Original Research

Nutritional status and factors associated with undernutrition among tuberculosis patients in Sri Lanka

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Abstract

Introduction: Apart from COVID-19, tuberculosis (TB) is the leading cause of death among infectious diseases globally and in Sri Lanka. It is known that the high-risk groups for developing TB are from lower socio-economic groups. Further, there is a close link between TB and nutrition.

Objectives: To assess the prevalence and associated factors of undernutrition among TB patients in Sri Lanka

Methods: A cross-sectional study was carried out using secondary data of a 2020 cohort of TB patients.

Results: Out of 4566, the majority were males (65.2%). According to age groups, 55–64-year age group reported the highest proportion of patients (n=1018; 22.3%). According to the classification of body mass index (BMI), 46.3% were underweight. In bivariate analysis, gender (p=0.07), presence of comorbidities (p<0.001), site of TB (p<0.001), use of alcohol (p=0.01), site of TB (p<0.001), treatment category (p<0.001), smoking (p<0.001), alcohol use (p=0.04) and illicit drug use (p<0.001) were associated with patients being underweight. In multivariate analysis, only presence of comorbidities (p<0.001), site of TB (p<0.001), treatment category (p<0.001), smoking (p=0.04) and illicit drug use (p=0.02) were associated with patients being underweight.

Conclusions & Recommendations: Creating awareness among clinicians and public health staff is important for them to be vigilant about TB patients with above associated factors. Proper nutritional counselling must be carried out for TB patients. Further, in implementing available nutritional interventions and patient awareness programmes, patients with lower BMI should be given priority although all TB patients are considered in need of nutritious diet.

Keywords: *tuberculosis patients, undernutrition, associated factors*

Introduction

Around one fourth of the global population is estimated to be infected with TB. Out of them, nearly 10 million people develop active disease each year. While TB is spread throughout in many continents, Southeast Asia leads with its contribution of nearly 44% caseload, which is disproportionate to its harbouring population of nearly one fourth of the global population. About two third of TB cases are reported from eight countries, namely India, China, Indonesia, Philippines, Pakistan, Nigeria, Bangladesh and South Africa; countries which are also known to face food insecurities within certain community strata (1). TB reports the third highest incidence and second highest mortality among infectious diseases in Sri Lanka. According to the current National Programme Goal of END TB, Sri Lanka must reach targets on reduced incidence and mortality for TB while maintaining zero levels of catastrophic cost due to TB by 2035. However, the latest estimates for TB incidence for Sri Lanka is 64/100 000 in 2021, while 554 TB deaths were reported in 2020. The catastrophic cost due to TB still remains to be estimated with the ongoing survey. Annually, around 8000-9000 diagnosed patients with TB are reported to the national programme with the highest contributions from Colombo, Gampaha, Kandy and Kalutara Districts, respectively. Tuberculosis is commonly known as a disease among lower socio-economic groups. Therefore, the affected are more commonly daily wage earners. Further, the prevalence of TB rises with increase in age. More males are affected compared to females (2). It has a close association with malnutrition, both being prevalent in underdeveloped areas in the world. The malnourished could easily succumb to activation of TB disease, while those who are affected by TB could readily develop malnutrition. Before anti-tuberculosis drugs were invented, a diet rich in nutritious food was recommended as essential for cure (3).

The value of a nutritious diet is explanatory as most individuals with active TB are in a catabolic state and experience weight loss and some show signs of vitamin and mineral deficiencies at diagnosis. Weight loss among those with TB can be caused by several factors, including reduced food intake due to loss of appetite, nausea and abdominal pain; nutrient losses from vomiting and diarrhoea and metabolic alterations caused by the disease. The socio-economic factors may also contribute to the above due to poor income levels and lack of health literacy. In children, one of the cardinal features of TB is failure to thrive. The child may present with loss of weight or poor weight gain without manifestations of common symptoms. During the routine weight gain assessments through medical officer of health (MOH) staff, this can be readily detected. Therefore, the pronounced effect of poor nutrition linked to TB is readily seen among children. The risk of TB with undernutrition and the association between TB and poor dietary factors are found in literature (3-6).

