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Prevalence and associated factors of undernutrition among adult tuberculosis patients in some selected public health facilities of Addis Ababa, Ethiopia: a cross-sectional study

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Abstract

Back ground: The prevalence of undernutrition among adult tuberculosis patients is high in developing countries. However it has not been well explored in Ethiopian situation. Therefore the aim of this study was to determine the prevalence of undernutrition and its associated factors among adult TB patients in some selected public health facilities of Addis Ababa.

Methods: An institution based cross-sectional study was conducted. The total sample size of the study was 360. The sample size was allocated to the selected health facilities proportional to their size and study subjects were consecutively enrolled to the study during the study period. Data were collected using a pretested structured questionnaire. The data were entered and cleaned by using EPI info version 3.6.1 and transferred to SPSS version 20 for analysis. Bivariate and multivariate logistic regression analyses were done to identify factors that are associated with undernutrition.

Results: The prevalence of undernutrition was 39.7 % (23.6 % mild, 8.6 % moderate and 7.2 % severe undernutrition). Functional status of the patients (AOR = 2.57; 95 % CI = 1.42, 4.68) and dietary counselling (AOR = 1.79; 95 % CI = 1.03, 3.12) were factors independently associated with undernutrition among adult TB patients.

Conclusion: The prevalence of undernutrition was found to be very high. Regular nutritional assessment and dietary counselling should be part of the routine care of adult TB patients.

Keywords: Prevalence, Undernutrition, TB, Health facilities

Background

Malnutrition is a broad term which refers to both undernutrition and over nutrition [1]. Individuals are undernourished if their diet does not provide them with adequate calories and protein for maintenance as well as growth or if they cannot fully utilize the food they eat due to illness [2]. 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 [3].

There are a number of adult tuberculosis (TB) patients suffering from profound undernutrition in the world especially in developing countries [3, 4]. It is estimated that undernutrition causes about one quarter of all new TB cases globally [5]. This can have serious public health impacts if those with undernourished adult TB are not identified early [6]. The relationship between undernutrition and active tuberculosis infection is bidirectional. Having active tuberculosis leads to loss of weight, and being underweight is known risk factor for developing tuberculosis either through the reactivation of latent

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tuberculosis or the development of progressive primary disease upon infection [7].

Tuberculosis is associated with various socioeconomic factors such as poverty [8], poor housing [9, 10] and economic deprivation [11, 12] which lead to poor nutritional status and impaired immune function [10–12]. Nutrition is important for health and functioning of all systems of the body including the immune system. This is because malnutrition weakens the immune system and thus the ability of the individual to fight infection like TB and their ability to control disease progression will be compromised [6]. Among the known risk factors for active tuberculosis (undernutrition, HIV infection, diabetes, cancer), undernutrition has the highest population attributable fraction of 27 % [7].

Understanding the magnitude of undernutrition and its associated factors among adult TB patients is crucial in designing appropriate interventions to address the nutritional problems of adult TB patients [13, 14]. However, despite the high burden of TB and undernutrition in Ethiopia only few studies have been conducted regarding the prevalence and associated factors of undernutrition among adult TB patients in Ethiopia. A study conducted at Yirgalem hospital in Sidama [15] found a high prevalence of undernutrition (77.9 %), though this study was mainly focused on the effect of malnutrition on the outcome of tuberculosis. Another study in Gondar (16) also showed a higher magnitude of undernutriiton (65.4 %), however this study was primarily investigated the general serum level of micronutrient among TB patients. Moreover, these studies were limited to few health facilities, were undertaken at hospital level, did not solely address the issue of undernutrition in adult TB patients and were conducted long ago. Hence, this study was planned to particularly assess the prevalence of undernutrition and its associated factors among TB patients in some selected public health facilities of Addis Ababa, Ethiopia.

Methods

Study design and setting

An institution based cross-sectional study was conducted. The study was conducted at Addis Ababa, the capital city of Ethiopia. According to the central statistical agency of Ethiopia, the city has an estimated total population of 3,103,999, out of which 1,479,000 were men and 1,624,999 women in 2012. In Addis Ababa there are ten sub-cities and 99 kebeles (the lowest administrative unit in Ethiopia). In the city there are 80 public health facilities, of which 14 are hospitals and the remaining 66 are health centers. Each health center has a catchment population of 40,000. There are also 35 private and 3 Non-Governmental Organizations (NGOs) hospitals in the city. The study was conducted from November 2013 to January 2014.

