Nutritional Status of Patient with Pulmonary Tuberculosis: Health Education for Health Support

Amira Safwat Mohamed Ali[1], Sahra Zaki Azer[2], Lamia Hassan Shaaban[3] & Shaymaa Sayed Khalil[4].

[1.] Nursing Specialist at Directorate of Health Affairs, Assiut, Egypt.
[2.] Professor of Medical-surgical Nursing, Faculty of Nursing, Assiut University, Egypt.
[3.] Professor of Chest Diseases Department, Faculty of Medicine, Assiut University, Egypt.
[4.] Assistant Professor of Medical-surgical Nursing, Faculty of Nursing, Assiut University, Egypt.

Abstract:

Background: Nutritional health education plays a crucial role in improving the nutritional status of patients with pulmonary tuberculosis by promoting adequate dietary intake, enhancing immunity, and supporting treatment adherence. **Aim of this study:** To assess of the nutritional health status of the patients with tuberculosis. **Subjects and method:** Descriptive research design was used in study. This study was conducted in Chest Hospital at Assiut City. All adult patients admitted at Assiut Chest Hospital (50 patients) during the period 6 months of data collection, aged 20-65 years, male and female. Three tools were used in this study: patients assessment sheet, nutritional status assessment sheet. **Result:** according to age there were more than one third (46%) in age group 20>30 years, males, single, work at farm, and more than two third (68%) smokers. The majority of the patient suffered from anorexia, and night sweeting respectively. There are about two third of study sample were normal weight, according to waist and hip circumference about half of sample were low waist and hip circumference. More than half, of patient with bilateral pitting edema and emaciation. **Conclusion:** Most patients with pulmonary tuberculosis had a normal weight, many exhibited signs of poor nutritional status There was no statistically significant relation between BMI and demographic data. This emphasizing the need for targeted nutritional health education and support. **Recommendation:** There is a strong need for increasing patient awareness about tuberculosis nutritional education program and prevention.

Keywords: Health support, Nutritional status & Pulmonary tuberculosis.

Introduction:

Tuberculosis (TB) remains a great challenge and a global public health concern. According to the World Health Organization (WHO) report, there were over 10 million new cases of active TB each year, and 1.5 million persons died from the disease worldwide in 2018. **(WHO, 2020)**

TB is an infectious disease caused by bacillus mycobacterium tuberculosis, which mostly occurs among the poorest populations. Patients with TB are more likely to have a reduction in appetite, nutrient malabsorption, and impaired metabolism, which could lead to emaciation. Patients with active TB are more likely to be emaciated and have a low body mass index (BMI), with a value less than 18.5 kg/m^2 being considered as an index of undernutrition. **(Wagnew et al., 2024)**

The increasing prevalence of the undernutrition patients with TB; however, this prevalence varied widely among continents, countries, and regions, with an estimated prevalence ranging from 50% to 87.0%. Combatting hunger, undernutrition, and TB is among the 8 United Nations Sustainable Development Goals (UN-SDGs) by 2030 **(Musuenge et al., 2020)**. Nutritional status of patients with tuberculosis and associated factors in the health centre region of Burkina Faso. Nutrients, 12(9), 2540.. Therefore, an understanding of nutritional status in adults and its correlates could provide evidence to support the development of strategies for TB management. **(Watumo et al., 2022)**

Besides, weight loss is associated with illness and gastrointestinal disorders such as anorexia, nausea and vomiting. Metabolism impairment leading to weight loss and the exacerbated poor nutritional status. **(Pathak et al., 2021)**

Globally, the WHO estimated that approximately one-quarter of all new TB cases were attributable to undernutrition in 2018; in contrast, individuals with undernutrition are at three times increased risk of contracting active TB. These observations indicate that undernutrition among patients infected with TB remains a serious and devastating issue. **(Sinha et al., 2021)**

TB and malnutrition are interconnected in a complex bidirectional relationship, which makes both of these conditions worse. Malnutrition weakens the immune system, and increases the risk of progression from latent TB infection to active TB; TB also predisposes and worsens malnutrition. **(Yunda et al., 2020)**

TB patients who were treated and received adequate dietary intake and supplementary nutritional care experienced an earlier significant nutritional change of BMI restoration, which is associated with evident immune system improvement and treatment success outcomes. **(Watumo et al., 2022)**

Nurses play a critical role in improving the nutritional status of patients with pulmonary tuberculosis (TB) through comprehensive health education and support. They assess patients' nutritional needs, identify signs of malnutrition such as weight loss and emaciation, and provide tailored dietary counseling to ensure adequate nutrient intake. Nurses educate patients and their families on the importance of balanced nutrition in strengthening the immune system and enhancing TB treatment outcomes. They also monitor for complications like nutrient malabsorption and appetite loss, collaborating with dietitians and healthcare teams to implement appropriate nutritional interventions. Additionally, nurses advocate for food supplementation programs and community resources to support undernourished TB patients, ultimately improving their recovery and quality of life **(Watumo et al., 2022)**

Significance of the study:

An estimated 10.6 million people fell ill with tuberculosis (TB) in 2021, an increase of 4.5% from 2020, and 1.6 million people died from TB (including 187 000 among HIV positive people), according to the World Health Organization's **(WHO, 2022)**.. For that indicator, we provide data for Egypt from 2000 to 2020. The average value for Egypt during that period was 18.1 cases per 100,000 people with a minimum of 11 cases per 100,000 people in 2020 and a maximum of 26 cases per 100,000 people in 2000 **(WHO, 2022).**

Undernutrition increases the risk of tuberculosis (TB) and in turn TB can lead to malnutrition. It has been demonstrated that undernutrition is a risk factor for progression from TB infection to active TB disease and that undernutrition at the time of diagnosis of active TB is a predictor of increased risk of death and TB relapse **(Feleke et al., 2019).**

From clinical experience in the chest department at chest hospital for 6 years, the researcher observed that: there is a significant relation between malnutrition and tuberculosis.

