that music therapists in hospice and palliative care utilize a variety of techniques, including song writing, lyric analysis, instrumental playing, guided imagery and music, singing, and music therapy relaxation techniques in order to address the immediate and personified needs of their patients[10]. The goal of this study was to establish the potential impact of music interventions for the management of various types of diabetic patients using available empirical evidence.

Diabetes is a chronic metabolic disorder which has become one of the most prevalent and major global health problems. Among the most notable features of diabetics are the absolute deficits in insulin secretion as well as chronic hyperglycemia and abnormalities in the metabolism of carbohydrate, lipid, and protein[11]. There are various types of diabetes described in the literature, including Type 1, Type 2 (DM2), prediabetes, gestational, monogenic, cystic fibrosis, and chemically induced diabetes[12]. A poorly managed form of diabetes can damage vital organs and tissues such as the kidneys, eyes, nerves, and heart[12]. This study deals with the utilization of music intervention in treating diabetes ailments.

The use of music intervention therapy has been found effective in treating a wide range of health issues, including diabetes. As a result, music has a significant impact on individual minds before its perceived meaning is transmitted into thoughts and feelings[13]. Since it helps create psychological wellness, increases the ability to concentrate and think critically, and enhances emotional expression and clarity of thinking, music can be used to treat psychological ailments as well as psychosomatic diseases[13]. The potential benefits of music therapy have been noted in the areas of health care, education and social welfare, as well as its artistic and cultural benefits[14]. Music therapy has been found to be the most accepted and evaluated modality of integrative medicine as well as complementary alternative medicine[14]. The major aim of this current study was to establish the potential impact of music intervention in the management of diabetic condition based on the available empirical studies.

## METHODOLOGY

This study adopted a descriptive literature review approach to investigate the potential impact of music interventions on managing diabetic conditions. Since this study was based on empirical literature analysis, ethical approval was not required. Based on an extensive literature search, we identified and cited published papers in reputable journals and databases. A multiple inclusion criteria were used to select papers for this literature analysis. Firstly, only studies that examined the potential effects of music intervention on the management of diabetes were included. The study must be conducted on the human population; hence, animal studies were excluded. The music intervention must involve listening to music, either live or recorded; any intervention studies that dealt with the making of music were excluded; the study must involve two groups. Studies must include either psychological or physiological outcome variable(s); thus, studies without any of these outcome variables were excluded; intervention studies that included participants less than 18 years were excluded; and finally, studies that were not written in the English language were not included. Based on these selection criteria, a total of 6 articles met the criteria for inclusion.

The descriptive literature review approach enabled us to describe the selected literature and present their implications for research and practice. We were able to find substantial information on people with diabetes, and the potential impact of music interventions on managing diabetic conditions from several sources including Google Scholar, Directory of Open Access Journals, Dimensions, SciLit, Bielefeld Academic Search Engine, Lens, Scopus, *Reference Citation Analysis* (<https://www.referencecitation-analysis.com/>) and PubMed Central. Qualitative and quantitative papers in the English version were rigorously searched, evaluated, selected, and synthesized by the researchers. Search terms used include music intervention, diabetes management, music intervention and diabetes intervention, music therapy and diabetes management, and the impact of music on diabetes management.

## POTENTIAL IMPACT OF MUSIC INTERVENTION IN MANAGING DIABETIC CONDITIONS

An extensive review of the medical literature has demonstrated that chronic illness associated with insulin inefficiency contributes significantly to the development of diabetes. However, the use of music interventions can greatly contribute in managing diabetes and accompanying psychological symptoms [13-19] (see Table 1). For instance, a past study[15] used an intervention program to evaluate the effects of Indian classical music on blood sugar levels of DM2 patients compared to non-diabetic participants. In all groups, a significant reduction was observed in blood glucose levels. In addition, the findings of the study indicated that no significant differences were observed in blood sugar reduction between participants in control and experimental conditions. The results of this study indicate that music intervention can reduce blood sugar levels to a certain extent, even though the effect is not statistically significant.

The effectiveness of active and silent music interventions on patients with DM2 was also examined by researchers[16] using a repeated measures study design. The results of this study revealed that the activation coefficient of DM2 patients using Gas Discharge Visualization parameters was significantly affected by both active and silent music. However, it was indicated that silent music intervention led to boredom as compared to active music. A session of active music intervention led to a significant improvement in the health condition of the DM2 patients, which could ultimately assist them in maintaining autonomous balance. The findings of this study affirmed that music intervention has the potential impact on management of diabetic conditions.