Source and study population

The source populations were TB patients who have follow up at public health facilities of Addis Ababa. Whereas the study populations were TB patients aged 18 years and above who have follow up at TB clinics of the selected public health facilities. TB patients who were 18 years and above, came to attend their follow up during the first two months of treatment and volunteers to participate were included in the study. All TB patients who cannot properly communicate, are mentally ill, have physical disabilities, and are pregnant or lactating mothers (Body Mass Index (BMI) was difficult to assess) were excluded from the study.

Study variables

The outcome variable was undernutrition. Adult TB patients with BMI <18.5 Kg/m^2 were considered to have undernutrition. BMI was calculated after measuring weight and height. In order to measure weight, the patient should remove shoes, in minimal clothing, standing erect on the center of the balance and record the weight to the nearest 0.1 kilo gram. By the same procedure the height was measured by asking the patient to be barefoot, wearing no head gear, knees were fully straight and both hands were held down to the side and record the height to the nearest 0.5 centimeter. The predictor variables were socio-demographic variables, eating problem, HIV status, dietary counselling, house hold hunger scale and participation in nutrition intervention.

Sample size determination

The sample size was determined considering the following assumptions using the single population formula. Z score at 95 % CI = 1.96, margin of error = 4 %, the prevalence of undernutrition among TB patients in Gondar 65.4 % [16] giving a sample size of 550. Since the numbers (470) of TB patient who have follow up at public health facilities in the study area were less than 10,000 we used correction formula which yields a sample size of 253. Then adding a 10 % non-response rate, the sample size became 278. A study conducted in Ghana [13] found income, educational status and family size to be factors associated with undernutrition among TB patients. By taking these factors into consideration, 95 % confidence interval, 10 % non-response rate, exposed to non-exposed ratio of 1:2 and taking 80 % power give the following results. Income (undernutrition among exposed 57 % and unexposed 43 % gives a sample size of 356), educational status (undernutrition among exposed 66 % and unexposed 44 % yields a sample size of 360) and family size (undernutrition in exposed 53 % and unexposed 47 % gives a sample size of 360). From the above calculation the minimum larger sample size was 360 which is the final sample size of this study.

Sampling procedure

In Addis Ababa there are ten sub-city health bureaus; from each sub-city one health center which renders anti-TB service was randomly selected based on the recent two months TB patient flow. Then the total sample size was proportionally allocated to the number of adult TB patients at each health center and participants were interviewed consecutively (Fig. 1). In order to avoid double counting those TB patients coming for follow up were asked if they were interviewed for this study in previous days and excluded from the interview if they had been.

Data collection tools, procedure and quality assurance

A pretested and structured questionnaire was used for the study (Additional file 1). After pretesting, some unclear or vague questions were modified and wrong skip patterns were also corrected. The questionnaire was prepared first in English and translated to Amharic (the official language of Ethiopia) then back to English so as to check for consistency. The data was collected by trained health professionals who have a previous basic knowledge of TB and those who are working in the TB clinic. Data collectors were provided with two days training on the objective, methods, tool and ethics of the study. The data collection process was supervised by two health officers and the principal investigator on a daily basis.

Data analysis and management

First, each questionnaire was cleaned and checked for completeness. Then the data were entered to EPI info version 3.6.1 computer software. Thereafter the data were exported to SPSS windows version 20 for analysis. Frequency, percentage and mean were run to get descriptive statistics of the data. Bivariate logistic regression analysis was done to explore the crude association between different predictor variables and undernutrition. To control for possible confounding factors and to identify factors that are independently associated with undernutrition, multivariate logistic regression analysis was performed for those variables with p value of less than 0.2 in the bivariate analysis. Having a p value less than 0.05 was used to declare the presence of statistically significant association between different variables.