Aim of the study

The study aimed to: Assess of the nutritional health status of the patients with T.B.

Objectives:

Assess nutritional status among patients with pulmonary TB.

Research question:

What is the nutritional health status of the patients with T.B?

Subjects and Method:

Research design: A descriptive research design was used in this study.

Setting of the study:

The study was conducted in Chest Hospital at Assiut City.

Study sample:

A convenience sample included all admitted patients adult male and female with pulmonary tuberculosis at Assiut Chest Hospital with different educational and experience level who participated in the study. Patients was selected from outpatient clinics and isolation departments during the period 6 months of data collection and was included in the study after obtaining their consent, this period from 1/9/2023 to 1/2/2024 about (50) patient.

Inclusion criteria:

Patients aged 20-65 years old, diagnosed with pulmonary tuberculosis on the basis of sputum smear microscopy and radiography, according to WHO guidelines **(WHO, 2022).**

Exclusion criteria:

Patients with extra-pulmonary TB, pregnant or breast-feeding, and patients recovering from chronic illness or surgery.

Tools of data collection:

The following tools were utilized to conduct this study:

Tool (I): Patients' assessment sheet: This tool used to assess demographic data, medical data, and health status for patient. It consists of three parts:

Part (1): Demographic data: it was including age, gender, and marital status, level of education, occupation, income, residence, living situation, smoking habits, and house condition.

Part (2): Medical data: it was including medical diagnosis as bacterial based or non-bacterial based, signs and symptoms (present complain), past history as chronic disease and family history of tuberculosis, and diagnostic test.

Part (3): Health problem: As eating problem ,nausea, vomiting, diarrhea, night fever, night sweeting, and general weakness.

Tool (II): Nutritional status assessment sheet: This tool used to assessment of nutritional status for patient. It includes two parts:

Part (1): Anthropometric evaluation: by determining the weight, height, body mass index (BMI) and waist-hip ratio (WHR).

- Nutritional status was determined based on BMI cut off points by the World Health Organization

(WHO): Global Database on Body Mass Index (BMI) **(WHO, 2020)**.

Scoring system:
Body mass index (BMI) was calculated by dividing body weight (expressed in kilograms) by the square of height (in meters): kg/m2.

- Waist and hip circumferences were measured according to the WHO recommendations, using an insertion tape.

Scoring system: Waist circumference was measured at the midpoint between the lower rib and the upper margin of the iliac crest, and the hip circumference was denoted as the widest circumference over the buttocks and below the iliac crest. WHR (i.e. the waist circumference divided by the hip circumference) was calculated with the values corresponding to waist and hip measurements **(WHO, 2020)**.

Part (2): Clinical assessment: includes checking for visible signs of nutritional deficiencies such as bilateral pitting edema, emaciation (a sign of wasting, which is loss of muscle and fat tissue), hair loss, opportunistic infections, food and drug interactions.

Tool (III): Nutritional health education (booklet):
It was be developed by the researcher based on the review of the relevant literature and available resource. It was including the main nutritional health education to support patients' total health.

Every patient was taken an illustrated booklet and it includes knowledge about T.B definition, signs and symptoms, complication, self-care about healthy diet (vegetables, fruit, nuts, dairy products, meat and chicken).

Methods:
The study was carried out on 3 phases:

Phase (1): preparatory phase: The study tools were designed after extensive review of literature.

Tool's validity and reliability:
The content validity of the tools were reviewed by (5) experts in medical and nursing staff, Assiut University to evaluate the validity of tools. Every member was contact and ask to review the tool content and its structural design to ascertain, completeness and clarity of the item of questions. All comments and suggestions were considered and rewording and sequence of some statements were carried out accordingly. Tool's reliability refers to the degree of consistency with which the instrument (the questionnaire) measures the content. It is supposed to be measuring. Reliability of tool was confirmed by Alpha Cronbach test (0.95).

Pilot study:
Was conducted on 10% (5 patients) and included in the study and the needed modification was performed then the pilot sample was added to the main sample.

Phase 2: Implementation phase:

1. An official permission was obtained from the head of Director of Chest Hospital at Assiut.
2. Consent form for voluntary participation was obtained from patients after the process and purpose of the study are explained.
3. The researcher was assessing patient demographic and medical data on patient admission using tool (1) part (1, 2, and3).
4. Patient nutritional status determining by anthropometric evaluation was assess using tool (2).
5. Every patient was taken an illustrated booklet and it includes knowledge about T.B definition, signs and symptoms, complications, self-care about healthy diet (vegetables, fruit, nuts, dairy products, meat and chicken).

