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BAHIR DAR UNIVERSITY

COLLEGE OF MEDICINE AND HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH

DEPARTMENT OF EPIDEMOLOGY AND BIOSTATISTICS

ASSESMENT OF WEIGHT GAIN AND ASSOCIATED FACTORS AMONG ADULTS OF TUBERCULOSIS PATIENTS DURING THE FIRST TWO MONTHS OF FOLLOW UP IN PUBLIC HEALTH FACILITIES OF BAHIR DAR CITY NORTHWEST ETHIOPIA: CROSS-SECTIONAL STUDY

By:-

TIGIST GENETU (BSC)

A THESIS REPORT SUBMITTED TO THE DEPARTMENT OF EPIDEMIOLOGY AND BIOSTATISTICS, SCHOOL OF PUBLIC HEALTH, COLLEGE OF MEDICINE AND HEALTH SCIENCES, IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER'S IN MPH EPIDEMIOLOGY

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BAHIR DAR, ETHIOPIA

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FULL TITLE OF RESEARCH PROJECT	ASSESMENT OF WEIGHT GAIN AND ASSOCIATED FACTORS AMONG ADULTS TUBERCULOSIS PATIENTS DURING THE FIRST TWO MONTHS OF FOLLOW UP IN PUBLIC HEALTH FACILITIES OF BAHIR DAR CITY NORTHWEST ETHIOPIA
STUDY PERIOD	AUGUST 28 TO DECMBER 28/ 2019
STUDY AREA	BAHIR-DAR CITY PUBLIC HEALTH FACILITIES, NORTHWEST, ETHIOPIA

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Abstract

Background: - Weight gain is gaining of fat and lean body which is lost from the diseases. It is defined as an increment of weight by≥5% from baseline after intensive phase. Ethiopia remains one of the highest tuberculosis burden countries in the world and tuberculosis is one of the most imperative health problems in the country. Patients with tuberculosis often suffer from severe weight loss and are used as useful marker to predict TB treatment outcome. Since TB is the single leading infectious cause of mortality in the country and weight of TB patient is associated with TB treatment outcome.

Objective: - To assess weight gain and associated factors among adults of tuberculosis patients in Bahir Dar public health facilities, North West Ethiopia.

Methods: - A facility based cross-sectional study was conducted from August 28-Decemeber 28 /2019 among all tuberculosis patients with the age of 18 and above who were under follow up in Tuberculosis Unit of Bahir Dar public health facilities. Systematic random sampling technique with proportional allocation was used for public health facilities in Bahir Dar. Weight of patients was recorded from TB treatment units at the time of diagnosis during the 2 months of intensive phase treatment. A total of 391 TB patients were enrolled. Data were entered in Epi-Info version 7 and exported to SPSS version 23 for analysis. A level of significance P< 0.25 was taken as cutoff point to identify candidate variables for multivariable binary logistic regression and level of significance 0.05 was taken for significance association for multiple binary logistic regression analysis.

Results: - The finding of this study shows that 277 (70.8%) with 95% CI (66.5, 75.4) of TB patients had weight gain during intensive phase of TB treatment. Supplementary feeding; AOR [4.548, 95% CI (2.36, 8.75)], HIV infection AOR; [3.22, 95% CI (1.82, 5.67)]. , parasitic infection AOR [4.41; 95%CI: (2.30, 8.43)] diabetics patients; AOR [5.68, 95% CI (2.09, 15.41)], and adherence of TB treatment AOR [3.50, 95% CI (1.542, 7.95)] were factors significantly associated with weight gain during intensive phase.

Conclusion: -The magnitude of weight gain in this study was found to be 70.8%. Supplementary feeding, co-morbidity and adherence of patients during the course of TB treatment in intensive phase were associated factors of weight gain.

Key words: - tuberculosis, weight gain, treatment out come

Acronyms and Abbreviations

AFB	Acid Fast Bacilli
AIDS	Acquired Immune Deficiency Syndrome
AOR	Adjusted Odd Ratio
BMI	Body Mass Index
CI	Confidence Interval
DOTS	Directly Observed Therapy Short Course
ETB	Ethiopian Birr
FMOH	Federal Ministry Of Health
HC	Health Center
HIV	Human Immune Virus
Kg	Kilogram
MDR	Multi-Drug Resistance
P	Probability Value
SDGs	Sustainable Development Goals
SPSS	Statistical Package For Social Science
TB	Tuberculosis
WHO	World Health Organization

Table of contents

Contents page

Acknowledgment II

Abstract III

Acronyms and Abbreviations IV

Table of contents V

List of tables VII

List of figures VIII

1. Introduction 1

1.1. Background 1

1.2. Statement of the problem 2

1.3. Significance of the study 4

2. Literature Review 5

2.1 Weight gain 5

2.2 Socio-demographic factors 5

2.3. Category of TB patient 6

2.4. Type of TB 6

2.5. Co morbidity 6

2.6. Nutritional status 7

3.Conceptual framework 8

4. Objective 9

4.1. General objective 9

4.2. Specific objectives 9

5. Methodology 10

5.1. Study Area & Period 10

5.2. Study design 10
5.3. Population 10
5.3.1. Source population 10
5.3.2. Study population 10
5.4. Inclusion criteria 10
5.5. Exclusion criteria 10
5.6. Sample size and sampling technique 10
5.7. Sampling technique 11
5.8 Variables of the study 13
5.8.1. Dependent variable 13
5.8.2. Independent variables 13
5.9. Operational definitions 14
5.10. Data Collection Procedure 14
5.11. Data quality assurance 14
5.12. Data analysis procedure 15
5.13. Ethical consideration 15
6. Results 16
7. Discussion 21
8. Strengths and Limitations 23
9. Conclusions 24
10. Recommendations 25
11. Reference 26
12. Annex 31

List of tables pages

Table 1:- Sample size determination: ----------9

Table 2:-Socio-demographic characteristics of respondents at public health facilities in Bahir Dar city 2019----------14

Table 3:- Co-morbidity and clinical characteristics of respondents at public health facilities in Bahir Dar city 2019----------16

Table 4:-Predictor variables for weight gain among adult TB patients during intensive phase at Bahir dar city public health facilities, crude and adjusted odds ratio and their 95% confidence intervals North West Ethiopia 2019----------18

List of figures

Figure 1:-Conceptual Framework----------8

Figure 2:- Schematic Presentation of Sampling Procedure----------12

1. Introduction

1.1. Background

Tuberculosis (TB) has existed for a long time and remains a major global health problem. It causes ill-health for approximately 10 million people each year and is one of the top ten causes of death worldwide (1).

