

Exercise Testing and Prescription for Type II Diabetes

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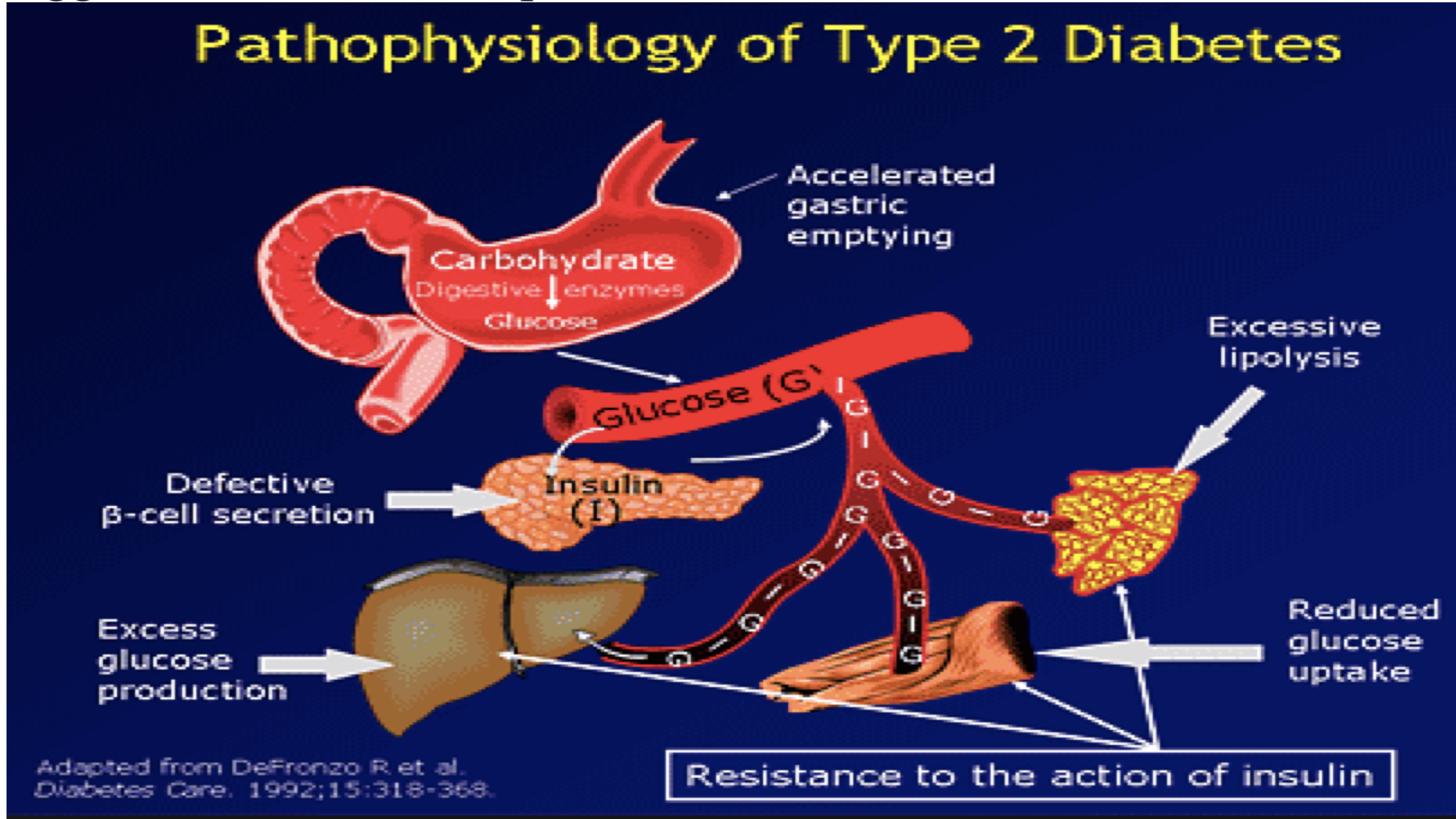


INTRODUCTION

The latest global estimates show that 382 million people had diabetes in 2013, and will rise to 592 million by 2035. The rise of diabetes is a major issue across the world. “The disease burden related to diabetes is rising and fueled by the global rise in the prevalence of obesity and unhealthy lifestyles” (Forouhi & Wareham, 2014). “Both forms of diabetes can lead to multisystem complications of microvascular endpoints, including retinopathy, nephropathy and neuropathy, and macrovascular endpoints including ischemic heart disease, stroke and peripheral vascular disease” (Forouhi & Wareham, 2014). Of the two types of diabetes, type II diabetes is seen to be the most prevalent. Type II diabetes is a lifelong chronic disease which is caused by high levels of blood glucose in the blood.

Insulin is a major hormone produced in the pancreas by beta cells. The hormone moves blood sugar glucose into different cells. Once the glucose is inside the cells, it is stored and later used for energy. When a person has type II diabetes, their fat, liver, and muscle cells do not respond to insulin correctly, this is called insulin resistance. Insulin resistance prevents the sugar to be used for energy. The blood glucose continues to build up inside the body because it is not going inside the different cells. Type II diabetes occurs over a period of time. “The causes of type II diabetes are multi-factorial and include both genetic and environmental elements that affect beta cell function and tissue (muscle, liver, adipose tissue, pancreas) insulin sensitivity” (Scheen, 2003). Insulin resistance and beta cell dysfunction is in the pathogenesis of type 2 diabetes. There are different prevention strategies that can be installed for a person that has type 2 diabetes. “Oral pharmacological agents used to treat type 2 diabetes that improve insulin sensitivity, preserve beta cell function that delay carbohydrate metabolism have been shown to prevent the progression of impaired glucose tolerance to type 2 diabetes” (Smith-Marsh, 2013).

