

Vitamin D deficiency and its associated factors in active TB patients at a tertiary hospital and three primary health care level facilities in Lusaka, Zambia

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# Disclosure



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# Outline

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# Introduction

- Vitamin D is a fat-soluble vitamin involved in calcium metabolism<sup>1</sup>
- Vitamin D deficiency (VDD) is principally caused by a lack of food sources or a reduction in sunlight exposure<sup>2</sup>
- VDD is classically associated with bone disorders<sup>3</sup>
- However, VDD been linked to increased susceptibility to TB<sup>4</sup>
- Prevalence of VDD among TB patients and its associated factors in Zambia unknown

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# Literature Review

<b>Author &amp; Year</b>	<b>Study Design</b>	<b>Location</b>	<b>Main Findings</b>
Huang et al (2016)	Met analysis	China (25 studies with 3,599 TB cases and 3063 controls)	Lower vitamin D levels was found in TB patients as compared to controls
Saturia et al (2014)	Systematic Review	USA (7 studies with 6,553 subjects)	Supplementation with vitamin D leads to better clinical outcomes in TB patients
Talat et al (2010)	Cohort	Pakistan (129 cases)	VDD deficiency was associated with increased risk for progression to TB

# Literature Review cnt'd

Author & Year	Study Design	Location	Main Findings
Workineh et al (2017)	Comparative Cross Sectional Study	Ethiopia (126 cases,57 household contacts,70 community controls)	Vitamin D levels in TB patients were lower than community controls and household contacts, Prevalence of vitamin D deficiency was higher in TB patients (83.3%) than in community controls (67.1%) (p <0.01)
Owolabi et al. (2016)	Matched Case-Control	Gambia (83 TB cases,98 controls)	25(OH) D levels are higher in serum of TB progressors and those with active disease compared to latently infected and uninfected subject
Banda et al (2018)	Cross-sectional	Malawi (161 cases)	74% of TB patients with suboptimal Vitamin D status. Lower vitamin D levels associated with colder months of the year, alcohol intake and food insecurity.

# Study Problem and Justification

- Zambia is one of the 30 high TB burden countries in the world<sup>1</sup>
- VDD associated with increased burden of TB<sup>2</sup>
- Level of VDD in Zambian TB patients and general population unknown
- Knowing the prevalence of vitamin D deficiency in our active TB patients:
  - Adding to the body of knowledge
  - Providing a platform for clinical trials

1.<https://www.who.int/news/item/17-06-2021-who-releases-new-global-lists-of-high-burden-countries-for-tb-hiv-associated-tb-and-drug-resistant-tb>

2. Talat N, Perry S, Parsonnet J, Dawood G, Hussain R. Vitamin d deficiency and tuberculosis progression. *Emerg Infect Dis.* 2010 May;16(5):853-5. doi: 10.3201/eid1605.091693. PMID: 20409383; PMCID: PMC2954005.

# Research Question

What is the prevalence and associated factors of vitamin D deficiency in TB patients at the UTH - Adult Hospital and three first level hospitals in Lusaka in comparison to adults without TB from the general population?



# Objectives



## General Objective:

To determine the prevalence of VDD in TB patients versus vitamin D deficiency in matched non-TB adults from the general population



## Specific Objectives:

To determine the factors associated with VDD in active TB patients in comparison to non-TB adults from the general population

To compare the clinical and radiological status of patients presenting with active TB, and their vitamin D levels

# Methodology

- Study Design: Cross sectional analytical study
- Study Sites
  - University Teaching Hospitals-Adult Hospital
  - Kanyama First Level Hospital
  - Chawama First Level Hospital
  - Chipata First Level Hospital
- Study duration: May 2020 to November 2020
- Study population: Laboratory confirmed TB patients and matched non-TB adults from the general population Sample size was calculated at 150
  - 20% added to account for non response and missing data (180 participants)
- TB patients were sampled conveniently while comparison group was recruited after matching (sex, age, HIV-status)

