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Economic and Lifestyle Factors Associated with the Vitamin D Deficiency among the Adult Population of Chandigarh

Divesh Dik*

Abstract

Background: Vitamin D deficiency is a matter of global concern. Various economic and lifestyle factors are associated with Vitamin D deficiency. However, the knowledge regarding the factors associated with Vitamin D deficiency is limited in consideration with the Chandigarh population, especially among adults. **Aim and Objective:** The present study aims at assessing the association of the Vitamin D deficiency with various economic and lifestyle factors among the adult population of Chandigarh. **Materials and Methods**: A cross-sectional study was conducted among 627 individuals of age group 30–70 years by adapting random sampling procedure. Economic and lifestyle particulars were collected using a detailed questionnaire. Vitamin D levels were analyzed using chemiluminescent immunoassay method. **Results**: The mean value of the Vitamin D level for the deficient, insufficient, and normal categories was reported to be 14.03 ± 3.41 ng/ml, 25 ± 3.16 ng/ml, and 36.96 ± 4.96 ng/ml, respectively. Vitamin D deficiency was significantly associated with occupation ($P < 0.001$), intake of multivitamin ($P < 0.05$), exposure to sunlight ($P < 0.001$), and type of food intake ($P < 0.05$). **Conclusion:** Working in closed environment, inadequate exposure to sunlight, lack of supplementation of multivitamin, and type of intake of food were possible factors significantly associated with the Vitamin D deficiency.

Keywords: Deficiency, Lifestyle, Multivitamin, Occupation, Sunlight

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Introduction

Health of an individual is derivative of lifestyle. The general awareness among people about vitamins and the benefits of their use are found to be quite low. It is to be noted that the deficiency of Vitamin D is also prevalent even among the people living in countries falling in the equatorial region, receiving sunlight in abundance. The researches reveal that the clothing habits, induced by the traditions and religious practices, also cause Vitamin D deficiency.[1] The majority of the scientists opine that a person is Vitamin D deficient, if her/his level of serum 25(OH)D is <20 ng/ml.[2] Bone mass in human body rises with the calcification of bone during childhood till youth. Peak bone mass is primarily dependent on Vitamin D status, intake of calcium, and physical activity.[3] Obesity and Vitamin D are inversely proportional. Several studies suggested that excessive calorie intake leads to higher body mass index, leading to low Vitamin D status.[4,5] The relative risk increases with the chronic exposure to excessive alcohol, leading to decline in level of Vitamin D level.[6] In addition, Vitamin D plays an important role in immunity modulation. Individuals with lower level of Vitamin D are more prone to upper respiratory tract infection in recent years than those having sufficient level of it, irrespective of the season, age, gender, body mass, and race.[7]

Chandigarh, known as the city beautiful, is a well-planned city of India. Planned on the concept of grid iron pattern by world fame architect planner, Le Corbusier, Chandigarh has wide open roads, open spaces, places of recreation such as Sukhna Lake, Rose Garden, Rock Garden, Children parks, neighborhood parks, and good quality of public health, educational, and transport services. On the whole, the quality of life is very good comparison to several other capital and metropolitan cities in India. Notwithstanding all this, there are a large number of people who suffer from deficiency of Vitamin D. According to a recent study conducted on adult population of Chandigarh, the overall deficiency among the adult population of Chandigarh was found to be 44.97%.[8]

Department of Anthropology, Research Scholar (UGC-SRF), Panjab University, Chandigarh, India

Corresponding Author: Divesh Dik, Department of Anthropology, Research Scholar (UGC-SRF), Panjab University, Chandigarh, India. E-mail: diveshdik1@gmail.com

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Materials And Methods

The study is based on primary source of data collected through a well-structured questionnaire from the field, conducted during December 2017 and March 2019. Random sampling technique was adopted to identify a sample size of 627 individuals in the age group of 30–70 years collected from urban localities of Chandigarh.

