



# THE NASM GUIDE TO INSULIN RESISTANCE AND WEIGHT LOSS



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## Disclaimer

The content in this guide is intended to be used for informational purposes only. It is not to be used to diagnose or treat any medical condition or disease, and not to replace guidance from a licensed healthcare provider.

# Welcome!

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We are excited that you are here and that we get to accompany you on the educational journey you are about to embark on about how insulin resistance works and why weight loss is such a powerful tool in addressing it. While this guide will primarily focus on the effect of weight loss on insulin resistance, we are going to take you through a crash course on how insulin works and what actually causes insulin resistance.

This guide is focused on helping you understand how body weight affects insulin resistance and how weight loss, even small amounts, is important for improving insulin resistance. This guide also will highlight how effective lifestyle-based weight loss is as a prevention and treatment strategy for insulin resistance and diseases of insulin resistance, such as type 2 diabetes. We hope that after reviewing this guide you take away useful concepts and powerful tools, and understand how your body weight affects insulin signaling and insulin resistance. We are thankful you are here and are excited to go on this journey with you.

## About NASM

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The National Academy of Sports Medicine is the leader in educating and credentialing fitness, wellness, and performance professionals across the globe. We provide valid, up-to-date content on topics that improve the health and well-being of those they serve. We pride ourselves on creating practical content you can apply right away. Learn more about us at [www.nasm.org](http://www.nasm.org), your favorite social media platform, or wherever you listen to podcasts.

## Getting the Most from This Guide

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This NASM Guide to Insulin Resistance and Weight Loss will walk you through information explaining a little bit of the “why” behind the “how”. We’ll make sense of the information out there so you won’t have to. Then we’ll give you some key takeaways and actionable steps to apply whenever you like.

Come back and use the information as a reference any time. Be sure to use the key takeaways and application strategies in whatever way makes sense for you. Don’t feel obligated to put everything into action right away. When you’re ready for a deeper dive on the topic, check out our recommended resources.



# Introduction

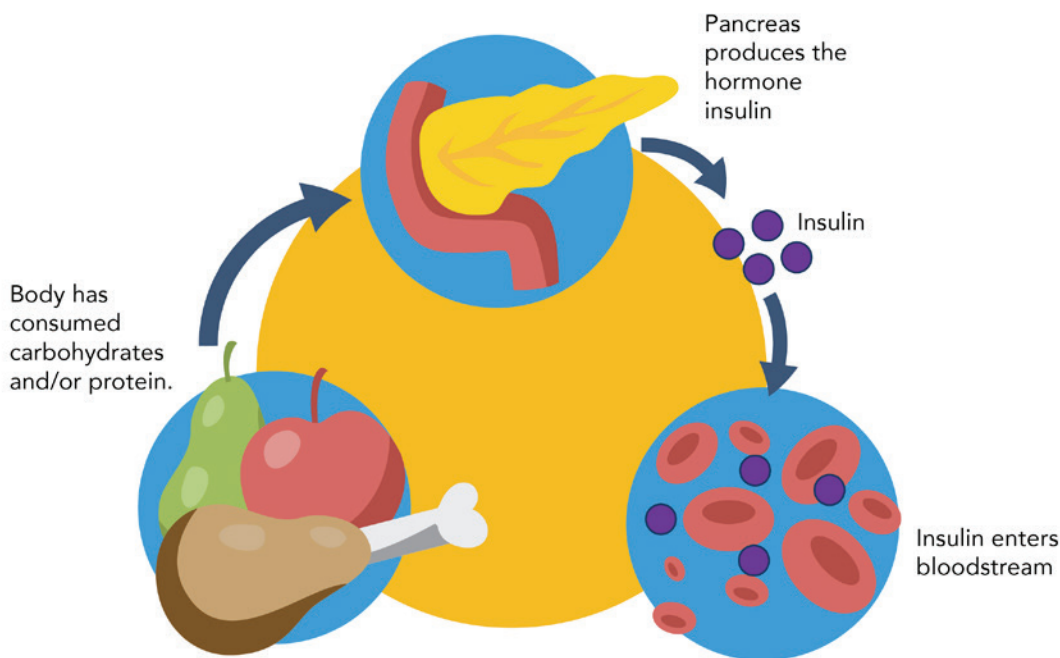
Insulin resistance affects roughly 40% of adults over the age of 18 in the United States, which is a staggering number when you consider that number equates to ~100 million people (Freeman et al., 2023). Despite the fact this condition affects such a large number of people, many of us are not sure exactly what it is. You have probably come across the term insulin resistance before, especially in the context of diabetes, because it is part of the disease process that leads to diabetes. However, you probably have never been given a full explanation for what insulin resistance is, what causes it, or how it relates to your blood sugar and the rest of your overall metabolism. Furthermore, you probably are not entirely certain about the role that body weight, and specifically weight loss, plays in insulin resistance and why it is such a powerful tool for helping prevent and treat insulin resistance.



