Original Article

Duration of Casual Sunlight Exposure Necessary for Adequate Vitamin D Status in Indian Men

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Abstract

Objectives: To investigate the duration of casual sunlight ultraviolet-B (UVB) exposure required to maintain optimal Vitamin D status (25-hydroxyvitamin-D [25(OH)D]) >50 nmol/L in urban Indian men, using polysulfone (PSU) dosimeters and a sunlight exposure questionnaire. **Methods:** In healthy men (aged 40–60 years) from Pune (18.52° N, 73.86° E), India, serum 25(OH)D was measured using enzyme-linked immunosorbent assay. Sunlight exposure was assessed using PSU dosimeter and by questionnaire. **Results:** Of 160 men (48.3 ± 5.6 years), 26.8% were deficient and 40.6% had insufficient Vitamin D concentrations. A hyperbolic function for the relationship between PSU measured sunlight exposure in standard erythema dose (SED) and serum 25(OH)D concentrations ($r = 0.87$, $P < 0.01$) revealed that daily exposure of 1 SED was sufficient to maintain serum 25(OH)D concentrations over 50 nmol/L. The curve plateaued around 5 SED (80 nmol/L) and extrapolation of the curve (>5 SED) did not increase 25(OH)D concentrations above 90 nmol/L. Receiver operating curve analysis confirmed that 1 SED-UV exposure was sufficient to maintain 25(OH)D concentrations over 50 nmol/L. Based on the questionnaire data, >1 h of midday casual sunlight exposure was required to maintain serum 25(OH)D concentrations above 50 nmol/L. Duration of sunlight exposure assessed by questionnaire and PSU dosimeter showed a significant correlation ($r = 0.517$, $P < 0.01$). **Conclusion:** In urban Indian men, >1 h of casual midday sunlight exposure daily was required to maintain serum 25(OH)D concentrations above 50 nmol/L, and >2 h of casual sunlight exposure was needed to maintain 25(OH)D concentrations above 75 nmol/L. Excess sunlight did not increase 25(OH)D linearly. The sunlight exposure questionnaire was validated for use in clinical studies and surveys.

Keywords: 25-hydroxyvitamin-D, Indian adult men, polysulfone dosimeter, sunlight exposure questionnaire, Vitamin D

Introduction

The most important source of Vitamin D is Vitamin D_3 (cholecalciferol) produced in the skin through exposure to solar ultraviolet-B (UVB) radiation (in the range of 290–315 nm). Dietary sources contribute to only a small amount in countries like India, where there is no widespread fortification of foods.[1] Despite the abundance of sunlight, a large section of the Indian population (~75%) suffers from Vitamin D deficiency.[2] Avoidance of sun exposure may also partially explain the observed Vitamin D deficiency in Indians and also throughout the world.[3]

Solar UV intensity is affected by latitude, altitude, time of day, and season, as well as by environmental factors, including air pollution, cloud cover, and natural ozone levels.[4] Pollution reduces incident UV radiation, and urban areas reduce the sky view factor and increase shade.[5] In a simulation study in an idealized situation (cloudless atmosphere, nonreflecting surface, typical level ozone layer thickness, and rural aerosol), for individuals with skin-type vitamin (i.e., most Indians), the duration of sunlight exposure equivalent to 1000 IU oral intake of Vitamin D has been reported to be 10–48 min (seasonally dependent) at 29° N and 10–17 min at 11.5° N (at solar noon).[6] This calculation assumed 25% skin area exposed to sunlight, and the calculation was for a flat horizontal, unshaded surface, not a mobile human body in a cityscape.

Adults exposed to sunlight, living in rural or less-polluted areas, have been reported to have better Vitamin D status,

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especially in summer months. In addition, in a real-life scenario, as a person is in motion when exposed to sunlight, stable exposure to sunlight is unlikely. Personal factors such as age, clothing type, and sunscreen use also affect cutaneous Vitamin D synthesis.[7] Therefore, sunlight exposure questionnaires need to account for the above factors while assessing sunlight duration in clinical studies. Such validated questionnaires are not readily available to quantify sunlight exposure for clinical purposes and surveys and thus need to be developed for accurate assessment of sunlight exposure.[8]

