

Prevalence and Factors Associated with Diabetes Mellitus in Bahir Dar Town, Northern Ethiopia, 2019: A Facility Based Cross-Sectional Study

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To cite this article:

Mengistu Biru, Tewdros Getinet, Mikias Alayu, Neamine Tesfaye, Adamu Tayachew. Prevalence and Factors Associated with Diabetes Mellitus in Bahir Dar Town, Northern Ethiopia, 2019: A Facility Based Cross-Sectional Study. *Biomedical Statistics and Informatics*. Vol. 7, No. 3, 2022, pp. 49-59. doi: 10.11648/j.bsi.20220703.12

Received: July 14, 2022; **Accepted:** August 9, 2022; **Published:** August 17, 2022

Abstract: Diabetes Mellitus (DM) is a common endocrine disorder characterized by hyperglycemia, often manifesting with symptoms and signs of osmotic diuresis such as polyuria, polydipsia, and polyphagia. The prevalence of DM in Ethiopia was 1.9% in 2017. Although the magnitude of DM is raised from time to time in Ethiopia; there are no or little pieces of evidence about the current magnitude and its associated factors in the study setting. This study aimed to assess the prevalence of diabetes Mellitus, and associated factors among individuals above the age of 15 years attending health facilities in Bahir Dar Town, Ethiopia, 2019. Facility based cross-sectional study was employed in Bahir Dar town from January 01 to February 30, 2020. Data was collected from selected health facilities by trained health workers using data collector administrator's questionnaire, and physical examination to get the required information. The data was entered and analyzed using SPSS version 23. Descriptive statistics were used to summarize the characteristics of the study participants. Bivariate and multivariable logistic regression analyses were used to assess the association between explanatory variables and the outcome variable. Statistical significance was interpreted using an odds OR odds ratio with a 95% confidence interval and p-value <0.05. A total of 1,525 participants were included in the study. The prevalence of DM was found to be 7.3% (112 / 1,525). High waist circumference; AOR= 4.9; 95% CI (2.3 – 10.9), body mass index greater than 25 kg.m⁻² AOR = 9.6; 95%CI (4.1 – 22.8), Age 54 years and above; AOR = 5.2; 95% CI (3.2 – 8.4), having family history of Diabetes Mellitus; AOR = 7.5; 95% CI (4.0 – 14.62) and didn't eat fruit at all per day; AOR = 9.6; 95% CI (5.0 – 18.0) were significantly associated with DM. Alcohol drinking was a protective factor for diabetes. AOR=0.3; 95% CI (0.2- 0.7) were significantly associated. In this study, a higher prevalence of diabetes mellitus was observed than the International Diabetic Federation Atlas (IDFA) reported a projected estimate of DM for Ethiopia. Both modifiable (low fruit intake, overweight/obese) and non-modifiable (Age 54 years and above, Family History of DM) associated risk factors were identified. Targeting the prevention strategy to modifiable risk factors might reduce the prevalence of diabetes mellitus in the area. For non-modifiable risk factors, frequent screening and creating awareness about the disease for early detection and treatment are essential.

Keywords: Diabetes Mellitus, Prevalence, Factors Associated, Bahir Dar, Ethiopia

1. Introduction

Diabetes Mellitus (DM) is a common endocrine disorder characterized by hyperglycemia, often manifesting with symptoms and signs of osmotic diuresis such as polyuria and polydipsia and calorie loss, generalized weakness, polyphagia,

and weight loss resulting from either an absolute deficiency (Type 1) or a relative deficiency (Type 2) of the hormone, Insulin [1]. It is one of the chronic non-communicable diseases (CNCDs) which have emerged as a leading global health problem. It is also a known risk factor for blindness, vascular brain disease, renal failure, and limb amputation [2].

Diabetes is an important public health problem, one of the four top priority non-communicable diseases (NCDs) targeted for action by world leaders. Both the number of cases and the prevalence of diabetes have been steadily increasing over the past few decades [3].

The global prevalence of diabetes was 8.8% in 2015 and is projected to be 10.4% in 2040. According to the International Diabetes Federation (IDF) report of 2017, the global burden of diabetes is now affected more than 425 million people, of which one-third are people older than 65 years [4].

The increase in diabetic prevalence is now becoming more significant in developing countries than in developed countries, where there are scarce resources for diabetes management, contributing to the increased OR increased risk of premature morbidity and mortality with major social and economic consequences of the disease [4]. Africa is not free from this disease, which traditionally is considered the disease of the affluent societies of the first world. In Tunisia, the prevalence of DM is 4%, in South Africa, 5%, and in Tanzania 0.9% [4].

In Ethiopia, national data on the prevalence and incidence of diabetes are lacking. However, patient attendance rates and medical admissions in major hospitals are rising. The estimated prevalence of DM in the adult population of Ethiopia is 1.9% [5]. Type 2 diabetes Miletus is associated with older age, obesity, family history of diabetes, history of gestational diabetes, impaired glucose metabolism, physical inactivity, and race/ethnicity. The risk of type 1 diabetes Miletus may be due to autoimmune, genetic, or

environmental causes [6]. This study will have importance to knowing the risk factors for diabetes Miletus and the burden of diabetes disease, which will be used as a decision for action and consideration for policymakers. This study will also use for health workers to consider the disease during a patient visit to a health facility OR the health facility, knowing the risk factors and prevalence of the disease will be important for effective prevention and control of the disease as well as to create an appropriate treatment protocol. This study will also have important for the community to create awareness of the Diabetes Miletus associated risk factors and prevention and control mechanisms.

2. Method

2.1. Study Settings

The study was conducted in Bahir Dar Town, which is the capital city of Amhara regional state, Ethiopia, located at an altitude of 1,820 meters (5,970 ft) above sea level which is approximately 578 km north-northwest of the capital city of Ethiopia, Addis Ababa. Based on the 2007 Census conducted by the Central Statistical Agency of Ethiopia (CSA), the projected population by 2019, Bahir Dar Special Zone has a total population of 345,084, of whom 169,091 are men and 175,993 women. The town has two governmental hospitals and ten health centers serving the population in the town.