This guide is going to teach you what insulin resistance is, why it affects so many people, and cover the importance of weight loss in this process. You will also learn the importance of exercise on insulin resistance and why it is such a great tool, independent of weight loss.

## Insulin Resistance

In order to fully understand insulin resistance, we need to understand what insulin is and how it works. So, let's begin this guide with a brief but thorough crash course on insulin and insulin resistance. Insulin is a hormone that is produced by your pancreas in response to either consuming food or changes in blood sugar. Other hormones can also cause your body to produce insulin but eating food (especially carbohydrates and proteins) or increases in blood sugar are the primary mechanisms that cause insulin to be released.



Once insulin is released, it coordinates a lot of different actions in your body. For example, it tells your liver to stop releasing glucose (sugar) into your bloodstream, it tells your muscles that it should start absorbing more nutrients from your bloodstream, and it tells your body to start storing those nutrients in the form of glycogen and triglycerides. It also tells your muscles that it can slow down on breaking down its own tissue so other processes can help it build more. When you think about all of those processes together, insulin essentially works like a train conductor. But in the context of your body, it conducts where the nutrients in your body go.

Insulin resistance describes the situation when insulin becomes less effective at being the “metabolic conductor”. The primary things that occur when your body experiences insulin resistance is that your muscles and other tissues

## What Insulin Coordinates



**Signals the liver to stop releasing glucose (sugar) in the bloodstream**



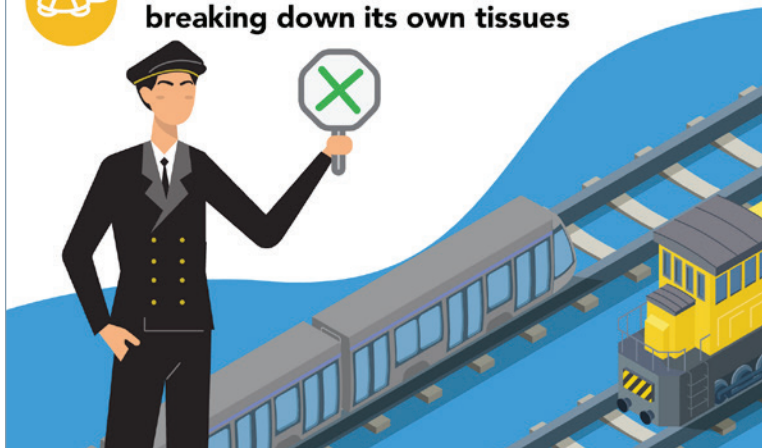
**Tells muscles to begin absorbing nutrients from the bloodstream**



**Communicates to the body to begin storing nutrients in the bloodstream as glycogen and triglycerides**

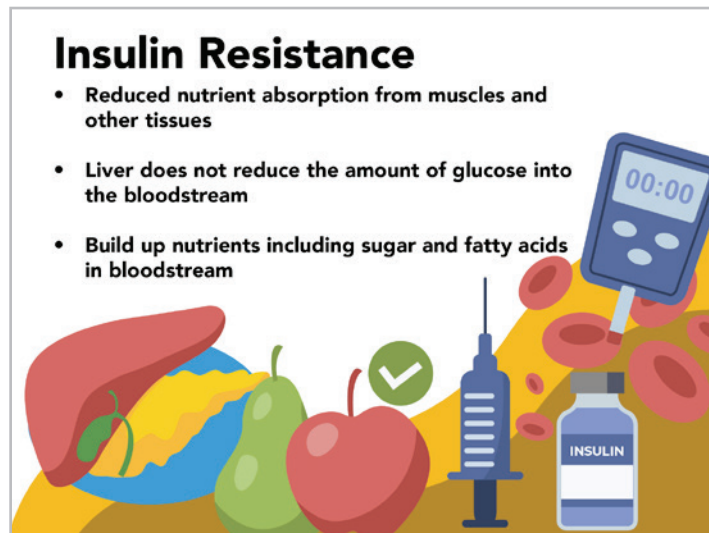


**Informs the muscles to slow down on breaking down its own tissues**



(e.g., other organs) don't absorb as many nutrients from your blood and your liver doesn't reduce how much glucose it is releasing into your bloodstream.

