

Aarti Kinikar<sup>1</sup>, Ajay Chandanwale<sup>1</sup> Sujit Dixit<sup>1</sup> Jennifer Jubilus<sup>2</sup>, Sanjay Jain<sup>2</sup>, Renu Bharadwaj<sup>1</sup>

Vidya Mave<sup>3</sup>, Nikhil Gupte<sup>3</sup>, Andrea DeLuca<sup>2</sup>, Amita Gupta<sup>3</sup>, Robert Bollinger<sup>3</sup>

1.Byramjee Jeejeebhoy Medical College; 2.Johns Hopkins Bloomberg School of Public Health; 3.Johns Hopkins School of Medicine

## BACKGROUND

- Vitamin D deficiency has been associated with active tuberculosis disease in adults but association not well understood in children (1).
- Vitamin-D, a modulator of monocyte-macrophage activity and plays a role in innate immunity, is associated with risk for TB and (poor?) TB treatment response when levels are low (2).
- Presently, India does not have a National Programme for Vitamin D supplementation in children inspite of high prevalence (3).
- We sought to estimate the prevalence of vitamin D deficiency in Indian children with TB as compared to healthy controls.

## METHODS

- Study Site** : BJGMC & Sassoon General Hospital, Pune, India.
- Study Design** : Case–Control study.
- Sample size** : Cases - 66 , Controls – 66.
- Cases** - Children with confirmed or probable TB, based on the current WHO TB definitions.
- Controls** - Healthy, age and sex-matched children attending immunization clinics and healthy siblings of admitted patients.
- Assay** : Serum 25 hydroxyvitamin D level was tested using the ELISA kit method with < 20 ng/ml as deficiency state
- Data Collection**: Sociodemographic, health, and nutrition questionnaire; Complete physical examination with anthropometry  
Investigations : CBC ; Sr calcium, Sr Phosphorous, Alkaline Phosphatase, Vitamin D levels, X-ray wrist.
- Statistical Analysis**: The data collected for cases and controls was tabulated and analyzed by STATA 11.0 Stata Corp, Texas,USA software. Chi square test, p value calculation was done to detect the significance.
- Baseline Characteristics**- Summarized using frequencies and compared between cases and controls using Fisher’s exact test. Odds ratio and confidence interval was calculated to analyze the risk factors.

## RESULTS

### Shown in Table 1 :

•132 children < 12 years of age (median 66 months, IQR 36 to 108 months) were enrolled with 66 cases and 66 controls.

• The **prevalence** of any vitamin D deficiency was **74% among cases** and **68% among controls**, but difference not statistically significant (p = 0.07)

### Chart 1

• In both groups as the vitamin D levels decreased to **severe levels (<10ng/ml)**, there was statistically significant Vit D deficiency changes in **biochemical** (low calcium, low /normal phosphorus and high alkaline phosphatase) and **radiological** (demineralization) parameters (p< 0.05)

•**Biochemical** evidence of vitamin D deficiency was suggested by low serum calcium, low or normal phosphorous and raised alkaline phosphatase ; noted in 31% of cases and 18% controls.

• **Radiological changes ( Fig 1 ) at wrist joint** were seen in **18% TB cases ( mainly 5 to 12 years age)** as against none of the controls.

•**Risk factors** for Vit D deficiency among cases were **malnutrition** (OR 19; p < 0.01)) and **low socio-economic status** ( OR 3.5; p < 0.01)

