

## A Holistic View of the Mesenchymal Stem Cells – Ready for Every Request

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### KEY WORDS

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Mesenchymal stem/stromal cells (MSCs) are isolated from various tissues—adult bone marrow, dental pulp & adipose tissues and fetal tissues – umbilical cord and placenta. These cells are the topmost potential candidates for regenerative and immunomodulatory therapies due to their remarkable capacity for self-renewal, differentiation into tissue-specific cells, anti-inflammatory, angiogenic and antibacterial properties. MSCs also safeguard and regulate tissue homeostasis by their presence in various adult tissues. They orchestrate their functions both through engraftment and secretion of trophic factors (1).

The fundamental of MSC based therapy lies on the ability of these cells to migrate to the injury sites and mediate their effects in the microniche. Furthermore, the diverse treatments with MSCs are proven to be safe and well tolerated due to their immunoprivileged status. There has been extensive literature where MSCs have been and are being used as therapeutic intervention in preclinical models as well as in clinical trials (2).

The exquisite quality of these cells lies in their capacity to be utilised as biologics in a varied number of conditions, they are available on demand for the aforementioned properties. Since the pathophysiology of numerous diseases has similar regulation factors, MSCs act as ALL IN ONE functional medicine if utilised in a proper way. Their robustness is effectively demonstrated in many studies but there are discordant outcomes too, which makes it difficult to effectively translate into the clinic. This clinical variability is expected due to different sources of MSCs, variable potency based upon age, gender or diseased condition. Moreover, the technical issue of obtaining a high number of cells for systemic

administration also comes with its challenges. Furthermore, for the better therapeutic results, MSCs need to have prolonged survival and longevity, proliferation capacity and active vascularization. Over the past few years, several approaches have been used to prime the MSCs for efficacious therapeutic application (3).

One of the promising aspects of licensing these MSCs is through prenatal exercises, Reports are coming about how exercises can empower these cells in their endogenous niche and transfer of the empowered cells can happen through mother to foetus. One such study by *Gao et al.* depicts the programmed phenotype in the offspring of mothers who practices aerobic exercises during pregnancy (4). Another recent study in a preclinical rat model of infraction has suggested the beneficial effects of synergistic action of MSCs and aerobic exercises on extracellular matrix and fetal gene expression (5). Likewise, treadmill exercises in synergy with MSCs have a protective effect on synaptic formation and axonal regeneration in an ischemic cerebrovascular preclinical model (6). Interestingly, vigorous exercise regime before pregnancy leads to an increase in endothelial progenitor cells in the umbilical cord that could potentially enhance the cardiovascular fitness of the child (7). Our group has shown the positive effect of prenatal yoga protocols on better functional capacity of MSCs (*unpublished data*). These preliminary studies point towards empowerment of MSCs through various form of aerobic exercises and yoga exercises. The development of standard procedures for preparation, preconditioning of MSCs followed by their functional characterisation forms the basis of clinical utility of MSC transplantation.

From a national healthcare perspective, a blend of traditional *yog kriyas* and regenerative medicine could lead to the development of potential therapeutics to improve the quality of life of a huge number of people suffering from debilitating diseases and conditions.

## References

1. Gao G, Fan C, Li W, Liang R, Wei C, Chen X, et al. Mesenchymal stem cells: ideal seeds for treating diseases. *Hum Cell*. 2021 Nov;34(6):1585–600.
2. Sharma A, Chakraborty A, Jaganathan BG. Review of the potential of mesenchymal stem cells for the treatment of infectious diseases. *World J Stem Cells*. 2021 Jun 26;13(6):568–93.
3. Caplan H, Olson SD, Kumar A, George M, Prabhakara KS, Wenzel P, et al. Mesenchymal Stromal Cell Therapeutic Delivery: Translational Challenges to Clinical Application. *Front Immunol*. 2019 Jul 31;10.
4. Chaves A, Weyrauch LA, Zheng D, Biagioni EM, Krassovskaia PM, Davidson BL, et al. Influence of Maternal Exercise on Glucose and Lipid Metabolism in Offspring Stem Cells: ENHANCED by Mom. *J Clin Endocrinol Metab*. 2022 Jul 14;107(8):e3353–65.
5. de Freitas JS, Neves CA, Del Carlo RJ, Belfort FG, Lavorato VN, Silame-Gomes LHL, et al. Effects of exercise training and stem cell therapy on the left ventricle of infarcted rats. *Revista portuguesa de cardiologia*. 2019 Sep;38(9):649–56.
6. Jiang XH, Li HF, Chen ML, Zhang YX, Chen HB, Chen RH, et al. Treadmill exercise exerts a synergistic effect with bone marrow mesenchymal stem cell-derived exosomes on neuronal apoptosis and synaptic-axonal remodeling. *Neural Regen Res*. 2023 Jun;18(6):1293–9.
7. Onoyama S, Qiu L, Low HP, Chang CI, Strohsnitter WC, Norwitz ER, et al. Prenatal Maternal Physical Activity and Stem Cells in Umbilical Cord Blood. *Med Sci Sports Exerc*. 2016 Jan;48(1):82–9.

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