The net effect of this is that nutrients, especially sugar and fatty acids, build up in your bloodstream. This is why insulin resistance leads to increased blood sugar levels.



## DIGGING DEEPER

### Insulin Resistance, Metabolic Syndrome, and Non-Alcoholic Fatty Liver Disease

Insulin resistance contributes to many other diseases and conditions outside of simply elevated blood sugar. The two most common ones are metabolic syndrome and non-alcoholic fatty liver disease.

**Metabolic syndrome** is a group of conditions that includes a cluster of different risk factors that can contribute to chronic diseases such as cardiovascular disease. These risk factors include:

- Hypertension (high blood pressure)
- Hyperglycemia (high blood sugar)
- Hyperlipidemia (high cholesterol and triglycerides)
- Increased waistline

Insulin resistance is a large contributor to metabolic syndrome because it results in higher blood sugars and higher cholesterol and triglycerides. As such, insulin resistance and metabolic syndrome are very tightly linked together.

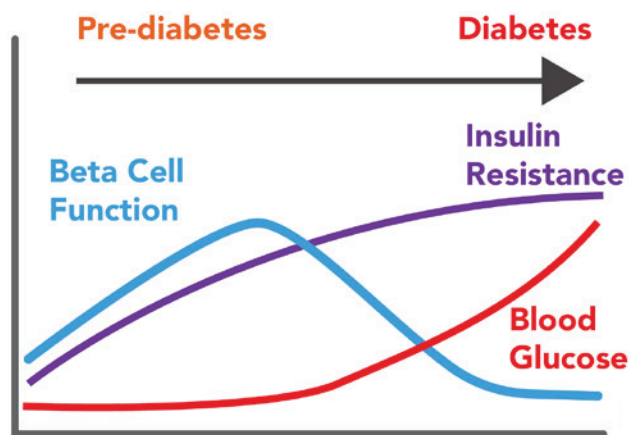
**Non-alcoholic fatty liver disease (NAFLD)** is a disease where your liver has increased levels of fat deposits, which in turn causes other metabolic issues, such as elevated LDL and decreased HDL. Insulin resistance is one of the largest contributing risk factors for NAFLD (Marchesini et al., 1999). In fact, some research shows that 70 to 80% of people with insulin resistance develop NAFLD (Kitade et al., 2017).

# Insulin Resistance and Blood Sugar

One of the most important questions to ask about understanding the relationship between insulin resistance and blood sugar is this:

## *Does increased blood sugar cause insulin resistance or does insulin resistance cause increased blood sugar?*

The best way to answer this question is to look at how something like insulin resistance and blood sugar evolves over time because they are both things you can measure. It turns out that when you measure both over weeks, months, and years, you can see that insulin resistance actually increases long before you see your blood sugar go up. This is because as your body starts to experience insulin resistance, your pancreas produces more insulin to counteract the “resistance”. Imagine it like putting earplugs in and then turning up the volume so you can still hear. Eventually your body is unable to turn the volume up anymore and things start to fall apart. This is when you start to see blood sugar levels increase.



This means that insulin resistance actually causes increased blood sugar, not the other way around. However, insulin resistance does not lead to just increased blood sugar. It results in increased blood lipids (e.g., cholesterol and fatty acids), inflammation, and other metabolic abnormalities.

### DIGGING DEEPER

#### What are beta cells?

Beta cells are a specific type of cell found in your pancreas. Beta cells are responsible for producing and releasing insulin. They are the only cells in your body that can produce insulin, which make them critical for regulating blood sugar and coordinating your metabolism.

**Type I diabetes** is a disease where your beta cells are actually destroyed by your own immune system, so your body no longer produces any insulin.

**Type II diabetes** is a disease where your body still produces insulin from your beta cells, but the rest of your body has become resistant to the effects of that insulin. This makes your beta cells produce more insulin to overcome that resistance.

## What Causes Insulin Resistance?

Now that we know a bit about insulin, what it does, and how insulin resistance leads to increased blood sugar and other metabolic abnormalities, and because we know it is not directly caused by elevated blood sugar, we should cover what exactly causes insulin resistance.

