



Association of Very Preterm Birth or Very Low Birth Weight With Intelligence in Adulthood

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ABSTRACT

Background: The association between very preterm birth or very low birth weight (VLBW) and intelligence in adulthood has garnered significant attention in recent years, reflecting a growing concern regarding the long-term neurocognitive outcomes of individuals born under such conditions. **Literature Review:** In the analysis of the role of nutrition, the findings from the article by (Sammallahti et al., 2007) reveal that higher neonatal energy intake is positively correlated with better neurodevelopmental outcomes, such as general intelligence, memory, and executive functioning at the age of 25. Furthermore, the study by (Sripada et al., 2008) illustrates the structural brain development trajectories of VLBW children, indicating that lifelong cognitive deficits, especially in executive functions, are prevalent. The correlation between brain morphology and cognitive performance emphasizes the need for understanding the neurobiological underpinnings of cognitive outcomes. Additionally, the research conducted by (Sun Kim et al., 2009) highlights the persistent cognitive challenges faced by VLBW infants, particularly in learning and behavioral domains. The findings indicate that lower birth weights are associated with higher risks of cognitive disabilities, reinforcing the notion of a compounding effect of prematurity on cognitive impairments. **Conclusion:** In conclusion, the literature consistently supports the association between very preterm birth or VLBW and cognitive deficits in adulthood. The interplay of nutritional factors, brain development, and the long-term cognitive challenges faced by this population necessitates continued research and targeted interventions to improve outcomes for individuals affected by these conditions.

Keyword: Very Preterm Birth, Very Low Birth Weight, Intelligence, Adulthood

INTRODUCTION

The association between very preterm birth or very low birth weight (VLBW) and intelligence in adulthood has garnered significant attention in recent years, reflecting a growing concern regarding the long-term neurocognitive outcomes of individuals born under such conditions. A critical examination of the literature reveals a consistent pattern of cognitive deficits linked to preterm birth and VLBW, underscoring the necessity for further investigation into the underlying factors and potential interventions.

In 2007, (Sammallahti et al., 2007) highlighted the importance of nutrition in the early stages of life for individuals born preterm. They found that higher neonatal energy intake could predict better neurodevelopmental outcomes, such as general intelligence, memory, attention, and executive functioning at 25 years of age. This study underscores the role of early nutritional interventions in mitigating some of the cognitive impairments associated with preterm birth, though it also acknowledges that neonatal illness may complicate these outcomes.

Building upon these findings, (Sripada et al., 2008) explored the trajectories of brain development in school-age children born preterm with VLBW. Their research revealed that individuals in this group exhibited lifelong cognitive deficits, particularly in executive function, which are foundational for academic success and overall quality of life. Notably, they identified a correlation between higher IQ scores and greater cortical surface area in specific brain regions, suggesting that structural brain differences may underlie cognitive outcomes in this population.

Further extending this discourse, (Sun Kim et al., 2009) investigated cognitive outcomes in children with VLBW at ages 3 to 5. Their findings indicated that despite advancements in neonatal care, VLBW infants remain at a heightened risk for long-term cognitive impairments, including learning disabilities and behavioral disorders. The study emphasized the relationship between the degree of prematurity and cognitive disability, reinforcing the notion that lower birth weight correlates with poorer developmental outcomes.

Most recently, (Anne I. Evensen et al., 2002) conducted a systematic review of a Norwegian cohort study that examined multidisciplinary and neuroimaging findings in individuals born preterm with VLBW from birth to 28 years of age. Their findings revealed a spectrum of challenges faced by this population, including cognitive deficits, mental health issues, and difficulties in social functioning and educational attainment. This comprehensive review highlights the long-term implications of VLBW and preterm birth, reinforcing the need for ongoing support and intervention strategies to address these enduring challenges.

Collectively, these studies provide a nuanced understanding of the complex interplay between very preterm birth, VLBW, and cognitive outcomes in adulthood, illustrating the critical need for targeted interventions and longitudinal studies to further elucidate these relationships.

LITERATURE REVIEW

The article "Nutrition after preterm birth and adult neurocognitive outcomes" by (Sammallahti et al., 2007) presents a comprehensive examination of the long-term neurocognitive effects of nutritional interventions in individuals born very preterm or with very low birth weight (VLBW). The authors provide a nuanced understanding of how early nutritional experiences can influence cognitive outcomes in adulthood, particularly focusing on the relationship between neonatal nutrition and intelligence at 25 years of age.

