

Prevalence of Vitamin D deficiency and its Co-relation with other related Parameters in a Tertiary Care Hospital in Rural area of North-West India

Amandeep Kaur*, Minni Verma, Brinder Chopra, Shalini Gupta, Vaneet Kaur

Department of Biochemistry, Gian Sagar Medical College and Hospital, Banur, Rajpura, Punjab, India.

Corresponding author: *Amandeep Kaur, Department of Biochemistry, Gian Sagar Medical College and Hospital, Banur, Rajpura, Punjab, India.

Abstract

Introduction: Many studies show a high prevalence of vitamin D deficiency across various populations the world over. But in rural areas the statistical analysis for vitamin D deficiency is not same. The level of vitamin D depends on the diet and exposure to sunlight.

Aim: This study was carried out to assess the prevalence of Vitamin D deficiency and other related parameters in North- West Punjab population.

Materials and methods: The present study was conducted in the Department of Biochemistry at Gian Sagar Medical College and Hospital, Banur. The study included 200 samples randomly selected from the population from age group 35-65 years. The samples were analyzed for the levels of vitamin D on Chemiluminescence and calcium, phosphorus, albumin, cholesterol levels on semi auto analyzer. The patients were divided into three groups depending on the levels of vitamin D. Group A individuals had sufficient levels of vitamin D (30-100 ng/dl), Group B included individuals having insufficient vitamin D levels (10-30 ng/ml) and Group C included individuals having vitamin D deficiency (< 10 ng/dl), and results were compared.

Results and conclusion: Out of 200 patients selected randomly, only 17.5% had sufficient levels of vitamin D whereas 45% had insufficient levels of vitamin D and 37.5% were found to be vitamin D deficient. The results of vitamin D were found to be statistically significant with p value < 0.0001. Furthermore, cholesterol, phosphorus and calcium levels were also statistically significant (p < 0.0001) in group C, whereas albumin levels were comparable in all the three groups. Thus, present study showed there is not much wide difference in vitamin D insufficient and deficient individuals. But difference can be seen between group A and B, C. The common reasons include their life style, taking vitamin D rich foods, and required skin exposure to sunshine.

Keywords: Vitamin D, Cholesterol, Calcium, Rural area

Introduction

Vitamin D is a fat soluble vitamin that is needed to form and maintain strong bones. Low levels of vitamin D can result in bones becoming thin, misshapen and can lead to

fractures. Vitamin D is also thought to be important in helping to maintain immune system. Vitamin D is found in foods such as fish, milk, eggs and fortified cereals. Our body also makes its own vitamin D when

our skin is exposed to sunshine. It is also produced endogenously when ultraviolet rays from sunlight strike the skin and trigger vitamin D synthesis. People may have low body stores of vitamin D for a number of reasons. It can be either not eating enough foods containing vitamin D or limited skin exposure to sunshine. Vitamin D obtained from sun exposure, food, and supplements is biologically inert and must undergo two hydroxylations in the body for activation. The first occurs in the liver and converts vitamin D to 25-hydroxyvitamin D [25(OH)D], also known as calcidiol. The second occurs primarily in the kidney and forms the physiologically active 1, 25-dihydroxyvitamin D [1, 25(OH)₂D], also known as calcitriol [1].

Vitamin D enhances absorption as well as maintains adequate serum calcium and phosphate concentrations in the gut and to enable normal mineralization of bone and to prevent hypocalcemic tetany. It is also required for bone growth and bone remodeling by osteoblasts and osteoclasts [1,2]. Inadequate intake of vitamin D results in deformation of bones, and as result becomes thin, brittle, or misshapen. Vitamin D sufficiency prevents rickets in children and osteomalacia in adults [1]. Together with calcium, vitamin D also helps protect older adults from osteoporosis.

