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Original Research

Magnitude of Under Nutrition and Associated Factors Among Children and Adolescent with Tuberculosis on Directly Observed Treatment at Public Health Facilities in Harar and Dire Dawa City, Eastern Ethiopia

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Abstract

Background: Tuberculosis (TB) remains a leading cause of mortality in developing countries, including Ethiopia, and has a bidirectional relationship with malnutrition. Malnutrition is more severe in patients with active TB, yet evidence and standardized protocols for nutritional support in Ethiopia particularly for children are limited.
Methods: A cross-sectional study was conducted from February 1 to March 16, 2025, among 253 children with TB on DOT in urban health facilities of Harar and Dire Dawa, selected by simple random sampling. Data on sociodemographic, nutritional, and clinical factors were collected using interviewer-administered questionnaires, and nutritional status was assessed with WHO Anthro and Anthro Plus software (version 1.0.4). Data were entered into EpiData 3.1.1 and analyzed in SPSS v. 26. Bivariate and multivariate logistic regression were used to identify factors associated with nutritional status, with significance set at $p < 0.05$ and results presented as crude and adjusted odds ratios with 95% CI.
Results: Among 249 children under 15 years on directly observed TB treatment in Harar and Dire Dawa, pulmonary TB was predominant 213 (85.5%), and more than half 143 (57.4%) had received treatment for two months or less. The prevalence of the undernutrition was 96 (38.6%), (95% CI: 32.4–44.9), although nearly all children 238 (95.6%) maintained a working functional status. Multivariate analysis showed that undernutrition was significantly associated with lower paternal education (AOR = 0.16; 95% CI: 0.03, 0.73), marital status (AOR = 3.44; 95% CI: 1.38, 8.62), higher wealth index (AOR = 0.04; 95% CI: 0.01, 0.16), and rural residency (AOR = 0.31; 95% CI: 0.11, 0.86).
Conclusion: The study shows that undernutrition is highly prevalent among children on TB treatment, with parental education, marital status, wealth, and residence significantly influencing nutritional outcomes. Strengthening nutritional support and addressing social determinants are crucial to improve health and treatment success in pediatric TB patients.

Keywords: Children and Adolescent, Undernutrition, TB

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1. Introduction

Undernutrition results from insufficient intake, absorption, or utilization of nutrients necessary for optimal health, growth, and development. It includes deficiencies in macronutrients such as energy and protein, as well as essential micronutrients. The World Health Organization (WHO) defines undernutrition as a deficiency in energy, protein, or essential micronutrients alone or in combination that leads to measurable adverse effects on body composition, function, or clinical outcomes [1]. Malnutrition broadly encompasses imbalances in nutrient intake, whether deficient, excessive, or disproportionate [2]. Common manifestations of undernutrition include stunting, wasting, underweight, and micronutrient deficiencies, all of which can have lasting impacts on physical and cognitive development and increase vulnerability to infections [3].

Tuberculosis (TB), caused by Mycobacterium tuberculosis, primarily affects the lungs but can involve other organs. It remains the second-leading cause of death worldwide from a single infectious agent [4]. The relationship between TB and undernutrition is bidirectional: active TB can lead to secondary malnutrition due to reduced appetite, weight loss, and generalized weakness, while pre-existing undernutrition impairs immunity, increasing susceptibility and disease severity [5,6,7]. Malnutrition compromises critical immune mechanisms, particularly cell-mediated immunity, which is essential for controlling TB infection. Consequently, undernourished individuals are at higher risk of severe TB and poorer treatment outcomes.

TB also increases the body's energy demands, requiring 20–30% more energy than the Recommended Daily Allowance (RDA) [8]. Undernutrition exacerbates TB-related weight loss and weakness, while the infection itself further elevates nutritional needs, creating a vicious cycle. Integrating nutritional interventions into TB care is therefore essential. The WHO recommends comprehensive nutritional services for TB patients, including assessment and counseling, malnutrition management, and micronutrient supplementation [9]. Adequate nutritional support can improve treatment response, reduce complications, and enhance overall quality of life.

