

VITAMIN D INSUFFICIENCY IN FOUR MAJOR HOSPITALS OF PUNJAB

UMAIR IRFAN¹, ANEEZA IRFAN², ADNAN LATIF MALIK³, MUHAMMAD IQBAL³, IRFAN MEHBOOB³

¹Department of Surgery, Mayo Hospital, Lahore, ²Department of Medicine, Children Hospital, Lahore,

³Department of Orthopaedics Surgery, PGMI/AMC/LGH, Lahore.

ABSTRACT

Objective: To demonstrate vitamin D deficiency in the general population of Punjab

Study Design: Observational, Cross-Sectional

Place and Duration: Multicentre study conducted at different Public Centre Teaching hospitals of Punjab – i.e. SIMS, SZH, PGMI/LGH, and FJMC

Methodology: The general population visiting hospitals that comprised of patients and visitors, as well as the local hospital staff that consisted of medical and paramedical staff, were given the opportunity to take part in the study.

Results: A total of 1075 samples were collected from the patients, visitors and staff working in hospitals. Two (0.186%) had hyper vitamin D levels, 8 (0.74%) had normal vitamin D levels, 475 (44.186%) had mild deficiency, 178 (16.56%) had moderate deficiency, 412 (38.338) had severe deficiency

Conclusion: Our population in general and those working in indoor environment in particular are vitamin D deficient. As a healthcare provider it is our duty to make people aware of deficiency and administer vitamin D in Food.

INTRODUCTION

Vitamin D is a fat-soluble, steroid hormone. It has two forms, D2 and D3. D3 is found and synthesized in the skin via 7 dehydrocholesterol. On exposure to sunlight 7 dehydrocholesterol is converted to cholecalciferol (vitamin D3) by ultraviolet B rays only. Ultraviolet A rays do not play a role in this conversion. The second form, D2 can be obtained via food sources e.g. eggs, milk and plants. Both forms are then metabolized by the liver and kidneys via 25 alpha hydroxylase and 1, 25 alpha hydroxylase respectively into their active form. Activated vitamin D, then acts on the gut wall, the kidneys, the bones and the parathyroid gland in a cumulative effort to increase absorption and therefore deposition of calcium in the bones. The resultant role is strengthening of bones and calcium homeostasis which is in turn vital for the adequate clotting of blood, proper contraction of muscles, conduction of nerve impulse, and regulation of cardiac rhythm, oocyte activation and fluid balance within the body. It is therefore necessary to maintain adequate levels of vitamin D in the body.

In spite of adequate sunlight, exposure of the population to sunlight is limited due to the sedentary and nocturnal lifestyle. Activities are limited to early morning hours and to the evening/night and people tend to remain indoors during mid-day a time that is most

crucial to obtain the UV-B rays from the sun. The darker skin tones of the Pakistani population are problematic as melanin in the skin hinders the proper absorption of vitamin D. This results in inadequate uptake of vitamin D3.

The lack of education and illiteracy results in poorly balanced diets while poverty results in meagre nutritional resources. The cumulative effect is a deficiency in body sources of D2⁵.

Thus vitamin D deficiency is not only common but is endemic. A study showed only 15.3% normal vitamin D levels in Pakistan¹. A second study showed 90% of people were deficient in vitamin D while a third one suggested that 45% of infants and 55% of females are deficient in vitamin D in Karachi². The resultant effect is fatigue, low energy levels, mood swings, muscular cramps, infertility, rickets and osteomalacia⁷. Vitamin D analysis is used clinically to diagnose Vitamin D deficiency. Due to the high incidence of rickets and osteomalacia this study was carried out to know the deficiency of this hormone in the public of Punjab.

