Nutritional Status among Tuberculosis Patients at the End of Initial Phase of Treatment

Md. Shifatul Farid[1], Golam Dastageer prince[2], Obaidullah Ibn Raquib[3], Sourav Kumar Nath[4], Sharmin Sultana[5], Saiduzzaman BM[6], Rubena Haque[7]

[1]Research Assistant, BK School of Research

[2]Medical Officer, DGHS

[3]Lecturer, NIPSOM

[4]Project Research Physician, ICDDRB

[5]Study physician, Icddrb

[6]Registrar (Urology), Singapore General Hospital, Singapore

[7]Professor, Program Coordinator, MPH program, NIPSOM

ABSTRACT

Background with Objective: Inadequate nutrition is often linked to an increased risk of getting TB and it also plays a role in the worse progression of the disease. Both undernutrition and TB are closely related and significantly affect public health. The aim of this study was to assess the nutritional status among tuberculosis patients at the end of initial phase of treatment.

Methods: A cross-sectional study was conducted among 199 adult TB patients taking antitubercular drugs at the end of initial phase in DOTS centres, Dhaka, Bangladesh from 1st January to 31st December, 2023. Data were collected following a convenient sampling technique through face-to-face interviews and record review using a semi-structured questionnaire and check list. Nutritional status was measured by body mass index. Ethical clearance was taken from the Institutional review board of National Institute of Preventive and Social Medicine (NIPSOM). Statistical analyses of the results were obtained by using window based computer software devised with Statistical Packages for Social Sciences (SPSS-20.1).

Results: More than half (56.3%) of undernutrition among TB patients was at the registration and newly two third patients (64.8%) of undernutrition was at the end of initial phase of treatment. Male and PTB patients were found significantly more undernourished. The median BMI difference between registration and end of initial phase was found significant (p<0.001).

Conclusion: The study revealed high proportion of undernutrition patients after initial phase which worsened from the onset of initial phase.

KEYWORDS: Malnutrition, Tuberculosis, Treatment

ARTICLE DETAILS

INTRODUCTION

Tuberculosis (TB) is a significant public health issue in Bangladesh, with high morbidity and mortality rates. Based on the data provided by the World Health Organization (WHO), Bangladesh is identified as one of the 30 nations with a high burden of tuberculosis (TB), with an approximate yearly incidence of 225,000 new cases (GLOBAL TUBERCULOSIS REPORT 2021) [1]. There is a strong correlation between undernutrition and tuberculosis in countries with high, middle, and low incomes [2,3]. About one-quarter of all new tuberculosis cases are thought to be caused by undernutrition and tuberculosis is thought to be one of the most common causes of wasting [4]. It has been shown that the condition of undernutrition has a deleterious effect on a person's immune system. As a consequence of this, individuals who are undernourished have a greater risk of being sensitive to the transition of a latent tuberculosis infection into an active tuberculosis state. It is well-known

that tuberculosis not only increases the likelihood of undernutrition but also makes the symptoms of undernutrition more severe [5,6]. An Indian study found that people with tuberculosis were 11 times more likely than the control group to have a BMI of less than 18.5 kg/m2. The World Health Organization (WHO) reported that undernutrition was responsible for about a quarter of all new cases of tuberculosis. In spite of these facts, inadequate nutrition in tuberculosis patients continues to be a serious problem that poses a potential threat to their lives [6]. It is possible for inadequate nutrition to lessen the effectiveness of medication, lengthen the duration of treatment, raise the risk of adverse side effects, and increase the possibility that the treatment will be unsuccessful (GLOBAL TUBERCULOSIS REPORT 2021) [1]. A nutritional diet is significant for tuberculosis prevention and treatment. As a consequence of this, it is of the utmost importance to take into consideration the dietary requirements of people who are plagued with illnesses such as tuberculosis[7]. To analyze the complex relationship between tuberculosis (TB) and nutritional deficiency to improve treatment outcomes in Bangladesh, it is necessary to acquire a complete understanding of the nutritional status of TB patients upon completion of the initial phase of therapy. The study will help fill in this research problem and help design program interventions for better nutrition management for tuberculosis patients in Bangladesh.