Operational definitions

Body mass index (BMI)

Is defined as the weight in kilogram of the individual divided by the square of the height in meter and 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), over weight (BMI = 25.0-29.99
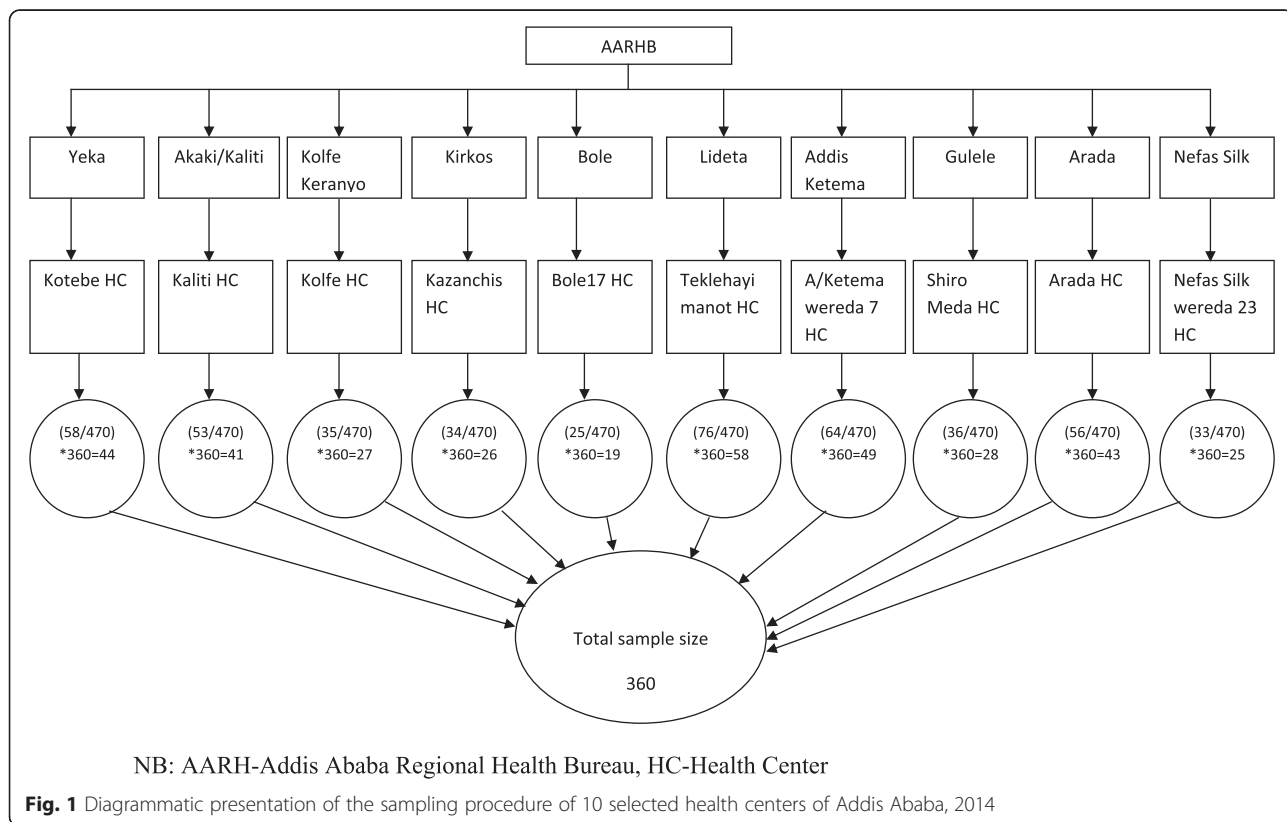

NB: AARH-Addis Ababa Regional Health Bureau, HC-Health Center

Fig. 1 Diagrammatic presentation of the sampling procedure of 10 selected health centers of Addis Ababa, 2014

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Kg/m^2) and obesity (BMI ≥30.0 Kg/m^2) (Source: WHO 1995, 2000 & 2004).

Household Hunger Scale (HHS)

Is a household food deprivation scale derived from the United States (U.S) household food security survey module for use in developing country contexts and to assess the validity of the Household Food Insecurity Access Scale (HFIAS) for cross-cultural use. HHS has three house hold hunger categories as follows: HHS of 0-1 (little or no hunger), HHS of 2-3 (moderate hunger), HHS of 4-6 (severe hunger) in the house hold. (Source: Food and Nutrition Technical Assistance III Project (FANTA), 2011).

Dietary counselling

Is a process by which a health professional with special training in nutrition helps people make healthy food choices and form healthy eating habits.