METHODOLOGY

A multicentre observational study was carried out at SIMS, FJMC, PGMI, and SZH of Punjab from 2008-2018. General public, patients, medical and paramedical staff were inducted in the study. No age limit was defined. Written consent was taken from all the participants. The samples were collected by trained laboratory persons. The tests were carried out by

Corresponding to: Dr. Umair Irfan, Department of Surgery, Mayo Hospital, Lahore.
E-mail: umairbart07@hotmail.com

standardized ELISA method from the serum of collected samples. Study results were divided into the following categories: hypervitaminosis, normal, mild vitamin D deficiency, moderate deficiency and severe deficiency. These were based on the lab values of 30-40ng/dL with chronic fatigue, indicating mild deficiency, value ranging between 20-30ng/dL with irritability and mood swings, back pains, indicating moderate deficiency and values <20ng/dL with osteomalacia, rickets and fractures, hinting at severe deficiency. The exclusion criteria included patients with chronic liver or kidney disease, pathological causes of hypervitaminosis (sarcoidosis, tuberculosis, primary hyperparathyroidism) and pathological causes of hypovitaminosis (malabsorption syndromes/protein losing enteropathies). Patients taking drugs that reduced the levels of vitamin D in the body (steroids, ant tubercular drugs, cholestyramine, phenytoin, carbamazepine etc.) were also excluded. This study had limitations as it did not include the population from the elite societies as they do not visit the public hospitals. It also did not include the unprivileged population of remote areas that have limited access to public hospitals.

RESULTS

A total of 1075 persons were included and samples were obtained. The study was conducted at different centres simultaneously. The age ranged from 12 to 87 years. The mean age of the population was 41.6 years. 98% of the study subjects had never taken vitamin supplements. The average number of hours spent directly in the sun were 1.3 hours per day per person. People with severe vitamin D deficiency were seen to be spending less than 15 minutes per day under direct sunlight. Overall 83% of the subjects were deficient in vitamin D. The highest number of participants having mild deficiency were between the ages of 43-79 years. The female population was more deficient compared to male population. Out of 570 female patients, 490 were found to be deficient in vitamin D. The second most common population to be deficient was children. Out of 200 patients aged 12-18, 86 were found to have reduced levels of vitamin D. Two patients having toxic levels of vitamin D up to 135 ng/ml had been taking vitamin D inappropriately and frequently without follow up labs. While When compared with other studies the different age groups with mild, moderate and severe deficiency of vitamin D, there was no significant difference ($P=0.51$). Since it was an observational study no cause was determined. Patients with chronic liver and kidney failure were excluded from the study as were patients with pathological causes of hypo/hypervitaminosis.

DISCUSSION

Vitamin D is a steroid hormone that plays a vital role in several bodily functions. It is obtained via the skin as well as several food sources. It is then synthesized by the liver to 25 hydroxycalciferol then by the kidneys under the influence of the parathyroid hormone to 1, 25 hydroxycalciferol which is the active form. Activated Vitamin D acts on the gut to absorb calcium and phosphate and on the bone to deposit both calcium and phosphate¹⁷. It acts on the parathyroid hormone to down regulate the release of PTH. Minor deficiency leads to tiredness, fatigue, irritability and a lack of concentration, aches and pains, muscle weakness and depression and imbalance¹⁴. It also plays an essential role in mineral deposition in bones, the absence of which can result in osteomalacia and rickets¹³. Adequate vitamin D levels can also help in the prevention of osteoporosis. Vitamin D deficiency in different ages has different signs and symptoms. In children it results in rickets, in adults it is manifested as osteomalacia. In the elderly it may result in fractures. Deformities of the leg, chest and pelvis are common. It is necessary for calcium homeostasis, in junction with parathyroid hormone, retains sufficient calcium in the blood¹². Disturbed calcium homeostasis can result in coagulation disorders, infertility, muscular spasms, aberrant cardiac conduction and constipation⁷. It regulates the insulin levels and glucose tolerance of the tissues and thereby has a supportive role in managing type II diabetes. Children received vitamin D injections are also known to have a lower risk of developing type I diabetes¹⁵. It lowers the arterial wall stiffness and prevents hypertension. It has an impact on lowering the cholesterol and triglyceride levels in the body and thereby preventing heart diseases². It acts on the immune system of the body by modulating the action of antigen presenting cells and regulating the function of helper T cells, thereby limiting inflammatory processes and preventing autoimmune disorders⁴. It is linked with lower levels of atopy and allergy. It also enhances the effect of steroids and can be used in steroid resistant asthma. It also inhibits the progression of the cell cycle thereby preventing various cancers^{4,5}, particularly colon, breast and prostatic carcinoma. Vitamin D is an essential hormone for mental health, a deficiency of which is noted in patients of depression, schizophrenia, Alzheimer's, anxiety and obsessive compulsive behaviour³.