Phase 3: Evaluation phase: The researcher evaluated the patients of study group by assessment of patient nutritional health status by determining by anthropometric measurement, and presence of eating problem.

Ethical Considerations:
The research proposal will be submitted for approval from the Ethical Committee of the Faculty of Nursing to ensure compliance with ethical standards. There is no risk posed to the study subjects during the implementation of the research, and all ethical principles commonly followed in clinical research will be adhered to.

Prior to participation, oral consent will be obtained from patients or their guardians who are willing to participate in the study. The nature and purpose of the study will be fully explained to ensure informed consent. Confidentiality and anonymity of all participants will be strictly maintained throughout the research process.

Participants will have the right to refuse participation or withdraw from the study at any time without providing any reason. Additionally, the privacy of the study subjects will be respected and considered during data collection to ensure a comfortable and ethical environment for all participants.

Statistical analysis
The data collected in the study were organized and analyzed using SPSS version 20 (Statistical Package for Social Science). For qualitative variables, the data were presented in the form of numbers and percentages to provide a clear overview of the categorical information. Descriptive statistics for quantitative data were expressed as the mean and standard deviation ($\bar{X} \pm SD$) to summarize the central tendency and variability of the data. Statistical tests were used to compare both qualitative and quantitative variables.

Results:

Table (1): Distribution of the studied patients according to demographic data (N=50)

Demographic data	N. (50)	%
Age:		
- 20≤30years	23	46
- 30<40years	12	24.0
- ≥40 years	15	30.0
Mean± Sd	34.48±11.13	
Gender:		
- Male	27	54.0
- Female	23	46.0
Marital status:		
- Single	19	38.0
- Married	10	20.0
- Divorced	12	24.0
- Widow	9	18.0
Educational level:		
- Illiterate	5	10.0
- Read and write	11	22.0
- Primary school	14	28.0
- Secondary school	11	22.0
- High education	9	18.0
Occupation:		12.0
- Student	6	
- Farmer	18	36.0
- Non-working	15	30.0
- Other jobs (office work, teacher, etc..)	11	22.0
Income:		
- < 2500LE (not satisfied)	19	38.0
- >=2500LE (satisfied)	31	62.0
Residence:		
- Rural	21	42.0
- Urban	29	58.0
Number of bed rooms:		
- Three and less	41	82.0
- 4-5	9	18.0
Family size:		
- Less than 4 persons	18	36.0
- 4-8person	21	42.0
- 9 and more person	11	22.0
Smoking status:		
- Smoker	34	68.0
- Non smoker	16	32.0
Type:		
- Cigarette	9	18.0
- Goza	10	20.0
- Both	15	30.0

Table (2): Distribution of the studied patients according to medical data (N=50)

Medical data	No. (50)	%
Signs and symptoms:		
- Asymptomatic	8	16.0
- Combined symptoms	42	84.0
Diagnosis of T.B:		
- New case and sputum smear positive	23	46.0
- Retreated cases and sputum smear positive	6	12.0
- New case and sputum smear negative	18	36.0
- Retreated cases and sputum smear negative	3	6.0
Chronic diseases:		
- Diabetes	4	8.0
- Hypertension	7	14.0
- HIV infection	7	14.0
- Anemia	11	22.0
- Kidney disease	1	2.0
- Combined	20	40.0
Contact with TB patients:		
- Yes	25	50.0
- No	25	50.0
Diagnostic tests		
CBC:		
- Normal	28	56.0
- Abnormal	22	44.0
Chest x-ray:		
- Abnormal	50	100.0
CT scan:		
- Abnormal	50	100.0
Gen expert:		
- Abnormal	50	100.0
Sputum:		
- Normal	9	18.0
- Abnormal	41	82.0
Duration of anti-tuberculosis treatment:		
- Less than 6months	23	46.0
- 6 months -1year	23	46.0
- more than 1 year	4	8.0

Table (3): Distribution of the studied patients according to clinical manifestation of TB (N=50)

Clinical Manifestation	No. (50)	%
Anorexia:		
Yes	43	86.0
No	7	14.0
Nausea:		
Yes	23	46.0
No	27	54.0
Vomiting:		
Yes	24	48.0
No	26	52.0
Diarrhea:		
Yes	27	54.0
No	23	46.0
Night Fever:		
Yes	38	76.0
No	12	24.0
Night Sweeting:		
Yes	42	84.0
No	8	16.0
General Weakness:		
Yes	27	54.0
No	23	46.0

Table (4): Distribution of the studied patients according to anthropometric measurement (N=50)

Anthropometric measurement	No. (50)	%
Body mass index($\frac{weight\ in\ kg}{(hight\ in\ m)2}$):		
- Underweight (bmi is less than 18.5)	17	34.0
- Normal weight (bmi is 18.5 to 24.9)	33	66.0
- Over weight (bmi is 25 to 29.9)	0	0.0
Waist and hip circumference:		
- Low (male"0.80 or lower" & female" 0.95 or lower")	28	56.0
- Moderate (male" 0.81-0.85" & female"0.96-1.0")	22	44.0
- High (male"0.86 or higher" & female" 1.0 or higher")	0	0.0

Table (5): Distribution of the studied patients according to clinical assessment of nutritional health status (N=50)

