

# Magnitude of undiagnosed diabetes mellitus and associated factors among middle aged urban residents in west Ethiopia.

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## Research Article

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## Abstract

# Background

People die due to biological impairment than chronological aging worldwide. Diabetic mellitus is becoming a public health problem and undiagnosed diabetes is a challenge for health providers. Nevertheless, the prevalence and associated factors of undiagnosed diabetes in west Ethiopia unnoticed at community level.

## Objective

To investigate the magnitude of undiagnosed diabetes (T2DM) and associated factors among middle aged urban residents in west Ethiopia.

## Methods

A community based cross-sectional study was conducted in March 01–30, 2019 on 266 undiagnosed middle aged urban residents. Data were collected using questionnaires, anthropometric measures and biomarkers. Fasting blood glucose  $\geq 126$ mg/dl at morning were taken as diabetes. With SPSS version 24 multivariable logistic regression analysis was applied and associated factors at 95%CI with  $p \leq 0.05$  considered statistically significant.

## Results

The overall prevalence of undiagnosed diabetic mellitus was 7.14% among urban residents in west Ethiopia. Being having sleep apnea, sedentary life, high (waist circumference, waist to height ratio, BMI, triglycerides, and blood pressure) were significantly associated with elevated fasting blood glucose. On multivariable logistic regression analysis: being high BMI four times (AOR: 4.87;  $p = 0.049$ ), elevated blood pressure five times (AOR: 5.22;  $p = 0.005$ ), and sleep apnea ( $p = 0.023$ ) were associated significantly.

## Conclusion

This study revealed undiagnosed diabetes was prevalent and associated to its risk factors in west Ethiopia. Therefore, community based education and early detection were significant to reduce the burden of diabetic mellitus.

## Introduction

Diabetes Mellitus (DM) is one of the four major NCDs causing a high morbidity and mortality globally. DM is a metabolic disorder of multiple etiologies characterized by chronic hyperglycemia induced from defects of insulin secretion and action or both [IDF, 2013].

In long acting elevated blood glucose leads to micro and macro vascular complications [Chawla A, et al, 2016] and it becomes a serious health problem unless early screened [WHO,2014]. Complication from undiagnosed diabetes leads to significant decline in quality of life [Hajifathalian K, et al, 2016] and the risk for premature death [WHO, 2016] which is prevented through early diagnosis of risks.

Globally, the magnitude of diabetes has been increasing among adults; 451 million people living with diabetes as of International diabetes Federation Atlas report in 2017, and projected to tall to 693 million by 2045[Karuranga S, *et al*, 2017]. Residentially base the prevalence of diabetes higher in urban than rural area [Huang Y, *et al*, 2017].

In 2014, about 179.2 million people lived with undiagnosed DM worldwide and African region had the highest percentage compared with others. About 62.3% of the people with the diseases do not know their being affected, and about 13.4 million had undiagnosed DM [Henriksen O, *et al*.2011; Motala A, & Ramaiya K, 2010; Roglic G., 2016].

In Ethiopia, the magnitude of diabetes is increasing; according to the WHO report, the number of cases was 800 000 in 2000, and is rising to an estimated 1.8 million by 2030[Shimels T, *et al*.2016, Yemane T, *et al*.2007]. Evidence from studies conducted in Ethiopia: in Gondar and Bahir dar city were 2.3% and 10.2% individuals lived with undiagnosed DM respectively [Gelaw YA, *et al*.2017; Bantie GM, *et al*. 2019]. Like to other world, study conducted in 2014 in Ethiopia showed, about 1,603,100(75.1%) of populations undiagnosed for diabetes mellitus [IDF, 2013, Beagley J,*et al*, 2014].

However, different factors contributed to risk of diabetes developing; it is not understood by community. Although undiagnosed DM prevalent; it was not addressed well Ethiopia, nothing has been done in community setting. Therefore, this study aimed to assess the magnitude of undiagnosed type two diabetic and its associated factors among middle aged urban residents in west Ethiopia.