The present study was conducted with an objective to assess the associated risk factors of Vitamin D deficiency among the adult population Chandigarh of age group ranging from 30 to 70 years. Chandigarh falls within 30°44′14N latitude and 76°47′14E longitude. A random sampling procedure was adopted. Data collection was carried out from December 2017 to March 2019 from various parts of Union Territory Chandigarh. Background information of all the subjects regarding their age, occupation, diet, etc., was collected using a detailed questionnaire. Informed consent was taken from each participant and ethical clearance for conducting the study was obtained from the Institutional Ethical Committee. The sample size was calculated by applying the formula ($n = Z\alpha 2 \times p \times q/d2$) with 95% of confidence interval and 5% probability of type 1 error.[9]

Exclusion Criteria: Subjects having any chronic liver disease, long illness, history of medication with corticosteroids, hormone

replacement therapy, and any record/history of surgery were excluded from the study. Pregnant women were also excluded from the data collection.

The estimation of the Vitamin D of the participants was done by chemiluminescence immunoassay. The levels of Vitamin D were classified into three categories, that is, normal range (>30–100 ng/ml), Vitamin D insufficiency (21–29 ng/ml), and Vitamin D deficiency (0–20 ng/ml).[10]

Statistical Analysis

The collected data were analyzed by employing Statistical Package for the Social Sciences version 21.0. Differences of categorical variables between normal and Vitamin D deficient participants were computed using Chi-square analysis. The level of significance for all analysis was set at $P < 0{\cdot}05$ and a confidence interval of 95%.

Results

The overall mean of the Vitamin D level of the adult population of Chandigarh was found to be 23.48 ± 10.37 ng/ml. The mean value of the Vitamin D levels for the deficient, insufficient, and normal categories was reported to be 14.03 ± 3.41 ng/ml, 25 ± 3.16 ng/ml, and 36.96 ± 4.96 ng/ml, respectively.

Table 1 presents the coverage particulars of the adult population of Chandigarh of the age group of 30–70 years. It is evident from the above table that in occupation category, entrepreneurs were present in the highest percentage. Maximum number of the individuals were reported with no calcium intake. The enormous number of the participants was found to have no Vitamin D intake. Intake of multivitamin was observed to be negligible as compared to the no intake of multivitamin. Participants having exposure to sunlight for 0–15 min and 15–30 min were present in comparable percentage but the proportion of the individuals having no exposure to sunlight was found to be highest. Alcohol consumers were present in very less percentage as compared to individuals having no consumption of alcohol. The proportion of the participants practicing vegetarianism was marginally higher than those who were having non-vegetarian diet intake. Ovo-vegetarian diet intake was followed by the least number of participants. Majority of the participants were unaware of the knowledge regarding the health ailments caused due to Vitamin D deficiency.

Table 2 presents the association of the economic and lifestyle parameters with the Vitamin D deficiency among the adult population of Chandigarh. The adult participants had been categorized into two groups of Vitamin D levels, that is, normal and deficient.

It is evident from the table that a substantial proportion of normal participants (14.5%) were government employees while 46%, 22.9%, and 16.5% were entrepreneurs, private job professionals, and homemakers, respectively. A considerable proportion of the deficient participants (34%) were government employees while 10.6% were entrepreneurs. The proportion of the private employees and homemakers in the deficient adult population was found to be 13.1% and 42.2%, respectively. The difference between the two groups of Vitamin D levels with respect to occupation was found to be statistically significant as portrayed from the Chi-square value (134.618**). The enormous percentage of the normal individuals (85.5%) was found to have no intake of calcium. The percentage of normal participants reported with the regular and irregular calcium intake was 7.8% and 6.7%, respectively. The percentage of the deficient participants reported with the no intake, regular intake, and irregular intake of calcium was 80.9%, 14.2%, and 5.0%, respectively. The difference between the two groups of Vitamin D levels with respect to intake of calcium was found to be statistically non-significant. The proportion of the normal participants with no intake, regular intake, and irregular intake of Vitamin D was observed to be 89.4%, 7.3%, and 3.4%, respectively. The difference between the two groups of Vitamin D levels with respect to intake of Vitamin D was found to be statistically non-significant. About 88.3%, 7.8%, and 3.9% of the normal participants were reported to have no, regular, and irregular intake of the multivitamin. The percentage of the deficient participants with no, regular, and irregular intake of multivitamin was 95.4%, 2.5%, and 2.1%, respectively. The difference between the two groups of Vitamin D levels with respect to intake of multivitamin was found to be statistically significant as portrayed from the Chi-square value (8.686*). The proportion of the normal participants reported with no exposure, exposure for 0–15 min, 15–30 min, and >30 min of sunlight was 15.6%, 17.9%, 36.9%, and 29.6%, respectively. About 45.7% of deficient participants were reported to have no exposure of sunlight.

