



ASSESSMENT OF NUTRITIONAL STATUS OF NEWLY DIAGNOSED PULMONARY TUBERCULOSIS PATIENTS AT TERTIARY CARE CENTER, AURANGABAD, MAHARASHTRA, INDIA: A CROSS SECTIONAL STUDY

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Abstract - BACKGROUND AND OBJECTIVE: Tuberculosis (TB) is a contagious disease which is closely related to under-nutrition, poverty and poor immune function. This study was aimed to assess under nutrition and associated factors among adult patients. **METHODS:** A cross sectional study was carried out at a Tuberculosis unit in tertiary care hospital within period of June 2019 to December 2019. New sputum positive pulmonary TB patients at registered at tuberculosis unit at a tertiary care centre were enrolled for study. A pre-designed, pre-tested, structured questionnaire was used for the interview. The weight and height were measured to calculate the BMI. **RESULTS:** Among 423 study participants 381(90.1%) study were undernourished (BMI<18.5) and 42 study participants were normal (BMI>18.5). Maximum study participants were in severe under nutrition (56.5%) followed by moderate under nutrition (33.6%). The study participants belonging to 15-24 age group were 118(31.0%). Study participants belonging to upper lower socioeconomic class 139(36.5%), suffering from diabetes mellitus 38(10%), Male 226 (59.3%) had under nutrition. Under nutrition was found to be significantly associated with occupation (p=0.000), socioeconomic status (p=0.000), the associated disease (p=0.000) and addiction (p=0.000).

keywords - under nutrition, pulmonary tuberculosis, BMI, India,

Introduction

Tuberculosis (TB) is the most common cause of death from infectious diseases that had affected mankind for more than 4000 years.¹ Tuberculosis (TB) is caused by Mycobacterium tuberculosis which often affects the lungs, although it can spread to other organs in the body. TB is the second deadliest disease worldwide caused by a single infectious agent. Globally, in 2014, 9.6 million people were estimated to have fallen ill with TB; among them, 3.2 million were women, 5.4 million were men, and 1.0 million were children.²

India tops in the list of high burden TB countries globally. Around 2.3 million new cases occur annually (185 cases per 1-lakh population) approximately one fifth of the global incidence. 0.32 million people are killed annually by the disease (26 deaths per 1-lakh population).³ Tuberculosis (TB) is a contagious disease which is closely related to under-nutrition, poverty and poor immune function. Loss of both fat and lean tissue can result in reduction of body mass index (BMI) by 13–20% in patients with TB¹⁴. Also,

tuberculosis is a wasting disease. In the 21st century, tuberculosis is still the most frequent underlying cause of wasting worldwide.¹⁵ The relationship between undernutrition and active tuberculosis infection is bidirectional. Having active tuberculosis leads to loss of weight, and being underweight is known risk factor for developing tuberculosis either through the reactivation of latent tuberculosis or the development of progressive primary disease upon infection .⁴

The nutritional status and, therefore, the health of individuals could be influenced by several factors, such as socio-economic status, urban environment, eating habits, education and access to health services. Considering that the early diagnosis of inadequate nutritional status is necessary to prevent the contagion of the population that is in contact with TB patients.⁵ Under-nutrition increases the risk of developing active tuberculosis (TB). TB can also directly and indirectly cause under-nutrition. This can happen through metabolic changes which can result in clinical wasting, alongside with changes in appetite, ability to eat, anti-tuberculosis treatment side effects and impacts of the disease and treatment on household income. For individuals hospitalized with TB the risk of poor clinical outcomes, associated with under-nutrition, is particularly high, especially TB related mortality. In low-income countries, patients may present to hospital settings with clinically advanced disease resulting in a high prevalence of TB associated wasting and mortality.⁶

One of the most efficient and economical measurement to describe nutritional status is Body Mass Index (BMI). The research from Tama et al (2016) shows that AFB-positive pulmonary TB patients with BMI < 18.5 kg/m² possess higher cumulative probability of conversion failure compared to those patients with BMI > 18.5 kg/m². The speed of sputum conversion (hazard rate) on patients with BMI < 18.5 kg/m² is lower compared to patients with BMI > 18.5 kg/m². Sputum conversion will take longer time if the increase of patients' body weight at the end of intensive phase is < 1 kg. Therefore, TB patients with low BMI at the beginning of treatment should be monitored for their nutritional improvement.⁷

An understanding of nutritional status in adults and its correlates could provide evidence to support the development of strategies for TB management. The objective of this study was to assess the prevalence and associated factors of under nutrition in adults with TB.⁸

Methodology

Study Design and Setting: A cross sectional study was carried out among all the patients enrolled at tuberculosis unit situated in tertiary care center as new sputum positive. within period of June 2019 to December 2019.

