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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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Vilniaus universiteto Medicinos ir sveikatos mokslų
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A PILOT INVESTIGATION OF PANCREATIC PSEUDOISLET SIZE AND MONOCYTE INTERACTIONS IN A NOVEL MICROFLUIDIC PLATFORM WITH IMPLICATIONS FOR TRANSPLANT OUTCOMES

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Background and Aim: The optimal size of pseudoislets differentiated from human induced pluripotent stem cells (hiPSCs) for functional success in transplantation remains unknown. This study introduces a novel microfluidic system designed to trap *beta* cells and facilitate the controlled aggregation of varied pseudoislets sizes for comparative *in vitro* analysis.

Materials and Methods: Fabricated via soft lithography using polydimethylsiloxane (PDMS), the system employs hydrodynamic traps composed of micropillars to aggregate cells into spheroids: „U” shaped trap for 100 µm islets and „W” shaped double traps for 50 µm islets. To validate the system’s biocompatibility and fluid dynamics, a pilot test using THP-1 monocytes was conducted. Viability of the cells was counted in the supernatant.

Results: This microfluidic device allows constant culture medium flow through the islet and between the micropillars ensuring optimal diffusion of oxygen, nutrients and removal of waste products. The dead space in the system is reduced to a minimum in order to achieve a high spatio-temporal resolution when switching culture medium in glucose stimulated insulin secretion test. Bright field and fluorescence microscopy are available to perform on the chip without removal of the pseudoislets from the trap. Although the small diameter of individual monocytes led to their washout from the traps, the system consistently maintained cell viability above 90% across varied flow protocols.

Conclusions: These results indicate that the microfluidic design provides a biocompatible environment with low shear stress, establishing a robust foundation for future research into the optimal size of hiPSC-derived pseudoislets for clinical transplantation.

Keywords: *beta* cell, hydrodynamic trap, microfluidic, monocytes, PDMS