

## Survey on Knowledge and Attitudes on Vitamin D and Sunlight Exposure in an Urban Population in Vietnam

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### Abstract

**Objective.** Vitamin D deficiency has been shown to be a risk factor for various chronic diseases and mortality. It is not clear why vitamin D deficiency affects a large proportion of individuals living in tropical Asian countries. The present study sought to examine the knowledge, behavior and attitudes of Vietnamese men and women toward vitamin D and sunlight exposure.

**Methodology.** The study was designed as a cross-sectional survey of a population in Ho Chi Minh City, Vietnam. Study participants were randomly drawn from the general community, supermarkets and hospital visitors. Each participant was given a questionnaire relating to knowledge on vitamin D and behavior toward sunlight exposure. The questionnaire was previously tested for reliability and accuracy in 20 participants.

**Results.** A total of 1,536 individuals aged 14 to 85 years participated in the study. Fifty three percent of participants did not like being exposed to sunlight. On the average, most reported approximately 14 hours per week under the sun. Majority (81%) reported that they had heard of vitamin D from newspapers (32%), friends (20%) or radio and television (13%). However, their knowledge about the source of vitamin D was inadequate: 37% thought that vitamin D comes from the sun, 28% from foodstuff and the sun, while 17% did not know the source of vitamin D. Analysis of the determinants of knowledge of vitamin D suggested that only educational level was a significant predictor of vitamin D knowledge.

**Conclusion.** A negative attitude toward sunlight exposure and inadequacy of knowledge on vitamin D could adversely affect bone and general health in the community. The data also provides a basis for developing public health strategies for the prevention of vitamin D deficiency in the Vietnamese population.

**Keywords:** vitamin D; osteoporosis; knowledge; behavior; attitude

### INTRODUCTION

Vitamin D plays an important role in the regulation of calcium and bone metabolism.<sup>1</sup> Vitamin D deficiency has been shown to be associated with—but not proven to be causally related to—an increased risk of diabetes, cancer, cardiovascular diseases, tuberculosis and even fever.<sup>2-12</sup> A recent meta-analysis showed that vitamin D deficiency is associated with an increased risk of all-cause mortality.<sup>13-16</sup> Maintaining an adequate level of vitamin D may reduce the burden of chronic diseases and contribute to better health outcomes.

In Asia, even in tropical countries, the prevalence of vitamin D deficiency has been estimated between 35% to 57%.<sup>17,18</sup> The reason for vitamin D deficiency in people living in tropical countries remains unclear. In Vietnam and in other Asian countries, women prefer to have fair

skin. Light-colored skin is perceived as a symbol of elite status, in contrast to dark skin which is usually associated with a lower socio-economic class. Moreover, among Asian women, pale or fair skin is believed to help improve appearance and enhance job prospects. Asian women tend to avoid the sun, which they believe will darken their skin color and cause wrinkles. Vietnamese women, particularly the younger ones, routinely cover their bodies when going outdoors, in the belief that this could prevent sunburn. Such behavior may contribute to vitamin D deficiency in the general population.

Ho Chi Minh City has a rapidly expanding young population. The city has a population of 6.4 million with a density of 7,943 individuals per square mile. The current annual average gross domestic product (GDP) of the city was USD 2,180 (adjusted GDP for purchasing power parity was USD 10,870).<sup>19</sup>

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Knowledge, attitude and behavior play an important role in the prevention and control of diseases. Therefore, the primary aim of this study is to assess the knowledge, behavior and attitude toward vitamin D and sunlight exposure of a group of Vietnamese individuals in Ho Chi Minh City. The secondary aim of the study is to identify patterns and determinants of knowledge and behavior.

## METHODS

### Study design and procedure

The study was a cross-sectional survey conducted in Ho Chi Minh City, Vietnam in January 2009.

Three teams of interviewers were sent to supermarkets and bus stations to interview participants. Shoppers and passengers were randomly approached and invited to answer a questionnaire concerning vitamin D and sunlight. In addition, relatives visiting patients in a major tertiary hospital in Ho Chi Minh City were also enjoined to participate in the study. The study protocol and all procedures were approved by the university's Research Committee. As per the committee's recommendation, written informed consent was not sought prior to study participation.

Participants completed a single questionnaire with assistance from a trained interviewer. The interview process was approximately 5 minutes. Participants were informed that their responses were anonymous and participation was entirely voluntary. All potential participants approached agreed to take part in the study. No names and address details were recorded to ensure anonymity.