The prevalence of undernutrition among TB patients is found to be over 50% in South African countries and Brazil (7-9). A lower prevalence between 20-40% are reported from Ethiopia, Latvia and Burkina Faso reporting a prevalence of 39.7% (10-12). In a study conducted in the district of Batticaloa in Sri Lanka, the prevalence of undernutrition among TB patients was estimated to be 37.9% (13).

The undernutrition among TB patients is identified to be linked with certain sociodemographic, health and functional related factors. These include young age, diabetes mellitus (DM), functional status of the patients, dietary counselling, low food frequency per day and human immunodeficiency virus infection (10, 12). Currently, Sri Lanka lacks larger scale evidence on relationship between TB and nutritional status. Therefore, this paper aims to study the national surveillance data during the year 2020 on TB patients reported to the National

Tuberculosis Programme to assess association between nutritional status among them. To measure the undernutrition, body mass index (BMI) which is routinely measured among TB patients during the first visit, would be used.

Methods

The study was carried out using secondary data collected through ePIMS (electronic Patient Information Management System) of the National Tuberculosis Programme. When a patient is diagnosed of TB, registration at the relevant district chest clinic with a district TB number is mandatory to issue the anti-TB drugs. With introduction of the online ePIMS system, more patients are being registered through this system.

The patient data recorded in the ePIMS system for the year 2020 was used for the current study. The socio-demographic factors, disease related factors and other health related factors were described for the study population. Under the TB related factors, disease category, site of disease, method of diagnosis and treatment outcome were described. The presence of comorbidities, smoking, use of alcohol and illicit drug use were described under other health related factors. The socio-demographic factors, disease related factors and other health related factors were described for the study sample using descriptive analyses.

During the local setting, the most sensitive measure of nutrition which can be accessed through routine reporting was BMI. Therefore, for this study, nutritional status was measured using BMI. The BMI was described according to international as well as Asian classifications. The international classification is as, underweight <18.5 kg/m^2, healthy weight ≥18.5 to 24.9 kg/m^2, overweight ≥ 25.0 to 29.5 kg/m^2 and obesity ≥30.0 kg/m^2. For the current study, overweight and obesity were considered together as 'overweight'. According to standard BMI categorization for Asians, underweight as <18.5 kg/m^2, healthy weight ≥18.5 to 22.9 kg/m^2, overweight ≥23.0-24.9 kg/m^2 and obesity ≥25 kg/m^2 (14). For the analysis, overweight and obesity were grouped together as 'overweight'. The lower BMI group of <18.5 kg/m^2 was compared with the healthy weight group using Asian BMI categorization for any significantly associated factors using bivariate and multivariate analyses. The socio-demographic factors, TB disease related factors and other health related factors were assessed for significance. Certain variables including sputum investigation and chest X ray findings, comorbidities and disease outcome were assessed separately with BMI for significance as the data were available for these variables only among a sub sample of patients. The Statistical package for Social Sciences (SPSS) version 26 was used for the analysis.

Results

The total number of patients reported for the year 2020 was 7258. Out of this, 6842 patients were recorded in ePIMS with a rate of 94.3% coverage by the e-system. However, the key variable of BMI was recorded only among 4585 patients in the study cohort. The patient records with missing data were also excluded from the analysis (n=19). Therefore, the nutritional assessment was carried out among 4566 patients.

Out of 4566, the majority were males (65.2%), with mean age of 48.7 years (SD=17.2) (Figure 1). According to the age groups, 15–64-year age group comprised the highest proportion of patients (68.0%) followed up by ≥60-year age group (30.2%). A majority of 74.8% were pulmonary tuberculosis (PTB) patients, while 25.2% were extra pulmonary tuberculosis (EPTB) patients. A majority of 92.0% (n=4200) belonged to the "new" treatment category. Only 32.5% patients reported comorbidities (Table 1), the commonest being diabetes mellitus (22.1%) and hypertension (8.1%).

Out of 3568 reporting on smoking, nearly 44.5% were smoking, while 44.1% out of 3524 were using alcohol. Around 4.6% out of 3044 were using illicit drugs.

