

ORIGINAL ARTICLE

MAGNITUDE AND ASSOCIATED FACTORS OF UNDIAGNOSED DIABETES MELLITUS AMONG MID-ADULTHOOD URBAN RESIDENTS OF WEST ETHIOPIA

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ABSTRACT

Introduction: People are more likely to die due to biological impairment than chronological aging. Diabetes is a public health problem, whereby diagnosing proves challenging for health providers. Likewise, the prevalence of undiagnosed diabetes in west Ethiopia is unnoticed.

Aim: To investigate the magnitude and associated factors of undiagnosed diabetes mellitus among middle aged adult urban populations in west Ethiopia.

Methods: A community based cross-sectional study was conducted from 01 March 2019 -August 2019 on 266 undiagnosed middle aged urban residents. Data was collected using questionnaires, anthropometric measurements, and biomarkers as per WHO steps. Fasting blood glucose ≥ 126 mg/dl in the morning was taken as diabetes and $FBS > 100-125$ mg/dl, pre-diabetes (impaired FBS). SPSS version 24 multivariable logistic regression analysis was applied, and associated factors were considered statistically significant at 95%CI with $p < 0.05$.

Results: The overall magnitude of newly diagnosed raised fasting blood sugar was 7.14% among urban residents in west Ethiopia. Of this, 2.25% was had diabetes and the remaining 4.89 % was pre-diabetes. Having a sleep disorder, sedentary lifestyle, increased waist circumference, waist to height ratio, BMI, triglycerides, and blood pressure were significantly associated with elevated fasting blood glucose. On multivariable logistic analysis, having a high BMI and elevated blood pressure were four (AOR: 4.87; $p=0.049$), and five (AOR: 5.22; $p=0.005$) times more associated with diabetes mellitus, respectively. Sleep apnea ($p=0.023$) was also shown to have significant association with diabetes.

Conclusions: This study revealed undiagnosed diabetes was prevalent and associated to common risk factors in west Ethiopia. Therefore, age targeted community-based education and early detection are significant to reduce its burden.

Key words: Undiagnosed diabetes, risks, Middle aged, urban

INTRODUCTION

Diabetes Mellitus (DM) is one of the four major non-communicable diseases (NCDs) causing a high morbidity and mortality, globally. It is a metabolic disorder of multiple etiologies characterized by chronic hyperglycemia induced from defects of insulin secretion and action or both (1).

Long standing elevated blood glucose leads to micro and macro vascular complications (2) and becomes a serious health problem unless early screened (3). Complication from undiagnosed diabetes could lead to significant decline in quality of life (4) and have a higher risk for premature death (5) unless prevented.

Globally, the magnitude of diabetes has been increasing among adults; According to International diabetes Federation Atlas report, as of 2017, there are 451 million people living with diabetes, with projections as tall as 693 million by 2045 (6). Domestically, the prevalence of diabetes is higher in urban than rural areas (7).

In 2014, about 179.2 million people lived with undiagnosed DM worldwide with Africa having the highest percentage compared to other regions; about 62.3% of the people with the diseases do not know the effects, and about 13.4 million were undiagnosed (8; 9; 10).

In Ethiopia, the magnitude of diabetes mellitus is increasing. According to the WHO report, the number of cases documented in 2000 (800,000), is rising and that it would hit an estimated 1.8 million by 2030(11, 12). Evidence from studies conducted in Ethiopia: in Gondar and Bahir Dar city were 2.3% and 10.2% individuals lived with undiagnosed DM, respectively (13, 14). Another study conducted in 2014 in Ethiopia showed, about 1,603,100 people (75.1% of population) were undiagnosed for diabetes mellitus (1, 15).

However, different factors, not quite understood by the community, contributed to risk of diabetes development. Although undiagnosed diabetes is prevalent, it was not addressed well in west Ethiopia. So far, nothing has been done at community level. Therefore, this study aims to investigate the magnitude and associated factors of undiagnosed diabetes among middle aged adult urban residents in west Ethiopia.

METHODS

Study design and setting:

A community-based cross-sectional study was conducted purposively in the hub of western Ethiopian Town, Nekemte, which is located 328km from Addis Ababa. It is divided into

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6 sub cities administratively with an altitude ranging from 1960 to 2170 Meters above sea level. Its average annual rainfall and temperature ranges are 1854.9mm and 14^{oc} to 26^{oc}, respectively. The total population of the city projection in 2017 was estimated to be 117,819, of which 51 % (60,088) of them were adults.

