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ANALISIS GEN BIOMARKER KONDROGENESIS KOLAGEN TIPE II *ADIPOSE MESENCHYMAL STEM CELL* PADA *SCAFFOLD* NANOFIBER PHA/*SILK* DENGAN BERBAGAI RASIO

(xvi + 73 halaman, 17 tabel, 6 bagan, 8 lampiran)

ABSTRAK

Tujuan
Kerusakan tulang rawan akibat obesitas, usia, genetik, atau cedera menyebabkan tulang rawan tipis dan rusak secara permanen. Penelitian ini bertujuan untuk mengetahui potensi *adipose mesenchymal stem cells* (ADSCs) dalam regenerasi jaringan dalam jalur kondrogenik sebelum digunakan untuk terapi pada kondisi defisiensi tulang rawan untuk meminimalkan risiko operatif.

Metode
ADSCs diekstraksi dari jaringan adiposa pasien melalui proses *liposuction*. Lipoaspirat diolah dan sel punca diisolasi kemudian dikultur selama 21 hari. Kombinasi *scaffold* nanofiber biomaterial dari *Polyhydroxyalkanoates* (PHA)/*silk* dengan rasio PHA/*Silk* 3:1 dan 0:4. Setelah 21 hari, potensi kondrogenesis dievaluasi dengan menganalisis ekspresi gen biomarker kondrogenesis kolagen tipe II menggunakan *real time* PCR.

Hasil
Hasil *fold change* kontrol positif adalah 1, ADSCs + *scaffold* nanofiber PHA/*Silk* 3:1 menunjukkan *fold change* sebesar 0.01, ADSCs + *scaffold* nanofiber PHA/*Silk* 0:4 menunjukkan *fold change* sebesar 7.57, dan hasil *fold change* kontrol negatif adalah 0.91.

Kesimpulan
Penurunan ekspresi gen pada kontrol negatif disebabkan oleh kurangnya sinyal spesifik dari medium DMEM + FBS yang tidak dirancang untuk diferensiasi kondrogenik, penurunan ekspresi gen pada ADSCs + scaffold PHA/Silk 3:1, diperkirakan akibat sifat hidrofobik PHA P(3HB-co-3HHx) yang mengurangi penyerapan protein serum, menurunkan adhesi sel, dan menghambat sel untuk proliferasi, pada ADSCs + *scaffold* nanofiber PHA/*Silk* 0:4 peningkatan ekspresi gen terjadi karena *silk* menghasilkan produk degradasi yang tidak toksik, sel dikultur pada medium yang didesain khusus untuk jalur kondrogenik serta peran penting *scaffold silk* dengan sifat hidrofiliknya yang memfasilitasi adhesi sel, kemampuan interaksi elektrostatik, kehalusan permukaan, dan banyaknya ikatan hidrogen.

Kata Kunci: ADSCs, Kondrogenesis, Kolagen Tipe II, *Scaffold* PHA/*Silk*

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ANALYSIS OF CHONDROGENESIS BIOMARKER GENES COLLAGEN TYPE II IN ADIPOSE MESENCHYMAL STEM CELLS ON PHA/SILK NANOFIBER SCAFFOLD WITH VARIOUS RATIOS

(xvi + 73 pages, 17 table, 6 chart, 8 appendices)

ABSTRACT

Objective

Damage to cartilage due to obesity, age, genetics, or injury leads to thinning and permanent damage of the cartilage. This research aims to determine the potential of adipose mesenchymal stem cells (ADSCs) in tissue regeneration, particularly in the chondrogenic pathway before their use in therapy for cartilage-deficient conditions to minimize operative risk.

Method

ADSCs were extracted from patient adipose tissue through a liposuction process. Lipoaspirate was processed, stem cells were isolated, and then cultured for 21 days. A combination of nanofiber biomaterial scaffold from Polyhydroxyalkanoates (PHA)/silk with a PHA/Silk ratio of 3:1 and 0:4 was used. After 21 days, chondrogenic potential was evaluated by analyzing the gene expression of chondrogenesis biomarkers, type II collagen, using real-time PCR.

Result

The fold change result for the positive control was 1. ADSCs + scaffold nanofiber PHA/Silk 3:1 showed a fold change of 0.01, ADSCs + scaffold nanofiber PHA/Silk 0:4 exhibited a fold change of 7.57, and the fold change for the negative control was 0.91.

Conclusion

Decrease in gene expression in the negative control was due to the lack of specific signals from the DMEM + FBS medium, which was not designed for chondrogenic differentiation. The reduced gene expression in ADSCs + scaffold PHA/Silk 3:1 was presumed to result from the hydrophobic nature of PHA P(3HB-co-3HHx), reducing serum protein absorption, cell adhesion, and inhibiting cell proliferation. In ADSCs + scaffold nanofiber PHA/Silk 0:4, the increased gene expression occurred because silk produced non-toxic degradation products, cells were cultured in a medium specifically designed for the chondrogenic pathway, and the significant role of the hydrophilic scaffold silk facilitated cell adhesion, electrostatic interaction ability, surface smoothness, and numerous hydrogen bonds.

Keywords: ADSCs, Chondrogenesis, Collagen Type II, PHA/Silk Scaffold