Type II diabetes is diagnosed by a blood test called Glycated hemoglobin A1C. This test shows the average blood sugar level from previous months. Normal levels are below 5.7%, results that are between 5.7% and 6.4% are considered prediabetes. A result that is higher is 6.5% on two separate occasions implies that diabetes is present. If a glycated hemoglobin test is not available then a doctor can use a random blood sugar test, fasting blood sugar test, or oral glucose tolerance test. For a random blood sugar test a reading that is 200 mg/dL or higher suggests that diabetes is present. For a fasting blood sugar test a reading that is 126 mg/dL or higher on two separate test suggest that diabetes is present. For an oral glucose tolerance test a reading that is 200 mg/dL or higher suggests that diabetes is present.



Retrieved from: <https://u.osu.edu/diabetestype2/diagnosis/>

EXERCISE TESTING

Individuals with type II diabetes need to be medically cleared before starting a vigorous exercise program and should undergo a thorough medical evaluation. If an individual with type II diabetes has a greater than 10% risk of a cardiac event, the individual should complete a medically supervised maximal clinical exercise test before starting the program. Silent ischemia is common with people who have type II diabetes, they will need to undergo a clinical exercise test with a radionuclide injection that allows for detection of ischemic areas of the heart. Those who present risks to be hypoglycemic during exercise need to be monitored closely, the exercise professional has to be aware of oral agents and insulin preparations because exercise cannot occur during the peak of insulin action. During each session blood glucose should be monitored before and after each session and also before starting an exercise program. With type II diabetes the clients blood glucose should not be more than 199 mg/dl. If an individual’s blood glucose is <100 mg/dl, the client should ingest 20 to 30 g of carbohydrate before starting exercise. Even after ingestion the glucose level should be measured every 10 minutes afterward. If insulin needs to be injected, it should not be injected into exercising limbs. For most clients it is ideal to inject them in the abdominal site, especially if blood glucose is above 200 mg/dl.

Ketone bodies can be checked in urine and if none are present, light to moderate exercise is possible, but no vigorous exercise should be involved. Type II diabetes puts individuals at a higher risk for dehydration during exercise, so hydration status should be monitored. Individuals with retinopathy should avoid vigorous-intensity exercise. Individuals with autonomic neuropathy should be referred to a medically supervised program. Individuals with type II diabetes and kidney disease, peripheral artery disease, or peripheral neuropathy also should go to a medically supervised program, because the risk is just too high. Vigorous exercise in patients with type II diabetes should always be cautious due to undiagnosed atherosclerosis of the coronary and peripheral arteries. Unfortunately, 75% of individuals with type II diabetes will die from cardiovascular disease.

EXERCISE PRESCRIPTION

	Aerobic Exercise	Resistance Training
Frequency	<ul style="list-style-type: none">Sedentary: 30 min of aerobic activity 5-7x/weekActive: 30 min of aerobic activity 5-7x/week	<ul style="list-style-type: none">2-3 days per week
Intensity	<ul style="list-style-type: none">50-85% of HRR12-16 rating on RPE scale	<ul style="list-style-type: none">50-70% of 1RM
Time	<ul style="list-style-type: none">10-30 min sessionsIf weight loss is needed: 60 minute sessions150-300 min per week	<ul style="list-style-type: none">30-60 min sessions
Type	<ul style="list-style-type: none">Rhythmic and continuousEmphasize working large muscle groups	<ul style="list-style-type: none">Free weight exercises

EXERCISE PRESCRIPTION

- Aerobic training should progress at no more than 10% increase per week in exercise intensity (Williams, et al, 2018).
- Aerobic training benefits:
 - Enhances glucose delivery to exercising muscles
 - Stimulates translocation of glucose transporter protein
 - Improves insulin receptor sensitivity
- Resistance training progression should occur slowly, and only if number of reps/set can be consistently exceeded each week (Williams, et al, 2018).
- Resistance training benefits:
 - Increases insulin receptors
 - Increased capacity for glucose intake

SPECIAL CONSIDERATIONS

- The exercise prescription should be accompanied with a low-fat, high fiber diet. When these are paired together, there is significant reduction for the risk of developing type II diabetes (Jacobs, 2018)
- Hypoglycemia is a common abnormal response to exercise
- Blood glucose levels need to be monitored before, during, and after exercise
- Hydration levels need to be monitored due to increased risk of dehydration

CONCLUSION

Exercising with type II diabetes can help increase the quality of life and has been essential to prevent and manage type II diabetes. Exercise will increase insulin sensitivity helping a person live a healthier lifestyle. Daily exercise will also provide an alternative mechanism for blood glucose disposal. When exercise is done regularly, a 71% reduction in the risk for developing type II diabetes has been seen. Long-term exercise with resistance training increases fat-free mass, causing an increased insulin receptors and capacity for glucose uptake to better manage type II diabetes as well as glycated hemoglobin levels that improve with both resistance training and aerobic training.

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