As an objective measure of personal UVB exposure, polysulfone (PSU) dosimeter badges are used, and these are sensitive to the same UVB wavelengths that cause erythema and are similar to those required for Vitamin D production in the human skin.[9] Several studies report significant correlations between self-reported sunlight exposure and measures of UV exposure by dosimeters.[10-12] A few have used dosimeters for the validation of sunlight exposure questionnaires.[8,13] However, the correlation between serum 25-hydroxyvitamin-D (25[OH] D) concentrations and sunlight exposure assessed using questionnaire methods (r = 0.2–0.4) as well as with dosimetric readings (r = 0.2–0.5) is found to be low.[11,12,14,15] A curvilinear relationship between recent solar UV exposure and serum 25(OH)D concentrations has been reported in Australian and UK adults.[16,17] Nevertheless, the association of UV exposure with serum 25(OH)D concentrations in Asian adults from tropical climates like India, where angle and latitude are favorable for receiving optimal sunlight, has to the best of our knowledge not been reported so far.

Personal dosimeter method is laboratory based, is expensive, requires expertise, and thus, is not suitable in clinical settings. Most of the currently available sunlight exposure questionnaires provide imprecise estimates of Vitamin D status. Research thus needs to be directed toward developing more objective, nonintrusive, and economic measures of sunlight exposure to help quantify personal Vitamin D status.[13] This technique is most likely to be effective in regions where oral intake of Vitamin D is negligible and daily activities are consistent. However, there are no validated questionnaires available for the assessment of sunlight exposure in Indian men, living in an urban inner-city setting. We have previously devised a questionnaire to assess sunlight exposure for estimating Vitamin D status of adult men aged 40–60 years.[18] The present study aimed to examine the precision of individual sunlight exposure assessed by our questionnaire against that measured using PSU dosimeter badges worn by the individual and to investigate the relationship between sunlight exposure assessed by questionnaire and PSU dosimeters with serum 25(OH)D concentrations. Serum 25(OH)D is an accepted measure of an individual's Vitamin D status. Thus, the specific objectives of the current cross-sectional study are as follows:

1. To determine the duration of casual sunlight (UVB) exposure required to maintain optimal body stores of Vitamin D above 50 nmol/L in Indian men living in an urban setting at latitude 18.52° N. More specifically, to determine solar UVB radiation dose received by an individual assessed using a PSU dosimeter and its relationship with serum 25(OH)D concentrations
2. To compare exposure to sunlight as assessed by detailed questionnaire with that assessed by PSU dosimeter badges and examine its relationship with serum 25(OH) D concentrations.

Methods

This was a cross-sectional, observational study in apparently healthy men (aged 40–60 years) enrolled from health checks clinics, social groups, and private establishments in Pune, India (18.52° N, 73.86° E). Out of 15 sites/groups approached, 11 expressed interest in participating in the study; of these, six sites were selected randomly using lottery method. From the six selected sites, out of eligible individuals, a total of 400 men provided consent. Of these, 180 men were randomly selected by computer-generated random number sequence.

The consort diagram for the primary aim of the study is illustrated in Figure 1. Ethical approval for the study was obtained from the Institutional Ethics Committee (dated 24/10/2013, IRB: ECR/352/Inst/MH/2013), and written informed consent was obtained from each man. The study was conducted between May 2013 and July 2014. Relevant past and present medical histories of the men were reviewed, and general clinical examination of all study men was performed by a physician to assess their health status. Exclusion criteria were individuals with known diabetes, liver, renal, thyroid, or cardiac disorders as assessed by history; individuals taking nutritional supplements and/or medications known to interfere with Vitamin D metabolism; individuals with fasting blood sugar concentrations >125 mg/dl, abnormal (serum glutamic pyruvic transaminase >65 IU/L), and abnormal serum creatinine (>1.2 mg/dl) concentrations. The sample size was calculated based on one-sample two-sided equality t-test. On the basis of observed variation reported in adults for the study parameter serum 25(OH)D, it was estimated that for the overall power of the study to be 0.8 and with a type 1 error probability of 0.05, the desired sample size was 131.[19]

Anthropometric measurements

Height was measured to the nearest 0.1 cm using Leicester height meter, UK (range 60–207 cm). Weight was measured on an electronic digital scale (Salter, India) to the nearest 0.1 kg. Body mass index (BMI) was computed as weight in kilogram/(height in meter)^2. The instruments used were calibrated daily.