About 23.4%, 17%, and 13.8% of the deficient participants were found to have sunlight exposure for 0–15 min, 15–30 min, and >30 min, respectively. The difference between the two groups of Vitamin D levels with respect to exposure of sunlight was found to be statistically significant as evident from the Chi-square value (61.816**). The percentage of the normal participants with

Table 1: Coverage particulars of adult population of Chandigarh (*n*=627)

Variables	*Frequency*	*Percentage*
Occupation		
Government jobs	146	23.3
Entrepreneurs	189	30.1
Private job	116	18.5
Homemaker	176	28.1
Intake of calcium		
No	526	83.9
Yes	66	10.5
Irregular	35	5.6
Intake of Vitamin D		
No	553	88.2
Yes	50	8
Irregular	24	3.8
Intake of multivitamin		
No	575	91.7
Yes	37	5.9
Irregular	15	2.4
Exposure to sunlight		
None	201	32.1
0–15 min	144	23
15–30 min	145	23.1
More than 30 min	137	21.9
Alcohol consumption		
Yes	162	25.8
No	464	74
Irregular	1	0.2
Type of intake		
Veg	280	44.7
Non-veg	262	41.8
Ovo-vegetarian	85	13.6
Hypovitaminosis D knowledge		
Yes	172	27.4
No	455	72.6

Table 2: Association of the economic and lifestyle factors with Vitamin D deficiency

Variables	*Vitamin D range*				*Chi-square*	*P-value*
	Normal, n (%)		*Deficient, n (%)*			
Occupation						
Government jobs	50	14.5	96	34	134.618	0.001**
Entrepreneurs	159	46	30	10.6		
Private Jobs	79	22.9	37	13.1		
Homemakers	57	16.5	119	42.2		
Intake of calcium						
No	153	85.5	228	80.9	4.656	0.098
Yes	14	7.8	40	14.2		
Irregular	12	6.7	14	5.0		
Intake of Vitamin D						
No	160	89.4	246	87.2	0.741	0.690
Yes	13	7.3	27	9.6		
Irregular	6	3.4	9	3.2		
Intake of multivitamin						
No	158	88.3	269	95.4	8.686	0.013*
Yes	14	7.8	7	2.5		
Irregular	7	3.9	6	2.1		
Exposure to sunlight						
None	28	15.6	129	45.7	61.816	0.001**
0–15 min	32	17.9	66	23.4		
15–30 min	66	36.9	48	17.0		
More than 30 min	53	29.6	39	13.8		
Alcohol consumption						
Yes	44	24.6	68	24.1	0.645	0.724
No	135	75.4	213	75.5		
Irregular	0	0	1	0.4		
Type of food intake						
Veg	75	41.9	145	51.4	7.281	0.026*
Non-veg	88	49.2	103	36.5		
Ovo-vegetarian	16	8.9	34	12.1		
Hypovitaminosis D knowledge						
Yes	46	25.7	79	28.0	0.297	0.586
No	133	74.3	203	72.0		

Association of Vitamin D deficiency among the study participants for economic and lifestyle variables *Differences were considered statistically significant at $P < 0.05$ remarked by (*) and highly significant marked by at $P < 0.001$ denoted by (**).

