



## RESEARCH ARTICLE

### MAGNITUDE AND DETERMINANTS OF DIABETES MELLITUS AMONG PEOPLE LIVING WITH HIV IN DESSIE REFERRAL HOSPITAL, NORTH EAST ETHIOPIA

<sup>1</sup>Wondwossen Yimam, <sup>2</sup>Shambel Wedajo and <sup>3,\*</sup>Prema Kumara

<sup>1</sup>School of Nursing and Midwifery, College of Medicine and Health Sciences, Wollo University, Dessie-Ethiopia

<sup>2</sup>Department of Public health, College of Medicine and Health Sciences, Wollo University, Dessie-Ethiopia

<sup>3</sup>Department of Comprehensive Nursing, College of Medicine and Health Sciences, Wollo University, Dessie-Ethiopia

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#### ABSTRACT

**Background:** At the moment, people living with Human Immuno Virus (HIV) are also at increased risk of developing non communicable diseases. Antiretroviral therapy (ART) use has resulted in increasing survival and ageing among HIV-infected persons and an accompanying rise in non communicable disease co-morbidities including diabetes.

**Objectives:** To assess the magnitude and determinants of diabetes among people living with HIV in Dessie Referral Hospital, Dessie town, North East Ethiopia, June 2017.

**Methods:** Institutional based cross sectional study was carried for a total of 355 HIV infected individuals who were on ART selected using systematic sampling method and data were collected using exit interview from diabetes patients.

**Results:** Out of 355 HIV infected individuals who were on ART, 6.5% had confirmed diabetes. Having sedentary work activity [AOR= 2.7, 95% CI ;( 1.1-6.3)], age greater than 35 year [AOR= 2.4, 95%CI ;( 1.3-5.94) and being overweight [AOR= 2.4, 95% CI, (1.1-6.2)] were positively associated with the development of diabetes.

**Conclusion and Recommendation:** Generally this study shows that a significant number of HIV infected individual affected by diabetes as co morbidity. So that ART clinicians should screen ART clients for diabetes and counsel their clients for life style modifications such as regular exercise and obesity reduction.

#### INTRODUCTION

Globally, non communicable diseases (NCDs) are the leading causes of morbidity, hospital admission and death, those disease kill 38 million people each year, of which almost three quarters (28 million) of NCD deaths occur in low and middle income countries and sixteen million NCD deaths occur before the age of 70; 82% of these "premature" deaths occurred in low and middle income countries (Diabetes mellitus Integrancy coordinating committee, 2011; Ethiopian Public Health Association, 2012; WHO, 2015). Diabetes is a metabolic disorder in which the body is unable to appropriately regulate the level of sugar, specifically glucose, in the blood, either by poor sensitivity to the protein insulin, or due to inadequate production of insulin by the pancreas. There are two types of diabetes mellitus namely, Type 1 DM and Type 2 DM, of which type 2 diabetes accounts for 90-95% of all diabetes cases (Diabetes mellitus Integrancy coordinating committee, 2011; United *et al.*, 2012). According to World Health Organization (WHO) and International diabetes federation 2015 report shows that 415 million people worldwide have diabetes.

Of this Africa account 14.2 million and this number is likely to more than double by 2030. Our country Ethiopia in 2015 there were 1.33 million diabetes cases (2.9 % of them were adult population) and one million expected undiagnosed DM cases (Ethiopian Public Health Association, 2012; WHO, 2015; Dawson *et al.*, 2013; Haregu *et al.*, 2014). Similarly in 2015, there were 1.3 million deaths globally due to diabetes, this number seems low but it is a major risk factor for other causes of death including the major non communicable disease like cardiovascular disease, kidney failure and has a high attributable burden of disability like lower limb amputation, blindness (WHO, 2015). Almost 80% of diabetes deaths occur in low and middle-income countries and half of diabetes deaths occur in people under the age of 70 years; 55% of diabetes deaths are in women. WHO projects that deaths due to diabetes will increase by more than 50% in the next 10 years without urgent action (WHO, 2015; Dawson *et al.*, 2013). According to WHO 2014 country profile report shows that in Ethiopia NCDs estimated 30 % ( 691,000) out of total death. Of which DM account 10% death in male and 20% female death (Haregu *et al.*, 2014). People with diabetes have an increased risk of developing a number of serious health problems since in long run diabetes damages nearly every organ system in the body. People with diabetes are at increased risk of heart disease and heart attacks, stroke, high blood pressure, kidney failure,

