Vitamin D status of a Dunedin sample, 2008-2009: Preliminary results.

Janet Jopson,[1] Anthony Reeder[1] & Andrew Gray[2]

[1] Cancer Society of NZ Social and Behavioural Research Unit, New Zealand, Department of Preventive & Social Medicine, University of Otago, PO Box 913, Dunedin 9054.

[2] Department of Preventive & Social Medicine, University of Otago, PO Box 913, Dunedin 9054.

Abstract. Serum 25(OH)D measurements varied seasonally among 170 Dunedin, NZ participants with highest values in summer, followed by spring and then autumn. There was no evidence of any difference between men and women, or for those identifying themselves as outdoor workers. Vitamin D levels increased with increasing age, and decreased with increasing BMI. Participants identifying as Asian had the lowest mean 25(OH)D levels.

Introduction

A significant proportion of New Zealanders have sub-optimal levels of vitamin D, particularly Pacific, Maori, South Asian and older European people. Analyses of serum samples from adults in the 1997 National Nutrition Survey showed that 84% of adult New Zealanders had serum 25(OH)D_3 levels below 80 nmol/L (Rockell, Skeaff et al. 2006), the level which recent studies indicate is recommended for optimum health (Bischoff-Ferrari, Giovannucci et al. 2006). Low levels of vitamin D have been implicated in a wide variety of health issues including cancer, diabetes and cardiovascular disease.

The results presented here are part of a larger study. The preliminary analyses were undertaken to explore relationships between serum 25(OH)D and other factors.

Methods

A community sample of 170 adults from Dunedin, NZ (latitude 45°S) was purposefully recruited to be equally spread across the sexes, main ethnic groups (NZ European, Maori, Pacific and Asian), and the full adult range (18-80 years). The participants were followed up for 8 weeks during autumn, winter or spring (March to early December, in either 2008 or 2009). Data collected at the baseline interview included demographics (age, sex, ethnicity); occupation (including hours of outdoor work); usual sun exposure over the previous 4 weeks; food frequency data to record usual intake over the previous 4 weeks of foods known to be high in vitamin D; use of dietary supplements over the previous 4 weeks; weight and height to calculate Body Mass Index (BMI); and skin reflectance to measure skin pigmentation. Thereafter, weekly interviews were conducted to collect ultraviolet radiation (UVR) exposure data from personal dosimeters, clothing diaries, and food diaries. Blood tests were taken at the end of Week 4 and Week 8 and analysed for levels of 25(OH)D.

Using both week 4 and week 8 vitamin D levels, with robust standard errors used to account for the repeated measures, selected factors were examined in terms of their association with vitamin D, both univariately and multivariately. The 'effective season' was calculated using solstice and equinox dates based on the date four weeks before the blood test date. BMI (kg/height in metres^2) was transformed using fractional polynomials (1/BMI^2) because of its non linear association, and so its effect is presented (**Table 2**, overleaf) for an increase from its 25th (24.3) to 75th (32.4) percentile. All other continuous variables were adequately modelled using linear associations.

Results

The sex and ethnicity distribution of the two-year Dunedin sample are presented in **Table 1**, along with measured serum 25(OH)D.

Table 1. Geometric mean 25(OH)D (nmol/L) in participants by sex, ethnicity, and year.

		Number (%)	Geometric mean 25(OH)D
Sex	Male	72 (42%)	39.53
	Female	98 (58%)	36.61
Ethnicity*	Maori	30 (18%)	38.96
	Pacific	40 (24%)	35.49
	Asian	46 (28%)	30.54
	NZ European	48 (29%)	50.95
Year	2008	84 (49%)	34.61
	2009	86 (51%)	41.24

*6 participants of 'other' ethnicity omitted from modelling

The unadjusted serum 25(OH)D levels are presented in **Figure 1** (overleaf) with 95% confidence intervals by actual month of blood sample for all 170 Dunedin participants across both years. Levels were lowest in the winter months of July and August.

