Current sun-exposure patterns provide inadequate vitamin D in adolescents with seasonal deficiency negatively impacting on bone health

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Vitamin D is essential for maintaining bone health, particularly in adolescence where there is rapid bone mineral content accrual, with skin synthesis on exposure to ultraviolet (UV)B in sunlight the predominant source. Cross-sectional surveys have shown low vitamin D status to be prevalent in adolescence but longitudinal data, including sunlight exposure information, are lacking. Thus we performed a prospective cohort study to assess seasonal vitamin D status and influence of contributory factors in white Caucasian adolescents, with examination of bone health in those found deficient.

Healthy white Caucasian adolescents (n=131; 12-15 years) were recruited from six schools in Greater Manchester, UK. Circulating 25-hydroxyvitamin D (25OHD), personal UVR dose levels and dietary vitamin D intake were assessed in each season. Personal UVR dose was measured using polysulphone film badges with one badge worn on school days and a separate badge worn at weekends. Adolescents found to be vitamin D deficient (25OHD <10 ng/mL/25 nmol/L) in one or more season underwent bone mineral density (BMD) assessment of the lower (lumbar) spine and neck of the thigh bone (femoral neck). A seasonal pattern of 25OHD levels was seen with mean (SD) 25OHD highest in September: 24.1 (6.9) ng/mL and lowest in January: 15.5 (5.9) ng/mL. Over the year, 16% were deficient in at least one season and 79% insufficient (25OHD <20 ng/mL/50 nmol/L) including 28% in September. Dietary vitamin D intake was low year-round. Personal UVR dose was seasonal and predominantly across the school week. Median (IQR) UVR dose in June was 0.39 (0.18-0.75) SED/day on weekdays and 0.14 (0.03-0.41) SED/day on weekend days. Holidays accounted for 17% variation in peak 25OHD (P<0.001). Nineteen adolescents underwent bone assessment, which showed low femoral neck BMD versus matched reference data (P=0.0002) and 3 adolescents had reduced BMD of the forearm. Sun-exposure levels failed to provide adequate vitamin D, with approximately one-quarter of white Caucasian adolescents insufficient even at summer-peak. Seasonal vitamin D deficiency was prevalent and those affected had low BMD. Increased oral intake and adjusted sun exposure patterns should be considered.