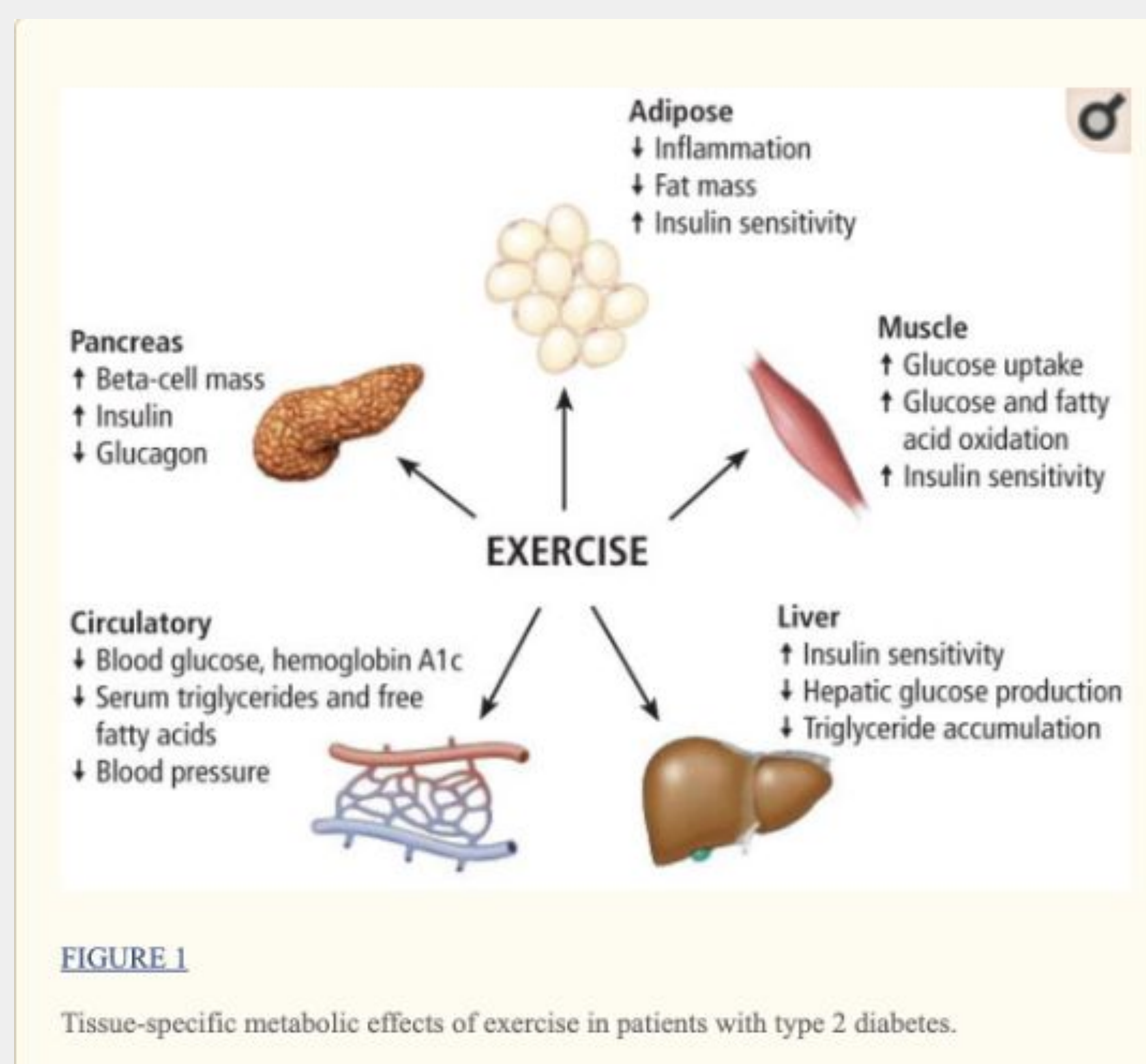


## Introduction

- Type 2 diabetes is estimated to afflict over 400 million people worldwide (Javeed & Matveyenko, 2018).
- Type 2 diabetes arises from a combination of genetic susceptibility and environmental factors including physical inactivity and poor nutrition (Stanford & Goodyear, 2014).
- People with type 2 diabetes have normal or high insulin levels, but tissues such as liver, skeletal muscle, and adipose tissue become resistant to insulin. The pancreas compensates by producing more insulin and this increase in circulating insulin can result in impaired glucose transport into these tissues (Stanford & Goodyear, 2014).