Children are particularly susceptible to undernutrition due to their elevated requirements for growth and development. Malnutrition in childhood can result in impaired physical growth, delayed cognitive development, and increased susceptibility to infections [2]. In regions such as Eastern Ethiopia, undernutrition remains a significant public health challenge [10]. Pediatric

TB patients are especially vulnerable, as the combined effects of infection and inadequate nutrition can lead to poor treatment responses, prolonged recovery, and higher morbidity and mortality. Understanding the prevalence and determinants of undernutrition in this population is therefore critical for effective intervention.

Assessing the prevalence and factors contributing to undernutrition among TB patients supports evidence-based clinical decision-making. Social determinants, including parental education, household wealth, and rural residence, can influence nutritional outcomes and treatment success. Addressing these determinants alongside direct nutritional interventions can improve patient care, enhance recovery, and reduce the burden of disease. This study aims to investigate the prevalence of undernutrition and its associated factors among children undergoing TB treatment, providing insights to inform public health strategies and optimize clinical management.

2. Methods and Materials

2.1. Study Area, Period, and Design

The study was conducted in Harar and Dire Dawa towns, located in the eastern part of Ethiopia. Dire Dawa is 515 km from Addis Ababa, 55 km north of Harar, and 311 km west of the port of Djibouti, situated between 9°28.1'N and 9°49.1'N latitude and 41°38.1'E and 42°19.1'E longitude, at an altitude of 1,276 meters above sea level. According to Dire Dawa Health Bureau projections for 2023/2024, the population of the administration is approximately 546,639, of which 23,911 are children and adolescents. Harar town is located 526 km east of Addis Ababa, comprising six districts and 19 kebeles (the smallest administrative unit in Ethiopia), with a projected population of 428,143, including 18,613 children and adolescents.

In Dire Dawa, there are two public hospitals, four private hospitals, 15 health centers, 36 health posts, and 17 medium-to-high private clinics. In Harar, there are three public hospitals, one private hospital, 15 health centers, 36 health posts, and 17 medium-to-high private clinics. All public health facilities in the cities provide DOT (Directly Observed Treatment) for TB patients, covering a total of 3,133 patients, of whom 501 (16%) are children 276 in Dire Dawa and 225 in Harar.

The study was conducted from February 1 to March 16, 2025, using an institution-based cross-sectional design to assess undernutrition and associated factors among children and adolescent TB patients receiving DOT at public health facilities.

2.2. Population

2.2.1. Source Population

All children and adolescent TB patients on DOT at public HFs in Harar and Dire Dawa.

2.2.2. Study Population

Children and adolescent TB patients on DOT at public health facilities who were randomly selected for participation.

2.3. Eligibility Criteria

2.3.1. Inclusion Criteria

- Children aged 0–14 years diagnosed with tuberculosis.
- Currently enrolled in the DOT program at public HFs in Harar and Dire Dawa.

2.3.2. Exclusion Criteria

- Children with chronic illnesses unrelated to TB that may affect nutritional status (e.g., diabetes, renal disease).
- Children who were severely ill or hospitalized at the time of the study.

2.4. Sample Size Determination

The sample size for the first objective was calculated using a single population proportion formula, assuming an estimated prevalence of malnutrition of 18.4% based on a study in Addis Ababa, with a 5% margin of error, 95% confidence level, and 10% non-response rate [11]. For the second objective, the sample size was determined using a double population formula with Epi Info version 7.2.2.6, assuming 80% power, 95% confidence, and a 1:1 exposed-to-unexposed ratio based on a similar study. The largest sample obtained from the single population proportion method (n = 253) was used as the final sample size.

2.5. Sampling Procedure

All public health facilities in Harar and Dire Dawa were included. In Dire Dawa, this included two public hospitals and nine health centers. The sample size was allocated proportionally to the number of children and adolescent TB patients in each facility. Eligible participants visiting the facilities were enrolled sequentially until the allocated sample size was reached, ensuring comprehensive coverage of the target population.