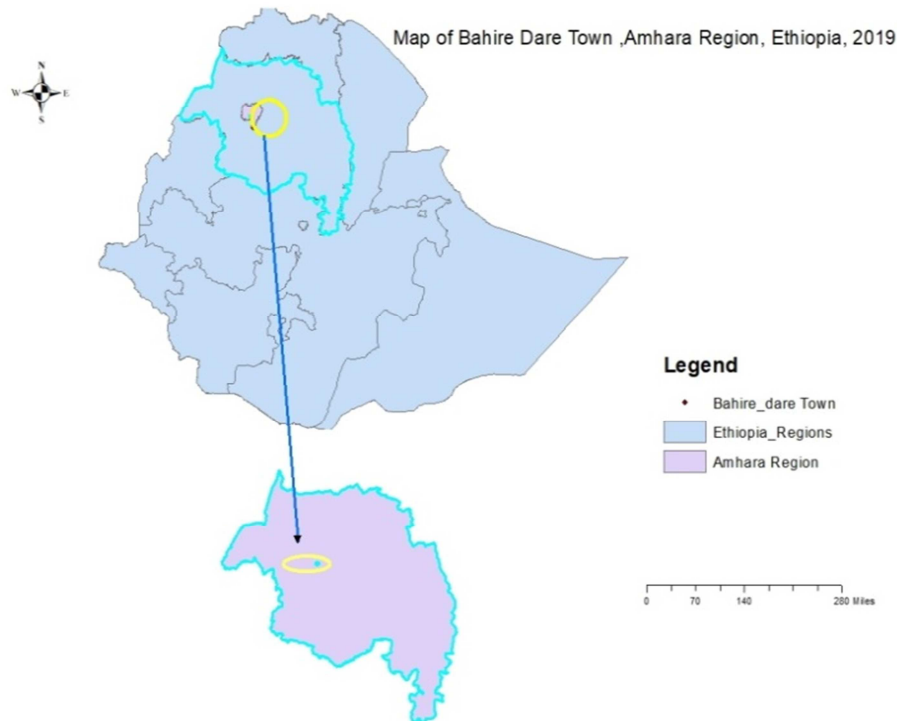


Figure 1. Map shows Bahir Dar Town, Amhara Regional State, Ethiopia, 2019.

2.2. Study Design and Period

Facility based comparative cross-sectional study was

conducted from December 15 to July 24 and the data was collected from January 01 to February 30, 2020. Study population: All individuals who are above 15 years or old

attended the health facility, Bahir Dar, from January 01 to February 30, 2020, and satisfied the study inclusion criteria. All individuals aged 15 years or more, who lived in Bahir Dar for 6 months or above were included. Pregnant women (possibly impacting anthropometric and laboratory parameters) were excluded from the study.

2.3. Sample Size Determination

In this study, the sample size was determined using a single population proportion formula, taking the prevalence of diabetes Miletus 6.48% Miza Aman town [13], this study assumes 6.48% prevalence to obtain the maximum sample size at 95% certainty and a maximum discrepancy of 1.26% between the sample and the underlying population. Thus, a minimum number of 1, 453 adults was the required number in the study. The formula to determine the sample size is below.

$$n = (Z_{\alpha/2})^2 p (1-p) / d^2$$

n= Sample size

z= standard score corresponding 95% confidence level

p= prevalence of diabetes Miletus in Mizan Aman town, 2016.

d= margin of sampling error (0.0126). For possible none, a response (5%) was used for this study and the final sample size was increased by 5% to n (Sample size of the study) = 1453 +5%, which is 72 = 1,525.

Since the prevalence of the disease is below 10%, the degree of precision (d) can't be 5%, which is impractical and yields in small sample size, the degree of precision (d) will be one-tenth of the prevalence of the disease with an adequate sample size for the study [28]. However, due to resource limitation, the degree of precision for this user was taken as 20% of the prevalence of DM, i.e., 0.2×0.0648 , which yields 0.0126 (d).

The sample size for associated risk factors for the second objective, the sample size was calculated by using Epiinfo Version 7.2.0.1 stat calc. According to the study conducted in Mizan Aman Town on the prevalence and associated factors of DM in 2016 [13]. The assumptions for calculating the sample size for two risk factors (Age and overweight) (Table 1).

Table 1. Sample size for two different associated risk factors for Diabetes Miletus.

Variables	Categories	Assumptions	Sample size
Age	Age > 55 years.	OR=4.724, P=18.6, R=4.37:1, Power=80%, CI=95%	353
BMI	BMI > 25 Kgm ⁻²	OR=4.94, P=16, R=, 5.3:1 Power=80%, CI=95%	381

OR, Odds Ratio; P, the proportion of DM from exposed; R, Ratio of unexposed to exposed; CI; Confidence Interval.

For this study sample size was 1,525. Since the sample size for the single population proportion (1,525) was larger than the sample size for associated factors, age above 55 years and overweight (353, 381) were calculated, respectively. *Sampling Procedure:* From the total 2 governmental hospitals and 10 health centers serving the town, taking one hospital, having high patient flow and 30% of the health facility through lottery method, the study participant was selected every three attendants by convenience, which is taking the population (N) the patient number of the last 3 months and average number to know the monthly patient flow. The sample size (n=1,525) was proportionally allocated to the selected health facility, hospital, and health centers.

2.4. Variables

Dependent Variable: Diabetes Mellitus status (Yes, No)

Independent Variables: Age, gender, religion, marital status, family history of diabetes, height, weight, body mass index (as an index of obesity), waist and hip circumference, sedentary lifestyle (physical inactivity), occupation, monthly income, education level, history of smoking, alcohol consumption and dietary consumption of fruits and vegetables. Operational Definition: Diabetes Mellitus - For this study, capillary whole blood fasting glucose value equal to or greater than 6.1 mmol l^{-1} ($\geq 110 \text{ mg dl}^{-1}$), was used to classify subjects as having diabetes using the WHO diagnostic criteria [29]. Age Group- The age classification used in these studies was based on National Hospital Ambulatory Medical Care Survey done by CDC; 1999