# Variables

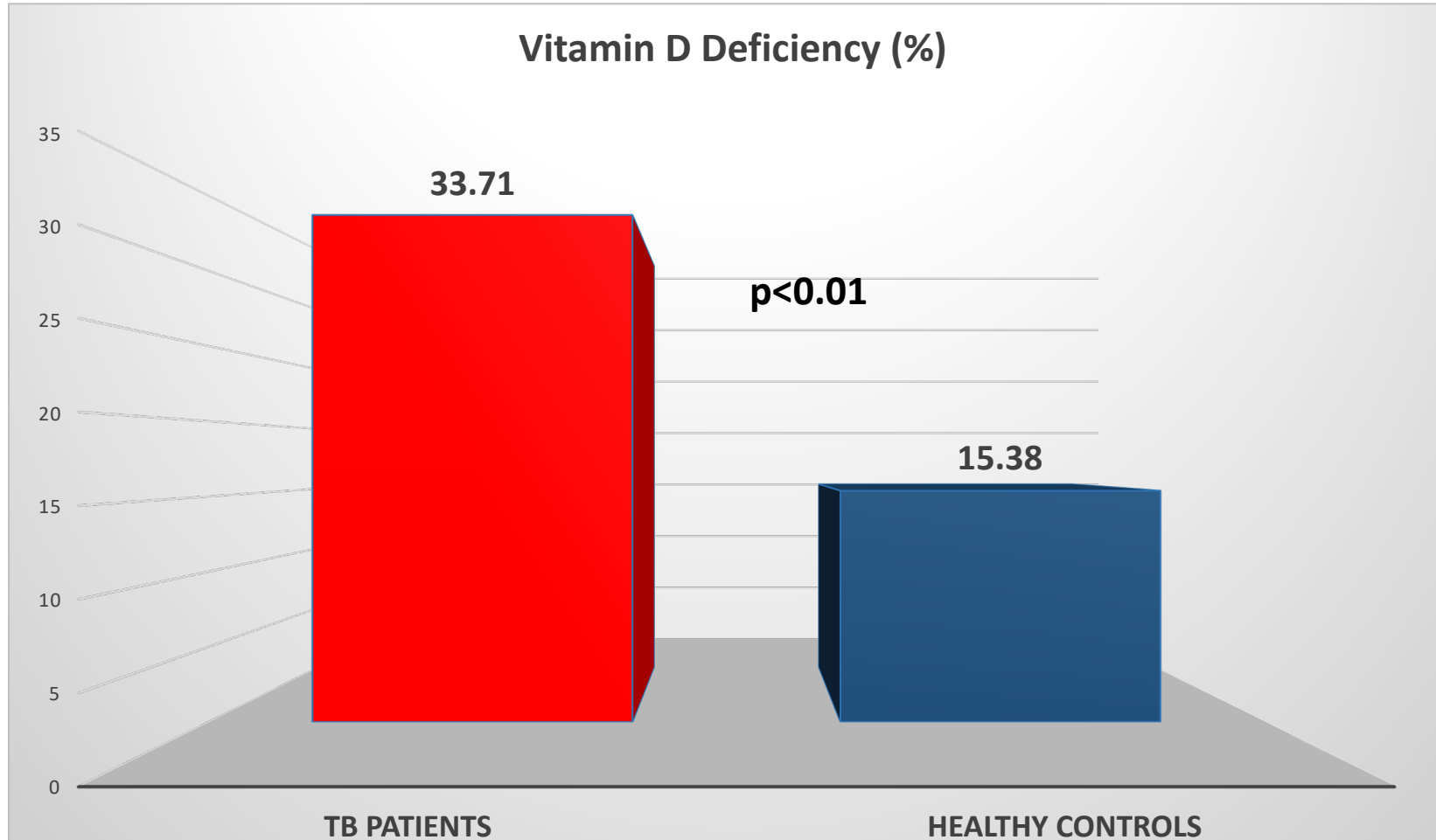
Independent variables	Scale of measurement	Dependent variable
Age	continuous	Vitamin D Status (as defined by the Endocrine Society) <sup>1</sup> <ul style="list-style-type: none"> <li>• Deficiency (&lt;30 ng/ml)</li> <li>• Non-Deficiency (≥30 ng/ml)</li> </ul>
Gender	categorical	
Area of Residence	categorical	
HIV Status	categorical	
Sunlight exposure (hours)	continuous	
Alcohol	categorical	
BMI	categorical	
MUAC	categorical	
Overt Malnutrition	categorical	
TB I Score	continuous	
Karnofsky Performance Index	continuous	
Timika Chest X-ray Score	continuous	

1. Michael F. Holick and others, Evaluation, Treatment, and Prevention of Vitamin D Deficiency: an Endocrine Society Clinical Practice Guideline, The Journal of Clinical Endocrinology & Metabolism, Volume 96, Issue 7, 1 July 2011, Pages 1911–1930, <https://doi.org/10.1210/jc.2011-0385>