2.6. Variables of the Study

2.6.1. Dependent Variable

- Undernutrition (Yes/No)

2.6.2. Independent Variables

- **Socio-demographic factors:** Age, gender, family marital status and size, wealth index
- **Nutritional intervention history:** Eating frequency, nutritional care and support, dietary counseling, Household Food Insecurity Access Score (HFIAS)
- **Clinical factors:** Type of TB, duration of anti-TB treatment, functional status, comorbid chronic illnesses

2.7. Operational Definitions

- ***Undernutrition:*** For children <5, defined as height-for-age Z-score (HAZ) < −2 SD; for children aged 5–15 years, defined as BMI-for-age Z-score (BAZ) < −2 SD, based on WHO reference standards [11].
- ***Directly Observed Treatment (DOT):*** TB treatment strategy in which a healthcare provider observes the patient taking their medication.
- ***Public Health Facilities****:* Government-operated hospitals or health centers providing medical services, including TB care.

Functional Status:

- ***Working:*** Capable of normal activities without special care.
- ***Ambulatory:*** Unable to work but able to live at home with occasional assistance.
- ***Bedridden:*** Unable to care for oneself and requiring hospital or institutional care [12].

2.8. Data Collection Tools and Procedures

Weight was measured to the nearest 100 g using a digital standing scale (SECA 877 or equivalent), calibrated daily with a 2 kg standard weight. Height was measured using a standardized measuring board (ShorrBoard or equivalent), with children under two years assessed in a recumbent position and older children measured standing. Age was determined from birth certificates or caregiver report and recorded to the nearest completed month.

Data were collected through face-to-face interviews using a structured questionnaire that captured socio-demographic characteristics, clinical factors, and history of nutritional interventions. Written informed consent was obtained from caregivers, and adolescents aged 13–15 years provided assent following parental consent. Four trained BSc nurses conducted the data collection under the daily supervision of the principal investigator, who monitored the process to ensure quality. Clinical information was extracted from medical records with permission from facility heads. Anthropometric measurements were standardized, calibrated, and repeated for a subset of participants to verify accuracy.

2.9. Data Quality Control

Data collectors underwent two days of training on the study objectives, data collection tools, procedures, and ethical considerations. The questionnaire was pretested on 5% of the sample at Haramaya General Hospital, outside the study area, and necessary modifications were made based on the pretest findings. The principal investigator supervised data collection daily and verified the completeness and consistency of all questionnaires.

2.10. Data Processing, Analysis, and Interpretation

Data were coded and entered into EpiData version 3.1 and subsequently exported to SPSS version 25 for analysis. Missing values and outliers were checked prior to analysis. Nutritional status indicators were calculated using WHO Anthro and AnthroPlus version 1.0.4. Descriptive statistics, including frequencies and percentages, were used to summarize the data. The household wealth index was constructed using factor analysis of household assets and categorized as poor, medium, or rich. Multicollinearity among independent variables was assessed using the variance inflation factor (VIF). Variables with a p-value < 0.25 in bivariable logistic regression were included in the multivariable model. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were reported to assess associations between independent variables and undernutrition, with statistical significance set at $p < 0.05$.

3. Results

A total of 249 children under 15 years of age, along with their index mothers or caregivers, were enrolled in the study, yielding a response rate of 98.4%. Of these children, 148 (59.4%) were female. The mean age of participants was 75.3 ± 37.1 months. Regarding residence, 139 (55.8%) of the children were from Dire Dawa city administration, while 110 (44.2%) were from Harari regional state. The majority of children (64.3%) were older than five years.