### Questionnaire

The instrument used in this study was a validated questionnaire modeled according to the questionnaire used by Kung et al., in Hong Kong<sup>20</sup> translated into Vietnamese. It is divided into 4 main sections: demographic details, knowledge, behavior and attitudes

We conducted a test-retest reliability study of the questionnaire in a sample of 20 participants, with an intervening period of two weeks. The coefficient of reliability ranged between 0.75 and 0.95 for the 16 questions. There was no significant difference in the reliability coefficients between men and women. Analysis of reliability by age group was not conducted because of the limited sample size.

### Data analysis

Descriptive statistics were used to characterize the sample. Frequency tables were constructed per question, and were subsequently stratified according to demographic characteristics. Absolute and relative frequency of

response for each question was first obtained for the whole sample for subgroups stratified by demographic characteristics. Bivariate relationships between variables were examined using t-tests and Chi squared tests for numerical and categorical variables, respectively. To assess the independent effects of demographic characteristics, knowledge and belief on behavior, the log-binomial regression model was performed for each behavior. All analyses were performed using the R-statistical software.<sup>21</sup>

## RESULTS

### Sample characteristics

A total of 1536 participants between 18 and 85 years of age were surveyed (Table 1). The average age of the participants was  $34 \pm 14$  years (mean  $\pm$  SD). Majority of participants were female (58.3%), students (41.5%), with secondary education (71.1%), and worked indoors (85.4%).

**Table 1.** Demographic characteristics of study participants, N=1536, Ho Chi Minh City, Vietnam.

Characteristics	Number	Percentage
<b>Gender</b>		
Male	641	41.7
Female	895	58.3
<b>Age group (year)</b>		
< 21	230	15.0
21-30	588	38.3
31-40	237	15.4
41-50	257	16.7
51-60	162	10.6
> 60	62	4.0
<b>Occupation</b>		
Student	638	41.5
Salesperson	212	13.8
Laborer	86	5.6
Office worker	305	19.9
Professional	41	2.7
Retirees	75	4.9
Housewife	143	9.3
Unemployed	36	2.3
<b>Education</b>		
Primary	91	5.9
Secondary	1087	71.1
College	106	6.9
University	246	16.1
<b>Working condition</b>		
Indoor	1311	85.4
Outdoor	224	14.6

### Attitude and behavior toward sunlight

Participants mostly responded that they liked going out in the sun or liked to be exposed to the sun (47%, n = 722) (Table 2). More men, compared to women, liked going out in the sun (53% and 43%, respectively;  $p=0.001$ ). Elderly men and women responded more positively about sun exposure compared with younger individuals (76% and 40%, respectively). Retirees were more likely to expose themselves to sunlight (76%), in contrast to laborers (57%), students (39%), and salespersons (48%).

On average, the participants spent approximately 14 hours per week exposed to the sun. Around 77% of women and 17.4% of men reported that they had adequate exposure to sunlight. Approximately 60% of participants reported that

they often used parasols, and 15% often used sunscreen products with sun protection factor (SPF) greater than 15.

**Table 2. Attitude and behavior toward sunlight exposure**

Question	Women (N = 895)	Men (N = 641)	Total (N = 1536)
<b>Do you like going in the sun?</b>			
Yes	383 (42.8)	339 (53.0)	722 (47.0)
No	512 (57.2)	301 (47.0)	813 (53.0)
<b>Do you often use a parasol to shade from the sun?</b>			
Yes	198 (73.6)	99 (43.2)	297 (60.0)
No	71 (26.4)	130 (56.8)	201 (40.0)
<b>Do you use sunscreen products containing SPF &gt; 15?</b>			
Yes	122 (20.0)	36 (8.4)	158 (15.2)
No	490 (80.0)	395 (91.6)	885 (84.8)
<b>How often sunscreen is used?</b>			
Everyday	80 (37.9)	14 (25.9)	94 (35.5)
<2 days/week	64 (30.3)	19 (35.2)	83 (31.3)
>2 days/week	67 (31.8)	21 (38.9)	88 (33.2)
On an average weekday, from 6:30 am to 7:00 pm, how many hours do you spend outdoors	2 (0, 30)	2 (0, 12)	2 (0, 30)
<b>Do you think you have enough exposure to sunlight?</b>			
Yes	685 (77.0)	111 (17.4)	1212 (79.3)
No	205 (23.0)	527 (82.6)	316 (20.7)

**Note:** numbers are actual frequencies and percentage (in brackets). Due to missing values, some numbers in subgroups do not add up to sex-specific totals.

**Knowledge of vitamin D**

A significant majority of women (80%) and men (81.4%) reported that they had heard of vitamin D. Usual sources of information were newspapers (32%), friends (20%), radio and television (13%), and other sources, including the internet. However, knowledge about the source of vitamin D was not adequate: 37% thought that vitamin D comes from the sun, another 28% thought that the sources of vitamin D are foodstuff and the sun, and 17% did not know the source of vitamin D (Table 3).