## Methods

### Study design, setting and period

A community- based cross- sectional study was conducted in hub of west Ethiopia Town in March 1–30, 2019. The Nekemte is located 328km from Addis Ababa. Administratively, it is divided in to six sub cities. Its altitude ranges from 1960 to 2170 Meters above sea level where as its average annual rain fall is 1854.9mm and the average temperature ranges from 14 °c to 26°c. The total population of the city projection in 2017 is estimated to be 117,819 and of this 51 % (60,088) of them were adults.

### Sample size and techniques

Since there was no prior study at the study site regarding metabolic syndrome, the minimum sample size was calculated using single proportion formula taking prevalence of dependent variable among healthy Ethiopian adults. According to [Girma B, *et al*. 2011], the most common component of metabolic syndrome is abdominal obesity with 19.6% prevalent. So, with margin of error of 5%, a confidence level of 95% and 10% gnawing away, minimum sample of 266 participants.

Adults aged 41–64 years who were eligible to participate in the study and asked to undergo diagnosis and respond questionnaires. While diagnosed and who have been receiving medication for NCDs, pregnant ,lactating, serious mental conditions, bariatric surgery and physically disables will be excluded. To reduce bias, one commune was selected by simple random sampling (Chalalaki), and control one (Burkajato) purposively selected from six sub-cities.

### Measurements

Data were collected using structured self administered questionnaire, and anthropometric measurements were taken from each participant. Fasting blood sugar (FBS) level was determined by samples taken early in the morning and readings of FBS  $\geq$  126 mg/dL were classified as diabetes. Also other biomarkers were collected to assess common associated risk factors of DM.

# Analysis

The data analyzed using SPSS version 24 (IBM corporation, NY, USA). Frequency, percentage and descriptive summaries used to explain the amount of study participants in the analysis. Descriptive statistics were used to summaries and describe various sample characteristics and association between high blood glucose and risk factors. The binary regression computed the crude OR and variables with p values less than 0.2 were entered into multivariable logistic regression model to control potential confounding effects in the model. The strength of associations between independent and outcome variables was assessed using AOR with a 95% CI; p values  $\leq 0.05$  were considered as statistically significant predictors of undiagnosed DM.

## Ethical review and confidentiality

Permission was sought from the Institutional Review Board (IRB), Institute of Health, Jimma University (1 January, Approval No. IHRPGD/596/2019) to conduct the study. The households, which affirmed their willingness to participate in the study, signed a consent form. Confidentiality of the respondents was ensured and each household had its own identification number. Subjects were free to participate in the study without any fear of retribution.

## Results

### Socio-demographic and lifestyles characteristics

Of hundred sixty six undiagnosed participants with age of 41–64 years range were comprised, majority (62.8%) of them were females. The average age of adults in our sample was 52.2 years, participants aged 41–48 years accounted for 54.5%; more than half (54.89%) of the participants were live below poverty threshold ( $< 1.25$ dollar/day). Regarding to the lifestyle behaviors, majority (75.2%) of them live sedentary life, about 40.6% sleep fragmented types, 24.8% had history of alcohol intake, currently 1.1% chewing khat and 2.3% smoking cigarette, the most common self-reported substance use. Besides these almost majority (91 %) of the participants performed low physical activity as compared to standard (Table 1).

Table 1  
Socio-demographic and lifestyle behavioral characteristics of participants in urban residents of west Ethiopia ,2019 (n = 266)