MATERIALS & METHOD
A single-group Cross-Sectional study was conducted among 199 adult TB patients taking anti-tubercular drugs at the end of initial phase of treatment. The study was conducted at selected DOTS centre's under National Tuberculosis Control Program (NTP), DGHS in Dhaka district from 1st January to 31st December, 2023. A non-probability convenient sampling technique was followed due to an inadequate of respondents within a short period of data collection. All possible respondents were recruited within the data collection period. Before the initiation of the interview, a brief introduction to the aims and objectives of the study was presented to the respondents. They were informed about their full right to participate or refuse to participate in the study. Nutritional status was measured by body mass index. Body mass index was calculated by the formula. BMI = weight in kg / (Height x Height) in the meter. Height was measured by a non-stretchable tape after ensuring each respondent stood in a straight position facing mouth forward with bare foot. Weight was measured by an analog weight machine. Normal nutrition BMI 18.50—24.99 Kg/ m^2, under nutrition BMI <18.50 Kg/ m^2, Overweight BMI $\geq$ 25 Kg/ m^2. However, prior to the initiation of the study ethical clearance was taken from the Institutional review board of National Institute of Preventive and Social Medicine (NIPSOM). The collected data were entered into the computer and analyzed by using SPSS (version 20.1) to assess the nutritional status among tuberculosis patients at the end of initial phase of treatment.

RESULTS
The majority of the patients that were 123 (61.8%) were between the ages of 18 and 40. (Table 1) The mean age was 36.8 ± 16.2 years. The number of male patients was 99 (49.7%) and the rest of 100 (50.3%) were female patients. 140 (70.4%) patients were married, while the remaining patients were either unmarried, widowed, or divorced which were 52 (26.1%), 5 (2.5%), or 2 (1%) respectively. Most of the 82 patients had completed primary school (41.2%). Among from the rest, 35 were illiterate (17.6%) and 39 were in secondary school (19.6%). 19 (9.5%) patients had graduated from university or another level of higher education, which was the lowest rate. The vast majority of the patients 197 (99%) were Muslims, whereas only 2 (1%) patients were Hindu. A majority of 153(76.9%) patients had no co-morbidities. A very low number of 24(12.1%) patients were found to have diabetes, while 12(6%) had two or more concurrent diseases. The remaining respondents presented with conditions such as hypertension, stroke, or other diseases which were 3(1.5%), 1(0.5%) and 6(3%) respectively. In terms of tuberculosis classification, the majority of findings showed that 114(57.3%) of the cases were diagnosed with pulmonary tuberculosis, while 85(42.7%) were diagnosed with extra-pulmonary tuberculosis. **(Table 1)**

Table 1: Socio-demographic and clinical Characteristics of the study population (n=199)

Parameter	Number	percentage
Gender		
Male	99	49.7 %
Female	100	50.3 %
Age in years		
18-30 years	90	45.2%
31-40 years	33	16.6%
41-50 years	29	14.6%
51-60 years	30	15.1%
$\geq$ 61 years	17	8.5%
Mean ± SD (min-max)	36.8 ± 16.2 (18-75)	
Educational level		
Illiterate	35	17.6%

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Primary	82	41.2%
Secondary	39	19.6%
Higher Secondary	24	12.1%
Graduated and post Graduated	19	9.5%
Marital status		
Unmarried	52	26.1%
Married	140	70.4 %
Widowed	05	2.5%
Divorced	02	1 %
Religion distribution		
Muslim	197	99 %
Hindu	02	1%
Type of TB		
Pulmonary TB	114	57.3%
Extra-pulmonary TB	85	42.7%
Co-morbidities of TB patients		
No co-morbidities	153	76.9%
Diabetes	24	12.1%
hypertension	3	1.5%
stroke	1	0.5%
two or more concurrent diseases	12	6%
other diseases	6	3%