Most mothers were married 194 (77.9%) and predominantly resided in urban areas 178 (71.5%). Educational attainment among mothers and fathers varied, with 152 (61.0%) of mothers and 96 (38.6%) of fathers having completed grades 1–8. Maternal occupation was mainly housewife 151 (60.6%), whereas the majority of fathers were self-employed 137 (55.0%). Over half of the children 137 (55.0%) lived in households with five or more family members. Regarding housing and assets, only 67 (26.9%) children lived in a private house, while 34 (13.7%) resided in Kebele housing and 148 (59.4%) in private rental accommodations. Ownership of basic household assets varied: 80 (32.2%) had electronic items such as televisions or tape players, 196 (78.7%) reported owning furniture (e.g., beds or chairs),

and transportation assets, such as motorcycles or bicycles, were the least common, with only 2 (0.7%) ownership (Table 1).

Table 1: Frequency of undernutrition of children with TB in Dire Dawa and Harar, 2025.

Variables	Total	Undernutrition	
	N (%)	No	Yes
		n (%)	n (%)
Sex			
Female	148 (59.5)	80 (54.1)	68 (45.9)
Male	101 (40.5)	73 (72.3)	28 (27.7)
Maternal Marital status			
Currently Married	194 (77.9)	123 (63.4)	71 (36.6)
Not Married	55 (22.1)	30 (54.5)	25 (45.5%)
Maternal Education status			
No formal Education	82 (32.9)	56 (68.3)	26 (31.7)
Grade 1 – 8	152 (61.1)	84 (55.3)	68 (44.7)
Grade 9 – 12	15 (6)	10 (66.7)	5 (33.3)
Paternal Education status			
No formal Education	25 (10)	14 (56.0)	11 (44.0)
Grade 1 – 8	96 (38.6)	52 (54.2)	44 (45.8)
Grade 9 – 12	78 (31.3)	57 (73.1)	21 (26.9)
College or Higher	50 (20.1)	30 (60.0)	20 (40.0)
Maternal Occupation			
Daily laborer	32 (12.9)	12 (37.5)	20 (62.5)
Government employee	23 (9.2)	14 (60.9)	9 (39.1)
Housewife	151 (60.6)	110 (72.8)	41 (27.2)
Self-employed	43 (17.3)	17 (39.5)	26 (60.5)
Paternal Occupation			
Daily laborer	47 (18.9)	19 (40.4)	28 (59.6)
Farmer	33 (13.3)	15 (45.5)	18 (54.5)
Government employee	17 (14.1)	14 (82.4)	3 (17.6)
Self Employed	152 (61)	105 (69)	47 (31)
Place of residency			
Rural	71 (28.5)	50 (70.4)	21 (29.6)
Urban	178 (71.5)	103 (57.9)	75 (42.1)
Region			
Dire Dawa	139 (55.8)	82 (59)	57 (41)
Harar	110 (44.2)	71 (64.5)	39 (35.5)
HH family Size			
< 5	112 (45)	66 (58.9)	46 (41.1)
≥ 5	137 (55)	87 (63.5)	50 (36.5)
Wealth Index			
Poor	77 (31)	40 (51.9)	37 (48.1)
Medium	86 (34.5)	67 (77.9)	19 (22.1)
Rich	86 (34.5)	46 (53.5)	40 (46.5)
HFIAS			
Secured	46 (18.5)	44 (95.7)	2 (4.3)

In secured	203 (81.5)	109 (53.7)	94 (46.3)
Completed Vaccination			
Yes	209 (83.9)	121 (57.9)	88 (42.1)
No	40 (16.1)	32 (80)	8 (20)
Type of TB			
Extra Pulmonary	36 (14.4)	20 (55.6)	16 (44.4)
Pulmonary	213 (85.6)	133 (62.4)	80 (37.6)
Functional Status			
Working	238 (95.6)	148 (62.2)	90 (37.8)
Ambulatory	11 (4.4)	5 (45.5)	6 (54.5)
Duration needs to reach health facility			
≥ 30min	53 (21.3)	24 (45.3)	29 (54.7)
15 – 30 min	154 (61.8)	100 (64.9)	54 (35.1)
≤ 15 min	42 (16.9)	29 (69)	13 (31)

The prevalence of undernutrition among children on DOT TB treatment was 38.6% (95% CI: 32.4–44.9). Among children under five years (n = 92), 13% were severely stunted (HAZ < −3), 21.7% were moderately stunted (−3 ≤ HAZ ≤ −2), and 65.3% were within normal height-for-age (HAZ > −2). For children aged five years and above (n = 157), 17.1% were severely thin (BAZ < −3), 23.6% moderately thin (−3 ≤ BAZ ≤ −2), and 59.3% had normal BMI-for-age (BAZ > −2) (Figure 1).