Also, a study examined the effects of Indonesian traditional music on DM2 patients using a quasi-experimental design of pre-test and post-tests[18]. It was revealed that Saluang music significantly reduced the incidence of DM2 in patients. Thus, it implies that Saluang music is effective in treating stress-related problems associated with DM2. Likewise, a study investigated the effect of combining music and exercise on elderly patients with diabetes mellitus using a quasi-experimental research approach[19]. During the following three months of intervention, it was found that music intervention improved adherence to low exercise levels significantly compared to the control group. Therefore, combining music and low exercise therapeutic intervention enhances the extent of exercise compliance in elderly patients suffering from diabetes and improves blood circulation in their feet. In addition, music therapy was used in a randomised controlled trial to treat DM2 with psychosomatic disease[13]. The study focused on two types of music that were both joyful and relaxing in reducing glucose levels. In both intervention groups, music therapy increased the psychological parameters of patients with DM2 as well as lowered their blood glucose levels.

Physiological disorders caused by stress can lead to functional abnormalities in a variety of organs, either temporarily or permanently. But, it has been shown that music therapy can reduce psychological and physiological stress, metabolic changes, and the pain experienced by diabetic patients[13]. Patients with diabetes, for example, have low hepatic carbohydrate stores due to insulin deficiency[13]. Because of this shortage, sugar cannot be transported from the blood to the liver or other cells that require it, resulting in elevated blood sugar levels. As a complex carbohydrate called glycogen, sugar is injected

**Table 1 Empirical literature on potential impact of music intervention among diabetic patients**

Ref.	Year	Duration	Study objectives	Method/sample	Results
Cioca[13]	2013	Not specified	To determine the impact of music intervention on reduction of glycaemia (glucose) among diabetic patients and healthy peoples	Randomised controlled experimental research design using criterion sampling to sample 120 participants	This study revealed that hypoglycemic role of classic music for DM2 patients decreased the patients' glucose levels
Pillai and Dave[15]	2018	A day	To establish the effect of Indian classical music on blood sugar level of DM2 and non-diabetic patients	Quasi-experimental controlled trial using criterion sampling technique to sample 100 participants	There was a significant reduction in the blood sugar of the selected participants, but not significant when compared to other groups
Rao and Nagendra [16]	2014	A day	The main purpose of this study was to compare the difference of the effect of active and silent music intervention on the autonomous balance of diabetic patients	Repeated measure of pre-post design was used in a sample of 42 participants	It was revealed that silent music was more bore compare to active music; active music led to significant change in the parameter towards enhancement of health status of patients which could be more helpful in achieving autonomous balance of the diabetic patients
Deshkar <i>et al</i> [17]	2022	A day	To evaluate the effect of music therapy on heart rate variability among diabetic patients	Pure experimental research using criterion sampling procedure sample 30 diabetic patients	It was revealed that music intervention lessened the heart rate. The difference was statistically significant
Sastra and Reni[18]	2022	7 d	The main purpose was to examine the effect of Salaung Indonesian music on reducing stress of DM2 patients	Quasi-experimental one-group pretest-post-test using criterion sampling procedure was used to sample 20 participants	The study revealed that Indonesian traditional music is effective in reducing patient stress level
Ji <i>et al</i> [19]	2015	6 mo	The objective was to evaluate the effectiveness of music therapy with lower exercise on elderly patient with diabetes compliance with lower exercise and blood circulation	Randomised control trial using criterion sampling procedure was adopted to sample 72 participants	The study affirmed that music intervention with lower extremity exercise can both enhance the extent of exercise compliance of elderly patients as well as improve blood circulation in their feet among elderly patients

