

# A study to assess the nutritional status and dietary gap among pulmonary tuberculosis patients in Raipur city

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## ABSTRACT

**Background:** Undernutrition raises the likelihood of progressing from tuberculosis (TB) infection to active TB illness and causes weight loss. Proper food and nutrition are important in the treatment of tuberculosis patients. Active tuberculosis necessitates a substantial energy expenditure. The Tuberculosis treatment guidelines neglect the nutritional supplementation part of Tuberculosis management. The study aims to determine the factors affecting the nutritional status of pulmonary Tuberculosis patients. **Material and Methods:** A hospital-based cross-sectional study was conducted from December 2021 to January 2022 among the patients newly diagnosed and above 18 years of age coming to DOTS Centre (DMC) of Pt J.N.M. Medical College, Raipur. Total 120 subjects were selected by consecutive sampling method. Data was analyzed using SPSS version 24, and  $P$  value  $<0.05$  was considered statistically significant. **Result:** Among 120 study subjects, malnourished was 54.16% (BMI  $<18.50$  kg/m<sup>2</sup>), normal was 35% (BMI 18.50–24.99 kg/m<sup>2</sup>), overweight was 6.67% (BMI 25–29.99 kg/m<sup>2</sup>), and obese were 4.17% (BMI 30–34.99 kg/m<sup>2</sup>). Among 120 study subjects, the maximum number of them (96.3%) had a dietary gap in their diets which was equal in two groups of 1–50% calorie deficit and 51–100% calorie deficit. **Conclusion:** A high proportion of tuberculosis patients were undernourished, and even a very distal factor for undernutrition became proximal for tuberculosis patients. To control tuberculosis and to end the tuberculosis disease, an improvement in the nutritional status of the patient should be our priority. By knowing the importance of nutrition in TB patients, the primary care physicians can decrease the morbidity and mortality in TB patients.

**Keywords:** Adult pulmonary tuberculosis, dietary gap, nutrition, undernutrition

## Introduction

Tuberculosis is an infectious disease caused by *Mycobacterium Tuberculosis* species. India is the highest Tuberculosis-burden country in terms of absolute number of Tuberculosis cases that occur each year. Active Tuberculosis requires high energy consumption, i.e., 20–30% of extra energy of

RDA. Undernutrition increases the risk of progression from Tuberculosis infection to an active Tuberculosis disease. Food insecurity and poor nutritional status in the population are important contributors to the global burden of Tuberculosis disease. The association between Tuberculosis and malnutrition is bi-directional. It predisposes the patient to malnutrition and malnutrition increases the risk of developing active Tuberculosis by 6–10 folds. One-quarter of Tuberculosis in the world was as a result of malnutrition, improving the nutritional status of the individual decreases the risk of Tuberculosis. Additionally, malnutrition increases Tuberculosis relapse and mortality. Nutritional status is significantly lower in patients having active

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Received: 13-12-2023

Revised: 16-01-2024

Accepted: 19-02-2024

Published: 24-05-2024

### Access this article online

#### Quick Response Code:



**Website:**  
<http://journals.lww.com/JFMP>

**DOI:**  
10.4103/jfmpc.jfmpc\_1948\_23

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**How to cite this article:** Sinha AK, Debata I, Pradhan PC, Panda PS, Behera BK, Mukhopadhyay A. A study to assess the nutritional status and dietary gap among pulmonary tuberculosis patients in Raipur city. *J Family Med Prim Care* 2024;13:2138-42.

Tuberculosis than normal adults. Conditions like genetics, metabolic disorders, medication side effects, eating disorders, and Tuberculosis predispose to underweight. Therefore, the present study intended to assess the nutritional status by measuring BMI of pulmonary Tuberculosis patients and to know dietary gap in adult pulmonary Tuberculosis patient in Raipur city. Also other risk factors, i.e., socio-demographic factors, eating habits, dietary counseling which are related to the nutritional status in pulmonary Tuberculosis patients, were found out.