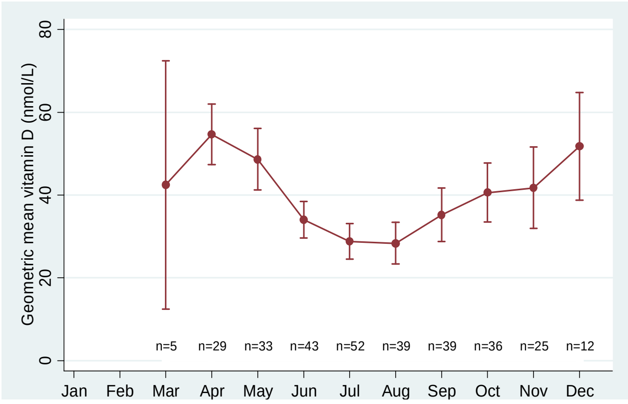

Figure 1. Unadjusted vitamin D blood level with 95% confidence intervals, by month of sample, using both week 4 and week 8 data.

The adjusted model is presented in **Table 2**. In the unadjusted model (data not shown) there was a tendency for 2009 vitamin D values to be slightly higher, but this effect was attenuated and no longer statistically significant in the adjusted model. Effective season was strongly statistically significant in both models, with highest values in summer, followed by spring, then autumn. There was no statistically significant difference between the sexes or for outdoor workers. Vitamin D levels increased with age and decreased with BMI in both models. In the unadjusted model, all ethnicities other than NZ European had lower vitamin D. However, after adjusting for other factors, only Asian vitamin D levels were statistically significantly lower than NZ European levels.

Table 2. Factors in the adjusted model for predictors of vitamin D blood level.

	Ratio of geometric means (95% CI)	p-value
Year (2009 c.f. 2008)	1.08 (0.94-1.24)	0.290
Effective Season (c.f. winter)		<0.001
Spring	1.38 (1.15-1.65)	
Summer	1.65 (1.36-2.02)	
Autumn	1.11 (0.96-1.29)	
Female (c.f. male)	0.95 (0.83-1.08)	0.416
BMI (25^{th} to 75^{th} percentile)	0.82 (0.71-0.93)	0.003
Age (per 10 years)	1.06 (1.02-1.11)	0.004
Ethnicity (c.f. NZE)		<0.001
Maori	0.96 (0.78-1.16)	
Pacific	0.89 (0.72-1.10)	
Asian	0.60 (0.50-0.73)	
Outdoor worker	1.11 (0.92-1.34)	0.281

Discussion

A surprising finding in this preliminary analysis is that Vitamin D blood levels increased significantly with age. Previous studies (McKenna 1992), (Rockell, Skeaff et al. 2006) have shown that older people tend to generally have lower vitamin D levels, although a recent Norwegian study found 25(OH)D levels to be higher in persons older than 50 years, compared with those younger (Moan, Lagunova et al. 2009). However, participants in our study may not represent a ‘typical’ older person, as they tended to be active, retired people, who volunteered to participate in the project. Further analysis of the data collected on UVR exposure may show that increased time outdoors, compared with younger working participants, would help explain their higher vitamin D levels.

Lower levels of serum 25(OH)D have previously been associated with higher BMI (Konradsen, 2008) (Konradsen, Ag et al. 2008), and this was confirmed in the Dunedin sample.

Data previously collected in NZ found lower levels of serum 25(OH)D among Pacific and Maori (Rockell, Skeaff et al. 2006) compared with NZ Europeans, but did not specifically investigate Asian ethnicity. The current data clearly show that the lowest levels occurred among those of Asian ethnicity. Further analysis of the entire dataset will be undertaken to explore associations between 25(OH)D levels, UVR exposure and dietary factors.

References

Bischoff-Ferrari, H. A., E. Giovannucci, et al. (2006). Estimation of optimal serum concentrations of 25-hydroxyvitamin D for multiple health outcomes. Am. J. Clin. Nutr. **84**(1): 18-28.

Konradsen, S., H. Ag, et al. (2008). Serum 1,25-dihydroxy vitamin D is inversely associated with body mass index. Eur. J. Nutr. **47**(2): 87-91.

McKenna, M. J. (1992). Differences in vitamin D status between countries in young adults and the elderly. Am. J. Med. **93**(1): 69-77.

Moan, J., Z. Lagunova, et al. (2009). Seasonal variation of 1,25-dihydroxyvitamin D and its association with body mass index and age. J. Steroid Biochem. & Mol. Biol. **113**(3-5): 217-221.

Rockell, J. E., C. M. Skeaff, et al. (2006). Serum 25-hydroxyvitamin D concentrations of New Zealanders aged 15 and older. Osteop. Intl. **17**: 1382-1389.