

Could Your Blood Sugar Levels Be Hindering Your Exercise Performance?

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STORY AT-A-GLANCE

- › Elevated blood sugar levels may interfere with certain aerobic fitness gains
- › Mice with hyperglycemia had reduced aerobic capacity compared to their healthy counterparts, despite equal exercise levels
- › Similar findings were observed in subsequent studies involving 24 young adult participants; those with higher blood sugar levels after ingesting glucose had diminished aerobic exercise capacity
- › Increased extracellular matrix proteins observed in hyperglycemic mice potentially obstructed the formation of new blood vessels, contributing to the blunted response to aerobic exercise
- › People with hyperglycemia or slightly elevated blood sugar levels may experience enhanced aerobic fitness gains by making dietary and lifestyle adjustments aimed at lowering blood sugar levels

If you've been exercising diligently but still aren't achieving the fitness gains you'd expect, elevated blood sugar levels could be at fault, according to a study conducted by researchers affiliated with Harvard Medical School's Joslin Diabetes Center.¹

Moreover, while diet and exercise are commonly lauded as synergistic components for overall health, emerging research indicates a deeper interconnection between them than many realize.

Specifically, findings suggest that a Westernized diet characterized by high sugar and processed food intake may undermine your exercise endeavors. The primary culprit behind this phenomenon is hyperglycemia, or high blood sugar levels, stemming from compromised insulin and leptin sensitivity.

Elevated Blood Sugar Dampens Exercise Advantages

Despite consistent exercise routines, certain individuals remain resistant to improvements in exercise capacity, a phenomenon influenced by both environmental and genetic factors that remain largely unknown. However, findings from a study involving two mouse models suggest that higher-than-normal blood sugar levels, including those falling within the "prediabetes" spectrum, may serve as a contributing factor.²

One cohort of mice was fed a Western diet, resulting in weight gain and hyperglycemia, while another cohort consumed a diet lower in fat and sugar. The latter group did not gain weight but had prediabetes, a condition characterized by elevated blood sugar levels, which increases the risk of Type 2 diabetes.

Over a six-week period, both groups engaged in running activities on a wheel equivalent to covering distances of about 500 kilometers.³ Although the overweight mice experienced weight loss by the end of the study duration, and all mice realized some metabolic benefits, those with hyperglycemia demonstrated significantly less gains in aerobic capacity.

Notably, their muscle adaptation to increased activity levels deviated from the anticipated norm. Ordinarily, muscle fibers undergo optimization in oxygen utilization and tissue remodeling in response to exercise, thereby enhancing endurance over time.

Sarah Lessard, Ph.D., lead author of the study and assistant investigator at Joslin Diabetes Center, elaborated in a press release, "We also grow new blood vessels to allow more oxygen to be delivered to the muscle, which helps to increase our aerobic fitness levels."⁴

Effects of High Blood Sugar on 'Extracellular Matrix' Proteins

The potential mechanisms underlying the blunting of certain exercise-induced benefits by high blood sugar were explored by the researchers, who proposed the involvement of extracellular matrix proteins.⁵ Situated amidst muscle cells within the vascular space, these proteins provide structural support for cells. Notably, the hyperglycemic mice exhibited an elevated presence of extracellular matrix, impeding the formation of new blood vessels.

The researchers hypothesized that the heightened extracellular matrix induced by hyperglycemia triggered increased c-Jun N-terminal kinase (JNK) signaling.⁶ Ordinarily, the JNK pathway responds to heightened mechanical stress, such as that induced by strength training. However, in hyperglycemic animals, aerobic activity prompted muscle cells to add bulk rather than adapt aerobically.