Study period: Study was conducted on 266 people in their mid-adulthood from 1 March 2019-1 August 2019.

Sample size: The minimum sample size was calculated using single proportion formula, by taking the prevalence of abdominal obesity the most common component of metabolic syndrome with 19.6% among healthy Ethiopian adults (16). Hence with a margin of error of 5%, confidence level of 95%, and 10% gnawing away, we had minimum sample of 266 participants.

Sampling techniques: Within decision the appropriate sampling method was identified for specific area and study participants. Accordingly, randomly one commune/kebele was selected by lottery method from six kebeles and one kebele not adjacent to the other was selected purposively. Totally two kebeles were selected. Each study participants were selected through simple random sampling techniques.

Eligibility: Adults aged 40-65 years who were eligible to participate in the study were asked to undergo diagnosis and respond questionnaires to be included in the study. While who were already on medication for NCDs, pregnant, lactating, serious mental conditions, bariatric surgery and physically disabled were excluded.

Measurements: Data was collected using structured self-administered questionnaire, and anthropometric measurements take of each participant. Fasting blood sugar (FBS) level was determined using samples taken early in the morning, with readings ≥ 126 mg/dL being classified as diabetes and 100-125mg/dl, pre-diabetes. In addition, other biomarkers like cholesterol level and blood pressure other biomarkers like cholesterol level and blood pressure were also collected to assess common associated risk factors of diabetes.

Analysis: The data was analyzed using SPSS version 24 (IBM corporation, NY, USA). Frequency, percentage, and descriptive summaries were used to explain the amount of study participants in the analysis. Descriptive statistics was used to summarize and describe various sample characteristics as well as the association between high blood glucose and other 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 and p values ≤ 0.05 were considered statistically significant predictors of undiagnosed DM.

Ethical review and confidentiality:

Permission was sought from the Institutional Review Board (IRB), Institute of Health, Jimma University (Approval No.IHRPGD/596/2019) to conduct this study. The households willing to participate in the study signed 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 coercion.

RESULTS

Socio-demographic and lifestyle characteristics: Out of two hundred sixty-six undiagnosed participants, majority (62.8%) of them were females and more than half (54.89%) were living below poverty threshold (< 1.25 dollar/day). The average age of adults in our study was 52.2 years, with participants aged 41-48 years accounting for 54.5%. Regarding lifestyle, majority (75.2%) of them live a sedentary life, and about 40.6% have fragmented sleep types, 24.8% had history of alcohol intake, 1.1% are current khat chewers and 2.3% smoke cigarette. (Table 1).

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

		Raised fasting blood sugar	
		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)
	High DD score	0	9(3.38)

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

Prevalence of undiagnosed Diabetes:

The prevalence of pre-diabetes (impaired fasting blood glucose) and diabetes of the participants was 4.89 % and 2.25 %, respectively (Table 2). Participants with elevated fasting blood sugar (FBS>126mg/dl) were linked to Wollega University Specialized Hospital chronic care unit for further diagnosis and follow up.

Table2. Description of fasting blood sugar by sex, west Ethiopia, 2019 (n=266)

		Pre-diabetes	
		(%)	Diabetes (%)
Variables		FBS >100-	FBS>126mg/
Sex	Female	8(3.01)	4(1.5)
	Male	5(1.88)	2(0.75)
Total		4.89	2.25

Factors associated with undiagnosed diabetes mellitus: From 266 participants, 7.14 % were newly diagnosed, of which the actual diabetes accounts for 2.25%. The magnitude of diabetes is shown to significantly be associated with sleep disorders, sedentary lifestyle, increased: waist circumference, waist to height ratio, BMI, blood pressure, TG and HDL on binary analysis. The multivariate logistic regression analysis showed that only sleep related problems, increased BMI and high blood pressure were independently associated with diabetes (Table 3).

The mean fasting blood glucose level was 99.7(29.60 mg/dl) with (95%CL: 96.12, 103.27; $p < 0.0001$). The prevalence of diabetes significantly increased with high BMI (6%) when compared to participants with BMI $< 25 \text{ Kg/m}^2$ (1.1%) by a factor of AOR: (4.87 (1.01, 23.45), $P = 0.048$). More than half (69.3 %) of the study participants have central obesity (high waist circumference).