## Material and Methods

**Study Design**—Hospital-based observational study

**Study Area**—DOTS centers (DMC) of Pt. J.N.M. Medical College Raipur (C.G)

**Study Centre**—Department of Community Medicine, Pt.J.N.M Medical College, Raipur (C.G)

**Study Duration**—December 2021 to January 2022 (i.e., 2 months)

**Study Population**—All adult pulmonary Tuberculosis patients reporting to the DOTS Centre (DMC) of Pt.J.N.M Medical College, Raipur (C.G)

**Sampling Method:** Non-probable sampling

**Sample size-**  $n = Z^2 P(1-P)/l^2$ , where  $Z = 1.81$ ,  $P = 0.79$ ,  $l = 0.07$

$$= (1.81 \times 1.81 \times 0.79 \times 0.20) / 0.07 \times 0.07$$

$$= 0.53 / 0.004 = 109.19$$

With the anticipated frequency of undernutrition among Tuberculosis patients to be 79.5% and 7% precision level, the required sample size for the study was 109 Tuberculosis patients. This number was further rounded off taking into consideration non response and refusal of 10%.

$$\text{Adjusted sample size} = 109.19 + (0.1 \times 109.19) \\ = 109.19 + 10.91 = 120.11$$

Final sample consisted of 120 pulmonary tuberculosis patients.

**Sampling method** - Consecutive method of sampling until the desired number of study subjects was reached.

### Inclusion criteria

- All adult pulmonary tuberculosis patients coming to the DOTS Centre for treatment.
- Newly diagnosed between July 2021 and January 2022.
- Aged >18 years

### Exclusion criteria

- Extra-pulmonary Tuberculosis.
- Patients who were not given consent for participation in the study.
- Patients who were critically ill, who were not able to participate in the study or not able to respond and understand the questions asked.
- Depressed or mentally unstable patients.

**Study tools**—Interview, anthropometric measurements, and 24-hour recall diet by using semi-structured predesigned pretested questionnaire

- Calorie intake record and dietary gap calculation sheet.
- Weighing machine and non-stretchable measuring tape.

### Ethical permission

Permission and approval from Institutional Scientific and Ethical Committee of Pt.J.N.M. Medical College, Raipur, Chhattisgarh, was taken. Consent was taken before taking information from the patient continue until the desired number of study subjects was reached.

### Statistical analysis

Data was entered into Microsoft Excel spreadsheet and was subjected for appropriate statistical analysis. Qualitative or categorical data was analyzed in frequency or percentage. Patients' characteristics by BMI groups were analyzed using the Pearson Chi-square test or Fisher's exact test. Associations were found between BMI (dependent variable) in two classes (<18.5 kg/m<sup>2</sup> [underweight] and ≥18.5 kg/m<sup>2</sup>) and socio-demographic, disease, lifestyle, and dietary characteristics. Data was analyzed using SPSS v 24, and  $P$  value <0.005 was considered as statistically significant.

## Results

Among 120 study subjects, the mean age of study subjects was 40.4 years. Male-to-female ratio was 1:1. 110 (91.67%) of the study subjects belonged to Hindu religion and only 2 (1.66%) belonged to Sikh and Christian. Most of the study subjects, i.e., 79 (66.6%), were married followed by single with 29 (23.3%), 26 (21.67%) were educated up to primary school, 20 (16.67%) were illiterate, and only 4 (3.33%) were postgraduate/professional. Among 120 patients, 27 (22.5%) were homemakers and only 1 (0.83%) was self-employed. Most of the study subjects 93 (77.5%) belonged to the lower class followed by the lower middle class 23 (19.16%). Out of 120 study subjects, 67 (55.83%) had 5 members in the family and 11 (9.17%) had 10 or more family members. Among 120 study subjects, the maximum number (12.5%) were taking anti-tubercular therapy from 6 and 13 months, and the minimum (0.833%) were taking anti-tubercular therapy from 20 and 21 months.

