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## Dietary vitamin D consumption, sunlight exposure, sunscreen use and parental knowledge of vitamin D sources in a cohort of children aged 1–6 years in North West England

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Hospital admission for children with rickets in England has dramatically increased, from <1 child per 100,000 in the early 1990's to 4.78 (4.58–4.99) per 100 000 between 2007 and 2011<sup>(1)</sup>. The re-emergence of rickets thus suggests poor vitamin D status<sup>(2)</sup>. Additionally, there has been a plethora of publications associating low vitamin D status with many adverse health outcomes other than the classical role of vitamin D in the development, maintenance and function of a healthy skeleton<sup>(3)</sup>. Vitamin D is a fat lipophilic steroid pro hormone obtained from few foods in the diet. However, the majority (90–95%) of vitamin D is synthesised from exposure of bare skin to sunlight<sup>(4)</sup>, and casual sunlight exposure has been considered adequate for the majority of the population. Consequently, there is no reference nutrient intake (RNI) for ages 4–65 yrs<sup>(5)</sup>. With modern indoor lifestyles, cautious sun screen usage and changes in food habits, sunlight exposure may no longer be sufficient to maintain adequate vitamin D status. To avoid vitamin D deficiency, supplementation and fortification may need to play a more prominent role in everyday lives<sup>(6)</sup>.

The aim of the present study was to investigate vitamin D dietary intake in children, parents' knowledge of vitamin D sources, children's outdoor habits and sun screen application practices. A retrospective, cross sectional study approach was utilised. Parents of children ( $n = 42$ ) aged between 1 and 6 yrs completed a semi-validated food frequency questionnaire, a sources of vitamin D knowledge questionnaire, and a sunlight exposure and sunscreen use questionnaire, in Adlington, N.W. England (latitude 55°N) during May 2013.

Children's mean ( $\pm$ SD) dietary vitamin D intake was  $4.4 \pm 2.5$   $\mu$ g/d, significantly lower than 7  $\mu$ g/d ( $P = < 0.001$ , for comparison 7  $\mu$ g/d, the RNI for ages 3 months–4 yrs was used). As expected, children taking supplements had a significantly higher mean ( $\pm$ SD) vitamin D intake ( $8.49 \pm 1.78$   $\mu$ g/d) compared to those that did not supplement ( $3.34 \pm 1.23$   $\mu$ g/d,  $P < 0.001$ ). The greatest contribution to dietary vitamin D intake from food was from butter and spreads (0.028  $\mu$ g/d), followed by cakes, biscuits & scones (0.023  $\mu$ g/d). Parents' knowledge of food sources was poor, with a mean ( $\pm$ SD) incorrect response of 76%  $\pm 11.2$ . Contrastingly, 93% correctly identified sunlight exposure as a potential source of vitamin D. Eighty nine percent of participants played outdoors daily for 1 hour or more, 81% used sunscreen with an SPF  $\geq 30$  and only 2% rarely applied sunscreen.

This study revealed that children's diet in the NW England is lacking sufficient vitamin D content, in line with larger surveys<sup>(7,8)</sup>. Parents' knowledge regarding vitamin D dietary sources was poor but 93% of parents knew that sunlight was the non-dietary source of vitamin D. Outdoor play indicated sufficient exposure time to produce endogenous vitamin D but sunscreen usage may have potentially diminished epidermal UVB exposures.

Further research is needed using biomarkers to confirm vitamin D insufficiency, and public health strategies should be implemented to promote existing recommendations regarding supplementation and consumption of vitamin D rich foods. Additionally, guidelines for safe sun exposure and sunscreen use are required.

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