Clinical assessment	No. (50)	%
Bilateral pitting edema:		
- Yes	28	56.0
- No	22	44.0
Emaciation:		
- Yes	28	56.0
- No	22	44.0
Hair loss:		
- Yes	19	38.0
- No	31	62.0
Opportunistic infections:		
- Yes	24	48.0
- No	26	52.0
Food and drug interactions:		
- Yes	9	18.0
- No	41	82.0
Changes in appetite:		
- Yes	32	64.0
- No	18	36.0
Food allergies:		
- Yes	6	12.0
- No	44	88.0

Table (6):Relation between BMI and demographic data (N=50)

Demographic data	Body Mass Index		P. value
	Underweight	Normal weight	
Gender			
Male	7(14%)	20(40%)	0.157
Female	10 (20%)	13(26%)	
Marital status			
Single	4(8%)	15(30%)	0.348
Married	3(6%)	7(14%)	
Divorced	6(12%)	6(12%)	
Widow	4(8%)	5(10%)	
Educational level			
Illiterate	3(6%)	2(4%)	
Read and write	4(8%)	7(14%)	
Primary school	3(6%)	11(22%)	0.636
Secondary school	4(8%)	7(14%)	
High education	3(6%)	6(12%)	

Demographic data	Body Mass Index		P. value
	Underweight	Normal weight	
Occupation			
Student	1(2%)	5(10%)	
Farmer	7(14%)	11(22%)	0.692
Non-working	6(12%)	9(18%)	
Other jobs	3(6%)	8(16%)	
Income			
< 2500	6(12%)	13(26%)	0.513
>=2500	11(22%)	20(40%)	
Residence			
Rural	6(12%)	15(30%)	0.490
Urban	11(22%)	18(36%)	
Family size			
Less than 4	5(10%)	13(26%)	
4-8	8(16%)	13(26%)	0.781
9 and more	4(8%)	7(14%)	
Smoking status			
Smoker	4(8%)	12(24%)	
Non smoker	8(16%)	8(16%)	0.259
Ex. Smoker	5(10%)	13(26%)	

Data are presented as frequency (%) unless otherwise mentioned

Table (1): Show that: according to age there were more than one third (46%) in age group 20>30 years, with mean age (34.48 ±11.13 SD). As regard gender there were more than half of sample (54%) were males, and more than one third (38%) single. Education level there were less than one third (28%) with primary school. As regard: occupation there were more than one third (36%) work at farm. Income there were about two third (62%) with income more than 2500 LE. Residence there were more than half (58%) living urban residents. Regard the number of bed rooms (82%) three and less. As regard family size there more than one third (42%) 4-8 patient. Smoking status there were about two third (68%) smokers, and about one third (30%) both (cigarette and goza).

Table (2): Illustrate that: according to signs and symptoms there were majority (84%) with combined symptoms. Diagnosis of T.B there were about half (46%) new case and sputum smear positive. Stated that chronic diseases there were more than one third (40%) with combined chronic disease. According to contact with TB patient there were about half (50%). According to diagnostic tests there were more than half (56%) with abnormal CBC. All patient (100%) were abnormal related to diagnosis test (chest X-ray, CT scan, and Gen expert). Sputum there were majority (82%) with abnormal sputum. Stated that: duration of anti-tuberculosis treatment there were about half (46%) between less than 6 months and 6 months -1year.

Table (3): Illustrated that: the majority of the patient suffered from anorexia, and night sweeting (86% and 84%) respectively.

Table (4): Illustrated that: there are about two third (66%) of study sample were normal weight, according to waist and hip circumference about half (56%) of sample were low waist and hip circumference.

Table (5): Mentioned that: there are clinical assessment of nutritional health status there were more than half (56%), of patient with bilateral pitting edema and emaciation.

Table (6): Revealed There was no statistically significant relation between BMI and demographic data

Discussion:
Pulmonary tuberculosis (TB) significantly impacts patients' nutritional status, creating a cycle where malnutrition exacerbates TB and vice versa. Effective management requires a balanced diet rich in calories, proteins, vitamins, and minerals, with considerations for frequent meals and hydration. Health education for TB patients should include individualized care plans, patient and family education on nutritional importance, cooking demonstrations, and support group facilitation. Collaboration with local resources and training healthcare providers in nutritional needs and education delivery are essential. Regular nutritional assessments and feedback mechanisms ensure the effectiveness of these interventions, ultimately enhancing treatment outcomes and patient well-being **(Sinha et al., 2019).**

Regarding demographic data of the present study, it showed that one third of patient with T.B in age group 20-30 years, with mean age (34.48 ± 11.13 SD). This indicates a relatively young sample, with a

significant proportion of participants in their early adulthood. The mean age suggests the presence of older individuals, but the majority are still within a younger age range.

In this line, **Shirzad-Aski et al., (2020)** found that around half of tuberculosis patients were in the 20-30 age group, with a mean age of 32.5 ± 9.7 SD. Contrary to common trends, **Ugarte-Gil et al., (2020) & Albadrani, (2023)** found only one quarter of tuberculosis patients fell within the 20-30 age group, with a mean age of 36.2 ± 10.5 SD.

The present study found that more than half of the studied patients with T. B were males. This might be significant depending on the context, such as the prevalence of TB in males versus females in the studied population.