Biochemical Estimations

A venous blood sample (8 ml) was collected between 9 and 10 AM from each man after an overnight fast for >12 h using vacutainers (BD, Franklin Lakes, NJ, USA). Serum 25(OH)D concentrations were estimated by enzyme-linked immunosorbent assay (ELISA, DLD Diagnostika, Germany; intra-assay coefficient of variation [CV] 4.9% and inter-assay CV 7.8%). The smallest detectable 25(OH)D concentration for

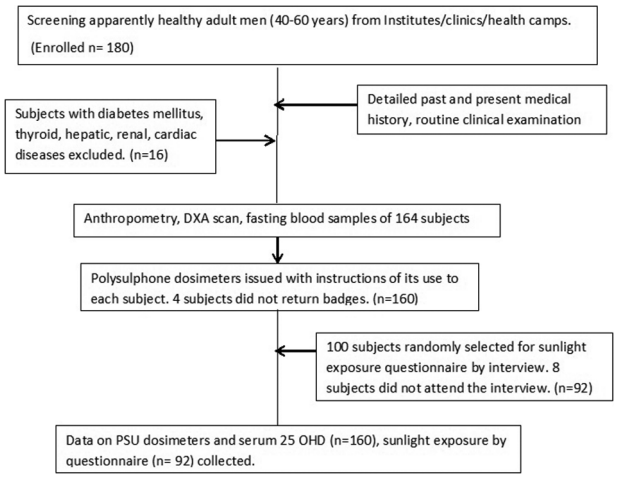

Figure 1: Consort diagram

the kit was 4 nmol/L while upper limit was 300 nmol/L. An important limitation of the immunoassay method is different sensitivity for 25(OH)D2 and 25(OH)D3 and cross-reactivity with 24,25$(OH)_2$D3, 25,26$(OH)_2$D3, and 23,25$(OH)_2$D3. However, ELISA kit used in the present study has identical sensitivity for 25(OH)D2 and 25(OH)D3 and cross-reactions with other metabolites are <0.5%.

Sunlight exposure questionnaire

A detailed sunlight exposure questionnaire was designed to record nature of the work/job, direct sunlight exposure in minutes per day (between 7 and 11 AM, 11 AM and 3 PM, and 3 and 7 PM separately), clothing pattern, mode of travel, average distance traveled, use of hat or helmet, and use of sunscreens [Appendix 1]. The questionnaire was pretested on a pilot sample of 10 adults to ensure reliability and standardization of data collection. Of the 160 men, 100 were randomly selected and invited for administering the detailed sunlight exposure questionnaire by a personal interview. The sunlight exposure questionnaire was administered to 92 men who agreed to the personal interview on a regular working day. Efforts were taken to verify details provided by the men about the pattern of sunlight exposure on typical working days (6 days a week).

Estimation of sunlight exposure from the questionnaire data

Solar radiation between 7 and 11 AM and 3 and 7 PM is approximately 40% of radiation between 11 AM and 3 PM.[20] Hence, estimated sunlight exposure duration between 7 and 11 AM and 3 and 7 PM from the questionnaires was converted to 40% and added to estimated sunlight exposure duration between 11 AM and 3 PM. Since skin area exposed is a critical determinant of Vitamin D synthesis for a given exposure, exposure time was then weighted by exposed skin area. In working urban men, approximately 15% of the skin area is typically exposed to sunlight, i.e., face, forearms, and hands. Estimation of the skin area percentage was based on Lund and Browder chart used to estimate affected area in burn patients.[21] Thus, depending on whether individuals wore full-sleeve/half-sleeve shirts and whether or not face was covered by a helmet (which was recorded in questionnaire), individuals had either 5% (full sleeves + full helmet), 10% (half sleeves + full helmet), or 15% (half sleeves + no helmet) of the skin area exposure. No corrections to sunlight exposure measurement were made for those with 15% exposure, whereas appropriate corrections (as above) were made to the minutes of exposure for less skin area exposed. Thus, all exposure durations refer to the middle of the day and 15% skin area equivalent durations. Based on this calculated equivalent duration for one typical working day, individuals were classified into three groups as (a) sunlight exposure <1 h/day, (b) sunlight exposure 1–2 h/day, and (c) sunlight exposure >2 h/day.

