Review Paper

Exploring the Interplay of Maternal and Prenatal Factors in the Development of Autism Spectrum Disorder: Insights for Future Research and Intervention.

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ARTICLE DETAILS	ABSTRACT
	Autism Spectrum Disorder (ASD) has a multifactorial aetiology, and while the role of maternal/ prenatal factors in its development has been recognized, their contribution remains poorly understood. ASD, which presents with difficulties in communication and social interaction, is affected by a combination of genetic, environmental, and neurobiological influences. Genetics is estimated to contribute about half the risk for ASD, and coupled with environmental risk factors such as maternal exposure to toxins, stress, and birth complications, these societal burdens seems pretty formidable. This review, by synthesizing the available evidence from multiple studies, identifies prominent maternal and prenatal risk factors such as advanced maternal age and delivery by caesarean section. The findings underscore the need for enhanced early identification and targeted interventions to support affected individuals. Limitations of the present studies, including variability in design and measurement methods, emphasize the necessity for further longitudinal research to elucidate causal relationships. Ultimately, this review aims to inform future research endeavours and intervention strategies, contributing to better outcomes for individuals with ASD.

1. Introduction

1.1 Background

Autism spectrum disorder (ASD) is a lifelong neuro developmental condition that affects an individual's ability to communicate, interact, and engage with the world around them. The prevalence of ASD has been steadily increasing over the past few decades, the prevalence of ASD in the world was 0.6%. The prevalence of ASD in Asia was 0.4%, America 1%, Europe 0.5%, Africa 1%, and Australia 1.7%(Salari et al., 2022). Understanding the underlying causes and pathological mechanisms of ASD is crucial for improving early identification, tailoring interventions, and supporting the well-being of individuals with this condition.

Numerous studies have attempted to identify the factors that contribute to the development of ASD, largely examining prenatal factors and maternal behaviors during pregnancy. A wealth of genetic studies has isolated many putative risk genes and related variants implicating a significant heritable contribution to ASD (Geschwind & State, 2015). Maternal environmental factors, including exposure to teratogens, infections and stress during pregnancy have also been associated with elevated risk of ASD (Modabbernia et al., 2017). Neurobiological studies have reported deviation from the normal trajectory of brain development, changes in connectivity and neurotransmission dynamics within the cerebral cortex (Geschwind & Levitt, 2007) There are also behavioral factors (e.g. smoking during pregnancy), associated with this higher risk of ASD (Tang et al., 2015). Despite the wealth of research on ASD, there is still a need for a comprehensive synthesis of the current evidence on the factors underlying this complex disorder.

1.2 Objective

This systematic analysis's primary aim is to synthesize the current evidence on the factors involved in developing autism spectrum disorder (ASD). By integrating findings from a broad range of studies, this analysis aims to provide a more comprehensive understanding of ASD's multifaceted nature and underlying causes.

2. Methodology

2.1 Search Strategy:

A comprehensive literature search was conducted in Google Scholar databases to identify relevant studies published between 2009 and 2024. The search incorporated a combination of keywords related to "autism spectrum disorder," "maternal," "prenatal," "factors," "pregnancy," and "Africa." Additionally, the reference lists of included studies and relevant review articles were screened to identify further eligible studies.

Inclusion and Exclusion Criteria:

Studies were included if they met the following criteria:

1. Investigated the aetiology or pathology of autism spectrum disorder (ASD).
2. Employed a clear case-control or cohort design.
3. Focused on prenatal factors associated with ASD.

Conversely, studies were excluded if they:

1. Concentrated on interventions or treatments for ASD.
2. Did not provide sufficient data for systematic analysis.

2.2 Data Extraction:

A standardized data extraction form was used to collect information on study characteristics (e.g., sample size, study design), participant demographics, exposure or outcome measures, and effect size estimates (e.g., odds ratios, and correlation coefficients).