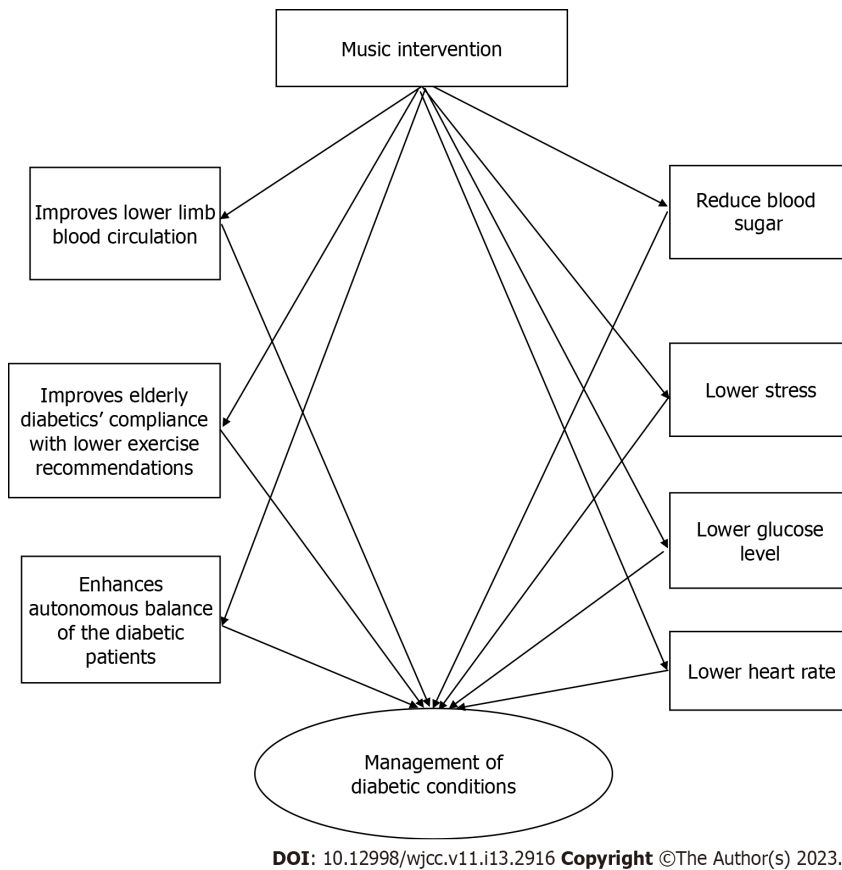
DM2: Type 2 diabetes mellitus.

into the bloodstream through epinephrine on demand. The stimulation of beta cells in the organs by classical music contributes to the maintenance of normality for a limited period of time. Emotional situations affect blood sugar levels[13]. As a result of gently altering the neurotransmitter epinephrine, classical music can assist in the promotion of relaxation.

From available literature, six studies focused on the potential impact of music intervention on the management of DM2 conditions. This indicates that there is a dearth of empirical studies on the potential impact of music intervention on the management of other types of diabetes. In other words, more studies on the impact of music intervention on the management of other diabetic conditions are required. Also, the type of music intervention adopted depends on the environment where the studies were carried out. The majority of the music used in this study were predominant Asian, involving joyful and relaxing music[13]; classical, folk instrumental, cheerful, religious, and soothing[19]; and Indonesian Salaung music[18]. There is a dearth of empirical studies in this regard in other parts of the world, especially on the African continent, where there is a high prevalence of diabetes cases.

Furthermore, two of the selected studies[13,19] used randomized controlled designs whereas other studies[15,18] used non-randomized designs. Therefore, there is a need for empirical studies with high levels of control and randomisation of participants. This will enable the establishment of the potential impact of music intervention on the management of diabetic conditions with robust design. Among the randomised groups, there was a significant reduction in the associated symptoms of diabetics in the treatment groups. But, most of the sample sizes used in the studies were small, which hinders the generalization of the findings. In some studies with larger samples, there was a substantial potential impact of music intervention on the management of diabetic patients. The period of intervention was not specified[13] while others used shorter periods, which ranged from 1-7 d. Only one study lasted for six months[19]. Hence, more studies that span a longer period of time are needed to establish the potential impact of music intervention on the management of diabetes since one time exposure to music intervention may not be sufficient to establish the potential effect of music intervention in the management of diabetic conditions.

Figure 1 show that music therapy has been found to enhance the psychological and physical health of patients with diabetes based on the four empirical evidences. First, music intervention has been found to lower the glucose level of patients with diabetes from 197.75 to 158.93, demonstrating its significant impact on managing overall diabetic conditions[13]. The efficacies of two kinds of music intervention (relaxing music and joyful music) were tested with regards to reduction in glucose levels. Specifically,



**Figure 1** Potential impact of music interventions in managing diabetic conditions.

music for relaxation reduced glucose levels from 169.76 to 148.1, whereas music for joy reduced glucose levels from 197.53 to 172.83. These two types of music intervention are of considerable benefit to diabetic patients by reducing glucose levels without taking any drug such as metformin.

Second, music therapy has been found to enhance lower limb blood circulation in patients with diabetes. Specifically, music therapy enhanced the peak velocity of the dorsal artery in patients with diabetes after 6 mo, as those in the control group had a mean score of 14.5 while those in the intervention group had a mean score of 15.91[19]. This indicates that music therapy is efficacious in enhancing a patient’s dorsal artery and an increase in the peak velocity of the dorsal artery translates to enhanced blood circulation in diabetics.

