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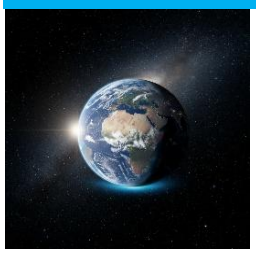

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Nordic Walking and Functional Outcomes in Individuals with Type 2 Diabetes

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Abstract

Introduction and aim:

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder characterized by impaired glucose regulation and insulin resistance. Physical activity plays a key role in its management. Nordic walking, involving the use of poles, may enhance exercise intensity and therapeutic effects. The aim of this study was to evaluate its impact on functional and metabolic outcomes in individuals with T2DM.

Material and methods:

This qualitative literature review is based on randomized controlled trials, systematic reviews, and meta-analyses. The analysis included studies involving adults with T2DM performing Nordic walking or structured walking interventions. Outcomes included HbA1c, VO_2max, body weight, BMI, muscle strength, and quality of life.

Results:

Nordic walking is associated with improved glycemic control, reduced HbA1c, body weight, and BMI, as well as enhanced insulin sensitivity. It also contributes to increased aerobic capacity, physical fitness, and functional performance. Additional benefits include improved body composition and quality of life. In some studies, Nordic walking demonstrated greater effectiveness than regular walking.

Conclusions:

Nordic walking is a safe and effective form of physical activity for individuals with T2DM. It supports improvements in metabolic and functional outcomes and can be recommended as part of comprehensive non-pharmacological management.

Key words: Nordic walking; type 2 diabetes mellitus; physical activity; aerobic training; walking-based interventions; HbA1c; glycemic control; insulin sensitivity; insulin resistance; oxidative stress; body weight; BMI; body composition; aerobic capacity (VO_2max); exercise tolerance; muscle strength; functional fitness; quality of life (QoL); metabolic health; rehabilitation; prevention of diabetes complications.

Contents:

1. Introduction

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disease characterized by impaired glucose regulation, mainly resulting from insulin resistance and the progressive dysfunction of pancreatic β-cells. Scientific literature consistently emphasizes that effective management of T2DM requires a comprehensive approach that includes both pharmacological treatment and non-pharmacological strategies, with regular physical activity playing a central role [11,16,20].

A growing body of evidence shows that physical activity, especially moderate-intensity aerobic exercise can significantly improve glycemic control, reduce glycated hemoglobin (HbA1c) levels, enhance insulin sensitivity, and promote beneficial changes in body composition [9,12,13,15]. Walking-based interventions are among the most commonly recommended forms of exercise due to their safety, accessibility, and high adherence among individuals with T2DM [7,8]. Studies have demonstrated that regular walking programs can lead to meaningful improvements in metabolic parameters as well as overall health status [7].

Nordic walking is an enhanced form of traditional walking that incorporates the use of specially designed poles. This technique increases the involvement of upper body and trunk muscles, making the exercise more engaging and effective. Compared to regular walking, Nordic walking leads to higher energy expenditure and greater exercise intensity, while still maintaining relatively low stress on the musculoskeletal system [3,4,6]. This makes it particularly suitable for individuals with chronic conditions, including type 2 diabetes.

Randomized controlled trials have shown that Nordic walking can produce significant improvements in glycemic control, physical fitness, and anthropometric parameters in individuals with T2DM [1,2,6]. Reported benefits include increased aerobic capacity (VO_2max), reduced body weight, and improved exercise tolerance [2,4]. Additionally, this form of activity has been associated with reductions in insulin resistance and oxidative stress, both of which play important roles in the development and progression of type 2 diabetes [18,19].

Another important aspect is the impact of Nordic walking on everyday functioning. Studies focusing on quality of life (QoL) indicate that regular physical activity, including Nordic walking, improves both physical and psychological aspects of health [5,7]. Improvements in physical fitness and endurance translate into greater functional independence and enhanced well-being.

In recent years, interest in Nordic walking as a supportive therapeutic strategy for T2DM has increased, as reflected in numerous clinical trials, systematic reviews, and meta-analyses [3,7,8]. These studies suggest that this form of exercise may be effective in improving both metabolic and functional outcomes.

Given these findings, it is justified to review the current scientific literature to evaluate the impact of Nordic walking on functional outcomes in individuals with type 2 diabetes.

2. Materials and methods

This study is a literature review based exclusively on the selected scientific publications provided, including randomized controlled trials (RCTs), systematic reviews, meta-analyses, and review articles focusing on the effects of Nordic walking and walking-based interventions in individuals with type 2 diabetes [3,7,8].

The analysis included clinical studies, among them the well-known randomized controlled trial by Gram et al. [1], which evaluated the effects of a Nordic walking program compared with other forms of physical activity in patients with T2DM. Additional RCTs examining outcomes such as aerobic capacity (VO_2max), glycemic control, and overall physical fitness were also considered [2].

