ASRAT WOLDEYES HEALTH SCIENCE CAMPUS SCHOOL OF PUBLIC HEALTH

MAGNITUDE OF OVERWEIGHT/OBESITY AND ASSOCIATED FACTORS AMONG TYPE TWO DIABETIS MELLITES PATIENT IN NORTH SHOA ZONE PUBLIC HOSPITALS, NORTH SHOA, ETHIOPIA

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DEBRE BERHAN UNIVERSITY, ASRAT WOLDEYES HEALTH SCIENCE CAMPUS

SCHOOL OF PUBLIC HEALTH, DEPARTMENT OF PUBLIC HEALTH

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Abbreviations/ acronym

AOR	Adjusted Odd Ratio
BMI	Body Mass Index
BSC	Bachelor of Science
CI	Confidence Interval
COR	Crude Odds Ratio
DBU	Debre Berhan University
DM	Diabetes Mellitus
MPH	Master of Public Health
NCD	Non Communicable Disease
SPSS	Statistical Package for Social Science

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Abstract

Background; Type 2 diabetes mellitus is a major global health threat worldwide. Obesity and overweight is major risk factor for its development. Recently increases in population obesity in low- and middle-income countries that are now increasingly being observed have been less recognized.

Objective; to determine the magnitude of overweight/obesity and associated factors among type two DM patients at north Shoa zone public hospitals, North Shoa, Ethiopia.

Methods; ; an institutional based cross-sectional study design was used among 361 type 2 DM patient at North Shoa zone public hospitals from May 5th to June 5th at four randomly selected public hospitals of north Shoa zone. Systematic sampling techniques was employed. Data were collected by face-to-face interviewer-administered pretested questionnaire and entered using epi data version 4.6 and exported to SPSS version 25 for analysis. Independent variables with a p-value of less than 0.2 during the bi-variable logistic regression were entered into the multivariable logistic regression analysis. Adjusted odds ratios along with 95% confidence intervals were calculated and P-values less than 0.05 was considered statistically significant.

Result: A total of 361 type 2 diabetic patients participated in the study with a response rate of 97.0%. The magnitude of overweight/obesity was (25.2%, 95% CI: 19.9%- 29.6%). Age greater than 50 years (AOR=3.54, 95% CI: 1.17, 10.67), not having food education AOR= (AOR=8.83, 95% CI: 3.99, 19.52), being female by sex (AOR=2.75, 95% CI: 1.34, 5.67) and monthly income of >9001 birr (AOR=6.04, 95% CI: 2.26, 16.08) were significantly associated with overweight/obesity.

Conclusion: the magnitude of overweight/ obesity among type 2 diabetic patients were relatively low as compared with some national-based studies. Age greater than 50 years, not having food education, being female by sex and monthly income of >9001 birr were factors significantly associated with overweight/ obesity. Support health care providers on diabetic education by organizing routine health education program and by providing assistance materials like guide lines, leaflets and other logistic support are recommended.

Key word; Magnitude, Overweight, obesity, North Shoa.

1. Introduction

1.1 Background

The magnitude of overweight/obesity is increasing at an alarming rate in many parts of the world(1). About 2 billion people are overweight and one third of them obese. The plight of the most affected populations, like those in high-income countries in North America, Australasia and Europe, been well publicized. However, the more recent increases in population obesity in low- and middle-income countries that are now increasingly being observed have been less recognized(2).

Globally, an estimated 422 million adults were living with diabetes in 2014, compared to 108 million in 1980 and the global of diabetes has nearly doubled since 1980, rising from 4.7% to 8.5% in the adult population(3). This reflects an increase in associated risk factors such as being overweight or obese. Over the past decade, diabetes prevalence has risen faster in low- and middle-income countries than in high-income countries. Recent estimates suggest that 1 in 2 adults in the united states is overweight or obese, defined by a body mass index(BMI) of higher than 25, an increase of more than 25% over the past 3 decades. Excess weight is associated with an increased incidence of cardiovascular disease, type 2 diabetes mellitus (DM), hypertension, stroke, dyslipidemia, osteoarthritis, and some cancers(4).

Diabetes caused 1.5 million deaths in 2012. Higher-than-optimal blood glucose caused an additional 2.2 million deaths, by increasing the risks of cardiovascular and other diseases. Forty-three percent of these 3.7 million deaths occur before the age of 70 years. The percentage of deaths attributable to high blood glucose or diabetes that occurs prior to age 70 is higher in low- and middle-income countries than in high-income countries(5). According to world health organization definition, obesity is defined as an abnormal or excess accumulation of fat that may impair one's health condition(6). Obesity usually associated with the imbalance between intake and energy expenditure, a condition that may be caused by either modifiable or non-modifiable factors and this imbalance results with an excess accumulation of energy which in turn is stored in the body causing in excess body weight(7).

Even if genetic factors are not modifiable risk factors, obesity can result from a complex interaction between environmental, economical and personal behaviors factors that are modifiable(8). So addressing the modifiable factors play as one of the critical strategies in preventing obesity(9). Obesity is highly correlates with diseases like metabolic disorder including diabetic mellitus, hypertension, dyslipidemia, cardiovascular disease and even some types of malignancy(3). When body max increases (BMI), it resulting in severe obesity and its consequence is particularly high among type 2 Diabetic than healthy individual(10).

In our country Ethiopia there were more than 1.33million diabetic cases in 2015, according to Ethiopian diabetic federation report. Evolution in diets because of changes in food availability, food prices, level of income, replacement of traditional plant-based diets by high sugars and animal fats and low in starches diets, dietary fiber, fruits, and vegetables has increased(11).

1.2 Statement of the problem

There is seven times greater risk of diabetic complication in individuals who have excess weight compared to those of healthy weight(12). Globally, over weight and obesity are the fifth leading risk factors of human death and each year a minimum of 2.8million adults die as a result of being overweight/obese(13). Studies revealed that diabetes combined with elevated BMI has become a major public health problem in people over 45years of age (14). People with severe obesity are at greater risk of type 2 diabetes than obese people with a lower BMI(15). Obesity is associated with mortality among diabetes; it does so by increasing high blood pressure, blood cholesterol, insulin resistance(16). Most of study reviled overweight among type 2 diabetic patients associated with; urbanization, income level, physical activities, sleeping hour and socio demographic factors like, sex and age(6,16–19). In Africa 92.1% of the participants had poor knowledge on the importance of exercise and weight loss in management of diabetic. And 73.3% had poor knowledge regarding a healthy nutrition(20).

Even though managing body weight is part of diabetic management; little is known about it of type 2 diabetic patients and associated factors in Ethiopia in general and in the study area in particular. This study will thus conducted with the aim of assessing overweight/obesity and associated factors among type 2 diabetic patients in the study setting and it helps in prevention of diabetic complication related to overweight/obesity like hypertension, insulin resistance and other.