\*Corresponding author: Prem Kumar,  
Department of Comprehensive Nursing, College of Medicine and Health Sciences, Wollo University, Dessie-Ethiopia.

blindness, nerve pain and other neurologic problems, limb amputation, chronic wounds and skin ulcers, gum disease, sleep apnea, erectile dysfunction, and bladder, gastrointestinal and pregnancy-related problems and it contributes a major cause of hospital admission (Diabetes mellitus Intergency coordinating committee, 2011; WHO, 2015; Dawson *et al.*, 2013). Diabetes an emerging public health problem in Ethiopia which have serious consequence besides its mortality and morbidity, it had serious consequence poverty reduction initiatives, particularly by cutting productivity/premature death and drain family resource associated with health care cost. In generally DM would be major threat for socio economic and nation development. In low-resource settings, health care costs for chronic care can quickly drain household resources, driving families into poverty (WHO, 2010; Abebe *et al.*, 2016).

According to WHO 2011 report global economic burden of NCD, cost of illness for DM account 5000\$ billion (in 2010) would rise up to 745\$ billion in 2030. A study done in Ethiopia, Addis Ababa showed that 459 birr was cost in average per month (Dawson *et al.*, 2013). Occurrence diabetes mellitus are driven by multiple forces that include some socio-cultural practices, harmful alcohol use, unhealthy diet, rapid unplanned urbanization, and the globalization of unhealthy lifestyles. However, those factors are not well addressed in Ethiopians local context like eating of fatty foods or being obese considered as normal or acceptable by society norms and rapid increment of substance use and alcoholism (World Economic Forum and THE Harvard School of public health, 2011; WHO, 2010). There for it requires prompt research in halting multi dimension effect of diabetes by identifying factors which contribute for the occurrence of DM in local context; this is also one of the GTP 2 strategic direction of ministry of health (Mutede *et al.*, 2015).

### Objectives

- To determine the magnitude of diabetes among people living with Human Immuno Virus (HIV)
- To assess determinate factor of diabetes among people living with Human Immuno Virus (HIV)

## MATERIALS AND METHODS

### Research design

Institution based cross sectional study design was employed

### Setting and sampling

The study was carried out at Dessie referral hospital, which is found in Dessie Town, north East Ethiopia. Systematic sampling technique was used to select patients (adults > 18 years) from ART clinic. Using ART registration book sampling frame was made by excluding new ART clients. Then the required study subjects were selected using systematic sampling method from the list of ART register in every K<sup>th</sup> interval. The first subject was selected by using lottery method. The required sample size was determined using Epi Info statistical software version 7.2, single population proportion formula by taking 50% proportion of diabetes mellitus among HIV positive individuals who started ART and 95% level of confidence, 5% marginal error and which yield 384 study subjects.

### Description of the tool

The tool is divided into mainly four parts

**Part-A:** Socio-demographic variables

**Part-B:** Behavioral factors

**Part-C:** Physical measures

**Part-D:** HIV/AIDS and ART related factors

### Content validity

Data collection was carried out by using structured exit interview questionnaire. The questionnaire was prepared by ART trainers and adult health specialists in English language and then translated into Amharic (local language). The data were collected by two data collectors for one month duration. To insure the quality of the data, one day training was given for data collectors on the objective of the study, the questionnaire and extent of explanations, and the way of keep the privacy and confidentiality. Further, inspection for completeness of questionnaires was carried out by principal investigators during the field work.

