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# The Hippocampal and Cortical Neuroprotective Effect of Silicon Reducing Proinflammatory Cytokines in a Late-Stage Type 2 Diabetes Mellitus Rat Model †

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**Abstract:** There is a close correlation between type 2 diabetes mellitus (T2DM) and cognitive impairment leading to dementia. Lately, the incidence of T2DM-related dementia has increased with population aging. Factors such as oxidative stress and inflammatory responses may contribute to the brain dysfunction in diabetes. The major inflammatory response found in diabetic rat brains occurs through the activation of nuclear factor-kappa B (NF-κB), and consequently, the expression of pro-inflammatory cytokines. Silicon is a micronutrient with antidiabetic, antioxidant, and anti-inflammatory properties; however, its effects on the inflammatory responses in the brain of T2DM rats are unclear. This study aimed to evaluate the anti-inflammatory effect of silicon in the cerebral cortex and hippocampus of late-stage T2DM rats. A late-stage diabetic model was established by injection of a low-dose streptozotocin plus nicotinamide combined with following the experimental diets. Sixteen rats were divided into two groups. Diabetic group (D) was fed a saturated-fat hypercholesterolemic diet containing a control restructured meat matrix (RM). In the treatment group, silicon was included into RM as a functional ingredient (D-Si). The NF-kB, interleukin-6 (IL-6) and tumor necrosis factor-α (TNF-α) levels were measured by immunohistochemistry in cortex and hippocampus. Silicon down-regulated NF-κB activation, showing lower pNF-κB-labeled cells and lower immunoreactivity in both cortex and hippocampus ($p < 0.05$). TNF-α levels decreased in both brain areas of D-Si rats ($p < 0.05$); whereas IL-6 levels were only decreased in cortex ($p < 0.05$). These results showed that silicon decreased the NF-κB pro-inflammatory pathway in cortex and hippocampus of late-stage T2DM rats. However, it would be interesting a further comprehension of underlying mechanisms. It can be concluded that silicon administration as a functional ingredient may offer a novel nutritional strategy in neuroprotection of T2DM-associated cognitive impairment.

**Keywords:** silicon; type 2 diabetes mellitus; neuroprotection; inflammation; functional food