

SEPTINTOJI TARPTAUTINĖ KONFERENCIJA

THE 7th INTERNATIONAL CONFERENCE

2026 m. liepos mėn. 7-10 d., Vilniaus universitetas, LIETUVA

7th-10th of July, 2026, Vilnius University, LITHUANIA

**EVOLIUCINĖ MEDICINA:
ŽMOGAUS RAIDOS PERSPEKTYVOS IR SVEIKATA
BESIKEIČIANČIOJE APLINKOJE**

**EVOLUTIONARY MEDICINE:
PERSPECTIVES ON HUMAN DEVELOPMENT AND HEALTH
CONSEQUENCES IN A CHANGING ENVIRONMENT**

Rengėjas:

Vilniaus universiteto Medicinos ir sveikatos mokslų
Doktorantūros mokykla, VU Medicinos fakultetas

Organized by

the Doctoral School of Medicine and Health sciences
at Vilnius University, VU Faculty of Medicine

STRESS UNDER THE MICROSCOPE: BETA-CELL AND NUCLEAR MORPHOMETRY IN EXPERIMENTAL TYPE 1 DIABETES

Hiba ACHAHBAR CHARKI¹, Ruta VOSYLIUTE², Renata SIMKUNAITE-RIZGELIENE², Justinas BALEISIS³, Romualdas RUDYS³, Inga BIKULCIENE^{3,4}

¹Faculty of Medicine, Vilnius University, Vilnius, Lithuania

²Department of Anatomy, Histology and Anthropology, Institute of Biomedical Sciences, Faculty of Medicine, Vilnius University, Vilnius, Lithuania

³Department of Preclinical Research, Centre for Innovative Medicine, Vilnius, Lithuania

⁴Department of Physiology, Biochemistry, Microbiology and Laboratory Medicine, Institute of Biomedical Sciences, Faculty of Medicine, Vilnius University, Vilnius, Lithuania

Contact e-mail: hiba.achahbar@mf.stud.vu.lt

Background and Aim: Chronic psychological stress and type 1 diabetes mellitus (T1DM) are associated with pancreatic beta-cell dysfunction, but their combined effects on beta-cell morphology remain unclear. This study evaluated morphometric alterations in pancreatic beta-cells within the islets of Langerhans under conditions of chronic psychological stress and experimental T1DM.

Materials and Methods: 33 mature healthy Wistar rats were randomly assigned to four experimental groups: Control ($n=7$), Stress ($n=8$), T1DM ($n=11$), and T1DM+Stress ($n=7$). T1DM was induced by a single intraperitoneal streptozotocin injection (65 mg/kg). Chronic psychological stress was induced using a restraint stress protocol. On day 29, animals were anaesthetised, and pancreatic tissue was collected for histological analysis. Sections were stained with toluidine blue, and beta-cell morphometric evaluation was performed using QuPath software (version 0.4.4). A total, 1,982 beta-cells and their nuclei were measured.

Results: Mean beta-cell size was highest in the Control group (14.71 μm), followed by the Stress group (13.47 μm), T1DM (11.04 μm), and T1DM+Stress (11.32 μm). Significant differences were found between all groups except a smaller but significant difference between the T1DM and T1DM+Stress groups. Mean nucleus size was highest in the Control (7.72 μm), followed by the Stress (7.29 μm), T1DM (6.74 μm), and T1DM+Stress (6.86 μm). Statistically significant differences were found in all groups, except T1DM vs T1DM+Stress.

Conclusions: Morphometric analysis showed a progressive reduction in beta-cell size and their nuclei, indicating structural alterations associated with both chronic psychological stress and T1DM. While psychological stress alone induced moderate morphological changes, experimental T1DM led to a more pronounced reduction in beta cells, consistent with greater cellular damage.

The observed differences suggest that both stress and diabetes negatively affect pancreatic islet morphology, although the additional impact of stress in established T1DM appears limited.

Keywords: beta-cells, morphometry, pancreatic islets, psychological stress, type 1 diabetes mellitus