People infected with TB bacteria have a 5-15 % life time risk of failing ill with TB. However, persons with compromised immune systems, such as people living with HIV, malnutrition or diabetes, or people who use tobacco, have a much higher risk of falling ill. People with active TB can infect 10-15 other people through close contact over the course of the year. Without proper treatment, 45% of HIV negative people with TB on average and nearly all HIV positive people with TB will die (2).

Effective treatment of TB always shows body weight gain of patients during treatment phases. The mechanism leading to weight loss in TB and subsequent weight gain after treatment is not completely understood. Even with increased calorie and macronutrient intake infection with TB leads to loss of fat-free and fat-mass. (3, 4)

Tuberculosis patients often suffer from severe weight loss, which is considered to be immunosuppressive and major determinant of severity and outcome of the diseases weight gain is gaining of weight after treatment BMI < 30Kg/m2 So conducting weight gain by measuring their body weight by easily available weight scale we can predict the treatment outcome of any TB patients during the directly observed treatment time course . Weight gain can be explained in TB patients after treatment based on percentage of body weight (5). Weight loss is a common feature during TB treatment and good indicator of treatment outcome. During active TB, catabolic processes that cause wasting usually begin before the patient is diagnosed(6)

The World Health Organization (WHO) End TB Strategy – adopted by the World Health Assembly, with targets linked to the Sustainable Development Goals (SDGs) – serves as a blueprint for countries to reduce the number of tuberculosis (TB) deaths by 90% and cut new cases by 80% between 2015 and 2030 (7).

1.2. Statement of the problem

TB is one of the top ten causes of death worldwide. Even though the burden of TB has shown significant decline over the past two decades

Implementation of the stop TB strategy has played a key role in the global reduction of TB as reported by World Health Organization an estimated 54 million lives have been saved between 2000 and 2017. Despite these gains, however TB is still remains a major global health threat. According to a recent WHO report globally there were 10 million people fell ill with TB, and 1.6 million died from the diseases including 0.3 million among people with HIV and also in 2017, the largest number of new TB cases occurred in South- East Asia and Western Pacific regions, with 62% of new cases followed by the African region, with 25% of new cases (8).

Ethiopia ranks 8th among 22 high burden countries in the world, and are 2nd in Africa behind South Africa in 2012. The mortality rate was 18/100,000 population in 2012 (9).

According to the Ethiopian Ministry of Health report, TB is the leading cause of morbidity, the third cause of hospital admissions and the second cause of death (10).

Body weight Change in patients with TB significantly affects treatment outcomes. Patients who lose body weight in the first 2 months of treatment are less likely to achieve successful treatment outcomes. On the other hand, patients with TB who gain 5% of their body weight within the first 2 months of treatment had smaller risk of unsuccessful treatment(11).

Weight loss and nutritional depletion are often seen in patients with tuberculosis at the time of tuberculosis diagnosis.(12, 13) so patients who have lost weight due to TB are expected to gain weight during the first two months of treatment which one of predictor for successful treatment weight gain and other improvements nutritional indicators after effective chemotherapy for tuberculosis have been reported (14). The presence of moderate to severe malnutrition has been identified as a risk factor for mortality during the first 4 weeks for TB (15). Lack of a 5% weight gain during the 2-month intensive phase of TB therapy in patients who are underweight at diagnosis has also been shown to be associated with an increased risk of relapse**.** Weight loss is a major feature of TB, in a study of patients with TB in Los Angeles, 44.5% had weight loss during intensive phase(16). Increased understanding of how patients gain weight during TB treatment in a resource poor country such as Ethiopia may provide an insight into the relationship between weight of TB patients and its associated factors (17). Different literatures

revealed that weight gain in the course of anti-TB treatment during intensive phase is a good indicator of treatment outcome.(11, 18-20) Weight of the patient taken at different time points during the intensive phase treatment is an important component to assess the progress of patients. The relationship between change in weight among patients during anti-TB treatment in the two months of follow up and factors such as socio-economic demographic characteristics, co-morbidity, category and clinical features of TB , has not been well documented in Ethiopia particularly in the region. Therefore despite high burden of TB in the country, weight loss in TB patients is critical, limited research in this study area and still the existence of the problem of Weight loss during TB treatment this study will focus to determine whether weight gain occurs during the two months of TB treatment in the study area and to determine whether patient or disease factors can associate with weight gain.

1.3. Significance of the study

This research is important to improve TB treatment outcome related to weight gain. The finding is primarily important for TB patients how to improve weight gain during treatment.

The finding may help to the community by increasing awareness level how to improve weight gain during TB treatment.

The finding may also help the health sector to understand about TB weight gain related to TB treatment outcome so as to take intervention strategy.

This finding will also use as a baseline data for nongovernmental organizations how to improve TB patients weight gain by providing technical support to prevent further complications related to this problem.

Furthermore, it will be preliminary study for further research related to TB patients weight gain in Regional public hospitals.

2. Literature Review

2.1 Weight gain

Studies from different countries shows that weight gain is frequently used as part of the assessment of a patient's response to DOTS and it is a predictor of good clinical outcome Successful tuberculosis treatment is associated with weight recovery and nutritional improvement as compared to baseline status. Wasting is a common feature in TB patients but with good treatment patients body weight can progressively increase (21-24). The study conducted from America shows that after 2 months of treatment, 31.9% of patients gained at least 5% body weight and another study in this area shows that those TB patients who gain 5% weight and above were lower risk for TB relapse than those who gain less than 5% weight (17, 23).

The study conducted in Malaysia and Vietnam shows that weight gain during intensive phase is 90% and 96% respectively (11, 25). The other study conducted from Vietnam shows that new TB patients with a successful treatment outcome gained an average of 2.6 kg during treatment but the study in India the average change in weight was 3.22 kgs (4, 11) other study conducted from India shows that the average weight gain for TB patients during intensive phase was 5.2% in which those we gained weight during treatment was 2 times for successful treatment outcome than those who did not have successful treatment and it revealed that the gain in body weight was more rapid during the first two months treatment(26). The study conducted in low resources limited countries shows that during two months of intensive phase follow up 73% of TB patients increases 5% weight gain(27). The study conducted in North West Ethiopia shows that weight gain during intensive phase is from 2.6 to 3 kg (18).

2.2 Socio-demographic factors

A longitudinal study conducted in India and a cross sectional study conducted in Addis Ababa shows age and sex are statistically insignificant (28, 29) but another study conducted in India and Peru revealed that younger age is significant association with weight gain(4) also a study conducted in South West Ethiopia shows sex and age have significant association and a study conducted about clinical response of TB patients show age as significant factor of weight gain (19, 30, 31) and the other study conducted in Ethiopia shows that educational status and meal

frequency of TB patients increases weight gain during TB treatment but marital status is insignificant with weight gain(18). Another study conducted in North West Ethiopia revealed that patients from rural area are more at risk for treatment outcome than to those urban TB patients(32).

