

Do sex differences in how adipose tissue responds to insulin explain why type 2 diabetes is more common in men?

May 10 2024



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New research presented at the [European Congress on Obesity](#) (ECO) in Venice, Italy (12–15 May), and [published](#) in the *International Journal of Obesity*, could help explain why type 2 diabetes is more common in men than in women.

"Previous studies have shown that men develop type 2 diabetes (TD2) at a younger age and at a [lower weight](#) than women and, overall, men appear to be at higher risk of the condition," says lead researcher Dr. Daniel P Andersson, at the Department of Endocrinology, Karolinska University Hospital Huddinge, Stockholm, Sweden. "One reason for this may be differences in how the sexes' [adipose tissue](#) responds to insulin.

"Adipose tissue is the main organ for the storage of [excess energy](#) and this is done in lipids called triglycerides that consist of [free fatty acids](#). When there is excess energy, insulin decreases the breakdown of triglycerides (lipolysis) and the release of free fatty acids to the blood and increases the storage of energy as triglycerides (lipogenesis) in fat cells.

"In [insulin resistance](#), fat cells are less sensitive to insulin and so both of these processes are impaired. This can lead to more fat circulating in the bloodstream, which raises the risk of T2D.

"If the insulin resistance of adipose cells is more pronounced, or severe, in men than in women, this could help explain why T2D is more common in men than women."

To explore this further, Dr. Andersson measured the adipose insulin resistance index (AdipoIR, a measure of insulin sensitivity of fat cells, with higher values indicating more resistance to insulin) in 2,344 women and 787 men, average age 44 years and BMI 35 kg/m².

Men had higher AdipoIR values than women but only when [obesity](#) ([body mass index](#) 30 kg/m² or more) was present. This was the case both for physically-active and sedentary people, in those with and without cardiometabolic disease and in people using nicotine and not.

In a subgroup of 259 women and 54 men living with obesity, the researchers also took biopsies from the adipose tissue to study the effect of insulin on isolated fat cells.

This showed clear differences between the sexes. In men, compared to women, a 10-fold higher concentration of insulin was needed to block the breakdown of triglycerides to fatty acids and the blockage was also less effective in men.

However, the storage capacity of the fat cells was similar for both sexes.

Dr. Andersson explains, "In individuals who are living with obesity, you often have an excess of energy available in the body and insulin should decrease the release of fatty acids and increase the storage of lipids in adipose tissue to reduce the free fatty acids circulating in the blood.

"When looking at sex differences, we found that men who were living with obesity had increased adipose insulin resistance and higher levels of free fatty acids in the blood.

"The differences seen between men and women were mainly related to decreased ability of insulin to block the breakdown of fatty acids in fat cells from men rather than sex differences in storage capacity.

"Fatty acids in the bloodstream have effects in the liver, muscle and the pancreas and could lead to further local insulin resistance in these organs, creating a vicious circle that, over time, could lead to development of type 2 diabetes."

The researchers conclude that in individuals who are living with obesity, adipose tissue insulin resistance is more severe in men than in women, which may partly explain why T2D is more common in men.

More information: Peter Arner et al, Sex differences in adipose insulin resistance are linked to obesity, lipolysis and insulin receptor substrate 1, *International Journal of Obesity* (2024). [DOI: 10.1038/s41366-024-01501-x](https://doi.org/10.1038/s41366-024-01501-x)

Provided by European Association for the Study of Obesity

Citation: Do sex differences in how adipose tissue responds to insulin explain why type 2 diabetes is more common in men? (2024, May 10) retrieved 20 June 2024 from <https://medicalxpress.com/news/2024-05-sex-differences-adipose-tissue-insulin.html>

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