It was seen that the majority of 112 (56.3%) patients showed signs of undernutrition, whereas 68(34.2%) patients had normal nutritional status and the rest of 19(9.5%) patients were overweight. Male patients were more undernutrition than female. Within the male patients, it was observed that 68(34.3%) patients had undernutrition, whereas 25(22%) patients showed normal nutritional status. Within the female patients, it was observed that 44(22%) patients showed undernutrition, whereas 43 (12.2%) patients showed normal nutritional status. Rest was overweight **(Table 2).**

Table 2: Nutritional status of TB patients during registration (n=199)

Nutritional status	Male (n=99)	Female (n=100)	Total
Undernutrition **(<18.50 kg/m2)**	68 (34.3%)	44 (22%)	112(56.3%)
Normal nutrition **(18.50-24.99 kg/m2)**	25 (22%)	43 (12.2%)	68 (34.2%)
Overweight **(≥25 kg/m2)**	6 (1.5%)	13 (8%)	19 (9.5%)

It was seen that the majority of 129 (64.8%) patients showed signs of undernutrition, whereas 54 (27.2%) patients had normal nutritional status and the rest of 16 (8%) patients were overweight. Male patients were more undernutrition than female. Within the male patients, it was observed that 72 (36.3%) patients had undernutrition, whereas 24 (13%) patients showed normal nutritional status. Within the female patients, it was observed that 57 (28.5%) patients showed undernutrition, whereas 30 (14.2%) patients showed normal nutritional status. Rest was overweight. **(Table 3)**

Table 3: Nutritional status of TB patients at the end of initial phase of treatment (n=199)

Nutritional status	Male (n=99)	Female (n=100)	Total
Undernutrition **(<18.50 kg/m2)**	72 (36.3%)	57 (28.5%)	129 (64.82%)
Normal nutrition **(18.50-24.99 kg/m2)**	24 (13%)	30 (14.2%)	54 (27.2%)
Overweight **(≥25 kg/m2)**	3 (1%)	13 (7%)	16 (8%)

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The median body mass index (BMI) upon registration was recorded as 18.2. Subsequently, at the end of the initial phase, the median BMI was observed to be 17.7. The calculated median difference between the two variables was found to be 0.43, with 95% confidence interval. A Wilcoxon signed ranks test revealed a statistically significant ($p<0.05$) that BMI was lower at the end of initial phase of treatment (Median= 17.7, N=199) compared to during registration (Median = 18.2, N=199), z = -4.72, p < 0.001 with a medium effect size, r = 0.33. **(Table 4)**

Table 4: Median comparison of BMI at registration and after treatment of Initial phase among TB patients (n=199)

Parameter	Median	Median difference	p-value
At registration	18.22	0.43	<0.001*
End of initial phase	17.77		

Note: Wilcoxon signed ranks test, *significant p< 0.05

Different Health status variables were found to be related with undernutrition of TB patients these include co-morbidities (Cramer's V = 0.19, Fisher's Exact test, p = 0.04) suggesting no co-morbidities patients were found more association (weak) with undernutrition and types of TB (Φ = -.0257, p<0.001) suggesting PTB was found more association (negatively weak to moderate) with undernutrition. **(Table 5)**

Table 5: Bivariate analysis for identification of responsible health-related factors of undernutrition of TB patients (n=199)

Variables	Undernutrition Yes (%)	Undernutrition No (%)	p-value
Co- morbidities			
None	107(69.9%)	46 (30.1%)	0.048*
Diabetes	11 (45.8%)	13 (54.2%)	
Two or more diseases	6 (50%)	6 (50%)	
Others	5 (50%)	5 (50%)	
Type of TB			
Pulmonary TB	86 (75.4%)	28 (24.6%)	<0.001
Extra-pulmonary TB	43 (50.6%)	42 (49.4%)	

Note: Chi-square test, *Fisher's Exact Test, Significant p=<0.05, ns= non-significant