1.3 Significance of the study

Identification of modifiable risk factors of overweight and weight management among patients with T2DM provides beneficial impacts in treatment, control of metabolic parameters and low cardiovascular risks among diabetic patients. In addition, weight loss plays significant role in improving dyslipidemia and insulin resistance which is associated with T2DM. But, in sub-Saharan Africa, including Ethiopia obesity has not been much of a concern until recently, because priority has been given to under nutrition and communicable diseases due to limited staff and infrastructure.

This study is also important by identifying what things determine overweight or obesity among type 2DM patient specifically in the study area. Similarly it provides evidence based information nutritional status and factors that enhance for overweight/obesity among type 2 DM patients for local health authorities, hospitals, and non-governmental organizations which are interested on interventions of diabetic mellitus. Furthermore, as per investigator knowledge there is limited evidence regarding the magnitude of overweight/obesity and its associated factors among diabetes patients in Ethiopia, including the study area. Hence, this study tried to solve this gap and provide basis for health professionals in designing appropriate intervention strategies to solve this problem.

2. Literature review

2.1 Introduction

Unhealthy diets and excess body weight are leading risk factors for death and disability which results in overweight/obesity and diet-related non- communicable diseases (NCDs) such as heart disease, stroke, diabetes and cancer(21). Public and global health policy- and decision-makers need timely, reliable quantitative information to develop effective interventions aimed at counteracting the burden generated by high body mass index (BMI). Few studies have assessed the high-BMI-related burden on a global scale(1). A successful response to the challenge of overweight/obesity needs timely, reliable quantitative information to design ad hoc, effective interventions aimed at counteracting the disease burden generated by high BMI, unless its complications bring about substantial economic loss to people with non-communicable disease and their families, and to health systems and national economies through direct medical costs and loss of work and wages(5).

2.2 Magnitude of overweight/obesity among type 2diabetic patients

A study conducted in Nawabganj Diabetic center, a branch of Bangladish from type two DM patients most of them (64%) have had normal body mass index (BMI 18.5-24.99) and nutritional status followed by overweight (31%) with body mass index of>25(22). Similarly a cross sectional survey which was conducted among nine health units of Estrategia Saude da Familia in the north east part of Brazil showed that 59.7% of patients were on the classification of excess weight, overweight 40.8% and obese 18.9% among type two diabetic patients(18). Another study carried out in United States of America revealed that more than 86% of those with type two DM were overweight or obese(23).

Study conducted in Yemen showed that from type two Diabetic patients 58.5% of them were overweight and the rest 28.8% patients were obese**.** A cross-sectional study among type two Diabetic patients in Nepal shows that 37.5% and 14.4% were overweight and obese respectively(24). A facility based cross-sectional study conducted in yekatit 12 hospital, Addis Ababa, Ethiopia shows that 46.4% of DM patents were overweight/obese(25). Additional study from Ethiopia in three hospitals Harari region revealed that 5.9% of participants were obese(26). And study done in Nigist Elleni memorial hospital, hadiya zone, southern Ethiopia, from 407 study participants 146 were found overweight/obese. Overweight /obesity was more common among study participants who were above 55 years old(18).

2.3 Factors associated with overweight/obesity

2.3.1 Sociodemographic factors

Globally there were studies to identify some related factors with overweight/obesity among type2 diabetic patients. Studies in different areas shows that sex of individuals was related factors; study in Saudi Arabia showed that being female were risk factor to be obese when compare to male(27). Similarly study carried out in Ogun state of Nigeria among type 2 DM patient showed that from 59.5 % of male type 2 DM patient were overweight and 13.5% were obese(28).

Being old age were significantly associated with overweight among diabetic patients which is confirmed by study conducted in china(19). Additionally, another study conducted in Benin revealed that living in urban areas increase the risk of being overweight and being obese nearly two times compared to people in rural areas(29). A study conducted in South West part of Ethiopia, Jimma showed that being urban resident and family history of overweight/obesity were significantly associated with overweight/obesity(30).

2.3.2 Behavioral and dietary related factors

Study conducted in USA among the adults between the age's range of 32 and 49 years show that obesity is strongly associated with sleeping hours(9). A community based cross-sectional study which is done in Chile revealed that adults who sleeps less than 6 hours sleep per night were 1.27 times risk for being overweight and obese than individuals who have used sleep 7 and above hours(31). Similarly behavioral related factors that increase the risk of overweight/obesity were physical activities; study in Ghana shows that Participants who were physically inactive were more obese than those who performs regular exercise(32).

Studies showed that dietary practice among type 2 DM patients were significantly related with overweight/obesity; study done in Syria revealed that frequent intake of some food items such as vegetables, fruits, olive oil, and coffee associated with overweight/obesity(5). Similar study in Bangladesh among 508 newly diagnosed type 2 diabetic patients shows that More than 90% of the respondents did not follow the dietary advice given by diabetes educator(33). Another study in outpatient department of Yekatit 12 Medical College Hospital, Addis Ababa, Ethiopia reveals that level of dietary practice among 207 (51.4%) type 2 diabetic patients was poor(34).

In similar way across sectional study among type 2 diabetic patients in Black Lion specialized hospital, in Addis Ababa, Ethiopia reveals that majority of the study participants 252 (79%) were not adhered to recommended diet management practices which means, apply the recommended diet management practices for about less than 1-2 times per week(35). Additional study conducted in Southern region of Ethiopia, Hosaena revealed that study participants who had been doing physical activity for less than 30 minutes per day and individuals taking of poor diet are significantly associated with overweight/obesity among type 2 DM patients(36).

A cross-sectional study conducted among Panamanian adult's showed that risk of obesity was nearly four times higher than among high income individuals when compared to low income individuals(37). Similarly study among type 2 diabetic patients at Bangladesh shows that Majorities (39.7%) of the respondents who had monthly family income above Taka 5,000/- were overweight compared to 23.7% among those with monthly family income at Taka 5,000(38).

Conceptual frame work

The conceptual framework was developed after reviewing of available literatures of the previous studies stated that socio demographic factors, dietary related factors and behavioral related factors were the most predictors for overweight/obesity among type 2 DM patients (Figure 1).