regular intake and no intake of alcohol was 24.6% and 75.4%, respectively. The proportion of the deficient participants with regular intake, no intake, and irregular intake of alcohol was 24.1%, 75.5%, and 0.4%, respectively. The difference between the two groups of Vitamin D levels with respect to alcohol consumption was found to be statistically non-significant. The frequency of the normal participants feeding on vegetarian, non-vegetarian, and ovo-vegetarian diet was observed to be 41.9%, 49.2%, and 8.9%, respectively. The proportion of the deficient participants consuming vegetarian, non-vegetarian, and ovo-vegetarian diet was 51.4%, 36.5%, and 12.1%, respectively. The difference between the two groups of Vitamin D levels with respect to type of intake was found to be statistically significant as evident from the Chi-square value (7.281*). The percentage of the normal participants having knowledge of the hypovitaminosis D was 25.7% and with no knowledge of same was 74.3%. About 28% of the deficient individuals were reported to have awareness regarding hypovitaminosis D and 72% of them were unaware of the hypovitaminosis D deficiency. The difference between the two groups of Vitamin D levels with respect to hypovitaminosis D knowledge was found to be statistically non-significant.

Discussion

Occupation was found to have a significant association with the Vitamin D levels ($P < 0.001$) in our study which is in agreement with the study conducted on Korean wage workers.[11] No significant association was observed between the occupation and Vitamin D deficiency among the population of Hyderabad.[12] Intake of calcium was found not to be associated with the Vitamin D levels in our study. A Germany based reported that only calcium supplementation had not been significantly associated with the serum Vitamin D levels in elderly women.[13] In Hungary-based study, a significant association between Vitamin D levels and calcium supplementation was found.[14] A study conducted on the individuals in New England also reported a significant association between D levels and calcium supplementation.[15] A study conducted on Chinese adults had shown that there is non-significant association between the Vitamin D supplementation and Vitamin D deficiency which is in coherence with our study.[16] There was a strong association reported between Vitamin D supplementation and serum Vitamin D levels reported in other studies.[17,18]

In our present study, there was a significant association observed between the Vitamin D levels and multivitamin intake ($P < 0.05$). A significant association between Vitamin D levels and multivitamin was suggested by a study conducted on the population of the USA.[17] The exposure to sunlight had significant association with the Vitamin D levels in the present study ($P < 0.001$) which was in agreement with a study done on Chinese population.[16] Several studies had suggested a significant association between the Vitamin D levels and sunlight exposure.[19-20] The consumption of alcohol was found to have no association with the Vitamin D deficiency in the present study which is in accordance with some studies.[11,12,21] A significant association between the alcohol intake and Vitamin D levels was reported in a study on Korean population.[22] Type of food intake impacts the level of vitamin D in human. In this study, it was observed that the type of food intake was significantly associated with the Vitamin D deficiency ($P < 0.05$) whereas in a study conducted on population of Hyderabad, it was found to be non-significant.[12] In our present study, the knowledge regarding the hypovitaminosis D was not reported to have a significant association with the Vitamin D levels which was in agreement with a study conducted on the population of Northwest England.[23]

Conclusion

Modern working environment and urbanized houses have very lesser exposure to sunlight which would be the causative factor for the Vitamin D deficiency. The lack of multivitamin supplementation and type to food intake were found to be the determinants of Vitamin D deficiency.