Sample Size: Sample size was calculated using the Cochran formula: $n = Z^2 [p \times q] / e^2$

The estimated proportion of tuberculosis patients who were underweight which was assumed to be 50%, with 95% confidence interval (CI) to be 1.96 and absolute error to be 5%, the sample size that was calculated was 384. Adding a nonresponse rate of 10%, the total sample size calculated was 422.

Study Population: Patients were enrolled at tuberculosis unit situated in tertiary care center as new sputum positive i.e., the one who have never been positive for any form of tuberculosis previously with patients who have been tested for acid fast bacilli

staining (ZN staining) or fluorescent microscopy and found positive for at least one sputum sample were included in the study.

Patients who were seriously ill were excluded from the study.

Data was collected by the principal investigator by interview technique. A pre-designed, pre-tested, structured questionnaire was used for the interview. Before proceeding with the interview, signed informed consent was obtained from each participant and the weight assessment was conducted using standard weighing scale with patients wearing light cloths. Height was measured using standard procedure with a stadiometer. Measurements were recorded to nearest centimeter. Every other eligible subject was recruited by convenient sampling to select 422 participants for this study. All measurements were done by the researcher themselves.

Measurement

In present study knowledge was assessed by using score. Median knowledge score was calculated using likert scale by asking questions. Median value was considered as cut of value. Value above median was considered as good knowledge and below or equal to was considered as average score. Nutritional assessment was carried out with anthropometric measurement. BMI (body mass index) was calculated from weight and height. Outcome was classified into two categories as under nutrition (BMI <18.5 kg/m²) and normal (BMI>18.5). To assess the socioeconomic status, Modified B. G. Prasad scale was used.

Operational Definitions:

New sputum positive pulmonary TB patient: The revised definition of a new sputum smear-positive pulmonary TB case is based on the presence of at least one acid fast bacilli (AFB+) in at least one sputum sample in countries with a well- functioning external quality assurance (EQA) system.

Body Mass Index (BMI): It is defined as the weight in kilograms divided by the square of the height in meters (kg/m²)⁴

Literacy Status: (By Kuppaswami's educational status scale)

- Illiterate: A person who cannot read and write in any language. This category also includes those who can only sign or reproduce some writings mechanically and not educated at all.
- Primary school: Those who had studied up to 4th standard
- Middle school: Those who had studied between 5th -7th standard
- High school: Those who had studied up to 10th standard
- Intermediate: Those who had studied between 11th -12th standard or with any other diploma.
- Graduate: A person who had obtained graduate degree from any recognized university.

- Post graduate: A person who had obtained post graduate degree from any recognized university.
- Professional: A person who had obtained professional degree like M.B.B.S., B.D.S, B.E. and L.L.B. etc.
- Un-employed: Those who have no employment or activity for their livelihood.

Occupation:(By Kuppuswami's occupation scale):

- Unskilled worker: Defined as those workers whose work requires no intensive training or special skill. The workers who engaged in field such as beedi, hotel, construction, mason, fishing, sales, rag picking, street vending, head load work etc. were treated as unskilled workers.
- Semi-skilled workers: Those whose work requires some type of skill like tailors, embroidery workers, weavers etc.
- Skilled workers: Those workers whose work requires some sort of regular training and skill which reflects in the quality of work done by them, like electricians, welders, fitters, turners, plumbers and drivers of different motor vehicles.
- Clerk, shop owner, businessmen, farm or plantation owner: Person owning or performing these activities.
- Semi profession: Occupations which involve post-high school or college education.
- Professional: occupations involved in decision making process and in laying down policies and executing them. Example: Doctors, senior administrative officers, professors, principals, bank managers, etc.

Statistical Analysis: The data entry was done on Microsoft office excel 2007 software, and analyzed using IBM SPSS software 16 trial version. Frequency, percentage, proportion were calculated. Chi- square test used for qualitative data. To test association binary logistic regression analysis was used. Values of $p < 0.05$ were considered significant.

Results:

Nutritional status

Among 423 study participants 381(90.1%) study were undernourished (BMI<18.5) and 42 study participants were normal (BMI>18.5). 8 (1.9%) study participants were very severely undernourished (BMI<14) .239 (56.5%) were having severe under nutrition (BMI<16), 142(33.6%) study participants had moderate malnutrition (BMI16-18.5). Maximum study participants were in severe undernutrition (56.5%) followed by moderate undernutrition (33.6%).

Table 1. Nutritional status of new sputum positive pulmonary TB study participants.

