



## Role of vitamin D levels in pulmonary tuberculosis

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*Received: 28-02-2019 / Revised Accepted: 17-03-2019 / Published: 03-04-2019*


### ABSTRACT

An estimated 1/3 population of the world has latent Tuberculosis. India accounts for 25% of the world's cases in tuberculosis. TB is curable, but fatal within 5 years in 50-65% of cases, if untreated. Transmission usually occurs through the airborne spread of droplet nuclei through patients with infectious pulmonary tuberculosis. There is epidemiological evidence to support the role of vitamin D, which is a lipid soluble vitamin, in the immune response to TB. The present study aimed to evaluate serum vitamin D levels in PTB cases. This study was conducted in GMC Jammu on 100 patients of sputum positive pulmonary tuberculosis, attending OPD of Chest Diseases Hospital, between January and March 2018. A range less than 30ng/ml was considered Hypovitaminosis D. Out of the subjects, 76 PTB patients were found to have low Serum Vitamin D levels, with 68.4% Males and 31.6% females. In case of controls, 52 subjects were suffering from hypovitaminosis D with 59.7% males and 40.3% females. Poor intake of vitamin D- containing food items and decreased sunlight exposure seemed to be the primary cause, while our results suggested therapeutic role for vitamin D in the treatment of tuberculosis.

**Keywords:** Pulmonary Tuberculosis, Vitamin D, Hypovitaminosis, Balanced Diet

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**How to Cite this Article:** Pallavi Mahajan, Sanjeev Kumar, Ashima Badyal. Role of vitamin D levels in pulmonary tuberculosis. World J Pharm Sci 2019; 7(4): 69-72.

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## INTRODUCTION

Tuberculosis being one of the oldest diseases known to affect humans is a major cause of death worldwide. It is caused by mycobacterium tuberculosis complex and usually affects the lungs, although other organs are involved in up to one-third of cases. If properly treated tuberculosis caused by drug-susceptible strains is curable.[1] If untreated, the disease is fatal within 5 years in 50-65% of cases. Transmission usually occurs through the airborne spread of droplet nuclei produced by patients with infectious pulmonary tuberculosis.

Tuberculosis is classified as pulmonary tuberculosis (PTB) or extra-pulmonary TB or both. The most common extra-pulmonary sites are lymph nodes, pleura, genitourinary tract, bones and joints, meninges, peritoneum, and pericardium. Another way to classify TB is by classifying it into: latent (hidden) or active (overt). Latent TB is asymptomatic because the bacteria remain inactive in the body, [2] however it can turn into active TB anytime. An estimated one-third population of the world's population has latent TB. Active TB is the clinically manifested form of TB. It can occur in the first few weeks after infection with mycobacteria, or it might occur years later. TB occurs in every part of the world. In 2012, the largest number of new TB cases occurred in Asia, accounting for 60% of new cases with over 255 cases per 100000 population. India accounts for the largest burden of tuberculosis worldwide, with nearly 25% of the world's cases. Of the total number of tuberculosis cases in the world, 2-2.5 million cases are from India alone.[3]

### Vitamin D

Vitamin D is a lipid-soluble-vitamin found in small amounts in few foods, including fatty fish, like tuna, mackerel, and salmon. Foods fortified with vitamin D, like some dairy products, orange juice, soy milk, and cereals also act as an important source of Vitamin D. The active form of vitamin D is calcitriol. Most of the vitamin D is obtained through exposure to sunlight. There are two forms of vitamin D: vitamin D<sub>2</sub>, which is of plant origin and vitamin D<sub>3</sub> which is of animal origin. Vitamin D<sub>3</sub> is synthesized in the skin from 7-dehydrocholesterol by ultraviolet radiation.[4,5] Immune responses to mycobacterium tuberculosis are complex and incompletely understood, however, there is increasing epidemiological evidence to support the role of vitamin D in the immune response to TB. Many immune cells express the vitamin D receptor (VDR), including T and B cells, dendritic cells, as well as macrophages. Initial studies found that calcitriol stimulates antimicrobial activity, but it is only recently that the possible mechanism has been described. Toll