Consequently, muscles in hyperglycemic animals had enlarged fibers and fewer blood vessels, outcomes typically associated with strength training rather than aerobic exercise, Lessard noted.⁷

Follow-up investigations involving 24 young adult participants yielded similar findings, with individuals exhibiting higher blood sugar levels in response to glucose ingestion displaying heightened JNK activity post-exercise, alongside reduced aerobic exercise capacity.⁸

"Looking at how their muscles responded to a single bout of typical aerobic exercise, we also saw that those with the lowest glucose tolerance had the highest activation of the JNK signaling pathway, which blocks aerobic adaptations," Lessard explained.⁹

Dietary Modifications May Enhance Fitness Gains

The researchers stressed the importance of aerobic exercise for individuals with hyperglycemia, pointing out its role in facilitating weight loss and metabolic improvements. However, the pivotal takeaway from their findings is that individuals with

hyperglycemia or slightly elevated blood sugar levels may experience greater aerobic fitness gains by making dietary changes aimed at reducing blood sugar levels.¹⁰ This assertion is supported by the researchers' conclusion:¹¹

"Our work indicates that current shifts in dietary and metabolic health, associated with increasing incidence of hyperglycemia, might impair muscular and organismal adaptations to exercise training, including aerobic capacity as one of its key health outcomes."

The study also underscores the intrinsic relationship between diet and exercise, highlighting how optimizing both may promote overall well-being. Notably, sedentary behavior heightens the risk of prediabetes, independent of your body weight.

In a survey of 1,153 individuals maintaining a healthy weight, those characterized as physically inactive (engaging in less than 30 minutes of physical activity per week) were more likely to have an A1C level indicative of prediabetes (5.7 or higher).¹²

Among all inactive participants aged 20 and above, approximately one-quarter were either prediabetic or diabetic. Notably, this percentage surged to 45.7% among inactive individuals aged 45 and above.

These findings imply that individuals leading predominantly sedentary lifestyles but maintaining a healthy weight may have "normal-weight obesity" or be "skinny fat," a term describing metabolic obesity despite a normal body weight.¹³

If you have elevated blood sugar levels, even if they're not high enough to be indicative of diabetes, proactive measures to mitigate associated health risks are warranted without delay, regardless of your age.

Optimizing Your Diet for Blood Sugar Control

Consuming meals high in grain and sugar carbohydrates often leads to a rapid surge in blood sugar levels. Your pancreas responds by releasing increased amounts of insulin into your bloodstream to counterbalance this elevation.

However, while insulin effectively reduces blood sugar levels, it also facilitates the conversion of glucose into fat, consequently promoting fat accumulation within your body. The more insulin secreted, the greater the propensity for fat accumulation.

Consistent consumption of a high-sugar, high-grain diet exacerbates this cycle, resulting in elevated blood sugar levels over time and contributing to insulin desensitization. Higher insulin levels are required to fulfill its blood sugar-regulating function, eventually culminating in insulin resistance, which increases the risk of weight gain and Type 2 diabetes.

To mitigate this risk, incorporating full-fat grass fed dairy products such as cheese and yogurt into your diet can be beneficial. These products have been shown to aid in blood sugar regulation and lower the risk of Type 2 diabetes.¹⁴

Furthermore, integrating foods rich in healthy fats can contribute to blood sugar management. Examples include avocado, olives, coconut, raw cacao butter and organic pastured egg yolks.

In addition to healthy fats, certain foods offer specific benefits for blood sugar control. Garlic, for instance, contains alliin, a compound known to enhance glucose homeostasis and increase insulin sensitivity.¹⁵ Similarly, cinnamon has been linked to blood sugar regulation,¹⁶ while the grape compound resveratrol has demonstrated potential in this regard as well.¹⁷

Black cumin (*nigella sativa*) warrants special attention due to its potential to prevent both Type 1 and Type 2 diabetes. Research also indicates that black cumin may enhance glucose tolerance comparably to the diabetes drug metformin.¹⁸

Optimizing Meal Timing for Metabolic Health

The timing of your meals plays a pivotal role in bolstering your metabolic well-being. Incorporating fasting periods into your routine enhances metabolic flexibility, enabling your body to efficiently utilize both fat and glucose for energy. This is crucial for

maintaining optimal health and mitigating metabolic rigidity associated with insulin resistance.

Various intermittent fasting regimens exist, with one example being daily fasting for 18 hours and confining all meals within a six-hour window. If you're new to intermittent fasting, starting out by skipping breakfast and scheduling your lunch and dinner within a six-hour timeframe, such as between 11 a.m. and 5 p.m., is advisable. It's essential to conclude your meals at least three hours prior to bedtime.

