Sun protection and low levels of vitamin D: are people concerned?

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Abbreviations: UV = ultraviolet radiation; SAQ = self-administered questionnaire

ABSTRACT

Objective: Recent reports on the association between low serum vitamin D and increased risk of cancer raised concerns about possible adverse effects of primary prevention strategies for skin cancer. To evaluate if these reports may influence peoples' sun protective behavior, knowledge and attitudes to the impact of sun protection on vitamin D.

Methods: Within a population-based survey in Queensland, Australia (5,611 participants, mean age 50.7 years (range 20-75); 48.2% men), agreement with the statement that sun protection may result in not having enough vitamin D as well as factors associated with agreement were assessed.

Results: Overall, 837 (15.0%) participants agreed that sun protection may result in not having enough vitamin D, 2,163 (38.7%) neither agreed nor disagreed, and 2,591 (46.3%) disagreed with this statement. Factors associated with agreement included older age, darker skin color and attempt to develop a suntan within the past year.

Conclusion: These results suggest that future sun protection campaigns may need to address the issue of vitamin D and present ways to achieve sufficient vitamin D levels without increasing sun exposure at least in countries with high UV radiation throughout the year.

Key words: vitamin D, sun protection, skin cancer prevention

Introduction

Bio-active vitamin D is formed through exposure of 7-dehydrocholesterol in the skin to ultraviolet radiation (UV) and two subsequent hydroxylations. A fine balance between beneficial and harmful effects of UV exposure is required to allow sufficient cutaneous vitamin D synthesis while preventing skin damage [1, 2]. Migration of white-skinned populations into regions with high levels of UV irradiation has resulted in a heavy burden of skin cancer. Coordinated campaigns to reduce sun exposure have resulted in a stabilization of melanoma incidence at least amongst younger birth cohorts in Australia and other countries [3-5]. The challenge now is to maintain the momentum of these programs, so their benefits can be fully realized.

Besides the role of vitamin D in preserving calcium and phosphate levels [6], roles in prevention of cancer and autoimmune conditions have been postulated [7-9], calculations to estimate the time necessary to receive 1/3 or 1/6 minimal erythemal dose across Australia have been published [10] and some professional bodies have proposed changes in sun exposure recommendations [11]. However, research supporting this is inconsistent and, even if vitamin D does have cancer-preventive properties, serum vitamin D levels optimal for human health and wellbeing are poorly defined. While there is agreement between authors about what defines vitamin D deficiency for bone health (<25nmol/L Serum 25-(OH) vitamin D), the definition of vitamin D insufficiency varies [12]. In addition, the amount of sun exposure needed to maintain appropriate vitamin D levels is influenced by environmental (such as latitude) and personal factors (such as skin color, calcium intake and physical exercise). Given all these factors to consider, it seems difficult to expect people to estimate how much time they need to spend in the sun to achieve enough vitamin D production while avoiding to increase their risk to develop skin cancer. Only one study reported 25-hydroxyvitamin D levels in Queensland, Australia, which has high UV levels almost throughout the year. Participants' mean serum 25-(OH) Vitamin D was 69.1 nmol/L (range, 12.2-174.5), with 8% of participants at or below 38 nmol/L and 23.4% at or below 50 nmol/L [13]. Previous studies have concluded that sun protection, especially regular use of sunscreen, does not substantially diminish vitamin D synthesis [14], although the results have been discrepant [15] and questioned [16].

Despite the lack of data to support recommendations for behavior change with regards to sun-protection, there has been considerable media coverage of the health effects of vitamin D insufficiency. We therefore aimed to assess the level of agreement with the statement that regular sun protection may result in not getting enough vitamin D, and the profile of those agreeing.

Methods

Data were collected within the population-based Queensland Cancer Risk Study [17], which explored cancer screening and risk behaviors amongst English-speaking residents (20-75 years) (overall response rate 45.6%). Participants were sampled at random within strata defined by gender, age and geographic region. Participants completed an anonymous 30-minute computer-assisted telephone interview in 2004, followed by a mailed, self-administered questionnaire (SAQ) from those who agreed to provide contact details. Details about participant characteristics and comparability with the Queensland population are described elsewhere [17], however, respondents were somewhat higher educated, more likely to be married and had more personal experience with cancer than the Queensland population. There was an under-representation of Indigenous people in the survey sample.

The interview collected information on demographic and on skin cancer risk factors (Table 1). Within the SAQ, participants were asked to indicate their level of agreement on a 5-point scale with the statement “If I regularly protect myself from the sun, I am in danger of not getting enough Vitamin D”.

