Prevalence of prediabetes in HIV-1 infected adults receiving antiretroviral therapy in Addis Ababa, Ethiopia.

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Abstract

Background: Prediabetes is a substantial risk factor for developing type-2 diabetes mellitus and its sequel, which include heart disease, stroke, nephropathy and retinopathy. Apart from the genetic and lifestyle risk factors, antiretroviral drugs aggravate the predisposition. Thus, detecting this condition can allow for the provision of better care for HIV infected patients.

Objective: The aim of the study was to determine the prevalence of prediabetes in HIV-1 infected patients on antiretroviral therapy.

Method: A cross sectional study was conducted in HIV-1 infected patients enrolled in ART program in a tertiary hospital ART clinic in Addis Ababa.

Result: A total of 134 subjects taking HAART were included in the study. 61 (45.5%) were males and 73(54.5%) were females. The age of the participants range from 20-69 with a median of 40 years. The median duration of HAART intake was 58 months. The prevalence of prediabetes was found to be 22.4%. Among the total study subjects, 19.4% of them had overweight. 50.5% of males and 41% females had a WHR of ≥0.90 and ≥0.85, respectively indicating a high prevalence of central obesity and future risk of cardiovascular problem among this group.

Conclusion: Pre-diabetes is common in HIV-1-infected patients receiving ART; putting this group at substantial risk of developing type 2 diabetes and cardiovascular disease.

Key words: Prediabetes, HIV-1, ART, overweight

Background

Pre-diabetes is a medical condition in which the blood glucose level is higher than the normal value but not high enough to meet the criteria for the diagnosis of diabetes mellitus [1]. It is characterized by fasting plasma glucose level of 5.6 – 6.9 mmol/l and/or plasma glucose level of 7.8 - 11.0 mmol/l two hours after a 75g oral glucose load.

Prediabetes produces no symptoms but it is a substantial risk factor for developing type 2 diabetes mellitus and its sequel, which include heart disease, stroke, nephropathy and retinopathy [2-6]. It has been estimated that a pre-diabetic person is 5 to 15 times more likely to develop type 2 diabetes mellitus compared to a person with normal blood glucose levels [7, 8]. Global reports show that an estimated 280 million people had pre-diabetes by 2011 - a figure that is expected to rise to 398 million by 2030. In sub - saharan Africa the number currently is at 32.8 million and this is expected to rise to 63.2% million by 2030 [9]. Moreover, Current estimates indicate that up to 70% of pre-diabetic subjects eventually get full blown diabetes mellitus.

Since the late nineties, studies on HIV-infected individuals have reported a wide spectrum of metabolic alterations associated with Highly Active Antiretroviral therapy (HAART); including changes in glucose homeostasis and fat redistribution [10–12]. As the lifespan of HIV- infected individuals have been prolonged, due to a decline in HIV- associated morbidity and mortality on account of HAART [13,14], such metabolic imbalances could affect the long term prognosis due to progression of insulin resistance to type 2 diabetes mellitus (DM) and subsequent risk of end organ disease. Lifestyle modification including weight control, exercise, smoking cessation, and pharmacological therapy have benefits in these patients [15].

Although the magnitude of diabetes mellitus is well recognized in human immunodeficiency virus (HIV) infected patients on HAART; the extent of prediabetes in this population has been little studied. Therefore, this study was aimed to determine the prevalence of pre-diabetes in HIV-1 infected patients on antiretroviral therapy.

Methodology

Study design and study subjects

A cross sectional study was conducted on 134 HIV-1 infected patients receiving combined antiretroviral therapy in a tertiary referral Hospital in Addis Ababa, Ethiopia. Patients were enrolled into the study if they were voluntary, aged over 18 years and took antiretroviral therapy for at least three months. Patients were not included in the study if they have confirmed diagnosis of diabetes mellitus prior to starting ART or if they were non adherent to ART. Voluntary patients who have been using either hypoglycemic or hyperglycemic drugs were also excluded from the study.

Patients who satisfied the criteria were informed of the study and its details, following which a consent form was signed. The demographic details were collected from each patient and the type and duration of combined antiretroviral therapy from their medication chart. Subsequent to this, anthropometric measurements were taken. After an overnight fast, 5 ml of venous blood sample was drawn from each patient using vacuum system on SST test tube. Specimen was allowed to clot for 30 minutes and serum separated by centrifuging at 3500 rpm for 5 minutes. Then after serum samples were aliquoted in to nunc tubes aseptically by using a micropipette with disposable sterile blue tips. Finally serum glucose was analyzed immediately using Humalyzer 3000.