2.3 Data Synthesis:

Random-effects systematic analysis was used to pool the effect sizes from the included studies, considering the heterogeneity between studies. Subgroup analyses were conducted to explore potential sources of heterogeneity, such as study design, population characteristics, and measurement methods.
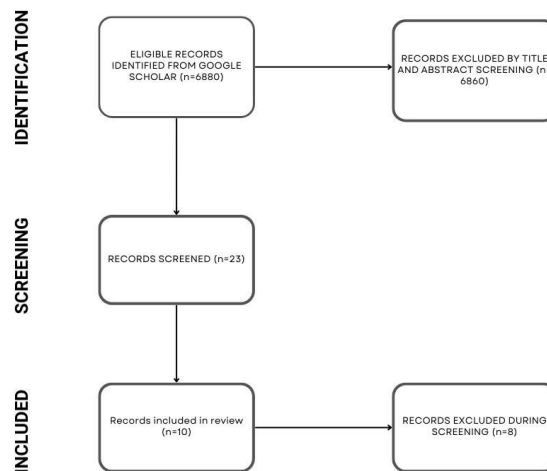
3. Results

3.1 Study Selection:

The initial search yielded 6880 potentially relevant articles. After screening and applying the inclusion/exclusion criteria, 10 studies were included in the systematic review.

3.2 Data Synthesis:

The systematic review revealed that genetic factors account for about 50% of the variance in the risk of developing ASD, with specific decreased gene expression of the MAOA, HAAO and AADAT due to their association with parental ages, iron and vitamin D3 levels. MAOA (Monoamine Oxidase A), HAAO (3-Hydroxyanthranilate3,4-Dioxygenase), AADAT (Aminoadipate Aminotransferase) genes are involved in various biochemical pathways and have been studied in relation to different health conditions, including neuro developmental disorders like autism spectrum disorder (ASD). Environmental factors, including maternal exposure to passive smoke, were also found to be significant risk factors for ASD. Other factors such as preterm labour and delivery complications leading to neonatal intensive care are associated with ASD.

4. Discussion

This comprehensive systematic analysis provides a systematic synthesis of the current evidence on the prenatal factors and maternal mechanisms underlying autism spectrum disorder. The findings highlight the risk of developing ASD due to risk factors such as caesarean section delivery, first pregnancy and mothers' older age. The results of this systematic review are generally consistent with previous studies, but offer a more holistic and up-to-date understanding of the multifaceted nature of ASD. The identified maternal and prenatal risk factors, as well as the neurobiological correlates, align with and expand upon findings from earlier reviews and meta-analyses.

5. Conclusion

This systematic review provides a comprehensive overview of the current evidence on the potential risk factors of autism spectrum disorder. The findings highlight the significant role of both maternal and prenatal factors in the development of ASD, as well as the underlying environmental alterations.

6. Recommendations

- The insights gained from this systematic review can inform the development of more targeted interventions, support strategies, and preventive measures for individuals with ASD. Continued research efforts, with a focus on longitudinal studies and the integration of multidisciplinary data, are needed to further elucidate the complex mechanisms underlying this condition.
- The insights gained from this systematic analysis have important implications for the diagnosis, treatment, and support of individuals with ASD. The identification of specific genetic variants and environmental risk factors can inform the development of targeted interventions and preventive strategies. An understanding of the underlying neurobiological mechanisms can guide the design of more effective therapeutic approaches and the optimization of support services.
- Future research should focus on longitudinal studies that can elucidate the dynamic interplay between prenatal, prenatal, and environmental factors in the development of ASD across the lifespan. Integrating data from multiple sources, such as neuro imaging, and clinical assessments, can provide a more comprehensive understanding of the complex pathways underlying this disorder.

Limitations: The main limitations of this systematic review include the heterogeneity in study designs, measurement methods, and population characteristics, which may have influenced the pooled effect sizes. Additionally, the cross-sectional nature of most included studies limits the ability to establish causal relationships between the identified factors and the development of ASD.

7. References

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