The prevalence of diabetes was shown to be higher in these participants (7.14 %) as compared to 0.8 % of the participants with normal/low waist circumference (AOR=1.61 (1.14, 18.53), $P = 0.702$). However, it was shown not to be significantly associated (Table 3).

In addition, our study revealed those participants with sleep apnea had 3.5 (OR=41.37 CI= (1.02, 11.81, $p = 0.046$) times higher chance of having diabetes than those with normal range of sleeping hours. Participants with sleep apnea AOR: (0.19 (0.05, 0.80), $P = 0.023$) and elevated blood pressure $> 130/85 \text{ mmHg}$ AOR: (5.22 (1.67, 16.33), $P = 0.005$) were significantly associated with undiagnosed DM (Table 3).

Table 3: Multivariate analysis to identify factors associated with undiagnosed diabetes among urban residents

Variable	Categories	Undiagnosed Diabetes		COR (95% CI)	P-		
		Present (%)	Absent (%)		value	AOR (95% CI)	P-value
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)	$\geq 94 \text{ cm}/80 \text{ cm}$	17(6.39)	139(52.26)	0.15(0.04,0.67)	0.013	1.61(1.14,18.53)	0.702
	$< 94 \text{ cm}/80 \text{ cm}$	2(0.75)	108(40.60)	1	1		
Waist to ht. ratio (M/F)	$> 0.49/0.50 \text{ (M/F)}$	17(6.39)	148(55.64)	5.69(1.29,25.16)	0.022	1.99(1.19,20.88)	0.565
	$< 0.49/0.50 \text{ (M/F)}$	2(0.75)	99(37.22%)	1	1		
BMI	$\geq 25 \text{ kg/m}^2$	16(6.02)	103(38.72)	0.14(0.04,0.47)	0.002	4.87(1.01,23.45)	0.049
	$< 25 \text{ kg/m}^2$	3(1.13)	144(54.14)	1	1		
Elevated BP	$\geq 135/85 \text{ mmHg}$	10(3.78)	39(14.66)	0.17(0.07,0.44)	0.000	5.22(1.67,16.33)	0.005
	$< 135/85 \text{ mmHg}$	9(3.38)	208(78.20)	1	1		
Raised Triglycer- ides	$\geq 150 \text{ mg/dl}$	10(3.78)	44(16.54)	5.13(1.97,13.36)	0.001	1.27(0.34,4.80)	0.722
	$< 150 \text{ mg/dl}$	9(3.38)	203(76.32)	1	1		
HDL low in (mg/dl)	$< 40, 50 \text{ for M/F}$	8(3.01)	43(16.17)	3.45(1.31,9.09)	0.012	0.38(0.11,1.31)	0.123
	$> 40, 50 \text{ for M/F}$	11(4.14)	204(76.79)	1	1		

DISCUSSION

The current magnitude of diabetes mellitus is 7.14%. This result is slightly higher than the estimated Ethiopian prevalence of DM by IDFA (5.2%) (17), and studies conducted on some urban residents of Ethiopia like Gonder city (5.1%) (17), Dessie Town (6.8%), (18), Mizan-Aman Town (6.5%) (19), and in Hosana, south Ethiopia (5.7%) (20).

Contrary to the above comparison, the magnitude of undiagnosed diabetes is low when compared with a study conducted on 2013 on HIV/AIDS patients taking HAART in Ethiopia (8%) (21), whereas, in Jimma town 15% had Impaired Glucose Tolerances (12). Likewise, the prevalence of undiagnosed DM was lower than studies done in North India, Punjab (8.3%)

(22), Pakistan (26.3%) (23), Bangladeshi (9.7%) (24) and previous studies in African Countries (25,26, 27,28.) This difference might be due to variations in socio-demographic and lifestyle behavior factors. Different scholars agree that a sleep disorder is highly associated with diabetes. For instance, diabetic patients often have a high prevalence of obstructive sleep apnea (OSA) (29). Clinical studies have shown an increase in serum glucose in patients with OSA, independent of obesity (30, 31). In this study, we observed an independent association ($P = 0.023$) between high fasting blood glucose and sleep apnea.

CONCLUSIONS

The magnitude of undiagnosed diabetes mellitus among adult urban residents was found to be high. On multivariate analysis it was shown that having a high body mass index, sleep disorder and elevated blood pressure were significantly associated

with diabetes mellitus. Therefore, age targeted community-based education on early detection and prevention of diabetes, as well as its complications are significant to save adult life.

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Competing Interest:

All the authors declare that they have neither financial nor non-financial competing interests.

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