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Prevalence of undernutrition and Associated Factors among Adult Tuberculosis Patients in Public Health Facilities in Dire Dawa Administration in Ethiopia a cross-sectional Study

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Abstract

Background: The prevalence of under nutrition among TB patients remains above 20% for 14 of the 30 high TB-burden countries. One of the main issues facing TB patients in the world's developing nations. Two out of every three TB patients who were registered in Ethiopia in 2015 were undernourished, despite the national TB treatment guidelines and the World Health Organization (WHO) recommendation for nutrition assessment and counseling, management of malnutrition, and supplementation of micronutrient services for TB patients. Therefore, this study aimed to determine the extent of undernutrition and associated factors among adult TB patients at public health facilities in Dire Dawa administration, Eastern Ethiopia.

Methods: An institutional-based cross-sectional study was conducted in Dire Dawa administrative public health facilities from October 15 to November 15, 2020, among 402 adult TB patients. The study participants were allocated to the selected health facilities proportional to their size and study participants were consecutively enrolled in the study during the study period. Measuring height and weight should be done at TB OPD taken by height measuring board and digital bath balance, Seca, which is the German model for weight measurement was used by trained data collectors. The collected data were entered into Epi-data version 3.3 and then was exported to SPSS version 25. To determine the variables associated to under nutrition among TB patients, bivariate and multivariate logistic regression analyses were conducted. Statistical significance was declared at P<0.05.

Results: The prevalence of under nutrition was 44.5% of adult TB patients (95% CI = 39%-49.4%). Age >= 55 years and above (AOR=0.15,95%CI:0.043-0.504); no source of monthly income with (AOR = 2.67, 95% CI: 1.409-5.037) and <= 1500 Ethiopian Birr (ETB) (AOR=2.13, 95% CI: 1.256-3.609); family size > four and above (AOR = 2.21, 95% CI: 1.363-3.572); ambulatory patients (AOR = 2.26, 95% CI: 1.403-3.640), and bedridden (AOR = 3.60, 95% CI: 1.724 -7.499); not receiving dietary counseling (AOR=2.63, 95% CI: 1.616-4.288) ;and not tested sputum smear (AOR=0.34,95%CI:0.185-0.617) were the predictors of under nutrition among TB patients. Regular screening of nutritional status, provision of nutrition support, stabilization, and strengthening dietary counseling and care an integral components of TB treatment necessary for better treatment outcomes and recovery with the collaboration of other stakeholders, and non-governmental organizations.

Conclusion: The prevalence of undernutrition was lower than the pooled prevalence of undernutrition among TB patients in Ethiopia. TB screening and diagnosis, as well as regardless of regular nutritional assessment, strengthening of dietary counseling, and provision of nutritional support, are therefore required for improved treatment outcomes in an effective TB management program.

Keywords: TB, under nutrition, BMI, public Health facilities

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1. Introduction

Tuberculosis (TB) is caused by bacteria (Mycobacterium tuberculosis) and it most often affects the lungs. TB is spread through the air when people with lung TB cough, sneeze, or spit. A person needs to inhale only a few germs to become infected. TB is the leading cause of death for people with HIV and is also a major contributor to antimicrobial resistance. Most of the people who fall ill with TB live in low and middle-income countries, but TB is present all over the world [1]. Also, it can cause under nutrition through raised metabolic demands and poor nutritional intake, which is related to those nutritional deficiencies, may exacerbate the TB disease, or take longer to recover by decreasing necessary immune functions [2].

In 2017, according to the FAO report, 815 million individuals were undernourished, with the majority living in low and middle-income countries (LMIC), particularly in Sub-Saharan Africa and Southeast Asia [3]. This may be due to illness that impairs nutrient intake and metabolism or results from inadequate intake of macronutrients, micronutrients, or both [4].

Even if people get enough to eat, they will become undernourished if the food they eat does not supply the proper amounts of micronutrients to meet daily nutritional requirements [5]. The body mass index (BMI) of an adult who scores less than 18.5 kg/m^2 is underweight, which is a malnutrition stage [6]. Among the known risk factors for active tuberculosis (under nutrition, HIV infection, diabetes, cancer), under nutrition has the highest population-attributable fraction of 27% [7].