Emergency Department Age Classification [30]. The monthly Income Classification- was taken from the previous study conducted in Mizan Aman Town [13]. Positive Family History of diabetes and hypertension - is a reported history of diabetes and/or hypertension in the father, mother, full brother or sister, or the respondent. Heavy Alcohol Consumption - Refers to the average consumption of more than 3 standard alcoholic drinks per day for men ($\approx 30 \text{ gm}$ of alcohol) or >2 alcoholic drinks (or 20 gm alcohol) for women. A standard alcoholic drink is the equivalent of one glass/can/bottle (330ml) of regular beer (with 3% ethanol), one glass (100ml) of wine (10% ethanol), or one glass or measure (40ml) of distilled spirit, each of which adds up to about 10g of ethanol per drink [31]. Currently unmarried: In this study, participants currently unmarried were those who are widowed and divorced individuals (not including participants who never married or were single participants). Single marital status: Participants who were not married until this study. Waist circumference (WC) - measured at the approximate midpoint between the lower margin of the last palpable rib and the top of the iliac crest using flexible plastic tape. WC values >94 and >80 cm for men and women, respectively, were considered high according to the World health organization (WHO) [32].

The number of hours spent at work: The normal daily hours spent at work were 8 hours for this study. Low consumption of fruits/vegetables - This is the consumption of less than one serving per day of fruits and vegetables, other than those added to foods such as soups, stews, and sauces. A serving is the

equivalent of one whole orange, one apple or banana, a slice of pineapple or papaya, half of one cup of diced vegetables or fruits, etc [33]. Data collection tools and procedures: Participants' eligibility was first determined by verifying the time of their last meal to ascertain that they had undergone an overnight fast of at least 8 hours. A written consent, as well as the participants' identification, was obtained after a careful explanation of the purpose and procedure of the study. Socio-demographic data and relevant behavioral and lifestyle characteristics were recorded in pretested structured questionnaires. Anthropometric measurement and the biochemical test was then taken and recorded for each participant. Five data collectors, comprising two registered nurses, two health assistants, and one laboratory technician were recruited for the study. The structured administered questionnaire used was a modified form of the WHO Global Risk Factor Surveillance Questionnaire [34]. *Data Quality Control*: Two days of training on data collection techniques, questionnaire administration, and physical measurement techniques were given to the data collectors a week before the actual survey by the principal investigator. To assure the data quality, high emphasis was given to each part socio-demographic, behavioral, lifestyle, and socio-economic variable parts. Before starting the actual study, the questionnaire and the data collectors were pretested on 10% of the sample population from the facilities which was not included in the study to know the clarity, and suitability of the questionnaire for the participants and to give exposure to the data collectors. Throughout the data collection, the data collectors were supervised at each site regularly by supervisors, the principal investigators had daily phone communication and weekly data was collected and sent to the principal investigator.

2.5. Data Processing and Analysis

Data was checked, coded, and entered into SPSS (Statistical Package for Social science) version 23 for analysis. Descriptive statistics, such as mean, median, and percentage, were used to summarize the characteristics of participants. Bivariable and multivariable binary logistic regression analyses were employed to identify factors associated with diabetes Mellitus. Simple binary logistic regression computed the crude OR, and variables with p values less than 0.2 were entered into a multivariable binary logistic regression model to control potential confounding effects in the model. The strength was assessed using the adjusted OR (AOR) with a 95% CI. Variables with p values less than 0.05 in the multivariable analysis were considered statistically significant predictors of diabetes Mellitus.

2.6. Ethical Consideration

Ethical clearance was obtained from the Ethical review committee of Saint Paul's Hospital Millennium Medical College, and a support letter was written to Bahir Dar town zonal health office, then permission was obtained from the office and a letter of support was written to health facilities. Once permission was

obtained from facilities, the selected adults (15 years of age and above) from each health facility were informed about the purpose of the study, the importance of their participation, the right to participate or not, withdraw at any time, jump to any question and verbal consent was obtained before data collection and for those selected study subjects from 15 up to 18 years of age assent form was prepared and verbal assent was obtained prior data collection. Privacy and confidentiality of the information given by each respondent were kept properly and personal details were not recorded.

3. Result

Socio-demographic characteristics of the participants; A total of 1,525 patients who had health facility visits for different health problems were approached, and all of them completed the questionnaire (response rate was 100%). Among the study participants, 878 (57.6%) were males. The median age of the participants was 31 years with an interquartile range (IQR) of 13 years. Among the participants, 1369 (89.8%) were Orthodox Christians followed by Muslims, 123 (8.1%) (Table 2).

Table 2. Socio-demographic characteristics of the study participants at Bahir Dar Town, Amhara Regional State, Ethiopia, January 01– February 30, 2020 (n=1, 525).

Characteristics	Category	Frequency	% study population
Gender	Male	878	57.6
	Female	647	42.4
Age (Yr.)	15-24	145	9.5
	25-34	837	54.9
	35-44	265	17.4
	45-54	108	7.1
	55-64	75	4.9
	>=64	95	6.2
Religious	Orthodox	1369	89.8
	Muslim	123	8.1
	Protestant	33	2.2
Marital status	Single	459	30.5
	Married	993	65.1
	Divorced	33	2.2
	Windowed	40	2.6
Occupation	Farmer	89	5.9
	Student	156	10.2
	Unemployed	199	13.0
	Daily laborer	206	13.5
	Merchant	180	11.8
	Housewife	159	10.4
	Governmental	419	27.5
	Others	117	7.7
Education	Illiterate	227	14.8
	1-6	190	12.5
	7-8	163	10.7
	9-12 & above	945	62.0
Family Hx. DM	Yes	60	3.9
	No	1465	96.1
Monthly Income	<300	26	1.7
	300- 600	46	3.0
	601- 900	27	1.8
	901- 1200	156	10.2
	>=1201	1270	83.3

(Yrs. Years, Hx; History, DM; Diabetes Mellitus).

Behavioral characteristics of participants: Among the study participants, 137 (9%) were Cigarette smokers, 462 (30.3%) participants were chatting chewers, and 1244 (81.6%) participants were alcohol drinkers (Table 3).

Table 3. Behavioral characteristics of the study participants at Bahir Dar Town, Amhara Regional State, Ethiopia, January – February 2020 (n=1, 525).