We compared participants who agreed or strongly agreed that sun protection may result in not getting enough Vitamin D with all other respondents. Logistic regression analyses, adjusted for age and sex, were conducted to establish factors associated with this response.

Results

A total of 9,419 interviews were completed, and 5,611 (59.6%) participants (mean age = 50.7 years (SD 14.9; range 20-75); 48.2% men) returned the SAQ with complete data for the present analysis available from 5,591 participants. Overall, 2,591 (46.3%) participants disagreed/strongly disagreed

that sun protection may result in not getting enough vitamin D, 2,163 (38.7%) neither agreed nor disagreed and 837 (15.0%) agreed/strongly agreed with this statement.

Men and women responded similarly, however, participants aged 60-75 years were almost 3 times as likely to agree that sun protection may result in not getting enough vitamin D (OR = 2.84; 95% CI 2.31-3.50), while participants with high school education were somewhat less likely to agree compared to other participants. Participants with dark skin (OR =1.73; 95% CI 1.01-2.98), and those who reported that they always tanned (OR = 1.26; 1.02-1.56), as well as those who attempted to develop a suntan (OR = 1.65; 95% CI 1.30-2.09) were more likely to agree than other participants. Agreement was negatively associated with sunburns, sunscreen use and concern about skin cancer. Participants who agreed reported a similar history of skin examinations by a doctor, and gave similar importance to checks for skin cancer compared to other participants (Table 1).

[Please insert Table 1 about her]

Discussion

These results suggest that fifteen percent agreed and an additional 39% of participants were uncertain that protection from the sun may result in insufficient vitamin D synthesis. This may, in part, reflect the prominence of media reports that vitamin D reduces the risk of cancer and other chronic diseases and that sun exposure increases the body's vitamin D [18]. The increased level of intentional tanning and reduced intention to use sunscreen observed among those who agreed that sun protection may result in not getting enough vitamin D was not altered by adjustment for skin type. This further suggests that some of this lack of sun protection behavior may be driven by concerns about vitamin D. This is despite the fact that the participants, who live across Queensland between 10° and 29° south latitude, are faced with the highest incidence of melanoma worldwide (lifetime risk of 1 in 16 for men and 1 in 24 for women [19]), and very high rates of keratinocyte carcinomas [20].

Even in populations with very low sun exposure [21], or among people who protect themselves well against the sun [14], vitamin D deficiency is uncommon. However, there is an indication from one study that amongst the Queensland population 23% have vitamin D serum levels below 50nmol/L, defined by some as being insufficient [13]. Some subgroups of the population, including the elderly and those with dark skin, are at risk of vitamin D deficiency even in countries with high sun radiation

[22], and our finding that those subgroups agree that sun protection may lead to not getting enough vitamin D corresponds with this. If older people in our sample were made aware of the importance of vitamin D for bone health by their doctor, this may have influenced some of their responses to our survey when weighing the importance of bone health against the value of using sunscreen. This, as well as the influence of vitamin D supplementation, should be explored in greater detail in subsequent studies. The apparent contradictory finding that people who are concerned about vitamin D deficiency reported fewer sunburns despite being more likely to report sunbathing could be explained by the higher proportion of older people, those with dark skin and those who tan easily amongst the same group, all factors known to be negatively associated with sunburn.

Strengths of our study include its large sample size, population-based design and the inclusion of measures of skin cancer risk factors, and attitudes towards skin cancer and sun protection. However, the study was designed to assess a broad range of cancer screening activities and therefore did not ask detailed questions about attitudes towards vitamin D, or actual intake of vitamin D supplements. Limitations of our study include the low response rate. The sample composition compared to the target population indicates that our results are likely to underestimate the uncertainty surrounding vitamin D deficiency among the general population.

Nevertheless it does establish some baseline enabling future assessment of the impact of reports in the public and scientific medical media with regards to vitamin D on sun protection behavior.

In conclusion, the results of our study suggest that a high level of uncertainty exists with regards to vitamin D and sun protection in the general population of Queensland. Future sun protection campaigns may need to address population concerns by explaining the balance between the risks and benefits of sun exposure as well as promote dietary vitamin D supplementation as a safe alternative [23, 24] to ‘self-medication’ with sun exposure to ensure that the impact of several decades of health promotion campaigns, which are successfully reducing skin cancer incidence, is not jeopardised.