When asked about the benefits of vitamin D, majority of participants thought that vitamin D had beneficial effects on general health (80%), particularly bone health (88%). Analysis of determinants of knowledge of vitamin D suggested that participants of younger age and higher education levels had better knowledge of vitamin D compared to those in the older age groups or lower levels of education.

About 70% of participants responded that they were prepared to undergo testing to know their vitamin D levels. They were also prepared to take vitamin D supplementation if found deficient (85%).

**Predictors of knowledge and behaviors**

The probability of being enthusiastic about exposure to the sun was independently related to gender, age, educational level and working environment (Table 4). Compared with males, females were less likely to respond to like going in

the sun [17%, 95% CI (9 to 25%)]. Furthermore, younger age, having secondary or tertiary education, and working indoors were associated with being less likely to be exposed to sunlight. Knowledge on vitamin D (particularly benefits on bone health) was significantly related to higher educational level.

**Table 3. Knowledge and awareness of vitamin D**

Question	Women (N = 895)	Men (N = 641)	Total (N = 1536)
<b>Have you ever heard of vitamin D?</b>			
Yes	489 (80.0)	351 (81.4)	840 (80.5)
No	123 (20.0)	80 (18.6)	203 (19.5)
<b>Effects of vitamin D on health</b>			
Good	726 (82.0)	485 (76.5)	1211 (80.0)
Bad	62 (7.0)	54 (8.5)	116 (7.6)
Don't know	97 (11.0)	95 (15.0)	192 (12.6)
<b>Do you know that vitamin D is good for bone health</b>			
Yes	787 (88.0)	570 (89.2)	1357 (88.5)
No	107 (12.0)	69 (10.8)	174 (11.5)
<b>What are the sources of vitamin D?</b>			
Food	132 (14.8)	113 (17.6)	245 (15.9)
Sunshine	326 (36.4)	248 (38.7)	574 (37.4)
Food and sun	279 (31.2)	156 (24.3)	435 (28.3)
Others	9 (1.1)	10 (1.6)	19 (1.2)
Don't know	149 (16.7)	114 (17.8)	263 (17.1)
<b>Do you know that sunlight can give you vitamin D</b>			
Yes	745 (83.2)	519 (81.0)	1264 (82.3)
No	149 (16.8)	121 (19.0)	270 (17.7)
<b>Source of information</b>			
Newspapers	199 (32.5)	136 (31.4)	335 (32.1)
TV/radio	79 (12.9)	61 (14.1)	140 (13.4)
Words of mouth	110 (18.0)	103 (23.8)	213 (20.4)
Friends	78 (12.8)	53 (12.2)	131 (12.5)
Others (multiple sources)	146 (23.9)	80 (18.5)	226 (21.6)
<b>Willing to undergo a test for vitamin D?</b>			
Yes	646 (72.2)	425 (66.3)	1071 (69.7)
No	249 (27.8)	216 (33.7)	465 (30.3)
<b>If you are deficient of vitamin D, do you want to take vitamin D supplementation?</b>			
Yes	769 (85.9)	531 (82.8)	1300 (84.6)
No	126 (14.1)	110 (17.2)	236 (15.4)

**Note:** numbers are actual frequencies and percentage (in brackets). Due to missing values, some numbers in subgroups do not add up to sex-specific totals.

**DISCUSSION**

The classical function of vitamin D is to regulate calcium absorption and excretion.<sup>22,23</sup> Thus, maintaining adequate vitamin D and calcium is recognized as an important means of prevention of osteoporosis and fragility fractures in the general population. The success of health promotion and community-based prevention of osteoporosis depends in part on the knowledge and behavior of members within the community. In this study, we found that the knowledge of vitamin D in an urban population in Vietnam is inadequate, and almost half of the population did not like to be exposed to the sun. This finding is consistent with the reality that many Asians, despite living in tropical regions, have vitamin D insufficiency or deficiency.<sup>24-26</sup> Our findings also suggest that a large proportion of the Vietnamese population may have vitamin D insufficiency.