The relationship between under nutrition and active tuberculosis infection is bidirectional, having active tuberculosis leads to weight loss, and being underweight can lead to developing tuberculosis either through the reactivation of latent tuberculosis or the development of progressive primary disease upon infection [7].

Undernutrition may worsen the disease, or delay recovery by depressing important immune functions [8-10]. Severe under nutrition at diagnosis is related to a twofold higher risk of death. Chronic severe undernutrition at diagnosis is common and can persist even after successful treatment in a significant proportion of them [11].

Tuberculosis is the top infectious killer worldwide, with 10 million people infected and 1.5 million deaths in 2018. It affects both sexes in all age groups, but the highest burden is in adult males, who accounted for 57% of all TB cases in the same year. Geographically, the WHO

regions of South-East Asia (44%) and Africa (24%) share most of the TB cases, whereas Ethiopia is on the list of 30 high TB burden countries that account for 87% of the world's cases [1]. There were an estimated 165,000 (incidence rate: 151/100,000) new TB cases with a case fatality ratio of 17% (9–25) by 2018 in Ethiopia [1]. A high incidence was observed in Dire Dawa (348/100,000) compared to Addis Ababa (262/100,000) and Harari (206/100,000) [12].

There are several adult TB patients suffering from profound undernutrition in the world, especially in developing countries [11]. It is estimated that undernutrition causes about one-quarter of all new TB cases globally [13].

The prevalence of undernutrition among TB patients was above 20% for 14 of the 30 high TB burden countries [1]. A report on rapid nutritional assessment in 2015 showed that two out of three registered TB patients had undernutrition in Ethiopia [14]. While adult male malnutrition in the general population is 33%, women's is 22% [15]. Similarly, studies from different regions in the country show the magnitude of undernutrition among TB patients is high. This can have serious public health impacts if those with undernourished adult TB are not identified early [16].

Evidence from a few studies recently conducted in Ethiopia shows undernutrition among adult TB patients; in Amhara, 57.17%, In Bala Zone 63.2%, in Addis Ababa 39.7% and in Adama shows 53% [17-20].

According to a WHO report, there is a strong link between tuberculosis and malnutrition, and other factors such as poverty, indoor air pollution, diabetes, HIV, alcohol use, and smoking are also present [1]. In different studies conducted in Ethiopia, factors like monthly income, educational status, family size, HIV status, dietary counseling, and anti-TB treatment were found to be associated with undernutrition among TB patients [17–20].

The interplay between undernutrition and tuberculosis has a clinical and developmental concern. Undernutrition is also highly associated with poverty. At least 75% of all TB cases are among people who are 15–54 years of age and in their prime working years, and most of the TB patients are undernourished, undernourished Adults allocate fewer days to have labor and are more likely to fail to appear for work owing to illness or exhaustion. As a result of this, it affects the countries' development [13].

Therefore, the effective management of tuberculosis requires a detailed evaluation of the nutritional status of the patients which can help to prevent many complications. This will also

help us to magnify the disease burden due to undernutrition, and it will also help us to make plans to rectify these issues.

Despite WHO recommendations for nutrition assessment and counseling, malnutrition management, and micronutrient supplementation for TB patients, as well as national TB treatment guidelines, two out of every three registered TB patients in Ethiopia were malnourished in 2015. This lack of full implementation of recommended service may put the nutritional status of TB patients on care at public health facilities disadvantage [13, 14].

Even if the pooled prevalence of undernutrition among TB patients in Ethiopia was 50.8% (95% CI 43.97, 57.63) [21], no national-level studies showing the burden of undernutrition among TB patients and limited published research work that shows the prevalence and associated factors of undernutrition among adult TB patients in eastern Ethiopia, especially in the study area in particular. Therefore, this study is designed to investigate the prevalence and associated factors of under nutrition among adult TB patients in Dire Dawa administration.