Functional status

  ✓ Working: Able to carry on normal activity and no special care needed.
  ✓ Ambulatory: Unable to work, able to live at home and able to care for most of personal needs and requires occasional assistance.
  ✓ Bed ridden: Unable to care for self, require institutional or hospital care

Nutritional care and support

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

Ethical consideration

The study protocol was reviewed and ethical clearance was obtained from Institutional Review Board of university of Gondar and Addis Ababa city administration health bureau. A formal letter of permission was sent to the respective health centers. The participant's confidentiality was assured by avoiding their name and other personal identifying information. Participants were assured that their decision not to participate wouldn't hamper their follow up care at the health facility and they can discontinue from participating in the research at any time. The interview took place after informed written consent was obtained from each participant.

Results

Socio-demographic characteristics

A total of 360 adult TB patients were involved in the study making the response rate 100 %. The mean age of the study participants was 33.6 (±SD = 12.7) years with a minimum age of 18 years and maximum age of 85 years. The majority of the respondents were male 201(55.8 %), Amhara 165(45.8 %), married 155(43.1 %), in secondary school education 113(31.4 %), merchants/self-employed 122(33.9 %) and have a family size less than or equal to four 255 (70.8 %). The average income of a house hold in this study was 1077 Ethiopian Birr (Table 1).

Nutritional intervention history and household hunger scale

Of the 360 respondents, 212 (58.9 %) did not get dietary counselling by their treating clinicians and only 13 (3.6 %) of respondents received nutritional support from any organization. The majority of respondents 310 (86.1 %) consumed three meals or more per day and 348 (96.7 %) and have little or no hunger based on their household hunger score (Table 2).

Nutritional status of adult TB patients

In this study, the prevalence of undernutrition was found to be 39.7 %, of this 23.6 % have mild, 8.6 % moderate and 7.2 % severe undernutrition. Furthermore, greater than half of the respondents 193 (53.6 %) had normal weight based on BMI classification (Fig. 2).

Health status of adult TB patients

Most of the respondents 324(90 %) had awareness about TB. Among the study participants, 259(71.9 %) had pulmonary tuberculosis and 232(64.4 %) were on anti-TB treatment for less than or equal to four weeks. More than half of the respondents 215(58.9 %) were ambulatory by their functional status. Of all participants in this study 59(16.4 %) had eating problem and 80(22.2 %) stated that they felt sadness or depression. Among the participants, 89(24.7 %) of them have had chronic illness, of which 74(83.1 %) were HIV positive (Table 3).

Factors associated with undernutrition in adult TB patients

In the bivariate analysis different variables were found to be significantly associated with undernutrition. These include functional status (ambulatory (COR = 2.14; 95 % CI = 1.36, 3.36) and bed ridden (COR = 9.95; 95 % CI = 1.08, 91.72)), received dietary counselling (COR = 1.71; 95 % CI = 1.11, 2.63), being HIV positive (COR = 1.70, 95 % CI = 1.02, 2.84) and eating problem (COR = 1.87, 95 % CI = 1.07, 3.28) with p-value of less than 0.05. In the bivariate analysis, undernutrition has no significant association with age,

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Table 1 Socio-demographic characteristics of adult TB patients in some selected public health facilities of Addis Ababa, Ethiopia, 2014

Variable	Number	Percent
Age(N = 360)		
< 24	90	25
24-30	94	26.1
31-40	87	24.2
> 40	89	24.7
Sex		
Male	201	55.8
Female	159	44.2
Ethnicity		
Amhara	165	45.8
Tigre	34	9.4
Oromo	76	21.1
Guraghe	66	18.3
Other	19	5.3
Marital Status		
Married	155	43.1
Unmarried	154	42.8
Divorced/separated	24	6.7
Widowed	27	7.5
Educational Status		
Illiterate/ read and write	83	23.1
Primary school	98	27.2
Secondary school	113	31.4
Tertiary education	66	18.3
Occupational Status		
Employed(Gov, NGO)	83	23.1
Merchant /self-employed	122	33.9
Daily Laborers/house made	53	14.7
Unemployed (student, housemaid)	102	28.3
Monthly income(N = 256)		
< =800 ETB	77	21.4
800-1500 ETB	86	24.4
> = 1500 ETB	130	25.3
Family Size		
< =Four	255	70.8
> Four	105	29.2