Furthermore, findings from meta-analyses and systematic reviews were incorporated to assess the broader impact of Nordic walking and walking interventions on HbA1c levels, physical performance, body weight, and metabolic health. The review also included studies exploring the effects of this type of activity on insulin resistance and oxidative stress [7,8,13].

The inclusion criteria were:

- studies conducted in adults with type 2 diabetes [1,2,5],
- interventions involving Nordic walking or structured walking programs [1,2,7,8],
- assessment of at least one of the following outcomes: HbA1c, VO_2max, body weight/BMI, muscle strength, quality of life (QoL), or metabolic parameters [2,4,7,9,13],
- publications in the form of experimental studies or evidence syntheses (systematic reviews and meta-analyses) [3,7,8,13].

Studies evaluating quality of life and physical functioning were also included, particularly those assessing the impact of exercise interventions on both physical and psychological aspects of health [5,7].

The analysis was qualitative in nature and involved comparing the results of individual studies and identifying consistent patterns regarding the effects of Nordic walking in individuals with type 2 diabetes [1,3]. Special attention was given to the consistency of findings between randomized controlled trials and meta-analyses [7,8,13].

The review also included studies comparing Nordic walking with other forms of physical activity, allowing for an assessment of its relative effectiveness [3,4,6].

Due to the nature of this review, no original statistical analyses were conducted, and all conclusions are based solely on the findings reported in the analyzed publications [3,7].

3. Research results

3.1. Effects of Nordic Walking on Glycemic Control and Metabolic Parameters

A large number of studies included in this review show that Nordic walking has a significant positive impact on glycemic control in individuals with type 2 diabetes. Randomized controlled trials and meta-analyses consistently report a meaningful reduction in glycated hemoglobin (HbA1c) following Nordic walking training programs.

Clinical studies have also observed:

- reductions in body weight and BMI [14,17],
- improvements in metabolic profile,
- increased insulin sensitivity [18,19].

Research examining the broader effects of physical activity on metabolism indicates that regular walking, especially Nordic walking, helps improve glucose regulation and overall metabolic health. Findings from meta-analyses confirm that Nordic walking interventions are effective in lowering HbA1c and improving other key metabolic indicators [7,8,9,13].

Additionally, studies exploring physiological mechanisms suggest that Nordic walking may reduce insulin resistance and decrease oxidative stress, both of which play an important role in the development and progression of type 2 diabetes.

3.2. Aerobic Capacity and Physical Fitness

An important focus of the analyzed studies was the impact of Nordic walking on physical fitness. Randomized controlled trials have shown that regular Nordic walking training leads to significant improvements in aerobic capacity, reflected by increased VO_2max [2,4].

Comparative studies indicate that Nordic walking:

- increases energy expenditure more than regular walking [3,6],
- leads to greater improvements in physical fitness [4],
- enhances exercise tolerance.

Additional benefits include:

- increased muscle strength,
- improved flexibility [4],
- enhanced overall functional fitness.

The involvement of upper body muscles during Nordic walking appears to boost training efficiency, which may explain the greater functional benefits compared to traditional walking.

3.3. Body Weight and Body Composition

Many studies included in this review demonstrate that Nordic walking contributes to reductions in body weight and BMI in individuals with type 2 diabetes. These effects have been observed consistently in both randomized controlled trials and meta-analyses.

Regular Nordic walking has been associated with:

- weight loss [14,17],
- improved body composition [4],
- reduced fat mass [22].

These changes are clinically important, as excess body weight and obesity are major risk factors for the development and progression of T2DM.

3.4. Quality of Life (QoL) and Patient Functioning

Research on quality of life shows that Nordic walking and other walking-based interventions significantly improve QoL in individuals with type 2 diabetes.

The analyzed studies report improvements in:

- physical functioning [5],
- psychological well-being [7],
- overall quality of life [5].

Particularly strong effects have been observed in long-term programs, where improved physical fitness translates into greater independence and better performance in everyday activities.

3.5. Nordic Walking Compared to Other Forms of Physical Activity

Comparative studies suggest that Nordic walking is at least as effective as, and in some cases more effective than, other forms of aerobic exercise used in individuals with type 2 diabetes.

In particular, Nordic walking:

- engages a larger number of muscle groups [4],
- increases exercise intensity while remaining safe [3],
- results in higher energy expenditure [6].

Compared to traditional walking, Nordic walking provides greater physiological benefits, making it a particularly valuable form of physical activity for people with T2DM.

3.6. Evidence from Systematic Reviews and Meta-Analyses

Systematic reviews and meta-analyses included in this work confirm the effectiveness of Nordic walking as a therapeutic intervention in individuals with type 2 diabetes.

