Seasonal variation in vitamin D status of office workers

R.S. Mason, A. Conigrave, F. Fayet, J. Wright, L. Ridges, P. Small

The University of Sydney

BOSCH INSTITUTE

Introduction

The aim of this study was to determine the Vitamin D status of office workers. This is the first study of its kind in office workers by Nestlé.

Study population

104 Nestlé head office staff were recruited. Average age was 36 years and average BMI was 24.6 kgm^{-2}. Fulltime (FT) workers made up 86% of the study population. Exclusion criteria included the following: those taking vitamin D supplements, suffering from illness, taking medication, pregnant or breast-feeding.

Table 1: Participant baseline characteristics

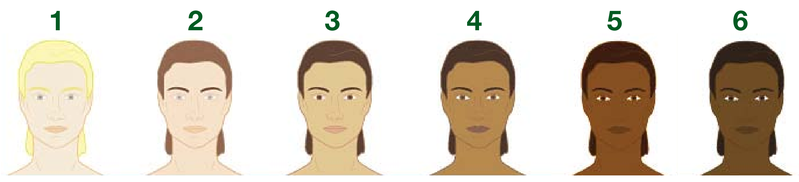
Characteristic	All n = 103 Mean ± SE	Males n = 41 Mean ± SE	Females n = 63 Mean ± SE	Range
Age (years)	36.2 ± 8.6	37.4 ± 9.1	35.4 ± 8.2	19 – 64
Height (m)	1.70 ± 0.1	1.77 ± 0.1	1.64 ± 0.1	1.47 – 1.96
Weight (kg)	71.3 ± 16	82.1 ± 14.3	64.3 ± 13.6	41.1 – 129
Waist circumference (cm)	76.8 ± 11	84.5 ± 8.8	71.8 ± 9.3	61 – 120
BMI (kg/m2)	24.6 ± 4.2	26 ± 3.4	23.7 ± 4.5	18 – 47.3

Study design

Blood samples were taken at peak summer and peak winter. Serum 25-hydroxy vitamin D (25(OH)D) was measured by radioimmunoassay. Anthropometric measurements and phototypes were recorded (Table 2). Staff were also given a questionnaire relating to physical activity, food intake (fish, vitamin D fortified milk/soy beverage) and sun exposure.

Table 2: Phototype

Skin Phototype	Typical features	Tanning ability	Summer (%)	Winter (%)
1	Pale white skin, blue/ hazel eyes, blond/red hair	Always burn, does not tan	2.9	3.8
2	Fair skin, blue eyes	Burns easily, tans poorly	**33.7**	**25.6**
3	Darker white skin	Tans after initial burn	**25**	**30.8**
4	Light brown skin	Burns minimally, tans easily	**26**	15.4
5	Brown skin	Rarely burns, tans darkly easily	5.8	11.5
6	Dark brown or black skin	Never burns, always tans darkly	6.7	12.8



Results

Mean vitamin D levels were found to be in the 'sufficient' range, but not 'optimal range'. There was a demonstrated seasonal variation between winter and summer, with a ~40% increase in the number of individuals with vitamin D insufficiency in winter and a 7-fold increase in the number of those with vitamin D deficiency in winter.

Vitamin D status ranges:

> 75nmol/L - **Optimal**
> 50nmol/L - **Sufficient**
< 50nmol/L - **Deficient**

Table 3: Vitamin D levels by season

Season	Serum 25(OH)D (nmol/L)[a]	Range
Summer	67.8 ± 3.4[b]	24 - 160
Winter	58.9 ± 3.8	15 - 174

[a] Mean ± standard error. [b] Summer significantly different from winter (P<0.001).

Table 4: Vitamin D insufficiency by season

Serum 25(OH)D	Summer	Winter
< 50 nmol/L	29%	42%
< 25 nmol/L	1%	10%

Vitamin D levels by phototype

Darker skinned individuals (5 and 6) showed high rates of vitamin D insufficiency in both summer and winter. In winter 75% and 90% of subjects with phenotype 5 and 6, respectively, were vitamin D insufficient.

