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Research Article

Selaginella bryopteris Aqueous Extract Improves Stability and Function of Cryopreserved Human Mesenchymal Stem Cells

Abhishek Kumar Singh,¹ Anubhuti Jha,² Arindam Bit,³ Andrey P. Kiassov,⁴ Albert A. Rizvanov,⁴ Archit Ojha,^{3,5} Pooja Bhoi,^{3,5} Pradeep Kumar Patra,⁶ Awanish Kumar,⁷ and Akalabya Bissoyi⁵

¹Department of Biochemistry, University of Allahabad, Allahabad 211002, India

²Department of Biotechnology, National Institute of Technology, Raipur 492010, India

³Department of Biomedical Engineering, National Institute of Technology, Raipur 492010, India

⁴Kazan Federal University, Kazan, Russia

⁵Shona Lab, Centre for Brain Development and Repair, InStem National Centre for Biological Sciences, Bangalore, Karnataka 560065, India

⁶Department of Biochemistry, Pt. JNM Medical College, Raipur 492001, India

Correspondence should be addressed to Awanish Kumar; awankb@nitrr.ac.in and Akalabya Bissoyi; bissoyiakalabya@gmail.com

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The effective long-term cryopreservation of human mesenchymal stem cells (MSCs) is an essential prerequisite step and represents a critical approach for their sustained supply in basic research, regenerative medicine, and tissue engineering applications. Therefore, attempts have been made in the present investigation to formulate a freezing solution consisting of a combination of *Selaginella bryopteris* water-soluble extract with and without dimethyl sulfoxide (Me₂SO) for the efficient long-term storage of human umbilical cord blood- (hUCB-) derived MSCs. The cryopreservation experiment using the formulated freezing solution was further performed with hUCB MSCs in a controlled rate freezer. A significant increase in postthaw cell viability and cell attachment of MSCs was achieved with freezing medium containing *Selaginella bryopteris* water extract along with 10% Me₂SO as compared to the freezing medium containing Me₂SO (10% v/v) alone. Furthermore, the decreasing apoptotic events and reactive oxygen species production along with increasing expression of heat shock proteins also confirmed the beneficial effect of *Selaginella bryopteris* water extract. The beneficial effect of *Selaginella bryopteris* water extract was validated by its ability to render postpreservation high cell viability. In conclusion, the formulated freezing solution has been demonstrated to be effective for the standardization of cryopreservation protocol for hMSCs.

1. Introduction

In the last few decades, the advent of stem cell research has been a promising milestone in the field of cryobiology. Mesenchymal stem cells (MSCs) are specialized cells with a wide range of multiple therapeutic properties like anti-inflammatory, antiapoptotic, antifibrotic, and immunomodulatory along with tumor tropism and differentiation [1, 2].

These cells possess an extensive array of functional properties, and an account of which has been very well documented [3, 4]. Considering various applications including versatile therapeutic nature of MSCs, their long-term storage is of grave importance. However, different groups of researchers have estimated the effect of cryopreservation on the phenotype of MSCs, but a complete effectiveness of cryopreservation protocol remains elusive [5]. Therefore,



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