Proceedings of the Nutrition Society (2012), **71 (OCE2)**, E128 doi:10.1017/S0029665112001851

Summer Meeting hosted by the Irish Section, 16–19 July 2012, Translational nutrition: integrating research, practice and policy

Estimation of the dietary requirement for vitamin D: impact of season

K. M. Seamans[1], M. Kiely[1], Jette Jakobsen[2], Christel Lamberg-Allardt[3], Christian Mølgaard[4] and K. D. Cashman[1]

[1]*Vitamin D Research Group, School of Food & Nutritional Sciences, University College Cork, Cork, Republic of Ireland,* [2]*The National Food Institute, Technical University of Denmark, Copenhagen, Denmark,* [3]*Department of Food and Environmental sciences, University of Helsinki, Helsinki, Finland and* [4]*Department of Human Nutrition, Faculty of Life Sciences, University of Copenhagen, Copenhagen, Denmark*

We have estimated the dietary requirement for vitamin D for a number of population sub-groups in winter[1–3] on the basis that the relative contribution of exposure of skin to UVB radiation from sunshine and diet to vitamin D status and vitamin D requirements are not fully understood. The North American Institute of Medicine took the same approach in establishing their recent Dietary Reference Intakes for vitamin D[4]. It has been suggested that these estimates of requirement would be much lower in the presence of UVB sunshine.

The objective of this study was to establish the distribution of dietary requirements for the maintenance of nutritional adequacy of vitamin D in adolescent girls during the darker part of the year (February to May) and the sunnier part of the year (August to November), as indicated by serum 25-hydroxyvitamin D (25(OH)D) concentrations ranging from ≥ 25 to ≥ 50 nmol/l. This was possible by using data available from 2 randomised, double-blind, placebo-controlled, 12-month vitamin D_3 intervention studies in adolescent Danish (55°N) and Finnish (60°N) girls (aged 11.3 y)[5,6]. Serum 25(OH)D was measured with a HPLC assay in a centralised laboratory. Girls were not sampled in June and July due to school holidays.

The mean serum 25(OH)D of the group of girls at baseline was 33.2 and 55.0 nmol/l, in February to May (*n* 157) and August to November (*n* 238), respectively. Regression analysis and mathematical modelling of the relationship between total vitamin D intake and status[3] at endpoint (month 12) showed that the vitamin D intake requirement at the 50th percentile (%ile) ranged from 0 to 13.9 µg/d depending on serum 25(OH)D threshold and season (see Table). The vitamin D intake requirement at the 97.5th percentile (i.e., the Recommended Daily Allowance [RDA]) showed greatest variability across the two seasonal sub-groups at low serum 25(OH)D thresholds (≥ 25 and ≥ 30 nmol/l) but converged at higher thresholds (≥ 40 and ≥ 50 nmol/l) (see Table).

	Dietary requirement for vitamin D (µg/d)			
	Dark Phase (Feb–May)		Light Phase (Aug–Nov)	
Serum 25(OH)D (*nmol/L*)	50th %ile	97.5th %ile	50th %ile	97.5th %ile
≥ 25	0.9	11.6	–	3.9
≥ 30	3.2	14.3	–	8.8
≥ 40	8.0	19.9	–	18.9
≥ 50	13.9	25.5	3.8	29.6

Even in the presence of late-summer UVB sunshine, vitamin D intakes of 3.9 and 8.8 µg/d were needed to maintain 97.5% of the 11-y old girls with serum 25(OH)D ≥ 25 and ≥ 30 nmol/l, respectively, compared to 11.6 and 14.3 µg/d, respectively, during late-winter. Despite the presence of late-summer UVB sunshine, 18.9 and 29.6 µg/d were needed to maintain serum 25(OH)D > 40 and 50 nmol/l, respectively.

In conclusion, there is a dietary requirement for vitamin D for adolescent girls living at northern latitudes even in late-summer, and the RDA depends on the serum 25(OH)D threshold.

This work was supported by in part by the OPTIFORD project (QLK1-CT-2000-00623) and in part by the EURRECA (EURopean micronutrient RECommendations Aligned) Network of Excellence under the European Commission through the 5th and 6th Framework Programme, respectively.

1. Cashman KD, Hill TR, Lucey AJ, *et al.* (2008) *Am J Clin Nutr* **88**(6): 1535–42.
2. Cashman KD, Wallace JM, Horigan G, *et al.* (2009) *Am J Clin Nutr* **89**(5): 1366–74.
3. Cashman KD, Fitzgerald AP, VIljakainen, *et al.* (2011) *Am J Clin Nutr* **93**(3): 549–55.
4. Institute of Medicine Food and Nutrition Board. Dietary reference intakes for calcium and vitamin D. Washington, DC: National Academy Press, 2010.
5. Viljakainen HT, Natri AM, Karkkainen M, *et al.* (2006) *J Bone Miner Res* **21**(6): 836–44.
6. Molgaard C, Larnkjaer A, Cashman KD, *et al.* (2010) *Bone* **46**(2): 432–9.

https://doi.org/10.1017/S0029665112001851 Published online by Cambridge University Press