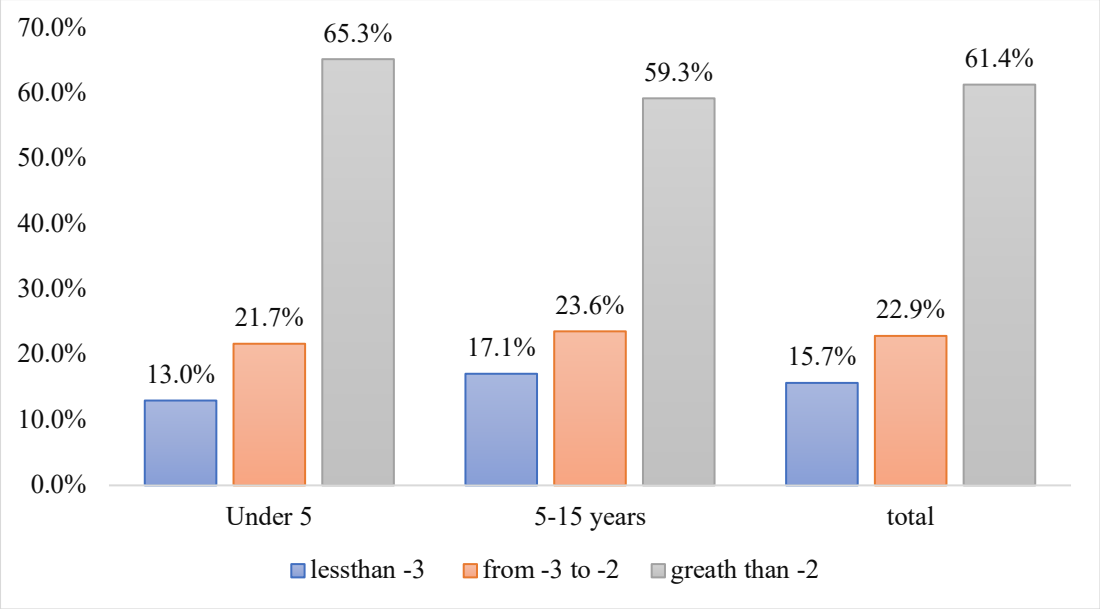

Figure 1: Prevalence of under nutrition among children taking DOT TB Treatment

The bivariate analysis examined the association between socio-demographic, economic, and clinical characteristics with undernutrition among children with TB in Dire Dawa and Harar. Variables with a p-value < 0.25 were considered candidates for multivariate analysis. The results showed that sex was significantly associated with undernutrition, where male children were more likely to be undernourished compared to females (COR = 2.21, 95% CI: 1.28, 3.81,

p = 0.004). Maternal education, paternal education, and occupation also showed trends toward association. Children of housewives (COR = 0.22, 95% CI: 0.10, 0.49, p < 0.001) and government-employed fathers (COR = 0.14, 95% CI: 0.03, 0.57, p = 0.006) had lower odds of undernutrition compared to daily laborers.

Economic factors were also important: children from households with a medium wealth index had significantly lower odds of undernutrition (COR = 0.30, 95% CI: 0.15, 0.60, p = 0.001). Food insecurity (HFIAS) was strongly associated, with insecure households showing substantially higher odds of undernutrition (COR = 0.05, 95% CI: 0.01, 0.22, p < 0.001). Vaccination status was significant as well; children who were not fully immunized had higher odds of undernutrition (COR = 0.34, 95% CI: 0.15, 0.78, p = 0.01). In addition, travel time to health facilities ≥30 minutes was associated with higher odds of undernutrition compared to those living 15–30 minutes away (COR = 2.6, 95% CI: 1.15, 6.29, p = 0.02) (Table 2).

