Computational Analysis of MicroRNA Variants Regulating GLUT3 in ADHD

Lee, Aden Geonhee (School: Phillips Exeter Academy)

This study aimed to investigate the role of microRNA (miRNA) variants in Attention Deficit-Hyperactivity Disorder (ADHD). ADHD is characterized by inattention, impulsivity, and sugar cravings, which are believed to relate to decreased glucose metabolism in the brain. The gene encoding Glucose Transporter 3 (GLUT3), SLC2A3, plays a crucial role in neuronal glucose metabolism. This study utilized various bioinformatics tools such as TargetScan, miRNASNP, RNAfold, RNA22, PRIMER1, and PSRR to identify and analyze miRNA variants that bind to SLC2A3 mRNA, which suggests changes in GLUT3 function. The study identified two conserved miRNAs (hsa-miR-103a-3p, hsa-miR-107) that target SLC2A3 mRNA. The single nucleotide polymorphisms (SNPs) rs769854452 and rs901180005 had a significant impact on the folding energy of the mRNA and miRNAs hsa-miR-103a-3p and hsa-miR-107, respectively. Negative G energy change of hsa-miR-103a-3p by SNP rs769854452 implied increased mature miRNA expression, while positive G energy change of hsa-miR-107 by SNP rs901180005 implied decreased mature miRNA expression. The miRNA and SLC2A3 mRNA binding analysis also revealed that rs901180005 resulted in a complete target loss, while rs769854452 partially regained binding function. This study designed Tetra arms PCR for miRNA SNP genotyping. Predictive drug analysis revealed that fluorouracil may target rs769854452, and ginsenoside Rh2 may target rs901180005. In conclusion, this study suggests that miRNA variants can affect the regulation of SLC2A3 mRNA and thus impact GLUT3 function, providing a new avenue for understanding the genetic basis of ADHD and potential targets for therapeutic intervention. Further studies are needed to validate these findings and explore their implications for ADHD treatment.

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