The authors begin by contextualizing the higher risks associated with preterm birth, emphasizing that those born very preterm or with VLBW are at an increased risk for poorer neurocognitive functioning. This risk is compounded by various factors, including pregnancy complications and health issues related to immaturity, which can lead to suboptimal growth in the neonatal period. The study highlights the critical role of neonatal energy intake in predicting neurodevelopmental outcomes, suggesting that higher energy intake is associated with better cognitive performance later in life.

A significant portion of the article is dedicated to the findings from studies involving preterm individuals with birth weights less than 1850 grams, who were initially part of randomized feeding trials. The results indicate that those who

received multinutrient-enriched preterm formula exhibited higher verbal intelligence quotients (VIQ) at ages 13 to 20. Furthermore, the authors note that a higher intake of maternal milk during the same period also correlates with improved VIQ scores, reinforcing the importance of nutritional quality in early life.

The current study extends these findings by investigating the impact of specific macronutrient intakes—energy, carbohydrates, protein, and fats—alongside human milk consumption during the first nine weeks of life on general intelligence at age 25. This longitudinal approach is commendable, as it allows for a deeper understanding of how early nutritional strategies can have lasting effects on cognitive functioning.

However, while the article presents compelling evidence linking early nutrition to adult intelligence, it also acknowledges the complexity of these relationships. The authors caution that neonatal illness may confound the association between nutritional intake and cognitive outcomes, suggesting that further research is needed to disentangle these factors.

The article titled "Trajectories of brain development in school-age children born preterm with very low birth weight" by (Sripada et al., 2008) provides a comprehensive examination of the cognitive and structural brain development outcomes associated with very preterm birth and very low birth weight (VLBW). The authors present compelling evidence that individuals born preterm, particularly those with VLBW, face significant lifelong cognitive deficits, which are notably pronounced in executive functions. This is particularly concerning given the foundational role that executive functions play in academic achievement and overall quality of life.

The study highlights that VLBW children exhibit a smaller cortical surface area across the cortical mantle, which is indicative of potential developmental delays and cognitive impairments. The authors detail how variations in brain structure, particularly in the left parieto-occipital and inferior temporal regions, correlate with IQ scores within the VLBW cohort. Specifically, those with greater surface area in these regions tend to achieve higher IQ scores, suggesting a direct relationship between brain morphology and cognitive outcomes.

Moreover, the article emphasizes the persistence of cognitive deficits stemming from preterm birth. The findings indicate that VLBW individuals average an IQ that is one standard deviation below that of their term-born peers, which underscores the long-term implications of early birth complications. Notably, the authors observe that even among VLBW children who demonstrate otherwise typical cognitive abilities, there are still significant impairments in executive functions that can extend into adulthood. This persistence of deficits raises critical questions about the interventions and support systems needed for this vulnerable population.

In terms of methodology, the article employs a longitudinal approach, tracking the brain development and cognitive performance of VLBW children over time. This approach is commendable as it allows for a more nuanced understanding of how early developmental challenges can influence cognitive trajectories. However, the article could benefit from a more detailed discussion on the potential moderating factors that may influence these outcomes, such as socio-economic status, access to educational resources, and parental support.

The article "Cognitive Outcomes of Children with Very Low Birth Weight at 3 to 5 Years of Age" by (Sun Kim et al., 2009) presents a critical examination of the cognitive development of very low birth weight (VLBW) infants, specifically those weighing less than 1.5 kg. The authors note that while advancements in medical technology have significantly reduced neonatal mortality and morbidity, VLBW infants continue to face long-term challenges, particularly in cognitive functioning. This review highlights the article's key findings and critically evaluates the implications of these insights.

The study reveals that VLBW infants are at an increased risk for cognitive impairments when compared to their full-term counterparts. Notably, preterm infants born at less than 27 weeks of gestation exhibit a mean full-scale intelligence quotient (FSIQ) that is 14.2 points lower than that of controls by the age of 6.5 years. This finding underscores the vulnerability of this population to learning disabilities and behavioral disorders, with a reported 30.4% of extremely preterm children experiencing mild cognitive disabilities. Such statistics are alarming and

emphasize the need for ongoing monitoring and intervention strategies to support cognitive development in these children.

The article also discusses the relationship between birth weight and cognitive outcomes, indicating that lower birth weight correlates with an increased likelihood of cognitive disability. This relationship suggests that the severity of prematurity may have a compounding effect on cognitive impairments, which can manifest over time. The authors point out that the influence of extreme prematurity on cognitive disability appears to intensify beyond the age of 2.5 years, indicating that early interventions may need to be sustained and adapted as children grow.