		Undiagnosed DM	
		Present (%), n = 19	Absent (%),n = 247
Sex	Female	12(4.51)	155(58.27)
	Male	7(2.63)	92(34.59)
Age in years	Range from 41–48 years	10(3.7)	135(50.75)
	Range from 49–56 years	5(1.8)	72(27.07)
	Range from 57-64years	4(1.5)	140(52.63)
Educational status	Illiterate	5(1.89)	81(30.45)
	Some school	10(3.78)	109(40.98)
	Diploma	3(1.13)	30(11.28)
	Degree and above	1(0.38)	27(10.15)
Marital status	Unmarried	1(0.38)	12(4.51)
	Married	15(5.64)	163(61.28)
	Widowed	2(0.75)	54(20.30)
	Divorced	1(0.38)	18(6.77)
Daily income	≥ 1.25USD	10(3.78)	110(41.35)
	< 1.25UD	9(3.38)	137(51.50)
Physical activity	Low	18(6.77)	224(84.21)
	Moderate > 120 < 150M'/W	0	13(4.89)
	Vigorous > 150M'/W /3days	1(0.38)	10(3.78)
Smoking	Current	0	6(2.26)
	Former	2(0.75)	19(7.14)
	Never	17(6.39)	222(83.46)
Alcohol consumption	Current	3(1.13)	23(8.65)
	Former	4(1.5)	36(13.53)
	Never	12(4.51)	188(70.68)
Chewing of chat	Current	0	3(1.13)
	Former	2(0.75)	16(6.02)
	Never	17(6.39)	228(85.71)
Healthy diet	Low DD score	13(4.89)	168(63.16)
	Medium DD score	6(2.26)	70(26.32)

	Undiagnosed DM	
	Present (%), n = 19	Absent (%),n = 247
High DD score	0	9(3.38)

*DM: diabetic mellitus, DD: dietary diversity, USD: US dollar,*

## Factors associated with undiagnosed diabetes

The prevalence of diabetes was averagely 7.14% and significantly associated with sleep, sedentary life, WC, waist to height ratio, BMI, blood pressure, TG and HDL on binary analysis. The multivariate logistic regression analysis showed that only sleep, BMI and blood pressure were independently associated with diabetes.

The mean fasting blood glucose level was 99.67 (29.60) mg/dl with (95%CL: 96.12, 103.27;  $p < 0.0001$ ). The prevalence of undiagnosed DM was found to be 6.4% with a fasting blood glucose level  $\geq 126$  mg/dL and 15.8% individuals were live with impaired fasting glucose. The prevalence of diabetes significantly increased with high BMI; diabetes prevalence in participants with high BMI (6.02%) is significantly higher than that in participants with BMI less than  $25 \text{ Kg/m}^2$  (1.13%) by factor of AOR: (4.87 (1.01,23.45),  $P = 0.048$ ). More than half (69.26%) of the study participants have central obesity (high waist circumference), and the prevalence of diabetes is higher in participants with high waist circumference (6.39%) compared to 0.75% of the participants with normal/low waist circumference (AOR = 1.61 (1.14, 18.53),  $P = 0.702$ ), but not significantly associated (Table 2).

In addition, our study revealed those participants who had sleep apnea had 3.47 (OR = 41.37 CI= (1.02, 11.81,  $p = 0.046$ ) times higher chance of having diabetes than normal range of sleeping hours. Being having sleep apnea AOR: (0.19 (0.05, 0.80),  $P = 0.023$ ) and elevated blood pressure greater than 130/85mmHg AOR: (5.22 (1.67, 16.33),  $P = 0.005$ ) were significantly associated with undiagnosed DM (Table 2).

Table 2

Multivariable logistic regression analysis to identify factors associated with undiagnosed diabetes among urban residents of west Ethiopia, 2019 (n = 266)

