Daylight rather than artificial light improves blood sugar control and nutrient use in type 2 diabetes, study finds

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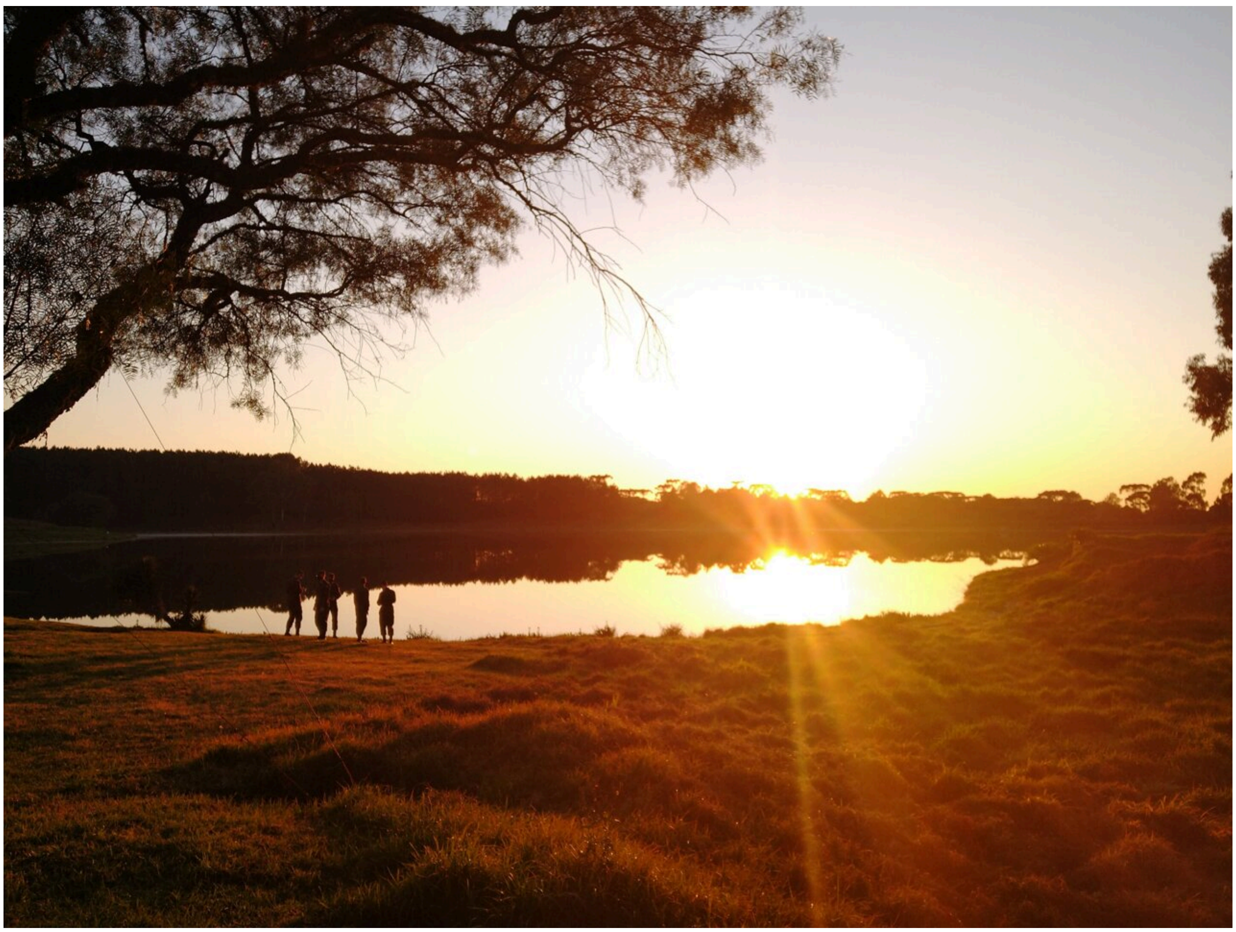

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Exposure to natural light could help treat and prevent type 2 diabetes, new research presented at the annual meeting of the European Association for the Study of Diabetes (EASD) in Hamburg, Germany (2–6 Oct), suggests.