Classification	Fasting Blood Glucose	Random (2hr after 75 g of glucose)
Normal	<100 mg/dl	<140 mg/dl
Prediabetes	100-125 mg/dl	140-199 mg/dl
Diabetes	>125 mg/dl	>199 mg/dl



- Physical activity is a key element in prevention and management of T2D as it improves blood glucose control. Most benefits of physical activity on diabetes management are realized through acute and chronic improvements in insulin action, accomplished with both aerobic and resistance training (Colberg et al., 2010).
- Aerobic exercise is the most traditional mode prescribed for diabetes prevention and management as just 1 week of aerobic training can improve whole-body insulin sensitivity in type 2 diabetes individuals. Moderate and vigorous intensities can improve insulin sensitivity up to hours or days (Colberg et al., 2010).
- A combination of aerobic and resistance training two to three times weekly may be more beneficial to blood glucose control than the two modes alone (Colberg et al., 2010).

## Exercise Testing

- Individuals with type 2 diabetes must be medically cleared prior to starting vigorous exercise. Those who have a greater than 10% risk of a cardiac event over the next 10 years should undergo a maximal clinical exercise test (Jacobs, 2018, p. 121).
- The cardiopulmonary exercise protocol should be selected according to the purpose of testing and the individual patient, similarly to what is done for non-diabetic individuals. The test supervisory should know the patient's specific hypo- and hyperglycemia symptoms, know how to interpret glycemia modifications during the test, and correct an eventual hypoglycemia (Kosinski et al., 2019).
- The Bruce protocol is supported by many published studies but has disadvantages such as the large interstage increments in workload that can make estimation of VO<sub>2</sub>max less accurate. Subjects who are elderly, obese, or have gait difficulties are forced to stop prematurely because of musculoskeletal discomfort. Other treadmill and cycle ergometer protocols can be used such as the Cornell, Naughton, and Balke which provide more modest increases in workload between stages or the YMCA cycle ergometer protocol to (Kosinski et al., 2019).

## ExRx

- Recommended Physical Activity for a person with T2D:
  - ◆ A individual with T2D should exercise moderately to vigorously for at least 150 minutes per week, spread out over at least three days during the week, with no more than two days between bouts of aerobic activity, (Colberg et al., 2010).
  - ◆ Individuals with T2D can do moderate to vigorous resistance training at least 2-3 times a week in addition to aerobic training (Colberg et al., 2010).
  - ◆ In most clients with T2D, moderate intensity is between 40% and 60% heart rate reserve, which is comparable to brisk walking. Engaging in high intensity exercise with a heart rate reserve of more than 60% has additional benefits, (William et al., 2018)
  - ◆ Flexibility and balance exercises are also important for diabetes individuals due to limited joint mobility from advanced glycation end products that accumulates by hyperglycemia (Colberg et al., 2016).
  - ◆ According to Colberg et al. (2010), there are no recent studies on progression or volume for individuals with type 2 diabetes, however gradual progression of both is advised to minimize risk of injury and to enhance compliance.

*Colossians 1: 10-11* “to walk in a manner worthy of the Lord, fully pleasing to him; bearing fruit in every good work and increasing in the knowledge of God; <sup>11</sup>being strengthened with all power, according to his glorious might, for all endurance and patience with joy”

## Special Considerations

- Hypoglycemia caused by PA is unlikely to occur in people with type 2 diabetes who do not use insulin or insulin secretagogues. To avoid hypoglycemia during and after exercise, insulin and insulin secretagogues users should supplement with carbohydrate when required (Colberg et al., 2010).
- Individuals taking insulin or such insulin secretagogues can need to change their medication dose to avoid exercise-induced hypoglycemia. With the exception of -blockers, certain diuretics, and statins, most other drugs prescribed for concomitant health conditions have little effect on exercise (Colberg et al., 2010).

## Conclusion

- For diabetic patients, a combination of resistance and aerobic exercise is ideal, and it should be an individualized and innovative program. While it is recommended and more likely to improve blood glucose regulation if both aerobic and resistance exercise training are used, (William et al., 2018)

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