DISCUSSION

The study was conducted among 199 TB patients in selected DOTS centres in Dhaka district. In this study, patients were 18 to 75 years old. The mean age was 36.8 ± 16.2 years. In a previous study in China (Musuenge, Poda and Chen, 2020) [6], the patient's ages were 15 to 89 years old with mean age was 43.6 ± 15.3 years. In this present study, ages were categorized into 5 groups. Most (45.2%) patients were found in 18-30 year's age group whereas, in the China study, ages were categorized into 6 groups. Most (29.5%) patients were found in 35-44 years age group among 6 categories of age group [6]. Out of 199 patients, almost half (49.7%) were male and (50.3%) were female patients. In a study of Ethiopia (Muse et al., 2021), 51.2%) patients were male and 48.8% were female [4]. The majority of (76.9%) patients had no co-morbidity but a notable (12.1%) diabetes was found among co-morbid patients in this present study. HIV infection (7.6%) and Diabetes (2%) were found notably among co-morbidities patients in a study in China (Musuenge, Poda and Chen, 2020) [6]. 1.4% diabetes and 6.8% gastritis found in Ethiopia study [4]. In the present study, no co-morbidity patients had higher proportion of undernutrition (69.9%) than co-morbid patients. But among co-morbidities patients, it was notable that diabetes patients had the highest proportion of undernutrition (45.8%). The difference was found to be statistically significant (p=0.048). Similar findings were also found in both study in China (Musuenge, Poda and Chen, 2020) and Ethiopia (Muse et al., 2021) [6,4]. The reason might be that poorly controlled DM causes metabolic decomposition making this more vulnerable to

undernourished patients and health outcomes. Several studies showed that tuberculosis (TB) can lead to the deterioration of glucose tolerance (Guptan and Shah, 2000; Dooley and Chaisson, 2009; Hayashi et al., 2014) metabolic alterations, and muscle wasting (Dooley et al., 2009), (Hayashi et al., 2014), (Workneh et al., 2017) [8,9,10]. Notably, weight loss is especially severe among TB patients with diabetes (Workneh, Bjune and Yimer, 2017) as compared to those without diabetes [11]. More than half (57.3%) of patients were diagnosed with PTB. PTB patients had the highest proportion of undernutrition (75.4%) than extra-PTB patients found in this present study. Higher prevalence (56.4%) of PTB was found in a study in Ethiopia (Muse et al., 2021) [4]. In this present study, the difference was found to be statistically significant (p<0.001). More than half (64.8%) of undernutrition patients at the end of initial phase of treatment was found. The Median BMI was 17.7 ± 4.5 kg/m2. 56.3% undernutrition patients were found at the time of registration. The median BMI was 18.2 ± 4.4 kg/m2. The previous study conducted in Bangladesh showed, (58.9%) of undernutrition at the end of the initial phase. The Median BMI was 17.8 ± 3.2 kg/m2. (67.1%) undernutrition was found at the time of registration. The median BMI was 18.3 ± 3.1 kg/m2 (Islam et al., 2013) [7]. Another study conducted in Nepal revealed, (21.8%) were undernutrition at the end of the initial phase. The Median BMI was 20.9 ± 5.8 kg/m2. (68.3%) undernutrition was found at registration (Gurung et al., 2018) [2]. In the present study, the median BMI reduced from the initial phase Median BMI. A significant median difference (r = 0.33, p<0.001) between registration and end of initial phase was found. That means patients significantly became more undernourished from registration. The possible reasons might be no dietary counseling, poor food intake frequency per day and poor food habit. Another study conducted in Nepal (Gurung et al., 2018) [2] showed improvement in undernutrition status after the initial phase from the registration period of 68.3% to 21.8% and the previous study in Bangladesh also showed improvement in undernutrition status after the initial phase from registration period of 67.1% to 59.9% (Islam et al., 2013) [7]. The reasons might be good sociodemographic and economic background, and good food intake frequency per day.

CONCLUSION

The proportion of undernutrition among adult TB patients has worsened from registration. Dedicated dietary counseling along with proper nutritional support and regular nutritional assessment should be implemented to prevent under nutrition effectively.

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CONFLICT OF INTEREST
Authors declare no conflict of interest.

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Corresponding Author: Md. Shifatul Farid