

Volumetric and Cellular Analysis of the Hypothalamus of streptozocin-Induced Diabetic Sprague-Dawley Rats observed over 21 days

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BACKGROUND AND OBJECTIVES: The global cost of diabetes mellitus (DM) diagnosis and treatment is estimated at 1 trillion USD, prompting experimental research for drug development. Poorly controlled DM is associated with neuronal loss and glial alterations in the hypothalamus, a key regulator of metabolic homeostasis. Streptozotocin (STZ) is widely used to induce diabetes in animal models, but dosing (25–70 mg/kg) and observation periods (14–40 days) vary, influencing outcomes. While the 21-day duration is frequently used to observe physiological parameters, there is limited data on structural and volumetric changes in the hypothalamus that could occur within 21 days. Such data helps determine whether the physiological effects of diabetes correspond with structural hypothalamic changes, improving understanding of underlying mechanisms.

MATERIALS AND METHODS: Brains of 16 [Normal, n=8, STZ-diabetic, n=8] SDR were used. Slide-mounted cryosectioned brains were stained with either Cresyl violet for cell counts and volumes or Giemsa for apoptotic cells in ARC, PVN, VMH, and DMH hypothalamic nuclei. Volumes and cell counts were done using ImageJ software in photomicrographs taken by a microscope camera, and means were compared in SPSS software.

RESULTS: There were no significant volumetric differences between diabetic and normal groups in the hypothalamic nuclei: ARC ($p = 0.192$), PVN ($p = 0.214$), VMH ($p = 0.229$), and DMH ($p = 0.161$). Neuronal counts were also not significantly different in ARC ($p = 0.096$), PVN ($p = 0.980$), VMH ($p = 0.889$), and DMH ($p = 0.650$). Apoptotic cell counts similarly showed no significant differences in ARC ($p = 0.629$), PVN ($p = 0.792$), VMH ($p = 0.623$), and DMH ($p = 0.847$). These results suggest that three weeks of STZ-induced DM had no effects on the hypothalamic nuclei.

CONCLUSION: The 21-day STZ-DM does not induce changes in the volume, cell count, and apoptosis in the hypothalamus.