Characteristics	Categories	Frequency	Percentage (%)
Cigarette Smoking	Yes, Daily	22	1.44
	Yes, Sometimes	115	7.54
	No, not at all	1388	91.01
Chat Chewing	Yes, Daily	34	2.2
	Yes, Sometimes	428	28.1
	No, not at all	1063	69.7
Drinking Alcohol	Yes	1123	73.6
	Yes, but not last 1 yr.	121	7.9
	No, I have never	281	18.4

(yr.; year, Source of classification, STEP-wise questionnaire).

Physical Measurement:

Out of the total study participants, 112 (7.3%) of them had ≥ 110 mg/dl Random blood glucose level. The different types of physical and biochemical measurements of the participants (Table 4).

Table 4. Physical and Biochemical Measurements characteristics of the study participants at Bahir Dar Town, Amhara Regional State, Ethiopia, January 01 – February 30, 2020 (n=1, 525).

Characteristics	Categories	Frequency	Percentage (%)
Blood Sugar Level	Non-Diabetic	1413	92.7
	Diabetic	112	7.3
Waist circumference	Low	1472	96.5
	High	53	3.5
Body Mass Index (kgm ⁻²)	<18	333	21.8
	18-24.9	989	64.9
	≥ 25	203	13.3
Hip circumference	Low	1364	89.4
	High	161	10.6

Feeding habits and physical activity: Among the participants who are involved in the study, 186 (12.2%) of them did not ever eat fruit at all per day and 1024 (67.1%) of them were working more than 8 hr/ day (Table 5).

Table 5. Feeding habits and physical activity of the participants at Bahir Dar Town, Amhara Regional State, Ethiopia, January – February 2020 (n=1, 525).

Variable Categories	Frequency	Percentage
Fruit consumption		
Do not eat fruit at all per day	186	12.2
Do not eat fruit every day	855	56.1
I take fruits once a day	484	31.7
Vegetable consumption		
Do not eat Vegetable at all	104	6.8
Do not eat Vegetable every day	809	53.0
I take Vegetables once a day	426	27.9
I take Vegetables 2-4 times per day	174	11.4
I take Vegetables 5 or more times per day	12	0.8
Number of Hours spent in work		
> 8 hrs.	1024	67.1
≤ 8 hrs.	501	32.9

(Hrs. hours, Source of classification, STEP-wise questionnaire for Assessment, and Ethiopian civil service).

Prevalence of Diabetes Mellitus: The mean \pm Standard Deviation random blood glucose level was 82.61 ± 2.62 mg/dl. The prevalence of diabetes was 7.3% (6.0% - 7.8%; 95% CI). The

crude prevalence of diabetes was 4.1% for males and 3.2% for females. Diabetes Miletus prevalence increased with increasing age, it was highest in the 25-34 years old group (Figure 2).

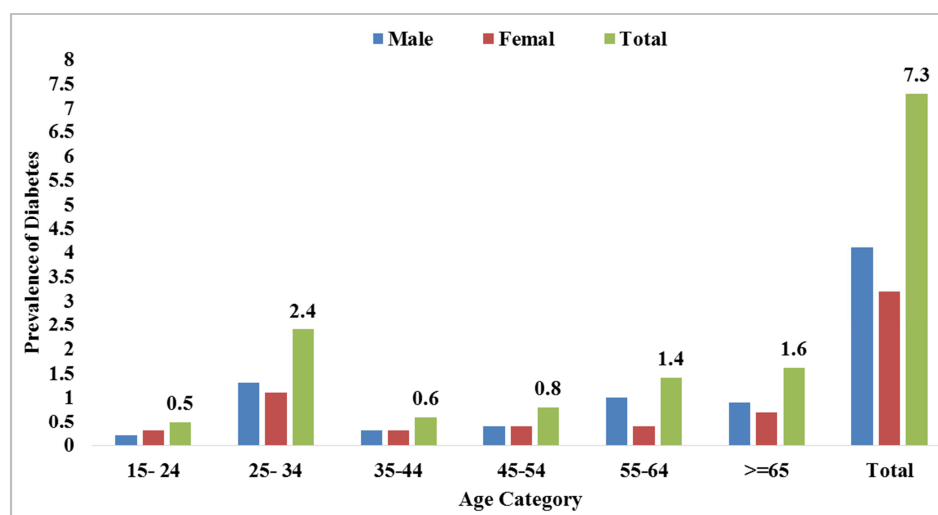


Figure 2. Prevalence of Diabetes Miletus by sex and age category in Bahir Dar town, April 2020.

Associated risk factors for Diabetes Miletus: Simple binary logistic regression analysis was done for the socio-demographic variables: age, sex, educational status, family history of DM, marital status, and the number of hours spent on daily work (Table 6).

Table 6. Estimation of diabetes Miletus and binary logistic regression analysis of socio-demographic factors associated with Diabetes status in study participants (n= 1,525).

Variable	Normal (n=1413)	DM (n=112)	COR (95%CI)	P-Value
Sex				
Female	596	43	1.0	
Male	815	69	0.9 (0.6-1.4)	0.78
Age (yrs)				
<54	1291	64	1.0	
>=54	122	48	8.0 (5.2-12.0)	<0.01*
Education				
Illiterate	206	21	1.7 (0.9-2.8)	0.05
1-6	172	18	1.7 (0.9-3.1)	0.05
7-8	144	19	2.17 (1.3-3.8)	<0.01
Above 9-12	891	54	1.0	
Marital status				
Single	434	25	1.0	
Cur. married	916	77	1.4 (0.9-2.3)	0.11
Cur. unmarried	63	10	2.8 (1.3-6.0)	0.01
FamilyHxDM				
Yes	35	25	11.4 (6.5-19.7)	<0.001*
No	1378	87	1.0	
No. Hrs Spent				
<8hrs	958	72	0.9 (0.6-1.3)	0.445
>8hrs	455	40	1.00	

(*P-Value less than 0.2, DM, Diabetes Miletus, Hx; History; Yrs.; Years, hrs; hours).

Simple binary logistic regression analysis for participants' behavioral characteristics: smoking cigarettes, alcohol, fruit consumption, body mass index, hip circumference, and waist circumference (Table 7).

Table 7. Estimation of diabetes and binary logistic regression analysis of Behavioral and physical factors associated with diabetes status in study participants (n= 1,525).