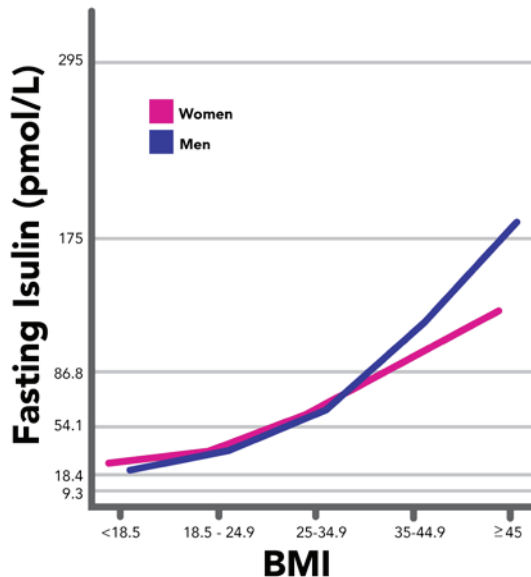


Insulin resistance can be caused by a variety of factors such as infection, acute stress, medications, and a host of other things. However, the single most common cause of insulin resistance is obesity or excess body fat. In fact, insulin sensitivity decreases almost linearly as BMI increases (Wiebe et al., 2022).

Additionally, the risk of developing insulin resistance to the point that it results in diagnosed type II diabetes is almost 250% higher among people with a BMI over 35 compared to people with a BMI between 18.5 and 25 (Narayan et al., 2007).



Now that it is clear that increasing body weight and body adiposity (body fat) increases insulin resistance, the next question you should be asking is, “why does it increase insulin resistance?” The answer involves a lot of complicated molecular biology, but is simple to understand as a broad concept. It comes down to the principle of energy overload.



Essentially, when skeletal muscle cells and fat cells contain more energy than they normally can, several processes occur that result in the cells becoming insulin resistant. Your cells end up holding too much glucose and fatty acids, and the cells start telling the body “we can’t handle any more energy, please stop sending it to us”. And because insulin is one of the primary ways the body gets nutrients and energy from the blood into the cells, your cells reduce how responsive they are to insulin. This is insulin resistance, which can, at least to some degree, slow down the amount of energy that enters the cells to address the present energy overload.

One aspect about this entire process that is interesting is that not everyone develops insulin resistance at a specific BMI. This means that some people can have a very high BMI and very high body fat and not develop insulin resistance. It also means that some people can have a lower BMI and lower body fat and will develop insulin resistance. This has been tested in the scientific literature and there appears to be a “personal fat threshold” in which every person will begin to experience insulin resistance at their own threshold where energy overload reaches a point that insulin resistance begins (Taylor et al., 2023; Taylor & Holman, 2015).

### FINDING YOUR OWN PERSONAL FAT THRESHOLD

Currently there is no way to predict what your personal fat threshold is. It is one of those things that you won’t know what it is until you find it. However, we don’t recommend that you purposefully gain body weight and body fat as a way to find this out.

The best way to understand what your body’s capacity for energy/fat storage is before insulin resistance sets in is to get routine blood work done. Have your physician monitor your fasting glucose AND your fasting insulin levels annually. You will actually see a rise in fasting insulin levels before you see a rise in blood glucose. If you start to see a rise in fasting insulin levels as your body weight increases, you will begin to find your threshold.

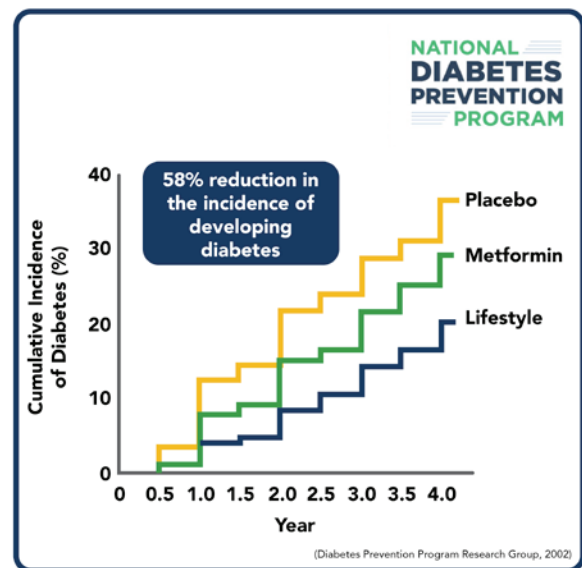
# Weight Loss and Insulin Resistance

If one of the main causes of insulin resistance is classified as “energy overload”, it stands to reason that one of the most effective ways in which you might improve insulin resistance is to remove the excess energy from your body. The primary way to do this is to lose body weight, because when you lose body weight, you are losing the excess energy your body has stored, usually in the form of body fat. In theory, this should be one of the most effective ways to improve insulin resistance, but let’s explore the actual evidence surrounding this idea.

