

## Early childhood predictors of adult body composition

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Intra-uterine life has been identified as a possible critical period for the development of obesity risk in both adults and children; others have highlighted the importance of growth and nutrition in the first few years. It is suggested that fetal growth, as assessed by birth weight, may programme lean body mass later in life. Children who are born small for gestational age also have a predisposition to accumulating fat mass, particularly intra-abdominal fat. It is not yet clear whether this predisposition is due to their prenatal growth restraint, their rapid postnatal catch-up growth or a combination of both. Recently, genetic and heritable factors have been shown to contribute to both rapid postnatal growth and childhood obesity risk in children and adults. Future studies should explore their timing of action and potential interactions with markers of antenatal growth restraint.

**Key words:** birth weight; growth; obesity; body composition.

The prevalence of obesity is clearly rising, with strong evidence that these trends are also seen in children.<sup>1,2</sup> Recent national health survey data from England show a rise in prevalence of obesity in children aged 2–15 years from 11% in 1995 to 19% in 2004 in boys, and from 12% to 18% in girls.<sup>3</sup> Childhood obesity has been shown to track strongly during adolescence and also into adult life.<sup>4,5</sup> In addition to efforts to change lifestyle in children and adults, long-term strategies to prevent

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obesity will also benefit from the robust identification of risk markers acting very early in life.

## BIRTH WEIGHT

### Birth weight and later body mass index

Birth weight is frequently used as an indicator of the conditions experienced prenatally. The 'critical period' hypothesis suggests that the prenatal period is important for the development of obesity, and that environmental conditions experienced in utero may have a life-long effect on later body composition and the propensity to become obese.<sup>6</sup>

More than two dozen studies have addressed the association between birth weight and later body mass index (BMI). Most have measured the outcome in childhood, but several have examined associations with adult BMI.<sup>7</sup> Almost all of these studies found positive associations, i.e. that higher birth weight is associated with subsequent higher BMI.<sup>8,9</sup> Some studies have found sex-discordant associations; e.g. in the East Flanders Prospective Twin Survey, birth weight was associated with later BMI in men<sup>10</sup> but not in women.<sup>11</sup> No studies have found an inverse association.

However, BMI is a measure of relative weight for height, and does not necessarily distinguish between different compartments of body composition. Associations between birth weight and BMI could be mediated by increases in total or central adiposity, or by increases in lean body mass. Several methods have been used to estimate body composition in large cohort studies, such as skin-fold thicknesses, bioelectrical impedance and dual X-ray absorptiometry (DXA).

### Birth weight and later body composition

Several studies have reported a positive correlation between birth weight and later lean body mass. The EarlyBird Study is a prospective cohort study of 300 healthy children from 4.9 years of age, which aims to identify childhood predictors of insulin resistance. Results from this study have shown that birth weight was positively correlated with lean mass at 6 years of age, measured by bioelectrical impedance.<sup>12</sup> Similarly, a study in adolescents (aged 13–16 years) by Singhal et al reported that a higher birth weight was associated with greater adolescent lean mass, measured by skin-fold thicknesses, bioelectrical impedance or DXA, but was not associated with greater fat mass.<sup>13</sup> Moreover, Ylihärsilä et al showed that, in men and women aged 56–70 years, birth weight was positively related to adult lean body mass measured by bioelectrical impedance, and that adult grip strength increased with birth weight.<sup>14</sup> Muscle strength is closely, but not exclusively, related to the amount of lean mass. Although most muscle growth and fibre-type transformations occur postnatally, an initially small reserve of muscle fibres, set at birth, may predispose to later muscle mass and premature decline in functional ability via muscle fibre loss with ageing.

The relationship between higher birth weight and higher BMI may represent an association between birth weight and lean mass rather than general adiposity. Indeed, programming of lean tissue, rather than fat mass, could explain associations between birth weight and later BMI. Low birth weight is associated with a smaller proportion of lean mass, and therefore lower metabolic activity, and could, in the presence of an energy-dense diet, predispose to greater adiposity later in life.

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