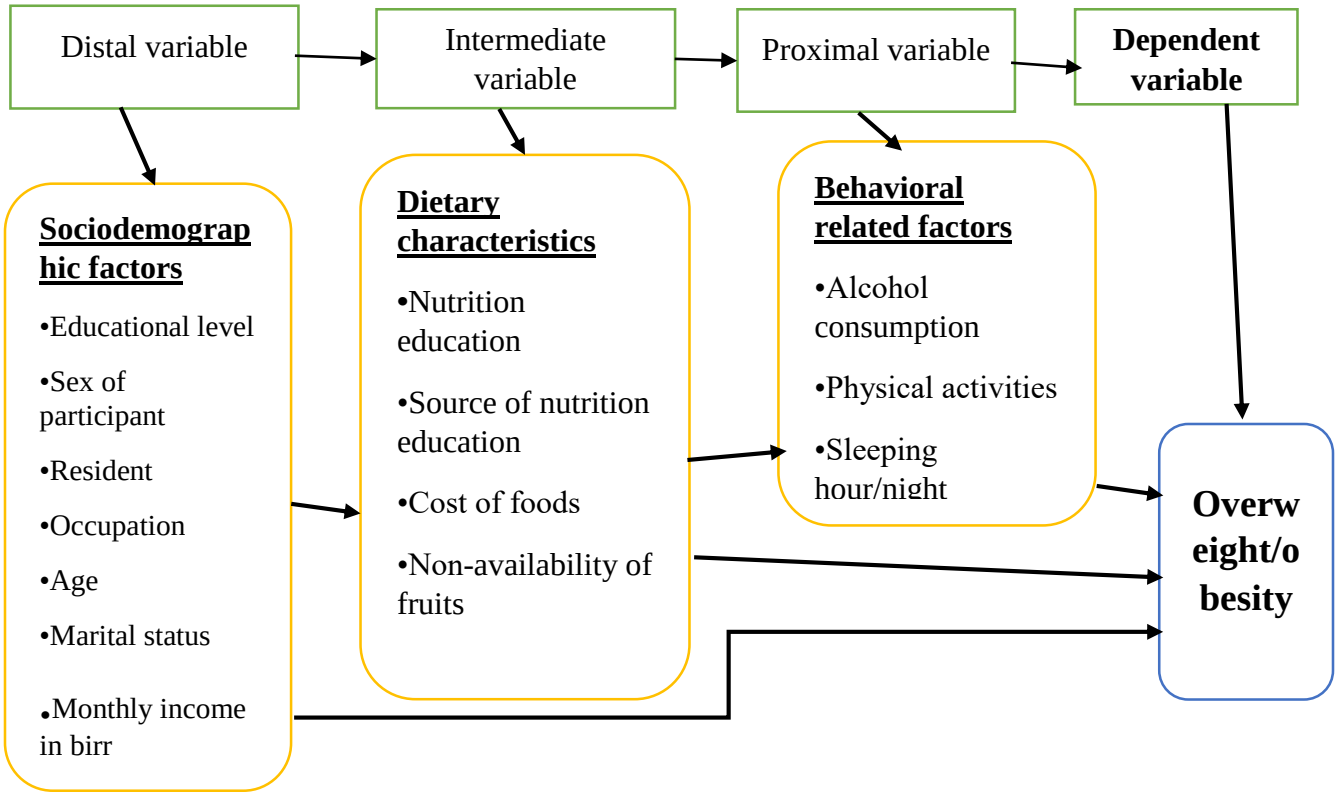

Figure 1 Conceptual framework of overweight/obesity among type 2 DM patient and associated factors at North Shoa zone public hospitals, adapted from different literatures(8,17,18,30,39–42).

3. Objectives

3.1 General objective

To determine the magnitude of overweight/obesity and associated factors among type two DM patients at north Shoa zone public hospitals, North Shoa, Ethiopia.

3.2 Specific objectives

- To determine the magnitude of overweight/obesity among type two DM patients.
- To identify factors associated with overweight/obesity among type two DM patients.

4. Methods and Materials

4.1 Study area

The study was conducted at North Shoa zone public hospitals. North Shoa Zone is located in Amara regional state, North East part of Ethiopia. The zone capital city Debre Berhan is 130 km far from Addis Ababa, and 695 km far from the regional city Bahir Dar. North Shoa zone has approximately 2,425,435 peoples living in the zone. Among them 1,188,463 are males. It has ten public hospitals.

4.2 Study design and period

An institutional based cross-sectional study design was conducted from May 5th - June 5th /2023.

4.3 Population

4.3.1 Source population

All type 2 DM patients on follow-up at North Shoa Zone public Hospitals, North Shoa, Ethiopia.

4.3.2 Study population

All randomly selected type 2 DM patients who were on follow up during data collection period in randomly selected public hospitals of North Shoa Zone.

4.4 Inclusion and exclusion criteria

Inclusion criteria

All selected type 2 diabetic patients in selected public Hospital of North Shoa zone during the study period were included in this study.

Exclusion criteria

Type 2 diabetic patients who was critically ill during data collection period.

4.5 Sample size Determination

- **Sample size determination by using first objective**

For this study Sample size was determined by using single population proportion formula by considering the following assumption, Proportion of overweight/obesity (p=35.9%)(18), 95% level of confidence (z=1.96) and 5% of marginal error (w=0.05)

n= (zα/2)2p (1-p)/w2.

n= (1.96)2 0.359(1-0.359)/ (0.05)2=**354**

After adding 5% non-response rate the total sample size is **372**

Sample size of the second objective was calculated using Epi Info Stat Calc version 7 with the assumption of 95% of confidence interval and 80% of power by considering exposed to unexposed ratio of 1:1 follows in the table below:

Table 1: Sample size determination by using second objective at north Shoa zone public hospitals

S. no	Factor	Odds ratio	%in non-exposed	%in exposed	Power	CL	Sample size	Reference
1	Monthly income	3.4	30	59.6	80	95	114	Reference number 29
2	Age	3.24	79	46.3	80	95	244	Reference number 17

Since the sample size of the second objective is smaller than the sample size of the first objective, the larger sample size (372) type 2 DM patients which is calculated by first objective was taken as final sample size.

4.6 Sampling procedure

North Shoa zone has ten public hospitals, from this ten public hospitals four hospitals are selected by using simple random sampling techniques. The sample size of each Hospital was proportionally allocated. The sampling interval of each hospital was calculated by dividing the number of eligible study participants for allocated sample size of that Hospital. There were 2156 type 2 DM patients who had at least one month follow up in north Shoa zone public hospitals By taking in to considerations of the past one month flow of type 2 DM patient follow up in selected four hospitals, which was 896. Finally K is 3 (k=N/n),where N is the total number of type 2 DM follow up patients and n is the total number of sample size (372). Then the value of K=896/372=3.

Finally, participants were selected using systematic random sampling technique every 3rd interval for all Hospitals by starting selection of the first participant by lottery method from 1-3 and subsequent participants were included randomly based on 3rd interval, based on their arrival at DM follow up clinics (Figure 2).