like receptors (TLR) on human macrophages upregulate the intracellular VDR and vitamin D hydroxylase genes, which results in induction of cathelicidin and  $\beta$ -defensin, both of which are potent antimicrobial peptides.[6] Cathelicidin induces fusion of the phagolysosome, which is essential for the containment, degradation and subsequent killing of mycobacteria. Calcitriol also exerts its effects on innate immune responses by the promotion of autophagy and the suppression of tissue remodelling and lung matrix breakdown. Autophagy is a potent mechanism by which the host defends against mycobacterial infection by degradation of cellular components through the lysosomal machinery.[7] Keeping in view the above facts, the present study was planned to evaluate serum vitamin D levels in pulmonary TB.

## MATERIALS AND METHODS

The current study was conducted in Department of Respiratory Medicine, GMC Jammu. It was conducted on 100 patients aged 15 years and above, of either gender of sputum smear positive for pulmonary tuberculosis, attending OPD of Chest Diseases Hospital, between January and March 2018. All the cases were selected by simple random sampling, while 100 healthy subjects in the age group of 15 years and above, of either gender, served as controls.

Patients showing sputum smear negative for pulmonary tuberculosis, or below the age of 15 years, or pregnancy and lactating mothers, or subjects on vitamin D and/or calcium supplements or on drugs that effect bone metabolism, like: anti-epileptic drugs; patients with known skeletal disease and parathyroid disorders; patients with chronic kidney /liver disease, and HIV positive patients were excluded from the study. 3ml of venous blood sample was aseptically collected as per the standard guidelines and protocol. Serum was allowed to separate and subsequently analyzed for serum vitamin D levels in Abbott Architect chemiluminescent micro-particle immunoassay for Vitamin D deficiency. [8] The Normal range for Vitamin D was considered between: 30-100 ng/ml, and Hypovitaminosis D for less than 30ng/ml levels.

## RESULTS AND DISCUSSION

The present study was conducted to assess the serum vitamin D levels in patients suffering from pulmonary tuberculosis at Department of Biochemistry in collaboration with Department of chest Medicine GMC Jammu. The age of TB patients and controls was comparable, with difference being statistically insignificant in our findings.(Table 1) Out of the subjects studied, 71%

were males and 29% females; similarly there were 66% males and 34% females in control group. Among the subjects, 76 PTB patients were found to have low Serum Vitamin D levels, with 68.4% males and 31.6% females. In case of controls, 52 subjects were suffering from hypovitaminosis D with 59.7% being males and 40.3% females. (Table 2) The results showed a significant population ratio of hypovitaminosis D amongst the cases while a seemingly normal ratio existed between them in controls. (Figure 1)

Poor intake of vitamin D containing food items and decreased sunlight exposure seemed to be the primary cause, which implied that there was need to get both sunlight as well as a balanced diet for adequacy of vitamin D. This was possible by consuming a vegetarian diet with a combination of cereals, pulses, vegetables, fruits in the right proportions every day while non-vegetarians could take eggs, fish and meat, besides pulses. Although there was no data available on the matter, it was a common observation that very few people knew as to what constitutes a balanced diet, and some beliefs and wrong concepts about diet prevented many from taking dietary items containing vitamin

D. There were only few who regularly got all that in their diet due to poverty and lack of awareness about what constituted a balanced diet, as also shown by Sasidharan, et al.[9] While Harinarayana, et al, proposed that reduced cutaneous biosynthesis of vitamin D could have been another reason, due to increased melanin in skin which could be interfering with ultraviolet light mediated vitamin synthesis.[10] Further it could be possible that the diet, poor in vegetables, resulted in magnesium deficiency, which lead to reduced parathyroid hormone secretion and the consequent reduction of 1- hydroxylation of vitamin D, as PTH is needed for this step in vitamin D biosynthesis.

