Exercise Later in the Day for Better Blood Glucose Control?

Miriam E. Tucker

Performing moderate to vigorous activity (MVPA) in the afternoon or evening may improve blood glucose control to a greater extent than exercising evenly throughout the day, new research suggests.

The data come from 775 participants with a mean body mass index (BMI) of 26.2 kg/m2 in the observational Netherlands Epidemiology of Obesity (NEO) study. The use of activity monitors for four consecutive days showed that performance of MVPA (defined as activity with intensity of >3 metabolic equivalents of task) in the afternoon or evening was associated with up to 25% reduced insulin resistance compared with an even distribution of activity during the day.

"This is one of the first studies where in humans the relation between timing of physical activity and insulin resistance was examined," lead author Jeroen van der Velde, of the Department of Clinical Epidemiology, Leiden University Medical Center, the Netherlands, told *Medscape Medical News*.

Moreover, he noted that while previous intervention studies have shown greater blood glucose reduction with high-intensity exercise performed in the afternoon compared with the morning in people with impaired glucose metabolism or type 2 diabetes, "as far as I am aware, we were the first to use a population-based study in a general population to study this."

Katarina Kos, MD, PhD, senior lecturer in diabetes and obesity, University of Exeter, UK, said: "This study is novel in that it relates the timing of physical activity if performed in the morning, afternoon, or evening to insulin resistance and fat content. This is from a cohort of middle-aged Dutch people between ages 45 to 65 studied 10 years ago and based on self-reports of weight and eating behavior and who were found to be generally overweight."

Is It Down to Circadian Rhythm?

"The results are of interest in that if the chosen timing was in the afternoon (63% of the studied population) or evening (8% of the studied population), it seemed to relate with improved metabolism when compared to the morning exercising... (16% of the population). Whether this was due to the (timing) of activity is yet to be shown," she told the UK Science Media Centre.

van der Velde agrees that the effect may be explained at least in part by the circadian rhythm of the body. "Physical activity may act as...a cue for the activation of clock genes. Previous research has suggested that our body's muscular system and oxidative system are also affected by our circadian rhythm and their peak activity seems to be in

the late afternoon. So, being mostly active in this time period...may elicit greater metabolic responses compared to being active in the morning."

But, he cautioned, "I think it is important to realize that we are just beginning to understand the potential impact of physical activity timing. At this stage, I believe it is most important to be physically active in general. So... if the morning is the only time of the day to go for a walk or a run, certainly do this."

Kos concurred: "As this is not an intervention study, further research is needed to explain the cause of the observed association." van der Velde also added that it's not yet clear which individuals or subgroups might experience additional benefits from timed activities. That's the current research focus of a large consortium of several research institutes in the Netherlands and Canada.

Timed Exercise Reduces Insulin Resistance but Not Liver Fat

The findings were published online November 1 in *Diabetologia*. The study population included men and women living in the greater Leiden area in the western Netherlands who were aged 45-65 years and self-reported a BMI of 27 kg/m2 or higher. A second cohort included inhabitants of one municipality who were invited to participate regardless of their BMI. All wore activity monitors for 4 consecutive days and nights during their usual activities.

Neither sedentary time nor breaks in sedentary time (defined as a period of activity with an acceleration >0.75 m/s2 following a sedentary period) were associated with lower insulin resistance, as calculated by blood sampling.

However, the number of breaks in sedentary time was associated with a significantly 22% higher liver fat content, assessed with a proton magnetic resonance spectroscopy.

One reason for the lack of effect of breaks on insulin resistance, the authors theorize, is that this was a real-world observational study where regular breaks aren't common. Alternatively, people might not have been intensively active enough during breaks to make a difference.

After adjustment for total body fat, an additional hour of MVPA was associated with a 5% drop in insulin resistance. An additional hour of MVPA in 5-minute bouts was associated with 9% lower insulin resistance.

Also, after adjustments, insulin resistance was reduced significantly in participants who were most active in the afternoon, by 18%, or evening, by 25%, whereas insulin resistance was not affected among those who were most active in the morning (–3%), all compared with people who distributed their MVPA throughout the day.

The timing of MVPA was not associated with liver fat content, and there were no significant differences in liver fat content and insulin resistance between groups based on the timing of light physical activity.

"This is just speculation, but perhaps for fat accumulation in the liver, the circadian system is less involved. Or perhaps the timing of other lifestyle variables is more important here, such as dietary intake," van der Velde said.

Finally, he observed, "Timing of physical activity is most likely just a piece of the puzzle. Timing of other lifestyle behaviors, such as sleep, and food intake are important cues for our circadian system as well, and all these behaviors likely interact with each other."

The NEO study is supported by Leiden University Medical Center, the Netherlands Cardiovascular Research Initiative, an initiative supported by the Dutch Heart Foundation, and the Netherlands Organization for Health Research and Development/Partnership Diabetes/Dutch Diabetes foundation Breakthrough. van der Velde has reported no further disclosures.

Diabetologia. Published online November 1, 2022. Full text
Miriam E. Tucker is a freelance journalist based in the Washington, DC, area. She is a regular contributor to Medscape, with other work appearing in The Washington Post, NPR's Shots blog, and Diabetes Forecast magazine. She is on Twitter: @MiriamETucker.