The Benefits of Exercise in Individuals with Type II Diabetes

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Introduction

- Type 2 Diabetes Mellitus is one of the most common metabolic disorders worldwide (Galicia-Garcia et al., 2020).
- The development of Type 2 Diabetes is primarily caused by a combination of:
  - Defective insulin secretion by pancreatic β-cells (Galicia-Garcia et al., 2020).
  - The inability of insulin-sensitive tissues to respond to insulin (Galicia-Garcia et al., 2020).
- Type 2 diabetes is a disease of insulin resistance (Jacobs et al., 2018)
- According to Khan and colleagues (2019), in 2017 it was estimated that 462 million individuals globally are affected by type 2 diabetes or 6.28% of the world's population.
- By 2035, it is estimated that there will be >590 million individuals diagnosed with type 2 diabetes (Reed et al., 2021).
- The prevalence of type 2 diabetes is greatest in African Americans Hispanic Americans (Jacobs et al., 2018).
- Medical therapy for type 2 diabetes is mostly used to improve insulin resistance, reduce liver secretion of glucose, and stimulate pancreatic beta cells to secrete insulin (Jacobs et al., 2018).
- Lifestyle has been shown to be more effective in reducing the risk for developing type 2 diabetes (Jacobs et al., 2018).
- It takes up to 10 years for insulin resistance to progress to diagnosis of type 2 diabetes (Jacobs et al., 2018).
- Over 75% of type 2 diabetes cases are among obese, inactive adults (Jacobs et al., 2018).

Exercise Testing

- Exercise has been an essential component of the prevention and management of type 2 diabetes (Jacobs et al., 2018).
- Increased physical activity and structured exercise can help improve insulin-dependent muscle glucose uptake independently of weight loss (Jacobs et al., 2018).
- Aerobic exercise has been shown to enhance glucose delivery to exercising muscles (Jacobs et al., 2018).
- Resistance training and aerobic exercise has been shown to benefit individuals through increased glucose uptake and decreased insulin resistance (Marín-Peñalver et al., 2016).
- HbA1c levels improves the greatest with a combined resistance training and aerobic training program compared to only resistance training program or only aerobic training program (Jacobs et al., 2018).
- Individuals with type 2 diabetes have to be medically cleared before starting a vigorous exercise program (Jacobs et al., 2018). Hypoglycemia, or blood glucose lower than 70 mg/dl, is the most common abnormal response to exercise (Jacobs et al., 2018).
- Also, blood sugar monitoring should be performed before and after an exercise session (Jacobs et al., 2018).
- Individuals with type 2 diabetes are prone to silent ischemia (Jacobs et al., 2018).

Exercise Prescription

Parameter	Guideline
Aerobic Exercise Frequency and Intensity	Sedentary individuals: start with two or three 10-minute bouts per day and progress to 30 minute of continuous aerobic exercise for 5 to 7 days per week. Intensity should start at 50-85% heart rate reserve, 12-16 rate of perceived exertion (RPE) (Jacobs et al, 2018)
Aerobic Exercise Duration and Modes	Minimum of 10-minutes per session with a minimum goal of 30 minutes per session. If weight loss is needed, gradually progress to 60 minutes per session. Minimum goal is 150 minutes per week, or up to 300 minutes if weight loss is needed. Modes include rhythmic, continuous, biking, walking, and swimming (Jacobs et al., 2018).
Resistance Training Frequency and Intensity	2-3 days per week, ideally every other day. Duration is 30-60 minutes per session using 8-12 repetitions, 2-3 sets, 10-12 large-muscle multijoint exercises. Intensity at the beginning should start at 50-70% 1RM and gradually progress so that 3-6 months into the program the goal is 50-65% 1RM with high repetitions for one session, 65-80% 1RM with moderate reps for one session, and 80-95% 1RM for one session each week (Jacobs et al., 2018).
Resistance Training Exercise Types	Resistance bands, pneumatic, hydraulic, plate-loaded, selectorized machines, and free weights. The use of all these types of exercises depends on the client's goals, interests, capabilities, and clinical status (Jacobs et al., 2018).

Special Considerations

- Individuals with type 2 diabetes must have medical clearance before starting a vigorous exercise program. They should also go thorough a thorough medical evaluation for cardiovascular, kidney, nervous, renal, or visual complications (Jacobs et al., 2018).
- Individuals are more susceptible to silent ischemia.
- Hypoglycemia or low blood sugar, is common in individuals with type 2 diabetes.
- Blood sugar should be monitored before and after an exercise session (Jacobs et al., 2018).
- Avoid injecting insulin into exercising limbs. It is best to use an abdominal site with individual has a blood glucose above 200 mg/dl.
- Individuals with type 2 diabetes that have kidney disease peripheral artery disease should be referred to a medically supervised exercise program (Jacobs et al., 2018).
- Be cautious with vigorous exercise with all individuals because many have undiagnosed atherosclerosis of the coronary and peripheral arteries (Jacobs et al., 2018).

Conclusion

- Type 2 diabetes is a a disease caused by insulin resistance caused by 1) Defective insulin secretion by pancreatic β-cells 2) The inability of insulin-sensitive tissues to respond to insulin (Galicia-Garcia et al., 2020; Jacobs et al., 2018). It is shown that lifestyle changes are more effective in reducing the risk for developing type 2 diabetes (Jacobs et al., 2018).
- Exercise is an essential component of preventing and managing type 2 diabetes. Resistance training is effective in prevention and management. Aerobic training is also effective with prevention and management of type 2 diabetes. However, exercise guidelines of a combination of resistance training and aerobic training is shown to be significantly more effective than when separate. Exercise enhances insulin-dependent glucose uptake in working muscles.
- Individuals with type 2 diabetes must have medical clearance before beginning a vigorous exercise program. They should also monitor blood glucose levels before and after an exercise session.
- Aerobic exercise should start out at 10 minutes, 2-3 times per day and progressively increase to 30 minutes of continuous exercise. This should be done with a minimum goal of 150 minutes per week and if weight loss is a goal, 300 minutes per week (Jacobs et al., 2018).
- Resistance training should start out at 2-3 days per week and increase to every other day with progression. Also, there is a variety of types of resistance exercises to use (Jacobs et al., 2018).
- Flexibility is an important aspect to exercise because individuals with type 2 diabetes are associated with poor range of motion (Jacobs et al., 2018)

References

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