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Original Research Article

INCIDENCE OF DIABETES AMONG PEOPLE LIVING WITH HIV: A CLOSER LOOK

Charu Jha[1], Ranweer[2], Jyotsna Chandwani[3], Geeta Parihar[4], Sunil Kumar Gothwal[5], Vijaylatha Rastogi[4]

[1]PG Resident, Department of Microbiology, JLN Medical College, Ajmer, Rajasthan, India
[2]Associate Professor, Department of Microbiology, Govt. Medical College, Banswara, Rajasthan, India
[3]Assistant Professor, Department of Microbiology, JLN Medical College, Ajmer, Rajasthan, India
[4]Senior Professor, Department of Microbiology, JLN Medical College, Ajmer, Rajasthan, India
[5]Assistant Professor, Department of Medicine, JLN Medical College, Ajmer, Rajasthan, India

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Corresponding Author:
Dr. Jyotsna Chandwani,
Email: chandwanijyotsna@gmail.com

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Abstract

Background: Diabetes mellitus may develop among HIV-positive patients due to various factors and such cases may require different management of diabetes than the general population. HbA1c testing is not preferred for diabetes detection among people living with HIV. Plasma glucose level is a test of choice for diabetes determination in HIV-positive patients. **Materials and Methods:** In this cross-sectional study the blood samples were collected from HIV-positive tested in ICTC and plasma glucose level was detected by a fully automatic analyzer. Viral Load assay and CD4 count were also performed in the patient's plasma. **Result:** A total of 565 patients who tested positive in the ICTC laboratory were included in the study. The male-to-female ratio was 1:0.72. Diabetes was recorded higher in males (33.74%) than females (27.97%). Most patients with diabetes were seen in the age group 41-50 years while the rate of diabetes was highest among those>60 years of age (51.72%). Urban populations (35.18%) were found to be affected by diabetes more than rural populations (29.23%). People with higher CD4 counts were found to be more associated with diabetes. The highest rates of diabetes were recorded in those individuals with a viral load of 500-1000 copies/ml (30.99%). **Conclusion:** The prevalence of diabetes mellitus is higher among the PLWH in the study area and which suggests an urgent need for DM screening & treatment technologies to address this problem.

INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disorder which is characterized by hyperglycemia due to impaired insulin synthesis and sensitivity, that primarily affects the population of developing and underdeveloped nations.[1,2] People living with HIV (PLWH) are more likely to develop metabolic disorders, particularly diabetes, as a result of various factors such as specific antiretroviral therapies (ART), including older generation protease inhibitors and nucleoside reverse transcriptase inhibitors, lipodystrophy, and Hepatitis C virus co-infection as well as weight gain and obesity, all of which are common in PLWH.[3]

It is important for a healthcare professional to recognize diabetes in PLWH because components of diabetes management, such as diagnosis and treatment, may differ in such cases compared to diabetes among general population.[4] Haemoglobin A1c (HbA1c) has been proven to underestimate glycemia in PLWH, and abacavir has been associated with greater discordance between HbA1c and blood glucose.[5] The antiretroviral therapy in HIV infection can cause inflammation, which can result in falsely elevated HbA1c levels. HIV positive individuals often experience anemia, which may affect HbA1c measurements while glucose levels in plasma are less affected by inflammation or hematological factors. As a result, a plasma glucose-based method is preferred.6 Hence the current study was conducted to determine the prevalence of diabetes mellitus among HIV-positive diagnosed populations in Ajmer district of Rajasthan, India, as well as the characteristics associated with it, given the scarcity of published data available.

MATERIALS AND METHODS

Study Type

A cross sectional study was conducted in a tertiary care teaching hospital at Ajmer for a period of four years and 4 months from January 2019 to May 2023.

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Permission to conduct the study was taken from Ethical Committee of the Institute.