While engaging in intermittent fasting, the meals you do consume must be well-balanced, featuring ample healthy fats and minimal net carbohydrates. Excessive net carbohydrate intake (total carbs minus fiber), excessive protein consumption and inadequate healthy fat intake are primary contributors to insulin resistance.

For optimal metabolic health, your body must effectively metabolize fat for energy, a process that's compromised by daily overconsumption of net carbs. Intermittent fasting helps diminish liver fat accumulation and enhances blood sugar regulation. This may curb pancreatic fat deposition, thereby mitigating Type 2 diabetes risk.¹⁹

Furthermore, research indicates that men predisposed to Type 2 diabetes can enhance blood sugar management by confining all meals within a nine-hour period, even in the absence of other dietary modifications.²⁰

Exercise: A Key Player in Blood Sugar Regulation

Interestingly, while elevated blood sugar levels may dampen some benefits of aerobic exercise, prioritizing strength training could help maintain optimal blood sugar levels, indirectly amplifying aerobic workout gains.

Published research in *Medicine & Science in Sports & Exercise* highlights that even a single session of moderate exercise can enhance your body's glucose regulation and diminish postprandial glucose spikes.²¹ Moreover, multiple studies underscore the specific advantages of strength training.²²

Strength training contributes to improved glucose metabolism by increasing the translocation of glucose transporter type 4 (GLUT4) in skeletal muscle. This translocation, triggered by muscle contractions,²³ plays a pivotal role in regulating glucose uptake within muscles. As explained in a review featured in *Physiological Reviews*:²⁴

"Exercise training is the most potent stimulus to increase skeletal muscle GLUT4 expression, an effect that may partly contribute to improved insulin action and glucose disposal and enhanced muscle glycogen storage following exercise training in health and disease."

A study involving individuals with Type 2 diabetes also demonstrated that a single interval training session improved blood sugar regulation – an effect that persisted for the next 24 hours.²⁵ Notably, stress induces the secretion of cortisol and glucagon, both of which influence blood sugar levels,²⁶ underscoring the significance of stress management in maintaining optimal blood sugar levels.

Improving Blood Sugar Levels Enhances Overall Health

Per conventional guidelines, those without diabetes or health issues should have a fasting blood glucose level below 100 mg/dL upon waking. However, I recommend striving for a fasting level below 90 mg/dL. Should your blood sugar levels fall outside of the optimal range, make dietary modifications, ramp up physical activity and mitigate daily stressors to foster improved blood sugar management.

Beyond potentially boosting the benefits derived from aerobic exercise routines, addressing insulin resistance linked to elevated blood sugar levels holds promise in warding off chronic ailments and mitigating your susceptibility to **infectious diseases**.

Sources and References

- [1, 8, 11 Nature Metabolism volume 2, pages 902–917 \(2020\)](#)
- [2, 3 Science Daily July 20, 2020](#)
- [4, 6, 7, 9 EurekAlert! July 20, 2020](#)

- ⁵ National Institutes of Health August 4, 2020
- ¹⁰ Medical News Today August 2, 2020, Recommendations
- ¹² Am J Prev Med. 2017 Jan 19
- ¹³ Obesity Volume 28 Number 2 February 2020
- ¹⁴ PLOS Medicine October 10, 2018
- ¹⁵ Scientific Reports, 2018;8: 3527, Abstract
- ¹⁶ Diabetic Medicine: A Journal of the British Diabetic Association October 2010
- ¹⁷ Phytother Res. 2019 Sep 1
- ¹⁸ Journal of Endocrinology and Metabolism April 2011; 1(1): 1-8
- ¹⁹ Metabolism, 2019;97:9
- ²⁰ Obesity April 19, 2019; 27(5)
- ²¹ Med Sci Sports Exerc. 2012 Feb;44(2):225-31
- ²² Mayo Clinic Proceedings, Online March 11, 2019 [Epub ahead of print]
- ^{23, 24} Physiol Rev. 2013 Jul;93(3):993-1017
- ²⁵ Diabetes, Obesity, and Metabolism, 2012 Jan 23 [Epub ahead of print]
- ²⁶ J Clin Endocrinol Metab. 1980 Jan;50(1):131-6