Impact of Sunscreens on Vitamin D: A Risk/Benefit Analysis

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Introduction

Repeated exposure to solar ultraviolet (UV) radiation is known to produce deleterious effects on human skin include-ing skin cancers and photoaging. Health-care providers including the AAD have advocated a "safe sun strategy" to reduce sunlight exposure and resultant acute and chronic skin damage. A part of this strategy is the daily use of sun-screens with a minimum SPF 15. It has been suggested that limiting exposure to solar light may have negative con-sequences. Specifically, protecting against sunlight exposure may significantly reduce the production of vitamin D (Vit. D) by skin increasing the risk of Vit. D de-ficiency leading to negative health effects.

Objective

The objectives of this analysis were to:

- **estimate the production of Vit. D based on measures of sunlight exposure; and**
- **determine the impact of an SPF 15 sunscreen on Vit. D levels in humans.**

Methods

A total of 92 female subjects from 5 locations, New York City, **NY** (n=15); Vail, **CO** (n=17); Plantation, **FL** (n=20), La Jolla, **CA** (n=18) and Chicago, **IL** (n=22), age 30-45 years, were recruited for this study.

Following enrollment, the investigator or designated technician at each site discussed details of the study with each participant, including the accurate documentation of time spent in sunlight during January 4-10 (IL) and March 1-7 (all other sites).

Each subject was provided a diary in which activities were recorded every 30 min throughout the day for 7 days. Subjects documented their outdoor activities and whether they were exposed to sunlight. At the end of the study, the diaries were returned to the investigator.

Each investigator measured the erythemally weighed flux (mW/cm^2) of sunlight. This value, together with the sunlight exposure (min), was used to calculate the daily dose of UV (mJ/cm^2).

The estimated amount of Vit. D synthesized was based on the formula of Holick (2001)[1] in which 1 MED of whole body exposure to sunlight is equivalent to 10,000 IU of Vit. D.

Results

Estimate of Vit. D Synthesis with a SPF 15 Sunscreen

Region	Time[A] (min)	UV (mJ/cm^2)[B] -SS	UV (mJ/cm^2)[B] +SS[D]	Est. Vit. D (IU)[C] -SS	Est. Vit. D (IU)[C] +SS
CA	41	33.1	2.2	2648	176
CO	59	37.0	2.5	2960	200
NY	62	20.1	1.3	1608	104
IL	29	16.7	1.1	1336	88
FL	70	79.3	5.3	6344	424

A: Average time (min) spent outside per day. B: Dose of erythemically-weighted solar UV. C: Assumes 1 MED = 10000 IU and 20% of body exposed, i.e., face, hands, arms.[1] D: -SS (no sunscreen) +SS with SPF 15 applied at 2 mg/cm^2 reducing UV by 93.6%.

Daily Adequate Intake: Vit. D*

Age (for males and females)	International Units (IU)	Micrograms (mcg)
0-50 years old	200	5
51-70 years old	400	10
71 years and older	600	15

*Institute of Medicine (1999)[2]

Discussion

In 5 geographies during the winter months, the average daily exposure to sunlight ranged from 29 to 70 min. Using the most conservative assumptions, the estimated synthesis of Vit. D was equivalent to half the AI (approximately 100 IU) even if an SPF 15 sunscreen was applied at the proper dose (2 mg/cm^2) during the coldest month of the year. The combination of diet[2] and sunlight even with daily use of an SPF 15 sunscreen provide the AI for Vit. D. This is consistent with population-based studies in which strict photoprotection practices had no impact on Vit. D levels[3-6].

Conclusion

The benefits of a "safe sun strategy" outweigh concerns associated with diminished exposure to solar UV, i.e., Vit. D deficits.

References:
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