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PREVALENCE OF DIAGNOSED AND NEWLY DIAGNOSED DIABETES MELLITUS AND ITS RELATED FACTORS IN EAST WOLLEGA ZONE, WEST ETHIOPIA

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ABSTRACT

Background: Currently the chronic illness status primarily the status of diabetes mellitus and its related complications are become a rapidly appearing significant public health problems especially in developing countries like Ethiopia. Thus knowing its level urge to design appropriate strategic interventions targeted at decreasing the burden of this existing problem. **Objective:** To assess prevalence of diagnosed and newly diagnosed diabetes mellitus and its related factors in east Wollega zone, West Ethiopia. **Methods:** A community based cross-sectional study was conducted in east Wollega from March 1 to May 30, 2016. About 576 planned study participants were selected using multi stage sampling method. Pretested interviewer administered structured questionnaire were used for this study. **Results:** The overall prevalence of diabetes mellitus in the study area was 16.4%. More than half (52.9%) of recognized diabetics were not diagnosed before the study. The prevalence was higher among urban (17.7%) residents than those rural (14.4%) inhabitants. Low physical activity level (AOR=3.412, 95%CI=1.318, 8.83), sedentary behavior for 4 and more hours (AOR=2.334, 95%CI=1.051, 5.18), diabetes family history (AOR=2.846, 95%CI=1.072, 7.552) and older age participants (AOR=4.978, 95%CI=1.205, 20.56) were significantly associated with the occurrence of diabetes mellitus among the study participants. **Conclusions:** In general the findings of the present study revealed that the magnitude of diabetes mellitus in the study area is higher and more importantly a relative larger proportion of identified diabetic patients were not diagnosed prior to this study; thus urge special attention. The odds of diabetes mellitus was significantly higher among those participants with; diabetes family history, older age group, low physical activity level and sitting behavior for 4 and more hours. Thus to minimize diabetes mellitus associated trauma, structured efforts of concerned local administrative body as well as organizations working on diabetes is necessarily to provide early therapeutic service as well as creating and increasing awareness on how to control blood glucose level in the study area.

KEYWORDS: Diabetes mellitus, Ethiopia, east Wollega zone.

INTRODUCTION

Diabetes is a lifelong condition that causes a person's blood sugar level to become excessively high, which if left untreated, can lead to severe complications such as heart disease, stroke, sight damage and kidney failure.[1] The amount of sugar in the blood is controlled by insulin, a hormone produced by the pancreas. When food is digested and enters the bloodstream, insulin moves glucose out of the blood and into cells, where it is broken down to produce energy. People are becoming at increased risk of diabetes when the body is unable to break down glucose into energy either because there is not enough insulin, or the insulin in the body does not work efficiently.[1]

According to the most recent 2016 data, an estimated 422 million adults are living with diabetes mellitus globally.[2] The figure showed, diabetes prevalence is increasing rapidly; as previous 2013 estimates from the International Diabetes Federation put the number at 381 million people having diabetes.[3] The number is projected to almost double by 2030.[4]

The highest increase in occurrence of diabetes mellitus is more in low- and middle-income countries[2] like Ethiopia. The increase in incidence in developing countries is due to the trend of urbanization and lifestyle changes, including increasingly sedentary lifestyles, less physically demanding work and the global nutrition transition, marked by increased intake of foods that are high energy-dense but nutrient-poor often high in sugar and saturated fats, sometimes stated to as the Western pattern diet.[2,4] Studies have tried to predict, increasing sedentary behaviors along with rapidly growing urbanization and dietary changes would increase the prevalence of diabetes mellitus by threefold in the next 25 years.[5,6]

Diabetes would hurt the different parts of human body like; heart, blood vessels, eyes, kidneys, and nerves from time to time. Approximately 50%[7] of people with diabetes would pass away mainly due to cardiovascular associated complication. One percent of global blindness can be attributed to diabetes.[8] Diabetic complications grow into very severe form when cases are not early identified and begin management services.