2.3. Category of TB patient

Longitudinal study conducted in India and Peru revealed the proportion of category I patients who gained weight was higher (86.1%) as compared to category II patients (13.9%) during the course of treatment (1,3) The other study conducted in India revealed that category of TB patients had statistically significant with weight gain which means category I TB patients had higher weight gain(91.1%) than from those category II TB patients(80.8%) during TB treatment(4) also a longitudinal study conducted in North West Ethiopia revealed previous tuberculosis treatment category II pervious history of treatment showed negative association with weight gain of study patients (18).

2.4. Type of TB

A longitudinal study conducted in Peru shows type of TB have insignificant association with body weight change (3) but A longitudinal study conducted in South west Ethiopia revealed type of TB were significantly associated with change in body weight and a longitudinal study conducted in north west Ethiopia indicates type of TB association with weight gain (5).

2.5. Co morbidity

A cross sectional study conducted in Tanzania, India and longitudinal study conducted in south west Ethiopia revealed HIV status has significant association with weight gain (31, 33, 34). Another study conducted revealed that TB patients with diabetics has more complication outcome than those with no diabetics(35). But a cross sectional study conducted in Addis Ababa shows TB/HIV co-infection has no significance association with weight gain (29). A study conducted in Jimma revealed Intestinal parasite during treatment has inverse relation with weight gain (31).

2.6. Nutritional status

The study conducted in china shows that supplementary feeding of nutrition is not significant with weight gain of TB patients.(36) but the other study in America shows that supplementary feeding has positive association with TB weight gain during TB treatment.(37)The study conducted in North West Ethiopia shows that meal frequency four and above has positive association with weight gain(18).

3. Conceptual framework

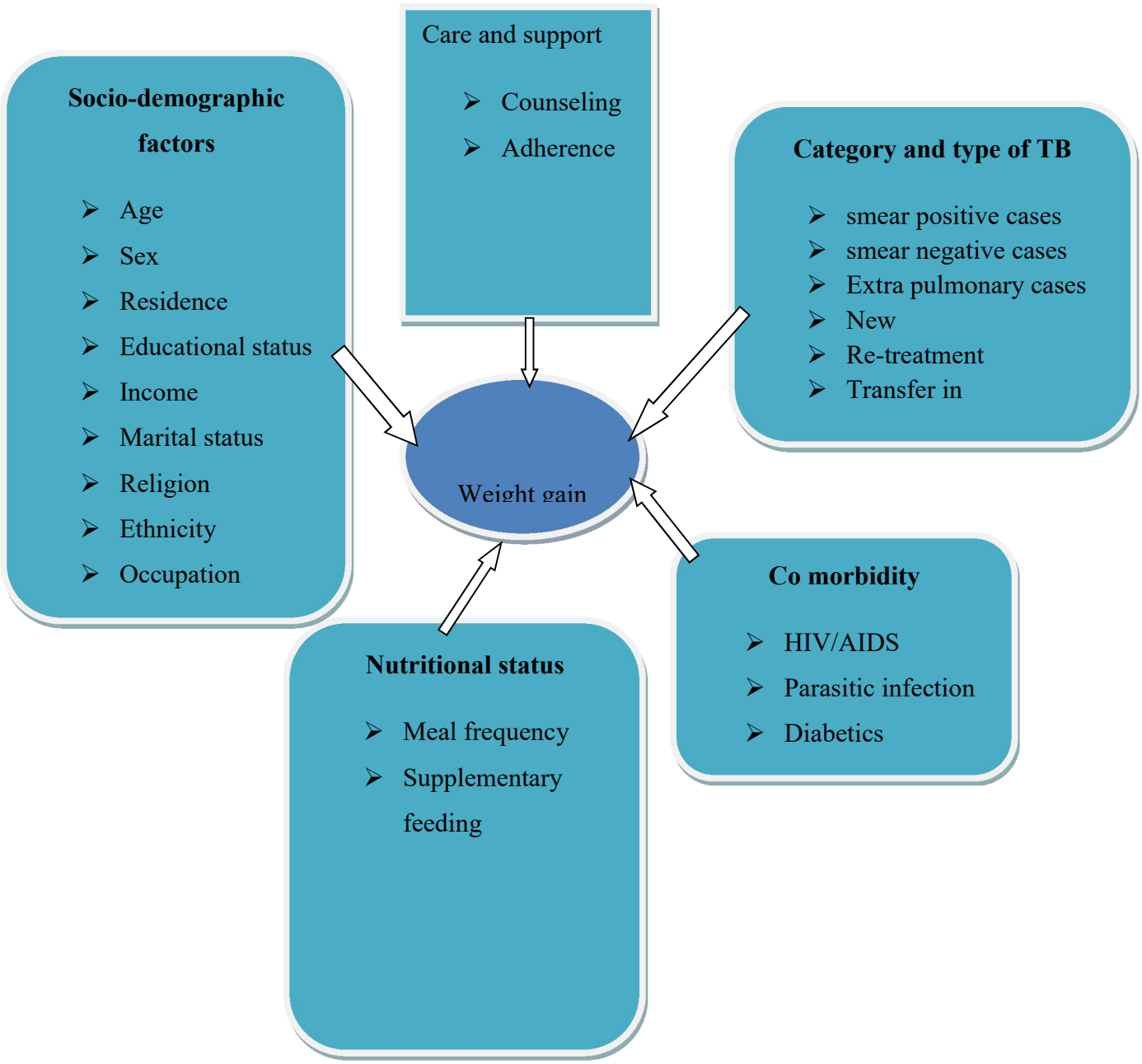

Figure 1 Conceptual framework adapted from different literatures, North West Ethiopia, 2019.(18, 19, 29, 31)

4. Objective

4.1. General objective

To assess weight gain and associated factors among adults of tuberculosis patients during two months follow up in Bahir Dar public health facilities, North West Ethiopia 2019.

4.2. Specific objectives

- To determine magnitude of weight gain among adults of tuberculosis patients during two months follow up in the study area
- To identify factors associated with weight gain among adults of tuberculosis patients during two months follow up in the study area.

5. Methodology

5.1. Study Area & Period

The study was conducted in Bahir Dar public health facilities. Bahir-Dar is capital city of Amhara Regional State located in the North Western part of Ethiopia. It is located 565kms from Addis Ababa and has 9 sub cities. During the study period, in the administration, there were 2 public hospitals, 2 private hospitals and 6 health centers which provide TB DOTS program. The study was conducted from August 28 to December 28/2019

5.2. Study design

A facility based cross-sectional study was conducted

5.3. Population

5.3.1. Source population

TB patients who had follow up at public health facilities of Bahir Dar

5.3.2. Study population

TB Patients 18 years and above who were under follow up at TB clinics of selected public health facilities of Bahir Dar from August 28 to December 28/2019

5.4. Inclusion criteria

TB patients who were 18 and above years attained their follow up during 2 months of treatment and voluntary to participate were included in the study.