Figure 1: Vitamin D status by phototype

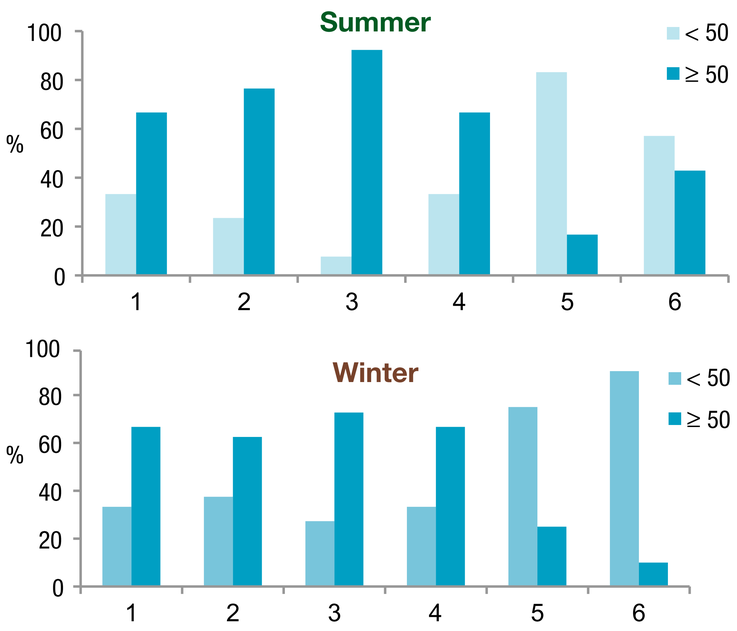
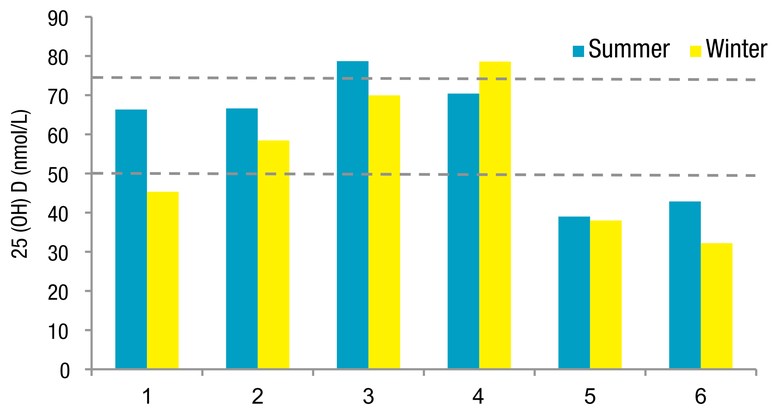


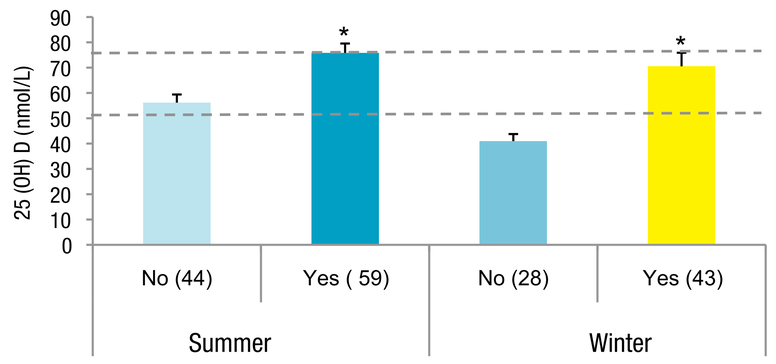
Figure 2: Vitamin D levels by season and phototype



Vitamin D and time spent outdoors

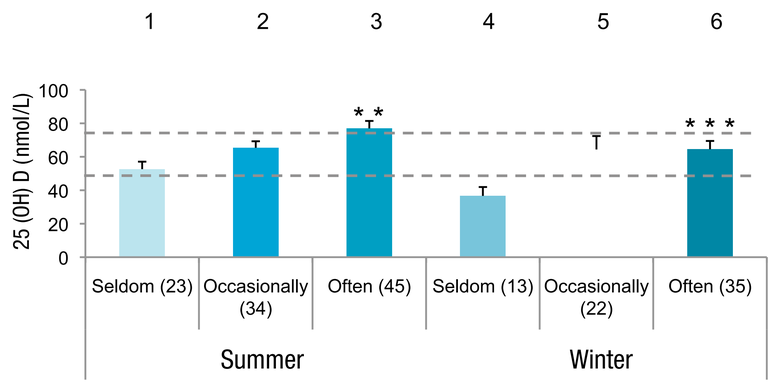
Individuals who habitually spent time in the sun had significantly higher serum 25(OH)D levels vs. sun avoiders. Individuals who often went outdoors were 6.4 times more likely to have sufficient levels of vitamin D in Winter in comparison to those who seldom went outdoors (p<0.01).