Out of the total study subjects, 80 individuals had tuberculosis, 63 (78.75%) TB-affected individuals had positive contact

with tuberculosis, and 22 (55%) non-TB-affected had positive contact with tuberculosis. 17 (21.25%) TB-affected individuals and 18 (45%) non-TB individuals had no known contact history. The association was found to be statistically significant ( $P < 0.01$ ). 75 (93.75%) study subjects with TB and 24 (60%) study subjects with no TB had knowledge about TB, it was found to be statistically significant ( $P = 0.00001$ ). 61 (76.25%) study subjects with TB and 12 (30%) individuals without TB had positive appetite change, and it was found to be statistically significant ( $P < 0.0001$ ). 67 (83.75%) TB-positive and 30 (75%) TB-negative individuals were doing exercise, and it was not statistically significant ( $P = 0.25$ ). 70 (87.5%) TB-positive individuals and 11 (27.5%) TB-negative individuals had unintentional weight loss, and the association was found to be significant ( $P < 0.0001$ ) [Table 1].

Fifty-five (68.7%) TB-affected individuals and 5 (12.5%) TB non-affected individuals received dietary counseling from ASHA, Counsellor, Doctor, and DOTS provider, and 60 individuals who did not receive dietary counseling had 25 (31.3%) TB-positive cases and 35 (87.5%) TB negative cases, and it was found to be statistically significant ( $P = 0.0000$ ). Forty-nine (61.3%) TB-positive individuals and 25 (62.5%) TB-negative individuals were told by a physician to take extra calories and 31 (38.7%) TB-positive individuals and 15 (37.5%) TB-negative individuals did not receive any advice from the physician to take extra calories, and the association was found to be statistically insignificant ( $P = 0.8944$ ). Out of 80 TB-positive individuals, 43 (53.8%) study subjects practiced taking extra calories, and out of 40 TB-negative individuals, 27 (67.5%) study subjects practiced eating an extra calorie diet and the association was found to be statistically insignificant ( $P = 0.1498$ ) [Table 2].

Out of the total TB-affected individuals, 96.3% of subjects were taking calorie deficit foods and out of non-TB-affected individuals, 87.5% of subjects were taking calorie deficit

**Table 1: Assessment of knowledge regarding tuberculosis in study subjects (n=120)**

Variable	TB-affected individuals (80)	Non-TB individuals (40)	Chi-square, P
Known contact history			
Yes	63 (78.75%)	22 (55%)	7.2807,
No	17 (21.25%)	18 (45%)	$P < 0.01$
Knowledge about TB			
Yes	75 (93.75%)	24 (60%)	21.039,
No	05 (6.25%)	16 (40%)	$P < 0.00001$
Appetite change			
Yes	61 (76.25%)	12 (30%)	23.940,
No	19 (23.75%)	28 (70%)	$P < 0.00001$
Exercise			
Yes	67 (83.75%)	30 (75%)	1.3178,
No	13 (16.25%)	10 (25%)	$P = 0.25$
Unintentional weight loss			
Yes	70 (87.5%)	11 (27.5%)	43.7607,
No	10 (12.5%)	29 (72.5%)	$P < 0.00001$

food. The calorie intake and TB positivity were statistically significant ( $P = 0.0097$ ) [Table 3].

