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**Diabetes mellitus and Alzheimer's disease: GSK-3 $\beta$  as a potential link**

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**Highlights**

- GSK-3 $\beta$  is involved in the physiological and pathological progress of DM and AD respectively.
- In DM, GSK-3 $\beta$  is one of the key factors leading to insulin deficiency and insulin resistance.
- In AD, GSK-3 $\beta$  plays an important role in hyperphosphorylation of microtubule-associated protein tau.
- GSK-3 $\beta$  as a potential link between DM and AD is reviewed.
- GSK-3 $\beta$  as a link between DM and AD further supports that AD is regarded as Type 3 diabetes.

**Abstract:** It is well known that Alzheimer's disease (AD) is closely related to diabetes mellitus (DM), and AD is also regarded as Type 3 diabetes (T3D). However, the exact link between AD and DM is still unclear. Recently, more and more evidence has shown that glycogen synthase kinase-3 $\beta$  (GSK-3 $\beta$ ) may be the potential link between DM and AD. In DM, GSK-3 $\beta$  is the crucial enzyme of glycogen synthesis, which plays a key role in regulating blood glucose. More importantly, GSK-3 $\beta$  is one of the key factors leading to insulin deficiency and insulin resistance, and insulin resistance is an important hallmark of the occurrence and development of DM. In AD, GSK-3 $\beta$  plays an important role in hyperphosphorylation of microtubule-associated protein tau (tau), which is one of the pathological features in AD. GSK-3 $\beta$  is one of the important kinases of tau phosphorylation and is involved in the insulin/phosphoinositide 3-kinase/protein kinase B (insulin/PI3K/Akt) signaling pathway. Dysfunction of the insulin/PI3K/Akt signaling pathway, which regulates glucose metabolism in the brain, can lead to tau hyperphosphorylation in the brain of AD patients. Additionally, insulin resistance in DM

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