

Correlation of vitamin D deficiency in children with the sun exposure and skin pigmentation

Ajay B Kale^{1*}, Engade Madhuri², Deokate Ojas³, Kalikivaya Naveenkumar³, Mohd Haseeb²

¹Senior Resident, ²Associate Professor, ³Junior Resident, Department of Paediatrics, MGM Medical College, Aurangabad, Maharashtra.
Email: ajaykale200@gmail.com

Abstract


Background: Sun exposure has been the main source of vitamin D for Indians with vitamin D synthesis occurring in the skin due to action of UVB light. Also, racial or ethnic groups with darker skin have been reported to have lower serum 25-hydroxyvitamin D levels than lighter skin colour groups living in same geographic area. Thus, lack of sun exposure and darker skin colour are identified as risk factors for poor vitamin D status. **Objective:** To study correlation of vitamin D deficiency with sun exposure and skin pigmentation in the paediatric population. **Methods:** The present hospital-based cross-sectional study was carried out from May 2012 to May 2013. 150 participants were recruited from population of young children aged 6 months to 15 years attending outpatient department of Dr. Babasaheb Ambedkar Central Railway Hospital at Byculla, Mumbai. Vitamin D levels were measured by electrochemiluminescent immunoassay. Vitamin D deficiency was defined as levels <50 nmol/L. Sun exposure was described as inadequate i.e. <3.5 hours per week or adequate i.e. ≥3.5 hours per week. Fitzpatrick skin grading system was used to grade the skin colour into 6 types. Assessment of vitamin D deficiency in relation to sun exposure and skin pigmentation was done. **Results:** Proportion of Vitamin D deficient children was found to be higher (89%) in subjects with < 3.5 hours per week sun exposure as compared to 59 % vitamin D deficient children among subjects with ≥3.5 hours per week of sun exposure time. Fitzpatrick grade 3 (lighter shade) were found to have lower prevalence of vitamin D deficiency as compared to grades 4, 5 and 6. Statistically significant correlation of vitamin D deficiency was noticed with sun exposure (p<0.001) and skin pigmentation grade (p = 0.009). **Conclusion:** In our study subjects, vitamin D deficiency was found to be significantly higher in subjects with < 3.5 hours per week sun exposure and dark grades (4, 5, and 6) of Fitzpatrick skin pigmentation. **Keywords:** Hypovitaminosis D, Sun exposure, Fitzpatrick skin pigmentation grades.

*Address for Correspondence:

Dr. Ajay B Kale, Senior Resident, 2Associate Professor, 3Junior Resident, Department of Paediatrics, MGM Medical College, Aurangabad, Maharashtra, INDIA.

Email: ajaykale200@gmail.com

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INTRODUCTION

Sun exposure has been the main source of vitamin D for Indians with vitamin D synthesis occurring in the skin due to action of UVB light¹. Also, racial or ethnic groups with darker skin have been reported to have lower serum 25-hydroxyvitamin D levels than lighter skin colour groups living in same geographic area²⁻⁵. Thus, lack of

sun exposure and darker skin colour are identified as risk factors for poor vitamin D status. The present study was done to assess the vitamin D deficiency status in relation to sun exposure and skin pigmentation grade in the paediatric population.

METHODS

The present hospital-based cross-sectional study was carried out from May 2012 to May 2013. 150 participants were recruited from population of young children aged 6 months to 15 years attending outpatient department of Dr. Babasaheb Ambedkar Central Railway Hospital at Byculla, Mumbai. Vitamin D levels were measured by electrochemiluminescent immunoassay. Vitamin D deficiency was defined as levels <50 nmol/L based on the previous definition of vitamin D deficiency as per the Endocrine Society Clinical Practice Guideline⁶. Sun exposure was described as inadequate i.e. <3.5 hours per week or adequate i.e. ≥3.5 hours per week. Fitzpatrick

skin grading system⁷ was used to grade the skin colour into 6 types. Assessment of vitamin D deficiency in relation to sun exposure and skin pigmentation was done.

RESULTS

Table 1 and 2 describe the results. Proportion of Vitamin D deficient children was found to be higher (89%) in subjects with < 3.5 hours per week sun exposure as compared to 59 % vitamin D deficient children among subjects with ≥3.5 hours per week of sun exposure time. Fitzpatrick grade 3 (lighter shade) were found to have lower prevalence of vitamin D deficiency as compared to grades 4, 5 and 6. Statistically significant correlation of vitamin D deficiency was noticed with sun exposure (p<0.001) and skin pigmentation grade (p = 0.009).

Table 1: Association between sun exposure and Vitamin-D deficiency

Sun Exposure	Vitamin D			Chi-square Value	p-value
	Deficiency	Sufficiency	Total		
≥ 3.5 hours	13(59%)	09(41%)	22(100%)	13.0	P=0.0005
< 3.5 hours	114(89%)	14(11%)	128(100%)		
Total	127	23	150		

S: Statistically Significant

Table 2: Association between Fitzpatrick Skin Colour Grades and Vitamin-D deficiency

Grades	Vitamin D			Chi-square Value	p-value
	Deficiency	Sufficiency	Total		
1	00(00%)	00(00%)	00(00%)	13.4	P=0.0095
2	01(100%)	00(00%)	01(100%)		
3	27(67.5%)	13(32.5%)	40(100%)		
4	63(90%)	07(10%)	70(100%)		
5	23(88.4%)	03(11.6%)	26(100%)		
6	13(100%)	00(00%)	13(100%)		
Total	127	23	150		

S: Statistically Significant

DISCUSSION

In our study, vitamin D deficiency was found to be significantly higher in subjects with < 3.5 hours per week sun exposure and dark grades (4, 5, and 6) of Fitzpatrick skin pigmentation. It is known that most of the vitamin D is synthesized in the skin through the exposure to UVB light⁸. Solar UVB radiation (wavelength 290 to 315 nm) penetrates the skin and converts 7-dehydrocholesterol to provitamin D3, which is then converted to vitamin D3^{5,8,9}. Efficiency of the provitamin D3 synthesis in skin is decided by the number of UVB photons that will penetrate the skin. Melanin, which is a skin pigment,

absorbs UVB and determines the number of photons reaching the site of vitamin D3 synthesis i.e. lower malpighian cellular layers of the skin¹⁰. So, racial or ethnic groups with darker skin have been reported to have lower serum 25-hydroxyvitamin D levels than lighter skin colour groups living in same geographic area²⁻⁵. However, race or ethnicity is just a proxy measure of skin colour. There are gradation of skin colour within the groups and also considerable overlap between the groups⁵. Our results are in line with that reported by Siddiqui *et al*¹¹. They reported that subjects with severe vitamin D deficiency had rare exposure to the sun and mentioned that their vitamin D deficiency may be related to living in small and crowded houses with limited internal sunlight. Similarly, in relation to skin colour, there are earlier reports of vitamin D deficiency being more common in dark skin colour groups^{5,12}.

Limitations of our study include cross-sectional design of study and small sample size especially very few subjects in some grades of skin colour. Also, another limitation was that we did not measure the exposure to UV radiation, including outdoor behaviour, like the clothing worn and related data.

CONCLUSION

In our study subjects, vitamin D deficiency was found to be significantly higher in subjects with < 3.5 hours per week sun exposure and dark grades (4, 5, and 6) of Fitzpatrick skin pigmentation.

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