Table 2 Nutritional Intervention History and Household Hunger scale of adult TB patients in some selected public health facilities of Addis Ababa, 2014

Variables	Number	Percent
Eating frequency < =2	36	10.0
> = 3	310	86.1
No specific meal time	14	3.9
Nutritional care and support		
Yes	13	3.6
No	347	96.4
Received dietary counseling		
Yes	148	41.1
No	212	58.9
Household Hunger Score		
0-1(Little or No hunger)	348	96.7
2-3(Moderate hunger)	11	3.1
4-6(Severe hunger)	1	0.3

problem, type of TB and income. After controlling the other variables, only functional status and dietary counselling remained significantly associated with undernutrition. Patients with ambulatory functional status were 2.6 times more likely to develop undernutrition compared to those who have working functional status (AOR = 2.57; 95 % CI = 1.42, 4.68). Patients who had not received dietary counselling were 1.8 times more likely to be undernourished compared with those who had received dietary counselling (AOR = 1.79; 95 % CI = 1.03,3.12) (Table 4).

Discussion

This study demonstrated that more than one third of adult TB patients were undernourished. Moreover, functional status of the patients and receiving dietary counselling were factors significantly associated with undernutrition among adult TB patients.

In this study, the prevalence of undernutrition among adult TB patients was (39.7 %) which is higher than a study conducted in Peru (21 %) [13] but it is lower when compared with another study done in Gulbarga, India (62.2 %) [17]. The difference in results between these two studies may be due to the socio-economic difference between the two countries and the study in India used a different method of data collection. In other African countries the prevalence of undernutrition among TB patients is also high. A study in Ghana [18] revealed that the prevalence of undernutrition among TB patients to be 51 %, which is higher than the findings of this study. This might be due to the fact that the study in Ghana was conducted among patients who have been followed in hospital level where they are expected to
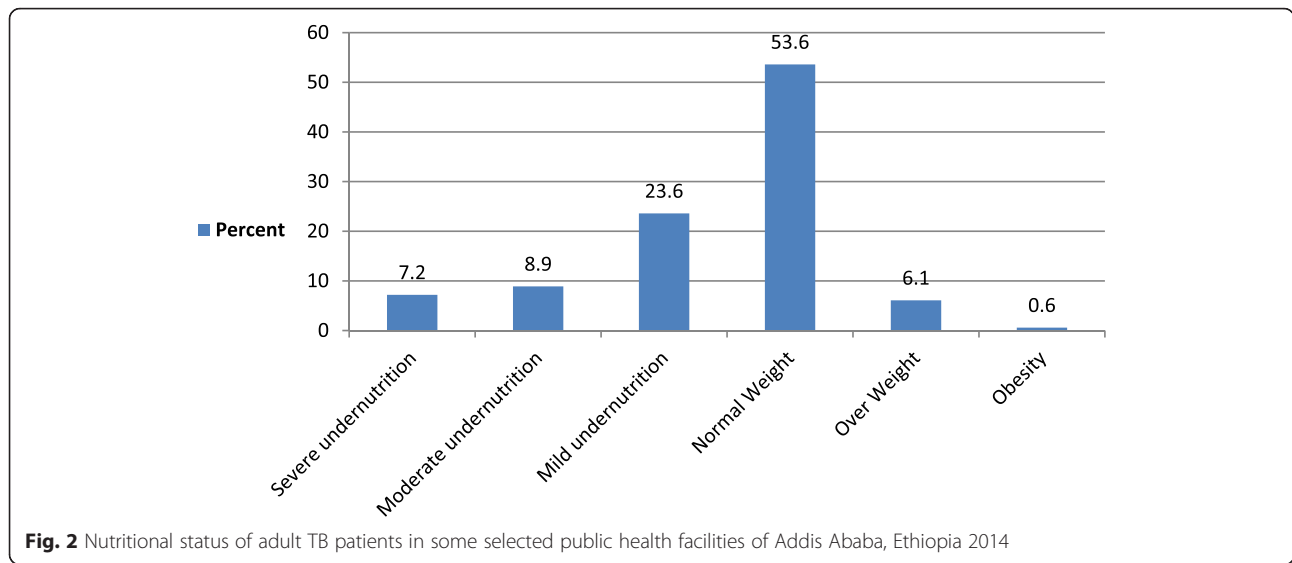
sex, marital status, occupational status, educational status, duration on anti-TB treatment, family size, income, type of TB, nutritional support and eating frequency. The following variables with a p-value less than 0.2 were taken to the final model for multivariate analysis: age, occupational status, functional status, TB/HIV co-infection, dietary counselling, eating