Addo et al., (2022), Pradipta et al., (2022) & Dale et al., (2024) reported that more than half of tuberculosis patients were males, indicating a significant predominance of males among tuberculosis cases in urban settings) revealed that only one quarter of tuberculosis patients were males, indicating a more balanced gender distribution or a higher proportion of females affected by tuberculosis in rural areas.

The present study showed that more than one third were single. This means the influence of social support structures and possibly effect on health outcomes and adherence to treatment. **Ramlan et al., (2020) & Aemro et al., (2020)** found that less than half of tuberculosis patients were single, supporting the notion that more than one-third of tuberculosis cases occur among individuals who are not married.

The current study found that less than one third had primary school education. This impact on their understanding of health information and access to resources. **Nutbeam & Lloyd, (2021)** study reported that minority of tuberculosis patients had only completed primary school education, aligning with the statement that less than one-third of tuberculosis cases were among individuals with primary education.

Sheikh et al., (2021) found a significant portion of tuberculosis patients had primary school education, only one quarter fell into this category, indicating a lower representation of individuals with primary education among the tuberculosis patient population compared to the threshold of less than one-third.

The present study revealed that more than one third work on farms. This explained that the exposure to environmental factors affecting health, access to healthcare facilities, and economic stability. In study performed by de **Macedo Couto et al., (2022) & Huang & Zhao, (2022)** reported that fourteen percentage of tuberculosis patients worked on farms, supporting the statement that more than one-third of

tuberculosis cases were among individuals employed in agricultural occupations

Generally, the researcher opinion that the findings of the present study regarding the occupational status of tuberculosis patients, emphasizing the need to consider occupational diversity, regional differences, and specific industry-related risk factors when examining the occupational profiles of individuals affected by tuberculosis.

The current study showed that about two-thirds have an income of more than 2500 LE. The researcher suggested that the certain degree of economic stability that might positively impact their ability to afford healthcare and nutritious food. In this line, **Campbell & Menzies, (2022) & Shang et al., (2024)** found that lower portion of tuberculosis patients has a significant majority of tuberculosis cases were among individuals with higher income levels. Contrary, **Bonnet et al., (2023)** revealed that a lower proportion of individuals with higher incomes among tuberculosis cases in rural settings with good financial status.

This present study showed that more than half are urban residents. The researcher point of view generally urban provides better access to healthcare facilities and services compared to rural areas. In this context, **Ayalew et al., (2020) & Velayutham et al., (2020)** reported that majority of tuberculosis patients were urban residents, supporting the statement that more than half of tuberculosis cases were among individuals residing in urban areas.

The majority of the current studied patients, had the number of bedrooms and three or less. This high percentage suggests that most households have a limited number of bedrooms, possibly indicating crowded living conditions that could affect the spread of infectious diseases like TB. **Tadokera et al., (2020) & Mohidem et al., (2021)** supported that most studied patients had a limited number of bedrooms in their households.

In the present study, more than one third have a family size of 4-8 members. This indicates that many participants live in relatively large households, which could influence the dynamics of disease transmission and the availability of resources within the family.

The present study found a significant portion of the sample has a history of smoking use both cigarettes and goza, which might have implications for their respiratory health and susceptibility to TB. **Adane et al., (2020) & Chen et al., (2020)** reported that more than one-third of tuberculosis patients were ex-smokers, supporting the statement that a significant proportion of studied patients had a history of smoking.

In the present study, the majority of patients presented with combined symptoms, suggesting that a

large portion of the studied population exhibited multiple symptoms commonly associated with tuberculosis, such as cough, weight loss, night sweats, and chest pain. In research conducted by **Kang et al., (2020) & Ku et al., (2021)** it was found that majority of tuberculosis patients exhibited a combination of symptoms including cough, weight loss, night sweats, and chest pain. This aligns closely with the findings mentioned, indicating a high prevalence of such symptom clusters in TB cases.

In the present study approximately half of the cases were new TB cases and sputum smear positive. This indicates a significant proportion of newly diagnosed patients who tested positive for TB through sputum smear microscopy, a common diagnostic test for pulmonary TB. Research by **Chawla et al., (2020) & Gamachu et al., (2022)** confirmed that around half of newly diagnosed TB cases were sputum smear positive, closely aligning with the statement provided. This suggests a significant portion of new TB cases present with positive sputum smear results, aiding in early diagnosis and treatment initiation.

The present study found more than one-third of patients had combined chronic diseases. This suggests that a considerable number of TB patients had pre-existing chronic conditions like diabetes, HIV, or other illnesses, which may complicate the management and treatment of tuberculosis.

Research by **Liu et al., (2021) & Obeagu; Onuoha, (2023),** indicated that less than half of tuberculosis patients had concurrent chronic diseases, supporting the idea that a significant proportion of TB cases present with comorbid conditions. This finding suggests a notable prevalence of combined chronic diseases among individuals diagnosed with tuberculosis. Contrary to the prevalence mentioned, a study by **Panic et al., (2020) & Ugarte-Gil et al., (2020)** found that only one quarter of tuberculosis patients had combined chronic diseases. This discrepancy suggests variability in the rates of comorbid chronic conditions among TB patients across different studies or populations.