Table 2: Bivariate analysis of children with TB in Dire Dawa and Harar, 2025.

Variable	Categories	Total	COR (95%CI)	p
		N (%)		
Sex				0.004*
	Female	148 (59.5)	1	
	Male	101 (40.5)	2.21 (1.28, 3.81)	
Maternal Marital status				0.23*
	Currently Married	194 (77.9)	1	
	Not Married	55 (22.1)	1.16 (0.37, 1.27)	
Maternal Education status				
	No formal Education	82 (32.9)	1	
	Grade 1 - 8	152 (61.1)	1.74 (0.99, 3.06)	0.05*
	Grade 9 - 12	15 (6)	0.33 (0.07, 1.57)	0.16*
Paternal Education status				
	No formal Education	25 (10)	1	
	Grade 1 - 8	96 (38.6)	0.84 (0.32, 2.24)	0.74
	Grade 9 - 12	78 (31.3)	1.07 (0.44, 2.61)	0.87
	College or Higher	50 (20.1)	0.46 (0.18, 1.19)	0.11*
Maternal Occupation				
	Daily laborer	32 (12.9)	1	
	Government employee	23 (9.2)	0.38 (0.12, 1.16)	0.09*
	Housewife	151 (60.6)	0.22 (0.1, 0.49)	0.00*
	Self-employed	43 (17.3)	0.91 (0.35, 2.35)	0.85
Paternal Occupation				
	Daily laborer	47 (18.9)	1	
	Farmer	33 (13.3)	0.81 (0.33, 2.00)	0.65
	Government employee	17 (14.1)	0.14 (0.03, 0.57)	0.006*
	Self Employed	152 (61)	0.35 (0.17, 0.7)	0.003*
Place of residency				0.06*

	Rural	71 (28.5)	1	
	Urban	178 (71.5)	0.57 (0.32, 1.04)	
Region				0.37
	Dire Dawa	139 (55.8)	1	
	Harar	110 (44.2)	1.26 (0.75, 2.12)	
HH family Size				0.46
	< 5	112 (45)	1	
	≥ 5	137 (55)	0.82 (0.49, 1.37)	
Wealth Index				
	Poor	77 (31)	1	
	Medium	86 (34.5)	0.3 (0.15, 0.60)	0.001*
	Rich	86 (34.5)	0.94 (0.5, 1.74)	0.84
HFIAS				0.00*
	Secured	46 (18.5)	1	
	In secured	203 (81.5)	0.05 (0.01, 0.22)	
Completed Vaccination				0.01*
	Yes	209 (83.9)	1	
	No	40 (16.1)	0.34 (0.15, 0.78)	
Type of TB				0.43
	Extra Pulmonary	36 (14.4)	1	
	Pulmonary	213 (85.6)	1.33 (0.65, 2.71)	
Functional Status				0.27
	Working	238 (95.6)	1	
	Ambulatory	11 (4.4)	1.97 (0.58, 6.65)	
Duration needs to reach health facility				
	≥ 30min	53 (21.3)	1	
	15 – 30 min	154 (61.8)	2.6 (1.15, 6.29)	0.02*
	≤ 15 min	42 (16.9)	1.2 (0.57, 2.5)	0.61

* p-value < 0.25

Multivariate logistic regression was conducted to adjust for potential confounders. After adjustment, several factors remained significantly associated with undernutrition. Children from urban households had significantly lower odds of undernutrition compared to those from rural areas (AOR = 0.31, 95% CI: 0.11, 0.86, $p < 0.05$). Paternal education showed a protective effect: children whose fathers had primary education (Grade 1–8) (AOR = 0.16, 95% CI: 0.03, 0.73) or college/higher education (AOR = 0.02, 95% CI: 0.04, 0.16) had markedly lower odds of undernutrition compared to those with no formal education.