When you look at the literature, weight loss is indeed the single most effective way to improve insulin resistance. One study examined adults across a weight-loss spectrum, and it included adults with obesity, adults who previously had obesity and lost and maintained weight loss, and adults who lost weight and regained most of it. This study found that adults who had lost and maintained weight loss had ~2 to 3 times greater insulin sensitivity than adults who had obesity and adults who lost weight and regained it (Clamp et al., 2017).

What is the most compelling about this concept is what this means for diseases like type II diabetes, which is driven primarily by insulin resistance. The idea that weight loss improves insulin resistance suggests that weight loss should prevent type II diabetes or potentially help treat it. The data surrounding this idea is quite clear and compelling. The most effective prevention and treatment of type II diabetes is in fact weight loss. This has been known for decades. [The National Diabetes Prevention Program](#) tested the effect of lifestyle-based weight loss (through diet and exercise) versus pharmaceutical intervention (Metformin) among people at risk for developing

diabetes. They found that weight loss from lifestyle actually led to a 58% reduction in the incidence of developing diabetes (Diabetes Prevention Program Research Group, 2002).



## DIGGING DEEPER

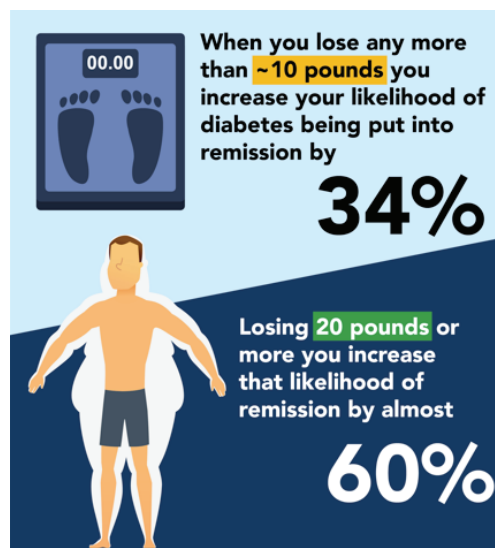
### WHAT IS METFORMIN?

Metformin is a pharmaceutical drug that is used to treat elevated blood glucose and insulin resistance in people with prediabetes and diabetes.

Metformin works by increasing insulin sensitivity within your cells. Essentially, it reduces the amount of sugar your liver produces and releases into your blood and it increases how much glucose your other tissues, such as your muscle tissues, can absorb from the blood.

Metformin has been considered a front-line therapy for decades, meaning that it is often the first thing prescribed to people who have elevated blood glucose.

The benefit of weight loss as it relates to insulin resistance really cannot be understated because the benefits even extend to people with already-established diseases that result from insulin resistance, specifically type II diabetes. A recent trial found that weight loss can actually put diabetes into remission and that the likelihood of someone being in remission is directly related to the amount of weight they lost. When you lose anything more than ~10 pounds, you increase your likelihood of diabetes being put into remission by ~34%, and when you lose 20 pounds or more, you increase that likelihood to almost 60% (Lean et al., 2018). The likelihood continues to increase up from there, which shows how much benefit individuals with insulin resistance receive from weight loss.



## Diet and Exercise and Insulin Resistance

Weight loss through lifestyle is clearly one of the most effective ways to improve insulin resistance. The two primary components of lifestyle-based weight loss are diet and exercise. Both diet and exercise alone can have direct effects on weight loss, but they can also have direct effects on insulin signaling itself. Let's explore how different dietary approaches and how different forms of exercise with and without weight loss might affect insulin resistance.



## Diet and Insulin Resistance

At this point it should be clear that weight loss is the primary tool for improving insulin resistance. But there are some remaining questions on exactly how diet plays a role in weight loss and how different diets might be better for weight loss and potentially better for insulin resistance directly, because different foods can affect how the body handles and processes glucose and insulin.