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Refrences

1. Lips TA. Worldwide status of Vitamin D nutrition. J Steroid Biochem Mol Biol 2010;121:297-300.

2. Holick F. High prevalence of Vitamin D inadequacy and implications for health. Mayo Clin Proc 2006;81:353-73.
3. Stagi S, Cavalli L, Iurato C, Seminara S, Brandi ML, Martino M. Bone metabolism in children and adolescents: Main characteristics of the determinants of peak bone mass. Clin Cases Mineral Bone Metab 2013;10:172-9.
4. Cheng S, Massaro M, Fox S, Larson MG, Keyes J, McCabe L, *et al*. Adiposity, cardiometabolic risk, and Vitamin D status: The Framingham heart study. Diabetes 2010;59:242-8.
5. Skaaby T, Husemoen LN, Thuesen BH, Pisinger C, Hannemann A, Jørgensen T, *et al*. Longitudinal associations between lifestyle and Vitamin D: A general population study with repeated Vitamin D measurements. Endocrine 2016;51:342-50.
6. Ogunsakin O, Hottor T, Mehta A, Lichtveld M, McCaskill M. Chronic ethanol exposure effects on Vitamin D levels among subjects with alcohol use disorder. Environ Health Insights 2016;10:191-9.
7. Ginde AA, Mansbach JM, Camargo CA. Association between serum 25-hydroxyvitamin D level and upper respiratory tract infection in the third national health and nutrition examination survey. Arch Intern Med 2009;169:384-90.
8. Dik D, Kaur M. Prevalence of Vitamin D deficiency and associated risk factors among adults in Chandigarh. Int J Adv Med Health Res 2020;7:67-73.
9. Charan J, Biswas T. How to calculate sample size for different study designs in medical research? Indian J Psychol Med 2013;35:121-6.
10. Holick MF, Binkley NC, Bischoff-Ferrari HA, Gordon CM, Hanley DA, Heaney RP, *et al*. Evaluation, treatment, and prevention of Vitamin D deficiency: An endocrine society clinical practice guideline. J Clin Endocrinol Metab 2011;96:1911-30.
11. Jeong H, Hong S, Heo Y, Chun H, Kim D, Park J, *et al*. Vitamin D status and associated occupational factors in Korean wage workers: Data from the 5th Korea national health and nutrition examination survey (KNHANES 2010-2012). Ann Occup Environ Med 2014;26:1-10.
12. Suryanarayana P, Arlappa N, Santhosh VS, Balakrishna N, Rajkumar PL, Prasad U, *et al*. Prevalence of Vitamin D deficiency and its associated factors among the urban elderly population in Hyderabad metropolitan city, South India. Ann Hum Biol 2018;45:136-9.
13. Pfeifer M, Begerow B, Minne HW, Nachtigall D, Hansen C. Effects of a short-term Vitamin D3 and calcium supplementation on blood pressure and parathyroid hormone levels in elderly women. J Clin Endocrinol Metab 2001;86:1633-7.
14. Bhattoa HP, Bettembuk P, Ganacharya S, Balogh A. Prevalence and seasonal variation of hypovitaminosis D and its relationship to bone metabolism in community dwelling postmenopausal Hungarian women. Osteoporos Int 2004;15:447-51.
15. Goussous R, Song L, Dallal GE, Hughes D. Lack of effect of calcium intake on the 25-hydroxyvitamin D response to oral Vitamin D3. J Clin Endocrinol Metab 2005;90:707-11.
16. Zhang M, Li P, Zhu Y, Chang H, Wang H, Liu W, *et al*. Higher visceral fat area increases the risk of Vitamin D insufficiency and deficiency in Chinese adults. Nutr Metab 2015;12:50.
17. Brock K, Huang WY, Fraser DR, Ke L, Tseng M, Stolzenberg-Solomon R, *et al*. Low Vitamin D status is associated with physical inactivity, obesity and low Vitamin D intake in a large US sample of healthy middle-aged men and women. J Steroid Biochem Mol Biol 2010;121:462-6.
18. Kmieć P, Żmijewski M, Waszak P, Sworczak K, Kmieć L. Vitamin D deficiency during winter months among an adult, predominantly urban, population in northern Poland. Endokrynol Pol 2014;65:105-13.
19. Brouwer-Brolsma M, Vaes MM, van der Zwaluw NL, van Wijngaardena P, Swart MA, Ham AC, *et al*. Relative importance of summer sun exposure, Vitamin D intake, and genes to Vitamin D status in Dutch older adults: The B-PROOF study. J Steroid Biochem Mol Biol 2016;164:168-76.
20. Chen J, Yun C, He Y, Piao J, Yang L, Yang X. Vitamin D status among the elderly Chinese population: A cross-sectional analysis of the 2010-2013 China national nutrition and health survey (CNNHS). Nutr J 2017;16:3.
21. Jacques PF, Felson DT, Tucker KL, Mahnken B, Wilson PW, Rosenberg IH, *et al*. Plasma 25-hydroxyvitamin D and its determinants in an elderly population sample. Am J Clin Nutr 1997;66:929-36.
22. Lee K. Sex-specific relationships between alcohol consumption and Vitamin D levels: The Korea national health and nutrition examination survey 2009. Nutr Res Pract 2012;6:86-90.
23. Alemu E, Varnam R. Awareness of Vitamin D deficiency among at-risk patients. BMC Res Notes 2012;5:17.