Variable	Categories	Undiagnosed DM (%)		COR (95% CI)	P-value	AOR (95% CI)	P-value
		Present	Absent				
History of sleep	Has apnea	4(1.5)	88(33.08)	3.47(1.02,11.81)	0.046	0.19(0.05,0.80)	0.023
	Deprived < 6hrs	6(2.26)	102(38.34)	2.68 (1.91,7.93)	0.074	0.35(0.10,1.18)	0.089
	Normal(6-8hrs)	9(3.38)	57(21.43)	1		1	
Sedentary life	yes	12(4.51)	188(70.68)	1.84(1.70,4.94)	0.200	0.80(0.25,2.50)	0.697
	No	7(2.63)	59(21.18)	1		1	
WC (Male/ Female)	≥ 94cm/80cm	17(6.39)	139(52.26)	0.15(0.04,0.67)	0.013	1.61(1.14,18.53)	0.702
	< 94cm/80cm	2(0.75)	108(40.60)	1		1	
Waist to ht ratio	> 0.49/0.50(M/F)	17(6.39)	148(55.64)	5.69(1.29,25.16)	0.022	1.99(1.19,20.88)	0.565
	< 0.49/0.50(M/F)	2(0.75)	99(37.22%)	1		1	
BMI	≥ 25 kg/m <sup>2</sup>	16(6.02)	103(38.72)	0.14(0.04,0.47)	0.002	4.87(1.01,23.45)	0.049
	< 25 kg/m <sup>2</sup>	3(1.13)	144(54.14)	1		1	
Elevated BP	≥ 135/85mmHg	10(3.78)	39(14.66)	0.17(0.07,0.44)	0.000	5.22(1.67,16.33)	0.005
	< 135/85mmHg	9(3.38)	208(78.20)	1		1	
Raised TGs	≥ 150mg/dl	10(3.78)	44(16.54)	5.13(1.97,13.36)	0.001	1.27(0.34,4.80)	0.722
	< 150mg/dl	9(3.38)	203(76.32)	1		1	
HDL low in (mg/dl)	< 40 ,50 for M/F	8(3.01)	43(16.17)	3.45(1.31,9.09)	0.012	0.38(0.11,1.31)	0.123
	> 40 ,50 for M/F	11(4.14)	204(76.79)	1		1	

## Discussion

The current prevalence of T-2DM was 7.14% and slightly higher than the study some urban residents like in Gonder city (5.1%)[ Atlas D, 2015]; and estimated Ethiopian prevalence of DM (5.2%) by IDFA [Atlas D, 2015]; Dessie Town, Northeast Ethiopia (6.8%) [Endris *et al*, 2019]; Mizan-Aman Town, south Ethiopia (6.5%) [Aynalem SB and Zeleke AJ,2016].

In contrary, a study conducted on HIV/AIDS patients taking HAART in Ethiopia showed DM prevalence of as high as 8% has been reported in 2013 [Internat STD Rese &Revi2013, in Jimma reported 15% Impaired Glucose Tolerances [Yemane T. et al, 2007]. Likewise, the prevalence of DM was lower than studies done in North India, Punjab (8.3%)

[Jeet G, *et al*, 2017], Pakistan (26.3%)[ Basit A, *et al*, 2018 ] and in Bangladeshi (9.7%)[ Akter S, 2014]. This difference might be due to variation in socio-demographic and lifestyle behavior factors.

As estimated, diabetes is associated with increasing adults aged  $\geq 40$  years, similarly the magnitude of undiagnosed diabetes significantly high in study participants with age 41–64 years. This is in agreement to previous studies in African countries [Maugendre D. *et al*, 2007; Mbanya et al, 1999]; including Ethiopia [Abebe *et al*,2014; Nigatu T. 2012].

Diabetic patients often have a high prevalence of obstructive sleep apnea (OSA) [Berne C, *et al*. 2001]. Clinical studies have shown an increase in serum glucose in patients with OSA independent of obesity [Lam KS *et al*.2002, Punjabi NM *et al*.2002]. In the present study we observed an independently association between high glucose levels and sleep apnea. The association of sleep disorder and diabetes was found to be statistically significant (P = 0.023).

## Conclusions

In this study we found that the prevalence of undiagnosed diabetic mellitus was 7.14% and it was significantly associated with sleep apnea, high BMI and elevated blood pressure. Therefore, to reduce the magnitude, it is recommended: active screening for early detection of diabetes and face-to-face education would bring significant changes.

## Limitations of the Study

The study is subject to recall bias because of the cross sectional nature and limitation to take large study population.

## Declarations

### Consent for Publication

- Not applicable

### Competing Interests

- We declare that we have no competing interests.

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The authors received no financial support for the publication of the article. All authors made substantial contributions to conception design of the study, data collection, analysis, interpretation and manuscript writing to final approval of the version to be published.

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