### Pilot study

Pilot study was conducted in Woldiya Hospital with 5% of the sample size before the main study and necessary correction was made.

### Measurement

Clients who had random blood sugar (RBS) test greater than or equal to 200 mg/dl (>11.1 mmol) and show sign and symptom of diabetes mellitus diagnosed as having diabetes mellitus. Otherwise clients considered as have no diabetes mellitus.

### Data collection procedure

Ethical clearance was obtained from Research Ethical Review committee of Wollo University, College Medicine and Health Sciences research. Further ethical issue was secured from Dessie referral hospital medical director office and ART clinic. For any of the eligible study participant the purpose, benefits, confidential nature, discomforts (spent time for interview) and right of withdrawal or stop filling the questioner was described and discussed with each participant. Only those who were willing to take part in the study and gave a written consent were included in the study.

### Statistical analysis

The collected data were analyzed by Epi Data version 3.1 software and SPSS version 23. To explain the study population in relation to relevant variables descriptive statistics like frequency distribution table, graph and summery measures were computed. Further, to identify statistically significant associated factors, first bivariate binary logistic regression analysis was made for each independent variable to outcome variable separately. And those variables having P-value  $\leq 0.3$  in bivariate were imported to multivariate binary logistic regressions. In multivariate binary logistic regressions those variables P-value < 0.05 were considered as statistically significant variable and presented with 95%CI and AOR and P value.

## RESULTS

### Socio-demographic characteristics

In this study out of 384 subjects proposed to study 355 subjects give a complete data which gives 92.4% response rate. Regarding magnitude, only twenty three (6.5 %) participants had diabetes. Among 355 respondents, 219 (61.7%) were females. Concerning residence distribution of respondents, about 230 participants (64.8%) were from urban residence. The majorities (55.2%) of participants were less or equal to 35 year old. Similarly, 133 (37.5%) participants were not formally educated and of whom 15(11.3%) participants had diabetes. Regarding marital status and occupation of respondents, 250(70.4%) and 160 (45%) participants were married and private workers respectively (Table 1).

**Table 1. Socio-demographic characteristics of study participants who had follow up in ART room in Dessie Referral Hospital, 2017**

Study variables	Frequency	Percent	Diabetes status	
			No	percent
Sex				
- Male	219	61.7	20	9.1
- Female	136	48.3	3	2.2
Residence				
- Urban	230	64.8	14	6.1
- Rural	125	35.2	9	7.2
Age in year				
- <35 yr	196	55.2	8	4.1
- >35yr	159	44.8	15	9.4
Educational status				
- Not formally educated	133	37.5	10	7.5
- Primary school	99	27.9	8	8.0
- Secondary school	72	20.3	1	41.3
- Above secondary	51	14.3	4	7.8
Ethnicity				
- Amhara	337	94.9	23	6.8
- Others	18	5.1	0	0
Religion				
- Orthodox	149	42	9	6
- Muslim	185	52	14	7.5
- Others	21	6	0	0
Marital status				
- Single	54	15.2	2	3.7
- Married	250	70.4	21	8.4
- Divorced	24	6.8	0	0
- Widowed	27	7.6	0	0
Occupation				
- Unemployed	18	5.3	7	38
- Private work	160	45	2	1.25
- Farmer	14	3.9	0	0
- House wife	71	20.3	3	4.2
- Government employee	35	9.8	7	2
- Merchant	56	15.7	4	7.1

### Behavioral factors

Regarding unhealthy behavioral characteristics of respondents, 62 (17.5%) and 79 (22.3%) of participants were drank alcohol and chew chat respectively. Similarly, about 80 (22.5%) and 57 (16.1%) participants were not ate fruit regularly and ate meat products respectively. Out of 57 participants who ate meat products regularly, 10(17.5%) had diabetes and similarly about 342(96.3%) participants used saturated oil for cooking (Table 2)

### Physical measurements

About 36 (10.1 %) participants were overweight (BMI >25Kg/m<sup>2</sup>) and of them 6(2.3%) participants had diabetes.