# Baseline Characteristics

	TB patients		Non-TB Adults		p-value
	N (%)	Mean (+/-SD) Median (IQR)	N (%)	Mean (+/SD) Median (IQR)	
Male	69 (77.53)		57 (73.08)		0.51
Age		27.5 (24-38)		32 (25-37)	0.30
HIV positive	31 (34.83)		28 (35.90)		0.89
High Density Residence	70 (78.65)		26 (33.33)		<b>&lt;0.01</b>
Sunlight Exposure (hrs)		1.5 [1-4]		2 [1-4]	0.38
Alcohol use	51 (57.30)		33 (42.31)		0.06
BMI (kg/m <sup>2</sup> )		18.22 ( $\pm$ 2.55)		23.1 ( $\pm$ 3.74)	<b>&lt;0.01</b>

# Prevalence of Vitamin D Deficiency



# Analysis of TB patients based on Vitamin D status

	VDD		Non VDD		p-value
	N(%)	Mean ( $\pm$ SD) Median (IQR)	N (%)	Mean ( $\pm$ SD) Median (IQR)	
Male	24 (80.00)		45(76.27)		0.69
Age		32 (28-38)		29 (25-37)	0.58
HIV positive	12 (40.00)		19 (32.20)		0.47
Symptom Duration		3 (2-12)		4 (3-9)	0.14
BMI <18.5	19 (63.33)		28 (47.46)		0.16
MUAC < 22cm	12 (40.00)		14(23.73)		0.11
O. Malnutrition	6 (20.00)		1(1.69)		<b>&lt;0.01</b>
TB I Score		5.98 ( $\pm$ 2.17)		6.36 ( $\pm$ 2.17)	0.43
KPI		70 (60-80)		80 (70-90)	<b>0.01</b>
T. CXR Score		75 (45-115)		42.5 (20-75)	<b>0.01</b>

# Logistic Regression for Associated Factors with Vitamin D Deficiency

Variable	COR	p-value	AOR	p-value
<b>TB Status</b>				
Non-Active TB	1		1	
Active TB	2.80 (1.31-5.96)	<0.01	2.27 (1.04-4.95)	<b>0.04</b>
<b>Nutritional Status</b>				
<b>BMI</b>				
>18.5	1		1	
<18.5	2.50 (1.20 -5.20)	0.01	1.34 (0.54- 3.29)	0.52
<b>Overt Malnutrition</b>				
No				
Yes	20.66 (2.4- 177.2)	<0.01	14.5 (1.65-126.97)	<b>0.02</b>

# Discussion

- Prevalence of VDD of 33.71% in TB patients in our study
  - Higher than Nouri Vaskeh et al in Iran and Wejste et al in Guinea Bissau<sup>1</sup>
  - Lower than Ustianowski et al in London and Workineh et al in Ethiopia<sup>2</sup>
  - Possible explanations are variances in climate, cultural and dietary habits of the populations<sup>2</sup>
- VDD of 15.38% in our controls is at odds with findings by Jaimni et al in India and Taseem et al in Ethiopia<sup>3</sup>
  - Included some relatives of admitted patients as controls in their study

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3. Tessema, B., Moges, F., Habte, D. et al. Vitamin D deficiency among smear positive pulmonary tuberculosis patients and their tuberculosis negative household contacts in Northwest Ethiopia: a case-control study. *Ann Clin Microbiol Antimicrob* 16, 36 (2017). <https://doi.org/10.1186/s12941-017-0211-3>



# Discussion cnt'd

- Association of VDD with TB in the study population which is in line with most literature<sup>1</sup>
- Link with overt malnutrition similar to findings by Meker et al.
  - TB and malnutrition have a bidirectional relationship
- VDD TB patients had a lower Karnofsky Performance index.
  - Implies a greater severity of illness which agrees with findings by Farazi et al<sup>2</sup>
- VDD TB patients had a higher extent of radiological damage in keeping with literature<sup>3</sup>

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# Limitations

- Cross-Sectional Study so causation cannot be inferred
- Matching was not done for Social Economic Status
- Recruitment of participants in the cold months (June 2020 and July 2020) was hampered by the first COVID-19 wave



# Conclusions

- A significant difference was found in the prevalence of vitamin D deficiency in active TB patients compared to a matched non-TB adults from the general population
- Vitamin D deficiency was associated with Active TB and under nutrition
- Vitamin D deficiency in Active TB was associated with more clinical and radiologically severe disease
- Findings warrant further studies in the role of vitamin D in TB in Zambia

# Recommendations

- TB patients with undernutrition should be screened for vitamin D deficiency
- Vitamin D supplementation ought to be considered in TB patients especially those with under nutrition
- We suggest a larger longitudinal study to be done to look at vitamin D deficiency and vitamin D supplementation in TB patients and their close contacts

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- Study Participants







“A journey of a thousand miles begins with a single step” – Lao Tzu