2. Methods and materials

2.1 Study area and period

Dire Dawa administration is located 515 km from the capital Addis Ababa, and has a total population of 506,609 (248,238 males and 258,371 females) [15]. The administration has nine urban and 38 rural kebeles. There are 6 hospitals (2 public and 4 private), 15 health centers (8 urban and 7 rural), 35 health posts, 56 primary, medium, and specialty clinics, and also 30 pharmacies, 42 drug vendors, and 4 private hospital pharmacies found in the Administration. The potential health service coverage of Dire Dawa is 100%. An institutional-based cross-sectional study design was employed from November 15 to December 15, 2020 in Dire Dawa administration public health facilities.

2.2 Population and sampling

The source population of the study was all adult TB patients currently recorded and on TB treatment follow-up care in Dire Dawa public health facilities, and the study population was all adults aged 15 and above TB patients on treatment follow-up at public health facilities. Two hospital, seven urban health centers and eight rural health centers were included in the study.

The sample size was determined by using the single population proportion formula for the first objective (prevalence) n=(Zα/2)2 p (1-p)/d2) by considering the following assumptions; prevalence of undernutrition (P=53%) research conducted in Adama Town [20], 95% level of confidence (Zα/2 = 1.96), 5% margin of error (d = 0.05) and became 383; by adding 5% non-response rate, the final sample size became 402.

There are 34 health facilities (12 private and 17 public health institutions and clinics) provide Direct Observed Therapy (DOT) services in Dire Dawa. The total number of TB patients in 2019 was 1588 [22]. All public health facilities that give TB treatment were included in the study and sampling with population proportional to size was calculated for each health facilities to give the total sample size and study participants were consecutively enrolled until the required sample size was achieved.

2.3 Data quality control

The data was collected using a checklist and face-to-face interview technique with a structured questionnaire which was adopted and modified from previous similar studies [18-19,23]. Then translated to local languages. Amharic, Afan Oromo, and Somali languages and translated back to English by experts in their respective languages. The questionnaires were pretested before the actual data collection in 5% of the sample size in a private health facility at to check the consistency and clarity of the questions. Finally, some modification was made to response categories as needed.

The weight scales used were validated by using standardized weight before the actual weighing of each study participant. A person with a BMI <18.5 kg/m2 was considered as under nutrition. Measuring Height and weight should be taken at TB OPD with height measuring board and digital bath balance, Seca, which is the German model for weight measurement was used. The weight was recorded at the nearest 0.1 kg and the height was recorded to the closest centimeter of 0.1cm with a studio-meter using standard procedures [25]. **Food Consumption Score**-frequency weighted diet diversity score for an individual over past 7 days. There are three thresholds (<28 - poor threshold, 28.5-42 -border threshold, and >42 acceptable threshold). All the data collection process was made coordinated and evaluated by the respective supervisors to maintain the validity and reliability of the data. The data collectors were trained and updated on the current situation of COVID-19 along with precautions. Appropriate protocol was followed before, during, and after data collection by data collectors.

Both height and weight were recorded with two decimal places. Body mass index (BMI in kg/m^2) will be calculated and classified as recommended by WHO [24, 25]. Reviews of records was made for the type and severity of the disease and treatment categories of HIV/AIDS status. The history of the last menstruation was asked.

Operational definition

Undernutrition: A person with a BMI <18.5 kg/m^2 was considered as undernutrition (24).

Body mass index (BMI) – This is defined as the weight in a kilogram of the individual divided by the square of the height in meters. It is used to determine the nutritional status of TB patients and classified as follows: Severe undernutrition (BMI < 16.0 Kg/m^2), moderate undernutrition (BMI = 16.0-16.99 Kg/m^2), mild undernutrition (BMI = 17.0-18.49 Kg/m^2), normal weight (BMI = 18.5-24.99 Kg/m^2), overweight (BMI = 25.0-29.99 Kg/m^2) and obesity (BMI ≥30.0 Kg/m^2) [24].

Adult TB patient –TB patient with age 15 and above [1, 14].

Dietary counseling - This is a process by which a health professional with special training in nutrition helps people to make healthy food choices and form healthy eating habits [19].

Functional status

- **Working**: Able to carry on normal activity and no special care is needed.
- **Ambulatory**: Unable to work, able to live at home, and able to care for most personal needs and requires occasional assistance.
- **Bedridden**: Unable to care for self, requires institutional or hospital care [19].