**Table 4.** Factors associated with being like to contact with the sun, and recognition that vitamin D is beneficial to health or bone health

	Sample size	Like to contact with the sun (yes)		Vitamin D is good for bone health (yes)	
		Percent	Prevalence ratio	Percent	Prevalence ratio
<b>Gender</b>					
Women	895	42.8	0.83 (0.75–0.91)	88.0	0.99 (0.94 – 1.04)
Men	640	53.0	1.00	89.2	1.00
<b>Age group</b>					
<21	230	39.1	0.58 (0.46 – 0.74)	95.2	1.21 (0.98 – 1.49)
21-30	588	40.5	0.61 (0.50 – 0.74)	95.2	1.20 (0.97 – 1.47)
31-40	237	49.4	0.70 (0.56 – 0.86)	82.6	1.06 (0.85 – 1.31)
41-50	257	52.1	0.74 (0.61 – 0.90)	81.7	1.07 (0.86 – 1.33)
51-60	162	59.6	0.81 (0.66 – 0.99)	82.7	1.08 (0.87 – 1.35)
>60	62	75.8	1.00	66.1	1.00
<b>Education</b>					
College + University	352	43.3	0.90 (0.75 – 1.08)	96.0	1.78 (1.40 – 2.27)
Secondary	1087	52.8	0.81 (0.68 – 0.96)	89.7	1.66 (1.31 – 2.10)
Primary	91	70.3	1.00	48.3	1.00
<b>Working condition</b>					
Indoor	1311		0.87 (0.79 – 0.96)	72.8	0.87 (0.79 – 0.96)
Outdoor	224		1.00	91.2	1.00

**Survey questions**

- What is your age ?
- What is your occupation?
- Do you work mainly indoors or outdoors?
- Do you like to have contact with the sun
- Do you often use a parasol to shade from the sun ?
- Do you use sunscreen products containing SPF > 15?
- On an average weekday, from 6:30 am to 7:00 pm, how many hours do you spend indoors?
- Do you think you have enough exposure to sunlight
- Have you ever heard of vitamin D?
- What does vitamin D do?
- What are the sources of vitamin D?
- Do you know that vitamin D is good for bone health?
- Do you know that sunlight can give you vitamin D?
- Are you willing to undergo a vitamin D test?
- If you are deficient of vitamin D, do you want to take vitamin D supplementation?

**Figure 1.** Survey questions

The present findings are highly consistent with a previous survey in Hong Kong.<sup>20</sup> In their study, approximately 62% participants responded that they did not like going out in the sun—similar to our findings where 57% of women had the same response. In our study, 80% of women did not use any sunscreen product, comparable to the Hong Kong findings (81%). In terms of knowledge, they reported that 73% of participants were aware of vitamin D, which was equivalent to our results (80%) after accounting for sampling variation. However, while 37% of our participants thought that the sun was the main source of vitamin D, only 23% responded similarly in Hong Kong. Taken together, these data show that the two Asian populations share very similar attitude, behavior, and knowledge of vitamin D and sunlight exposure.

There were some demographic variations in vitamin D knowledge and behavior toward sunlight exposure in this study. These variations are largely consistent with the published literature. As noted in a previous study, vitamin D knowledge, female gender and having attended higher education were associated with less enthusiasm to be exposed to the sun.<sup>20</sup> These findings suggests that doctors and health professionals should be particularly careful in providing dietary advice to individuals with these demographic characteristics. They are more likely to

need detailed information in order to implement any lifestyle changes.

We observed a lack of consistency between attitude toward sunlight exposure and knowledge of vitamin D. While individuals working mainly indoors responded that they did not like to be exposed to the sun, the same individuals also recognized that vitamin D was good for health and bone health. Further analysis identified that these individuals were mainly university students and office workers.

The present findings should be interpreted within the context of the study’s strengths and limitations. Because the study was based on a large sample size, and the participants were drawn from various occupational and educational backgrounds, these results have a high degree of external validity and generalizability. The participation was entirely voluntary, and direct interview was conducted without any drop out. However, the limitations of this study include the fact that the participants were slightly younger than the general population, which limit the generalizability of the results to the total population. Because the study was conducted in the Vietnamese population, whose lifestyle and cultural background may be different from other populations, the present findings may not be consistent with those in other parts of the world.

Despite these limitations, our findings have important implications on the prevention of vitamin D deficiency in the general population in Vietnam. The understanding of attitudes, behaviors and knowledge of the community may help design more appropriate public health programs. Our findings suggest that educational intervention programs may be targeted to reach younger women with high levels of education, especially those who have negative perceptions on sunlight exposure. Since the sources of information were mainly newspapers, television and radio, mass media campaigns with national coverage may be more preferable than educational materials or talks in community organizations.



In recent years, there has been increasing interest in the influence of vitamin D on tissues other than bone.<sup>27,28</sup> It is also recognized that living in tropical areas does not necessarily protect against vitamin D deficiency. The present study findings help explain why there was a high prevalence of vitamin D deficiency in Asian populations, particularly among young women.

In summary, the present data showed that approximately half of the sampled urban population in Vietnam had negative attitudes toward sunlight exposure, despite their recognition that vitamin D has beneficial effects on health. Given the importance of vitamin D in maintaining good health, these results imply that there is a need to develop effective strategies to educate the general community about the prevention of vitamin D deficiency.

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