BMI categories	Frequency (%)
Very severe (BMI<14)	8(1.9)
Severe (BMI<16)	239(56.5)
Moderate (BMI16 -18.5)	142(33.6)
Undernutrition (BMI<18.5)	381(90.1)
Normal (BMI>18.5)	42(9.9)

Table 2. Sociodemographic distribution of undernutrition among study participants

variables	Nutritional status		Total (n=423)	p	
	Under nutrition (BMI<18.5) (n=381)	Normal(n=42) (BMI>18.5)			
AGE	<15	7(1.8)	0(0.0)	7(1.6)	0.324
	15-24	118(31.0)	10(23.8)	128(30.3)	
	25-34	103(27.0)	15(35.7)	118(27.9)	
	35-44	43(11.3)	7(16.7)	50(11.8)	
	45-54	45(11.8)	5(11.9)	50(11.8)	
	55-64	30(7.9)	0(0.0)	30(7.1)	
	>64	35(9.2)	5(11.9)	40(9.5)	
Gender	Male	226(59.3)	28(66.7)	254(60.0)	0.356
	female	155(40.7)	14(33.3)	169(40.0)	
Residence	Urban	324(85.0)	37(88.1)	361(85.3)	0.595
	Rural	57(57(15.0)	5(11.9)	62(14.7)	

Religion	Hindu	156(40.9)	17(40.5)	173(40.9)	0.867
	Muslim	107(28.1)	10(23.8)	117(27.7)	
	Buddhist	113(29.7)	14(33.3)	127(30.0)	
	Others	5(1.3)	1(2.4)	6(1.4)	
Education	Illiterate	29(7.6)	6(14.3)	35(8.3)	0.527
	Primary	55(14.4)	5(11.9)	60(14.2)	
	Middle	60(15.7)	7(16.7)	67(15.8)	
	High	137(36.0)	12(28.6)	149(35.2)	
	Intermediate	31(8.1)	2(4.8)	33(7.8)	
	Graduate	53(13.9)	9(21.4)	62(14.7)	
	Post Graduate	16(4.2)	1(2.4)	17(4.0)	
occupation	Unemployed	103(24.3)	0(0.0)	103(24.3)	
	Unskilled	138(36.2)	28(66.7)	166(39.2)	
	Semiskilled	49(12.9)	7(16.7)	56(13.2)	
	Skilled	49(12.9)	0(0.0)	49(11.6)	
	Semi-professional	42(11.0)	0(0.0)	42(9.9)	
	Professional	0(0.0)	7(16.7)	7(1.7)	
Marital status	Single	91(23.9)	7(16.7)	98(23.2)	0.520
	Married	278(73.0)	33(78.6)	311(73.5)	
	Widowed	12(3.1)	2(4.8)	14(3.3)	
Socioeconomic status	Upper	14(3.7)	7(16.7)	21(5.0)	0.000
	Upper middle	56(14.7)	0.(0.0)	56(13.2)	
	Lower middle	62(16.3)	21(50.0)	83(19.6)	

	Upper lower	139(36.5)	0(0.0)	139(32.9)	
	Lower	110(28.9)	14(33.3)	124(29.3)	
Associated disease	COPD	35(9.2)	0(0.0)	35(8.3)	0.000
	HTN	3(0.8)	4(9.5)	7(1.7)	
	DM	38(10.0)	3(7.1)	41(9.7)	
	HIV	7(1.8)	0(0.0)	7(1.7)	
	Others	7(1.8)	0(0.0)	7(1.7)	
	No associated	291(76.4)	35(83.3)	326(77.1)	
knowledge	Average	229(60.1)	21(50.0)	250(59.1)	0.206
	Good	152(39.9)	21(50.0)	173(40.9)	
Addiction	Smoking	7(1.8)	0(0.0)	7(1.7)	0.000
	Alcohol	22(5.8)	0(0.0)	22(5.2)	
	Tobacco	74(19.5)	20(47.6)	94(22.3)	
	Gutkha	20(5.3)	5(11.9)	25(5.9)	
	No Addiction	249(65.5)	17(40.5)	266(63.0)	
	Others	8(2.1)	0(0.0)	8(1.9)	

Sociodemographic distribution

Majority (128) of study participants were in 15-24 age group and among undernourished, the study participants belonging to 15-24 age group were 118(31.0%). Among 423 study participants, 254 (60%) were male and 169 (40%) were female. Male 226 (59.3%) had more frequency of under nutrition. 361(85.3%) of study participants lived in urban area and 324(85.0%) were undernourished. Hindu study participants had 156(40.9%) under nutrition as compared with Muslim 107(28.1%) religion. Study participants who attended high school education had maximum under nutrition 137(36%). Study participants, who were unskilled had maximum undernutrition 138(36.2). Study participants belonging to upper lower socioeconomic class 139(36.5%) had more under nutrition. The ones suffering from diabetes mellitus (38(10%)) had major under nutrition. Under nutrition was found to be significantly associated with occupation ($p=0.000$), socioeconomic status ($p=0.000$), the associated disease ($p=0.000$) and addiction($p=0.000$).