Figure 3: Questionnaire: "During the summer months do you habitually spend hours in the sun aside from vacation?"



Note: n is shown in brackets
* Yes is significantly different to No (p<0.0001)

Figure 4: Questionnaire: "How often were you outdoors in the last 3 months?"

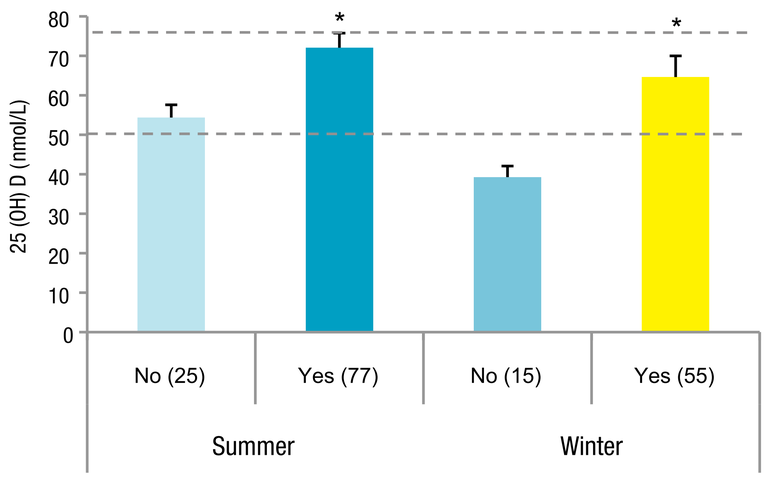


Note: n is shown in brackets
Significant difference between groups for summer ** p<0.01

Lifestyle and vitamin D

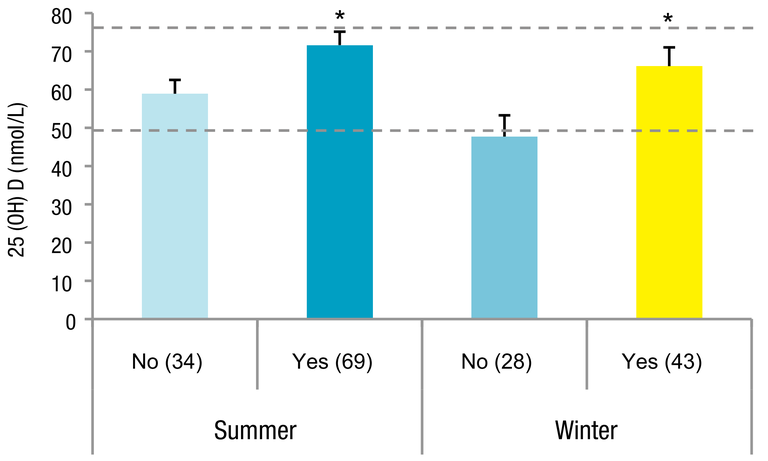
Sunscreen users were found to have significantly higher 25(OH)D vs. non-users. Non-users of sunscreen were vitamin D insufficient during the winter. Fish consumers had significantly higher 25(OH)D vs. non-consumers.

Figure 5: Questionnaire: "Do you usually use sunscreen?"



Note: n is shown in brackets
* Yes is significantly different to No (p<0.01)

Figure 6: Questionnaire: "Do you consume fish?"



Note: n is shown in brackets
* Yes is significantly different to No (p<0.05)

Summary

- This study shows that vitamin D insufficiency is a significant problem in healthy Australian office workers.
- In a healthy and young population, 10% were frankly deficient in winter.
- Vitamin D status was significantly higher with outdoor living, sunscreen use and fish consumption.
- Periods of sun exposure may increase vitamin D levels despite sunscreen use.
- Increased vitamin D fortification of foods could benefit the whole population.
- Vitamin D supplements should be targeted to individuals who are darker skinned or unable to obtain adequate sun exposure.