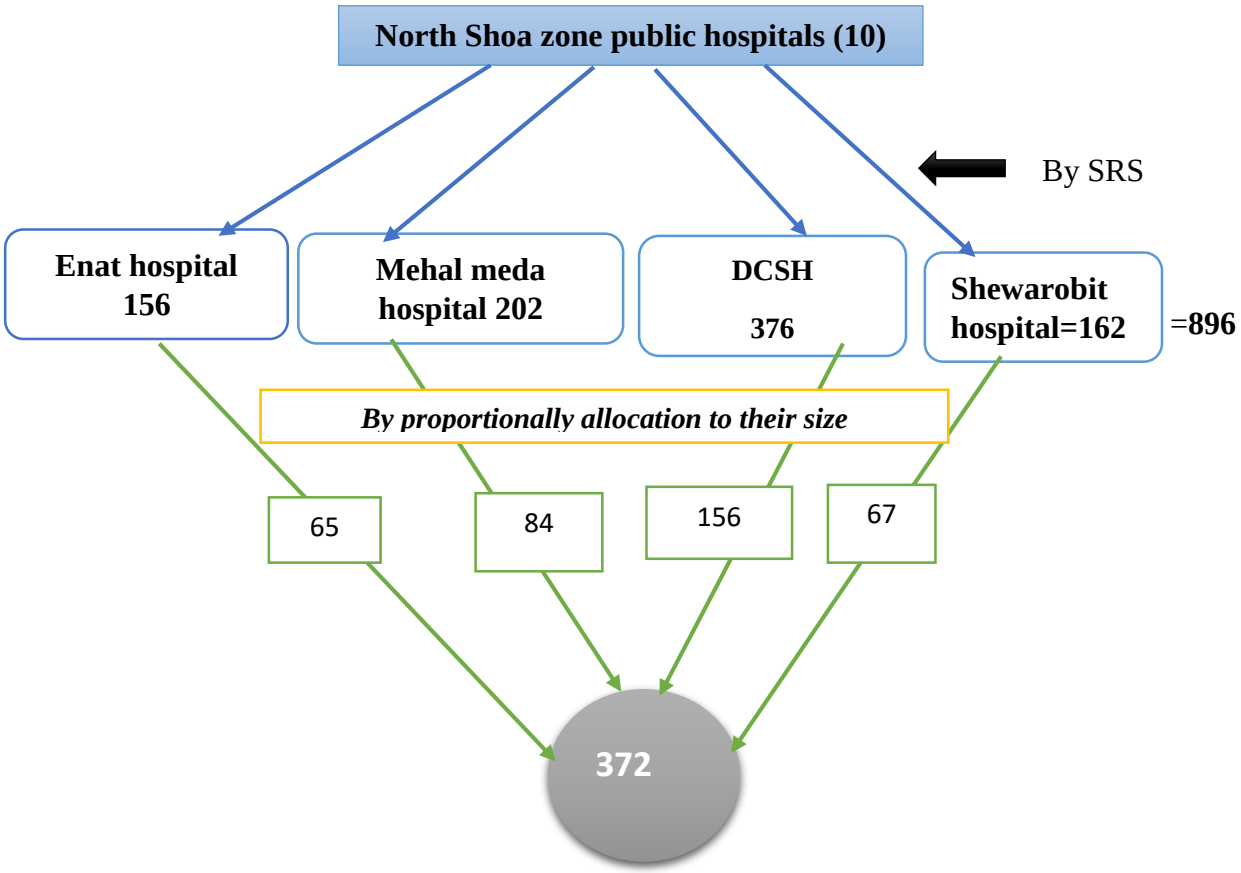

Figure 2 Schematic presentation of sampling procedure for study participants on magnitude of overweight/ obesity among type 2 DM patients at North Shoa zone public hospitals, Ethiopia, 2023.

4.7 Study variables

Dependent variable: overweight/obesity (yes/no)

Independent variables;

Socio-Demographic factors; Sex, age, residence area, educational status and occupation. **Behavioral and health factors**; Alcohol consumption, physical activities, sleeping hour/night, duration of diabetics and other chronic disease.

Dietary Factors; nutrition education, source of nutrition education, difficulty to choose foods, non-availability of fruits and vegetables and cost of foods.

4.8 Operational definitions

Overweight is type 2DM patient whose body mass index is 25 to 30 kg/m2, and **Obese** is type 2 DM patient whose body mass index is ≥30 kg/m2(21).

Type 2 diabetes; formerly called non-insulin-dependent or adult-onset diabetes results from the body's ineffective use of insulin and confirmed by the health care providers (43).

Sweet foods: foods high in fats and sugar (like cookies, coffee cake, biscuits, ice-cream, yogurt, macaroon,..).

Daily physical activity walking for at least 30 min per day/ it can be like walking, gardening, and housework.

4.9 Data collection procedure and tools

Data were collected by using face-to-face interviewer administered questionnaire. Questionnaires were adapted from previous similar literature. The questionnaire were designed to enable to acquire information concerning Socio demographic, behavioral and dietary characteristics. The questionnaire were first prepared in English and then it was translated into the local Amharic language with the assistance of a language expert.

Data were collected by four trained nurses and supervised by three trained Health officers. Data were collected after one day of training about the objective, definitions of terms that are in the questionnaire and on issues of confidentiality and privacy by long term experienced data collectors and supervisors. The questionnaires were checked for completeness before data processing based on the pre-test result and all relevant corrections were made. Daily meeting was conducted among data collectors, supervisors and PI for discussion regarding difficulties and to assess the progress of data collection. Every day, data was reviewed and checked for completeness before data entry. Probing of the respondents about the event was carried out to minimize recall and social desirability bias respectively.

Anthropometric measurement: anthropometric measurement were conducted to measure height and weight of the study participant. Weight was measured by the mechanical weighting scale in kilograms to the nearest 0.5kg, without footwear with the scale being placed on a flat firm surface

and height was measured by a measuring tap against a flat vertical surface and recorded in meter, to the nearest 0.1cm, then BMI was calculated as kg/m2 to determine the nutritional status of the study participants. Based on WHO classification BMI was categorized as overweight/obesity.

4.10 Data processing and analysis

First, data were check for completeness and consistency, and then it was coded. The coded data were entered into Epi Data software version 4.6 and exported to statistical package for social science (SPSS) version 25 for further statistical analysis. Descriptive analysis was explained by using texts, frequency tables, charts and graphs. Bivariable and multivariable logistic regression analyses was done to see the association between each independent variable and the outcome variable. Then, variables with p-value < 0.2 were entered into multivariable logistic regression to control the possible confounders. The multi collinearity test was carried out to see the correlation between independent variables using variance inflation factor (VIF) which showed a value of less than ten. The model fit test was adequate with Hosmer-Leme Show statistics indicating goodness of fit with 0.78.

Finally the strength of association was determined by computing adjusted odds ratio (AOR) at 95% CI and a statistical significance was declared at p value < 0.05 and the result is presented with texts, tables and figures.

4.11 Data quality assurance

The items were prepared in English and translated into local language (Amharic) and then re-translated to English to verify consistency and Amharic version was used to collect data. The validity and reliability of the tool used in the current study ensured. The tool was modified and some aspects of depth literature review was added to fit the context of Ethiopian Population. Experts in the clinical and academic area were involved to evaluate the content of the questionnaire. Pretesting of the tool was conducted on a 5%.

One day training was given to data collectors and supervisor on how to collect the data. Each day, the collected data were checked for completeness and consistency by the supervisors. The principal investigator was closely communicating the performance of the data collectors and supervisors on a daily basis. The collected data were reviewed and checked for completeness before data entry.