Under nutrition does not differ with age ($p=0.324$), gender (0.356), residence ($p=0.356$), religion (0.867), education (0.527), marital status($p=0.520$) and having knowledge about TB (0.206).

Table 3. Factors associated with under nutrition.

Variables				Odds ratio(95%CI)	p	Adjusted odds ratio(95%CI)	p
Age	<34	228	25	1.013(0.529-1.93)	1	0.987(0.516-1.899)	0.968
	>34	153	17				
Gender	Male	226	28	0.885(0.468-1.672)	0.829	0.729(0.372-1.429)	0.358
	Female	155	14				
Residence	Urban	324	37	0.768(0.289-2.037)	0.762	1.302(0.491-3.453)	0.596
	Rural	57	5				
Religion	Hindu	156	17	1.020(0.532-1.951)	1	1.02(0.533-1.951)	0.953
	Others	225	25				
Education	Illiterate	144	18	0.810(0.424-1.544)	0.636	0.810(0.425-1.544)	0.522
	Educated	237	24				
Occupation	Unemployed	102	1	15.043(2.042-110.78)	0.000	11.881(7.749—16.013)	0.000
	Employed	278	41				
Marital Status	Single	103	9	1.358(0.628-2.936)	0.550	1.357 (0.628-2.936)	0.434
	Married	278	33				
Socioeconomic Status	Upper	110	14	0.812(0.411-1.600)	0.671	0.812(0.412-1.60)	0.547
	Lower	271	28				
Associated Disease	Present	90	7	1.546(0.664-3.600)	0.409	1.546(0.664-3.601)	0.309
	Absent	291	35				
Knowledge	Average	152	21	0.664(0.350-	0.271	0.664(0.350-	0.209

	Good	229	21	1.257)		1.257	
Addiction	Present	132	25	0.360(0.187-0.694)	0.002	0.361(0.187-1.691)	0.002
	Absent	249	17				

Factors associated with under nutrition.

The table shows the adjusted and unadjusted odds ratio (OR) with 95% confidence interval (CI) estimated from multiple logistic regression. Odds of under nutrition were found to be increase in unemployment AOR [11.881(7.749—16.013), (p=0.00)] and addiction AOR [0.360(0.361-1.87-1.691), (p=0.002)].

Discussion: Present study was carried out to assess nutritional status of new sputum positive pulmonary TB patients using BMI (body mass index). The study shows 90.1% of under nutrition among pulmonary TB patients which was found to higher than study at public TB hospital in Lucknow, Uttar Pradesh, India (79.5%)¹ and study in Dhaka, Bangladesh shows 36% under nutrition¹⁷. Higher frequency of under nutrition in this study may be due socio-economic pattern and dietary pattern.

Majority of under nutrition was found in 15-24 (31%) age group and 89% study participants with under nutrition belongs to economically productive (15-64) age group. Study in Tripura shows that majority of the study participants were in the age group of 40-60 years (47.3%)¹⁸. In current study has male predominance with predominance with under nutrition also (59.3%). There was a prevalence of males (69.2%) in a study by Eduardo Campos-Góngora et al⁴.

Under nutrition was found prevalent in urban (85.0%) similarly study in Burkina faso had 83.8% of participants live in urban area¹⁹. As per religion Hindu (40.9%) followed by Buddhist (28.1%) had under nutrition. Study by Akanksha shukla et. al. had 62.7% undernutrition in Hindu participants.¹ Majority participants were had high school education (35.2%) and under nutrition was found in them was 36%. Study by Tsige Brhane et. Al. had (26.2%) had secondary education¹¹.

Undernutrition was found unskilled worker participants (36.2%), study by shaily et al, most of (85.5%) our patients were unemployed (41%) and unskilled worker (44.5%), whereas only 1.5% was skilled worker in regular employment.⁸ (36.5%) of study participants had under nutrition belongs to upper lower class of socioeconomic status. Study by Beatrice B. Musuenge had (84.3%) who had monthly income <10,000. Diabetic study participants had 10% under nutrition¹³. Similarly study by Tsige Brhane had 15% study participants with diabetes mellitus had undernutrition²⁰. Study participants with history of tobacco chewing (19.5%) had under nutrition¹¹.

On bivariate analysis, occupation and addiction was found to be associated with under nutrition.

Conclusion:

In this research, sputum positive TB patients have poor nutritional status. Malnutrition is found in individuals with factors of urban residence, male patients, poor literary status, low family income, and addiction. Hence, we advise to promote the awareness among patients regarding the importance of nutrition and to discourage the addiction to improve the prognosis of TB patients.

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