Nutritional care and support

Have many components such as nutrition education and counseling in health facilities, water, and hygiene or food safety interventions to prevent diarrhea as well as provision of adequate quality/quantity of food and food aid by any organization [19].

Smear-positive TB- is diagnosed when at least two smears are positive or one smear-positive plus suggestive chest x-ray finding [14].

Smear negative TB: If all 3 sputum smears are negative and the patient has suggestive clinical and chest x-ray findings [14].

TB treatment category

Categories 1 -

- New smear-positive PTB
- Smear negative PTB with extensive TB

- Severe forms of extra pulmonary TB [14].

Category 2

- Relapse
- Treatment Failure
- Return after Default [14].

2.4 Data analysis

First, each questionnaire was checked for completeness and then, the data was entered into Epi-data version 3.1 and exported to SPSS version 25.0 software for cleaning and analysis. Descriptive statistics like tables, graphs, and charts present the results frequency distribution, proportion, mean & standard deviation used to summarize the variables. Continuous variables like age, family size, and BMI were first transformed into categorical variables before they were analyzed. First, the frequency of all the variables and their significance was determined. Bivariable logistic regression was done to assess the association of factors with undernutrition among adult TB patients. Variables with a p-value of less than 0.25 in the bivariate analysis were entered into the final multivariate logistic regression to control all possible confounders and identify predictors of undernutrition. The odds Ratio along with 95% CI was used to estimate to measure the strength of association between variables. The level of statistical significance was declared at p-values less than 0.05. The fitness of the model was tested by the Hosmer- Lemeshow goodness of fit test had a P-value > 0.05 [18, 19]. Finally, the results of the study were presented using graphs and tables.

3. Results

Socio-demographic characteristics

A total of 402 adult TB patients participated. The mean age of the study participants was 31.6 (SD±12.7) years, the majority of the respondents were male 220 (54.7%), and about 256 (63.7%) of the study participants had fewer than four family members. Regarding the residence, the majority 340 (84.6%) of them reside in urban areas. Two hundred fifty-four (63.2%) of the participants were Muslim by religion and more than half 209 (52.0%) of the participants were Oromo by Ethnicity. The average monthly income for the households in the study was above 1500 ETB. (Table 1).

Table 1: Socio-economic and demographic characteristics of Adult TB patients in public health facilities in public health facility of Dire Dawa Administration, Eastern Ethiopia 2020.(n=402)

Variable	Category	Frequency (n)	Percent (%)
Age in years	15-25	166	41.3
	26-35	113	28.1
	36-54	96	23.9
	>=55	27	6.7
Sex	Male	220	54.7
	Female	182	45.3
Marital status	Married	191	47.5
	Single	114	28.4
	Widowed	18	4.5
	Separated	28	7.0
	Student	51	12.7
Ethnicity	Oromo	209	52.0
	Amhara	115	28.6
	Somali	44	6.0
	Tigra	10	2.5
	Other*	24	28
Religion	Orthodox	124	30.8
	Muslim	254	63.2
	Catholic	3	0.7
	Protestant	21	5.2
Educational status	No formal education	99	24.6
	Can read and write	33	8.2
	Primary school	122	30.3
	Secondary school	90	22.4
	College and above	58	14.4
Occupational status	Civil servant	56	13.9
	Private worker	155	38.6
	Unemployed	43	10.7
	Housewife	85	21.1
	Student	63	15.7
Partner Occupation	Civil servant	28	7.0
	Private worker	90	22.4
	Unemployed	4	1.0
	Student	70	17.4
	No partner	210	52.2
Residence	Urban	340	84.6
	Rural	62	15.4

Family size	≤4	256	63.7
	>4	146	36.3
Average Monthly Income (ETB)**	No monthly income	101	25.1
	<=1500	149	37.1
	>1500	152	37.8

Prevalence of under nutrition

In this study, the prevalence of under nutrition was 179 (44.5%), of this 68(16.4%) were severely under nutrition. Furthermore, 200(49.8%) had normal weight based on BMI classification. (Figure 1).