4.12 Ethical consideration

Ethical clearance was obtained from the ethical review board of Asrat Woldeyes Health Science campus, Debre Berhan University. And also letters of cooperation from the zone health department was written to each selected hospital for an effective approach in data collection process. Verbal consent was obtained from each participant voluntarily. They were informed about their rights to withdraw from the interview at any time. The information they provide used only for the study purpose. Data obtained from them were keep confidentially by using codes instead of using personal identifiers.

4.13 Dissemination of the result

The findings of this study will be disseminated to Debre Berhan University Asrat Woldeyes Health Science campus and further for North Shoa health department. Finally it will also be prepared and sent for publication.

5. Result

5.1 Socio -demographic characteristics of study participants

A total of 361 type 2 diabetic patients participated in the study with the response rate of 97.0%. Of these, one hundred ninety one 191(52.9%) participants were female and 170(47.1%) were male. The majority349 (96.7%) were orthodox Christians follower followed by 12(3.3%) Muslims. Two hundred seventy two 272(75.3%) of study participants were married in marital status and ninety nine (27.4 %) of respondents were unable to read and write in educational status (see table 2).

Table2: Socio-demographic characteristics of type 2 diabetic patients at North Shoa zone public hospitals, north Shoa, Ethiopia, 2023 (n=361),

Variable	Category	Frequency	Percent
Sex of participant	Male	170	47.1
	Female	191	52.9
Age of participant	<30	68	18.8
	30-39	41	11.4
	40-49	111	30.7
	>=50	141	39.1
Religion	Orthodox	349	96.7
	Muslim	12	3.3
Marital status of participant	Unmarried	49	13.6
	Married	272	75.3
	Divorced	7	1.9
	Widowed	33	9.1
Educational level of participant	Unable to read and write	99	27.4
	Primary	81	22.4
	Secondary	67	18.6
	Diploma	24	6.6
	Degree and above	90	24.9

Occupational status	Governmental employer	86	23.8
	Private worker	58	16.1
	House wife	19	5.3
	Retired	78	21.6
	Farmer	61	16.9
	Merchant	59	16.3
Residence	Urban	232	64.3
	Rural	129	35.7
Average monthly Income in birr	<3000	162	44.8
	3001-6000	89	24.7
	6001-9000	63	17.5
	>=9001	47	13

5.2 Dietary and behavioral related characteristics of study participants

Regarding to dietary and behavioral related practices of type 2DM patients in the study participants, majority of respondents (81.1%) received nutritional education/advice by doctors, nurses, friends/families or medias like radio and television. Type 2DM patients regarding sleeping hours of per night, 108(29.9%) of study participants were sleep during night seven and above hours and 12(3.3%) used to sleep two and less than two hours during night time. Majority 286(79.2%) of study participants were a habit of eating/ drinking sweet foods/drinks after food (table 3).

Table3: Dietary and behavioral related characteristics of study participants at north Shoa zone public hospital, north Shoa, Ethiopia (n=361).

Variable		**Frequency**	**Percent**
Sleeping hours of study participants per night	<+=2 hours	12	3.3
	3hours	65	18.0
	4 hours	62	17.2
	5hours	74	20.5
	6hours	40	11.1
	7and above hours	108	29.9
Food education	Yes	300	83.1
	No	61	16.9
Eating/drinking sweat foods/drinks	Yes	75	20.8
	No	286	79.2
Problem of choosing foods	Yes	164	45.4
	No	197	54.6
Source of nutrition education	Doctors	105	29.1
	Nurses	189	52.4
	Radio/TV	28	7.8
	Friends/family	3	0.8
Alcohol drinking in the last 12 month	Yes	99	27.4
	No	262	72.6

5.3 Nutritional status of type 2 diabetic patients

With respect to body weight, 270(74.8%) of study participants had normal body weight (BMI: 18.5-25), while 69(19.1%) had overweight and 22(6.1%) of respondents had obesity. The prevalence of overweight/obesity among type 2 DM patients was (25.2%, 95% CI: 19.9%- 29.6%). Sex specific nutritional status among study participants were assessed. Among male participants 56.8% were normal weight and 10.5% of female respondent were obese. See fig 3.

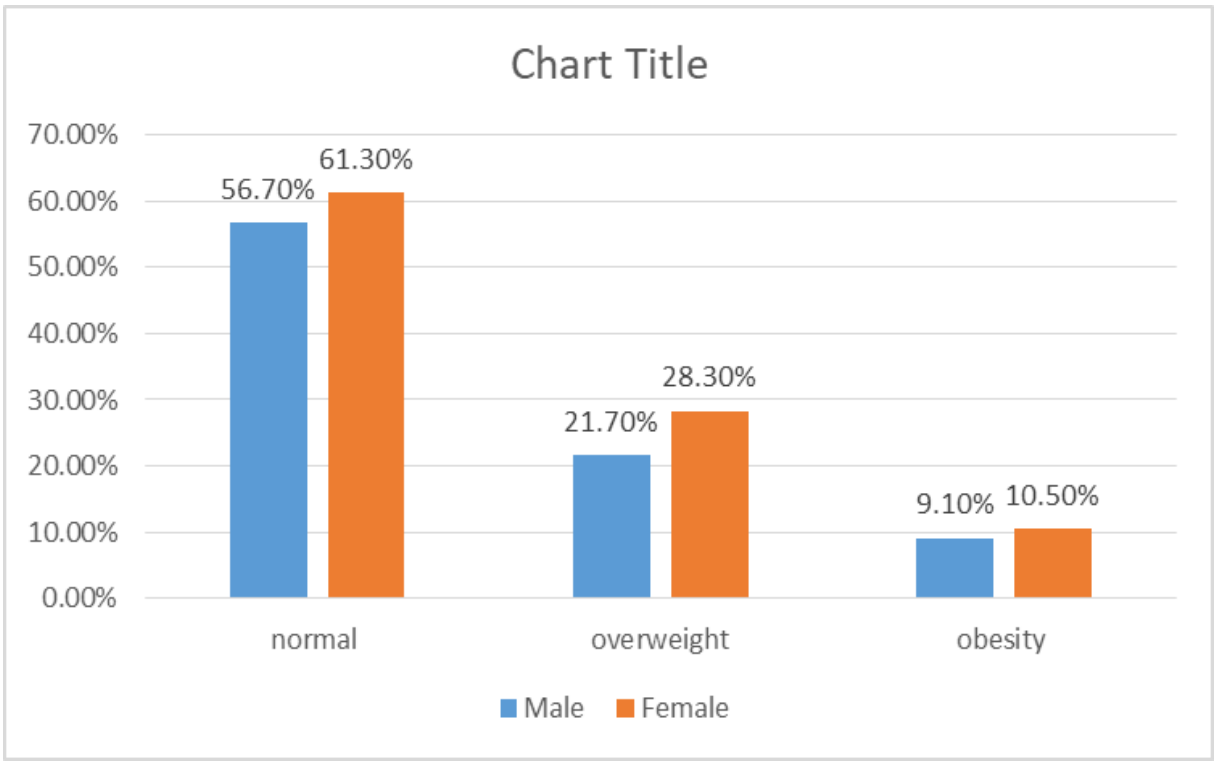

Figure3: Sex specific nutritional status of type 2 diabetic patients at North Shoa zone public hospitals, North Shoa, Ethiopia, 2023 (n=361).