5.5. Exclusion criteria

TB patients who were 18 and above years but seriously ill and unable to answer the questionnaire and defaulted during two month follow up.

5.6. Sample size and sampling technique

5.6.1 **Sample size determination for Weight gain**

Since there is limited study on prevalence of weight gain among adult TB patients in our country for the first objective of the study the sample size was determined based on the following assumptions:

- Single population proportion (p) = 50%
- Marginal error (d) =5%.
- Confidence interval (CI) = 95%
- zα/2=1.96

Then, n1= $(z\alpha/2)^2 p\ (1-p)/d^{2.}$ n= $(1.96)^2\ (0.5)\ (1-0.5)/(0.05)^2$ =385

Then, by assuming 10% non-response rate

N_F = n1+n1x10% = 385+385x10% = 424

5.6.2 Sample size determination for determinant Factors

The required sample size for the second objective was determined based on the study conducted from North West Ethiopia, associated variables with the outcome variable. The following assumptions were considered while calculating the sample size.

Table1. Sample Size Determination Bihar Dar, 2019

Variables	Category	Percentage of Outcome in exposed/unexposed		Confidence level	Power	AOR 95%(CI)	N	Remark
Sex	Male	Exposed	83.2%	95%	80%	0.347 (0.132 0.917)	292	(38)
	Female	Unexposed	92.3			1.0		
Residence	Urban	Exposed	85%	95%	80%	0.342 (0.118–0.986)	356	
	Rural	Unexposed	84.1%			1.0		

Since the minimum required sample for objective one is greater than objective two we enrolled 424 participants in this study.

5.7. Sampling technique

All public health facilities in the study area were included. Then the calculated sample size was distributed to all public health facilities proportionally to size based on the 2019 TB patients follow up in public health facilities TB unit (39). Then each TB patients were selected by a

systematic random sampling technique, by taking an interval with K=1. The sampling interval (k = 1) was calculated by dividing the source population to the total sample size (424) and this interval was used in all facilities to select study subjects. The first TB patient was selected by simple random sampling from TB patients in the sample frame.

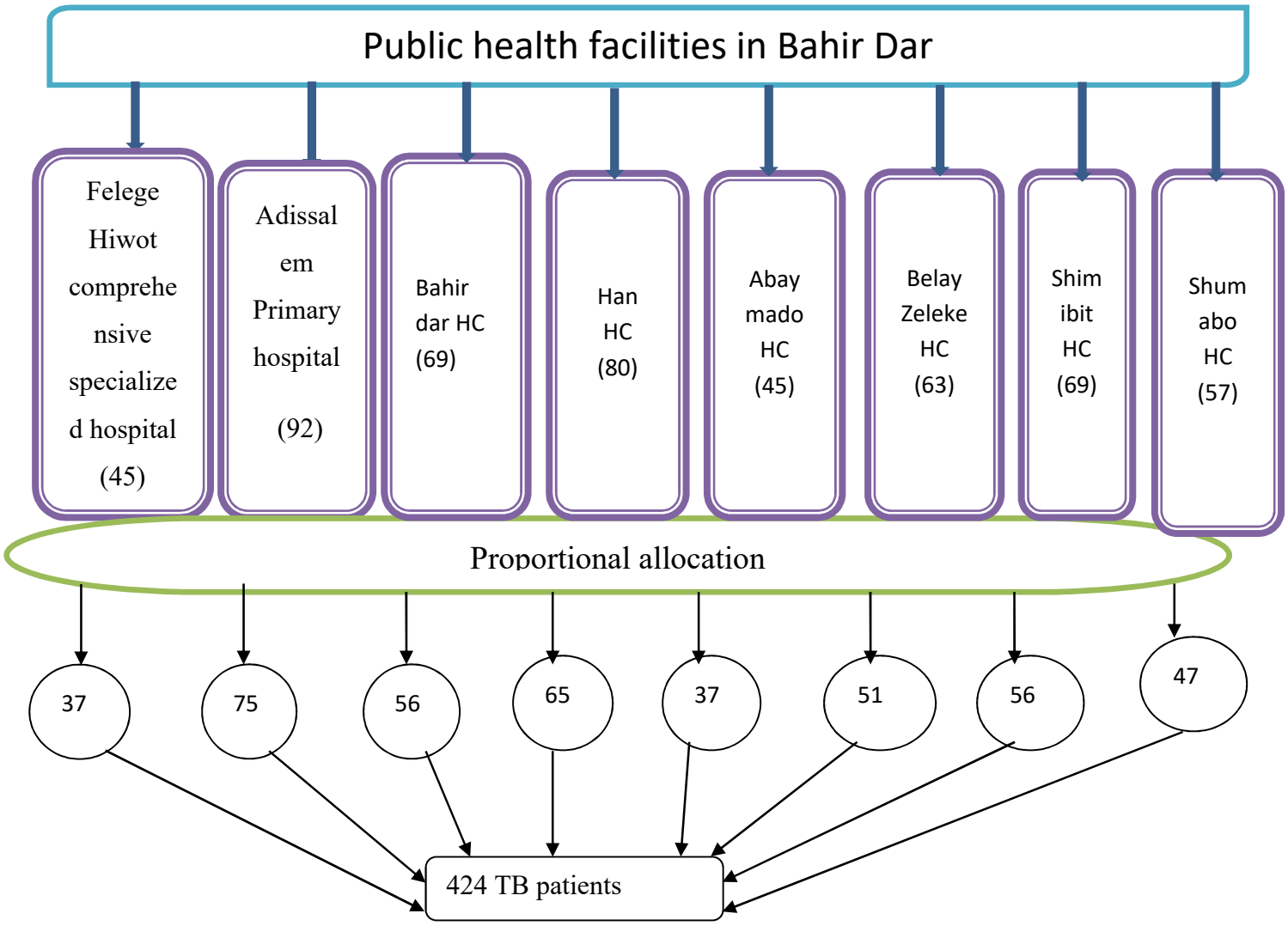

Figure2:-Schematic presentation of sampling procedure during intensive phase in Bahir Dar public health facilities 2019, North West Ethiopia

5.8 Variables of the study

5.8.1. Dependent variable

- Weight gain

5.8.2. Independent variables

Socio-demographic variables

- Age
- Sex
- Residence
- Profession
- Income
- Religion
- Marital status
- Ethnicity