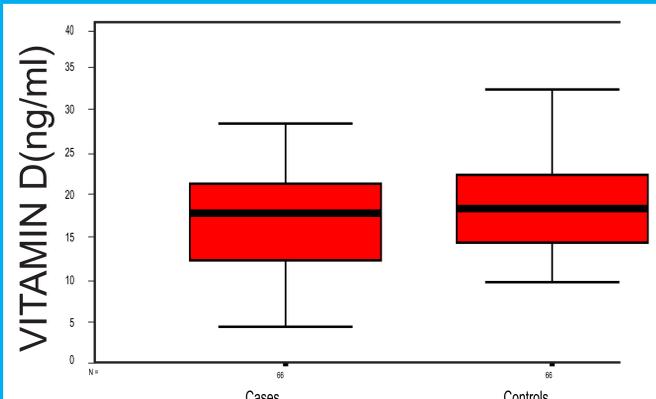


Table : 1

Parameter	Cases n(%)	Controls n(%)	OR ( CI)	p-value
Age				
<1 yrs	13 (20)			
1 < 4yrs	17 (26)			
4 <8 yrs	19 (28)			
8 <12 yrs	17 (26)			
Sex				
Male	42 (64)			
BCG yes	55(83)	66(100)		0.001
SE status (class4)	52 (79)	34 (56)	3.49 (1.63–7.49)	0.001
TB - CONTACT YES	25 (38)	nil		0.001
Malnutrition			19.3 (7.55–49.78)	0.001
Severe	25 (38)	Nil		
Moderate	34 (51)	20 (30)		
TST-positive	21 (32)			
Sputum positive	06 (10)			
TB Type				
Pulmonary	44 (67)			
Suspected	03 (5)			
Probable	55 (83)			
Confirmed	08 (12)			
Sr Calcium low	22 (33)	13 (20)		0.076
Sr Phosphorus low	24 (36)	22 (33)		0.715
Sr Alkaline Phosphatase high	28 (42)	33 (50)		0.383
Vitamin D levels				
Deficient (<20)	41 (63)	43 (65)		
Normal (> 20)	25 (37)	23 (35)		0.0717
Very severe (<5)	01 (2)	00		
Severe (5 - 10)	05 (8)	00		
Deficient (10-20)	35 (53)	43 (65)		0.075
Normal (>20)	25 (37)	23 (35)		
X-ray wrist Abnormal	12 (18)	00		0.001

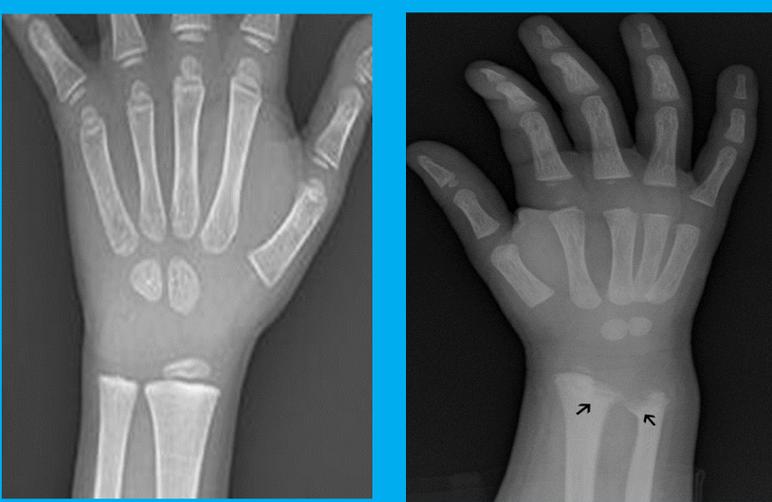


Figure 1:  
Left image is a child with no vitamin D deficiency  
Right image is child with vitamin D deficiency with changes suggestive of Rickets.

## CONCLUSIONS

- Prevalence of Vitamin D deficiency was high among children with TB as well as healthy controls
- However, severe form of vitamin D deficiency (<10ng/ml) was higher among children with TB and clinicians should be aware of associated malnutrition and low socio economic status as risk factors for severe deficiencies among them.
- Data suggest Vitamin D supplementation or food fortification is needed for most children in this area regardless of TB status

**Limitation** : Being a cross sectional study- Difficult to differentiate if severe deficiency increases the risk of TB OR whether TB leads to severe Vitamin deficiency in an already compromised population of children

**Further research** : To see if vitamin D supplementation in these children leads to lower complication rates and better TB outcomes.

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## ACKNOWLEDGEMENT

Dr. Aarti Kinikar is supported by the BJGMC JHU HIV TB Program funded by the Fogarty International Center, NIH (grant # 1D43TW009574) poster is solely the responsibility of the authors and does not necessarily represent the official views of BJGMC or the NIH  
Funding: Indo US ICMR and NIH 1R03HD0610509 01(Indian PI Renu Bharadwaj; US PI Sanjay Jain,); NIH 5U01A106977 (PI Amita Gupta); Gilead Foundation (PI Amita Gupta)