Personal polysulfone dosimeter measurements

The PSU dosimeters were mounted on a leather bracelet [Figure 2]. Individuals were asked to wear this bracelet (with PSU film dorsally facing) on a typical working day from sunrise to sunset, within 1 week of enrolment and collection of the blood sample. They were instructed to store the dosimeter in the supplied envelope (prepared from thick and dark material to prevent further UVB exposure during storage) and return it within next week. They were also instructed to record the date on which it was used and record activity for that day for cross-referencing with the administered questionnaire. When all exposed badges were returned by participants, they were sent to the laboratory at the University of Manchester for analysis and the resulting individual badge doses were reported in standard erythema dose (SED) units (1 SED = 100 J/m^2).

Statistical methods

All statistical analyses were performed using SPSS software for Windows (version 16.0, 2001, SPSS Inc., Chicago, IL, USA). Outcome parameters were tested for normality and normal variables (age, BMI, and Vitamin D) are presented as mean and standard deviation. Nonnormal variables PSU (SED) are expressed as median and interquartile range. One-way ANOVA or Kruskal–Wallis test was carried out to examine differences in means of parameters, i.e., PSU dose in SED, serum 25(OH) D, and BMI between the three groups of sunlight exposure (<1/day, 1–2 h/day, and >2 h/day). Pearson's or Spearman's correlation coefficients were computed to estimate association of serum 25(OH)D and sunlight exposure. Curve fitting analysis was performed to determine the nature of response of sunlight (UV) exposure as PSU dose in SED in terms of serum 25(OH)D concentrations in the study individuals.

Results

Of 180 enrolled individuals, 16 were excluded on screening as they were on Vitamin D supplements and four subjects lost their PSU dosimeter badges. Thus, data on PSU dosimeter and serum 25(OH)D concentrations were available on 160 individuals.

The study was spread over two seasons, summer (n = 110) and winter (n = 50). The difference between mean PSU in summer (0.95 ± 0.08 SED) and winter (0.80 ± 0.12 SED) was

Figure 2: Polysulfone film in holder and bracelet used for the measurement of individual ultraviolet-B radiation

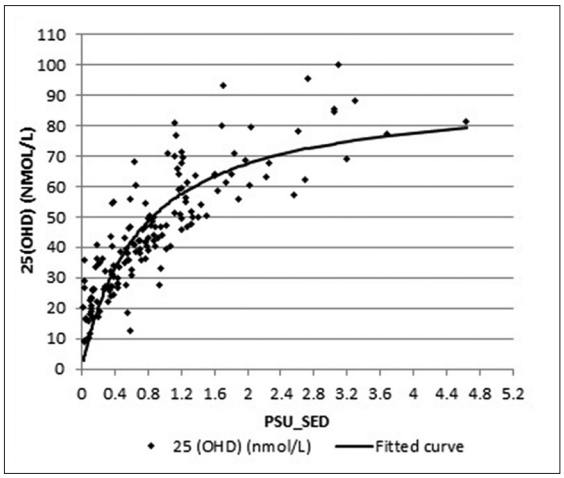

Figure 3: Relationship between 25-hydroxyvitamin-D concentrations and polysulfone dosimeter dose in standard erythema dose. Fitted curve is a hyperbolic function 25-hydroxyvitamin-D (nmol/L) = a × polysulfone standard erythema dose/(b + polysulfone standard erythema dose). Parameter estimates are a (±SE) = 91.33 (±4.77) ($P < 0.0001$) and b (±SE) = 0.705 (±0.09) ($P = 0.0002$), where SE represents standard error, 25-hydroxyvitamin-D (nmol/L) = a × polysulfone standard erythema dose/(b + polysulfone standard erythema dose)

not statistically significant ($P = 0.287$). Therefore, the two groups were combined for further analysis. Based on Institute of Medicine report cutoff for 25(OH)D, of the total 160 participants, 26.8% were found to be deficient (<30 nmol/L) in Vitamin D and 40.6% had insufficient (30–50 nmol/L) Vitamin D levels [Table 1].[22] PSU-UVB levels showed increasing trend across the three groups of Vitamin D status, indicating varying sunlight exposure. This relationship was further examined by nonlinear regression analysis. Only 13 of 180 individuals (8.1%) had 25(OH)D >75 nmol/L and mean PSU-UVB levels in these individuals were 2.6 ± 1.02 SED.