Inclusion of Subjects:
The patients tested positive for HIV at Integrated Counseling and Testing Center (ICTC) attached within the hospital premise, as per National AIDS Control Organization (NACO) guidelines, were included in the study. The socio-economical and educational data of individual was collected in a proforma. All the patients were further tested for measurement of fasting and postprandial blood sugar levels upon taking a prior consent from individual.

Blood Sugar Level Testing: Two blood samples were collected by venipuncture from each participant in fluoride containing blood collection vials. First sample was collected upon overnight of fasting while second sample was collected between 90-120 minutes after breaking the fast. The blood samples were centrifuged at 3000 rpm for 3-5 minutes for separating plasma. Separated plasma was used for determination of blood sugar levels by using fully automatic biochemistry analyzer (AU2700/5400 Beckman Coulter AU Analyzer, Beckman Coulter, USA).

CD4 cell count: EDTA blood sample was used for CD4 cell count by flow cytometer Navios (Beckman Coulter, USA). 50µl of blood sample was transferred to flow cytometer tube and 10 µl of CD4 testing reagent was added, mixed and incubated for 15 minutes at room temperature. The tube was loaded in the instrument. CD4 count was calculated using instrument's software.

Viral Load Assay: Each volunteer was also tested for viral load assay by reverse transcription-polymerase chain reaction. Sample was prepared using Abbott M200SP Sample preparation. Automated M2000 RT Real Time PCR system (Abbott, USA) was used for HIV 1 quantitation in patients' plasma samples over the range of 40 to 10,000,000 copies/ml.

Statistical Analysis: The data was entered in MS Excel sheet and analyzed using SPSS version 27. Student t test was used to compare the variables and a p-value of 0.05 or less was considered statistically significant.

RESULTS

A total of 565 patients, tested positive for HIV in the ICTC laboratory, were included in the study. Out of 565 patients, the gender ratio (male:female) was observed 1:0.72 which included 329 males and 236 females.

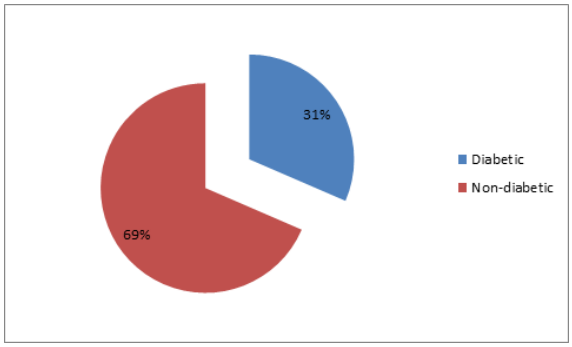

Figure 1: Distribution of patients on the basis of their diabetic status.

The overall diabetic population among the study subject was observed higher among males (33.74%) in comparison to females (27.97%). The percentage of diabetic population was also observed to higher with older age groups. [Table 1]

Table 1: Socio-economic, bio-demographic and laboratory data distribution of patients.

	Diabetic		Non-Diabetic		Total
	Count	Percentage	Count	Percentage	
Females	66	27.97	170	72.03	236
Males	111	33.74	218	66.26	329
20-30 years	0	0.0	03	100	03
31-40 years	48	25	144	75	192
41-50 years	76	32.07	161	67.93	237
51-60 years	38	36.54	66	63.46	104
>60 years	15	51.72	14	48.28	29
Rural	107	29.23	259	70.77	366
Urban	70	35.18	129	64.82	199
Driver	12	25.53	35	74.47	47
Employed	44	35.48	80	64.52	124
Farmer	12	25	36	75	48
Labor	44	32.35	92	67.65	136
Uneducated	65	30.95	145	69.48	210
CD4 Count					
<100	33	24.63	101	75.37	134
101-200	39	28.89	96	71.11	135
201-400	16	11.51	123	88.49	139
401-600	52	55.91	41	44.09	93
>600	37	57.81	27	42.19	64
Viral Load					
<20	63	42.86	84	57.14	147
21-100	36	24.16	113	75.84	149
100-500	33	29.20	80	70.80	113

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500-1000	22	30.99	49	69.01	71
>1000	23	27.06	62	72.94	85

DISCUSSION

The prevalence of diabetes mellitus is emerging as a major non-infectious co-morbidity in the HIV population. The prevalence of type 2 DM (T2DM) has been reported to be five to nine times higher in HIV-positive individuals than in HIV-negative individuals.[7] The aim of the present study was to determine the prevalence of DM among PLWH and to identify factors associated with its onset.