Vitamin D has ample number of other roles in the body, including modulation of cell growth, neuromuscular and immune function, and reduction of inflammation [1,3,4]. At the genetic level, many genes encoding proteins regulate cell proliferation, differentiation, and apoptosis which is modulated in part by vitamin D. Many cells have vitamin D receptors, and some convert 25(OH)D to 1,25(OH)₂D. Serum concentration of 25(OH)D is the best indicator of vitamin D status. It reflects vitamin D produced cutaneously and that obtained from food and supplements [1] and has a fairly long

circulating half-life of 15 days [5]. Whereas 1,25(OH)₂D is generally considered, not a good indicator of vitamin D status because it has a short half-life of 15 hours and serum concentrations are closely regulated by parathyroid hormone, calcium, and phosphate [5]. Levels of 1, 25(OH)₂D do not typically decrease until vitamin D deficiency is severe [2,6]. The other parameters to exemplify Ca, P, and cholesterol are important in regulation of vitamin D.

According to surveys conducted in the recent past, over vitamin D deficiency prevails in epidemic proportions all over the Indian subcontinent, with a prevalence of 70%–100% in the general population. Despite of consuming food items such as dairy products there is deficiency in majority of population. In India, food is rarely fortified with vitamin D. Other than food, there are ample numbers of causes which includes Indian socio-religious and cultural practices which do not facilitate adequate sun exposure, thereby negating potential benefits of plentiful sunshine. Consequently, subclinical vitamin D deficiency is highly prominent among both urban and rural settings, and across all socio-economic and geographic strata [7]. So, inadequate vitamin D is frequent and deficiencies can be found in all countries in all ethnic groups, and across all ages. The purpose of the study was designed to determine the prevalence of vitamin D and related parameters in north-west population.

Materials and methods

The present study was conducted in the Department of Biochemistry at Gian Sagar Medical College and Hospital, Banur. The study included 200 samples randomly selected from the population from age group 35–65 years. The samples were analyzed for the levels of vitamin D on Chemiluminescence and calcium, phosphorus, albumin, cholesterol levels on semi auto analyzer. After obtaining approval

from institutional ethics committee samples were collected from patients visiting various outdoor departments of Gian Sagar Medical College & Hospital. The reference ranges of vitamin D are as follows:

Deficiency - < 10 ng/ml, Insufficiency - 10-30 ng/ml, Sufficiency - 30-100 ng/ml

Results

This study in the initial stage was started with the view of vitamin D deficiency according to the literature but on analysis it was found that in the rural region of north-west Punjab, the difference in percentage was no doubt there in deficient and insufficient group but the gap between was not so wide. Out of 200 patients selected randomly, only 17.5% had sufficient levels of vitamin D whereas 45% had insufficient levels of vitamin D and 37.5% were found to be vitamin D deficient. The results of vitamin D were found to be statistically significant with p value < 0.0001. Furthermore, cholesterol, phosphorus and calcium levels were also statistically significant (p < 0.0001) in group C, whereas albumin levels were comparable in all the three groups. There is no alarming difference in percentage of vitamin D sufficient and insufficient patients, though the percentage of Vitamin D sufficient individual is quite low that is 17.5% only. In this region of North West, people of rural region have vitamin D rich diet due to their life style. Moreover, they work in a field which is bread and butter for them so it's a blessing in disguise. They get sufficient amount of vitamin D through natural source. Comparing the three tables: 1, 2 and 3, group A, individuals have sufficient levels of vitamin D, calcium, phosphorus, cholesterol, albumin levels. The results of vitamin D were found to be highly significant with p value < 0.0001 as compared to group B and C. The serum cholesterol, calcium and phosphorus were comparatively low in Group 2 and 3.

But albumin was found to be comparable in all the three groups.

Table1: Group A (30-100ng/ml); Co-relation of vitamin D and other parameters.

Parameters	Mean±S.D	S.E	P
Vitamin D	49±14.4	2.43	< 0.0001
Cholesterol	186±12.0	2.0	< 0.0001
Albumin	4.4±0.5	0.09	0.3
Calcium	9.5±0.2	0.034	< 0.0001
Phosphorus	2.9.0±0.1	0.085	< 0.0001

Table 2: Group B (10-30ng/ml); Co-relation of vitamin D and other parameters.