Eighty six (33.2%) participants were not mostly movable in their daily activity and of those 9(5.6%) participants had diabetes. Concerning annual health screening and counseling service from health care providers, about 326 (91.8%) and 234 (65.9%) participants had at least one times annual health checkup and got counseling on avoiding Chat and alcohol respectively (Table 3).

**Table 2. Behavioral factors/measurement of HIV positive individual who had follow up in ART room Dessie Referral Hospital, 2017**

Study variables	Frequency	Percent	Diabetes status	
			No	percent
Smoking cigarette currently				
- yes	9	2.5	2	22.2
- No	346	97.5	21	6.0
Drinking Alcohol currently				
- yes	62	17.5	3	4.8
- No	293	82.5	20	6.8
Chewing kchat currently?				
- Yes	79	22.3	2	2.5
- No	279	77.7	21	7.5
Did you eat fruit regularly?				
- Yes	275	77.5	18	6.5
- No	80	22.5	5	6.25
Commonly/daily taken food item				
- Legume Product	201	56.6	13	6.4
- Meat products	57	16.1	10	17.5
- Fruit and vegetable	97	27.3	0	0
Commonly used cooked oil				
- Yes	342	96.3	20	5.8
- No	13	3.7	3	23
- Unsaturated				

**Table 4. HIV/AIDS and ART related variables among HIV positive individual who attended ART room in Dessie Referral Hospital, 2017**

Study variables	Frequency	Percent	Diabetes status	
			No	percent
Conducted regular exercise				
- yes	237	66.8	10	15.4
- No	118	33.2	13	7.6
Type of work in relation to exercise (Mostly)				
- Movable	269	75.7	14	17.4
- Not movable	86	24.3	9	5.6
Do you conduct annual health screening?				
- Yes	326	91.8	20	21.1
- No	29	8.2	3	1.9
Body Mass Index (BMI)				
- Overweight	36	10.1	6	2.3
- Not overweight	320	89.9	17	20.7
Type of counseling you got from health professionals? (multiple answer possible)				
- Salt reduction	18	9.8	3	8.5
- Weight reduction	234	5	8	44.4
- Voiding chat and Alcohol	83	65.9	7	2.9
- To do regular exercise		23.3	5	6.0

### HIV/AIDS and ART related characters

Regarding participant profile about HIV/AIDS condition and ART, about 96 (27%) participants had taken antiretroviral therapy (ART) for more than five years. Concerning current CD4 count and virus delectability with in serum, about 222 (62.5%) and 265 (74.6%) participants had CD4 count less than 500 cells per mm<sup>3</sup> and detectable virus with in their blood respectively. Most of study participants are taking TDF/3TC/EFV and had WHO clinical stage 3 (Table 4)

**Table 4. HIV/AIDS and ART related variables among HIV positive individual who attended ART room in Dessie Referral Hospital, 2017**

Study variables	Frequency	Percent
Duration on ART		
- <5 yr	259	73
- >5 yr	96	27
Current CD4 count		
- < 500 cells per mm <sup>3</sup>	222	62.5
- >500 cells per mm <sup>3</sup>	133	37.5
Viral load		
- Detectable	265	74.6
- Undetectable	90	25.4
Current regimen of ART		
- 1c	14	3.9
- 1d	99	27.9
- 1e	224	63
- 1f	18	5.1
WHO clinical staging		
- Stage 1	9	2.5
- Stage 2	67	18.9
- Stage 3	189	53.2
- Stage 4	45	12.7

**Table 5. Bivariate and multivariate binary logistic regression analysis on factors associated with Diabetes status among HIV positive individuals who attended their ART in Dessie Referral Hospital, 2017**

