Commentary: Early growth and cognitive development

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British adults who were born small for gestational age (birthweight below the fifth percentile for age at birth) in 1970 have academic difficulties that persist into adolescence. As young adults their professional and economic attainment was found to be lower than that of those born at normal birthweight. These results were obtained in the largest study to date on the long-term educational and social implications of impaired fetal growth. About 14,000 infants born in one week in the UK were included and more than 50% of them were followed-up for 26 years. Despite the observed differences in academic and professional achievement, the adults who were small at birth were as likely to be employed, married and satisfied with life as their normal birthweight counterparts. These findings raise intriguing questions about the underlying factors that led to the observed disadvantages as well as about their implications for public health worldwide.

Other studies in adults have failed to show associations between size at birth and adult cognitive performance. Some
studies in children found modest developmental delays in those who had been small at birth, whereas others only found an impact of poor fetal growth on intelligence and motor development if there were large reductions in head circumference. An explanation for the absence of an effect of poor fetal growth on cognitive performance in adult life was that the fetus responds to adverse conditions, predominantly undernutrition, by slowing down its growth and preferentially redistributing blood flow towards the head in an attempt to maintain brain development. These adaptations to protect the brain may alter the development of organs and tissues in the thorax and the abdomen which in turn might lead to coronary heart disease later in life. The results of the 1970 British Birth Cohort study, which focused on more subtle measures of mental and social development than signs of neurological abnormalities or IQ scores used in previous studies, suggests that this brain-sparing mechanism is not completely protective.

The study by Cheung et al., published in this issue, examined the influence of prenatal and postnatal growth on motor development in the first 2 years of life after birth in about 1000 babies born in Lahore in Pakistan. It is an important study for several reasons. First, it did not focus on cases with a very low birthweight, but analysed associations with motor development over the entire range of size at birth. Second, not only weight but also length at birth was available, and the study of body proportion provides further insight into fetal responses to adverse intrauterine conditions and their long term consequences. Thirdly, it also looked at the effects of growth in the first 6 months after birth, and brain growth is particularly fast in the months around birth. Finally, it studied the development of babies born in a developing country, which is relevant as the effects of adverse intrauterine conditions may vary according to the adequacy of the preconceptual nutritional condition of the mother.

Babies who were longer or fatter at birth started to walk and to build a 3-cube tower earlier than those who were short or thin. The effect of body length at birth on motor development was particularly clear in babies of below average length. Fast postnatal growth in weight as well as in length led to earlier walking, whereas only last growth in weight led to early tower building. In other words, thinness and shortness at birth as well as poor postnatal growth seem to be linked to a slower motor development in the first 2 years of life.

In an earlier report on the same group of babies, it has been shown that the psychomotor development of Pakistani children born in upper-middle class families and that of children born in industrialized countries is similar, but that the development of children born in slums or a rural village was considerably delayed. The results that are reported in this issue demonstrate, although the authors do not deal with this topic explicitly, that the differences in motor development between Pakistani children from different backgrounds persist if size at birth and early postnatal growth is taken into account. Moreover, the reported differences in motor development between children born in a rural village and those from an upper-middle class background are relatively large and correspond to a decrease in either length or weight for length of at least 3 standard deviations. This indicates that environmental factors related to poverty influence motor development in infancy and childhood independently of their effects on size at birth and postnatal growth.

Cheung et al. conclude that being short at birth appeared to be more influential than being thin. Although it is debatable to what extent this conclusion is supported by the data—the effects of shortness and thinness seem to be rather similar—it points the discussion into the right direction. Birthweight is a rather crude marker of fetal growth, and the study of body proportions at birth might provide a first step towards a better understanding of the mechanisms underlying the link between impaired fetal growth and disorders later in life. It is thought that thinness is predominantly an indication of undernutrition during the last trimester of gestation, whereas shortness might indicate undernutrition with an earlier onset.

It is suggested by Cheung et al. that ‘interventions to improve fetal and postnatal growth may be helpful in facilitating early child motor development’. The key question now is how that can be achieved. In a study in India, body size of newborn babies was strongly predicted by maternal pre-pregnancy weight, which in itself is the result of the mother’s prenatal and postnatal development as well as her energy and protein balance in adult life. This indicates the importance of interventions to improve the nutrition and growth of girls from early on in their lives. On the other hand, a rapid ‘nutritional transition’ within one generation may have disadvantages. A sudden improvement of nutrition will increase the amount of body fat in women who were deprived early on in life but not increase their height. Studies in Finland and India have shown that children of women who were relatively short and fat have an increased risk of coronary heart disease and non-insulin-dependent diabetes. Finally, as it was found that the children’s background was a more important determinant of their development than their growth in utero, the fight against poverty might be more effective than measures that solely focus on the improvement of nutrition for girls and young women. The results of the 1970 British Birth Cohort study indicate, however, that there are links between impaired fetal growth and lower academic and professional achievement even in a highly developed society.

References