According to the International Classification of BMI, 46.3% were underweight while 11.7% were overweight. The corresponding values as per the Asian categorization were 46.3% and 20.7% (Table 2). The mean BMI was 19.6 kg/m^2 (SD=4.54) (Figure 2).

In bivariate analysis, gender (p=0.07), presence of comorbidities (p<0.001), site of TB (p<0.001), use of alcohol (p=0.010), site of TB (p<0.001), treatment category (p<0.001), smoking (p<0.001), alcohol use (p=0.049) and illicit drug use (p<0.001) were associated with underweight. However, in multivariate analysis, only presence of comorbidities (p<0.001), site of TB (p<0.001), treatment category (p<0.001), smoking (p=0.047) and illicit drug use (p=0.023) were associated with underweight (Table 3).

Among the comorbidities, DMs (OR= 96.36), hypertension (OR=21.06), chronic lung pathologies (OR=6.68) and dyslipidaemia (OR=4.94) were significantly associated with undernutrition.

Discussion

The study sample comprised 4566, out of which 7258 TB patients were reported for the year 2020. In the study, the majority were males (65.2%) which is similar to the trend observed globally and in Sri Lanka. According to the WHO estimates during 2020, 56% of TB caseload was among the males (1, 15). The highest number of cases were reported in 55–64-year age group which is consistent with the recent trend in TB among different age groups in Sri Lanka (15). However, globally 25–34-year age group reports the highest caseload of TB (1).

Nearly 36% of the patients were reported from Western Province. This is in line with the observed trend in Sri Lanka. The Western Province reports the highest population densities and numbers for the country, with the possibility of more people reporting TB from the province. Further, the higher availability of high-risk populations such as congested communities, institutionalized individuals and the presence of risk factors such as smoking, alcohol use and drug use might be contributory for the higher number. Nearly 75% of the study sample reported pulmonary TB which is similar to the observed trends of around 80% (15).

Nearly 50% of the TB patients were having undernutrition indicating a strong linkage between the two. This prevalence is slightly lower than that reported in South African countries such as Ethiopia and Brazil which ranged around 50-60%. However, the values are much higher compared to certain European countries such as Latvia. Further, the prevalence reported in a previous study in Batticaloa District, Sri Lanka reports a lower prevalence compared to the current study. In the local setting, the socio-economic difficulties as well as lack of proper knowledge and guidance on nutritious diet might be some contributory factors for the higher rate of undernutrition among the TB patients.

In the current study, out of the eight variables assessed, seven indicated statistical significance during the bivariate analysis. When accounted for compounding, five remained significant. In a previous study, functional status and presence of eating problem were associated with undernutrition. The presence of comorbidities in the current study also may trigger similar conditions affecting under-nutrition among the patients (10), especially DM (12). In the current study too, DM (OR=96.36) was strongly associated with undernutrition among TB patients. In addition, other common pathologies of hypertension (OR=21.06), chronic lung pathologies (OR=6.68) and dyslipidaemia (OR=4.94) were significantly associated with undernutrition, even

after accounting for confounding.

Even though previous research lacks association between undernutrition and sex of the TB patient, considering the cultural context in countries such as Sri Lanka, it is highly probable that being female increases the risk of undernutrition among the study group. In the lower socio- economic group families where TB is mainly seen, the mothers are more likely to suffer from undernutrition compared to males and children.

Risk factors for TB such as smoking, alcohol use and illicit drug use may cluster together with other risk environments such as congested urban dwellings, prisons and rehabilitation centres which commonly associate with economic deprivation. Therefore, the affected individuals from these environments are more likely to suffer from undernutrition due to the economic inability as well as the other risk factors. However, in the current study, even after excluding for confounding, smoking and illicit drug use remain associated with undernutrition among TB patients. The detrimental effects of smoking and illicit drug use on an individual's health are widely known (16-17). The resulting oral intake might be contributory to undernutrition in these circumstances.

Pulmonary TB patients had a significantly higher risk of undernutrition compared to EPTB patients. In literature, pulmonary TB is identified as associated with undernutrition along with other respiratory diseases such as chronic obstructive pulmonary disease, asthma and lung cancer (18).