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Fig. 2 Nutritional status of adult TB patients in some selected public health facilities of Addis Ababa, Ethiopia 2014

Table 3 Health status of adult TB patients in some selected public health facilities of Addis Ababa, 2014

Variables	Frequency	Percent
Ever heard of TB		
Yes	324	90
No	36	10
Types of TB		
Pulmonary TB	259	71.9
Extra pulmonary TB	101	28.1
Duration on anti TB		
< =4 weeks	232	64.4
5-8 Weeks	128	35.6
Functional Status		
Working	143	39.7
Ambulatory	215	58.9
Bed ridden	5	1.4
Eating Problem		
Yes	59	16.4
No	301	83.6
Feel sad or depressed		
Yes	80	22.2
No	280	77.8
Chronic illness(N = 91)		
HIV/AIDS	74	83.1
Diabetes	10	11.2
Hypertension	6	6.7
Cancer	1	1.1
HIV/AIDS		
Yes	74	20.6
No	286	79.4

be undernourished. Moreover, the BMI of the participants was taken at the time of diagnosis before starting anti-TB medications when patients have not recovered from their illness and were at the state of critical undernourishment which could overestimate the expected figure. A study conducted in other African countries such as Malawi 57 % and Uganda 62 % also found a high prevalence [6, 19]. This higher prevalence of undernutrition in those studies compared to the current study could be attributed to the difference in socio-cultural situation, life style, feeding pattern and economic status of the countries. Other Ethiopian based studies have also shown a higher result. A study conducted in Gondar, 65.4 % [16] and Sidama, 77.9 % [15] revealed higher prevalence of undernutrition among adult tuberculosis patients compared to this study. This may be attributed to the difference in study context (urban dweller TB patients) and in socio-economic status of the society in those areas. Besides, those studies were conducted a long time ago when the economic status of the country was relatively low which had an impact on the nutritional status of the society in general TB patients in particular.

Many patients with TB in Ethiopia have low functional status when first seen at TB treatment unit. Functional status of the patients is usually related with their underlying medical condition in which patients with deteriorated functional status could have a compromised health status. This condition may result in reduced intake of food which may in turn result in undernutrition [15]. This fact is in line with the findings of this study in which those patients with ambulatory functional status were more likely to be undernourished compared to those who had working functional status.

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Table 4 Bivariate and multivariate analysis on factors associated with undernutrition among adult TB patients in some selected public health facilities of Addis Ababa, 2014