These studies show that Nordic walking:

- significantly reduces HbA1c levels [7,13],
- improves aerobic capacity (VO_2max),
- reduces body weight,
- enhances metabolic parameters [8],
- contributes to overall health improvement [3].

The consistency of findings across different types of studies, including RCTs and meta-analyses, strengthens the reliability of these results.

3.7. Clinical Significance

The collected evidence indicates that Nordic walking is an effective supportive intervention in the management of type 2 diabetes. Its benefits extend beyond metabolic improvements to include enhanced physical functioning and quality of life [3,11].

Due to its accessibility, safety, and high effectiveness, Nordic walking can be recommended as part of a comprehensive therapeutic approach for individuals with type 2 diabetes.

4. Discussion

The findings of this review indicate that Nordic walking is an effective intervention for improving glycemic control, physical fitness, and quality of life in individuals with type 2 diabetes. The observed reductions in HbA1c and improvements in VO_2max suggest that this form of exercise may play a significant role in diabetes management [1,2,7,13].

These results are consistent with previous research on aerobic exercise in T2DM, which highlights the importance of regular physical activity in improving metabolic outcomes

[9,10,12]. However, some studies suggest that the benefits of Nordic walking may not be substantially greater than those of traditional walking, indicating that exercise intensity and adherence may be more important than the specific modality [3,7].

The mechanisms underlying these effects may include increased muscle activation, higher energy expenditure, and improved insulin sensitivity. The involvement of upper body muscles during Nordic walking may contribute to enhanced glucose uptake and metabolic regulation [3,4,18,19].

Despite the positive findings, several limitations should be considered. Many studies included small sample sizes and short intervention periods, which may limit the generalizability of the results. Additionally, there is considerable variability in training protocols, making it difficult to determine optimal exercise parameters [3,7,8].

From a clinical perspective, Nordic walking appears to be a safe, accessible, and effective form of exercise, particularly for older adults and individuals with limited mobility. Its low joint load and relatively high adherence potential make it a valuable component of lifestyle interventions in T2DM [5,11].

Future research should focus on long-term randomized controlled trials with standardized protocols to better assess the sustained effects of Nordic walking and to compare its effectiveness with other forms of exercise. Further studies exploring the impact on insulin resistance and oxidative stress are also warranted [7,8,18].

5. Summary

Based on the analyzed randomized controlled trials, systematic reviews, and meta-analyses, Nordic walking can be considered an effective form of physical activity for individuals with type 2 diabetes, with beneficial effects on both metabolic and functional outcomes [1,2,4,7].

In terms of glycemic control, regular Nordic walking training has been shown to significantly reduce HbA1c levels. This effect has been consistently confirmed in both randomized trials and meta-analyses. At the same time, improvements in insulin sensitivity and reductions in insulin resistance have been observed [18,19]. Some studies also suggest a decrease in oxidative stress, which may play a role in slowing disease progression.

Another important outcome of Nordic walking interventions is the reduction in body weight and BMI, which has direct clinical relevance in the management of type 2 diabetes. These results were consistent across different types of studies, regardless of the duration of the intervention.

Regarding physical fitness, Nordic walking has been shown to significantly improve parameters such as VO_2max and exercise tolerance. Randomized studies suggest that these improvements may be greater than those achieved through traditional walking, likely due to increased muscle engagement and higher energy expenditure.

Additional benefits include improvements in muscle strength, flexibility, and overall functional fitness. These changes translate into better daily functioning and greater independence for patients.

In terms of quality of life, research indicates that Nordic walking positively affects both physical and psychological aspects of health. Improvements in physical fitness and metabolic control are associated with better well-being and overall quality of life.

Comparisons with other forms of physical activity suggest that Nordic walking is at least as effective—and in some aspects more effective—than traditional aerobic exercise. At the same time, it remains a safe and well-tolerated form of activity for individuals with type 2 diabetes.

Findings from systematic reviews and meta-analyses are consistent and clearly demonstrate the positive impact of Nordic walking on key health indicators, including HbA1c, VO_2max, body weight, and metabolic parameters.

In conclusion, Nordic walking can be considered a valuable component of non-pharmacological therapy for type 2 diabetes. Available scientific evidence indicates that regular participation in this form of activity leads to comprehensive improvements in patients' health, including metabolic control, physical function, and quality of life [11,16].

Disclosure

Author Contributions

Conceptualization: [SSz], [PW]

Methodology: [JM], [KRT], [NM]

Check: [SFS], [PK], [PAK]

Investigation: [MMi], [PW], [JM]

Data curation: [SFS], [SSz], [MMa], [KRT]

Writing - rough preparation: [PK], [MMi], [NM]

Writing - review and editing: [PAK], [JM]

Visualization: [JM], [MMi], [MMa]

Project administration: [SSz], [PW], [KRT]

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Conflict Of Interest

The authors declare no conflict of interest.

All authors have read and agreed with the published version of the manuscript.

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