Third, music therapy has the potential to improve elderly patients' compliance with lower extreme exercise regimens after 6 mo of treatment[19]. The elderly diabetic patient increased their compliance with lower limb exercise from 13.56 to 21.18, indicating that music therapy had a significant impact on their health condition management. Fourth, the significant impact of music therapy in the management of diabetes has been established in lowering the heart rate of patients. For instance, music therapy reduced the elderly diabetic's heart rate from 93.9 to 84.7, demonstrating the importance of music therapy in the management of diabetic conditions[17]. Fifth, high blood sugar has been found to be one of the symptoms of diabetes. However, application of music intervention therapy has been found to lower blood sugar from 225.925 to 216.025, indicating that this therapy is efficacious in managing the symptoms of DM2[15].

Finally, diabetic patients suffer numerous pains (physical and psychological pains) that are sometimes persistent and resistant to any type of medication, which results in the patient being stressed. However, application of music intervention therapy has been found to lessen stress associated with diabetic patients, as study indicates that the stress level of patients with diabetes decreased from 22.5 to 14.5[18]. Music therapy assists by stimulating endorphin secretions or distracting them. Music can also make a diabetic patient believe that he/she is in charge, thus relaxing him/her by regulating his heartbeat and respiration. Music therapy is one of the creative and experimental forms of alternative medicine used to restore people's psychic and physical well-being[13]. Music therapy is also helpful in moderating the metabolic changes, as an increase in catecholamine levels occurs when music is complex and intense, whereas a slow and discrete piece of music lowers glycaemia levels.

Music intervention therapy was tolerated by all the patients as there was no report of any specific adverse effect in any study. Music intervention therapy has a positive in management of diabetic conditions as it plays a dual role in the management of diabetic patients. The first impactful role of

music therapy in the management of individuals with diabetes is to improve the self-care of patients as well as enhance individuals' engagement in some activities that improve their health conditions[20-22].

Music therapy intervention mostly plays the role of solidifying treatment effectiveness by enhancing exercise compliance[23]. This suggests that music therapy increases the rate at which a patient with diabetes engages in exercise. When diabetic patients exercise more regularly, the incidence of complications decreases[24,25]. Music intervention is mainly applied to patients in order to relieve pains, depression, and muscle spasms, as well as to improve neurological deficits and enhance recovery of motor function[9,26].

The use of music intervention programme designed specifically for active and silent music categories has been found to improve the autonomous balance of diabetic patients[16]. Active music has been demonstrated to be beneficial in preserving energy levels and reducing the right-side entropy which assist in sustaining left balance in the integral area. Active music has been demonstrated to impact significantly on the parameters that improve health conditions which contributes to enhancing autonomous balance among diabetic patients. Similarly, silent music has been found to be less effective in improving health conditions that translates to autonomous balance of diabetic patients.

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## REFLECTIONS BASED ON AVAILABLE LITERATURE

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In the music literature, it has been demonstrated that listening to music and understanding it bring about an unavoidable alteration in an individual's mindset. This modification has been linked to a significant reduction in blood sugar levels in DM2 patients who listen to western classical music[13]. Furthermore, Indian music such as Raga Bageshree has been revealed to have a positive impact on the management of diabetic conditions through the reduction of blood sugar[27]. So, music therapy intervention including traditional music can help an individual with diabetes lower their blood sugar level, which is important for taking care of diabetic patients.

Music therapy has been found to be effective in managing the stress that diabetics often encounter. This assertion is strengthened by the disclosure that the Saluang form of Indonesian music positively affects the stress of patients with DM2[18]. Thus, the use of some areas of native music has had important influence on diabetics' well-being. Music therapy, including the use of classical music, exerts positive influence diabetics' mood states, stress level, heart rate, blood pressure, memory, and attention thereby leading to feelings of relaxation, calmness, and comfort[28,29]. Slow-tempo or rhythmic music has been shown to inhibit catecholamine release into blood vessels, resulting in a decrease in catecholamine concentrations in plasma. This process triggers the sympathetic nerves, which in turn stimulate the release of stress hormones that cause the body to relax[30]. Music impact in lessening stress associated diabetic condition has found to be low cost, free from side effects as well as uses indigenous approach. Diabetic patients' emotional attachment to a particular music or emotion conveyed through music tends to be affected by their cultural background[31].