Co morbidity Variables

- HIV infection
- Parasitic infection
- Diabetics

Type of TB

- Smear negative pulmonary TB
- Smear positive pulmonary TB
- Extra pulmonary TB
- Category of TB

Nutritional status

- Meal frequency
- Supplementary feeding

Care and support

- Counseling
- Adherence during intensive phase

5.9. Operational definitions

- **Weight gain**: - was defined as an increment of weight by≥5% from baseline after intensive phase. Percentage of weight change was calculated as the difference in weights at the two times divided by the weight at the earlier time, multiplied by 100. (17, 23, 31, 40, 41)
- **Income :-**was explained by wealth index by using principal component analysis which would categorized in to five and was used EDHS questionnaire(42).
- **Category of TB: -** The revised definitions given by WHO was used in this study to define the cases and treatment outcomes. Patients were categorized as follows:
- Cat I- New sputum smear positive
- Cat II- Smear positive relapse, Smear positive failure and Smear positive treatment after default (previously treated)(43)
- **Dietary counseling:-** Is a process by which a health professional with special training in nutrition helps people make healthy food choices and form healthy eating habits(29).
- **Nutritional care and support:-**Is food safety as provision of adequate quality/quantity of food and food aid by any organization to increase weight gain(29)

5.10. Data Collection Procedure

Data were collected from TB patients during intensive phase follow up in TB clinic. The contents of the questionnaire included socio-demographic variables, co-morbidity status, type of TB, category of TB, dietary counseling. Eight nurses' as data collector and one supervisor were deployed for follow up. Data collectors and supervisor were trained for a day on data collection instruments. The principal investigator and the supervisor monitored the overall activities on daily basis to ensure the completeness of questionnaire, to give further clarification and support for data collectors.

5.11. Data quality assurance

Training was given for a day about the data collection tool. A pre-test was done on 5% of the sample size at Bahir Dar health center of study area based on the prepared questionnaire. Findings and experiences from the pre-test tool was utilized in modifying the data collection tool. Supervision was conducted by the principal investigator and supervisor. Each questionnaire was given a unique code and data were cleaned for errors prior to data analysis. Any errors

identified were corrected after revision of the original data using the code numbers given to the questionnaires.

5.12. Data analysis procedure

Data were cleaned for inconsistencies and missing values by using Epi-Info version 7 and analyzed using SPSS version 23.0 statistical software. The results were presented in the form of tables, figures and summary statistics. The strength of association between weight gain and independent variables (covariates) were expressed in odds ratio (OR) with 95% confidence interval. Simple binary logistic regression was conducted to identify candidate variables for multiple binary logistic regression at p-value <0.25. Those independent variables with a p-value less than 0.25 in simple binary logistic regression were included in a multiple binary logistic regression to control for potential confounding variables. Independent variables significant at p-value< 0.05 level in the multiple binary logistic regression analysis was considered as determinant factors of weight gain. Hosmer and Lemeshow test was used to check the model fitness of logistic regressions at "p" value=0.6

5.13. Ethical consideration

. Ethical clearance was obtained from Bahir Dar University, College of Medicine and Health Science. An official letter from the School of Public Health was written to Amhara Regional Health Bureau and then to Bahir Dar city administration zonal health department. Furthermore, a letter of permission was obtained from Bahir Dar administration Zone health department to health facilities and issues of confidentiality was discussed by the data collectors how to use unique codes before proceeding with data collection. Informed verbal consent was obtained from the study subjects after they were informed about objectives and procedures of the study and their right to refuse participation any time they want to refuse. For this purpose, a one-page consent letter was attached as a cover page of each questionnaire stating about the general objective of the study.

6. Results

6.1 socio-demographic characteristics of respondents

In this study, a total of 391 TB patients with the mean age of 34.37 and SD ± 13.72 years responded to the interview with 92.2% response rate. Ninety four (24%) of respondents were in the age groups of 25-29 years. Majority of the respondents, 350(89.5 %,) were from the urban area. Two hundred thirteen (54.5%) and 147 (37.6%) respondents were married and single respectively. Three hundred fifty four (90.5 %) respondents were Amhara ethnic. Three hundred twenty four (82.9%) of the respondents were followers of Orthodox Christian. Two hundred seventeen (55.5%) were male respondents (Table2).

Table 2:-Socio-demographic characteristics of respondents in public health facilities of Bahir-City, Dec 2019 (N=391)

Variables	Category	Frequency	Percent (%)
Age	<=24	87	22.3
	25-29	94	24
	30-34	65	16.6
	35-39	41	10.5
	40-44	21	5.4
	>=45	83	21.2
Residence	Rural	41	10.5
	Urban	350	89.5
Marital status	Single	147	37.6
	Married	213	54.5
	Divorced	29	7.4

	Widowed	2	0.5
	Cannot read and write	68	17.4
	only read and write	67	17.1
Educational status	Primary(grade 1-8)	57	14.6
	Secondary(grade 9-12)	101	25.8
	college and above	98	25.1
	Orthodox Christian	324	82.9
Religion	Muslim	46	11.7
	Protestant	21	5.4
	Amhara	354	90.5
	Agew	25	6.4
Ethnicity	Oromo	5	1.3
	Tigrie	7	1.8
	Government employee	84	21.5
	Private employee	58	14.8
	House wife	78	20
Occupation	Merchant	34	8.7
	Farmer	22	5.6
	Daily laborer	75	19.2
	Student	40	10.2
Income	Poorest	81	20.7

Poorer	98	25.1
Middle	57	14.6
Richer	90	23
Richest	65	16.6

6.2 Co-morbidity and clinical characteristics of respondents

Ninety, twenty and sixty four respondents were diagnosed with HIV, diabetes and parasitic infection respectively. Among 391 cases majority of respondents 327(83.6%) were new TB cases. From the respondents, almost half of them (48.3%) had extra pulmonary TB (Table 3).

Table 3:-Co-morbidity and clinical characteristics of respondents in public health facilities of Bahir-City, Dec 2019(N=391)

Variables		Frequency	Percentage
HIV infection		90	23
Diabetics		20	5.1
Intestinal Parasitic Infection		64	16.4
Category of TB	New case TB	327	83.6
	Retreatment	34	8.7
	Transfer in	30	7.7

Type of TB	Smear positive	112	28.7
	Smear negative	90	23.0
	Extra pulmonary	189	48.3
Adherence of TB treatment		349	89.3

6.3 Magnitude of weight gain

Among TB patients during the first two months of follow-up, two hundred seventy seven (70.8%) 95% CI, 66.5. 75.4)) respondents gained weight.(Table 4)

6.4 Factors associated with weight gain

From simple binary logistic regression residence, educational level, taking food three times and above per day, supplementary feeding, HIV infection, diabetic cases, intestinal parasitic infection and adherence to TB treatment during intensive phase were identified as candidate variable for multiple binary logistic regression at p-value<0.25. From these, supplementary feeding, HIV infection, diabetics cases, intestinal parasitic infection and adherence of TB treatment during intensive phase were significantly associated with weight gain in the multiple binary logistic regression at P<=0.05. (Table 4)

The odds of weight gain during intensive phase among clients who received supplementary feeding were 4.5 times higher compared to those patients who did not receive supplementary feeding AOR; [4.54, 95% CI (2.36,8.75)]. The odds of weight gain for patients who had no HIV/AIDS history was 3.2 times higher as compared to patients with HIV/AIDS, AOR; [3.22, 95% CI (1.83,5.67)].

