Insulin Resistance and HbA$_{1c}$ Benefits for Adolescents and Adults Aged 18-70 with Type 1 Diabetes after Completing HIIT Programs
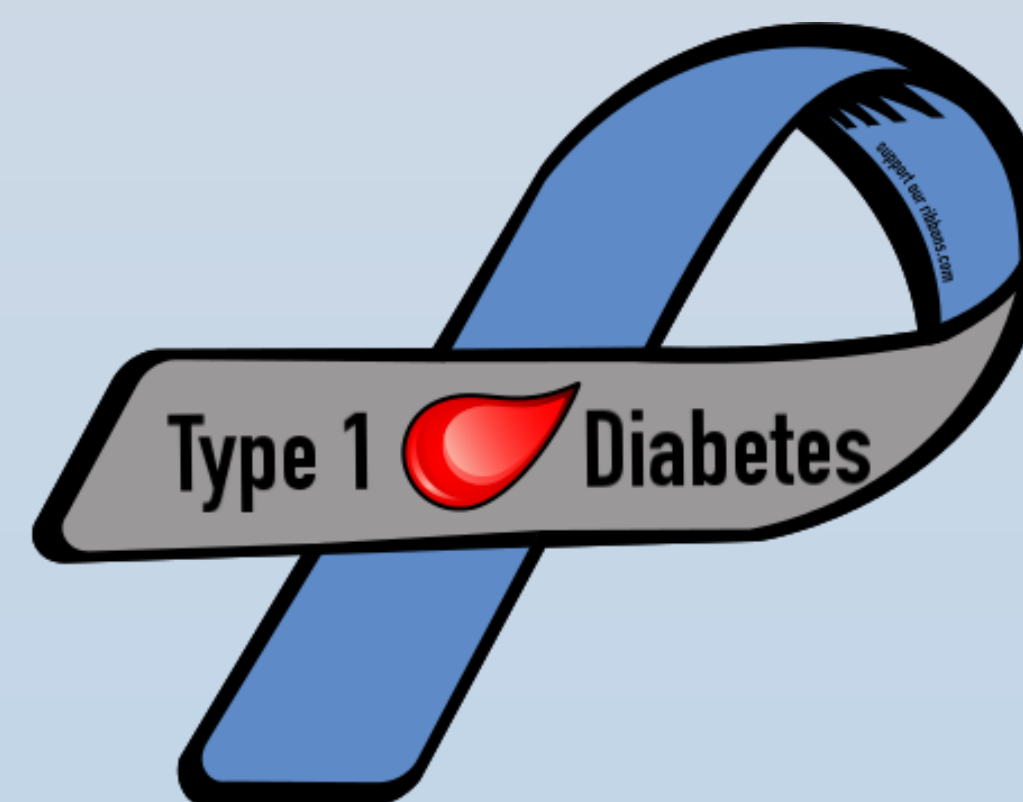
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ABSTRACT

- T1D is considered an autoimmune disease in which the pancreas is unable to produce insulin to balance blood glucose levels.

- Research has shown that type 1 diabetes is also the result of an autoimmune reaction that induces the destruction to the pancreatic beta-cells in the pancreas, which produce insulin (Rodbard, 2017).

- HIIT is a style of exercise that has gained popularity throughout the 2010s (Ito, 2019).

- HIIT involves a series of anaerobic exercises at high intensity levels ($\geq$80% of VO$_2$ peak) (Lee, A., Johnson, N., McGill, M., & Overland, J., 2020).

INTRODUCTION AND OBJECTIVES

- In 2021, the CDC reported that there are approximately 1.24 million individuals with type 1 diabetes (T1D) (Dimeglio, Evans-Molina, Oram, 2018).

- High intensity interval training (HIIT) workouts are a form of exercise that requires individuals to perform exercises with high amounts of effort for short bursts and are then followed by brief recovery periods (Lee, et. al, 2020).

