Research Article

Effect Of Structured Physiotherapy-Based Exercise On Menopause-Specific Quality Of Life In Postmenopausal Women With Type 2 Diabetes: A Prospective Interventional Study

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Abstract

Background: Postmenopausal women diagnosed with Type 2 Diabetes Mellitus (T2DM) often encounter metabolic disturbances and menopausal symptoms that considerably impact their quality of life. Structured physiotherapy-based exercise programs have the potential to enhance metabolic parameters and improve quality of life specific to menopause. Objective: To assess the impact of a structured physiotherapy-based exercise program on menopause-specific quality of life and biochemical parameters in postmenopausal women with type 2 diabetes mellitus. Methods: A prospective interventional study was carried out involving 62 postmenopausal women diagnosed with T2DM. Participants engaged in a 12-week organised physiotherapy exercise regimen that included aerobic exercises, resistance training, flexibility training, and breathing exercises. The MENQOL questionnaire was utilised to evaluate menopause-specific quality of life. Demographic, clinical, and biochemical parameters were documented prior to and following the intervention. Statistical analysis was conducted utilising a paired t-test, with significance established at $p < 0.05$. Results: The average age of participants was 56.8 ± 5.4 years, with an average duration of diabetes of 7.3 ± 3.2 years. Following a 12-week exercise intervention, a notable enhancement in MENQOL scores was recorded ($p < 0.001$). Notable decreases were observed in fasting blood glucose, HbA1c, and BMI. Conclusion: In conclusion, a structured physiotherapy-based exercise program has shown significant improvements in menopause-specific quality of life and glycaemic control among postmenopausal women diagnosed with T2DM. Exercise-based interventions can be an effective non-pharmacological approach to enhancing metabolic and menopausal health.

Keywords: Menopause, Physiotherapy exercise, Quality of life, Type 2 diabetes, MENQOL, Postmenopausal Women.

1. Introduction

Menopause is a physiological transition marked by the cessation of ovarian function and a decline in estrogen levels, resulting in vasomotor symptoms, psychological disturbances, and metabolic changes. The alterations have a considerable impact on the quality of life for women, especially those experiencing chronic metabolic disorders like Type 2 Diabetes Mellitus (T2DM). [1]

Women with T2DM experience a heightened risk of cardiovascular disease, obesity, and insulin resistance during the postmenopausal phase, attributed to hormonal changes and the ageing process. Menopause-specific symptoms, including hot flashes, sleep disturbances, mood fluctuations, and reduced physical capacity, may further deteriorate health status.

Physical exercise is recognised as a valuable non-pharmacological approach to optimising metabolic control and promoting both physical and psychological well-being. Well-organised physiotherapy exercise programs that integrate aerobic training, resistance training, flexibility training, and relaxation techniques have demonstrated effectiveness in improving insulin sensitivity, reducing body mass index, and enhancing functional capacity. [2,3]

The Menopause-Specific Quality of Life (MENQOL) questionnaire is a recognised tool for evaluating menopausal symptoms in four key areas: vasomotor, psychosocial, physical, and sexual. Nonetheless, there is a scarcity of studies

assessing the impact of physiotherapy-based exercise interventions on MENQOL outcomes in postmenopausal women diagnosed with T2DM. [4,5]

The current study sought to assess the effects of a structured physiotherapy-based exercise program on menopause-specific quality of life and biochemical parameters in postmenopausal women diagnosed with Type 2 diabetes.[6]

2. Materials and Methods

This study was structured as a prospective interventional investigation involving 62 postmenopausal women diagnosed with Type 2 Diabetes Mellitus, who visited the outpatient department of a tertiary care hospital. Women between the ages of 45 and 65 who had reached menopause, received a diagnosis of Type 2 diabetes mellitus, were physically capable of engaging in an exercise program, and were prepared to give informed consent were included in the study. Individuals with severe cardiovascular disease, musculoskeletal disorders that restrict exercise, those undergoing hormone replacement therapy, or those experiencing severe diabetic complications were not included in the study. All eligible participants engaged in a structured physiotherapy-based exercise intervention over a period of 12 weeks.
The exercise program comprised various components, including aerobic activities like brisk walking and cycling, resistance training with elastic bands and light weights, flexibility exercises that incorporated stretching techniques, as well as breathing and relaxation practices. Each exercise session was conducted for approximately 45 minutes and took place five days a week under supervision.

Baseline and post-intervention assessments encompassed demographic parameters, including age, duration of menopause, duration of diabetes, and body mass index (BMI). Biochemical parameters such as fasting blood glucose (FBG), glycated haemoglobin (HbA1c), and total cholesterol levels were documented.

