

## **Abstract (AJ)**

Mesenchymal stem cells (MSC) are multipotent cells that serve to regenerate tissue in the body. One of the most important sources of MSC is adipose tissue, from which cells can be isolated easily and in large quantities. The behavior of cell culture *in vitro* is mainly influenced by the biomaterial's physicochemical properties, the cell's properties and the culture medium's composition.

The dissertation thesis aimed to study the behavior of adipose tissue-derived mesenchymal stem cells (ADSC). Their adhesion, growth and differentiation towards smooth muscle cells were investigated in an *in vitro* cultivation environment influenced by the composition of the culture medium, physicochemical properties of the biomaterial and dynamic stimulation of the culture.

Galectin-3 was found to mediate ADSC adhesion to the culture substrate surface by interacting with integrin receptors. ADSC also showed adhesion interaction with fibroblast growth factor 2 (FGF-2) and vascular endothelial growth factor A (VEGF-A). FGF-2 also promoted ADSC proliferation, whereas VEGF-A did not. ADSC were cultured on polylactide foils with various surface modifications (argon plasma treatment, polyethylene glycol or dextran coating). The surface modifications positively affected the adhesion and growth of ADSC. Surface modifications did not affect ADSC differentiation towards smooth muscle cells, which was induced by biochemical differentiation factors in the culture medium. ADSC proliferated on soft porous 3D scaffolds made of polylactide and polycaprolactone. The material without the addition of hydroxypropyl cellulose was the most suitable for cell proliferation. However, cells did not penetrate deep into the material. Dynamic stimulation of the culture resulted in increased cell proliferation on the porous scaffold. Cells also proliferated on polylactide meshes prepared by 3D printing. In this case, the cells penetrated deep into the material, and when cocultured with human umbilical vein endothelial cells with dynamic stimulation, pre-capillary structures were formed.

This work provided new insights into the behavior of ADSC *in vitro* under different culture conditions. The obtained results will potentially be used in regenerative medicine or cardiovascular tissue engineering where ADSC are applied.

**Keywords:** mesenchymal stem cells from adipose tissue, adhesion, proliferation, differentiation, smooth muscle cells, fibroblast growth factor 2, vascular endothelial growth factor A, galectin-3, polylactide, polycaprolactone, 3D printing, cardiovascular tissue engineering