Marital status of mothers was also significant: children of unmarried mothers were more likely to be undernourished compared to those of married mothers (AOR = 3.44, 95% CI: 1.38, 8.62). Wealth index continued to show significance, with children from rich households less likely to be undernourished (AOR = 0.04, 95% CI: 0.01, 0.16). Other variables, including sex, maternal

education, family size, and vaccination status, were not statistically significant in the multivariate model (Table 3).

Table 3: Multivariate logistic regression model predicting the likelihood of undernutrition among children 0-15 years with TB in Dire Dawa and Harar, 2025.

Variables	COR (95% CI)	AOR (95 % CI)
Sex		
Male	1	1
Female	2.21 (1.28, 3.81)	0.73 (0.3, 1.77)
Mother Education		
No formal Education	1	1
Grade 1 – 8	1.74 (0.99, 3.06)	1.30 (0.56, 3.02)
Grade 9 – 12	0.33 (0.07, 1.57)	0.21(0.02, 1.73)
Father Education		
No formal Education	1	1
Grade 1 – 8	0.84(0.32, 2.24)	0.16(0.03,0.73) *
Grade 9 – 12	1.07(0.44, 2.61)	0.24(0.05,1.08)
College or higher	0.46(0.18, 1.19)	0.02(0.04,0.16)
Place of Residence		
Rural	1	1
Urban	0.57(0.32, 1.04)	0.31(0.11,0.86) *
Marital Status		
Currently married	1	1
Not Married	0.69(0.37, 1.27)	3.44(1.38, 8.62)*
Wealth Index		
Poor	1	1
Medium	0.3(0.15,0.60)	0.75(0.28,2.02)
Rich	0.94(0.5,1.74)	0.04(0.01,0.16) *
Family size		
< 5	1	1
>= 5	0.56 (0.35, 0.89)	0.38(0.13, 1.08)
Fully Immunized Status		
No	1	
Yes	0.34(0.15,0.78)	0.44(0.15, 1.28)

Note: COR – Crude Odd Ratio, AOR – Adjusted Odd Ratio, * p-value < 0.05

4. Discussion

The primary objective of this study was to assess the prevalence of undernutrition and identify associated factors among children and adolescents under 15 years on DOT TB treatment in Harar and Dire Dawa urban health facilities. The study found that 38.6% (95% CI: 32.4–44.9) of children undergoing tuberculosis treatment were undernourished. Factors such as paternal education, place of residence, maternal marital status, and household wealth were significantly associated with undernutrition among children on DOT TB treatment.

The prevalence of 38.6% observed in this study is lower than that reported in several other studies. For example, a study in West India found that 55% of children under 19 years receiving TB treatment were malnourished, while a cohort study reported 45% of children on TB treatment affected by malnutrition. Similarly, a cross-sectional study from Malawi found 48% of children on TB medication were stunted [13]. In Ethiopia, a retrospective cohort study in Addis Ababa reported that 45% of children aged 5–18 years on TB treatment were malnourished at diagnosis [14]. In contrast, the prevalence in this study is slightly higher than in Uganda, where 36% of children under 15 years undergoing TB treatment were malnourished at the start of therapy.

Variations in prevalence across studies may be attributed to several factors. Differences in socioeconomic conditions, such as food insecurity and access to healthcare, can influence nutritional outcomes. The burden and severity of TB may also contribute as more severe or prolonged illness can exacerbate malnutrition. Methodological differences including study design, sample size, participant age ranges, and timing of nutritional assessment (at diagnosis versus during treatment) can further affect prevalence estimates. Additionally, differences in local health policies, the availability of nutritional support programs, and cultural practices related to diet and caregiving may explain discrepancies. Differences in the criteria used to define undernutrition (stunting, wasting, underweight, or combinations thereof) may also contribute to variability. Despite being lower than in some studies, the prevalence observed here remains a significant public health concern.