The odds of weight gain for patients who had no parasite disease were 4.4 times as compared to patients who have history of parasite disease AOR[4.41; 95%CI: (2.30,8.43)]. The odds of weight gain for patients who had no diabetics diseases were 5.6 times as compared to patients

who have history of diabetics AOR[5.68; 95%CI: (2.09,15.41)]. The odds of weight gain for patients who had adherence of TB treatment during intensive phase were 3.5 times higher than for those who had no adherence of TB treatment during intensive phase AOR; [3.50, 95% CI (1.54,7.95)] (Table 4).

Table 4:-Predictors of weight gain among adult TB patients during intensive phase at Bahir dar city public health facilities, North west Ethiopia 2019 (N=391)

Variables	Category	Weight gain	Not weight gain	COR(95% CI)	AOR (95%CI)	P-vale
Residence	Urban	243	107	0.467(0.20,1.08)	0.915 (0.34,2.43)	0.422
	Rural	34	7	1.0	1.0	
Educational level	Literate	222	101	0.52(0.27,0.99)	1.90 (0.90,3.89)	0.291
	Illiterate	55	13	1.0	1.0	
Meal frequency per day	Yes	205	93	0.64(0.373,1.108)	0.79 (0.42,1.48)	0.253
	No	72	21	1.0	1.0	
Supplementary feeding	Yes	89	18	2.525(1.438,4.434)	4.54 (2.36,8.75)*	0.000
	No	188	96	1.0	1.0	
HIV infection	Yes	52	38	1.0	1 .0	0.000
	No	225	76	2.45(1.62,3.11)	3.22 (1.82,5.67)*	
Diabetics	Yes	10	10	1.0	1.0	0.001
	No	267	104	2.57(1.25, 8.96)	5.68(2.09,15.41)*	
Intestinal parasitic infection	Yes	33	31	1.0	1.0	0.000
	No	244	83	2.76(1.66,5.34)	4.41 (2.31,8.43)*	
Adherence of TB treatment during intensive phase	Yes	260	96	2.868(1.420,5.792)	3.50 (1.54,7.95)*	0.003
	No	17	18	1.0	1.0	

* Significant at p value less than 0.05 in multivariable analysis

7. Discussion

In this study the magnitude of weight gain among TB patients during the intensive phase was 70.8 % with 95% CI, (66.5, 75.4). The finding of the study is in line with the study conducted in low resource setting like Tanzania ,Zanzibar which shows the magnitude of weight gain was 73% during the two months of follow up (27).This might be due to the socio-economic status of the country. The finding of this study was higher than the studies done in America and India 31.9 % and 5.2% respectively (17, 26). This might be due to the age difference between the countries since they are aged population countries. The mean age in this study was 34 years but in America and India it was 48 and 36 years respectively. Age-related diminution in immune function can complicate the overall clinical response to tuberculosis in elderly patients(44).

But the finding of the study was lower than the study conducted in Malaysia and Vietnam (90%) 96% respectively (11, 25) which might be due to lack of adequate nutritional care and support for patients during tuberculosis treatment. Delay in tuberculosis diagnosis and time to start treatment might also affect the weight gain of patients. The other possible reason for this difference might be the difference in health care service delivery system.

Supplementary feeding, adherence of TB treatment during intensive phase, diabetics, parasitic disease, and HIV/AIDS were factors associated with weight gain.

Supplementary feeding was one of the factors associated with weight gain in this study, which implies those who were got supplementary feeding of TB patients were 4.5 times higher than to have weight gain from those who did not gate supplementary feeding. This finding is in line with the study done in America and Ethiopia (18, 37) this might be due to nutritional supplements could help people recover from the illness by strengthening their immune system, and by improving weight gain, and muscle strength, allowing them to return to an active life(45). whereas the study conducted in china(36) had no any association between feeding practices and weight gain. This might be due to biological response of patients and severity of the diseases. It implies that supplementary feeding will improve weight gain and better treatment outcome. This finding is again supported by the study conducted in India that shows patients with tuberculosis leads to reduction in appetite, nutrient mal-absorption, micronutrient mal-absorption, and altered metabolism leading to wasting. Both, protein-energy malnutrition and micronutrients

deficiencies increase the risk of tuberculosis. It has been found that malnourished tuberculosis patients have delayed recovery during intensive phase treatment. Nutritional supplementation may represent a novel approach for fast recovery of weight gain for tuberculosis patients.(46)

HIV infection was one of the associated factors with weight gain during intensive phase of TB treatment in this study. The finding of the study was in line with the studies done in Tanzania, India and South west Ethiopia(18, 31, 33, 34) This might be due to TB/HIV Co-infection may lead to poor appetite with decreased nutrient intake, which may interact with the altered metabolism associated with both infections as part of the immune and inflammatory response(47).however the study conducted in Adiss Abeba showed that HIV infection has no significant association with weight gain during intensive phase TB treatment.(29). This might be due to awareness level variations and special care given for HIV/AIDS patients in Addis Ababa

The finding of this study shows diabetic's patients had less weight gain than no diabetic's patients during intensive phase of TB treatment. This finding is in line with the studies conducted in Mexico and India(35, 48). This might be due to patients with diabetes might have lower plasma concentrations of anti TB drugs which lead to poor treatment outcome during intensive phase(49).This implies effective diabetics patient management may increase weight gain.

The odds of weight gain for patients who had no intestinal parasite disease were 4.41 times higher compared to patients who have history of intestinal parasite infection. This finding is in line with studies conducted in Jimma and Tanzania (31, 33) revealed patients who haven't any intestinal parasite were getting weight as compared to their counterpart. This might be due to the effect of intestinal parasites on the immune system of the host which consumes nutritive elements from our body(50). This implies routine de-warming program could improve weight gain during intensive phase of TB patient treatment.

Adherence of TB treatment during intensive phase was strong predictor of weight gain among TB patients. The finding of this study in lines with studies conducted in Uganda and India (20, 51). This might be due to poor counseling from health providers, bad experience of patients and poor supply from health care settings. Therefore poor adherence of anti-TB treatment decreases weight gain.