Parameters	Mean±S.D	S.E	P
Vitamin D	19.0±0.28	0.03	< 0.0001
Cholesterol	190±17.6	1.9	< 0.0001
Albumin	4.3±0.5	0.056	0.2
Calcium	9.3±0.1	0.011	< 0.0001
Phosphorus	3.9±0.2	0.022	< 0.0001

Table 3: Group C (<10ng/ml); Co-relation of vitamin D and other parameters.

Parameters	Mean±S.D	S.E	P
Vitamin D	6.2±2.2	0.23	< 0.0001
Cholesterol	167±24.0	2.6	< 0.0001
Albumin	4.3±0.2	0.02	1.0
Calcium	8.9±0.1	0.011	< 0.0001
Phosphorus	3.0±0.5	0.054	< 0.0001

Discussion

Vitamin D plays vital role for the normal functioning of our body and serves umpteen numbers of functions. Vitamin D deficiency has already reported nationally as well as internationally by many researchers. Its deficiency has effect on various metabolism and in all age groups. In 2000, vitamin D deficiency was reported by Goswami et al, but could not found the cause behind it, inspite of abundant sunlight in South Asian countries. A similar type of study also reported by Zagar et al in 2007[8, 9]. Dr. Holick after his research in nutrition

recommended fortified food which helped in conquering the disorders and resolving the health problems due to vitamin D deficiency [10], though it is a common problem worldwide. The supplements are recommended to recover from the loss and the treatment is effective and preventive [11]. Vitamin D deficiency (VDD) in our country is reported in all ages groups including toddlers, school children, pregnant women ,adult male, female residing in rural and urban india.VDD has been associated and has prevalence in other disorders such as type 2 diabetes mellitus(DM), cardiovascular disease (CVD), immune competence including relation to tuberculosis, malignancy and osteoarthritis[12,13,14,15,16].

Our study is supported by the findings by bailey et al and other co- workers about the more prevalence of vitamin D deficiency along with disturbance in cholesterol metabolism the LDL levels are increased in urban than in rural areas. [17]. In addition , need for the revision of vitamin D levels was highlighted and vitamin D was reviewed with respect to age groups, sexes and euthenics groups[18].The frequency of VDD is reported to be more in very young children (1-5 years) 78% which is due to dietary insufficiency, in aged individuals and females due to socio-religion issues76.2% [19,20].A similar study was reported by Rachna et al in 2015 which also supported our present study, for lower prevalence of vitamin D deficiency in people who have greater opportunities for sunlight exposure ,to exemplify rural individuals and farmers[21]. Last but not least, VDD is associated with metabolic disease, cancer as well as affecting the overall health of an individual. [22, 23]

Conclusion

The individuals living in the metro cities who have table jobs, white collar jobs have null exposure to sunlight. The root cause of

VDD is, not taking vitamin D rich foods, sufficient supplements, defect at genetic level regulation, limited skin exposure to sunshine and life style of modern era. Addition of fortified food has resolved the ongoing health issues, but it is not in reach of all people. Moreover, supplements are not cost effective, so individuals should have sufficient diet rich in vitamin D, optimum exposure to sunlight, leave socio-religious belief to combat against this global issue.

References

- [1] Institute of Medicine, Food and Nutrition Board. Dietary Reference Intakes for Calcium and Vitamin D. Washington, DC: National Academy Press, 2010.
- [2] Cranney C, Horsely T, O'Donnell S, Weiler H, Ooi D, Atkinson S, et al. Effectiveness and safety of vitamin D. Evidence Report/Technology Assessment No. 158 prepared by the University of Ottawa Evidence-based Practice Center under Contract No. 290-02.0021. AHRQ Publication No. 07-E013. Rockville, MD: Agency for Healthcare Research and Quality, 2007.
- [3] Holick MF. Vitamin D. In: Shils ME, Shike M, Ross AC, Caballero B, Cousins RJ, eds. Modern Nutrition in Health and Disease, 10th ed. Philadelphia: Lippincott Williams & Wilkins, 2006.
- [4] Norman AW, Henry HH. Vitamin D. In: Bowman BA, Russell RM, eds. Present Knowledge in Nutrition, 9th ed. Washington DC: ILSI Press, 2006.
- [5] Jones G. Pharmacokinetics of vitamin D toxicity. Am J Clin Nutr 2008; 88:582S-6S. [PubMed abstract].
- [6] Holick MF. Vitamin D deficiency. N Engl J Med 2007; 357:266-81.
- [7] Ritu G 1 and Gupta A. Vitamin D Deficiency in India: Prevalence, Causalities and Interventions. Nutrients.2014; 6:729-775.
- [8] Goswami R, Gupta N, Goswami D, Marwaha RK, Tandon N, Kochupillai

