Is Maternal Cigarette Smoking Connected to Neurodevelopmental Disorders in Fetuses? An Analysis of Critical Genes Associated with Neurodevelopmental Disorders in Cord Blood Cells

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The detrimental effects of smoking during pregnancy are readily visible. Despite several studies linking prenatal smoking to fetal brain damage and subsequent neurodevelopmental disorders, the mechanisms involved remain poorly understood. In our present study, we investigated DNA methylation: an epigenetic factor that commonly correlates with transcriptional silencing. We aimed to examine the methylation patterns of DNA samples from umbilical cord blood cells to establish the fetus's predisposition to neurodevelopmental and other critical disorders. The study was conducted on DNA isolated from cord blood cells from delivering mothers who; i) smoked cigarettes (case) and, ii) were not exposed to cigarette smoke during pregnancy (control). Whole genome analysis revealed differentially methylated regions (DMRs) between these groups. Gene ontology (GO) enrichment and pathway enrichment performed in these regions highlighted processes of multicellular organ development, system development, and regulation of multicellular organismal processes. The disease annotation function analysis indicated that the methylated genes can be mostly classified as schizophrenia, Alzheimer's disease, and many cancer-related genes. This shows that prenatal cigarette smoke exposure is correlated with adverse mutations in genes which may lead to neurodevelopmental disorders.

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder with many underlying causes and severities. Ultimately, it impairs social interaction, communication, and learning. We utilized GPT-4 from OpenAI to compare our data to Simons Foundation Autism Research Initiative (SFARI) autism genes database. This process revealed that our differentially methylated regions were implicated in over 800 autism genes. Furthermore, we are investigating an X-linked biomarker for autism; FMR1, as the sex chromosomes were not yet analyzed. Our research helps shape understanding of the mechanisms underlying neurodevelopmental disorders like ASD. Our methylation data contributes sites of importance along the human genome of all manners as they relate to prenatal cigarette smoke exposure.