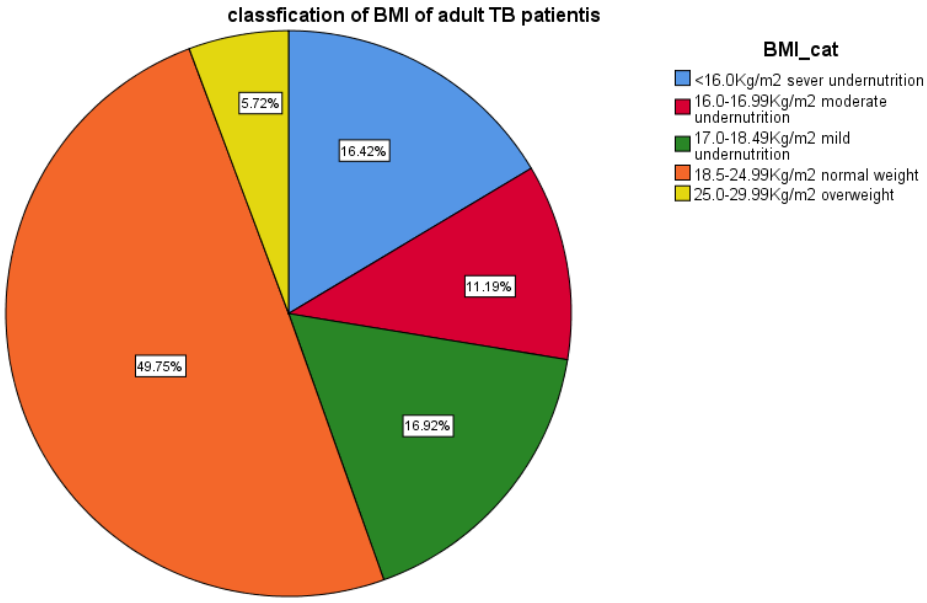

Figure 1: Prevalence of under nutrition among Adult TB patients in in public health facility of Dire Dawa Administration, Eastern Ethiopia 2020.

Nutrition and diet information

Of the total study participants, three fourth 301 (74.9%) oil, 287(71.4%) staples,214(53.2%)vegetables, 208(51.7%)sugar, 101(25.1%)milk,41(10.2%)fruit, 41 (10.2%)meat,22(5.5%)pulses were commonly consumed foods groups in seven days frequency pattern respectively. (Table 2).

Table 2: Seven-day consumption of food group frequency of adult TB patients in public health facilities of Dire Dawa Administration, Eastern Ethiopia 2020. (n=402)

Freq. of days	Cereals, grains, roots, and tubers	Legumes/nuts	Milk and its products	Meat, fish and eggs	Vegetables and leaves	Fruits	Oil/fat/ butter	Sugar, or sweet	Condiments / Spices
0 Days	0	179	106	85	16	124	13	57	14
1 Day	1	73	40	96	20	102	6	26	1
2 days	6	50	35	78	26	63	4	17	4
3 Days	9	50	60	56	28	43	6	27	5
4 Days	10	15	30	31	15	14	5	21	11
5 Days	29	11	15	8	28	11	22	18	22
6. Days	60	2	9	7	55	4	45	28	36
7 Days	287	22	101	41	214	41	301	208	309

Source of food and food consumption score

Of the total study participants, 298 (74.1%) were purchased from the market, 256 (63.7%) had seven days of food consumption scores in the acceptable range, and 371 (92.3%) of study participants did not get nutrition support from any organization. **(**Table 3).

Table 3: Source of food and food consumption score of Adult TB Patients in public Health facilities of Dire Dawa Administration, Eastern Ethiopia 2020. (n=402)

Variable	Category	Frequency (n)	Percent (%)
Source of food	Market purchase gift food from family and relatives own product	298 79 16	74.1 19.7 4.0
Food consumption scores	acceptable thresh hold borderline thresh hold poor food thresh hold	256 108 38	63.7 26.9 9.5
Nutrition support	yes No	31 371	7.7 92.3