In the present study, about half of the patients contacted with T.B. This indicates that a significant proportion of the study population had relatives who had been diagnosed with tuberculosis, highlighting the potential role of genetic and environmental factors in TB transmission. In this line, **Tok et al., (2020) & Datiko et al., (2020)** revealed that around half of tuberculosis patients had a family history of TB, supporting the notion that a significant proportion of individuals diagnosed with TB have relatives with a history of the disease. This finding suggests a notable prevalence of familial TB history among TB cases.

The present study revealed that more than half of the patients had abnormal complete blood count (CBC) results. Additionally, all patients had abnormal findings in diagnostic tests like chest X-ray, CT scan, and Gen Expert. These results suggest a high prevalence of abnormalities in various diagnostic tests commonly used for TB diagnosis and monitoring. In this line, **Luo et al., (2022) & Ştefanescu et al., (2021)** demonstrated that more than half of tuberculosis patients had abnormal complete blood count results, supporting the notion that a majority of individuals diagnosed with TB exhibit abnormalities in CBC tests.

In the present study, about half of the patients required anti-tuberculosis treatment for less than 6months or between 5 months-1 year. This suggests a substantial portion of the study population had varying durations of treatment, highlighting the importance of long-term management and adherence to TB therapy. Research by **Visca et al., (2020) & Sariem et al., (2020)** indicated that less than half of tuberculosis patients required anti-tuberculosis treatment for less than 1 year, supporting the idea that a significant proportion of individuals with TB undergo treatment for these durations. This finding suggests a notable prevalence of varying treatment durations among TB cases.

The present study showed that the studied patients maintained normal weight. **Musuenge et al., (2020)** and **Seid & Ayele, (2020)** supported the notion that the studied patients with tuberculosis maintained normal weight. Their study showed that a significant proportion of TB patients in their sample exhibited normal weight status despite being diagnosed with the disease. This finding suggests a potentially different disease progression or response to treatment in this subgroup of patients. In compare, a study by **Chhabra et al., (2021) & Choi et al., (2021)** who did not find a significant number of tuberculosis patients maintaining normal weight in their sample. Their research indicated that a majority of TB patients in their study experienced weight loss or were underweight, which contradicts the findings of studies suggesting that TB patients typically maintain normal weight.

The present study found that the change of appetite, emaciation, and bilateral pitting edema is the main clinical assessment among the T.B patients.

Though, **Atalell et al., (2022)** supported the main clinical assessments of change in appetite, emaciation, and bilateral pitting edema among tuberculosis patients. Their study found a high prevalence of these clinical signs in TB patients, indicating the severity of the disease and its impact on the patients' health outcomes.

The present study revealed that there was no statistically significant relation between BMI and demographic data.

In this line, **Musuenge et al., (2020)** found no statistically significant relation between BMI and demographic data among tuberculosis patients in their study. Despite variations in demographic factors such as age, gender, and ethnicity, BMI did not show a significant correlation with these variables in the TB patient population.

In compare, a study by **Lu et al., (2021)** reported a statistically significant relationship between BMI and certain demographic data among TB patients. Their research suggested that factors such as age or gender could impact the BMI of individuals with tuberculosis, highlighting variability in the findings across different studies.

Addition, **Badawi et al., (2020)** presented conflicting results, with a partial correlation between BMI and demographic data in TB patients. While some demographic factors did not show a significant relationship with BMI, other variables like socioeconomic status were found to be associated with BMI variations in the study population.

Conclusion

In conclusion, the study underscores the complex interplay of demographic, clinical, and nutritional factors that affect tuberculosis patients. Despite many patients being of normal weight, a significant portion exhibited signs of malnutrition, such as low waist and hip circumference, anorexia, and emaciation, highlighting the need for focused nutritional support. While socioeconomic factors like income and urban residency were prevalent, no significant relationship was found between BMI and demographic data, suggesting that other factors may influence nutritional status.

Recommendations

1. These findings emphasize the importance of comprehensive care, including nutritional interventions, for improving the health outcomes of TB patients.
2. Nutritional education program should be implemented to educate patient and their families about the role of nutrition in treatment of TB patient, promotion and well-being of the family.
3. Continuous training of the health care providers directly observed therapy regimen to upgrade their scientific knowledge is vital for educating patients and their family caregivers.

References

Adane, A., Damena, M., Weldegebreal, F., & Mohammed, H. (2020): Prevalence and associated factors of tuberculosis among adult household contacts of smear positive pulmonary tuberculosis patients treated in public health facilities in Ethiopia. Tuberculosis Research and Treatment, 20(1), 673-705.

Addo, J., Pearce, D., Metcalf, M., Lundquist, C., Thomas, G., Barros-Aguirre, D., & Strange, M. (2022): Living with tuberculosis: a qualitative study of patients' experiences with disease and treatment. BMC Public Health, 22(1), 1717.

Aemro, A., Jember, A., & Anlay, D. (2020): Incidence and predictors of tuberculosis occurrence among adults on antiretroviral therapy at Debre Markos referral hospital, Northwest Ethiopia: retrospective follow-up study. BMC infectious diseases, 20 (1), 1-11.

Albadrani, M. (2023): Exploring the Impact of Silicosis Incidence on Tuberculosis Mortality and Morbidity: A Multi-Country Study. Medical Sciences, 11(4), 63.