Ultraviolet-B Radiation Measured by Polysulfone Dosimeter and Vitamin D Status

The relationship between serum 25(OH)D concentrations and daily sunlight exposure (UV) as assessed by PSU dosimeter in the individuals was found to be curvilinear [Figure 3]. The increase in the serum 25(OH)D concentrations with the increasing sunlight exposure was best fitted by a hyperbolic function (correlation coefficient = 0.87).

Serum 25(OH)D (nmol/L) = 91.33 × SED/(0.705 + SED) ($P < 0.01$).

The graph shows that there was a rapid increase in 25(OH)D concentrations at lower (<1 SED) UV exposures and 1 SED radiation corresponded to 50 nmol/L 25(OH)D concentration and 2.8 SED radiation corresponded to 75 nmol/L. The curve showed a plateau at higher UV exposures (>3 SED) and reached a maximum value of 80 nmol/L at 4.6 SED. Extrapolating the curve further did not exhibit a rise in 25(OH)D beyond 90 nmol/L, indicating that additional sunlight exposure would not result in significant increase in 25(OH)D concentrations.

Almost all individuals with low levels of measured UV exposure (<1 SED) had 25(OH)D concentrations in the deficiency range (<50 nmol/L), whereas 83% of those with >1 SED-UV exposure had adequate 25(OH)D levels (>50 nmol/L). Receiver operating characteristic curve analysis of PSU-SED UV exposure values was used to estimate the PSU-SED cutoff for sufficiency of 25(OH)D concentrations, which corroborated with 1 SED for 25(OH)D level of 50 nmol/L [Figure 4].

Sunlight exposure by questionnaire and polysulfone dosimeter and Vitamin D status

Of the total 92 individuals, 36% had low exposure (<1 h/day), 42% had moderate exposure (1–2 h/day), and 22% had high (>2 h/day) sunlight exposure as assessed by questionnaire. Mean PSU radiation dose by badges showed a significant increasing trend from low (<1 h) to high sunlight exposure group (>2 h) ($P < 0.01$) [Table 2 and Figure 5]. Spearman's rank correlation between PSU-SED tertiles and sunlight exposure groups was found to be significant ($r = 0.517$, $P < 0.01$).

There were no significant differences in mean age and BMI in the three sunlight exposure groups ($P > 0.1$). Serum 25(OH) D concentrations were significantly lower in individuals with less sunlight exposure (<1 h) and increased with increasing duration of sunlight exposure ($P < 0.05$). Serum 25(OH)D concentrations showed a significant correlation with sunlight exposure groups (Spearman $r = 0.518$, $P < 0.001$) and PSU-SED values (Pearson $r = 0.82$, $P < 0.001$).

Discussion

Our study indicates that in western Indian men living in an urban setting at 18.5° N, with a dark skin (Fitzpatrick Type 5), over 1 h of casual sunlight exposure of the face, forearms, and hands (15% skin surface area) was required (between 11 AM and 3 PM, or scaled equivalent time), to get a minimum 1 SED-UVB dose and to maintain serum 25(OH)D concentrations above 50 nmol/L and >2 h of casual sunlight

Table 1: Characteristics of all the individuals in the study by Vitamin D3 status

Parameter	Vitamin 25(OH)D status			All
	Deficient (<30 nmol/L)	Insufficient (30-50 nmol/L)	Sufficient (≥50 nmol/L)	
N	43	65	52	160
Age (years)	47.7±6.5	49.1±5.4	47.7±5.0	48.3±5.6
BMI (kg/m²)	24.5±3.8	24.8±3.5	25.8±3.0	25.0±3.6
25OHD (nmols/L)	21.4±6.0	40.4±5.6	66.9±12.4	43.9±19.6
PSU (SED)[!]	0.14 (0.09-0.35)	0.70 (0.46-0.87)*	1.47 (1.1-2.17)*	0.70 (0.35-1.20)

[!]Values are mean±SD for all parameters, except PS-UV, which is expressed as median (IQR), *P<0.05. 25(OH)D: 25-hydroxyvitamin-D, PSU: Polysulfone dosimeter, BMI: Body mass index, IQR: Interquartile range, SD: Standard deviation, SED: Standard erythema dose