- HIIT workouts have varying effects on those with T1D including, lowering HbA$_{1c}$, improving a person's resistance to insulin, and increasing quality of life (Alarcón-Gómez, Chulvi-Medrano, Martin-Rivera, & Calatayud, 2021).

- HIIT also prevents the occurrence of hypoglycemia which is one of the main barriers for the T1D population in completing physical activity along with the amount of time required to do the exercise (Dimeglio, et. al, 2018). The exercise intervention should have a positive impact on the individuals with T1D, specifically a decrease in HbA$_{1c}$ and a decrease in insulin resistance.

OPERATIONAL DEFINITIONS

Continuous glucose monitor (CGM): continuous glucose monitors are a form of diabetic equipment which enables a person to visualize patterns of glucose throughout the day and check blood sugar at any given point in time (Rodbard, 2017).

Hemoglobin A$_{1c}$ (HbA$_{1c}$): HbA$_{1c}$ or hemoglobin A1C is a diagnostic test used to evaluate a person's blood glucose levels over the past two to three months (Gilstrap, et. al, 2019).

High intensity interval training (HIIT) exercise: The term high intensity interval training (HIIT), refers to a style of exercise that focuses on high-intensity exercise with aerobic intervals (Ito, 2019).

Type 1 Diabetes (T1D): Type 1 diabetes mellitus is a condition which is caused by an autoimmune response against pancreatic ß cells. This chronic condition causes the pancreas to produce little or no insulin (DiMeglio, et. al, 2018).

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REFERENCES

Chetty, T., Shetty, V., Fournier, P. A., Adolfsson, P., Jones, T. W., & Davis, E. A. (2019). Exercise management for young people with type 1 diabetes: A Structured Approach to the exercise consultation. *Frontiers in Endocrinology*, 10(10), 326. doi: 10.3389/fendo.2019.00326

Ito, S. (2019). High-intensity interval training for health benefits and care of cardiac diseases - the key to an efficient exercise protocol. *World Journal of Cardiology*, 11(7), 171–188. doi: 10.4330/wjc.v11.i7.171

Lee, A. S., Johnson, N. A., McGill, M. J., Overland, J., Luo, C., Baker, C. J., Martinez-Huenchullan, S., Wong, J., Flack, J. R., & Twigg, S. M. (2020). Effect of high-intensity interval training on glycemic control in adults with type 1 diabetes and overweight or obesity: A randomized controlled trial with partial crossover. *Diabetes Care*, 43(9), 2281–2288. doi: 10.2337/dc20-0342

Mobasseri, M., Shirmohammadi, M., Amiri, T., Vahed, N., Hosseini Fard, H., & Ghojazadeh, M. (2020). Prevalence and incidence of type 1 diabetes in the world: A systematic review and meta-analysis. *Health Promotion Perspectives*, 10(2), 98–115. doi: 10.34172/hpp.2020.18

Stanojevic, V., & Habener, J. F. (2015). Evolving function and potential of pancreatic alpha cells. *Best Practice & Research Clinical Endocrinology & Metabolism*, 29(6), 859–871. doi: 10.1016/j.beem.2015.10.002

METHODS

Participants:
- 150 total
- 75 males
- 75 females

Criteria:
- Must have been diagnosed with T1D for at least five years.
- Own and be comfortable with using a CGM.
- Be within the age range parameters of the study.
- Have an HbA$_{1c}$ of $\geq$6.2%.

Limitations:
- Smaller population size.
- Limited exercises for accessibility.
- Had to exercise under professional supervision.

Data Analysis:
- Data collection was used to compare the improvements and effects of exercise in the insulin resistance and HbA$_{1c}$ levels of type 1 diabetics (McArdle, et. al, 2015).
- This study employs parametric statistics which uses interval data and a Pearson Product-Moment calculation.
- An independent t test was utilized since there were two groups being tested.
- The blood samples collected from participants fingers and HbA$_{1c}$ results collected from the arm of the participants were conveyed by utilizing descriptive statistical analysis in order to alter the variables during the HIIT workouts.

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