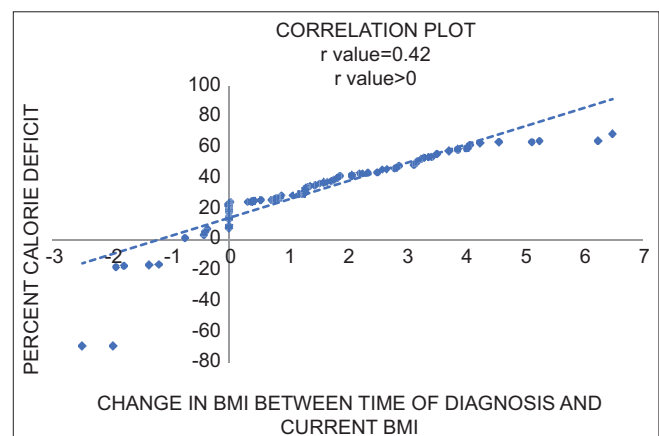
Out of total calorie-deficit individuals, almost the same percentage of individuals had 1–50% and 51–100% calorie-deficit diets, and the association of TB positivity and calorie-deficit diet intake was found to be insignificant. Around two-thirds of the study subjects out of non-TB individuals had a 1–50% calorie deficit diet, the rest study subjects had 51–100% calorie deficit diets, and it shows statistical insignificance ( $P = 0.1734$ ). Among the calorie excess non-TB individuals, 75% of study subjects had 51–100% calorie excess, whereas 25% of study subjects had 1–50% calorie excess, and it shows statistical insignificance ( $P = 0.5403$ ) [Table 4]. Furthermore, the Figure 1 shows a positive correlation between the calorie intake and change in BMI from the time of diagnosis to current BMI. ( $r$  value  $> 0.42$ ).

## Discussion

In this study, the mean age group of study subjects was 40.4 years with an equal number of males and females. In a similar study conducted among 133 subjects by Lal M Gurung *et al.*,<sup>[1]</sup> the mean age was 35.23 years and 60.9% belonged to males.

In our study, most of the study subjects 55 (45.83%) had a BMI of 18.50–24.99 kg/m<sup>2</sup> and the least number of them 1 (0.83%) had BMI  $\geq 40$  kg/m<sup>2</sup> at the time of diagnosis, and 42% of study subjects were underweight. In contrast, studies conducted in other countries found that 51% in Ghana,<sup>[2]</sup> more than 85% in India,<sup>[3]</sup> 70.6% in Brazil,<sup>[4]</sup> 57% in Malawi,<sup>[5]</sup> and more than 58% in Tanzania<sup>[6]</sup> were underweight during the time of registration.

The prevalence of underweight among TB patients was 63.39%; the prevalence of underweight among TB free residents was 22.12%. This proportion was statistically significant ( $X^2$  73.8,  $P$  value  $< 0.01$ ). This finding indicates that 41.27% of excess malnutrition was observed because of TB. This is because TB infection increases the anabolic process and consumes additional energy.<sup>[7]</sup> In a similar study by Feleke BE



**Figure 1: Positive correlation between change in BMI and percentage calorie deficit**

**Table 2: Dietary counselling provided to the study subjects (n=120)**

Parameter	TB-affected individuals (80)	Non-TB individuals (40)	Chi-square, P
Diet counselling provided?			
Yes	55 (68.7%)	05 (12.5%)	33.750, P=0.0000
ASHA	4 (7.3%)	02 (40%)	
Counsellor	15 (27.3%)	00 (0%)	
Doctor	27 (49.1%)	03 (60%)	
DOTS provider	9 (16.3%)	00 (0%)	
No	25 (31.3%)	35 (87.5%)	
Physician told to take extra calories?			
Yes	49 (61.3%)	25 (62.5%)	0.018, P=0.8944
No	31 (38.7%)	15 (37.5%)	
Do u practice it?			
Yes	43 (53.8%)	27 (67.5%)	2.074, P=0.1498
No	37 (46.2%)	13 (32.5%)	

**Table 3: Dietary gap among study subjects**

Dietary parameter	TB-affected individuals (80)	Non-TB individuals (40)	Chi-square P
Calorie Excess	2 (2.4%)	4 (10%)	9.275, P=0.0097
Normal Intake	1 (1.3%)	1 (2.5%)	
Calorie Deficit	77 (96.3%)	35 (87.5%)	
Dietary gap (in kcal)			
<-1400 to 0	3 (3.7%)	2 (5%)	3.019, P=0.3887
0 to 100	1 (1.3%)	1 (2.5%)	
Above 100-<1000	32 (40%)	20 (50%)	
1000 and above	44 (55%)	17 (42.5%)	

