

Response of serum 25-hydroxyvitamin D concentrations to vitamin D supplementation during lactation

J. Y. Zhang¹, A. Lucey¹, J. R. Higgins², K. D. Cashman¹ and M. Kiely¹

¹Vitamin D Research Group, School of Food and Nutritional Sciences, University College Cork, Republic of Ireland and

²Anu Research Centre, Department of Obstetrics and Gynaecology, Cork University Maternity Hospital, University College Cork, Ireland

Pregnancy, lactation and early childhood are life stages when the risk of low vitamin D status is high and the knowledge basis for determining nutritional requirements for vitamin D is weak. The current dietary reference intervals (DRI) for vitamin D in pregnant and lactating women are the same as those in non-pregnant adult females below 70 years (600 IU/15 µg/d)⁽¹⁾. The aim of the current study was to investigate vitamin D requirements during lactation. We conducted a double-blind randomised placebo-controlled trial across three intervention groups using 20 µg/d of vitamin D₃ (to achieve a total vitamin D intake of ~25 µg/d), with or without 500 mg Ca, or placebo, over 12 weeks of lactation. The study protocol was implemented across a calendar year to account for seasonal effects.

Concentrations of serum 25-hydroxyvitamin D (s25(OH)D) were measured at baseline (BL) and endpoint (EP) in mothers and in umbilical cord blood using ELISA. Vitamin D metabolites (D₃, D₂ and 25(OH)D) were quantified in expressed breast milk at four time points during the intervention study using HPLC. Dietary intakes of vitamin D and Ca, anthropometric data, socio-demographic and lifestyle data were collected, as well as antenatal supplement use and habitual sunshine exposure. The s25(OH)D data are described here.

25(OH)D (nmol/L)	Total (n 100)	Placebo (n 27)	Vitamin D (n 36)	D and Ca (n 37)	P
Baseline*	43.4 (31.5–60.1)	45.2 (29.2–64.9)	45.4 (38.1–54.2)	39.5 (30.1–62.6)	0.835
Endpoint†	71.8 (58.6–88.7)	48.3 (36.7–65.6)	78.4 (67.9–94.1)	75.9 (67.7–98.0)	<0.001

Median; interquartile range in parentheses; *One-way ANOVA followed by Tukey’s test.

†ANCOVA adjusting for BL s25(OH)D, dietary intake of vitamin D and season of EP blood sampling.

At BL, 21 and 63% had a s25(OH)D level below the thresholds for vitamin D deficiency and sufficiency of 30 and 50 nmol/l, respectively. Season of blood sampling was the main determinant of BL s25(OH)D (adj. $R^2 = 0.338$; $\beta = 0.571$; $P < 0.001$), as expected. Other determinants were parity and total vitamin D intake ($\beta = 0.157$ and 0.150 , respectively; $P < 0.05$). Mean (SD) cord s25(OH)D levels were 33.8 (14.8) nmol/l (n 92) and were 78% of maternal levels on average ($R^2 = 0.7$; $P < 0.001$). Season of birth (adj. $R^2 = 0.274$; $\beta = 0.137$) and antenatal vitamin D supplement use (adj. $R^2 = 0.004$; $\beta = 0.140$) were independent predictors of cord s25(OH)D levels (both $P < 0.05$).

A final sample of 100 women completed the intervention protocol, of which ninety were more than 80% compliant. The intervention considerably increased s25(OH)D levels in the treatment groups by ~30 nmol/l (see Table) with no difference in the EP concentrations between women who received vitamin D only and those who received vitamin D+Ca. Given that the average habitual vitamin D intake in the group was 4.3 µg/d, supplementation with 20 µg/d vitamin D₃ to achieve a total intake of ~25 µg/d, maintained s25(OH)D levels >30 nmol/l in all lactating women and brought 96% above the desirable threshold of 50 nmol/l.

In conclusion, the current DRI of 15 µg/d is inadequate to achieve a target s25(OH)D of 50 nmol/l in 97.5% of lactating women at a latitude of 51°N.

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1. IOM (Institute of Medicine) (2011) *Dietary Reference Intakes for Calcium and Vitamin D*. Washington, DC: The National Academies Press.