Furthermore, the quality of life specific to menopause was assessed utilising the validated Menopause-Specific Quality of Life (MENQOL) questionnaire. This tool evaluates symptoms across four domains: vasomotor, psychosocial, physical, and sexual, facilitating a thorough assessment of the effects of the physiotherapy-based exercise program on the quality of life of postmenopausal women with Type 2 diabetes.[7,8]

The data were examined using descriptive and inferential statistics. Participants' demographic and clinical features were summarised using descriptive statistics, and continuous variables were reported as mean and SD. The paired t-test was used to compare pre- and post-intervention values to assess the structured physiotherapy-based exercise intervention. This test determined if biochemical markers and menopause-specific quality of life scores changed statistically before and after the exercise regimen. Statistically significant differences between baseline and post-intervention assessments were indicated by p-values below 0.05.

3. Results

Table 1: Basic Demographic Characteristics (n = 62)

Parameter	Mean ± SD
Age (years)	56.8 ± 5.4
BMI (kg/m²)	28.2 ± 3.1
Duration of menopause (years)	6.4 ± 2.7
Duration of diabetes (years)	7.3 ± 3.2

The study participants had a mean age of 56.8 ± 5.4 years, indicating that the majority were the late middle-aged group typical of postmenopausal women. The mean BMI was 28.2 ± 3.1 kg/m², falling within the overweight range according to the WHO classification. This indicates that a significant fraction of participants had gained body weight, a known risk factor for metabolic diseases.

The average duration of menopause among participants was 6.4 ± 2.7 years, showing that most women had been postmenopausal for years. Hormonal alterations during this stage may impact metabolic health and insulin sensitivity. The average duration of diabetes was 7.3 ± 3.2 years, indicating that most patients had Type 2 Diabetes Mellitus for a significant period. Effective disease management is crucial in this population since longer-term diabetes may cause chronic metabolic problems.

This baseline data characterises the study population and provides a clinical context for assessing intervention results.

Table 2: Biochemical Parameters Before and After Exercise Intervention

Parameter	Pre-Intervention Mean ± SD	Post-Intervention Mean ± SD	p-value
Fasting Blood Glucose (mg/dL)	152.4 ± 22.5	134.2 ± 18.7	<0.001
HbA1c (%)	7.9 ± 0.9	7.1 ± 0.7	<0.001
Total Cholesterol (mg/dL)	208.6 ± 24.3	192.5 ± 21.8	0.002

The intervention significantly improved glycemic and lipid markers. The intervention significantly reduced fasting blood glucose levels from 152.4 ± 22.5 mg/dL to 134.2 ± 18.7 mg/dL ($p < 0.001$). Similarly, the mean HbA1c levels declined from 7.9 ± 0.9% to 7.1 ± 0.7% ($p < 0.001$), suggesting improved long-term glycemic control in participants with Type 2 Diabetes Mellitus. Additionally, total cholesterol levels dramatically dropped from 208.6 ± 24.3 mg/dL to 192.5 ± 21.8 mg/dL ($p = 0.002$), improving lipid profile. The intervention significantly improved glycemic status and cholesterol levels in trial participants.

Table 3: MENQOL Scores Before and After Intervention

Domain	Pre-Intervention Mean ± SD	Post-Intervention Mean ± SD	p-value
Vasomotor	4.5 ± 1.2	3.1 ± 1.0	<0.001
Psychosocial	4.1 ± 1.3	3.0 ± 1.1	<0.001
Physical	4.7 ± 1.4	3.4 ± 1.2	<0.001
Sexual	3.9 ± 1.1	3.2 ± 1.0	0.01
Total MENQOL score	**4.3 ± 1.0**	**3.2 ± 0.9**	**<0.001**

Exercise improved Menopause-Specific Quality of Life (MENQOL) ratings significantly. The intervention reduced Menopause symptoms like hot flashes and night sweats, with a decrease in vasomotor domain score from 4.5 ± 1.2 to 3.1 ± 1.0 ($p < 0.001$). The psychosocial domain score considerably improved, decreasing from 4.1 ± 1.3 to 3.0 ± 1.1 ($p < 0.001$), indicating enhanced emotional and psychological well-being.

The physical domain score fell from 4.7 ± 1.4 to 3.4 ± 1.2 ($p < 0.001$), indicating less discomfort and improved daily functioning. The sexual domain score improved moderately, dropping from 3.9 ± 1.1 to 3.2 ± 1.0 ($p = 0.01$). Menopause-related quality of life improved considerably after the intervention, with a decrease in total MENQOL score from 4.3 ± 1.0 to 3.2 ± 0.9 ($p < 0.001$).

