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The relationship between body mass index and vitamin D status in children attending a paediatric tier 3 weight management programme

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Rising prevalence of childhood obesity is a significant public health problem, with urgent interventions required to reduce childhood obesity at a population level, and lessen the risk of detrimental effects on the health and life-course of an individual[1]. Vitamin D is essential for mineral metabolism and maintenance of bone health and its association with the crippling childhood disease, rickets, is well recognised[2]. More recently, vitamin D deficiency has been implicated in a diverse range of disease conditions[3]. Research has also suggested obesity may be associated with vitamin D deficiency, with greater adiposity associated with poorer vitamin D status[4]. A number of potential mechanisms and causative factors have been postulated for this, including sequestration of vitamin D in adipose tissue reducing its bioavailability, disruption of hormonal pathways such as leptin-dependent renal synthesis of the active form of vitamin D, as well as a vitamin D poor diet or insufficient synthesis through sun exposure[5]. However, evidence for an association between obesity and vitamin D in UK children is sparse. The aim of this study was therefore to investigate the relationship between vitamin D status and obesity in a group of highly obese UK children.

Socio-economic deprivation in Great Yarmouth and Waveney (GYW) correlates with higher prevalence of childhood obesity compared to regional and national averages[6]. In response to this, a multi-disciplinary team (MDT) led programme for children with BMI >98th percentile for their age (UK90 reference cohort) or >91st percentile with complex needs was commissioned by Norfolk County Council (NHS GYW Clinical Commissioning Group responsibility from April 2014). This programme involves regular weight measurement, weight management discussion, dietary advice, and physical activity referral. Standard protocols were used to measure height and waist circumference, and a Tanita BC420MA was used to measure total weight and estimate muscle-mass from bioelectrical impedance. Blood samples were taken by venepuncture and serum vitamin D (25-hydroxyvitamin D; 25-OHD) was assayed in a subset (40 of a total 202 participants) where further clinical investigation was warranted.

Mean age was 12·2 (SD 3·7) years, there were equal numbers of each sex, and 67·5 % resided within the two most deprived national quintiles (2010 Index of Multiple Deprivation). Analysis of biochemical data showed mean serum vitamin D to be 47·5 (SD 21·3) nmol/L, with a range of 16–91 nmol/L, and demonstrated a moderate strength significant inverse correlation between serum vitamin D concentration and BMI (Pearson's $r = -0{\cdot}390$, $p = 0{\cdot}01$, $n = 40$). National Osteoporosis Society vitamin D categories[7] classed 42·5 % as sufficient (>50 nmol/L), 32·5 % as insufficient (30–50 nmol/L), and 25·0 % as deficient (<30 nmol/L). Stratification by BMI group (<35 or ⩾35 kg/m^2) showed that serum vitamin D was 52·6 (SD 21·0) nmol/L in the <35 kg/m^2 group ($n = 26$), and 38·1 (SD 19·1) nmol/L in the ⩾35 kg/m^2 group ($n = 14$), a significant difference according to independent sample t test ($p = 0{\cdot}04$, $n = 40$).

This study has demonstrated a significant negative association between vitamin D status and BMI in a group of highly obese UK children attending a weight management programme in a deprived area. Further investigation will be required to determine whether the poor vitamin D status in these obese children is a result of biological mechanisms linked to adiposity, or a more fundamental insufficiency in dietary vitamin D or sun exposure.

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