8. Strengths and Limitations

Limitations

This study focuses on intensive phase during TB treatment .This research did not use qualitative method to support descriptive findings which was as one of the limitation.

9. Conclusion

The magnitude of weight gain in this study was low. This study revealed that Supplementary feeding, co-morbidity and adherence of anti-TB treatment during intensive phase were associated factors of weight gain during the first two months of follow in TB patients.

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10. Recommendations

Based on the study findings we forward the following recommendations:-

For regional health bureau

- Micronutrient supplementary feeding practice and de-worming programs should be regularly monitored

For Bahir Dar zonal health department

- Screening co-morbidities promotion at the public should be strengthen

For health facilities

- Strong monitoring and follow up of TB patients should be strengthen to increase adherence
- ✓ Special care is mandatory for patients with co morbidities.
- ✓ De-warming and nutritional care support should be strengthen

For the researchers

- It is better to make another weight gain research related to quality on mixed method to explore additional determinate factors of TB weight gain.

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12. Annex

Consent form

Dear TB treatment followers, how are you?

My name is _____Working as data collector in this study that focuses on weight gain and its associated factors among adult TB patients in public health facilities in Bahir dar Amhara region , Ethiopia. The purpose of this research is to study “weight gain and associated factors among adult TB patients in Bahir Dar public health facilities：：

By participating in this research I believe there is minimal discomfort except dedication of sometime by respondents. There is no direct benefit from participating in this research but the results of the study are no doubt to be important for improvement TB treatment.

On this questionnaire your name will not be written and no one can access it except the principal investigator and data collectors, in which all your issues related to weight gain will be kept completely confidential. In this study, interview and necessary measurements will be made to all adult TB patients’ in this health facility. You do not have to answer any questions that you do not want to answer; even you may end this interview at any time you want too. However, your honest answers to those questions will help us for better understand on research and is also important to develop strategies and organizing future TB patients health related to weight gain. We would greatly appreciate your truthful and keen participation in responding to this questionnaire.

At this time do you want to ask me anything about the follow up?

May I begin the interview based on my questionnaire now? Yes / No _____

If the answer is “yes” pass to the next sub-section

If the answer is “No” thank you the respondent and stop the interview.

Signature of interviewer _____

Questionnaires

Facility----------

MRN----------

TB Unit Number ----------

PART I. socio economic and demographic characteristics.			
Code	Questions	Answer	Skip to
101.	Age of the patient	1. ……..years	
102	Sex of the patient	1. Male 2. Female	
103	Place of residence	1. Urban 2. Rural	
104	Educational level	1. Cannot read& write 2. Can write & read 3. Primary school (1-8) 4. Secondary school (9-12) 5.higher level	
105	What is your current marital status?	1.Single 2. Married 3. Divorced 4. Widowed	
106	Religion	1. Orthodox 2. Muslim 3. Protestant 4. Other …..	
107	Ethnicity	1. Amahra 2. Oromo 3. Tigre 4. Other ….	

108	What is your occupation?	1.Government employee 2. House wife 3.Merchant 4. Farmer 5.Daily laborer 6.selfe employer 8. Other……..	
109	Wealth index/circle pleases	1. Radio yes no 2. Television yes no 3. Mobile yes no 4. Computer yes no 5. Home-phone yes no 6. Refrigerator yes no 7. Table yes no 8. Chair yes no 9. Bed yes no 10. Electric baking system yes no 11. Bicycle yes no 12. Mule/horse yes no 13. Car yes no 14. Baggage yes no 15. Source of water -------- 16. Agricultural land ---- 17. Amount of domestic animals---	
	Part II Co-morbidity		
201	HIV infection during treatment	1. Yes 2. No	
202	Diabetic patient	1. Yes 2. No	

203	Parasitic infection	1. Yes 2. No	
PART III. Clinical information			
301	Category of TB	1. New case 2. Retreatment(specify ----- 3. Transfer in	If no skip to Q---
302	Type of TB	1. Smear positive 2. Smear negative 3. Extra pulmonary	
303	Body weigh	At diagnosis time-------k.gs	At 2 month completion-----Kgs
304	Adherence during intensive phase	1. Yes 2. No	
Part IV. Nutrition and supplementary feeding			
401	Average intake of food per day	1. Once a day 2. Twice 3. Three times 4. 4 and above	
402	Did you take your medication in front of health care workers	1. Yes 2. No	
403	Did you take supplementary food from the health facility	1. Yes 2. No	
404	If no for number 403 why	----------	
405	Did you gate daily counseling from health workers	1. Yes 2. No	

Name of data collector_____ signature ___ Date_____

Name of supervisor _____signature ___ Date_____

የፍቃደኝነት ማረጋገጫ ቅጽ

ጤና ይስጥልኝ እንዴት ናችሁ ?

ስሜ--------ይባላል

የዚህ ጥናታዊ ጽሁፍ መረጃ ሰብሳቢ ስሆን አሁን ላይ ከአዋቂ የቲቢ ህሙማን ከሚከታተሉ ጋር አጠቃላይ ስለ ቲቢ ህሙማንና የክብደት መጠናቸዉ ላይ በህክምና ጊዜ ስለሚኖረዉ ተያያዥ ጉዳዮች አብረን በጋራ ለማየት ነዉ።የዚህ ጥናታዊ ጽሁፍ ዋና ዓላማ በባህርዳር ከተማ ያሉ የመንግስት ጤና ተቋማት በአዋቂዎች የቲቢ ህሙማን ላይ የክበደት መጠንና ለዚህ ምክንያቶችን መለየት ነዉ።

ጥናቱ በዋናነት በአዋቂዎች የቲቢ ህሙማን ላይ የክበደት መጠንና ለዚህ ምክንያቶችን ለመለየት በተዘጋጀዉ መጠይቅ መሰረት በ2 ወር ህክምናቸዉ ጊዜ በመከታተልና በመጠየቅ፤ስለ ክብደታዉና ተያያዝ ጉዳዮች ላይ ጥናት ለማድረግ የሚካሄድ ነዉ።

ይህ ጥናታዊ ጽሁፍ ዉስን ጊዜን ከመዉሰድ ባለፈ ምንም አይነት ጉዳት የለዉም።

ይህ ጥናታዊ ጽሁፍ ለተሳታፊዎች ምንም ቀጥታ ጥቅም ባይሰጥም ግን ለወደፊት ለአዋቂ ቲቢ ህሙማን ስለ ክብደትና መጨመርና ተያያዘዥ ጉዳዮች ላይ ማሻሻያ ለማድረግ ያግዛል።