Significant variables	Diabetes Mellitus(DM) status		COR (95%CI)	AOR (95%CI)	P-value
	DM	No DM			
Age of respondents					
-< 35 year	8 (4.1%)	188 (95.9%)	1	1	
-> 35 year	15 (9.4%)	144 (90.6%)	2.4(1.0- 5.3)	2.41(1.3-5.94)	0.05
Do you have regular exercise?					
-No	13 (13.0%)	105(89%)	2.8(1.3-7.9)	2.63 (1.1-6.3)	<
-Yes	10 (4.2%)	227(95.8%)	1	1	0.039*
Body Mass Index (BMI)					
-Overweight	6 (16.7%)	30 (83.3%)	3.5 (1.2-7.5)	2.4 (1.1 - 6.2)	0.029*
-Not Overweight	17(5.3 %)	302(94.7%)	1	1	

\*(p < 0.05)

**Factors associated with Diabetes status**

Variables with P-value < 0.30 from bi-variate analysis were entered in the multivariable logistic analysis and there were significant associations between regular exercise and body mass index with diabetes among HIV positive subjects. In the multivariable logistic analysis, HIV positive subjects who had regular exercise were 2.6 times (AOR = 2.6, CI=1.1, 6.3) less likely to have diabetes as compared to HIV positive subjects who had no regular exercise. HIV positive subjects who were overweight were 2.4 times (AOR = 2.4, CI = 1.1, 6.2) more likely to have diabetes as compared to not overweight counterparts but there were no significant associations with the majority of determinant factors and diabetes in this study subjects (Table 5).

**DISCUSSION**

This study showed that the overall magnitude of diabetes mellitus among ART clients was 6.5 percent. Similarly a study done in Gondar hospital (Ethiopia) showed that the overall prevalence of diabetes among HIV infected individual was 8% (95% CI 5.5% to 10.5%) (Abebe, 2016). Whereas another studies done in Tanzania & Zimbabwe among ART patients showed that the magnitudes of diabetes were 4.2% and 4.3 % respectively (Magodoro *et al.*, 2016; Kagaruki *et al.*, 2014). This finding is in contrast with other study conducted in Senegal that has revealed 14.5 % of ART clients had diabetes (Diouf *et al.*, 2012). This difference in magnitude of diabetes could be explained by their due difference in health care

settings, patient loads and socioeconomic conditions, ethnic and genetic differences, culture and societal system and health promotion intervention differences among different countries. The present study result revealed that, HIV positive participants who had regular exercise were 2.6 times (AOR = 2.6, CI=1.1, 6.3) less likely to have diabetes as compared to HIV positive patients who had no regular exercise. Similarly, age greater than or equal to 35 yr old HIV positive clinets were 2.41 times more likely to have diabetes as compared with age less than 35year. HIV positive participants who were overweight were 2.4 times (AOR = 2.4, CI = 1.1, 6.2) more likely to have diabetes as compared to their non overweight counterparts. Study done in Tanzania also showed that overweight/obesity, and abnormal waist circumferences were predictors among clients on ART to develop diabetes. Another study done in Senegal on prevalence and associated factor of diabetes among ART clients showed that long duration of ART (≥119 months), older age, higher body mass index (BMI), and higher levels of total cholesterol were associated with higher risks of diabetes. Having diabetes with relation to obesity and sedentary life style could be due to the resistance to utilization of insulin by the body after excess fat deposit. Thus, ART health workers shall encourage their ART clients to actively participate in regular exercise.

**Conclusion**

This study revealed that the prevalence of diabetes mellitus among ART client was high. Obesity, old age and exercise

were more prevalent risk factors among clients on ART to have diabetes in this study subjects.

### Recommendation

Based on these findings, we recommend strengthening of health interventions on health education and awareness creation on the importance of having regular exercise and weight reduction to prevent the occurrence of diabetes for ART clients. Moreover, regular monitoring and early screening of diabetes shall be integrated at ART room to properly manage diabetes and its unwanted complications. However, additional research is needed to further investigate the potential relationship with among other extraneous variables.

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### Conflict of interest

The authors declare that they have no competing interests.

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