Patients under retreatment category had a significantly higher risk of undernutrition compared to patients on new treatment regimen. Under the retreatment category, TB patients with relapse, failure of initial treatment, previously loss to follow up were included. Therefore, it can be assumed that the nutritional status among them also might not be that satisfactory. Those with a relapse are likely to be having poor immunity and along with it, poor nutrition as well; whose treatment failed are more likely to have poor body response to treatment again which might accompany poor nutrition; those who loss to follow up previously indicate general negligence to self-care including proper nutrition.

Conclusions & Recommendations

The current study demonstrated a higher prevalence of undernutrition (46.3%) among TB patients in Sri Lanka during 2020. The sex of patient, presence of comorbidities and other behavioural risk factors such as smoking and illicit drug use were strongly associated with undernutrition among TB patients. Other factors associated were site of TB, treatment category, pulmonary TB and the under-retreatment category.

The study emphasises on paying more attention to the nutritional status of TB patients as it greatly affects the outcome of anti-TB treatment. The clinicians at chest clinic should be sensitized on the importance of shared care on addressing this issue. Nutritional counselling for patients should be incorporated into routine care. To address the risk factors such as smoking, alcohol use and illicit drug use, collaboration with the National Dangerous Drug Control Board should be strengthened to provide specialised counselling and rehabilitation care. Though limited, currently available services such as provision of Thriposha and financial allowance for low-income patients should be implemented efficiently. Further, coordination with stakeholders such as divisional secretariat staff, non-governmental organizations and community-based organizations should be explored as avenues to improve nutritional status of TB patients.

Table 1: Distribution of socio-demographic, TB disease and other health related factors among the study sample

Variable		No.	%
Age	≤ 14 years	80	1.8
	15 to ≤ 59 years	3106	68.0
	≥ 60years	1380	30.2
Sex	Males	2978	65.2
	Females	1588	34.8
Geographical area	Western Province	1664	36.4
	Other provinces	2902	63.6
Disease category	New	4200	92.0
	Retreatment	366	8.0
Site of disease	Pulmonary Tuberculosis	3414	74.8
	Extra Pulmonary Tuberculosis	1152	25.2
Method of diagnosis	Bacteriologically confirmed	2746	60.1
	Clinically diagnosed*	1820	39.9
Treatment outcome**	Cured	1402	51.0
	Treatment completed	971	35.3
	Death	178	6.5
	Loss to follow up	103	3.7
	Treatment failure	50	1.8
	Not evaluated	45	1.6
Presence of comorbidities	Yes	1486	32.5
	No	3080	67.5

* Includes 1126 extra pulmonary TB patients diagnosed clinically

**Outcome available for 2749 patients only

Table 2: Distribution of nutritional status among the TB patients for the year 2020

Nutritional status	International categorization (%)	Asian categorization (%)
Underweight	2115 (46.3)	2115 (46.3)
Normal	1917 (42.0)	1508 (33.0)
Overweight	534 (11.7)	943 (20.7)
Total	**4566 (100.0)**	**4566 (100.0)**

Table 3: Associated factors for undernutrition among TB patients in Sri Lanka: bivariate and multivariate analyses

Variable	Bivariate analysis		Multivariate analysis	
	Odds ratio	p value	Odds ratio	p value
Gender	2.39	0.07	0.96	0.632
Male				
Female				
Age	16.93	0.79	1.01	0.067
<15 years				
15-59 years				
60 years and above				
Presence of comorbidities	48.91	<0.001	0.54	**<0.001**
Yes				
No				

Site of TB	109.33	<0.001	2.6	**<0.001**
PTB				
EPTB				
Treatment category	20.51	<0.001	1.6	**<0.001**
New				
Retreatment				
Smoking	13.56	0.001	1.3	**0.047**
Yes				
No				
Alcohol	6.06	0.049	0.83	0.143
Yes				
No				
Illicit drug use	16.15	<0.001	1.65	**0.023**
Yes				
No				

