

Seasonal ultraviolet B light availability in European countries and its impact on serum 25-hydroxyvitamin D

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The major source of vitamin D in humans is the dermal synthesis of cholecalciferol in the presence of ultraviolet B (UVB) radiation⁽¹⁾. Food sources of vitamin D are few; typical mean intakes in populations within the European Union are generally around 3–7.5 µg/d⁽²⁾. Recent research has shown that 13 % of European individuals have vitamin D deficiency (serum 25-hydroxyvitamin D [25(OH)D] concentrations <30 nmol/L⁽¹⁾) on average in the year⁽³⁾. The objectives of this work were to assess the availability of UVB (Jm⁻²) across Europe and to compare this UVB data with monthly serum 25(OH)D concentrations (nmol/L) in two case-study Northern and mid-latitude European countries (Tromsø, Norway [69°N] and Ireland [51–54°N], respectively) as exemplars.

UVB availability was modelled for countries across Europe, as previously described and validated⁽⁴⁾. The results showed that UVB availability increased with decreasing latitude (from 69°N to 35°N) (data not shown). Standardized serum 25(OH)D concentrations from the National Adult Nutrition Survey in Ireland and from the Tromsø 6 cohort study in Tromsø, Norway were used to generate monthly means and standard deviations. Fig 1 shows the seasonal variation in both the UVB availability (average of 10 year period) and serum 25(OH)D concentrations for Ireland and Northern Norway over a typical 12 month period. Using a cut-off of 1000 Jm⁻², below which the capacity for dermal synthesis of vitamin D is insufficient, showed that Ireland and Northern Norway had 5 and 8 months of the year, respectively, where UVB fell under this threshold. Despite this, serum 25(OH)D concentrations of Norwegian adults is noticeably higher than that of Irish adults during these vitamin D winter periods. The seasonal fluctuations in serum 25(OH)D concentrations was largely absent in Norwegian adults, despite clear variation in UVB availability (Fig 1).

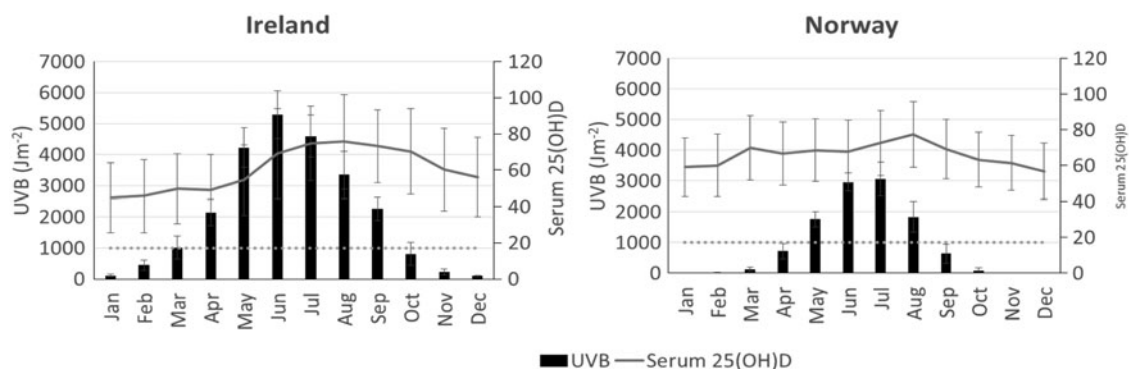


Fig. 1. Modelled UVB availability and measured serum 25(OH)D concentrations ($n = 25\text{--}1896/\text{month}$) over 1 year in Ireland and Northern Norway (monthly means and standard deviations).

The mean daily intake of vitamin D by Irish adults in 2009/10 was 5 µg/d compared to 12 µg/d in Norwegian adults in 2011. The higher intake in Norway stems from a higher rate of vitamin D supplement usage and greater fish consumption compared to that in Ireland. In conclusion, increasing the vitamin D intake (via food fortification and/or supplement use) can ameliorate the impact of low UVB availability on serum 25(OH)D status in Europe.

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