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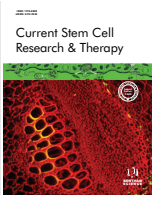
REVIEW ARTICLE

Comparison of the Characteristics of Breast Milk-derived Stem Cells with the Stem Cells Derived from the Other Sources: A Comparative Review



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Abstract: Breast milk (BrM) is not only a nutrition supply but also contains a diverse population of cells. It has been estimated that up to 6% of the cells in human milk possess the characteristics of mesenchymal stem cells (MSC). Available data also indicate that these cells are multipotent and capable of self-renewal and differentiation to other cells. In this review, we have compared different characteristics such as CD markers, differentiation capacity, and morphology of stem cells derived from human breast milk (hBr-MSC) with human bone marrow (hBMSC), Wharton's jelly (WJMSC), and human adipose tissue (hADMSC). The literature review revealed that human breast milk-derived stem cells specifically express a group of cell surface markers, including CD14, CD31, CD45, and CD86. Importantly, a group of markers, CD13, CD29, CD44, CD105, CD106, CD146, and CD166, were identified which were common in the four sources of stem cells. WJMSC, hBMSC, hADMSC, and hBr-MSC are potently able to differentiate into the mesoderm, ectoderm, and endoderm cell lineages. The ability of hBr-MSCs in differentiation into the neural stem cells, neurons, adipocyte, hepatocyte, chondrocyte, osteocyte, and cardiomyocytes has made these cells a promising source of stem cells in regenerative medicine, while isolation of stem cells from the commonly used sources, such as bone marrow, requires invasive procedures. Although autologous breast milk-derived stem cells are an accessible source for women who are in the lactation period, breast milk can be considered a source of stem cells with high differentiation potential without any ethical concern.

Keywords: Mesenchymal stem cell, breast milk, bone marrow, Wharton's jelly, adipose tissue, differentiation.

1. INTRODUCTION

Breast milk (BrM) is not just a nutrition supply, it also contain a wide range of bioactive molecules, such as hormones, growth factors, cytokines, and antioxidants, involved in the normal development of the offspring. BrM also contains a diverse population of cells such as lactocytes, myoepithelial cells, progenitor cells, and stem cells [1-3]. The cellular composition of human milk is dynamic, and the proportion of different cell types can be changed by many factors, such as the stage of lactation, health, and infant feeding. Cells in the BrM include probiotic bacteria, immune cells, desquamated epithelial cells as well as stem cells [2]. Generally, BrM cells are categorized as blood-derived and breast-derived cells, and in both of these sources, a small subpopulation of progenitor or stem cells has been identified. Interestingly, some of these cells are able to pass through the infant's gastrointestinal tract and populate in some tissues such as the brain, spleen, liver, and lymph nodes [1, 3]. Although extensive research has been carried out on the field of breast milk stem cells, the source and origin of multipotent cells found in breast milk are still not completely addressed.

Several studies have shown that BrM contains a group of cells expressing typical features of stem cells. For example, it has been shown that some of them express mammary stem cell and epithelial progenitor markers such as α6 integrin (CD49f) and p63 [4, 5]. Evidence also indicates that these cells are multipotent [5]. These cells have the capability of self-renewal, and under certain conditions, can undergo differentiation towards at least two types of epithelial lineages, milk proteins-producing CK18+ luminal cells and CK14+ myoepithelial cells [6].

Evidence indicates that a mesenchymal stem cell-like population exists in BrM. It has been estimated that up to 6% of the cells in human milk have the characteristics of MSCs [7]. MSCs are self-renewing, highly proliferative, and potentially differentiating cells with adherent growing features [8]. This population was positive for MSC surface markers such as CD44, CD29, SCA-1 and negative for

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stem cells in regenerative medicine. Often, isolation of stem cells from the commonly used sources, such as bone marrow, requires invasive procedures. Although autologous breast milk-derived stem cells are an accessible source for lactating women, breast milk is a non-invasive and abundant source of stem cells, with high potential cells for differentiation without any ethical concern. Several studies indicate hBr-MSC have the potency to differentiation to a wide variety of cells; however, more studies are needed to further clarify the characteristics of the differentiated cells and their functionality.

LIST OF ABBREVIATIONS

BrM	=	Breast milk
MSC	=	Mesenchymal Stem Cell
hBr-MSC	=	Human Breast Milk MSC
WJMSC	=	Warton Jelly MSC
hBMSC	=	Human Bone Marrow MSC
hADMSC	=	Human Adipose MSC
ESC	=	Embryonic Stem Cell
USC	=	Urine-derived Stem Cells
PDB-MSC	=	Placenta Decidua Basalis-derived Stem Cell
EEC	=	Endometrial Epithelial Cell
ESC	=	Endometrial Stromal Cell

CONSENT FOR PUBLICATION

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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