Anti-viral Potential of Small Double-stranded RNA (dsRNA) Produced by Food Fermenting Lactic Acid Bacteria

Imrat
Department of Anatomy, All India Institute of Medical Sciences, New Delhi, India

Rajendra Kumar Labala
Bioinformatician, Laboratory of Genomics and Bioinformatics Institute of Molecular Genetics of the Czech Academy of Sciences, Prague, Czech Republic

Kumaraswamy Jeyaram
Department of Anatomy, All India Institute of Medical Sciences, New Delhi, India

Abstract:

Recent years, the role of human endogenous microRNA in immunomodulation is well recognised. However, the diversity and role of exogenous microRNA from the food fermenting lactic acid bacteria and human gut bacteria are not yet investigated. In this study, we investigated the diversity and functionality of small double-stranded RNA (dsRNA) produced by different lactic acid bacterial species predominantly present in the naturally fermented foods of Northeast India, to understand the potential health promotion properties. We characterised the dsRNA produced by 12 different species of lactic acid bacteria. The dsRNA was selectively extracted from bacterial culture, purified, and sequenced in Illumina NextSeq500 platform. Millions of dsRNA sequences generated with a size range of 18-51 bases were analysed by using custom made Python and Perl scripts. Our results showed that the dsRNAs were unique to each species range from 2041 to 20949 dsRNA sequences per species, and very few dsRNA sequences were common to all the lactic acid bacteria studied. Further in-silico analysis predicted the targets of these dsRNAs on the human transcriptome; most of these dsRNAs are having potential targets in cancer and inflammatory-related pathways. We also predicted the anti-HIV potential of these dsRNAs by using bioinformatics tools and successfully validated the antiviral activity of the dsRNA more abundantly (9.17 % of the dsRNA fraction) produced by Bacillus subtilis MTCC5480, which has much higher base complementarity values than previously reported miRNAs studied for anti-HIV activity. Our study has given a new dimension and several new leads on dsRNA-based health promotion potential of food fermenting bacteria.

Keywords:

Fermented foods, Lactic acid bacteria, dsRNA production, in-silico prediction, anti-viral activity.