In spite of this burden of the disease diabetes very little studies are conducted in Ethiopia in general and there is no any previous study conducted in the current study area in particular. Thus the main objective of the current study was to estimate prevalence of diagnosed and newly diagnosed diabetes mellitus and to identify factors related to diabetes mellitus among inhabitants of east Wollega zone, West Ethiopia in 2016. The finding of this study is thus, would enable as a base line evidence for further study in the area. The study would also enable to design appropriate intervention strategies targeted at decreasing the magnitude and thereby associated morbidities and mortality of the problem, diabetes in the area.

4. METHODS AND MATERIALS

Study settings and populations

The current work was conducted using cross sectional community based study design in east Wollega, west Ethiopia from March 1 to May 30, 2016. All permanent residents (living in the study area 6 months or above) who are aged above 15 years were eligible to be included the study. The sample size for the study was calculated using single population proportion determination formula based on the assumption of 95% confidence interval, 5% margin of error, 1.5 design effect and using 50% estimated prevalence because no prior study in the study area. As a result, the final calculated sample size for this study was 576. A multistage random sampling approach was employed to select study participants in the study area. First, representative Kebeles (smallest administrative units in Ethiopia) in the zone were selected by lottery method. Then from the selected Kebeles households were selected by systematic random sampling method. At last, in those households having more than one eligible participants only one was selected by lottery method.

Data collection tools and procedures

Data was collected by using pretested structured questionnaire through house to house visit by interview. The questionnaire utilized for data collection was a translated into local language version and it was included questions that was suggested in literature as possible risk factors of diabetes which includes; socio-demographic and economic characteristics, behavioral characteristics, previous history of different chronic illness. For laboratory data, fasting blood glucose was measured as per the WHO recommendations.[9] Early in the morning before participants took their breakfast, peripheral blood samples on the ring finger was punctured and collected. Plasma glucose levels were then measured using the glucose oxidase-6 phosphate dehydrogenase method.[10] Participants were classified as having diabetes mellitus when they had fasting glucose levels > 126mg/dl which were confirmed by repeating the test on another day.[9] Weight and height were measured by using calibrated instruments through standardized procedures. Weights were measured with participants in light clothing and without wearing shoe and results were recorded to the nearest 0.1 kg. Similarly the height of study participants were measured while subjects were stand erect with bare feet and results were recorded to the nearest .0.1 cm. After that, body mass index (BMI) was considered as the weight of study participants in kilograms divided by height square in meters. The field study groups were laboratory technicians, supervisors as well as principal investigator and co-investigators. Three days intensive training were given for the data collectors and supervisors mainly by the principal investigator. To assure the quality of data supervision were on daily bases and only correctly complete questionnaires were collected from data collectors by principal investigator.

Data processing and analysis

Each questionnaire was given a code and double entered in to Epi Data version 3.1 statistical package and exported to SPSS 20.0 statistical package for performing descriptive and inferential analysis. Before running the multiple logistic regressions assumption of multi-co linearity was checked using Pearson correlation, tolerance/variance inflation factor. Bi-nominal logistic regressions was used to calculate the uni-variate and multivariate adjusted odds ratio and to determine independent predictors of dependent variable. In multi-variate logistic regressions model, only those variables which was associated with dependent variable with p-value < 0.2 in uni-variate analysis, biologically important and not collinear was used. Finally, the findings were declared statistically significant at $P < 0.05$.

The proposal of this research finding was approved by Wollega university ethical review committee. Permission was also obtained from the concerned bodies of East Wollega zone. Verbal informed consent was obtained

from study participants to get permission to participate in the study. Participants were informed as they had a full right to quit to participate in the study at any time of collection procedures. Study participants who have identified as having DM was referred to the nearby health institutions by data collectors for further dealing and actions.

5. RESULTS

The present study achieved the response rate of about 98%. About 322 (60.8%) of the study participants were residing in urban area. Among the total study participants 271 (51.1%) were male and 259 (48.9%) were female which makes sex ratio of 1.05. The mean age of study participants were about 38 years with SD of ±17.21 and about 287 (54.2%) fell in age group 20-39 years. Out of the total study participants 340 (64.2%) were currently married, 154 (29.1%) had no formal education, 191 (36%) had diploma and above certificate, 281 (53%) had monthly household income of less than 1700 ETB and about 72 (13.6%) had BMI greater or equal to 25 (table.1).