In addition, a high glucose level, which is a commonly reported symptom of DM2 occur as a result of resistance to insulin, and have been found to decrease due to the impact of music therapy in the management of patients with diabetic conditions. In the music intervention literature, joyful and relaxing music therapies have been found to be impactful in reducing the level of glucose in individual patients with diabetes[32]. According to music literature, walking and jogging outside at a consistent pace while listening to favourite music lowers glucose levels in diabetics[33]. Despite the fact that music therapy has been shown to reduce glucose levels in diabetic patients, there was no significant difference in blood glucose levels before and after intervention in one study[34]. Despite this, music therapy is essential in the management of the general health condition of patients with diabetes.

The impact of music on resilience to exercise is probably attributed to its affecting sympathetic nerve excitability, slowing heart rate and breathing, and ultimately affecting the patients' nerve and muscle systems, which further improves perception and involvement with activities[35,36]. Also, different types of somatic and mental disorders can be managed through the use of music therapy in DM2 patients[37]. It is an efficient therapeutic method that modulates emotions and autonomous nervous system activity[17]. Because music intervention induces high relation and low tension subjectively in young people, it is often effective.

Additionally, ecological momentary music interventions and usual music interventions are feasible and pleasant activity-based approaches that can reduce psychological stress, chronic pains, lower voluntary mobility during pain episodes and decrease perceived stress, burnout, traumatic stress among patients[38-41]. A recent longitudinal study on management of DM2 also revealed that music with painting therapies positively lowers the level of blood glucose among individuals with DM2[42]. Another recent research revealed that music therapy remains the best way to reduce anxiety and depression among DM2 patients since it consistently reduced their mean post-test and follow-up ratings [43]. Also, spiritual music could decrease heart rate and blood pressure[44]. In comparison to DM2 patients treated without music-assisted alaglipatin, music-assisted alaglipatin was shown to reduce blood glucose levels and improve quality of life of DM2 patients[45]. Thus, various forms of music interventions have continued to date to demonstrate their efficacy in the management of diabetics'

mental and physical health symptoms.

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## IMPLICATIONS AND RECOMMENDATIONS

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The results of this study have implications for future research on the effective use of music therapeutic interventions for diabetes management. Music intervention was found to be impactful in the management of diabetic conditions by improving patients' engagement in exercise, autonomous balance, and lower limb blood circulation. The number of people that are diagnosed with diabetes is increasing on a daily basis, and these cases are prevalent among the aging population. Considering the fact that music intervention is inexpensive and easy to integrate into the medical setting as well as the daily lives of these aged patients in order to enhance their lives, it is very imperative to recognize the significant impact of music intervention on the management of their mood, mental health, glycemic control and emotions[37].

Also, this study established that music intervention is impactful in the management of diabetic conditions through reduction in blood sugar, heart rate, glucose level, and stress. These symptoms have been widely recognized as the manifestation of diabetic conditions among patients. It is crucial to further investigate the significant effects of music intervention in curtailing these symptoms through the selection of specific music that reduces these specific symptoms in diabetics.

The majority of the empirical studies in the music intervention literature focused on DM2 condition. This means that the impact of music intervention in the management of diabetic conditions has not been tested on other types of diabetic conditions. Therefore, further studies should consider establishing the impact of the management of other types of diabetic conditions using music intervention therapy.

Also, most of the studies on music intervention in the management of diabetes are non-randomised controlled trials. This review suggests that future research should focus on a randomised control trial involving two or more groups in order to effectively establish the potential impact of music intervention on the management of diabetic conditions that other researchers can easily replicate. Additionally, the study revealed that the sample size of the available studies and the duration of the intervention programme were small and short. Small sample size with a short period of intervention affects the efficacy of the intervention as well as the generalizability of the findings. Thus, further studies should consider recruiting a substantial sample size as well as allocating a sufficient period for executing the programme.

Also, the majority of the available empirical literature was conducted in Asia, where Indonesian and Indian music were used in the management of DM2 conditions. Hence, further studies should consider validating the potential impact of music intervention in other regions including sub-Saharan Africa, where there is a prevalence of different categories of diabetes.

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## CONCLUSION

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This study has demonstrated the potential impact of music intervention in the management of diabetic conditions using available empirical evidence. The evidence from music literature affirmed that music intervention is impactful in the management of diabetic conditions through enhancement of individuals with diabetes' compliance with exercise, autonomous balance and lower limb blood circulation among patients, as well as facilitation of reduction in blood sugar, heart rate, glucose level, and stress level. The potential impact of music intervention on diabetics is still a work in progress, and the available findings so far suggest the viability of conducting further research in this area.

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## FOOTNOTES

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**Author contributions:** Eseadi C and Amedu AN conceived the study; Eseadi C and Amedu AN designed the study, conducted the literature review and were all responsible for the analysis, drafting, editing, and approval of the final version of this manuscript.

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