The result suggested that the prevalence of diabetes is strongly associated with the bio-demographic, socio-economic, and lifestyle behavioral factor. The study found a significant prevalence of diabetes, with 31% of the 565 participants being diabetic. Another finding from this study related to gender, which revealed that the prevalence of diabetes is higher among men (111 out of 329) than women (66 out of 236). This gender disparity can be attributed to several factors, including lifestyle differences, hormonal variations and possibly greater exposure to risk factors such as smoking and alcohol consumption in men. This is consistent with other studies that have found a higher prevalence of diabetes in men among the general population and PLWH. Several publications in HIV-infected populations from Africa show a higher prevalence of diabetes in men than women.[8-9]

This study also showed that older age is a predictor for diabetes in PLWHIV, such that those older than 41 years of age were more likely to have diabetes than those younger than 41 years of age [Table 1]. This is similar to other studies showing that older age is a risk factor for chronic co-morbidities in PLWHIV.[10-12]

The low prevalence in the 20-30 years age group (0 diabetics) highlights the effect of aging on diabetes risk among PLWH.

The study found that the prevalence rate of diabetes was higher among rural participants (107 diabetics) than among urban participants (70 diabetics). This reflects differences in healthcare access, lifestyle and dietary habits between rural and urban areas. Rural populations may have less access to healthcare services and preventive measures, leading to delays in the diagnosis and management of diabetes.

Occupational status showed different prevalence of diabetes, with higher numbers of diabetics among laborers and employed individuals (44 each). This may be due to the physical demands and stress associated with these occupations, which may contribute to the development of diabetes. Additionally, these groups may have limited access to regular health checkups and diabetes management resources. Diabetes prevalence was higher among illiterate participants (65 diabetics). Lack of education may lead to lower awareness of diabetes risk factors and management strategies, resulting in higher susceptibility.[13]

The study observed that participants with a CD4 count of less than 100 had fewer cases of diabetes (n=33) among PLWH, suggesting a potential link between immune status and diabetes risk. PLWH who were diagnosed with diabetes had better CD4 counts than PLWH without diabetes. Similar results were observed in an earlier study conducted by Indira P. et al. (2015).[14] In PLWH with diabetes, having diabetes may lead to more frequent follow-up visits, which may indirectly improve adherence to antiretroviral therapy (ART), resulting in higher CD4 counts. Alternatively, PLWH with diabetes may have complications from opportunistic infections (OIs), which are less likely to be successfully treated on an outpatient basis; therefore, these patients may have higher CD4 counts when admitted. This finding indicates that PLWH with better immune function may still be at risk for diabetes, possibly due to the metabolic effects of ART. The influence of these factors on CD4 levels should be further studied.[14]

Additionally, people with low viral loads (<20) had a higher incidence of diabetes (n=63), which may reflect long-term effects of HIV and its treatment on glucose metabolism.

CONCLUSION

The findings of this study show a high prevalence of diabetes among PLWH in Ajmer district. Gender, age, residence, occupation, education, CD4 count and viral load are important factors influencing the prevalence of diabetes in this population. There is a dire need for diabetes screening and treatment technologies in HIV care settings to address the unique challenges faced by PLWH. Future research should focus on understanding the underlying mechanisms linking HIV and diabetes and developing customized care protocols to improve health outcomes for PLWH.

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