

PENGARUH STARVASI TERHADAP KEMAMPUAN MIGRASI SEL PUNCA MESENKIMAL TALI PUSAT DENGAN METODE SCRATCH ASSAY

ABSTRAK

Latar Belakang: Terapi sel punca mesenkimal (SPM) tengah berkembang pesat. SPM sebagai sel penyusun keseluruhan tubuh melalui potensi regenerasi dan diferensiasi menjadi berbagai turunan sel yang spesifik. Keterbatasan terapi SPM yaitu respon rejeksi tubuh resipien terhadap sel punca donor, proses diferensiasi, dan migrasi tidak terkontrol. Upaya mengatasi keterbatasan tersebut dengan mengembangkan prekondisi starvasi pada SPM melalui sinkronisasi siklus sel pada fase *quiescence* sehingga sel dapat beradaptasi pada lingkungan rendah nutrisi.

Tujuan: Penelitian ini bertujuan untuk mengetahui pengaruh starvasi terhadap kemampuan migrasi sel punca mesenkimal tali pusat manusia dengan metode *scratch assay*.

Metode: Penelitian ini menggunakan metode *quasi experimental* dengan pendekatan *post test only with control group*. SPM dibagi menjadi tiga kelompok perlakuan yaitu media DMEM+FBS sebagai media komplit (MK), media DMEM *only* sebagai starvasi serum (BASAL) dan media HBSS sebagai starvasi asam amino (HBSS). Sampel didapatkan dari pengambilan gambar mikroskop inversi pada jam ke-4,8,24, dan 48. Proses editing dan kuantifikasi persentase luas penutupan migrasi sel SPM menggunakan *ImageJ*. Analisis data menggunakan *One-Way ANOVA* dilanjutkan dengan uji statistik *Post-Hoc Games Howell*.

Hasil: Rerata Persentase luas penutupan migrasi SPM tertinggi pada kelompok MK ($82,80 \pm 15,37\%$) dengan durasi starvasi 48 jam dan terendah pada kelompok HBSS ($21,29 \pm 7,91\%$) dengan durasi starvasi 4 jam. Nilai statistik menunjukkan terdapat perbedaan signifikan ($p < 0,05$) kemampuan migrasi pada kelompok MK, BASAL, dan HBSS pada jam ke-4 dan 8. Selain itu, Terdapat perbedaan signifikan ($p < 0,05$) rerata kemampuan migrasi pada media BASAL dan HBSS.

Kesimpulan: Kemampuan migrasi pada kelompok HBSS lebih lambat dibandingkan kelompok lainnya. Durasi starvasi terbaik pada tiga kelompok media pada jam ke-4 dan 8.

Kata Kunci: Migrasi, Sel punca mesenkimal. Siklus sel, Starvasi

THE EFFECT OF STARVATION ON THE MIGRATION ABILITY OF HUMAN UMBILICAL CORD MESENCHYMAL STEM CELLS USING THE SCRATCH ASSAY METHOD

ABSTRACT

Background: Mesenchymal stem cell (MSC) therapy is rapidly advancing. MSCs, as the building blocks of the entire body, have the potential for regeneration and differentiation into various specific cell derivatives. Limitations of MSC therapy include the recipient's immune rejection response to donor stem cells, as well as uncontrolled differentiation and migration processes. One approach to address these limitations is to develop a starvation preconditioning for MSCs through synchronization of the cell cycle in the quiescence phase, allowing the cells to adapt to nutrient-poor environments.

Objective: This study aims to determine the effect of starvation on the migration ability of human umbilical cord mesenchymal stem cells using the scratch assay method.

Methods: This study used a quasi-experimental design with a post-test only control group approach. MSCs were divided into three treatment groups: DMEM+FBS as the complete medium (MK), DMEM only as serum starvation (BASAL), and HBSS as amino acid starvation (HBSS). Samples were obtained by capturing inverted microscope images at 4, 8, 24, and 48 hours. The process of editing and quantifying the percentage of cell migration area closure was performed using ImageJ. Data analysis was conducted using One-Way ANOVA followed by Post-Hoc Games Howell statistics.

Results: The average percentage of migration area closure was highest in the MK group ($82.80 \pm 15.37\%$) with 48 hours of starvation and lowest in the HBSS group ($21.29 \pm 7.91\%$) with 4 hours of starvation. Statistical values indicated significant differences ($p < 0.05$) in migration ability between the MK, BASAL, and HBSS groups at 4 and 8 hours. Additionally, significant differences ($p < 0.05$) were found in the average migration ability between the BASAL and HBSS media.

Conclusion: The migration ability of the HBSS group was slower compared to the other groups. The best starvation duration for all three media was at 4 and 8 hours.

Keywords: Cell cycle, Mesenchymal stem cells, Migration, Starvation