5.4 Factors associated with overweight/obesity among type 2 diabetic patients

To see the effect of independent variable on the dependent variable, Bivariable logistic regression analysis was carried out with 95% confidence interval at P-value ≤ 0.2 and all factors which show significant association were entered into multivariable logistic regression analysis. Finally predictors of overweight/ obesity among type 2 DM patients were identified.

In this study significantly associated variables with overweight/obesity among type 2 diabetic patients was conducted by a cut of entry < 0.2 of p-value during bivariate analysis to multivariable analysis. There were a total of fourteen variables considered to be investigated for their association with overweight/obesity among type 2 diabetic patients. Among them, seven predictor variables were significant during bivariate analysis with cut point of p-value <0.2 which were age of the patient, duration of DM in year, drinking alcohol, receiving food education, sex of participant and eating/drinking sweet food after food intake. During multivariable logistic regression analysis four associated factors were significantly associated with overweight/obesity among type 2 diabetic patients (P-value<0.05).

Type 2 diabetic patients with age greater than 50 years were three times more likely becoming overweight/obesity as compared to those study participants with the age group of less than 30 years old (AOR=3.54, 95% CI: 1.17, 10.67). The odds of becoming overweight/obese among type 2 diabetic patients among those who didn't get nutritional advice were nearly nine times more likely as compared with those who did get food education (AOR=8.83, 95% CI: 3.99, 19.52). The odds of overweight/obesity among female type 2 diabetic patients were two times more likely compared with male type 2 diabetic patients (AOR=2.75, 95% CI:1.34, 5.67). Type 2 diabetic patients who had an average monthly income of greater than or equal to 9001birr were six times more likely developing overweight/obesity as compared with patients monthly income of <3000birr (AOR=6.04, 95% CI: 2.26, 16.08)**(Table 4).**

Table4: Factors associated with overweight/obesity among type 2 diabetic patients in North Shoa zone public hospitals, North Shewa Zone, Amhara Regional State, Ethiopia, 2023(n=361).

Variables	**categories**	**Overweight/obesity**		**COR(95% CI)**	**AOR(95% CI)**	**AOR P-value**
		Yes	**No**			
Age of the patient	<30	8	60	1	1	1
	30-39	11	80	2.75(1.00, 7.55)	0.75(0.17, 3.28)	0.701
	40-49	23	88	1.96(0.82, 4.67)	1.56(0.47,5.11)	0.466
	>=50	49	92	3.99(1.77, 9.03)	**3.54(1.17, 10.67)***	**0.025**
Length of time with DM	<5years	37	138	1	1	
	>=5years	54	132	1.53(0.94, 2.47)	1.46(0.74, 2.90)	0.276
In the last 12 months can you drink alcohol	Yes	12	87	0.32(0.16, 0.62)	0.38(0.15, 1.99)	0.068
	No	79	183	1	1	1
Did you get nutritional advice	Yes	49	251	1	**1**	**1**
	No	42	19	11.32(6.08,21.09)	**8.83(3.99, 19.52)***	**0.0001**
Sex of participant	Male	17	153	1	1	1
	Female	74	117	5.69(3.19,1016)	**2.75(1.34, 5.67)***	**0.006**
Average monthly income in Birr	<3000	26	136	1	1	**1**
	3001-6000	14	75	0.97(0.48,1.98)	1.27(0.52,3.16)	0.597
	6001-9000	21	42	2.61(1.34, 5.12)	2.96(0.12, 7.30)	0.072
	>=9001	30	17	9.23(4.46,19.12)	**6.04(2.27,16.08)***	**0.0001**
Do you eat/drink sweet food after food intake	Yes	49	26	1.95(0.15,1.50)	1.33(0.98, 2.17)	0.456
	No	42	244	1	1	1

***statistically significance (p<0.05), 1-reference**

6. Discussion

This study was aimed to assess magnitude of overweight/obesity and its associated factors among type 2 DM patients who have follow up in public hospitals of North Shoa Zone. Overweight/obesity among type 2DM has become an enormous public health problem and a bigger health crisis than hunger and the leading cause of death and disabilities around the world with the burden expected to increase through time(44). It has long been established as one of the independent risk factors for cardio vascular disease and is associated with a different form of cardio vascular disease(29).

The current study reveals that the magnitude of overweight/obesity among study participant was 25.2% (95% CI: 19.9%- 29.6%). This finding was lower than studies done in Hosaena(18), Jimma, South west Ethiopia(30), Yirgalem hospital Sidama regional state(8) and Estrategia Saude da Familia in the north east part of Brazil. The variation could be attributed to differences in study period or it might be related to socio-economic difference and employment status of the study population.

This study was also aimed at identifying the factors of overweight/obesity among type 2 diabetic patients. Type 2 diabetic patients with the age group greater than 50years were three times more likely becoming overweight/obesity as compared to those study participants with the age group of less than 30 years old (AOR=3.54, 95% CI: 1.17, 10.67). This finding was in agreement with study done in Hosaena, Hadiya zone(18). This similarity might be related with; low physically activates due to old age decreased skeletal muscle strength and decreased mobility this may result in weight gain at old age.

The odds of becoming overweight/obese among type 2 diabetic patients those who didn't get food education were nearly nine times more likely as compared with those who did get food education (AOR=8.83, 95% CI: 3.99, 19.52). This finding is in contradict with studies finding from Mekelle(40), Sidama, Southern part of Ethiopian(8) and china(14). The possible justification for this, it might be due to the difference in the health educator ability of changing the food eating behaviors of type 2 diabetic patients or it may be due to the understanding capacity of the patient.

The odds of overweight/obesity among female type 2 diabetic patients were two times more likely compared with male type 2 diabetic patients (AOR=2.75, 95% CI:1.34, 5.67). This study finding is in contrast to studies done in Nigist Elleni hospital, Hosaena, and Sidama region. The reason for this finding is it might be due to difference study population socio-cultural difference and fatty nature of women's and less in activity in strong work areas.

Type 2 diabetic patients who had an average monthly income of >9001birr were six times more likely becoming overweight/obesity as compared with patients whose monthly income of <3000birr (AOR=6.04, 95% CI: 2.26, 16.08). This finding is in line with study done in Jimma city. The reason for this similarity it might be due to the fact that peoples with relatively high in income status they will exposed to un necessary weight gain , and finally result with overweight/obesity.

