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Letter to Editor

The miR-29 family as novel therapeutic option for retroviral infection; Letter to the editor

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Introduction

Dear Editor;

microRNA is a small non-coding RNA (about 18-22 nucleotides) molecules which regulate post-translation process in eukaryotic cells by interfering with messenger RNAs (mRNAs); There are 1900 different microRNAs which can cause silencing different gene expression in humans [1]. According to the review of literatures, expression levels of microRNAs are alternated during infection which can be used as diagnosis biomarker for monitoring of treatment [1-2].

The miR-29 families in human include hsa-miR-29a, hsamiR-29b-1, hsa-miR-29b-2, and hsa-miR-29c which are coded by MIRN29 in chr 7q32.3 (position 6651878-6651943) in human [3]. The miR-29 family is regulated by extracellular matrix, cell proliferation, differentiation, apoptosis and inflammatory process of human [3-4]. In recent years, it is suggested that the role of the microRNA 29 family in retroviral pathogenesis particularly HIV-1, HTLV-1 and HCV infections is significant. There are serious limited information about the potential roles of the miR-29 family in retroviral pathogenesis. The aim of this study was to report the potential role of the miR-29 members on retroviral pathogenesis in present short letter.

The PI3K-Akt signaling pathway is known as an important signaling pathway during retroviral infection because of its role in cell death and survival. Initially, the microRNAs influenced the PI3K-Akt signaling pathway which were obtained by searching in microRNA databases including DIANAmT, miRanda, miRDB, miRWalk, RNA hybrid, PITA, mirtarget, RNA22, PICTAR5 and Targetscan. The microRNAs influenced several genes of PI3K-Akt signaling pathway and were selected for subject study. On the other hand, we performed a systematic search of original papers to provide microRNAs reported based on practical study and to compare with our results.

This investigation showed that, there are miR-155, miR-125a and miR29 which are common between our bioinformatics and previous published papers. Then, the expression levels of the microRNAs (miR-155, miR-125a and miR29) are evaluated in differentially expressed genes (DEGs) analysis using Gene Expression Omnibus (GEO) databases. We noted that expression levels of the miR-29 are down-regulated in retroviral infection compared to healthy individuals (Accession numbers: GDS4231, GDS4227, GDS4390). Subsequently, we determined targets of the miR-29 members on the PI3K-Akt (KEGG pathway: hsa04151) for next evaluation (Figure 1).

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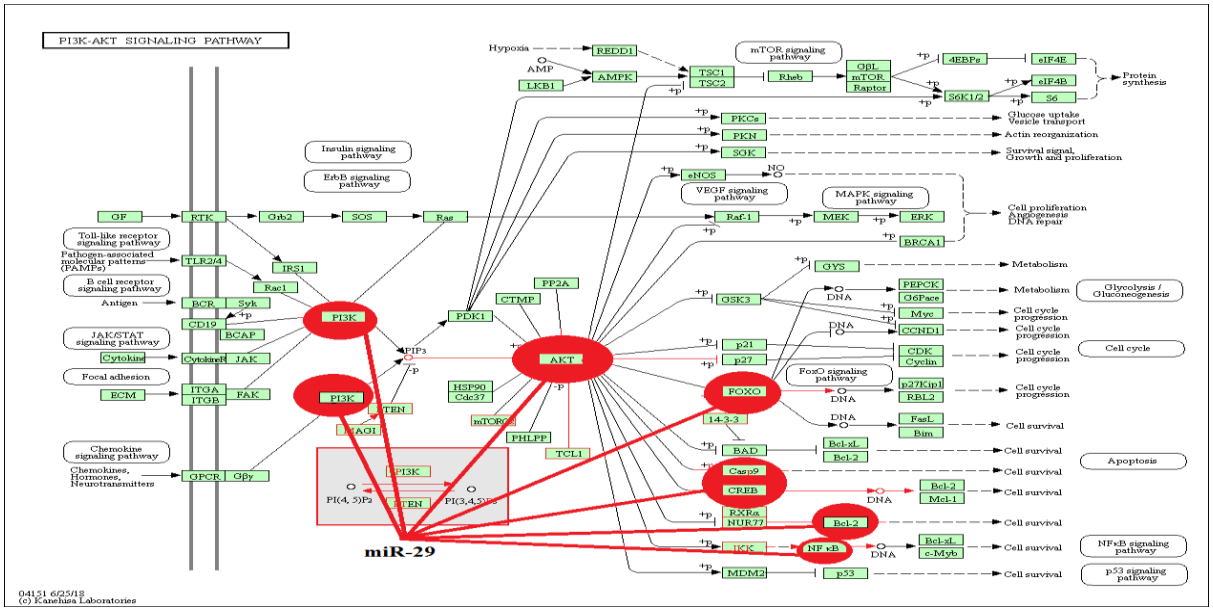

Fig. 1. The miR-29 targeting option in PI3K-Akt signaling pathway.