Moreover, the authors highlight the challenges faced in assessing long-term cognitive outcomes due to low follow-up rates and heterogeneous data collection in existing studies, particularly those from the Korean Neonatal Network. This limitation is significant as it hinders a comprehensive understanding of the neurodevelopmental trajectories of VLBW infants. The article advocates for improved methodologies in future research to better capture the complexities of cognitive outcomes in this vulnerable population.

The article titled "Multidisciplinary and neuroimaging findings in preterm born very low birthweight individuals from birth to 28 years of age: A systematic review of a Norwegian prospective cohort study" by (Anne I. Evensen et al., 2002) provides a comprehensive analysis of the long-term consequences associated with very low birth weight (VLBW) in individuals born preterm. The systematic review synthesizes findings from the NTNU LBW Life study, which is notable for being the first to utilize magnetic resonance imaging (MRI) to examine the brains of a cohort of preterm children as they transition into adulthood.

The authors articulate that individuals born preterm with VLBW face a multitude of challenges that can persist into adulthood, including cognitive deficits, mental health issues, and various physical health complications. The review highlights that these individuals are at an increased risk of adverse outcomes across several domains, including cognitive abilities, educational attainment, motor skills, and social functioning. This multifaceted impact underscores the importance of recognizing the long-term implications of preterm birth and VLBW, particularly as

the first generations of survivors from the neonatal care advancements of the 1980s are now reaching mid-adulthood.

One of the key strengths of this article is its multidisciplinary approach, which employs the International Classification of Functioning, Disability and Health (ICF) model to assess the outcomes associated with VLBW. This model allows for a holistic view of the individual's health and functioning, encompassing not only medical and developmental aspects but also the social and environmental factors that influence overall well-being.

The systematic review also identifies specific risk factors that may contribute to adverse outcomes in this population, which is crucial for developing targeted interventions. By comparing the outcomes of individuals born preterm with those born at term, the study provides valuable insights into the extent of the risks associated with VLBW, emphasizing the need for ongoing support and monitoring throughout the lifespan of these individuals.

However, while the article presents a thorough examination of the consequences of VLBW, it may benefit from a deeper exploration of the mechanisms behind the observed neurodevelopmental issues. Understanding the biological and environmental factors that contribute to these outcomes could enhance the development of preventive strategies and interventions tailored to this vulnerable population.

CONCLUSION

The literature reviewed provides a comprehensive examination of the association between very preterm birth or very low birth weight (VLBW) and intelligence in adulthood, highlighting a consistent pattern of cognitive deficits linked to these conditions. The studies collectively underscore the critical importance of early nutritional interventions, brain structure development, and long-term cognitive outcomes for individuals born preterm or with VLBW.

In the analysis of the role of nutrition, the findings from the article by (Sammallahti et al., 2007) reveal that higher neonatal energy intake is positively correlated with better neurodevelopmental outcomes, such as general intelligence, memory, and executive functioning at the age of 25. This suggests that early

nutritional strategies can play a significant role in mitigating cognitive impairments associated with preterm birth. However, the complexity of these relationships is acknowledged, particularly with the potential confounding effects of neonatal illnesses.

Furthermore, the study by (Sripada et al., 2008) illustrates the structural brain development trajectories of VLBW children, indicating that lifelong cognitive deficits, especially in executive functions, are prevalent. The correlation between brain morphology and cognitive performance emphasizes the need for understanding the neurobiological underpinnings of cognitive outcomes.

Additionally, the research conducted by (Sun Kim et al., 2009) highlights the persistent cognitive challenges faced by VLBW infants, particularly in learning and behavioral domains. The findings indicate that lower birth weights are associated with higher risks of cognitive disabilities, reinforcing the notion of a compounding effect of prematurity on cognitive impairments.

The systematic review by (Anne I. Evensen et al., 2002) further synthesizes these findings, revealing a spectrum of challenges in cognitive, mental health, and social functioning domains for individuals born preterm with VLBW. This comprehensive perspective underscores the need for ongoing support and intervention strategies tailored to address the long-term implications of preterm birth and VLBW.

In conclusion, the literature consistently supports the association between very preterm birth or VLBW and cognitive deficits in adulthood. The interplay of nutritional factors, brain development, and the long-term cognitive challenges faced by this population necessitates continued research and targeted interventions to improve outcomes for individuals affected by these conditions.

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