Variables	Undernutrition		COR(95 % CI)	P value	AOR(95 % CI)	P value
	Yes (%)	No (%)				
Age						
< 24	42(29.4)	48(22.1)	1.00		1.00	
24-30	31(21.7)	63(29.0)	0.56(0.31,1.02)	0.059	0.58(0.26,1.30)	0.187
31-40	34(23.8)	53(24.4)	0.73(0.40,1.33)	0.309	0.84(0.39,1.81)	0.661
> 40	36(25.2)	53(24.4)	0.78(0.43,1.40)	0.402	0.55(0.25,1.23)	0.146
Occupational status						
Employed(Government & NGO)	37(25.9)	46(21.2)	1.00		1.00	
Merchant /Self -Employed	40(28.0)	82(37.8)	0.61(0.34,1.08)	0.088	0.64(0.33,1.25)	0.188
Daily laborer/house made	21(14.7)	32(14.7)	0.82(0.41,1.64)	0.569	0.63(0.26,1.56)	0.319
Unemployed (house wife, Student)	45(31.5)	57(26.3)	0.98(0.55,1.76)	0.950	0.76(0.33,1.76)	0.518
Functional Status						
Working	41(28.7)	102(47.0)	1.00		1.00	
Ambulatory	98(68.5)	114(52.5)	2.14(1.36,3.36)	0.001	2.57(1.42,4.68)	0.002
Bed ridden	4(2.8)	1(0.5)	9.95(1.08,91.72)	0.043	2.34(0.16,33.82)	0.532
TB/HIV co-infection						
Yes	37(25.9)	37(17.1)	1.00		1.00	
No	106(74.1)	180(82.9)	1.70(1.02,2.84)	0.044	1.28(0.66,2.52)	0.466
Dietary Counseling						
Yes	70(49.0)	78(35.9)	1.00		1.00	
No	73(51.0)	139(64.1)	1.71(1.11,2.63)	0.014	1.79(1.03,3.12)	0.039
Eating Problem						
Yes	31(21.7)	28(12.9)	1.00		1.00	
No	112(78.3)	189(87.1)	1.87(1.07,3.28)	0.029	1.75(0.85,3.62)	0.129
Type of TB						
Pulmonary TB	109(76.2)	150(69.1)	1.00		1.00	
Extra pulmonary TB	34(23.8)	67(30.9)	0.70(0.43,1.13)	0.143	0.77(0.41,1.45)	0.420
Income(N = 256)						
< 800 ETB	38(36.5)	39(25.7)	1.00		1.00	
800-1500 ETB	34(32.7)	54(35.5)	0.65(0.35,1.20)	0.167	0.61(0.31,1.19)	0.061
> 1500 ETB	32(30.8)	59(38.8)	0.56(0.30,1.04)	0.064	0.51(0.25,1.03)	0.593

In this study patients who did not receive dietary counselling were more likely to be undernourished compared with those who received dietary counselling. This might be because those TB patients who have received dietary counselling became more knowledgeable about the dietary issues and they might appropriately apply the advices to take adequate quantity and quality of variety of foods. Due to this reason those patients who received dietary counselling tend to be well nourished.

Even though TB and HIV infections are both independently associated with undernutrition, co infection with HIV may exacerbate the extent of undernutrition [7]. A study in Gondar showed that the prevalence of undernutrition in adult TB patients co-infected with HIV was 71.6 %, which is higher when compared with the finding of this study 25.9 %. This could be due to the fact that the study in Gondar has included high number of TB/HIV co-infected patients who were more exposed to undernutrition because of double burden [16].

A study conducted in Ghana [18] showed that income, educational status and family size were factors associated with undernutrition. However, in this study these factors were not found to be associated with undernutrition.

This could be due to the relatively smaller sample size of this study that may not be powered to detect the difference.

Tuberculosis was associated with feeding problems which directly affects the amount of food intake by the patient. Some studies [8, 20] revealed that eating problem mainly loss of appetite, nausea and vomiting had significant association with undernutrition. However the finding of this study was inconsistent with the above studies, which might be due to the difference in duration since on anti-tuberculosis, because this study has only involved TB patients who were taking medications up to two months which was the expected time for the patients to start recovering from the disease in whom there is less episodes of loss of appetite, nausea and vomiting.

Strengths and limitations of the study

The study has addressed an important area of research which could be an input for prevention of health problems related to undernutrition in adult TB patients and the study has high response rate. Besides, use of BMI machines to determine undernutrition made the data more reliable. This study has also some limitations; the study may not be generalized to other parts of country because of the difference in socio-demographics and economic situations as well as the inclusion of health centers only. Additionally, there is lack of data on undernutrition in comparable groups of adult patients without TB infection.

Conclusions

The prevalence of undernutrition among adult TB patients was very high with the majority having a mild form. Functional status of the patient and receiving dietary counselling were factors independently associated with undernutrition in adult TB patients. Regular nutritional assessment and dietary counselling of all TB patients should be the part of routine care for TB patients. Interventions by different stake holders should be targeted based on the patient's nutritional status. TB care providers should receive training which focus on dietary counselling for TB patients.

Additional files

Additional file 1: English version of the questionnaire. (DOCX 24 kb)

Competing interests
The authors would like to declare that they have no competing interest.

Authors' contributions
BD has conceived of the study, carried out the overall design and execution of the study, performed data collection and statistical analysis. GT has participated in data analysis, revised the paper for intellectual content and has drafted the manuscript. AW has critically revised the design of the study, data collection techniques and worked out statistical analysis. All authors read and finally approved this manuscript for submission.

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