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Impact of Exercise on Type 2 Diabetes Mellitus: A Comprehensive Review

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ABSTRACT

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder characterized by insulin resistance and hyperglycemia, often accompanied by obesity and cardiovascular complications. Lifestyle interventions, particularly exercise, have proven to be effective in managing T2DM by improving glycemic control, enhancing insulin sensitivity, and reducing cardiovascular risk factors. This review examines the impact of different types of exercise—such as aerobic, resistance, and high-intensity interval training (HIIT)—on glycemic control and metabolic health in individuals with T2DM. The review also explores the mechanisms underlying these benefits and discusses challenges in adherence and future directions for integrating exercise into diabetes care.

1. Introduction

T2DM has become a global health challenge, with rising prevalence due to sedentary lifestyles and increasing obesity rates. Exercise is a cornerstone of T2DM management, recommended alongside dietary and pharmacological interventions. Physical activity improves insulin sensitivity, lowers blood glucose levels, and reduces the risk of diabetes-related complications, making it an essential tool for diabetes care(1).

2. Mechanisms of Exercise in Managing T2DM

2.1. Improved Insulin Sensitivity

Exercise enhances glucose uptake in skeletal muscles by increasing GLUT4 (glucose transporter type 4) expression and its translocation to the cell membrane, independent of insulin action (1,2). This mechanism is crucial for individuals with insulin resistance.

2.2. Enhanced Glycemic Control

Physical activity reduces blood glucose levels acutely by increasing energy expenditure and chronically by improving HbA1c levels, a marker of long-term glycemic control(3).

2.3. Weight Management

Exercise helps in reducing visceral fat, which is closely linked to insulin resistance and T2DM progression. The reduction in adiposity leads to decreased inflammation and improved metabolic health (4).

2.4. Reduction of Cardiovascular Risk

Exercise lowers blood pressure, improves lipid profiles, and reduces inflammation, mitigating cardiovascular complications associated with T2DM (5).

3. Types of Exercise and Their Effects on T2DM

3.1. Aerobic Exercise

Aerobic exercises, such as walking, cycling, and swimming, are effective in improving cardiorespiratory fitness and glycemic control. A systematic review showed that aerobic exercise reduces HbA1c levels by 0.6–0.8% in individuals with T2DM(6).

3.2. Resistance Training

Resistance training increases muscle mass, enhancing glucose disposal capacity. Studies have demonstrated that resistance training improves insulin sensitivity and glycemic control, even in the absence of weight loss.

3.3. High-Intensity Interval Training (HIIT)

HIIT involves short bursts of intense exercise alternated with recovery periods. It has been shown to improve insulin sensitivity and reduce blood glucose levels in less time than traditional aerobic exercise (7).

4. Exercise in Special Populations with T2DM

4.1. Older Adults

In older adults, exercise is beneficial for improving mobility and reducing the risk of diabetes-related complications, such as cardiovascular events and neuropathy. Resistance training is particularly effective in preserving muscle mass and strength.

4.2. Individuals with Obesity

Exercise helps reduce visceral and subcutaneous fat, improving metabolic health and insulin sensitivity. Combining aerobic and resistance training yields the best outcomes in obese individuals with T2DM (8)

4.3. Pregnant Women with T2DM

Exercise is recommended for managing gestational diabetes or pre-existing T2DM during pregnancy. Light to moderate aerobic activity can improve glycemic control without adverse effects on maternal or fetal health .

5. Challenges in Exercise Adherence

Despite its benefits, adherence to exercise programs remains a challenge due to:

- Lack of time and motivation.
- Physical limitations or comorbidities.
- Limited access to structured exercise programs.

Strategies to improve adherence include personalized exercise plans, incorporating wearable fitness devices, and providing social or professional support.

6. Future Directions

Future research should focus on:

- Exploring the effects of different exercise modalities on molecular pathways in T2DM.
- Developing personalized exercise programs based on genetic and metabolic profiles.
- Integrating technology, such as mobile health apps and virtual trainers, to improve adherence.

7. Conclusion

Exercise is a cornerstone of T2DM management, offering multifaceted benefits in glycemic control, insulin sensitivity, weight management, and cardiovascular health. The integration of regular physical activity into diabetes care plans can significantly improve quality of life and reduce disease complications. Encouraging adherence through innovative approaches and personalized interventions will be critical in maximizing these benefits.

References

1.Kitabchi AE, Umpierrez GE, Murphy MB, Kreisberg RA. Hyperglycemic crises in adult patients with diabetes: A consensus statement from the American Diabetes Association. In: Diabetes Care. 2006.

2.Dantas WS, Roschel H, Murai IH, Gil S, Davuluri G, Axelrod CL, et al. Exercise-induced increases in insulin sensitivity after bariatric surgery are mediated by muscle extracellular matrix remodeling. Diabetes. 2020;69(8).

3.Amanat S, Ghahri S, Dianatinasab A, Fararouei M, Dianatinasab M. Exercise and Type 2 Diabetes. In: Advances in Experimental Medicine and Biology. 2020.

4.Deldin AR, Lee SJ. Role of physical activity in the treatment of nonalcoholic fatty liver disease in children and adolescents. Vol. 38, Applied Physiology, Nutrition and Metabolism. 2013.

5.BK, Saltin B. Exercise as medicine - Evidence for prescribing exercise as therapy in 26 different chronic diseases. Scand J Med Sci Sports. 2015;25.

6.Umpierre D, Ribeiro PAB, Kramer CK, Leitão CB, Zucatti ATN, Azevedo MJ, et al. Physical activity advice only or structured exercise training and association with HbA1c levels in type 2 diabetes: A systematic review and meta-analysis. Vol. 305, JAMA. 2011.

7.Gillen JB, Gibala MJ. Is high-intensity interval training a time-efficient exercise strategy to improve health and fitness? Applied Physiology, Nutrition and Metabolism. 2014;39(3).

8.Dunstan DW, Kingwell BA, Larsen R, Healy GN, Cerin E, Hamilton MT, et al. Breaking up prolonged sitting reduces postprandial glucose and insulin responses. Diabetes Care. 2012;35(5).