REFERENCES

[1] Diamond J (2005) Evolutionary biology: geography and skin colour. Nature 435:283-4

[2] Jablonski NG, Chaplin G (2000) The evolution of human skin coloration. J Hum Evol 39:57-106

[3] Coory M, Baade P, Aitken J, Smithers M, McLeod GR, Ring I (2006) Trends for in situ and Invasive Melanoma in Queensland, Australia, 1982-2002. Cancer Causes Control 17:21-7

[4] Montague M, Borland R, Sinclair C (2001) Slip! Slop! Slap! and SunSmart, 1980-2000: Skin cancer control and 20 years of population-based campaigning. Health Educ Behav 28:290-305

[5] Geller AC, Miller DR, Annas GD, Demierre MF, Gilchrest BA, Koh HK (2002) Melanoma incidence and mortality among US whites, 1969-1999. Jama 288:1719-20

[6] Holick MF (2004) Sunlight and vitamin D for bone health and prevention of autoimmune diseases, cancers, and cardiovascular disease. Am J Clin Nutr 80:1678S-88S

[7] Lehmann B, Querings K, Reichrath J (2004) Vitamin D and skin: new aspects for dermatology. Exp Dermatol 13 Suppl 4:11-5

[8] Grau MV, Baron JA, Sandler RS, Haile RW, Beach ML, Church TR, et al. (2003) Vitamin D, calcium supplementation, and colorectal adenomas: results of a randomized trial. J Natl Cancer Inst 95:1765-71

[9] Garland CF, Garland FC, Gorham ED, Lipkin M, Newmark H, Mohr SB, et al. (2006) The role of vitamin D in cancer prevention. Am J Public Health 96:252-61

[10] Samanek AJ, Croager EJ, Giesfor Skin Cancer Prevention P, Milne E, Prince R, McMichael AJ, et al. (2006) Estimates of beneficial and harmful sun exposure times during the year for major Australian population centres. Med J Aust 184:338-41

[11] Working Group of the Australian and New Zealand Bone and Mineral Society, Endocrine Society of Australia, and Osteoporosis Australia (2005) Vitamin D and adult bone health in Australia and New Zealand: a position statement. Med J Aust 182:281-5

[12] Wolpowitz D, Gilchrest BA (2006) The vitamin D questions: how much do you need and how should you get it? J Am Acad Dermatol 54:301-17

[13] McGrath JJ, Kimlin MG, Saha S, Eyles DW, Parisi AV (2001) Vitamin D insufficiency in south-east Queensland. Med J Aust 174:150-1

[14] Marks R, Foley PA, Jolley D, Knight KR, Harrison J, Thompson SC (1995) The effect of regular sunscreen use on vitamin D levels in an Australian population. Results of a randomized controlled trial. Arch Dermatol 131:415-21

[15] Holick MF, Matsuoka LY, Wortsman J (1995) Regular use of sunscreen on vitamin D levels. Arch Dermatol 131:1337-9

[16] Fuller KE, Casparian JM (2001) Vitamin D: balancing cutaneous and systemic considerations. South Med J 94:58-64

[17] DiSipio T, Rogers C, Newman B, Whiteman D, Eakin E, Aitken J (2006) The Queensland Cancer Risk Stuyd: behavioural risk factor results. Austr N Z J Public Health 30:375-82

[18] Berwick M, Armstrong BK, Ben-Porat L, Fine J, Kricker A, Eberle C, et al. (2005) Sun exposure and mortality from melanoma. J Natl Cancer Inst 97:195-9

[19] Baade P, Coory M, Ring I. National health priority cancers in Queensland (1982-1997). . Brisbane: Queensland Health; 2000.

[20] Staples MP, Elwood M, Burton RC, Williams JL, Marks R, Giles GG (2006) Non-melanoma skin cancer in Australia: the 2002 national survey and trends since 1985. Med J Aust 184:6-10

[21] Sollitto RB, Kraemer KH, DiGiovanna JJ (1997) Normal vitamin D levels can be maintained despite rigorous photoprotection: six years' experience with xeroderma pigmentosum. J Am Acad Dermatol 37:942-7

[22] Nowson CA, Diamond TH, Pasco JA, Mason RS, Sambrook PN, Eisman JA (2004) Vitamin D in Australia. Issues and recommendations. Aust Fam Physician 33:133-8

[23] Robinson JK (2005) Sun exposure, sun protection, and vitamin D. Jama 294:1541-3

[24] Janda M, Kimlin MG, Whiteman DC, Aitken JF, Neale RE (2007) Sun protection messages, vitamin D and skin cancer: out of the frying pan and into the fire? Med J Aust 186:52-4