Quality assurance

To ensure the quality of data, structured questionnaire was prepared by referring previous studies. Then, the required data was collected by interviewing the patients and from their medication chart. Anthropometric measurements were taken in accordance with the WHO guideline. Blood samples were collected aseptically, processed properly and analyzed in accordance with the International Federation of Clinical Chemistry (IFCC) criteria. Finally data was analyzed employing appropriate statistical treatment following proper entry and cleaning.

Ethical consideration

The study was commenced after securing ethical clearance. All patients were provided with details of the aims of the study and the procedure following enrollment. A consent form was signed by all patients who were included in the study. Moreover, confidentiality was strictly maintained throughout the study period.

Statistical analysis

Data was entered in to excel sheet, cleaned, exported to and analyzed using SPSS version 16.

Result

A total of 134 subjects taking HAART were included in the study. 61 (45.5%) were males and 73(54.5%) were females. The age of the participants range from 20-69 with a median of 40 years. All of the participants were on HAART whereby half of them on first line regimen (NNRTI based) and the other half on second line regimen (PI based). The median duration of HAART intake was 58 months (table 1).

Table1. Summary of base line characteristics of the study subjects

Variable	Frequency	Median	proportion (%)
Sex, n (%)			
Male	61	NA	45.5
Female	73	NA	54.5
Age (years)			
Median (1^{st} - 3^{rd} quartile)	NA	40(34 - 48)	NA
ART Regimen			
PI based	67	NA	50
NNRTI based	67	NA	50
Duration of ART (months)			
Median (1^{st} - 3^{rd} quartile)	NA	58(29 - 69)	NA
Family history of Diabetes Mellitus, n (%)	19	NA	14

NA- not applicable

The mean fasting plasma glucose level of the study participants was 5.3 mmol/l (± 1.45). Out of the total 134 subjects; 95 of them had a plasma glucose level of less than 5.6 mmol/l. 30 (22.4%) and 9 (6.7%) of the participants had a plasma glucose level of 5.6 - 6.9mmol/l and greater than 6.9 mmol/l falling in the prediabetic and diabetic range, respectively (figure 1). With regard to family history of diabetes mellitus, 7/30 (23.3%) and

2/9 (22.2%) of the patients having prediabetes and diabetes respectively had family history as compared to only 10/95 (10.5%) in those with plasma glucose level of less than 5.6 mmol/l.

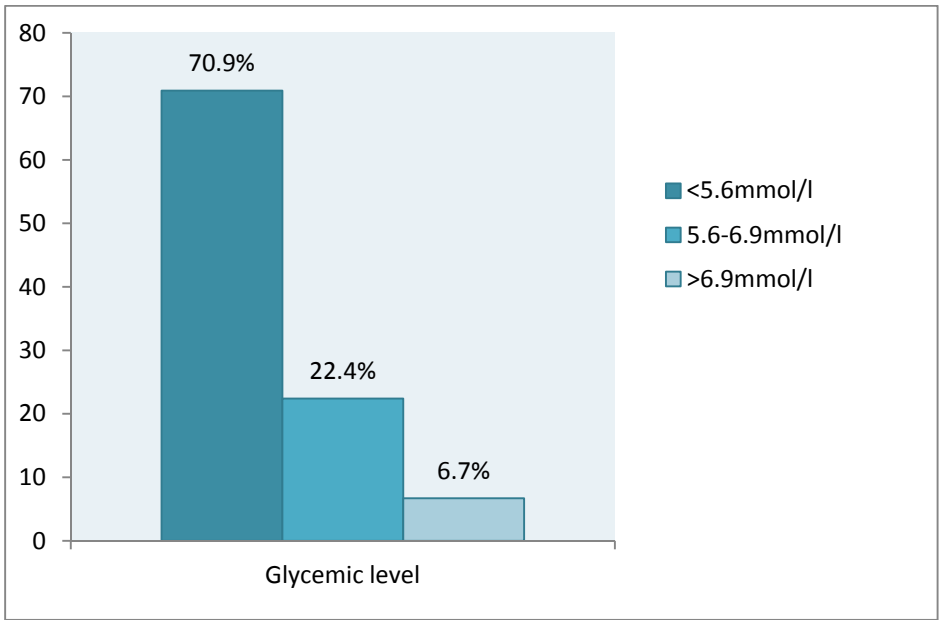

Figure 1: Proportion of HIV-1 patients with regard to their glycemic level

The mean BMI and WHR of the participants were 21.5 (± 3.31) and 0.9 (± 0.06), respectively. Among the total study subjects, 19.4% of them were in the overweight category (fig. 2) and 50.5% of males and 41% females had a WHR of ≥0.90 and ≥0.85, respectively indicating a high prevalence of central obesity and future risk of cardiovascular problem among these group.