Among the study participants about 7.5% reported family history of diabetes mellitus, 5.6% had history of delivered baby that weighs more than 4 kg, 6.6% reported smoking practices, 45.1% reported current drinking practices of alcohol, 38.7% had no practices of eating fruits and vegetable, more than half (59%) reported involvement in low level of physical activity and around 48% have reported sitting behavior for 4 and more hours per day (table 2).

Table 1: Socio-demographic and economic characteristics of the study participants by diabetic status, west Ethiopia, 2016.

Variables and coding categories	Diabetic status		Total, n (%)
	Diabetic case, n (%)	Non-diabetic case, n (%)	
Area of residence (n=530)			
Urban	57 (17.7%)	265 (82.3%)	322 (60.8%)
Rural	30 (14.4%)	178 (85.6%)	208 (39.2%)
Sex of participants(n=530)			
Male	40 (14.8%)	231 (85.2%)	271 (51.1%)
Female	47 (18.1%)	212 (81.9%)	259 (48.9%)
Age group of participants (years) (n=530)			
15-19	0	50 (100%)	50 (9.4%)
20-29	21 (12.6%)	146 (87.4%)	167 (31.5%)
30-39	23 (19.2%)	97 (80.8%)	120 (22.6%)
40-49	19 (26.0%)	54 (74.0%)	73 (13.8)
50-59	10 (33.3%)	20 (66.7%)	30 (5.7%)
>=60	14 (15.6%)	76 (84.4%)	90 (16.98%)
Marital status (n=530)			
Currently married	68 (20.0%)	272 (80.0%)	340 (64.2%)
Never married	8 (6.0%)	125 (94.0%)	133 (25.1%)
Divorced	5 (16.1%)	26 (83.9%)	31 (5.85%)
Widowed	6 (23.1%)	20 (76.9%)	26 (4.91%)
Education level (n=530)			
No formal education	21 (13.6%)	133 (86.4%)	154 (29.1%)
Primary education	17 (18.5%)	75 (81.5%)	92 (17.4%)
Secondary education	17 (18.3%)	76 (81.7%)	93 (17.5%)
Diploma and above	32 (16.8%)	159 (83.2%)	191 (36.0%)
Monthly household income (ETB) (n=501)			
<1700	42 (14.9%)	239 (85.1%)	281 (53.0%)
>=1700	43 (19.5%)	177 (80.5%)	220 (41.5%)
Body mass index (kg/m^2) (n=530)			
<18	6 (14.6%)	35 (85.4%)	41 (7.74%)
18-24	67 (16.1%)	350 (83.9%)	417 (78.7%)
>=25	14 (19.4%)	58 (80.6%)	72 (13.6%)

Table 2: Past history and health behaviors of study participants by diabetic status, west Ethiopia, 2016.

Variables and coding categories	Diabetic status		Total, n (%)
	Diabetic case, n (%)	Non-diabetic case, n (%)	
Diabetes family history (n=521)			
Yes	17 (43.6%)	22 (56.4%)	39 (7.5%)
No	70 (14.5%)	412 (85.5%)	482 (92.5%)
History of gestational diabetes (n=409)			
Yes	6	0	6
No	70 (17.4%)	333 (82.6%)	403 (98.5%)
History of having baby weighing >4kg at birth (n=396)			
Yes	12 (54.5%)	10 (45.5%)	22 (5.6%)
No	62 (16.6%)	312 (83.4%)	374 (94.4%)
Current smoking (n=530)			
Yes	6 (17.1%)	29 (82.9%)	35 (6.6%)
No	81 (16.4%)	414 (83.6%)	495 (93.4%)
Current alcohol drinking (n=530)			
Yes	30 (12.6%)	209 (87.4%)	239 (45.1%)
No	57 (19.6%)	234 (80.4%)	291 (54.9%)
Frequency of eating fruits and vegetables per week (n=530)			
Not consuming	29 (14.1%)	176 (85.9%)	205 (38.7%)
1-3 times	41 (17.8%)	189 (82.2%)	230 (43.4%)
4-7 times	17 (17.9%)	78 (82.1%)	95 (17.9)
Physical activity level in a typical week (n=316)			
Low	39 (21.1%)	146 (78.9%)	185 (58.5%)
Moderate	9 (7.8%)	106 (92.2%)	115 (36.4%)
High	4 (25.0%)	12 (75.0%)	16 (5.1%)
Sedentary behavior (n=527)			
<240 minutes per day	36 (13.0%)	240 (87.0%)	276 (52.4%)
>=240 minutes per day	50 (19.9%)	201 (80.1%)	251 (47.6)