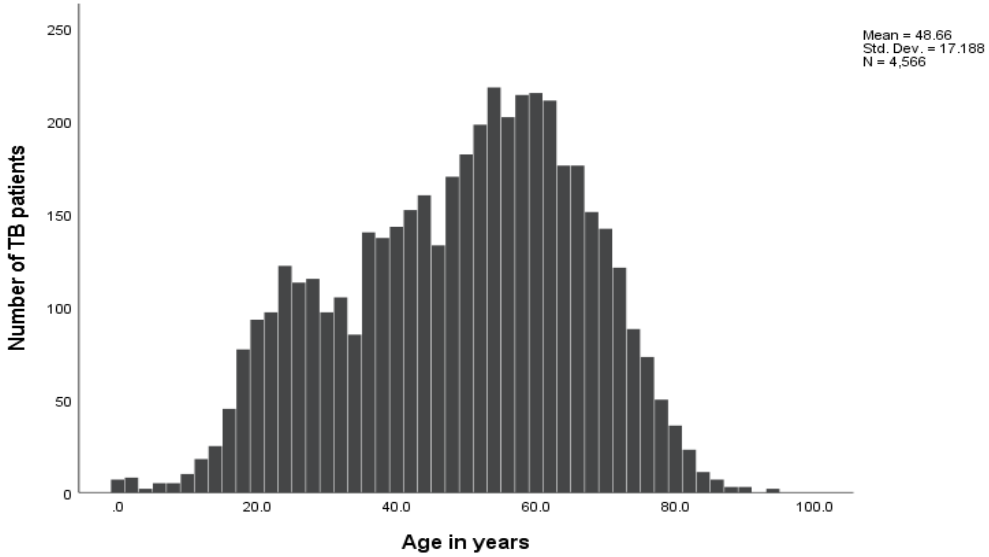

Figure 1: Distribution of TB patients in the study sample by age

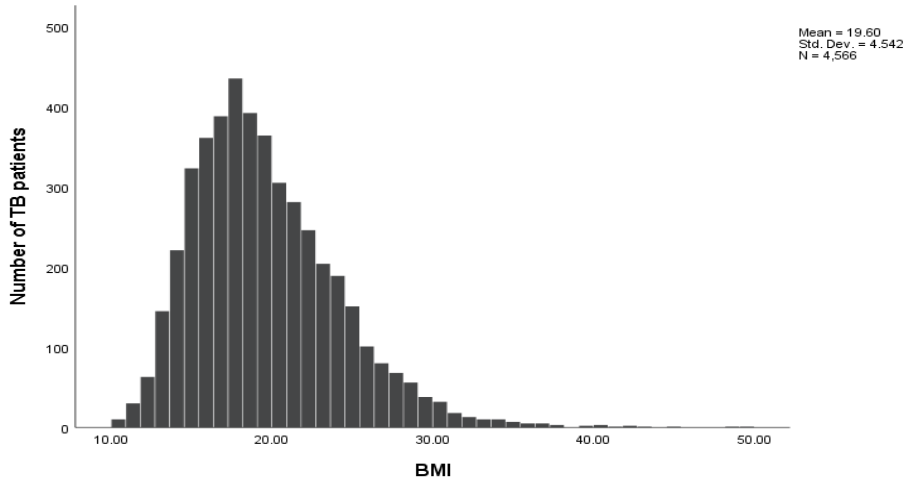

Figure 2: Distribution of TB patients in the study sample by body mass index

Public Health Implications

- The study indicated higher prevalence of 46.3% of underweight among TB patients which indicates poor nutritional status among them.
- Factors associated with their nutritional status were socio-demographic and disease related factors and other dimensions of social and personal health. These need to be addressed by the preventive and curative health care staff attending to these patients. Counselling and provision of nutritional aids play a key role in improving nutritional status of the TB patients.

Author Declarations

***Competing interests*:** Authors declare that there is no conflict of interest.

***Ethics approval and consent to participate*:** The study was performed on secondary data collected by the National Programme and analysis is carried out originally for the annual report of NPTCCD 2020. Therefore, ethical clearance was not taken.

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***Author contributions*:** OR participated in writing the article. SN participated in the analysis of data. PL participated in writing the article.

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