Variable	Normal (n=1413)	DM (n=112)	COR (95%CI)	P-Value
Smoking Cigarette				
Yes	122	5	1.6 (0.9-2.9)	<0.1*
No	1291	97	1.0	
Heave Alcohol drinking				
Yes	1171	73	0.4 (0.3-0.6)	<0.001*
No	244	39	1.0	

Variable	Normal (n=1413)	DM (n=112)	COR (95%CI)	P-Value
Fruit Consumption				<0.001*
Don't eat /day at all	134	52	9.5 (5.4-16.6)	<0.001
Don't eat every day	814	41	1.2 (0.7-2.1)	0.2
Eat fruit once a day	465	19	1.0	
BMI				<0.001*
<18 kg m ⁻²	323	10	1.0	
18-24.9 kg m ⁻²	922	67	2.3 (1.2-4.60)	<0.01
>=25 kg m ⁻²	168	35	6.7 (3.2-13.9)	<0.001
HC				
Low	1271	93	1.0	
High	142	19	1.8 (1.1-3.1)	0.024*
WC				
Low	1375	97	1.0	
High	38	15	5.6 (2.9-10.5)	<0.001*

(*P-Value less than 0.2, DM Diabetes Miletus, Hx; History; Yrs.; Years).

In simple binary logistic regression analysis, ten variables: Age, family history, educational status, marital status, smoking cigarettes, alcohol drinking, fruit consumption, body mass index, waist circumference, and hip circumference with diabetes Miletus disease were significantly associated among all variables.

The variables that showed a statistically significant association in the bivariable analysis, variables with a p-value less than 0.2, were further analyzed in multivariable logistic regression to adjust for potential confounders and to identify independent factors that affect the outcome. In multivariable logistic regression, variables with a p-value less than 0.05 were considered as independent factors for the outcome in multivariable analysis age, having a family history of DM, BMI, waist circumference and fruit consumption were independent risk factors associated with diabetes Miletus disease in Bahir Dar Town, Amhara Regional State.

Age was a significant variable for diabetes Miletus disease. Thus, individuals aged above 54 years old had 5 times the risk for developing diabetes as compared to those aged <= less than 54 years old, AOR = 5.2; 95% CI (3.2 – 8.4).

Family history of diabetes Miletus was a significant predictor variable for diabetes Miletus disease. Thus,

individuals having a family history of DM had 7 times the risk of developing the disease as compared to individuals who had no family history of DM, AOR = 7.5; 95% CI (4.0 – 14.62).

Fruit consumption was another significant predictor variable for diabetes Miletus disease. Thus, individuals who did not eat fruit at all per day had 10 times the risk of developing diabetes disease as compared to individuals who eat fruit frequently, AOR = 9.6; 95% CI (5.0 – 18.0).

Body mass index was a significant predictor for diabetes Miletus disease. Thus, individuals having a body mass index greater than 25 kgm⁻² had 10 times the risk of developing DM disease as compared to individuals who had BMI less than 18 kgm⁻², AOR = 9.6; 95% CI (4.1 – 22.8).

Waist circumference was a predictor for diabetes Miletus disease. Thus, individuals having high waist circumference had 5 times the risk of developing diabetes Miletus disease as compared to low waist circumference, AOR= 4.9; 95% CI (2.3 – 10.9).

Drinking alcohol was protective against diabetes Miletus disease. Thus, individuals who drank alcohol had 0.3 times more protection from developing diabetes Miletus disease as compared with non-alcohol drinkers, AOR=0.3; 95% CI (0.2– 0.7) (Table 8).

Table 8. Logistic regression analysis for risk factors of Diabetes Mellitus, Bahir Dare 2012 E.

Risk Factors	COR (95%CI)	P-Value	AOR (95%CI)	P-Value
Age (yrs)				
<54	1.0		1.0	
>=54	8.0 (5.2-12.0)	0.00*	5.2 (3.2- 8.4)	0.000**
Education		0.02*		0.6
Illiterate	1.7 (0.9-2.8)	0.05	1.0 (0.6-2.0)	0.8
1-6	1.7 (0.9-3.1)	0.05	1.3 (0.7-2.6)	0.4
7-8	2.17 (1.3-3.8)	0.01	1.4 (0.7-2.7)	0.3
Above 9-12	1.0		1.0	
Marital status		0.03*		0.69
Single	1.0		1.0	
Cur. Married	1.4 (0.9-2.3)	0.11	0.9 (0.5-1.7)	0.9
Cur. unmarried	2.8 (1.3-6.0)	0.01	1.4 (0.5-3.8)	0.5
Family HxDM				
Yes	11.4 (6.5-19.7)	0.001*	7.5 (4.0-14.6)	0.000**
No	1.0		1.0	
Smoking				
Yes	1.6 (0.9-2.9)	0.09*	1.7 (0.9-3.4)	0.09
No	1.0		1.0	

Risk Factors	COR (95%CI)	P-Value	AOR (95%CI)	P-Value
Alcohol drinking				
yes	0.4 (0.3-0.6)	0.001*	0.3 (0.2-0.7)	0.00**
No	1.0		1.0	
Fruit Consumption				
Don't eat /day at all	9.5 (5.4-16.6)	0.001*	9.6 (5.0-18)	0.00**
Eat fruit every day	1.0		1.0	
BMI		0.000*		0.00**
<18 kg m ⁻²	1.0		1.0	
18-24.9 kg m ⁻²	2.3 (1.2-4.60)	0.01*	2.6 (1.2-5.5)	0.01
>=25 kg m ⁻²	6.7 (3.2-13.9)	0.001*	9.6 (4.1-22.8)	0.001
HC				
Low	1.0		1.0	
High	1.8 (1.1-3.1)	0.024*	1.5 (0.8-28)	0.18
WC				
Low	1.0		1.0	
High	5.6 (2.9-10.5)	0.001*	4.9 (2.3-10.9)	0.001**

(*P-Value less than 0.2, ** p value less than 0.05).

4. Discussion

The study was conducted to assess the prevalence and associated factors of diabetes mellitus. The crude prevalence of diabetes Miletus is comparable with most studies. Some of the community-based and facility-based studies are documented as higher than this study [33, 25, 15] and some of the facility- based are documented as lower than this study [10, 17, 18, 34].