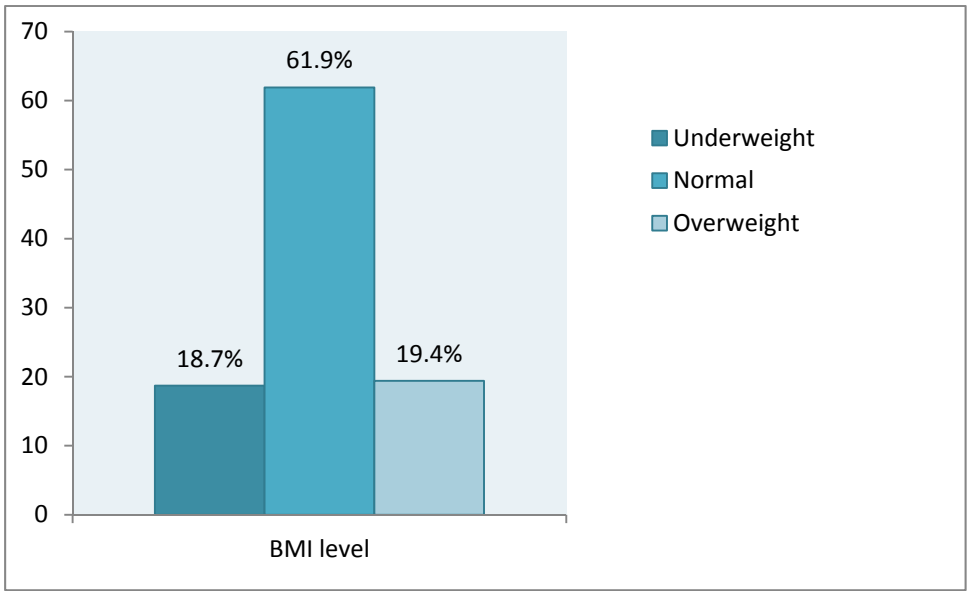

Figure 2**:** proportion of HIV-1 patients with under, normal and overweight.

Correlation of plasma glucose with age and anthropometric indices

According to spearman's correlation coefficient, plasma glucose level had shown a non significant positive correlation with WHR and statistically significant positive correlation with age and BMI, r_s=0.1879 (p= 0.031) and r_s= 0.187(p =0.03), respectively.

Discussion

This study was conducted with the aim of determining the prevalence of prediabetes in HIV-1 infected patients taking combined antiretroviral therapy. It has revealed that the overall prevalence of prediabetes is 22.4%. Our finding is concordant with the 24.4% prevalence of prediabetes reported for HIV-1 patients on antiretroviral

therapy in Kenya [16]. Moreover, our result is almost similar with the 27.5% and 31.2% prevalence of prediabetes observed in HIV-1 infected patients taking combined antiretroviral therapy in Thailand and kameroon, respectively [17,18].

In the current study, 19.4% of the study subjects had overweight. Our finding is lower than the overweight indicated in Brazilian study, 34.2% [19]. 50.5% of males and 41% females had a waist- to- hip ratio of ≥ 0.90 and ≥ 0.85, respectively signifying a high prevalence of central obesity and future risk of cardiovascular problem among this group. The prevalence of abdominal obesity observed in our study is much higher than that reported from a related study in Brazil, 8.3% [19]. However, it is almost similar with prevalence of central obesity obtained in Cameroonian study, 40.5% [18].

In the present study, plasma glucose level had shown a non- statistically significant positive correlation with WHR and statistically significant positive correlation with age and BMI, $r_s= 0.188$ ($p= 0.031$) and $r_s= 0.187$($p = 0.03$), respectively. Though the reported correlation here in our study doesn't guarantee causation, a study conducted in Denmark indicated that HIV - infected individuals showed an increasing risk of DM with increasing age and BMI [20].

Conclusion and recommendation

Pre-diabetes is common in HIV-1 infected patients receiving ART; thus provision of advice on lifestyle modification should be integral part of their management.

Competing interest

There is no conflict of interest with regard to this research article.

Author's contribution

HA designed the study, performed the overall activity of data collection, entry, analysis and manuscript drafting.

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