በጥናታዊ ጽሁፉ መረጃዉ ሲሰበሰብ የማንም ተሳታፊ ስም አይጠቀስም፤በተጨማሪም ከአጥኝዉና ከመረጃ ሰብሳቢዎች ዉጭ ይህንን መረጃ ማንንም ማየትና መጠቀም አይችልም።

በዚህ ጥናት ላይ ሁሉም እድሜያቸዉ 18 እና ከዚያ በላይ የሆኑና በመጀመሪያ 2 ወር ዉስጥ የቲቢ ህክምና ክትትል የሚያደርጉ አዋቂዎች ይካተታሉ።ማንኛዉም የማትፈልጉትን ጥያቄ አለመመለስና በመጠይቁ መካከል ላይም ሆነ በክትትሉ ወቅት ካልተመቾት ማቋረጥ ይችላሉ ።

ነገር ግን ያለምንም ይሉኝታና ፍርሃት ይህንን ጥያቄ ከመለሱልን ለጥናታዊ ስራዉ እጅግ አስተዋጽኦ ያበረክታሉ።በዚህ ጥያቄ ላይ የጎላ ተሳትፎ ስለሚያደርጉ በጣም እናመሰግናለን።ስለ ዓለማዉ ግልጽ ያልሆነ ጥያቄ አልዎት? ጥያቄየን መጀመር እችላለሁ? አዎ-----አይቻልም

መልሱ አዎ ከሆነ ወደ ሚቀጥለዉ ጥያቄ ማለፍ፤አይቻልም ከሆነ አመስግኖ መሰናበት

የመረጃ ሰብሳቢዉ ፊርማ ----------

የሱፐርቫይዘሩ ፊርማ ----------

ቃለ-መጠይቅ

የጤና ተቋም ስም----------

የህክምና ካርድ ቁጥር----------

የቲቢ ህክምና ቁጥር ----------

ክፍል 1፤-የማህበራዊና ኢኮኖሚያዊ ጉዳዮች ቃለ-መጠይቅ			
ኮድ	**ጥያቄ**	**መልስ**	**እለፍ**
101.	**እድሜዎ ስንት ነዉ**	1. ……..ዓመት	
102	**ጾታ**	1. **ወንድ** 2. **ሴት**	
103	**የት ነዉ ሚኖሩት**	1. **ከተማ** 2. **ገጠር**	
104	**የትምህርት ደረጃዎ ስንት ነዉ?**	1. **ማንበብና መጻፍ የማልችል** 2. **ማንበብና መጻፍ እችላለሁ** 3. **የመጀመሪያ ደረጃ** (1-8) 4. **ሁለተኛ ደረጃ** (9-12) 5. **ከፍተኛ ትምህርት**	
105	**የጋብቻ ሁኔታዎ?**	1.**ያላገባ/ች** 2.**ያገባች** 3.**የፈታች** 4.**ፈታያገባች**	
106	**የምን እምነት ተከታይ ኖት**	1. **ኦርቶዶክስ** 2. **እስላም** 3. **ፕሮቴስታንት** 4. **ሌላ ካለ ይጠቀስ------**	
107	**የምን ብሄር ተወላጅ ኖት**	1. **አማራ** 2. **ኦሮሞ** 3. **ትግሬ**	

		4. ሌላ ይጠቀስ----	
108	ስራዎ ምንድን ነዉ?	1.የመንግስት ሰራተኛ 2. የቤት እመቤት 3.ነጋዴ 4.ግብርና 5.የቀን ሰራተኛ 6.የግል ሰራተኛ 7.ሌላ ካለ----	
109	የገቢ መጠን ለማወቅ የሚከተለዉን ይምረጡ	1. ሬዲዮ አለ የለም 2. ቴሌቪዥን አለ የለም 3. ሞባይል አለ የለም 4. ኮምፒዉተር አለ የለም 5. የቤት ስልክ አለ የለም 6. ፍሪጅ አለ የለም 7. ጠረንጴዛ አለ የለም 8. ወንበር አለ የለም 9. አልጋ አለ የለም 10.የኤሌክትሪክ ምጣድ አለ የለም 11.ሳይክል አለ	

		የለም 12.በቅሎ/ፈረስ አለ የለም 13.መኪና አለ የለም 14.ባጃጅ አለ የለም 15.የሚጠጣ ዉሃ የሚቀዳበት ------ 16.የእርሻ መሬት በሄ/ር---- 17. የቤት እንስሳት ብዛት ---	
ክፍል 2 ተያያዥ ህመሞች(በክትትል ጊዜ የሚሞላ)			
201	በኤች አይ ቪ የተያዘ ነዉ	1. አዎ 2. የለም	
202	የስኳር ህመም አለ	1. አዎ 2. የለም	
302	በተለያዩ ጥገኛ ተዋህሲያን ተጠቅተዋል	1. አዎ 2. የለም	
ክፍል 3 የክሊኒካል መረጃዎችን በተመለከተ			
301.	የቲቢ ህመሙ አይነት የሚመደብበት	1.አዲስ ታካሚ 2.እንደገና ለህክምና የተመለሰ 3.ከሌላ ቦታ በሪፈር የመጣ	
302	የቲቢ ህመም አይነት	1.በአክታ የተረጋገጠ ሳንባ 2.በአክታ ያልተረጋገጠ ሳንባ 3.ከሳንባ ዉጭ የሆነ ነቀርሳ	
303	ህክምና ሲጀምሩ የነበረዉ ክብደት	----------ኪሎግራም	የ2 ወር ህክምና ሲጨርስ

			የነበረዉ ክብደት----ኪሎ ግራም
304	በመጀመሪያዎቹ 2 ወር ክትትል ላይ ስለ ቲቢ ህክምና በመመሪያዉ መሰረት ህክምናዉን የመዉሰድ ዝንባሌ	1.አዎ 2. የለም	
ክፍል 4፡- የአመጋገብና የክትትል ስርዓትን በተመለከተ			
401	በቀን በአማካይ ምን ያህል ጊዜ ይመገባሉ	1. 1 ጊዜ 2. 2 ጊዜ 3. 3 ጊዜ 4. 4 ጊዜና በላይ	
402	መድሃኒት ሲወስዱ ከባለሙያ ፊት ለፊት ነዉ	1. አዎ 2. አይድለም	
403	ተጨማሪ የሚወሰድ አልሚ ምግብ ተሰጥቷል	1. አዎ 2. የለም	
404	ለጥያቄ 403 የለም ከሆነ ለምን	----------	
404	የባለሙያ ምክር በየቀኑ ያገኛሉ	1. አዎ 2. የለም	

I, the undersigned, MPH/Epidemiology student declare that this research report is my original Work in partial fulfillment of the requirement for the degree of Master of Public Health in Epidemiology. Furthermore my work has never been presented in this or any other universities in which that all resources and materials used for this work has been fully acknowledged.

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