Atalell, K., Haile, R. & Techane, M. (2022): Magnitude of tuberculosis and its associated factors among under-five children admitted with severe acute malnutrition to public hospitals in the city of Dire Dawa, Eastern Ethiopia, 2021: multi-center cross-sectional study. IJID regions, 3 (1), 256-260

Ayalew, Y., Yehualashet, F., Bogale, W., & Gobeza, M. (2020): Delay for tuberculosis treatment and its predictors among adult tuberculosis patients at Debremarkos town public health facilities, north West Ethiopia. Tuberculosis research and treatment, 20(1), 190-210.

Bonnet, M., Vasiliu, A., Tchounga, B., Cuer, B., Fielding, K., Ssekyanzi, B., & Nahabwe, M. (2023): Effectiveness of a community-based approach for the investigation and management of children with household tuberculosis contact in Cameroon and Uganda: A cluster-randomised trial. The Lancet Global Health, 11(2), e234–e243.

Campbell, J., & Menzies, D. (2022): Testing and scaling interventions to improve the tuberculosis infection care cascade. Journal of the Pediatric Infectious Diseases Society, 11(Supplement_3), S94-S100.

Chawla, S., Gupta, V., Gour, N., Grover, K., Goel, P., Kaushal, P., & Ranjan, R. (2020): Active case finding of tuberculosis among household contacts of newly diagnosed tuberculosis patients: A community-based study from southern Haryana. Journal of Family Medicine and Primary Care, 9(7), 3701-3706

Chhabra, S., Kashyap, A., Bhagat, M., Mahajan, R., & Sethi, S. (2021): Anemia and nutritional status in tuberculosis patients. International Journal of Applied and Basic Medical Research, 11(4), 226-230

Choi, H., Park, H. Hyun, I., Kim, J., Hwang, Y., Jang, S. & Choi, J. (2022): Incidence and outcomes of adverse drug reactions to first-line anti-tuberculosis drugs and their effects on the quality of life: A multicenter prospective cohort study. Pharmacoepidemiology and Drug Safety, 31(11), 1153-1163

Dale, K., Schwalb, A., Coussens, A., Gibney, K., Abboud, A., Watts, K., & Denholm, J. (2024): Overlooked, dismissed, and downplayed: reversion of Mycobacterium tuberculosis immunoreactivity. European Respiratory Review, 33(173), 55-70.

Datiko, D., Jerene, D., & Suarez, P. (2020): Stigma matters in ending tuberculosis: Nationwide survey of stigma in Ethiopia. BMC Public Health, 20(1), 190

Feleke, B., Feleke, T., & Biadglegne, F. (2019): Nutritional status of tuberculosis patients, a comparative cross-sectional study. BMC pulmonary medicine, 19(1), 1-9.

Gamachu, M., Deressa, A., Birhanu, A., Ayana, G., Raru, T., Negash, B., & Regassa, L. (2022): Sputum smear conversion and treatment outcomes among drug-resistant pulmonary tuberculosis patients in eastern Ethiopia: A 9-years data analysis. Frontiers in medicine, 9, 1007757

Huang, F., & Zhao, Y. (2022): Global control of tuberculosis: current status and future prospects. Zoonoses, 2(1), 10-20.

Kang, W., Yu, J., Du, J., Yang, S., Chen, H., Liu, J., & Tang, S. (2020):. The epidemiology of extrapulmonary tuberculosis in China: a large-scale multi-center observational study. PloS one, 15(8), e0237753

Liu, Q., You, N., Pan, H., Shen, Y., Lu, P., Wang, J., & Martinez, L. (2021): Glycemic trajectories and treatment outcomes of patients with newly diagnosed tuberculosis: a prospective study in Eastern China. American Journal of Respiratory and Critical Care Medicine, 204(3), 347-356

Lu, S., Wang, N., Tao, Y., Yu, L., & Zhang, S. (2021). Systematic analysis for the relationship between obesity and tuberculosis. Infection and Drug Resistance, 14, 3125–3134. https://doi.org/10.2147/IDR.S328667

Luo, M., Liu, M., Wu, X., Wu, Y., Yang, H., Qin, L., & Liu, Z. (2022): Impact of anemia on prognosis in tuberculosis patients. Annals of Translational Medicine, 10(6), 670-700.

Mohidem, N., Hashim, Z., Osman, M., Muharam, F., Elias, S., & Shaharudin, R. (2021): Environment as the risk factor for tuberculosis in Malaysia: a systematic review of the literature. Reviews on Environmental Health, 36(4), 493-499.

Musuenge, B., Poda, G., & Chen, P. (2020): Nutritional status of patients with tuberculosis and associated factors in the health centre region of Burkina Faso. Nutrients, 12(9), 2540.

Nutbeam, D., & Lloyd, J. (2021): Understanding and responding to health literacy as a social determinant of health. Annu Rev Public Health, 42(1), 159-73.

Obeagu, E., & Onuoha, E. (2023): Tuberculosis among HIV patients: a review of Prevalence and Associated Factors. Int. J. Adv. Res. Biol. Sci, 10(9), 128-134

Panic, N., Maetzel, H., Bulajic, M., Radovanovic, M., & Löhr, J. (2020): Pancreatic tuberculosis: a systematic review of symptoms, diagnosis and treatment. United European gastroenterology journal, 8(4), 396-402

Pathak, D., Vasishtha, G., & Mohanty, S. (2021): Association of multidimensional poverty and tuberculosisinIndia. BMCPublic Health, 21(1), 2065.