Let's start with how different diets affect weight loss and insulin resistance. Interestingly, it turns out that almost all diets are highly effective for improving insulin resistance when they lead to weight loss. This includes diets like low-carb diets, higher-protein diets, vegetarian diets, Paleo diets, and the Mediterranean diet (Ajala et al., 2013; Schwingshackl et al., 2018). While each diet might have subtle differences in other changes (e.g. some might lead to slightly better blood lipids or slightly more weight loss), they all have roughly the same effect on insulin resistance and overall metabolic health. As long as there is a negative energy balance/calorie deficit, there is no singular best diet when it comes to weight loss and insulin resistance.

While different diets can affect blood glucose levels and the total glucose load your body experiences, there is very little effect that a diet has on the underlying insulin resistance without weight loss. In fact, there is no conclusive evidence to date that any dietary intervention without weight loss has any meaningful impact on overall insulin resistance.

## DIGGING DEEPER

### What About Protein?!

One of the most interesting things about the human body is that we release insulin in response to carbohydrates AND protein. In fact, some proteins like fish and beef cause more insulin release than pasta or rice (Holt et al., 1997).

At first glance you might think this means that protein intake should be lower among people with insulin resistance. It turns out that is not quite the case. Short-term acute changes in insulin levels from food do not have a large impact on your body's insulin resistance. The thing that matters the most is your longer-term energy balance. Since higher protein diets promote higher levels of satiety and often lead people to eating fewer total calories, higher protein intake can actually help improve insulin resistance.

## Exercise and Insulin Resistance

Exercise can be an important component of a holistic lifestyle intervention that helps individuals lose weight. However, exercise is not necessarily required for weight loss. Diet alone can result in meaningful weight loss and improve insulin sensitivity. However, exercise itself can also directly impact insulin resistance because exercise can help reduce energy overload inside cells and make your muscle tissue more sensitive to insulin without weight loss.

Exercise can directly improve insulin sensitivity in a few ways. The first is that it will utilize some of the energy found in your cells and directly and acutely decrease the "energy overload" your cells experience, leading to short-term improvements in insulin sensitivity (Holloszy, 2005). Additionally, exercise also directly activates molecular machines inside your cells that cause your body to absorb

glucose from your bloodstream (Borghouts & Keizer, 2000; Sjøberg et al., 2017). This would suggest that exercise should accentuate weight-loss-induced improvements in insulin resistance. It turns out that this is in fact what happens. Weight-loss-induced improvements in insulin resistance are greater when exercise is included in a weight loss plan (Beals et al., 2023). In addition to exercise accentuating weight-loss-induced improvements in insulin resistance, exercise alone without weight loss can help improve insulin resistance as well, albeit not to the same extent as when weight loss occurs alongside exercise (Sampath et al., 2019; Way et al., 2016).

This means that exercise is a critical part of a healthy lifestyle to help maintain or improve insulin sensitivity. Regardless of whether your exercise routine leads to dramatic weight loss or not, exercise plays a critical role in ensuring your body's insulin signaling system works properly.

## Resistance Training vs. Cardio

You now know that exercise can be an important component of weight loss and that exercise, independent of weight loss, can help with insulin resistance. The next logical question you might ask is, should I do cardio or lift weights? And that is the perfect question to ask.

The perfect answer here is that you should ideally do both, as both cardio/aerobic-based exercise and resistance training can improve insulin resistance. Each form of exercise provides slightly different benefits. Cardio/aerobic exercise might have slightly better effects on improving overall insulin resistance, whereas resistance training might be more effective at increasing your body's total capacity to absorb blood glucose (García-Hermoso et al., 2018; Huang et al., 2021; Nery et al., 2017; Yang et al., 2014). If you can only do one, you will still receive most of the benefits. As such, the primary focus should be on consistently engaging in exercise, ensuring you get adequate volume of exercise, and making sure you do some moderate-to-vigorous intensity exercise several times a week.