- N. Prevalence and significance of low 25-hydroxyvitamin D concentrations in healthy subjects in Delhi. *Am J Clin Nutr.* 2000; 72(2):472-5.
- [9] Zargar AH¹, Ahmad S, Masoodi SR, Wani AI, Bashir MI, Laway BA, Shah ZA. Vitamin D status in apparently healthy adults in Kashmir Valley of Indian subcontinent. *Postgrad Med J.* 2007Nov; 83(985):713-6.
- [10] Holicks M F. Vitamin D Deficiency. *N Engl J Med.* 2007; 266-281.
- [11] Hyppönen E, Power C. Hypovitaminosis D in British adults at age 45 y: Nationwide Cohort study of dietary and lifestyle predictors. *Am J Clin Nutr.* 2007 Mar; 85(3): 860-8.
- [12] Goswami R, Mishra SK, Kochupillai N. Prevalence & potential significance of Vitamin D deficiency in Asian Indians. *Indian J Med Res.* 2008 Mar; 127(3):229-38.
- [13] Harinarayan C.V, Ramalakshmi T, Prasad U V, Sudhakar D. Vitamin D status in Andhra Pradesh: A population based study. *Indian J Med Res.* 2008 ;127: 211-218.
- [14] Marwaha RK, Tandon N, Garg MK, Kanwar R, Narang A, Sastry A, Saberwal A, Bandra K. Vitamin D status in healthy Indians aged 50 years and above. *J Assoc Physician India.* 2011 Nov; 59:706-9.
- [15] Jones G. Metabolism and biomarkers of vitamin D. *Scand J Clin Lab Invest. Suppl.* 2012; 243:7-13.
- [16] Khadilkar AV. Vitamin D Deficiency in Indian Adolescents. *Indian Pediatrics.* 2010; 47:755-756.
- [17] Bailey BA, Manning T and Peiris AN. The impact of living in rural and urban areas: Vitamin D and medical costs in veterans. *J Rural Health.* 2012; 28(4): 356-63.
- [18] Chopra B, Singh S and Singh K. Is there A Need to Reassess Reference Levels of Vitamin D for India? - A Preliminary Survey of Vitamin D Levels in the Normal Population of Punjab. *International J Science and Research.* 2013; 4(1); 1246-48.
- [19] Khan H, Ansari MS, Waheed U and Farooq N. Prevalence of Vitamin D Deficiency in General Population of Islamabad, Pakistan. *Ann. Pak. Inst. Med. Sci.* 2013; 9(1): 45-47.
- [20] Dhillon PR, Narang GS, Arora S and Kukreja S. A hospital based prospective Study of vitamin D deficiency in a selected group of apparently healthy children. One to five years of age. *Sri Lanka Journal of Child Health,* 2015; 44(3): 158-162.
- [21] Bachhel R, Singh NR, and Sidhu JS. Prevalence of vitamin D deficiency in north-west Punjab population: A cross-sectional study. *Int J Appl Basic Med* 2015. Jan-Apr; 5(1): 7-11.
- [22] Kim KT, Kang KC, Shin DE, Lee SH, Lee JH, Kwon TY. Prevalence of Vitamin D Deficiency and Its Association with Metabolic Disease in Korean Orthopedic Patients. *Orthopedics.* 2015 Oct; 38(10):898-903.
- [23] Paul M. Low Vitamin D Predicts Aggressive Prostrate Cancer. *North WESRERN University News.* 2016.