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

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

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STRUCTURAL CARDIAC REMODELING: CARDIOMYOCYTE AND NUCLEAR MORPHOMETRIC CHANGES ASSOCIATED WITH TYPE 1 DIABETES AND CHRONIC PSYCHOLOGICAL STRESS

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Background and Aim: Cardiovascular disease is a major cause of morbidity and mortality in individuals with type 1 diabetes mellitus (T1DM), with diabetes-associated metabolic disturbances contributing to structural and functional cardiac abnormalities. Chronic psychological stress is also recognised as a contributing factor to both metabolic and cardiovascular dysfunction. This study aimed to investigate the individual and combined effects of Type 1 diabetes mellitus and chronic psychological stress on cardiac tissue remodelling.

Materials and Methods: Groups in this study were: Control (n = 9), Stress (n = 9), induced using a 28-day restraint stress protocol; T1DM (n = 7), induced using streptozotocin (65 mg/kg); and T1DM + Stress (n = 8). On day 29, the animals were anaesthetised, and the hearts were removed for histological analysis using H&E staining. Cardiac tissue sections were evaluated using QuPath (0.4.4). A total of 1,650 longitudinally sectioned cardiomyocytes and their nuclei were measured. Statistical analysis was performed using Microsoft Excel.

Results: A statistically significant increase in cardiomyocyte size was observed in all experimental groups compared with the Control (17 µm): Stress (20.25 µm), T1DM (21.86 µm), and T1DM+Stress (22.45 µm). Statistical analysis also revealed significant differences in cardiomyocyte nuclear size across all groups (p < 0.001): Control (6.96 µm), Stress (7.4 µm), T1DM (7.86 µm), and T1DM + Stress (8.88 µm).

Conclusions: The increase in cardiomyocyte and nuclear size in both the Stress and T1DM groups suggests that each condition alone is sufficient to induce myocardial hypertrophy. Since the T1DM group exhibited larger cardiomyocytes and nuclei than the Stress group, diabetes appears to have a more pronounced effect on cardiac remodelling. The T1DM+Stress group

demonstrated the greatest increases in cardiomyocyte and nuclear size, suggesting that chronic stress exacerbates diabetes-induced cardiac damage. These findings may indicate additive or potentially synergistic pathological mechanisms.

Keywords: cardiac morphology, cardiomyocytes, psychological stress, type 1 diabetes mellitus