Finally, the miR29 family role in PI3K-Akt was constructed by Cytoscape software (Figure 2). We concluded that the miR-29 members influenced numerous genes in the PI3K-Akt particularly AKT3 which activated cascade for proliferation, death and pro-inflammatory process.

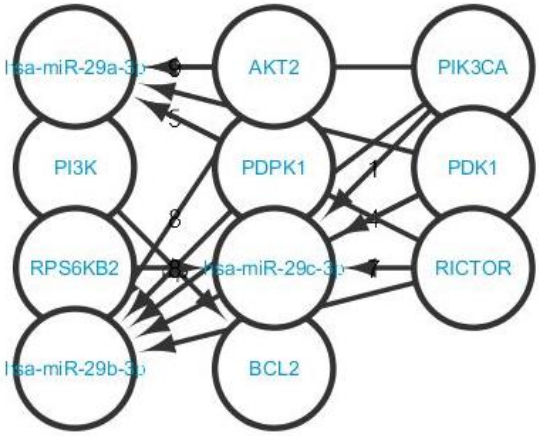

Fig. 2. The network interaction of the miR29 members and their outcomes.

According to Adoro et al. microRNA-29 has antiviral effects which are induced by IL-21 throughout STAT3 signaling cascade. They found that HIV viremia declined due to up-regulation of MIR29 gene in mice [5]. McCaffrey et al have shown that the miR29 expression levels are reduced following administration of TGF-β during HCV infection. In addition, they reported that miR-29 can cause reduction of fibrosis and inhibition of HCV replication [6]. Saito et al. suggested that the expression levels of PI3K-Akt signaling pathway are upregulating in HTLV-1 infection caused by Tax oncoprotein which leads to cell proliferation and HTLV-1 replication; in which miR29 is down-regulate during HTLV-1 infection [7]. The miR-29 has critical role in regulation of apoptosis, cell proliferation and induction of pro-inflammatory response in response to intracellular pathogeneses; therefore, targeting of the miR29 expression by retroviral plays key role in cell proliferation and evading from immune-response [8].

In summary, we accomplished the in silico survive for determination of the miR-29 role in the PI3K-Akt signaling pathway using various microRNA online databases. In addition, the expression level of miR-29 during retroviral infection by GEO database information provide several documents which can imply potential role of the miR-29 family as novel therapeutic option against retroviral infection particularly HIV, HTLV-1 and HCV infection cases.

Conflict of Interests

None to declared.

Ethcal Considerations

The Ethics Committee of Mashhad University of Medical Sciences was approved the study.

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References

1. Catto JW, Alcaraz A, Bjartell AS, White RD, Evans CP, Fussel S, Hamdy FC, Kallioniemi O, Mengual L, Schlomm T, Visakorpi T, et al. MicroRNA in prostate, bladder, and kidney cancer: a systematic review. Eur Urol. 2011;59(5):671-81.
2. Keikha M, Karbalaei M. Antithetical Effects of MicroRNA Molecules in Tuberculosis Pathogenesis. Adv Biomed Res. 2019;8:3-5.
3. Kriegel AJ, Liu Y, Fang Y, Ding X, Liang M. The miR-29 family: genomics, cell biology, and relevance to renal and cardiovascular injury. Physiol Genomics. 2012;44(4):237-44.
4. Moles R, Nicot C. The emerging role of miRNAs in HTLV-1 infection and ATLL pathogenesis. Viruses. 2015;7(7):4047-74.
5. Adoro S, Cubillos-Ruiz JR, Chen X, Deruaz M, Vrbanac VD, Song M, Park S, Murooka TT, Dudek TE, Luster AD, Tager AM, et al. IL-21 induces antiviral microRNA-29 in CD4 T cells to limit HIV-1 infection. Nat Commun. 2015;6:7562.
6. Bandyopadhyay S, Friedman RC, Marquez RT, Keck K, Kong B, Icardi MS, Brown KE, Burge CB, Schmidt WN, Wang Y, McCaffrey AP, et al. Hepatitis C virus infection and hepatic stellate cell activation downregulate miR-29: miR-29 overexpression reduces hepatitis C viral abundance in culture. J Infect Dis. 2011;203(12):1753-62.
7. Saito K, Saito M, Taniura N, Okuwa T, Ohara Y. Activation of the PI3K–Akt pathway by human T cell leukemia virus type 1 (HTLV-1) oncoprotein Tax increases Bcl3 expression, which is associated with enhanced growth of HTLV-1-infected T cells. Virol. 2010;403(2):173-80.
8. Advay S, Ahmadi A, Abdi M, Arabzadeh A M. Study of miR-29a-5p Expression in HIV Positive and HIV/HCV Co-Infected Patients in Sanandaj-Iran, Hepat Mon. 2017;17(1):e41594.