General health status

From the total study participants, 252 (62.7 %) did not get dietary counseling from healthcare providers. About 71(17.7 %) participants had problems with eating, among these 39 (9.7%) had nausea or vomiting. One-fourth 98 (24.4%) of the study subjects had other chronic illnesses, among these 66 (16.4%) were HIV positive. Sixty-four (15.9%) had an illness in the last 2 weeks before the study period of whom 41(10.2%) had diarrhea. Regarding the TB status

of all study participants majority of 332(82.6%) had a new type of TB, of these about 239 (59.5%) of them are on the continuation phase, and 216(53.7%) were smear-positive. (Table 4)

Table 4: General Health Status of Adult TB Patients in Government Health Facilities in Public Health Facilities of Dire Dawa Administration, Easter Ethiopia 2020. (N=402)

Variable	Category	Frequency (n)	Percent (%)
Reason of visit	For collecting anti-medication	343	85.3
	For anti-TB initiation	59	14.7
Pre-existing comorbidities	HIV/AIDS	66	16.4
	Diabetes	12	3.0
	Hypertension	4	1.0
	Others***	16	4.0
eating problem	Normal eating	331	82.3
	Poor appetite	32	8.0
	Nausea or vomiting	39	9.7
illness in the last two weeks	No illness	338	75.1
	Diarrheal disease	13	3.2
	Febrile illness	41	10.2
	Other**	10	2.5
Provision of nutritional care and support	Yes	31	7.7
	No	371	92.3
Type of TB	Pulmonary TB	301	74.9
	Extra pulmonary TB	101	25.1
TB treatment	New case	332	82.6
	Previous history of TB treatment	70	17.4
TB treatment category	Intensive phase	163	40.5
	Continuation Phase	239	59.5
Smear result	Smear-positive	216	53.7
	Smear-negative	104	25.9
	Note taken	82	20.4

*** Gastritis, Amoebiasis, Asthma; **Urinary tract infection, common cold

Behavior and lifestyle characteristics of the study participants

Half of the study participants 200(49.8%) were working their job. Considering behavior 135 (33.6%) chew khat, 35(8.7%) smoke cigarettes and drunk alcohol. (Table 5).

Table 5: Behavior and Lifestyle of Adult TB Patients in Public Health Facilities of Dire Dawa Administration, Easter Ethiopia 2020. (N=402)

Variable	Category	Frequency (n)	Percent (%)
Functional status	working	200	49.8
	Ambulatory	149	37.1
	Bedridden	53	13.2
Kchat chewing	Yes	135	33.6
	No	267	66.4
Cigarette smoking	Yes	35	8.7
	No	367	91.3
Alcohol drinking	Yes	35	8.7
	No	367	91.3

Factors associated with undernutrition among adult TB patients

In bivariate analysis, different variables were found to be significantly associated with undernutrition. These include the age of participants, educational status, occupation, monthly income, family size, functional status, last two weeks of disease, dietary counseling, HIV/AIDS status, type of TB, treatment category, and smear status with a p-value less than 0.25. After controlling the other variable, only the Age of participants, monthly income, family size, functional status, smear status and dietary counseling were significantly associated with an undernutrition p-value of less than 0.05.

In multivariable logistic regression analyses, the current study shows TB patients in the age group greater than 55 years were 85% less likely to be undernutrition than those age category of 15-25 (AOR=0.15,95% CI: 0.043- 0.504). Regarding the average monthly income of TB patients who had no monthly income were 2.67 times more likely to be undernutrition than those who had greater than 1500 ETB (AOR=2.67, 95% CI: 1.409-5.037). TB patients who come from a family size of more than four were 2.21 times more likely to have undernutrition as compared to less than four household members (AOR= 2.21, 95%CI: 1.363-3.572).

TB patients who were bedridden were 2.21 times more likely to develop undernutrition than those TB patients who had ambulatory functional status (AOR=2.21, 95% CI: 1.363-3.572). Concerning nutritional care and service TB patients who had no dietary counseling and care were 2.63 times more likely to develop undernutrition than their counterparts (AOR=2.63, 95% CI: 1.616-4.288). TB patients who have no sputum test are 66% less likely to be undernutrition than those who had smear-positive tests result (AOR= 0.34, 95% CI: 0.185-0.617). (Table 6).

