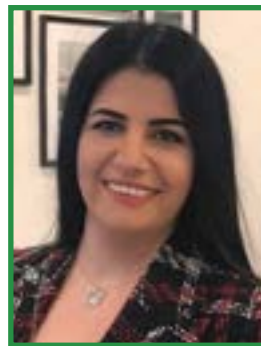


# Poor Metabolic Health Can Harm Brain Function



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The brain is one of the most energy-demanding organs. Although it comprises only about 2% of total body weight, it consumes roughly 20% of body's energy. This energy mostly comes from glucose, which acts as brain's primary fuel source. To function optimally, the brain requires a constant and adequate supply of both glucose and oxygen to maintain a normal function. These resources are vital for maintaining cellular health, supporting neuronal activity, facilitating the communication between neurons (known as synaptic transmission), and enabling cognitive functions such as, memory, reasoning, and decision-making.

Metabolic disorders, such as Type 2 diabetes and obesity, can disrupt this delicate energy balance. Type 2 Diabetes is a progressive condition primarily characterized by chronically elevated blood sugar levels and insulin resistance, a state in which the pancreatic beta cells become less responsive to insulin. Initially, these cells attempt to compensate by producing more insulin, but, over time, their function deteriorates. This leads to a decline in insulin levels and persistent hyperglycemia (high blood sugar).

This disruption in glucose regulation can negatively affect brain function and increase the risk of developing cognitive conditions such as Mild Cognitive Impairment (or MCI) and, eventually, dementia. MCI refers to a measurable decline in cognitive abilities, including memory, language, processing speed, and decision making, that is more

significant from what's expected for a person's age, but not yet significant enough to interfere substantially with daily life. Dementia, on the other hand, is an umbrella that describes a group of symptoms, including significant impairment in memory, thinking, language and behavior, that interfere with everyday functioning.

A recent large-scale neuroimaging study conducted using data from approx. 30,000 dementia-free adults between the age of 40 and 70 years in the UK biobank, investigated the impact of prediabetes on the brain ageing. The finding revealed that individuals with diabetes or prediabetes had brains that appeared significantly older than their chronological age. People with diabetes had brains that are 2.29 years older than chronological age. Those with prediabetes showed a brain age 0.5 years older. Individuals with poorly controlled diabetes ( $HbA1c \geq 8\%$ ) had brains that appeared 4.18 years older. Therefore, these finding emphasize on the importance of maintaining a good metabolic health to support healthy brain ageing.

While not everyone with MCI progresses to dementia, individuals with diabetes are at significantly higher risk. Alzheimer's disease is the most common cause of dementia, accounting for 60%-80% of all cases. It is a progressive neurodegenerative condition marked by significant buildup of a protein called beta-amyloid and abnormal form of a protein called tau in the brain. These changes are accompanied brain inflammation and a reduced capacity to utilize glucose efficiently, that eventually lead to the damage and loss of the neurons.

There is a well-established link between diabetes and Alzheimer's disease. Although not an official clinical diagnosis, some researchers have used the term "Type 3 Diabetes" to underscore the metabolic aspect of Alzheimer's, particularly the role of brain insulin resistance and impaired glucose metabolism in its development and progression.

## Protecting your Brain Through Metabolic Health

The good news is that improving metabolic health can also support brain health and may help reduce your risk of cognitive decline. In the study mentioned, researchers showed that people with type 2 diabetes who follow an optimal lifestyle, including not smoking, not or light-to-moderate drinking and regular physical activity, were able to slow brain aging. In fact, their "brain age gap" reduced by 1.68 years compared to those with diabetes who had non-optimal lifestyle.

This highlights the powerful impact of adopting healthy habits. Making positive lifestyle change, such as exercising

regularly, eating a well-balanced diet, and maintaining a healthy body weight, could protect both your body and brain.

### References:

- Dove A, Wang J, Huang H, Dunk MM, et al. Diabetes, Prediabetes, and Brain Aging: The Role of Healthy Lifestyle. (2024) *Diabetes Care*. Oct 1;47(10):1794-1802. doi: 10.2337/dc24-0860.
- 2025 Alzheimer's disease facts and figures. *Alzheimers Dement*. 2025 Apr 29;21(4): e70235. doi: 10.1002/alz.70235.

