Acta Scientific Veterinary Sciences (ISSN: 2582-3183)

Volume 3 Issue 1 January 2021

Editorial

Re-Evaluation of Milk Components and Stem Cells

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Received: October 31, 2020

Published: November 21, 2020

Milk is a wholesome food, contains nutritional and non-nutritional elements. Nutritional elements like carbohydrates, proteins, fats, vitamins and minerals provide building blocks of cell and tissue growth of not only to the young ones but to the adult and elderly humans. Non-nutritional components may include non-cellular biomolecules like immunoglobulins, cytokines and antimicrobials, while the cellular component include various cell types mainly inflammatory cells, lactocytes, and stem cells. Cellular components of milk may provide direct or indirect non-nutritional elements required for the growth of young ones. Of these various cellular components, existence of stem cells in milk are of particular interest. The presence of stem cells in the milk was reported earlier in human [1,2] and later in murine and bovine [3,4]. Molecular characteristics of milk-derived stem cells were positive for hematopoietic stem cell markers ($CD34^+$, $CD133^+$, and $CD\ 123^+$), mesenchymal stem cell markers ($CD90^+$, $CD44^+$, $CD271^+$, and $CD146^+$) [5], endothelial progenitor cell marker ($CD105^+$) and embryonic stem cell markers ($OCT4^+$, $SOX2^+$, $NANOG^+$, and TRA 60-1^+) [1]. Cellular characteristic of milk-derived stem cells includes multipotency *in vitro* assay and demonstrated adipogenic, chondrogenic and osteogenic differentiation capacity, suggesting the possibility of utilizing these special cells for therapeutic applications [4]. About 30 - 40% of cells of bovine milk were immunopositive with mesenchymal makers - $CD90^+$, $CD73^+$ and $CD105^+$ and pluripotent stem cell markers- $SOX2^+$ and $OCT4^+$ [4].

Milk production is a function of mammary epithelial cells (MEC) means the number and secretory activity of MEC determines the quantum of milk production. More the numbers of MEC, more the milk will be produced. Though, various efforts have been exercised to stimulate growth of mammary gland development (for larger size and more parenchymal tissues) including genetic, nutritional and managemental efforts during the growth period of calf and during pregnancy. Likewise, during pregnancy, due to elevated levels of two hormones, estrogen and progesterone, allometric mammary growth occurs. Upon reaching peak level of milk production (2 - 3 months after calving in cow), milk production started decline till the onset of the dry period. The length of the dry period, in cow, is usually 2 months and is very crucial for mammary growth, cell turnover optimally required for ensuing lactation. Loss of MEC, after peak lactation, is the main reason for the decline in milk yield. Furthermore, disease conditions, such as mastitis and heat stress, induce MEC apoptosis and results in loss of milk production. Thus, the restoration of MEC in the mammary gland is critical to prevent loss of milk production. Recent rapid progress in stem cell research raises promising approach to use stem cell technology in the mammary development and enhanced regeneration of mammary tissue. Investigators attempting to reduce losses in milk production after the peak lactation, by enhancing tissue regeneration by manipulation of mammary stem cells using exogenous administration of nucleotide analogs inosine [6] or xanthosine [7,8].

The presence of stem cells in milk opens new possibilities of *in vivo* application for mammary tissue growth and regeneration in veterinary science. Milk of dairy animals like cow, buffalo, sheep and goat may be evaluated for the presence of pluripotent or multipotent stem cells for possible role in therapeutic applications as well as novel role of these stem cells in young ones [9].

Figure : Cow milk showing various nutritional and non-nutritional components. Presence of special types of cells, in particular stem cells, is of particular importance in mammary tissue regeneration.

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