The study revealed that the prevalence of diabetes Miletus in Bahir Dar town is higher than the national figure for Ethiopia of 3.2% reported by the International Diabetes Federation (IDF) in the year 2020 [36] and Africa 7.1% conducted in 2014 [3].

This study showed that the prevalence of DM was lower than the study conducted in Nigeria in the Abua district, 2018 which was 8% [14]. Another study conducted in China in 2002 stated that the prevalence of DM was 8% [37], which was higher than the current study. The cross-sectional study conducted in Gonder town in 2012 showed that the prevalence of DM was 5.1% which is lower than the current study [5].

According to this study, the prevalence of DM is lower than the global Diabetes Miletus prevalence of 8.5% in 2014 [3]. and higher than the study conducted in southern nation nationalities peoples Mizan Aman town showed that the prevalence was 6.5% [13]. The discrepancy among results from different studies in different vicinities may be due to differences in sample size, study design, and study period. The current study used random blood glucose levels, which may be less powerful to identify diabetes cases so that the prevalence may be less than the actual burden of the disease.

In this study, BMI was a significant predictor of DM and those obese individuals were at risk as compared with individuals having BMI less than 18 kg.m⁻² which is in line with the study conducted in Gondar town in 2012 [5], the study conducted in East Gojjam in 2016 [25], a study conducted in Mizan Aman town in 2016 [13], study conducted in Kenya 2015 [38] and study conducted in

Nigeria [14]. On the contrary, the study conducted in the Bona district [24],

In this study, participants aged 54 and above were a significant predictor of DM, and those individuals aged 54 and above were at risk of developing DM as compared with participants aged less than 54 years which is in with this study conducted in southern nation nationalities and peoples of Ethiopian region, Mizan Aman town [13], Amhara regional state east Gojjam [25], Somali regional state Jigjig city [35], Tigray regional state Ryder hospital [27] and Nigeria Abuna district [14]. Each study had different strengths and associations with the occurrence of diabetes Miletus, which may be due to the difference in sample size, lifestyle modification, different study areas, different sampling techniques, and time of study conducted.

According to this study, participants who had a family history of DM were a significant predictor of DM, and those individuals having a family history of diabetes Miletus were at risk of developing DM as compared with individuals who had no family history of DM which is in line with the study conducted in Mizan Aman town [13], Ayder hospital [27], Somali jig city [35], Tanzania [39] and Nigeria abuna district [14].

In this study, waist circumference was found to be a significant predictor for DM and those who had high waist circumference individuals were at risk of developing diabetes Miletus disease as compared with participants having low waist circumference which is in line with studies conducted and proved family history as an independent factor for developing diabetes Miletus; Addis Ababa police commission [23], a study conducted in Gilgile Geba [26], a study conducted in Indian among age group above 20 years old [40], South African communities [41] and population survey in china shanghai [42]. On the contrary, a study conducted in Amhara regional state, Dessie town, 2019 showed waist circumference had no association with the development of diabetes Miletus [43]. This discrepancy in different studies is due to different sample size, time of the study, lifestyle differences, and the study population.

In this study, eating the fruit was a significant predictor for

DM and those who didn't eat fruit at all per day individuals were at high risk as compared with individuals who eat fruit frequently which is in line with a study conducted in Jigjig City Somali Region Ethiopia [35], Mizan Aman town, southern nation nationalities peoples region, Ethiopia [13].

There was no significant association with gender variation in the use of diabetes Miletus development in the study population. This is consistent with reports from many studies on diabetes Miletus in different parts of the world, like the Transkei South African study and the 3rd NHANES in the USA [32, 33].

In general, although gender differences have been noted in diabetes prevalence in some communities, there are no consistent patterns seen in the various studies across the globe. The consensus, therefore, is that the differences sometimes observed, may represent the effects of the prevalence of different risk factors in different populations [46].

According to our study, the development of diabetes Miletus is not associated with marital status, educational status, and the number of hours spent in the working area character of participants which is in line with studies documented in different study areas and study periods [9, 25].

Strengths and Limitations of the Study: This study was conducted with a large number of participants with proper sampling strategies which could enhance the representation of the study population. The data was collected using WHO step-wise approach customized questionnaire through trained health workers.

The study has its own limitations; first, it was a cross-sectional study which affects hindering the causal effect. Thus it needs to be done by observation or follow-up to confirm the result we found here with real practice so that it can help to develop strategies for identifying risk factors of diabetes and managing early. The second limitation of the study was being institutional-based, might be affected by selection bias, and the conclusions might not apply to the population at large. Thus, it needs to be done through community-based studies to draw a conclusion from the large community and to reduce the selection bias of the study participants. Activity and substance consumption practices were self-reported which may not be accurate due to recall bias.

5. Conclusion

This study indicated a 7.3% prevalence of diabetes mellitus, which was higher than the projected national prevalence of DM (5.2%) by the international diabetics' federation Association (IDFA). Age 54 years and above, having a family history of diabetes Miletus, high waist circumference, body mass index greater than 25kg m⁻² (Overweight/obese), and low fruit intake was significantly associated with diabetes Miletus disease in Bahir Dar Town, Amhara regional state, Ethiopia. These findings suggest that the government should work on creating a conducive environment for the community to produce or grow and distribute fruits to Bahir Dar Town, the Amhara region

population. Prevention strategies should be taken through the government to prevent diabetes Miletus disease due to low fruit intake, and overweight /obesity in Bahir Dar town communities. Physical activity should be promoted by health care providers to reduce the occurrence of metabolic diseases like DM and others. The health care providers should give health education to the individuals to have frequent screening for those who had a family history of diabetes Miletus and those who are of advanced age.

According to this study, alcohol drinkers were protective from developing the disease, so I strongly suggest that future studies should be conducted on assessing the number of alcohol levels preferable to be consumed and protective against diabetes Miletus.

Article Highlights

Diabetes Miletus is increasingly affecting the urban community.

Having a bad personal lifestyle (way of life) and having a family history of DM were at high risk of Developing DM.

Targeting preventive strategies to modifiable risk factors reduces the prevalence of diabetes Miletus in this area OR our area of study.