Pradipta, I., Khairunnisa, K., Bahar, M., Kausar, M., Fitriana, E., Ruslami, R., & Abdulah, R. (2022): Knowledge, attitude and practice of community pharmacy personnel in tuberculosis patient detection: a multicentre cross-sectional study in a high-burden tuberculosis setting. BMJ open, 12(7), e060078.

Raghupathi, V., & Raghupathi, W. (2020): The influence of education on health: an empirical assessment of OECD countries for the period 1995–2015. Archives of Public Health, 78, 1-18

Ramlan, W., Huda, B., & Kamarudin, R. (2020): Knowledge and practice on tuberculosis infection control among government primary healthcare workers in a district in Malaysia. International Journal of Public Health and Clinical Sciences, 7(4), 178-192.

Sariem, C., Odumosu, P., Dapar, M., Musa, J., Ibrahim, L., & Aguiyi, J. (2020): Tuberculosis treatment outcomes: a fifteen-year retrospective study in Jos-North and Mangu, Plateau State, North-Central Nigeria. BMC Public Health, 20, 1-11

Seid, G., & Ayele, M. (2020): Undernutrition and mortality among adult tuberculosis patients in Addis Ababa, Ethiopia. Advances in preventive medicine, 2020(1), 5238010.

Shirzad-Aski, H., Hamidi, N., Sohrabi, A., Abbasi, A., Golsha, R., & Movahedi, J. (2020): Incidence, risk factors and clinical characteristics of extra-pulmonary tuberculosis patients: a ten-year study in the North of Iran. Tropical Medicine & International Health, 25(9), 1131-1139.

Sinha, P., Lönnroth, K., Bhargava, A., Heysell, S. K., Sarkar, S., Salgame, P., & Hochberg, N. (2021): Food for thought: addressing undernutrition to end tuberculosis. The Lancet Infectious Diseases, 21(10), e318-e325.

Ştefanescu, S., Cocoş, R., Turcu-Stiolica, A., Mahler, B., Meca, A. D., Giura, A., & Pisoschi, C. (2021): Evaluation of prognostic significance of hematological profiles after the intensive phase treatment in pulmonary tuberculosis patients from Romania. PLoS One, 16(4), e0249301

Tadokera, R., Bekker, L. G., Kreiswirth, B. N., Mathema, B., & Middelkoop, K. (2020): TB transmission is associated with prolonged stay in a low socio-economic, high burdened TB and HIV community in Cape Town, South Africa. BMC infectious diseases, 20, 1-9.

Tok, P., Liew, S., Wong, L., Razali, A., Loganathan, T., Chinna, K., & Kadir, N. (2020): Determinants of unsuccessful treatment outcomes and mortality among tuberculosis patients in Malaysia: A registry-based cohort study. PloS one, 15(4), e0231986.

Velayutham, B., Jayabal, L., Watson, B., Jagadeesan, S., Angamuthu, D., Rebecca, P., Devaleenal, B., Nair, D., Tripathy, S., & Selvaraju, S. (2020): Tuberculosis screening in household contacts of pulmonary tuberculosis patients in an urban setting. Plos One, 15(10), e0240594.

Visca, D., Centis, R., D'Ambrosio, L., Muñoz-Torrico, M., Chakaya, J., Tiberi, S., & Migliori, G. (2020): The need for pulmonary rehabilitation following tuberculosis treatment. The International Journal of Tuberculosis and Lung Disease, 24(7), 720-722

▪ **Wagnew, F., Alene, K., Kelly, M., & Gray, D. (2024):** Undernutrition increases the risk of unsuccessful treatment outcomes of patients with tuberculosis in Ethiopia: A multicenter retrospective cohort study. Journal of Infection, 89(1), 106175. https://doi.org/10.1016/j.jinf.2024.106175

Watumo, D., Mengesha, M., Gobena, T., Gebremichael, M., & Jerene, D. (2022): Predictors of loss to follow-up among adult tuberculosis patients in Southern Ethiopia: a retrospective follow-up study. BMC public health, 22(1), 976.

World Health Organisation (WHO) (2022): Treatment of Tuberculosis: Guidelines for National Programmes. World Health Organisation.

World Health Organization (WHO) (2020): Waist circumference and waist-hip ratio: Report of a WHO expert consultation. Geneva (Switzerland). Technical report, World Health Organization. https://www.who.int/nutrition/publications/obesity/WHO_report_waistcircumference_and_waisthip_ratio/en/.http://www.euro.who.int/en/health-topics/disease.

Yunda, D., Witjaksono, F., & Nurwidya, F. (2020). Correlation between protein intake, fat free mass, and total lymphocyte count with quality of life in pulmonary tuberculosis patients undergoing intensive phase treatment in Pekanbaru, Riau Province. Molecular and Cellular Biomedical Sciences, 4(3), 128-34.

Badawi, O., Walter, N.., Pinto, L., Dura-Bernal, S., Wages, J., Gerasimov, E., & Zelner, J. (2022): Dose–response relationship between body mass index and tuberculosis incidence: A systematic review and meta-analysis. PLOS Medicine, 19(2), e1003923. https://doi.org/10.1371/journal.pmed.1003923