Prevalence of diagnosed and newly diagnosed diabetes mellitus

The overall prevalence of diabetes mellitus in the study area was 16.4%. Higher proportion (52.9%) of identified diabetic patients were not diagnosed before the study. The prevalence was 14.4% [95%CI=9.1, 18.6] in rural area of which 14% was among men participants and 14.9% was among female participants. In urban area the prevalence was 17.7% [95%CI=14, 22.3] among which 15.3% was men and 19.8% was women participants (figure 1). The study found that, in urban area the prevalence of diabetes mellitus was relatively decreased as the age of the participants increased with the highest prevalence occurred among participants aged 30-39 years. In contrary, in rural areas the prevalence of diagnosed and newly diagnosed diabetes mellitus was relatively increased as the age of the participants increased with the highest prevalence occurred among those aged 60 years and above (figure 2).

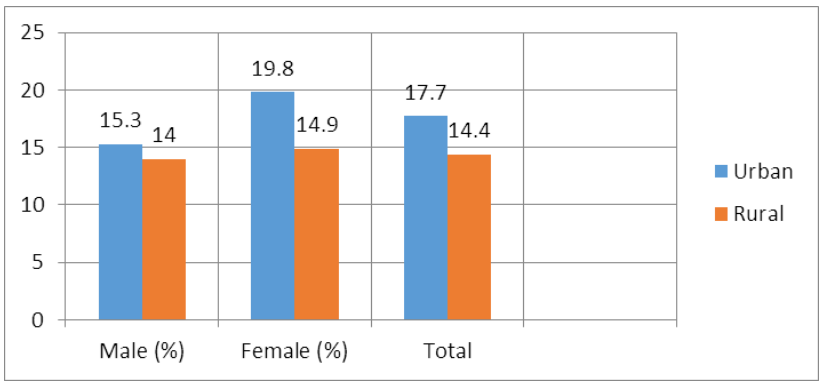

Figure 1: Prevalence of diabetes mellitus by residence and sex, west Ethiopia, 2016.

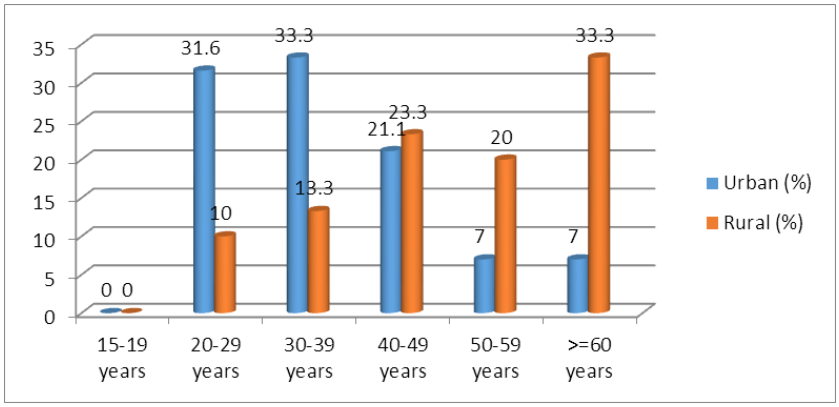

Figure 2: Prevalence of diabetes mellitus by residence and age group, west Ethiopia, 2016.

In this study among male sex study participants aged above 35 years, the prevalence of undiagnosed diabetes mellitus has showed an increased fashion as age of the participant's increased. On the other hand as the age of those female study participants aged above 35 years has increased, the prevalence of undiagnosed diabetes mellitus showed decreased state (figure 3).