Abbreviations

BMI	Body Mass Index
BSC	Bachelor of Science
CI	Confidence Interval
CNCDs	Chronic Non-Communicable Diseases
COR	Crude Odds Ratio
CSA	Central Statistical Agency
DM	Diabetes Miletus
EFETP	Ethiopian Field Epidemiology Training Program
GDP	Gross Domestic Product
IDFA	International Diabetic Federation Atlas
MPH	Master's in Public Health
OR	Odds Ratio
SPSS	Statistical Package for Social Science
TB	Tubercle Bacilli
WHO	World Health Organization
WHR	Waist-to-Hip Ratio

Declarations

Ethical Approval

Ethical approval was obtained from the Institutional Review Board (IRB) of the St. Paul's Hospital Millennium medical college (SPHMMC). Approval was granted by the IRB committee of the university St. Paul's Hospital Millennium medical college.

Consent for Publication

All authors consent for publication. Oral informed consent was obtained from the Participants for publication.

Conflicts of Interests

All the authors do not have any possible conflicts of interest.

Authors Contributions

MB designs the study, analysis it, and writes the manuscript. MA and NT were involved in data entry and data cleaning. AT did a laboratory investigation. TG reviews and comments on the design and manuscript. Finally, all authors reviewed and approved the manuscript.

Availability of Data and Materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Acknowledgements

The authors would like to acknowledge Saint Paulo's Hospital Millennium Medical College (SPHMMC) for providing Technical Assistance for this study. The authors also acknowledge the data collectors and field supervisors for their contribution to this study.

References

- [1] Tizazu G, Anteneh T. Internal Medicine. Produced in collaboration with the Ethiopian Health Training Initiative, The Carter Center, The Ethiopian Ministry of Health, and the Ethiopian Ministry of Education. 2006;
- [2] Chobanian A V., Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL, et al. Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. *Hypertension*. 2003; 42 (6): 1206–52.
- [3] Cataloguing WL. Global Report on Diabetes. Isbn [Internet]. 2016; 978: 6–86. Available from: <http://www.who.int/about/licensing/>
- [4] Forouzanfar MH, Afshin A, Alexander LT, Anderson HR, Bhutta ZA, Biryukov S et al. Global, regional, and national comparative risk assessment of 79 behavioral, environmental and occupational, and metabolic risks or clusters of risks, 1990–2015: a systematic analysis of the Global Burden of Disease Study 2015. *Lancet* [Internet]. 2016 Oct; 388 (10053): 1659–724. Available from: file:///Users/ximeneacarballo/Downloads/IDF_DA_8e-EN-final.pdf
- [5] Abebe SM, Berhane Y, Worku A, Assefa A. Diabetes mellitus in North West Ethiopia: A community-based study. *BMC Public Health* [Internet]. 2014; 14 (1): 1–8. Available from: BMC Public Health.
- [6] Centers for Disease Control and Prevention UD of H and HS. Centers for Disease Control and Prevention. National Diabetes Fact Sheet, 2011. 2011;
- [7] Vinay Kumar, Abul K. Abbas JCA. Robbins and Cotran's Pathological Basis of Disease [Internet]. Vol. 2, Elsevier Health Sciences. 2014. 897–957 p. Available from: <https://www.semanticscholar.org/paper/Robbins-and-Cotran-pathologic-basis-of-disease-Kumar/d04446d9754f21f43ebfda30fb3d5702c29e97d2>
- [8] Uhomibhi PE, The OF, For R, Degree THE, Masters OF. SCHOOL OF GRADUATE STUDIES PREVALENCE AND DETERMINANTS OF DIABETES MELLITUS AND IMPAIRED FASTING GLUCOSE AMONG WORKERS AT THE SPARE PARTS SHARED SCHOOL OF GRADUATE STUDIES PREVALENCE AND DETERMINANTS OF DIABETES MELLITUS AND IMPAIRED FASTING GLUCOSE AMONG. 2003; 1–104.
- [9] Annis AM, Caulder MS, Cook ML, Duquette D. Family History Diabetes, and Other Demographic and Risk Factors Among Participants of the National Health and Nutrition Examination Survey 1999 – 2002. 2005; 2 (2): 1–12.
- [10] Asiiimwe D, Mauti GO, Kiconco R. Prevalence and Risk Factors Associated with Type 2 Diabetes in Elderly Patients Aged 45-80 Years at Kanungu District. *J Diabetes Res*. 2020; 2020.
- [11] WHO. WHO-CHERG Methods and Data Sources for Country-Level Causes of Death 2000 - 2012. 2014;
- [12] Radzeviciene L, Ostrauskas R. Smoking habits and type 2 diabetes mellitus in women. *Women Heal*. 2018; 58 (8): 884–97.
- [13] Aynalem SB, Zeleke AJ. Prevalence of Diabetes Mellitus and Its Risk Factors among Individuals Aged 15 Years and above in Mizan-Aman Town, Southwest Ethiopia, 2016: A Cross-Sectional Study. *Int J Endocrinol*. 2018; 2018.
- [14] Harcourt P, Harcourt P. Risk Factors for Diabetes Mellitus among adult Residents of a Rural District in Southern Nigeria: Implications for Prevention and Control. 2018;
- [15] Bantie GM, Wondaye AA, Arike EB, Melaku MT, Ejigu, ST, Lule A, et al. Prevalence of undiagnosed diabetes mellitus and associated factors among adult residents of Bahir Dar city, northwest Ethiopia: a community-based cross-sectional study. *BMJ Open*. 2019; 9 (10): 1–7.
- [16] Wang R, Zhang P, Li Z, Lv X, Cai H, Gao C, et al. The prevalence of prediabetes and diabetes and their associated factors in Northeast China: a cross-sectional study. *Sci Rep*. 2019; 9 (1): 1–8.
- [17] Tripathy JP, Thakur JS, Jeet G, Chawla S, Jain S, Pal A, et al. Prevalence and risk factors of diabetes in a large community-based study in North India: results from a STEPS survey in Punjab, India. *Diabetol Metab Syndr*. 2017; 9 (1): 1–8.
- [18] Agbogli HK, Annan R. Archives of Clinical and Biomedical Research Prevalence and Risk Factors of Diabetes Mellitus Among the Inhabitants of Kumasi Metropolis. 2017; 1 (4): 224–34.
- [19] Town B, Shoa E, Institutions S, Shoa E. Prevalence of Undiagnosed Diabetes Mellitus and Its Risk Factors in Selected Diabetes & Metabolism Prevalence of Undiagnosed Diabetes Mellitus and its Risk Factors in. 2013; (May 2014).
- [20] Ahmed SM, Mansour M Al. A study on the prevalence of risk factors for diabetes and hypertension among school children in Majmaah, Kingdom of Saudi Arabia, on commercial use. 2017; 6: 14–9.