7. Strength and limitations of the study

7.1 strength of the study

- Data collectors were selected from those who do not work at DM follow up clinics to minimize bias
- This study data was collected during instability among some of study areas specifically Enat hospital and Shewarobit hospital.

7.2 Limitation of the study

- Institutional based nature of the study that considers only patients under follow-up might limit the generalizability of the findings for all diabetic populations.
- Overweight/obesity could be better assessed if supported by qualitative study.

8. Conclusion and Recommendation

8.1 conclusion

In this study, the magnitude of overweight/ obesity among type 2 diabetic patients were relatively low as compared with some national based studies. The study implied that factors such as: age of study participant, sex, inability getting nutritional advice and patients who had problem with food choose were found to influence overweight/obesity.

8.2 Recommendation

Based on the result of the study, the following recommendations were made to the following concerned bodies and stake holders to minimize risk of developing overweight/obesity among type 2 diabetic patients. Thus, it is recommended that these factors should be worked on for managing body weight.

North Shoa zone Health Department

Support health care providers on diabetic education organizing routine health education program and by providing assistance materials like guide line, leaflet and other logistic support.

For health care providers of diabetics in selected public hospital of north Shoa zone;

- Regular monitoring of nutritional status of type 2 diabetic patients.
- Have a clear health education and material for health educator by local available materials; on their physical exercise and dietary practice.
- Promoting old age (>50years) to do exercises like walking, gardening.

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Annex I: English version of participant Information sheet

Title of the Research: magnitude of overweight/obesity and associated factors among type two DM patients at north Shoa zone public hospitals, North Shoa, Ethiopia, 2023.

Name of Investigator: Meseret Demisew (BSc)

Introduction

You are invited to participate as study subject in a research conducted by Mph student, from Debre Berhan University. Your participation is voluntarily. The re- search teams include one principal investigator, data collectors and two advisors. Please take as much time as you need to read or hear about the information sheet.

Purpose of the Research

The aim of this study is to assess the magnitude of overweight/obesity and associated factors among type two DM patients at north Shoa zone public hospitals. It is important to determine the prevalence of overweight/obesity that will helpful to provide baseline information for designing and implementing specific effective interventions.

Procedure: In order to perform the study, you are invited to take part in this project. If you are willing to participate, you need to understand the purpose of the study and give your consent. The required data will be collected by a nurse. Then, you are requested to give your consent to the data collector.

Risks and Discomforts

There are no anticipated risks to your participation.

Benefits of the study

The result of the study will be beneficial to design effective prevention magnitude of overweight/obesity and associated factors among type two DM patients.

Compensation for participation: You will not receive any payment for your participation in this research study.

Confidentiality: There is no sensitive issue that you will be asked related with your social desirability but any information that is obtained in connection with this study and that can be identified with you will remain confidential. The in- formation collected about you will be coded using numbers.

Participation and withdrawal: You can choose whether to be a part of this study or not. You may withdrawal at any time without consequences of any kind. You may also refuse to give any information.

Person to contact: If you have any question you can contact Investigator and you may ask at any time you want.

Meseret Demisew (Investigator), phone: +251-942808202

Informed consent form

I have read/heard and understood the sheet telling me what will happen in this study and why it is important. I have been able to ask questions and to have them answered.

I understand that while the information is being collected, I can stop being part of this study whenever I want and that it is perfectly ok for me to do this.

If I stop being part of the study, I understand that all information about me will be discarded. I agree to take part in this research.

Name and signature of data collector_____ Date____/____/____

Name and signature of supervisor's _____ Date___/_____/_____

Time taken_____

Appendix 2: Questionnaire (English version)

Survey questionnaire to identify magnitude and determinants of growth monitoring and promotion service utilization.

Questionnaire No_____ card number_____

S.no	Questions	Answer	
1	Sex	1.male 2.female	
2	Age in complete year?	----------	
3	Religion	1. Orthodox 2. Muslim 3. Protestant 4. other	
4	To which ethnic group do you Belong?	1.amhara 2.oromo 3.other	
5	Current Marital status?	1) Single 2) married 3) Separated 4) Widowed 5) Divorced	
6	Educational status?	1.no formal education 2) Primary level1-8 3) High school 9-12 4) TVT 10+3 5) University	
7	Occupation?	1) Civil servant 2) Private employee 3) Private work 4) Student 5) Housewife 6) Retired 7) Farmer 8) merchant	
8	What is your house holds monthly income in Ethiopian birr?	----------	
9	Resident	1. urban 2. Rural	
10	Have you consumed alcohol with in the past 12 months?	1. Yes 2. no	
11	If yes for question (11) how often?	1) all days in a week	

		2) some days in a week 3) occasionally	
12	On a daily activities do you have strong Work?	1) Yes 2. no	
13	If yes for (13) how much time do you spend doing such work	----------	
14	How many hours do you used to hours' sleep/night?	1. Two hours sleep/night? 2.Three hours 3.Four hours 4.Five hours 5.Six hour 6.Seven hours and above	
15	Duration of diabetics after diagnosis?	---------years	
16	Current BMI	----------	
17	Do you have any other chronic non Communicable disease from the listed?	1)Hypertension 3) Cancer 2) Heart disease 4) Other	
dietary practices related questionnaire			
18	Have you got nutrition education	1. Yes 2. no	
19	If yes for the question 18 where you got nutrition education	1) Doctor 2) nurse 3) Radio/TV 4) Journal 5) Friends 6) Other ----------	
20	Are you using some sweet food items as dessert	1. Yes 2. no	
21	Is there any difficulty to choose your food	1. Yes 2. no	
22	If yes for the question 21 what is the reason	1) my food choice is not available 2) my food choice is cost	

s.n	Item	Responses in number of days
1	On how many of the last SEVEN DAYS did you eat the number of fruit and vegetable servings you are supposed to eat based on Ethiopian Food Guide?	01 2 3 4 5 6 7
2	On how many of the last SEVEN DAYS did you eat carbohydrate-containing foods with a low Glycemic Index? (Example: enjera, bread, kinche, kita, atmit, Foods items prepared from peas, beans, lentils, Potato, sweet potato,)	01 2 3 4 5 6 7
3	On how many of the last SEVEN DAYS did you eat foods high in sugar, such asSugar, honey, candy, marmalade, Cakes, Sweet Biscuits, and Soft drinks (Coca Cola, Mirinda) Alcohols?	01 2 3 4 5 6 7
4*	On how many of the last SEVEN DAYS did you eat foods of freely or with minimal restrictions for diabetic (Lean meat, fish, Eggs, milk, cheese Green leafy vegetables (cabbage, tomato, carrots, and onion) Tea, coffee and lemon juice without sugar, Ambo water, other mineral waters Spices: garlic, 'berbere')?	01 2 3 4 5 6 7
5	On how many of the last SEVEN DAYS did you eat fish?	01 2 3 4 5 6 7
6*	On how many of the last SEVEN DAYS did you eat foods high in fat (such as High fat dairy products, fatty meat, fried foods or deep fried foods)?	01 2 3 4 5 6 7

*for question number 4 and number 6 lowest value or 0 will be given if individual have used 7 Days and 7 will be given if individual have used to eat that item for 0 days that means if persons Used to eat less day means he will be given the highest number from the options given.