Table 6: Factors Associated With Under nutrition Among Adult TB Patients in Public Health Facilities of Dire Dawa Administration, Easter Ethiopia 2020. (N=402)

variable		Undernutrition (BMI of TB patients)		COR(95%CI)	AOR(95%CI)	P-value
		No	Yes			
Age	15-25	88 (53.0%)	78(47.0 %)	1	1	
	26-35	64 (56.6%)	49(43.4 %)	0.86(0.534-1.397)	1.05(0.581-1.897)	0.873
	36-54	48(50.0%)	48(50.0 %)	1.13(0.682-1.866)	1.35(0.731-2.481)	0.339
	>=55	23(85.2%)	4(14.8%)	0.20(0.065-0.592)	0.15(0.043-0.504)**	0.002
Income	No income	45(44.6%)	45(55.4 %)	2.46(1.470-4.133)	2.67(1.409-5.037)**	0.003

	<=1500 ETB	77(51.7%)	72(48.3 %)	1.85(1.163-2.949)	2.13 (1.256-3.609)**	0.005
	>1500 ETB	101(66.4 %)	51(33.6 %)	1	1	
Family size	<=4	161(62.9 %)	95(37.1 %)	1	1	
	>4	62(42.5%)	84(57.5 %)	2.30(1.517-3.476)	2.21(1.363-3.572)***	0.001
Functional status	Working	134(67.0 %)	66(33.0 %)	1	1	
	Ambulatory	70(47.0%)	79(53.0 %)	2.29(1.481-3.545)	2.26(1.403-3.640)***	0.001
	Bedridden	19(35.8%)	34(64.2 %)	3.63(1.927-6.849)	3.60(1.724-7.499)***	0.001
Dietary counseling	Yes	98(70.0%)	42(30.0 %)	1	1	
	No	125(47.7 %)	137(52.3 %)	2.56(1.655-3.952)	2.63(1.616-4.288)***	0.000
Smear status	Not Tested	56(68.3%)	26(31.7 %)	0.44(0.257-0.751)	0.34(0.185-0.617)***	0.000
	Negative	62(59.6%)	42(40.4 %)	0.64(0.399-1.029)	0.61(0.356-1.037)	0.068
	Positive	105(48.6 %)	111(51.4 %)	1	1	

NB: - These variables are from the total variables statistically significant while cross-tabulation done at *P<0.05; **P<0.01; ***P<0.001

4. Discussion

This study has attempted to identify the magnitude of undernutrition and predictors of undernutrition among adult TB patients in public health facilities in the Dire Dawa administration. Accordingly, the magnitude of undernutrition was 44.5% (95% CI: (0.396-0.494). Moreover, age, monthly income, family size, functional status, dietary counseling, and smear status were factors significantly associated with undernutrition among adult TB patients.

The current study's finding of a 44.5% prevalence of undernutrition is consistent with studies conducted in Kenya (43%) [26] and Tanzania (47%) [27] The prevalence of undernutrition among TB patients in the current study is lower than that reported in Amritsar City, India (69.2%) [28], Timor and Rote Islands (87%) [29], Malawi (59%) [30], Cameroon (78.21%) [31] and Uganda (62%) [32].This might be cultural differences, socio-demographic characteristics, method of data collection, and sample size.

The findings of this study are still lower than the findings of studies conducted in some parts of Ethiopia, including Sidama (77.9%) [33], Gondar (65.4%) [34], Ambo (63.5%) [35], and Adama

(53%) [20]. This might be due to cultural differences, socio-demographic characteristics, sample size, method, and duration of the studies conducted.

Studies conducted in Addis Ababa (39.7%) [19], Shashemane (28.8%) [36], and Hossana (38.9%) [23]. This might be due to the difference in the socioeconomic status, study area, lifestyle, feeding pattern, and economic status of the countries and the sample size of the study.

The age group of TB patients greater than 55 years old was 85% less likely to be undernourished than those within the age category of 18–25. This study line is within Dehradun, India [25]. The finding contradicted studies conducted by Amhara and Shashemane [17,36]. This could be due to the result of fewer energy losses related to their physical activity, use of substance abuse, and a high proportion of HIV/AIDS-positive status in the age group of 18–25.