Table 2: Characteristics of the subjects across sunlight exposure groups

Parameter	Daily sunlight exposure groups			Total
	<1/day	1-2 h/day	>2 h/day	
N	33	39	20	
Age (years)	47.5±5.9	49.9±6.2	48.1±5.2	48.7±5.8
BMI (kg/m²)	24.4±3.8	24.7±3.4	26.6±3.4	24.8±3.5
25(OH)D (nmol/L)	26.2±10.8	42.8±16.8*	58.7±20.8*	41.3±19.4
PSU (SED)	0.36 (0.12-0.58)	0.79 (0.43-1.25)*	1.93 (0.82-2.72)*	0.64 (0.29-1.27)

Values are mean±SD for all parameters, except PSU, which is expressed as median (IQR), *P<0.05. 25(OH)D: 25-hydroxyvitamin-D, PSU: Polysulfone dosimeter, IQR: Interquartile range, SD: Standard deviation, SED: Standard erythema dose, BMI: Body mass index

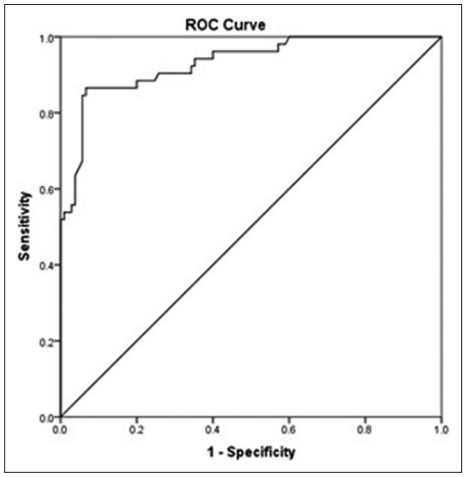

Figure 4: Receiver operating characteristic curve of polysulfone standard erythema dose ultraviolet exposures for men with Vitamin D sufficiency cutoffs. Area under the curve is 0.93 (±0.022), P < 0.001, sensitivity 0.865 and specificity 0.933. Cutoff at 1.033 standard erythema dose to have 25-hydroxyvitamin-D ≥50 nmol/L, with positive and negative predictive values of 92.5% and 88.0%

exposure needed to maintain 25(OH)D concentrations above 75 nmol/L. Moreover, extrapolation of the curve showed that even with sunlight exposure >4.5 SED 25(OH)D concentrations do not exceed 90 nmol/L. This reaffirms that in the skin, concentrations of pre-Vitamin D reach equilibrium at moderate UV doses and prolonged exposures do not result in hypervitaminosis D in humans.[6,23] Thus, nature has provided a regulatory mechanism which protects us from Vitamin D toxicity in case of continued prolonged exposure to sunlight and probably also indicates optimum upper limit for Vitamin D status. Several other studies have also observed that prolonged sunlight exposures either due to outdoor work or sunbathing result in mean 25(OH)D concentration always below 100 nmol/L. Therefore, this natural upper limit needs to be considered while deciding targets of 25(OH)D during intervention with Vitamin D supplements.[24]

Our study results have shown that serum 25(OH)D concentrations were significantly correlated with sunlight exposure as assessed by PSU dosimeters and by sunlight exposure questionnaire.

Our study provided a reliable and realistic estimate of sunlight exposure duration by the newly developed questionnaire. The interview-administered questionnaire was designed to cover most of the regular activities of the subjects, their type of clothing, use of sunscreen measures, and time of day in sunlight, which enabled us to evaluate the sunlight exposure between daily hour categories, especially 11 AM–3 PM. The exposure data were then processed to obtain a precise estimate by applying factors for exposed skin area, amount of time in each time category, and sunscreen application. Of the total 92 individuals, 44 individuals were observed in summer and remaining were assessed in winter. However, even after accounting for the seasonal difference, Vitamin D (25[OH] D) levels were similar in the two seasons (43.1 ± 3.0 nmol/L vs. 39.1 ± 2.8 nmol/L, P = 0.332). Furthermore, mean PSU-SED levels in the two seasons showed no significant difference (1.112 ± 0.14 vs. 0.80 ± 0.13, P = 0.11).

Thus, incorporating external factors affecting exposure to sunlight improved the accuracy and reliability of the estimate. Furthermore, the sample size of 92 for testing the sunlight exposure questionnaire was found to be adequate with a *post hoc* power of 0.81. The validation of the questionnaire with PSU badges demonstrated its utility in epidemiological studies and clinical settings.