Since vitamin D plays such a vital role in the normal functioning of the body it is necessary to establish the causes of deficiency and to adequately treat patients¹⁶. Patients should undergo regular screening of vitamin D to check for deficiencies even if

concrete physical signs are not present since patients are unlikely to report symptoms such as irritability, mood swings and mild fatigue⁸. A majority of our patients were deficient in adequate sunlight exposure, while the rest were not getting adequate calories. It is pertinent to address these two concerns⁹. Additionally it is necessary to obtain a detailed history for the cause of vitamin D deficiency¹⁰. Deficiency due to the usage of drugs or due to pathological causes should be ruled out before vitamin D supplementation is given. Due to the overlapping symptoms with depression, vitamin D deficiency should be ruled out before treatment for depression is given¹¹. In addition adequate guidelines need to be established to treat vitamin D deficiencies to prevent toxic dosages as evident in two of our patients.

CONCLUSION

Vitamin D deficiency is a global problem in general and in under developed, poor countries in particular. An early and cost effective screening tool to rule out deficiencies is needed. Vitamin D should be administered as daily maintenance dose. It should be added in milk, oil and other food items. The population should be educated on adequate food intake, exposure to sunlight and vitamin D supplementations. Vitamin D should be administered only after lab tests in case of deficiency and labs should be monitored to prevent over dosages.

REFERENCES

1. Ahmed Atiq 1998. Vitamin D in breast fed infants. *Acta paediatrica* 87:737-40
2. Bischoff Ferrari HA, Willet WE – 2007 Vitamin D level and risk of hypertension, 49: 1063-9 march 19
3. Bednacczuk T, Nouman J. 2007. Vitamin D deficiency on cancers and autoimmune disease *Endokrynol Pol* 2007; 58:140-52
4. Escobar Morreale HF, Balsa JA, Vazquez C, villa fruela JJ. 2007. Vitamin D deficiency and metabolic syndrome. *Clin nutr* 2007; 26:573-80 July 18
5. Hollic MF 2007. Vitamin D deficiency *NEJM* 2007; 357:266-81
6. Irfan, Pervaiz, Nasim Khalid 2013 Vitamin D deficiency in Pakistan, *JPOA* 25-1, 18-19, March 13
7. Pasco JA – 2007 Vitamin D and depression. *Med hypothesis* 8:1316-9
8. Prevalence of Vitamin D deficiency in Pakistan and implications for the future. Riaz H¹, Finlayson AE^{2,3}, Bashir S¹, Hussain S⁴, Mahmood S⁵, Malik F⁴, Godman B^{6,7}.
9. <https://www.medicalnewstoday.com/articles/318415.php>
10. <https://my.clevelandclinic.org/health/articles/15050-vitamin-d--vitamin-d-deficiency>
11. <https://www.pharmacytimes.com/publications/issue/2010/february2010/otcfocusvitamind-0210>
12. <https://www.ncbi.nlm.nih.gov/pubmed/30648367>
13. <https://www.medicalnewstoday.com/articles/161618.php>
14. https://www.researchgate.net/publication/274708965_Calcium_and_its_Role_in_Human_Body
15. <http://www.vivo.colostate.edu/hbooks/pathphys/endocrine/otherendo/vitamind.html>
16. <https://www.medicalnewstoday.com/articles/318060.php>
17. <https://www.medicalnewstoday.com/articles/318415.php>