Questionnaire No_____

ተ.ቁ	ጥያቄ	መልስ	
1	ጸታ?	1 ወንድ 2 ሴት	
2	ዕድሜ በዓመት?	----------	
3	ሀይማኖት?	1) ኦርቶዶስ 2) ሙስልም 3) ፕሮቴስተንት 4) ሌላካለ_____	
4	ብሔር?	1) አማራ 3) ሌላ_____ 2) ኦሮሞ	
5	በአሁኑ ግዜ የትዳር ሁኔታ?	1) ያላገባ/ች 2) ያገባ/ች 3) ተለያይተውየሚኖሩ 4) የትዳርአጋሩየሞተበት 5)የተፋቱ	
6	የትምህርት ደረጀ?	1) መደበኛ ትምህርት ያልተማረ/ች 2)አንደኛ ደረጃከ 1-8 3)ሁለተኛ ደረጃከ 9-12 4) ቴክኒክናሙያ 10+3 5) ዩኒቨሪስቲ	
7	ሥራ?	1) የመንግሰት ሠራተኛ 2) የግል ተቀጣሪ 3) የግል ሥራ 4) የቤት ዕመቤት 5) ጡረተኛ 6) አርሶአደር 7)ነጋዴ 8) ሌላ_____	

8	የ ቤተሰብ ወርሃዊ ገቢ በኢትዮጵያ ብር?	----------	
9	የመኖሪያ ቦታ ?	1)ከተማ 2) ገጠር	
10	ላለፉት 12 ወራት አልኮል ጠጥቶ ያዉቃሉ?	1)አዎ 2) አይደለም	
11	አዎ ከሆነ ለ ምን ያህል ጊዜ	1) በሳምንት ሁሉንም ቀን 2)በሳምንት አልፎአልፎ 3) ባጋጣሚ	
12	በየዕለት እንቅስቃሴ ዉስጥ ከባድ ሥራ ይሰራሉ?	1አዎ 2 አይደለም	
13	አዎ ከሆነ ስንት ሰዓት /ስንት ደቂቃይ ሠራሉ?	----------	
14	ማታ ማታ ስንት ሰዓትይተኛሉ?	1.ሁለትሰዓት 2.ሶስትሰዓት 3.አራትሰዓት 4.አምስት ሰዓት 5.ስድሰት ሰዓት 6.ሰባት ና ከዚያ በላይ	
15	የስኪር ታማሚ መሆኖን ካወቁ ስንት ዓመት ነዉ?	--------	
16	ክብደት ና ቁመት ይለኩ **(Current BMI)**	----------	
17	ከሚከተሉት አማራጮች ዉስጥ ሌላ ተጨማሪ ሕመም አለቦት?	1) የደምግፊት 2) የልብ ሕመም 3) ካንሰር 4) ሌላካለ-------	
ከፍል፡-ከአመጋገብ ጋር የተያያዙ እክሎች			
19	የአመጋገብ ትምህርት ተምረዋል?	1 አዎ 2 የለም	
20	ተምረዉ ከሆነ ትምህርቶን ከየት አገኙ?	1)ከዶክተር 2) ከነርስ 3) ከሬድዎን 4) ከጋዜጣ 5) ከጓደኛ 6) ሌላ ----------	
21	ከተመገቡ በኃላ ጣፋጭ ምግቦችን ይጠቀማሉ?	1 አዎ 2 የለም	
22	ምግቦትን ለመምረጥ ይቸገራሉ?	1 አዎ	

		2 የለም	
23	ለ ጥያቄ አዎ ከሆነ ከምን አኪያ	1.የምፈልገውን ምግብ አለማግኘት 2.የምፈልገው ምግብ ዉድ መሆን	

ክፍል 3፤ የአመጋገብ ሁኔታ መጠይቅ			
1	ባለፉት ሰባት ቀናት ዉስጥ ስንት ቀን አትክልትና ፍራፍሬ ተመገቡ?	01 2 3 4 5 6 7	
2	ባለፉት ሰባት ቀናት ዉስጥ ስንት ቀን ትንሽ ስኪር መጠን ያላቸዉን ምግብ ተመገቡ? (ለምሳሌ፡-እንጀራ፤ዳቦ፤ቂንጮ፤ቂጣ፤አተር፤ባቄላ፤ምስር፤ድንች ና ስኪርድንች)	01 2 3 4 5 6 7	
3	ባለፉት ሰባት ቀናት ዉስጥ ስንት ቀን ከፍተኛ ስኪር መጠን ያላቸዉን ምግቦች ና መጠጦችተጠቅመዋል? (ለምሳሌ፡-ስኪር፤ማር፤ከረሜላ፤ማልማላታ፤ኬክ፤ጣፋጭብስኩት፤መጠጦችኮካኮላ፤ሚሪንዳና አልኮል?	01 2 3 4 5 6 7	
*4	ባለፉት ሰባት ቀናት ዉስጥ ስንት ቀን ለስኪር ታማሚዎች የተፈቀደዉን ምግብ ተጠቅመዋል? ለምሳሌ፡-ስብየሌለውስጋ፤እንቁላል፤ወተት፤አትክልት(ጎመን፤ቲማቲም፤ካሮት) መጠጦች፤ ሻይ፤ቡና፤ሎሚ ጭማቂ፤፤ ቅመማ ቅመም ነጭ ሽንኩርት፤በርበሬ፤፤	01 2 3 4 5 6 7	
5	ባለፉት ሰባት ቀናት ዉስጥ ስንት ቀን ዓሣ ተመገቡ	01 2 3 4 5 6 7	
*6	ባለፉት ሰባት ቀናት ዉስጥ ስንት ቀን የቅባት መጠን ከፍተኛ የሆኑ ምግቦችን ተመገቡ?	01 2 3 4 5 6 7	

***ማሳሰቢያ** ለጥያቄ ቁጥር *4* ና *6* መልሱ *0* ቀን ከሆነ *7* ቁጥር ይሞላል *7* ቀን ከሆነ ግን *0* ይሞላል በዚሁ መሰረት ትንሽ ቀን ለተጠቀመው ከአማራጮቹ ትልቅ ቁጥር ይሞላል።

10. DECLARATION SHEET

I, the undersigned, declare that this is my original work and has never been presented by another person in this or any other University and that all the source materials and references used for this thesis have been duly acknowledged.

Name: Meseret Demissew

Signature: _____

Date of Submission: _____

The proposal has been submitted for examination with my approval as a university advisor.

Name of advisor: 1. Dr. Solomon H/meskel

Signature: _____

Date: _____

Name of advisor: 2. Michael Amera

Signature: _____

Date: _____