

MicroRNAs; their therapeutic and biomarker properties

ABSTRACT

MicroRNAs (miRNAs) are, small (roughly 19–25 nucleotides in length), conserved, non-coding, single-stranded, and functional RNA molecules with the properties of gene expression regulation through mRNA degradation, translation repression, mRNA deadenylation as well as gene silencing via histone methylation. They even have the ability to increase gene expression levels. The biogenesis of miRNAs is divided into two canonical and non-canonical pathways. The second pathway has a divergent mechanism for the biogenesis of miRNAs. miRNAs can be transcribed from specific genes or introns of protein-coding genes. A single miRNA species can control the expression of hundreds of genes, and also one gene can be the target of different miRNAs. These molecules have been identified in eukaryotic organisms such as mammals and plants and even in viruses. miRNAs play an inevitable role in the life cycle of eukaryotic cells. They are involved in any biological processes such as the regulation of cell proliferation and differentiation, apoptosis, signaling, and defense responses through their spatio-temporal expression manner. Aberrant expression of miRNAs is involved in a large number of biological disorders, which illustrates their great potential to be applied in the diagnosis and treatment of various diseases. miRNA inhibitors (anti-miRs) and artificial miRNAs (miRNA mimics) are two general approaches to balance the dysregulated miRNA levels that make it possible to treat various biological disorders. In this study, in general, the biogenesis and the role of miRNAs, the origin of miRNAs, viral miRNAs, miRNA detection procedures, in silico miRNA analysis tools, miRNA-based therapies and their obstacles, and miRNAs as potential non-invasive biomarkers are discussed. Finally, it is stated the importance of dietary miRNAs.