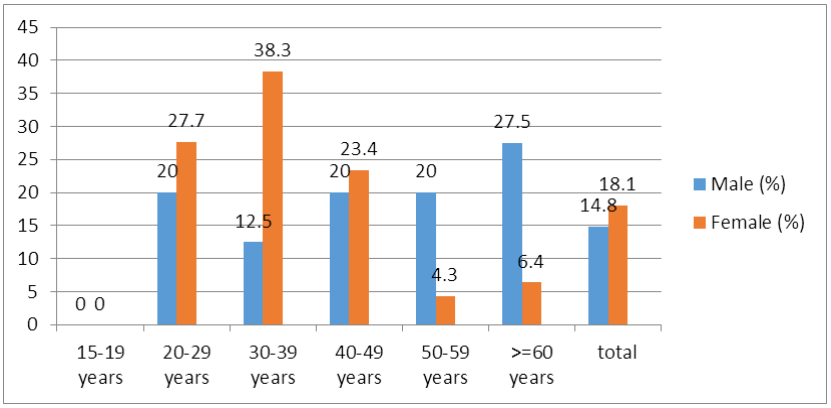

Figure 3: Prevalence of diabetes mellitus by sex and age group, west Ethiopia, 2016

Factors associated with diagnosed and newly diagnosed diabetes Mellitus

Bivariate and multivariate logistic regression analysis result found age of the participants, marital status, diabetes family history, history of participants having baby weighing greater than 4 kg at birth, current alcohol drinking status, physical activity status and sedentary behavior condition were among the factors that showed significant association with the occurrence of diabetes mellitus.

The occurrence of diabetes mellitus was about 3.2 times higher (AOR=3.19, 95%CI=1.10, 9.23) among study participants aged 30-39 years, about 5 times higher (AOR=4.99, 95%CI=1.55, 16.04) among study participants aged 40-49 years, about 8 times higher (AOR=7.76, 95%CI=1.68, 35.90) among those aged 50-59 years and about 5 times higher (AOR=4.98, 95%CI=1.21, 20.56) among those study participants aged greater or equal to 60 years compared to those participants aged less than or equal to 29 years. The occurrence of diabetes was about 4 times higher (COR=3.91, 95%CI=1.82, 8.37) among currently married participants and about 4 times higher (COR=3.74 95%CI=1.41, 9.87) among divorced/widowed study participants compared to those never married participants. The risk of diabetes was about 3 times higher (AOR=2.85 95%CI=1.07, 7.55) among those participants having history of diabetes mellitus in 1st degree relatives compared to those having no family history. The occurrence of diabetes mellitus was about 6 times higher (COR=6.04 95%CI=2.59, 14.59) in those respondents with history of having baby weighing greater than 4kg at birth compared to those without the history. The study also found, the occurrence of diabetes mellitus was about 41% less likely (COR=.59, 95%CI=.37, .95) in those who have drinking practices of alcohol compared to those who didn't have drinking practices. Respondents with low physical activity status had about 3 times at increased risk of diabetes (AOR=3.41, 95%CI=1.32, 8.83) compared to those participants having moderate to high physical activity state. Participants with sedentary behavior for greater and equal to 4 hours were about 2 times at increased risk diabetes (AOR=2.33 95%CI=1.05, 5.18) compared to those having sedentary behavior for less than 4 hours (table 3).

Table 3: Bivariate and multivariate logistic regression analysis result that showed factors associated with diabetes among inhabitants of east Wollega, west Ethiopia, 2016.

Variables	Coding categories	COR (95%CI)	AOR (95%CI)
Area of residence	Urban	1.28 (.789, 2.07)	.56 (.237, 1.33)
	Rural	1	1
Age group of participants (years)	<=29	1	1
	30-39	2.2 (1.27, 4.26)*	3.19 (1.10, 9.23)*
	40-49	3.28 (1.65, 6.55)**	4.99 (1.55, 16.04)*
	50-59	4.67 (1.93, 11.28)**	7.76 (1.68, 35.90)*
	>=60	1.72 (.832, 3.55)	4.98 (1.21, 20.56)*
Marital status	Currently married	3.91 (1.82, 8.37)**	2.12 (.65, 6.86)
	Divorced/ Widowed	3.74 (1.41, 9.87)*	1.50 (.36, 7.61)
	Never married	1	1
Diabetes family history	Yes	4.55 (2.30, 8.99)**	2.85 (1.07, 7.55)*
	No	1	1
History of having baby weighing >4kg at birth	Yes	6.04 **(**2.59, 14.59)**	2.55 (.53, 12.36)
	No	1	1
Current smoking	Yes	1.06 (.43, 2.63)	.68 (.15, 3.12)
	No	1	1
Current alcohol drinking	Yes	.59 (.37, .95)*	.546 (.22, 1.35)
	No	1	1
Physical activity level in a typical week	Low	3.15 (1.5, 6.77)**	3.41 (1.32, 8.83)*
	Moderate	3.93(1.05, 14.70)*	3.71 (.79, 17.46)
	High	1	1
Sedentary behavior	<240 minutes per day	1	1
	>=240 minutes per day	1.66 (1.04, 2.65)*	2.33 (1.05, 5.18)*

