Association between Anthropometric Status at Birth and Postnatal Growth Trajectories in Infants: Evidence for Brain Sparing Effect

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Delayed growth at birth has been associated with postnatal developmental plasticity events, where nutrients would be preferentially allocated to maintain brain growth. According to the brain-sparing hypothesis, increasing energy allocation to brain growth would favor an early catch-up of this structure. Previous studies suggest that brain growth is less affected than other tissues in fetuses with intrauterine growth restriction, and maternal nutrient restriction has a greater effect on body mass than on brain size, supporting that brain growth would be relatively more preserved. However, fetal growth impairment has been associated with altered developmental processes leading to structural alterations and poorer cognitive functioning, social achievement, and educational success, suggesting that protection is not always complete and has long-lasting effects on brain development. Postnatal growth studies that adjust to large longitudinal databases to test this hypothesis are scarce. The objective of this study is to evaluate the association between anthropometric status at birth and postnatal physical growth during the first year of life. We expect a faster physical recovery in cases of low head circumference (HC) at birth compared to recovery rate of length in cases of low length at birth. This is a longitudinal design that includes anthropometric records of 3,399 newborns in Argentina, with a minimum of 3 HC and length records during the first year of life. We used the mixed Count model to adjust longitudinal growth data based on age, comparing four categories of birth growth status, separately for each sex. Each category arises from the combination of low/normal levels of HC and length z-score (HCZ and LAZ) at birth. Recovery indicator for HC and length was taken as the time until the mean growth trajectory estimated for each category surpassed the threshold curve predicted by z-score = -2 for age (which is low/normal z-score threshold). There were significant differences between groups in all growth parameters ($p < 0.05$). Within the group with **low** HCZ and low LAZ at birth, the recovery rate of HC was higher than that of length. In the case of low z-score at birth in only one variable, newborns with low HCZ recovered HC more quickly than the recovery rate of length in individuals born with low LAZ. These results suggest that the trade-off between brain and bone growth is relevant in vulnerable infants, especially for those with low HCZ and low LAZ at birth. We found that, during the first postnatal year, those infants who presented signs of intrauterine delayed growth at birth displayed an accelerated recovery of HC growth. This finding is in line with previous studies that found that fetal brain growth is spared under adverse conditions and adds evidence to support that energy and nutrient trade-off are also present postnatally and is determined by the growth status at birth. Future studies assessing maternal nutritional status and diet habits would enrich our understanding of the extent to which specific types of malnutrition impose trade-offs on the growth of the offspring. The study contributes to the understanding of the consequences of environmental conditions on fetal growth and highlights the importance of monitoring fetal growth during critical periods.

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