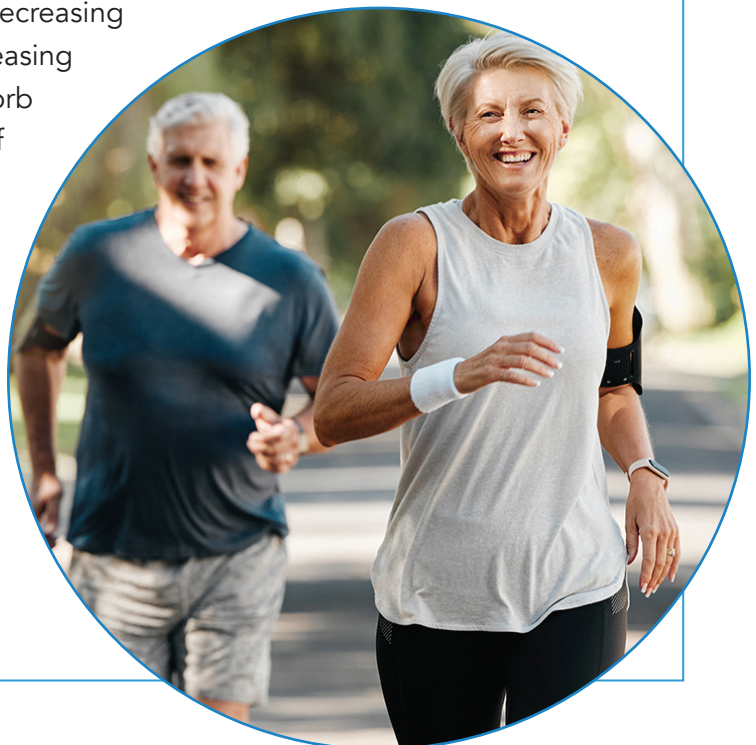


# Conclusion

Insulin resistance affects roughly 40% of all adults in the United States, which means almost 100 million people are impacted by it. This is important because insulin resistance leads to a metabolic state that can result in type II diabetes and increases your risk for cardiovascular disease, neurocognitive disease, and a host of other chronic diseases (Ormazabal et al., 2018; Reaven, 2012; Willmann et al., 2020). Given the prevalence of insulin resistance and the risk it carries, it is important to understand how you, as an individual, can reduce your risk of developing it, or help address it if you currently have insulin resistance.

The single most effective way to reduce your risk of developing insulin resistance or address it if you have it is through weight loss. Weight loss is effective because it helps address the primary cause of insulin resistance: energy overload in your cells. Even modest weight loss of ~5 to 10 pounds substantially improves insulin resistance and greatly reduces your risk of developing insulin resistance related diseases, such as type II diabetes. Weight loss is such a powerful tool that even among people with established and diagnosed type II diabetes can put their disease into remission through weight loss. In fact, almost 60 percent of people with type II diabetes are able to put their disease into remission with ~20 to 30 pounds of weight loss.

While both diet and exercise are critical tools for weight loss, they play different roles when it comes to insulin resistance. Any form of diet that results in caloric restriction and weight loss leads to improvements in insulin resistance, and it appears that no specific diet or dietary pattern is substantially more beneficial than any other. This means that you can follow almost any dietary pattern you find useful for losing and maintaining weight loss. Exercise is also an important tool for addressing insulin resistance as it can work synergistically with dietary modifications to accelerate weight loss. Additionally, exercise by itself, without weight loss, can directly improve insulin sensitivity because it reduces the actual insulin resistance in your cells by decreasing the total energy inside your cells, temporarily increasing insulin sensitivity. Exercise also helps your body absorb glucose from your bloodstream independent of insulin, which helps your overall metabolic state.



## What You Can Do Now

- If you suspect you have insulin resistance or have a BMI over 25, consider consulting a physician and having blood work done to determine if you have insulin resistance or are at risk for developing insulin resistance.
- Set an initial weight-loss target that is achievable and sustainable. Even modest weight loss of ~5 to 10% of your current body weight leads to substantial improvements in insulin resistance and insulin sensitivity.
- Find a dietary pattern or protocol that best fits your needs and lifestyle, and aim for a modest calorie deficit. You can estimate your calorie needs with our **Calorie Calculator** and then reduce those calories by ~200 to 500 calories per day as a target for weight loss.
- Find a type of exercise you enjoy. Both aerobic/endurance exercise and resistance training show benefits for insulin resistance. You can do one or the other, or you can do both.
- The American Diabetes Association recommends at least 150 minutes per week of moderate to vigorous physical activity. They recommend you exercise 3 to 7 days a week with no more than 2 consecutive days without exercise (Colberg et al., 2016).

## Online Resources

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Want to learn more about nutrition? Here are a few places to find reliable information and insight about nutrition and healthy eating behaviors.

- [NASM's Certified Nutrition Coach Certification \(NASM-CNC\)](#)
- [NASM Blog](#)
- [NASM's YouTube Channel](#)

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**THANKS FOR  
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