- [21] Chen G, Xu X, Fan J. Prevalence of and Risk Factors for Type 2 Diabetes Mellitus in Hyperlipidemia in China. 2015; 2476–84.
- [22] Acharya AS, Singh A, Dhiman B. Assessment of Diabetes Risk in an Adult Population Using Indian Diabetes Risk Score in an Urban Resettlement Colony of Delhi. 2017; 65 (March): 46–51.
- [23] Tesfaye T, Shakur B, Shimels T, Firdu N. Prevalence and factors associated with diabetes mellitus and impaired fasting glucose levels among members of the federal police commission residing in Addis Ababa, Ethiopia. BMC Endocr Disord [Internet]. 2016; 16 (1): 1–9. Available from: <http://dx.doi.org/10.1186/s12902-016-0150-6>
- [24] Zekewos A, Loha E, Egeno T, Wubshet K, Merga Z. Prevalence of Diabetes Mellitus and Associated Factors in Southern Ethiopia: A Community-Based Study. Ethiop J Health Sci. 2018; 28 (4): 451–60.
- [25] Wondemagegn AT, Bizuayehu HM, Abie DD, Ayalneh GM, Tiruye TY, Tessema MT. Undiagnosed diabetes mellitus and related factors in East Gojjam (NW Ethiopia) in 2016: A community-based study. J Public health Res. 2017; 6 (1): 18–23.
- [26] Prevalence and risk factors for diabetes mellitus and impaired fasting glucose among adults aged 15–64 years in Gilgel Gibe Field Research Center, southwest Ethiopia, 2013 : through a step-wise approach. 2015; 2 (4): 4–11.
- [27] Ambachew Y, Kahsay S, Tesfay R, Tesfahun L, Amare H, Mehari A. Prevalence of diabetes mellitus among patients visiting medical outpatient department of Ayder referral hospital, Mekelle, Ethiopia : Three years pooled. Int J Pharma Sci Res. 2015; 6 (02): 435–9.
- [28] Arya R, Antonisamy B. Sample Size Estimation in Prevalence Studies. 2012; (May 2014).
- [29] WHO_NCD_NCS_99.2.pdf.
- [30] Hing E, Hall MJ, Xu J. National Hospital Ambulatory Medical Care Survey: 2006 outpatient department summary. Natl Health Stat Report. 2008; (4).
- [31] WHO. DISTRIBUTION : GENERAL Summary Surveillance of risk factors for noncommunicable diseases, The WHO STEPwise approach, Noncommunicable Diseases, and Mental Health. World Heal Organ. 2001;
- [32] Consultation WHOE. Waist Circumference and Waist-Hip Ratio Report of a WHO Expert Consultation. 2008; (December): 8–11.
- [33] Slavin JU M, Lloyd Beate PNG. Health Benefits Of Cassava Karapendalam. www.yadtek.com > Heal > Diet Nutr [Internet]. 2012; 3 (4): 506–16. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3649719/>
- [34] World Health Organization. WHO STEPS Instrument (Core and Expanded) STEPS Instrument Overview. 2012; 18. Available from: www.who.int/CHP/steps
- [35] Abas AH. Prevalence and associated risk factors for type 2 diabetes mellitus among adults (> = 40 years of age) in jigjiga City, Somali region, Eastern Ethiopia. 2019; (April).
- [36] International Diabetes Federation. IDF Diabetes Atlas Ninth [Internet]. Dunia : IDF. 2019. 168 p. Available from: <https://diabetesatlas.org/en/sections/worldwide-toll-of-diabetes.html>
- [37] Hu M, Wan Y, Yu L, Yuan J, Ma Y, Hou B, et al. Prevalence, Awareness and Associated Risk Factors of Diabetes among Adults in Xi ' an China. Sci Rep [Internet]. 2017; (August): 1–9. Available from: <http://dx.doi.org/10.1038/s41598-017-10797-x>
- [38] Mohamed SF, Mwangi M, Mutua MK, Kibachio J, Hussein A, Ndegwa Z, et al. Prevalence and factors associated with pre-diabetes and diabetes mellitus in Kenya : results from a national survey. 2018; 18 (Suppl 3).
- [39] Ruhembe CC, Mosha TCE, Nyaruhucha CNM. Prevalence and awareness of type 2 diabetes mellitus among adult population in Mwanza city, Tanzania. 2014; 16 (2): 1–11.
- [40] Ahmad J, Masoodi M. Ahmad, J Masoodi,. Al Ameen J. [Internet]. 2011; 4: 38–44. Available from: <http://ajms.alameenmedical.org/ArticlePDFs/AJMS4.1.38-44.pdf>
- [41] Risk M. The Prevalence of Metabolic Syndrome and Determination of the Optimal Waist in South African Community. 2011; 34 (October 2010).
- [42] Ruan Y, Mo M, Joss-Moore L, Li YY, Yang Q Di, Shi L, et al. Increased waist circumference and prevalence of type 2 diabetes and hypertension in Chinese adults : two surveys in Shanghai, China. 2013;
- [43] Asmelash D. Prevalence of Diabetes Mellitus, Prediabetes and Its Associated Factors in Dessie Town, Northeast Ethiopia : A Community-Based Study. 2019;
- [44] Health N. Prevalence of Diabetes and Impaired Fasting Glucose in Adults in the U. S. 2006; 29 (6).
- [45] Africa S. SILENCE OF DIABETES LITUS AND IMPAIRED GLUCOSE TOLERANCE IN FACTORY WORKERS FROM. 2001;
- [46] State U. National Diabetes Fact Sheet, 2011; 1–10.