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Early life determinants of muscle strength at five years of age

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Pre-conceptual and antenatal maternal body composition and offspring birth weight have been shown to influence childhood body composition^(1, 2). Other than studies on birth weight⁽³⁾ and one on vitamin D⁽⁴⁾, investigations of determinants of muscle function and strength in childhood have been limited. The aim of this analysis was to explore early life determinants of muscle strength in five-year old children.

The Cork BASELINE Birth Cohort Study collected socio-demographic, dietary and anthropometric data in maternal-infant dyads, from 15 weeks gestation⁽⁵⁾. Blood from mothers at 15 weeks gestation and umbilical cords at delivery were collected and serum 25-hydroxyvitamin D [25(OH)D] concentrations were quantified using liquid chromatography-tandem mass spectrometry (LC-MS/MS), using a method which is traceable to the NIST higher order reference measurement procedure⁽⁶⁾. Fat mass (kg) and fat free mass (kg) were measured within four days of birth using air displacement plethysmography (PEA POD). At the five-year assessment, muscle strength indicated by hand grip strength was measured using a Jamar hand grip dynamometer. Linear regression models were developed to identify independent predictors of hand grip strength and all models were adjusted for gender, gestational age, age and height at time of muscle strength assessment.

For this preliminary analysis, 212 participants were included; 51 % were male and the majority of mothers were Caucasian (98 %) and attended third level education (90 %). A maternal BMI at 15 weeks gestation ≥ 30 kg/m² was associated with decreased hand grip strength in their children at five years [adjusted estimate (95 % CI), -0.661 (-1.263 , -0.058), $P = 0.032$]. No other maternal factors including ethnicity, country of birth, education status or smoking status were associated with muscle strength at five years (all $P > 0.05$). Birth weight, length, fat mass or fat free mass were not significant determinants of muscle strength at five years (all $P > 0.05$). Serum 25(OH)D concentrations of mothers at 15 weeks gestation [0.004 (-0.004 , 0.011), $P = 0.323$] and in umbilical cords [0.003 (-0.009 , 0.015), $P = 0.600$] was not associated with muscle strength.

In conclusion, maternal obesity in early pregnancy was associated with decreased muscle strength in five-year old children. No other early life factors were significant determinants of muscle strength at five years. These findings suggest that body composition in pregnancy is a potentially important determinant of muscle strength in childhood and further highlight the importance of obesity prevention in women prior to pregnancy.

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