## CONCLUSION

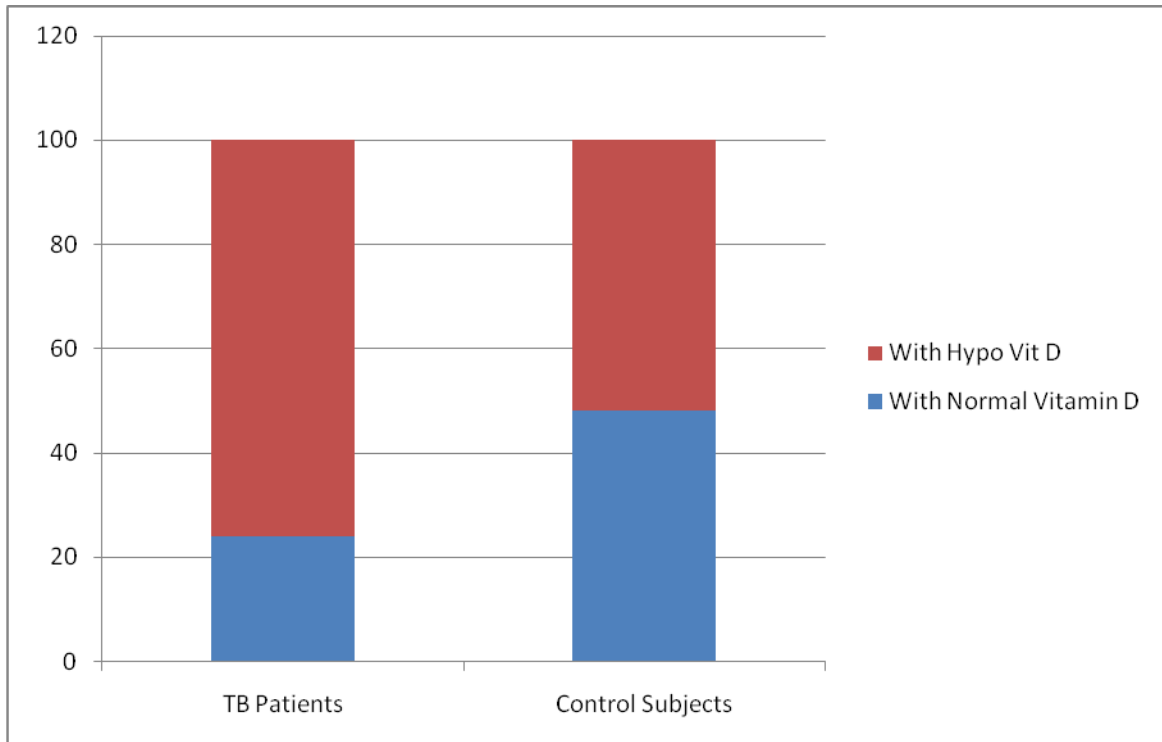
It could be observed that vitamin D deficiency commonly occurs in pulmonary tuberculosis and even, apparently healthy people may have vitamin D deficiency. The results and findings of the present study suggest a significant and therapeutic role for vitamin D in the treatment of tuberculosis, while the country fights to eradicate this disease on mission mode.

**Table 1: Age distribution amongst TB patients and controls**

	Range (Years)	Mean $\pm$ SD (Years)	p-value
<b>TB Patients</b>	15-75	45.22 $\pm$ 15.03	0.090
<b>Control Subjects</b>	15-69	42.39 $\pm$ 13.38	

**Table 2: Distribution of TB in cases and controls**

	Range (ng/mL)	Normal Vitamin D		Hypovitaminosis D	
		Frequency	% of Normal Vitamin D	Frequency	% of Hypovitaminosis D
TB Subjects	5.7 – 98.3	Males = 19	Males = 79.2%	Males = 52	Males = 68.4%
		Females = 5	Females = 20.8%	Females = 24	Females = 31.6%
		Total = 24	Total = 100%	Total = 76	Total = 100%
Control Subjects	14.2 – 85.5	Males = 35	Males = 73%	Males = 31	Males = 59.7%
		Females = 13	Females = 27%	Females = 21	Females = 40.3%
		Total = 48	Total = 100%	Total = 52	Total = 100%



**Figure 1: Serum Vitamin D levels amongst cases and controls**

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