*=p<0.05, **=p<0.005

6. DISCUSSION

The overall prevalence of diabetes mellitus were found to be higher than earlier local studies conducted in Gondar, north west Ethiopia[11] and in Bishoftu town, east Ethiopia.[12] This may be attributed to difference in study area which implies different in culture, beliefs, religion, Ethnicity of study participants.

The occurrence of undiagnosed diabetes mellitus significantly increases with increasing age of the participants. The risk was significantly higher among older age group participants compared to younger age groups which is in line with previous local study conducted elsewhere.[11] This is probably because people tend to exercise less, loss muscle mass and gain weight as they get older. As known the more fatty tissue people have, the more resistant their cells become to insulin.

The study found that study participants with physical inactivity were at significantly increased risk of diabetes mellitus which is consistent with previous studies conducted elsewhere.[11,13] This may be due to the fact that physical activity helps one to control his/her weight, use up glucose as energy and make once cells more sensitive to insulin.

Respondents with history of diabetes among 1st degree relatives were at increased risk of undiagnosed diabetes mellitus that is supported by previous studies.[11,14] This might be attributed to genetics of diabetes. In addition lifestyle choices tend to run in the family. Sedentary parents tend to have sedentary children. Parents with unhealthy eating habits are likely to pass them on to the next generation. Moreover genetics play a big part in determining weight.

The odds of undiagnosed diabetes among participants with history of having babies greater than 4kg birth weight were significantly higher compared to those who didn't have the history. This is due to the fact that the most probable causes of large babies are high blood sugar level. When maternal blood sugar is high, more glucose which the baby's favorite for growth is available to the fetus. The pancreas of the fetus senses the high glucose levels and produces more insulin in an attempt to use this glucose and converts the extra glucose to fat. The combination of high blood glucose levels from the mother and high insulin levels in the fetus results in large deposits of fat which causes the fetus to grow excessively large.

Alcohol consumption significantly decreases the risk of undiagnosed diabetes which is in line with previous studies conducted elsewhere.[11] This may be attributed to the fact that consumption of alcohol will cause blood sugar level to fall down. This study might have the following limitations. As the study is cross sectional in nature it doesn't show temporal relationships. In addition, it can provide a chance for interviewer bias as the study is interviewer based.

7. CONCLUSIONS AND RECOMMENDATIONS

In general the findings of the present study revealed that the magnitude of diabetes mellitus in the study area is higher and more importantly a relative larger proportion of identified diabetic patients were not diagnosed prior to this study; thus urge special attention. The odds of diabetes mellitus was significantly higher among those participants with; diabetes family history, older age group, low physical activity level and sitting behavior for 4 and more hours. Thus to minimize diabetes mellitus associated trauma, structured efforts of concerned local administrative body as well as organizations working on diabetes is necessarily to provide early therapeutic service as well as creating and increasing awareness on how to control blood glucose level in the study area. In addition, doing daily physical activity among inhabitants of the study area is suggested.

Consent for publication
Not applicable

Competing interest
The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTION

Amsalu Taye Wondemagegn: principal investigator involved in conception, designing and writing of the proposal, data collection, data entry, analysis, interpretation of the data, prepare the manuscript.

Habtamu Mellie Bizuayehu: involved in conception, designing and writing of the proposal, data entry, analysis and preparation of the manuscript.

Melese Chego Cheme: involved in revising the proposal, data collection, analysis and interpretation of data as well as manuscript preparation.

Emiru Adeba Gerbi: involved in revising the proposal, data collection, analysis and interpretation of data as well as manuscript preparation.

Hylemariam Mihiretie Mengist: involved in revising the proposal, data collection, analysis and interpretation of data as well as manuscript preparation.

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