Monthly income has shown a significant association with undernutrition. In the study, participants who had no monthly income were undernourished compared with TB patients who had a monthly income of > 1500 ETB. This finding is in line with studies conducted in Kenya, Ghana, and Bale [8,18,26]. This could be due to the absence of monthly income, which affects one's nutritional status as a result of undernutrition being more rampant among those participants who had no income. There were 101 (25%) of those study participants. 78 (19.4%) were aged less than 25, and 56 (13.9%) were students. Furthermore, 55 (13.7%) come from families larger than four, which may result in fewer opportunities to afford a balanced diet and reliance on family and relatives.

Family size was found to be significantly related to undernutrition. TB patients who had family sizes of more than four in their households were more likely to be underweight when compared with study participants who had family sizes of less than four. The findings of this study are supported by studies conducted in Indonesia, Ghana, Hossana, Bale zone, and Amhara [8,17,18,29,23]. This could be due to the effect of less favorable socioeconomic conditions on household income, leading to low dietary intake, less access to balanced nutrition, and less access to health care for the household members.

The functional status of the TB patients was significantly associated with undernutrition. TB patients who were bedridden were more likely to have undernutrition when compared with TB patients who had worked. However, the findings of this study contradicted those of a study

conducted in Addis Ababa [19]. Many patients with TB in Ethiopia have low functional status when first seen at a TB treatment unit. The functional status of the patients is usually related to their underlying medical condition, in which patients with deteriorated functional status could have a compromised health status. This condition may result in a reduced intake of food, which may in turn result in undernutrition.

In this study, TB patients who had no dietary counseling and no care had a significant association compared with those who had received dietary counseling. This finding is in line with studies conducted in Addis Ababa, and Shashemane [19,36]. These might be those TB patients who had received dietary counseling and who had become more aware of the dietary issues and might have appropriately applied the advice to take an adequate quantity and quality of a variety of foods. Also, the smear status of TB patients who had not tasted was 66% less likely to be associated with undernutrition compared to smear-positive TB patients. This study is in line with a study conducted in Amhara [17]. This could be because, in this study, participants who had not tasted were from 99% EPTB, which means TB patients are less likely to experience undernutrition than PTB. On the other hand, their treatment category places them more in the continuation phase, which may reflect the progress or recovery stage of the patient's health status.

5. Conclusion

The magnitude of under nutrition among adult TB patients was 44.5% (95% CI: (0.396-0.494). with the majority of them having a mild form. Study participants who were greater than 55 years of age, had no monthly income, had a family size greater than four, had bedridden and ambulatory functional status, had no dietary counseling, and had smear status were associated with undernutrition. In this study, some associated factors of nutritional status, such as the problem of eating, food consumption score, and nutritional support, didn't show a significant effect on clients' nutritional status.

6. Recommendation

Regional health bureau should strengthen dietary counseling and care as an integral component of TB treatment. And also TB patients who have a large family size with under nutrition should be considered in the provision of nutrition support, stabilization, and recovery with the collaboration of other stakeholders, non-governmental organization. Health care provider should be implemented regular nutritional status screening activities for TB patients

to know the current status of patients and to improve service quality. And TB patients should accept and implement the health care workers counseling to gate well nutritional status.

Abbreviations: ADIS: Acquired Immune Deficiency Syndrome, BMI: Body Mass Index, HIV: Human Immunodeficiency Virus, ND: Nutritional Deficiency, TB: Tuberculosis, PTB: Pulmonary Tuberculosis, WHO: World Health Organization

Ethical consideration

Dire Dawa University's Institutional Review Board (reference number: DPH/20/0017), and a formal letter of cooperation was written to the Dire-Dawa city administration health bureau and to selected health facilities. After explaining the purpose, significance, benefits, and risks of the study, voluntary, informed, written, and signed consent was taken from the participants after participant information was read in their local language. In order to assure the privacy of the respondents, the data was collected separately.

Availability of data

All relevant data are included in the paper.

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Competing interests

The authors declare that, we have no conflicts of interest to disclose

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