4. Discussion

This study assessed the effects of a structured physiotherapy-based exercise program on menopause-specific quality of life in postmenopausal women diagnosed with Type 2 Diabetes Mellitus. The results revealed a notable

enhancement in overall MENQOL scores following the 12-week intervention, suggesting that regular supervised exercise can effectively alleviate menopause-related symptoms and enhance overall well-being in this demographic.
The enhancement noted in vasomotor symptoms, including hot flashes and night sweats, aligns with previous research examining exercise interventions in women experiencing menopause. Prior studies indicate that regular aerobic exercise could enhance thermoregulatory control and autonomic balance, potentially leading to a decrease in vasomotor instability. Daley et al. reported that moderate-intensity physical activity significantly reduced the severity and frequency of menopausal symptoms while enhancing overall health perception among postmenopausal women.[9] Elavsky and McAuley similarly demonstrated that structured physical activity programs enhance quality of life and alleviate menopausal symptoms by fostering improved psychological well-being and physiological adaptation.[10,11]
The psychosocial enhancements noted in this study may be linked to the neuroendocrine impacts of exercise. Engaging in physical activity promotes the release of endorphins, serotonin, and dopamine, which are recognised for their ability to improve mood and alleviate anxiety and depressive symptoms frequently encountered during menopause. Engaging in exercise enhances sleep quality and mitigates stress-related hyperarousal, thereby fostering greater emotional stability. Elavsky et al. reported comparable findings, noting significant enhancements in mental health and life satisfaction among menopausal women engaged in regular exercise programs.[10]The current study revealed notable enhancements in the physical domain scores of the MENQOL questionnaire, alongside psychosocial benefits. Consistent engagement in physiotherapy-oriented exercise programs enhances muscle strength, flexibility, joint mobility, and overall functional capacity. The advantages are especially significant for postmenopausal women, who frequently encounter musculoskeletal discomfort, fatigue, and diminished physical performance as a result of hormonal changes and ageing. Prior research indicates that integrating aerobic and resistance training programs can markedly enhance functional capacity and physical health in postmenopausal women.

The current study revealed a noteworthy decrease in fasting blood glucose and HbA1c levels as a result of the exercise intervention. The findings corroborate the established evidence that physical activity is a crucial element in the management of diabetes. Consistent physical activity improves insulin sensitivity, boosts glucose uptake in skeletal muscle, and enhances mitochondrial function, leading to better glycemic control in individuals with Type 2 Diabetes Mellitus. A comprehensive meta-analysis conducted by Umpierre et al. indicated that structured exercise training leads to a significant reduction in HbA1c levels among patients with type 2 diabetes, underscoring the critical role of regular physical activity in metabolic regulation.[12]

The noted decrease in total cholesterol levels further reinforces the cardiometabolic advantages of exercise. Postmenopausal women face a heightened risk of cardiovascular disease as a result of decreasing estrogen levels, which negatively influence lipid metabolism and vascular function. Engaging in exercise positively influences lipid profiles by elevating high-density lipoprotein (HDL) cholesterol, decreasing low-density lipoprotein (LDL) cholesterol, and improving endothelial function. Asikainen et al. indicated that regular aerobic exercise notably enhances lipid profiles and cardiovascular fitness in postmenopausal women, consequently lowering long-term cardiovascular risk.[13]

The findings of this study indicate that structured physiotherapy programs may play a significant role in enhancing body composition and facilitating effective weight management through the observed reduction in BMI. Obesity and central adiposity are prevalent in postmenopausal women and are closely linked to insulin resistance and cardiovascular disease. Engaging in exercise contributes to a decrease in visceral fat accumulation and enhances metabolic efficiency, which may partially account for the observed improvements in metabolic and quality-of-life outcomes in the current study.[14]

The findings of this study align with existing literature, indicating that exercise interventions serve as effective non-pharmacological strategies for enhancing menopausal symptoms, metabolic health, and overall quality of life. The incorporation of aerobic, resistance, flexibility, and breathing exercises within a well-structured physiotherapy program offers a holistic strategy that effectively targets both the physical and psychological dimensions of menopausal health. Such programs may thus contribute significantly to the long-term management of postmenopausal women with diabetes.[15]

5. Conclusion

Structured physiotherapy-based exercise significantly improved menopause-specific quality of life and metabolic parameters among postmenopausal women with Type 2 diabetes. Incorporating supervised exercise programs into routine management may enhance both physical and psychological well-being in this population.

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