Children living in urban areas were 69% less likely to be undernourished compared to those in rural areas. This finding aligns with other studies indicating that rural residence is a major risk factor for child undernutrition. A cross-sectional study in southern Ethiopia reported that rural children were 2.5 times more likely to be stunted than urban children [15]. Similarly, the 2021 Ethiopia Demographic and Health Survey (EDHS) found stunting prevalence among rural children was 39%, compared to 25% in urban settings. The disparity may be explained by better access to healthcare, improved sanitation, diversified food sources, higher parental education levels, and greater utilization of public health interventions in urban areas. Rural communities often face food insecurity, limited healthcare access, lower maternal education, inadequate water and sanitation infrastructure, and poverty, contributing to higher malnutrition rates.

Paternal education was also significantly associated with child nutritional status. Children whose fathers had attained college-level education or higher were 84% less likely to be

undernourished than those whose fathers had no formal education. Similar findings have been reported in Nigeria [16] and a multi-country analysis in BMC Public Health [17], emphasizing that paternal education can improve child nutrition through greater income, employment stability, health awareness, and decision-making power regarding food and healthcare.

Household wealth was another important determinant. Children from wealthy households were significantly less likely to be undernourished compared to those from poor households. This aligns with prior research demonstrating the protective effect of higher socioeconomic status against undernutrition, including studies in Ethiopia [15] and India [18]. Wealthier families typically have better access to nutrient-rich diets and healthcare, which supports growth and recovery during TB treatment. Conversely, economic constraints in poorer households can compromise diet, delay care-seeking, and increase the risk of co-infections, exacerbating undernutrition.

Maternal marital status was also associated with nutritional outcomes. Children of unmarried mothers were significantly more likely to be undernourished compared to those of married mothers. This finding is consistent with studies in Southern Ethiopia [19] and Nigeria [20], which reported higher undernutrition rates among children in single-parent households due to reduced income, limited social support, and increased caregiving burden. Married mothers benefit from partner support, which can positively influence child-feeding practices, healthcare utilization, and adherence to TB treatment. In contrast, unmarried mothers may face financial and social challenges that limit their ability to provide adequate nutrition and care, which is particularly critical for children undergoing TB treatment.

5. Conclusion

The study shows that undernutrition is a moderate public health problem among children under 15 years receiving DOT TB treatment in Harar and Dire Dawa. Higher paternal education, urban residence, and greater household wealth were protective factors, while children of unmarried mothers were at increased risk. These findings emphasize the need for interventions targeting parental education, family support, and rural-urban disparities in healthcare and nutrition to improve child health and treatment outcomes.

Abbreviations

ASSIST: Alcohol, Smoking and Substance Involvement Screening Test, ATT: Anti-Tuberculosis Treatment, BMI: Body Mass Index, CI: Confidence Interval, ETB: Ethiopian Birr, HIV: Human Immunodeficiency Virus, HHS: Household Hunger Scale, HC: Health Center, MUAC: Mid-Upper Arm Circumference, PH: Primary Hospital, RDA: Recommended Daily Allowance, RH: Referral Hospital, SPTBSH: Saint Peter TB Specialized Hospital, TB: Tuberculosis, WHO: World Health Organization.

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Authors Contribution

All authors contributed to the conceptualization, formal analysis, methodology, software, and writing review & editing. In addition, some authors were involved in data curation, funding acquisition, investigation, and writing the original draft.

Ethics Approval

The ethical clearance was obtained from Dire Dawa University Institutional Review Board (DDU-IRB) before the actual data collection and permission letter were obtained from Harar Regional Health Bureau and Dire Dawa Regional Health Bureaus. The objective and purpose of the study were verified briefly to the study participants or care givers and confidentiality was assured. Finally, written informed consent was being obtained from the care givers of study participants before conducting the interview. The right of study participants to refuse or discontinue participation at any time they want and the chance to ask any thing about the study were respected.

Conflicting Interests

The author(s) declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

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Availability of Data and Materials

Data will be available upon submitting a reasonable request to the corresponding author.

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