In a similar study by Humayun *et al*. from Karachi (24.8° N), sunlight exposure questionnaires were validated by PSU dosimeters. However, correlation between average score of sunlight exposure and Vitamin D concentrations was lower (r = 0.36 and 0.43, P = 0.01) than that obtained in the present study (r = 0.518, P < 0.01).[8]

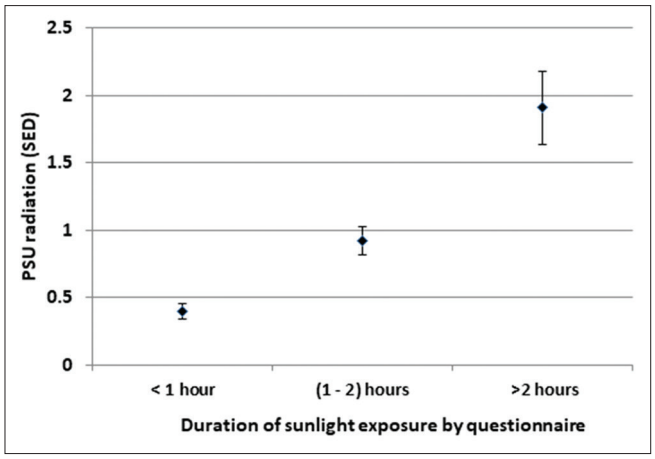

Figure 5: Mean (±standard error) ultraviolet-B radiation in each sunlight exposure group. Mean (±standard error of the mean) polysulfone radiation dose showed a significant increasing trend from low (<1 h) to high sunlight exposure group (>2 h) ($P < 0.01$)

Mean 25(OH)D concentrations in Indian men of the present study (43.1 ± 19.6 nmol/L) were lower than Australian adult men (82.9 ± 1.3 nmol/L) who mostly (74%) had very fair or fair skin color[25] but were in agreement with other Asian adult men.[8,26]

One of the limitations of the present study is that women were not examined for the sunlight exposure and Vitamin D status. It is likely that the prevalence of Vitamin D deficiency is more in women. Furthermore, due to household work and more indoor activities, sunlight exposure may be less in women, thus aggravating the Vitamin D deficiency.[27] However, in the age group of 40 years and above, women pose a complex scenario due to menopause and need separate consideration. Second, the sample size for the entire study ($n = 160$) was inadequate with *post hoc* power of 0.69. However, the associations of serum 25(OH)D with sunlight in our study were in agreement with other studies in different seasons.[7,25,26]

Conclusion

For the first time, our study provides guidance on duration of casual sunlight exposure (face, forearm, and hands) to maintain adequate Vitamin D status (serum 25[OH]D concentrations >50 nmol/L) in Indian men in an urban setting, at 18.5° N. We have also validated the sunlight exposure questionnaire using PSU dosimeters which may be useful for estimation of sunlight exposure in epidemiological studies.

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Conflicts of interest

There are no conflicts of interest.

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Appendix

Appendix 1: Sunlight exposure Questionnaire

(In case of day to day variation. Please enter average for week)

Enrolment Number and Name:

1. **Nature of work** (*Tick all that apply*)

Table work

Shop floor

Field work

Agriculture

Retired/Other

2. **For how long are you in direct sunlight** (*Mark only one*).

< 15 min

15- 30 min

30 - 60 min

> 60 min

3. **Duration and time of sunlight** (*Mark only one per row*).

	<30 min	30-60 min	1-2 hrs	2-3 hrs	3-4 hrs
7 am - 11 am					
11 am - 3 pm					
3 pm - 7 pm					

4. **What is the length of your sleeves?** (*Mark only one*).

Half sleeves

Full sleeves

5. **Do you use sunscreen on your face/arm?** (*Mark only one*).

Yes

No

Sometimes

6. **How do you travel?** (*Tick all that apply*).

Walking

Two wheeler

Car

Car with sunscreens

Bus/Railway

Combination/Other

7. **Do you use helmet?** (*Mark only one*)

No

Yes (head only)

Yes (head and face)

Sometimes

8. **Do you use cap?** (*Mark only one*).

Yes

No

Sometimes

9. **Any other comment?**

Daily exposure beyond travelling to workplace

Significant but non-regular exposure

Any significant (>15 days) change from routine in last 4 months