

**EVALUATION OF BONE MARROW MESENCHYMAL STEM CELLS GROWTH *IN VITRO* FOR CARTILAGE TISSUE ENGINEERING**

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ABSTRACT

Stem cell has been widely researched during the last decade due to its potential to differentiate into many cell types. This study attempts to compare the growth of bone marrow mesenchymal stem cells (BMMSC) aspirated from rabbits' iliac crest and femur in two culture media i.e. (1) α -Minimum Essential Medium (α -MEM) and, (2) the mixture of Ham F12 Nutrient Mixture and Dulbecco's Modified Eagle Medium (FD). Growth kinetics assessment used in this study includes cell viability, total cell yield, growth rate, population doubling time and total number of cell doubling. FD was found to be an appropriate culture medium to promote better BMMSC growth. BMMSC from iliac crest region showed better proliferation potential than the femur region. Hence, it can be inferred from this study that BMMSC harvested from the iliac crest site and cultured in FD medium is better than femur samples in terms of growth profile.

1.0 Introduction

The needs for stem cells in tissue engineering arise from limited availability of differentiated cells, morbidity of a harvest procedure at the donor site, limited proliferative capacity and biosynthetic activity of adult progenitor cells or differentiated cells. Stem cells are characterized as self-renewing unspecialized cells that have the ability to divide for indefinite periods in culture and differentiate into many types of specialized cells in the body. They have the capacity to regenerate or repair tissues that have been damaged due to injury, ageing or disease, and thus important in tissues that do not have the ability to regenerate spontaneously such as articular cartilage. Ease of availability and high capacity of *in vitro* expansion are thus making stem cells an attractive cell source for cartilage tissue engineering. Other than BMMSC,

stem cells can be harvested and undergo chondrogenesis from periosteum (1), adipose derived stem cells (2), muscle (3), synovium (4), and umbilical cord blood (5). This study attempted to evaluate the growth of BMMSC harvested from femur and iliac crest in *in vitro*. Although stem cell has been widely researched during the last decade, basic research is still necessary to develop its full potential for cartilage tissue engineering.

2.0 Materials and Methods

This study was approved by the IIUM Research and Ethical Committee. Mononuclear cells (n=6) were isolated from femur BMMSC and iliac crest BMMSC. Cells were cultured in two culture media; α -MEM and FD until passage 3 under the same conditions as depicted in Figure 1. Cells

proliferation activity was evaluated by means of growth kinetics study. Cells viability was determined using Trypan Blue Dye exclusion test. Non-parametric statistical analysis

was carried out since the data was not normally distributed. The differences were considered significance when $p < 0.05$.

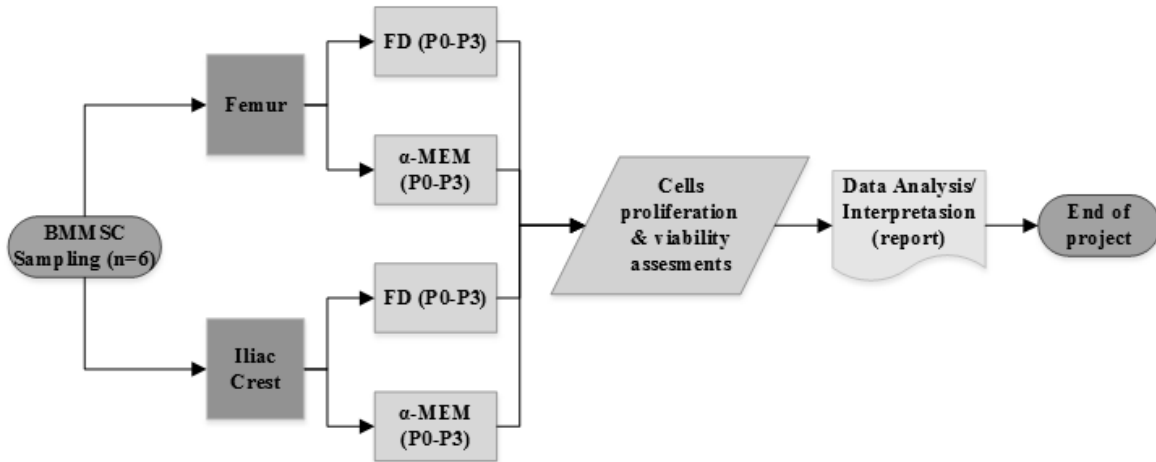


Fig. 1 Summary of methodology

3.0 Results

The morphology of BMMSC cultured in α -MEM from both harvesting sites changed from polygonal to become more fibroblast-like throughout passages. Conversely, BMMSC cultured in FD maintained the fibroblast-like structure in culture. The viability of BMMSC in all groups ranged from 83.3% until 94.1%. Although, femur BMMSC cultured in α -MEM showed higher total cell yield (1.499 million) than the other three groups, iliac crest BMMSC cultured in FD showed better potential than the others in terms of growth rate, population doubling time and total number of cell doubling. The differences were significant statistically.

4.0 Discussion and Conclusion

The study revealed the growth of BMMSC from iliac crest region is better than the femur region. Besides, from the result obtained, it can be found that FD served as an appropriate culture medium than α -MEM to promote better BMMSC growth. It can be inferred from this study that BMMSC that harvested from iliac crest site and cultured in FD medium is better than other samples in terms of its cell viability, population doubling time and total number of cell doubling.

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