Mean Dietary Gap-892.0042 Kcal

**Table 4: Percentage of calorie excess/deficit consumption among study subjects**

% Calorie excess/deficit	TB-affected individual	Non-TB individual	P
Percentage calorie excess (06)			
1-50%	01 (50%)	01 (25%)	0.375, P=0.5403
51-100%	01 (50%)	03 (75%)	
Percentage calorie deficit (112)			
1-50%	40 (51.94%)	23 (65.71%)	1.853, P=0.1734
51-100%	37 (48.06%)	12 (34.29%)	

*et al.*,<sup>[8]</sup> the prevalence of underweight among TB patients was 57.17% and that among non-TB patients was 23.37%.

Out of the total study subjects, 80 individuals had tuberculosis and 63 (78.75%) TB-affected individuals had positive contact with tuberculosis. In a study conducted by Adane A *et al.*<sup>[9]</sup> among Adult Household Contacts of Smear Positive Pulmonary Tuberculosis Patients Treated in Public Health Facilities of Haramaya District, Oromia Region, Eastern Ethiopia, the prevalence was 45.6%, which is less compared to our study. This may be due to high endemicity of tuberculosis in India. In our study, 93.75% individuals with TB had prior knowledge of Tuberculosis, whereas only two-thirds (65%) patients had good knowledge about TB according to a study conducted by Nautiyal RG *et al.*,<sup>[10]</sup> which is comparatively less compared to our study. This may be attributed

to less awareness level among different populations of India. In our study, the change in appetite was observed in more than three-fourths of individuals with positive Tuberculosis. This may be due to increased serum leptin level in TB patients. Around 87.5% individuals with Tuberculosis had unintentional weight loss as per our study. Weight loss among TB cases can be caused by several factors, including reduced food intake due to loss of appetite. Wasting is recognized as a prominent feature of TB and a major determinant of severity and disease outcome.<sup>[11]</sup> In a study conducted by Bosch X *et al.*<sup>[12]</sup> showed only 14% prevalence of unintentional weight loss in TB patients.

In this study, most of the study subjects 55 (68.7%) were provided dietary counseling by a healthcare provider in TB positive patients, mostly dietary counselling was done by doctors (49.1%), whereas the maximum number of study subjects, 216 (73%) had received dietary counseling from a health professional that was treating them in a study conducted by Muse AI *et al.*<sup>[13]</sup> Moreover, in this study out of a total 80 subjects with TB positivity, 49 study participants (61.3%) were informed by the physicians to take extra calories. Regarding intake of extra calorie intake by TB patients, 53.8% of individuals in this study practiced to take extra calories. In a similar study conducted by Gurung ML *et al.*,<sup>[11]</sup> 78.2% of individuals took extra calories to maintain their health.

Also in this study, the calorie deficit dietary intake was higher in TB patients (96.3%) compared to non-TB patients (87.5%). Also, it was found that the percentage of calorie deficit individuals almost remained the same in 1–50% and 51–100% categories. Similar results of calorie deficit were seen in a study conducted by Ren Z *et al.*,<sup>[14]</sup> where 87.4% of males and 83% of females were taking calorie-deficit diets.

## Conclusion

This study showed that most individuals with TB witnessed appetite reduction and unintentional weight loss. Moreover, the study participants had sufficient knowledge about Tuberculosis. The diet which plays an important role in speedy recovery from Tuberculosis, and for that counselling has to be done by the

healthcare providers. Proper nutritional counseling along with nutritional support should be given to severely malnourished TB patients, and nutritional assessment of TB patients should be done periodically to achieve the target of TB elimination by the year 2025. Primary care physicians can counsel TB patients about nutrition and ensure the proper functioning of the TB nutrition program, thereby decreasing the morbidity and mortality of TB patients.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

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