"The misalignment of our internal circadian clock with the demands of a 24/7 society is associated with an increased incidence of metabolic diseases, including type 2 diabetes," says Ivo Habets, of Maastricht University, Maastricht, the Netherlands, who co-led the research.

"Natural daylight is the strongest zeitgeber, or environmental cue, of the circadian clock but most people are indoors during the day and so under constant artificial lighting.

"We were interested in whether increasing daytime exposure to natural light would improve blood sugar control in individuals with T2D.

"We also wanted to know if it would affect their substrate metabolism or nutrient use. This usually follows a 24-hour rhythm, with the body switching from using carbohydrates as its source of energy during the day, to fat at night. We'd previously shown that people at higher risk of type 2 diabetes are less able to make this switch and we wanted to find out if exposure to natural light would make the switch over easier in people who already have diabetes."

To explore this, Mr. Habets and colleagues in the Netherlands and Switzerland carried out a range of metabolic tests on a group of people with T2D when they were exposed to natural light and when they were exposed to artificial light and compared the results.

The 13 participants (average age: 70 years, BMI: 30.1kg/m^2, HbA_{1c}: 6.1, fasting plasma glucose: 8.1mmol/L) stayed in research facilities, which allowed their light exposure, meal and activity patterns to be tightly controlled.

They were exposed to two lighting conditions during office hours (8am to 5pm) in a randomized cross-over fashion: natural daylight from windows and artificial LED lighting. There was a gap of at least four weeks between the two interventions, each of which lasted 4.5 days.

During the natural daylight intervention, the light intensity was usually highest at 12:30pm, with an average reading of 2,453 lux. The artificial light was a constant 300 lux.

Evenings were spent in dim light (less than 5 lux) and the sleeping period (11pm to 7am) in darkness. The participants were provided with standardized meals, meaning they ate the same food in both interventions. Blood sugar levels were continuously recorded by monitors worn on the upper arm and a range of other tests were performed on the final day and a half of each intervention.

On day four, 24h substrate metabolism, resting energy expenditure and respiratory exchange ratio (this provides an indication of whether fat or carbohydrates are being used as the source of energy), were measured every five hours and blood was taken assess circulating metabolites.

Core body temperature was measured for 24h. Substrate metabolism, resting energy expenditure, respiratory exchange ratio and core body temperature all follow a 24-hour rhythm and the researchers wanted to see if this differed in the two conditions.

On day five (the final half day), a fasted muscle biopsy was taken to assess clock gene expression—the activity of genes known to be involved in the circadian clock. A mixed meal test (MMT), a measure of insulin production, was then carried out.

Blood glucose levels were within the normal range (4.4–7.8 mmol/L) for longer during the natural daylight intervention than in the artificial light intervention (59% of the 4.5 days vs. 51%).

The respiratory exchange ratio was lower during the daylight intervention than during the artificial light intervention, indicating that the participants found it easier to switch from using carbohydrate to fat as an energy source when exposed to natural light.

Per1 and Cry1, genes that help control circadian rhythms, were more active in natural light than in artificial light.

Resting energy expenditure and core body temperature followed similar 24-hour patterns in both light conditions. Serum insulin levels, measured during the MMT, were similar in both light conditions but the pattern of serum glucose and plasma free acids was significantly different between conditions.

The results, particularly the better blood sugar control, during the natural light invention, suggest that exposure to natural daylight is beneficial to the metabolism and so could help with the treatment and prevention of type 2 diabetes and other metabolic conditions, such as obesity, says Mr. Habets.

He adds, "Our research shows that the type of light you are exposed to matters for your metabolism. If you work in an office in almost no exposure to natural light, it will have an impact on your metabolism and your risk or control of type 2 diabetes, so try to get as much daylight as possible, and ideally, get outdoors when you can.

"Further research is still needed to determine the extent to which artificial light affects metabolism and the amount of time that needs be spent in natural light or outdoors to compensate for this."

Provided by Diabetologia