

**ORIGINAL RESEARCH**

# Evaluation of immuno-virological status and its associated factors among people living with HIV receiving highly active antiretroviral therapy

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**ABSTRACT**

**Background:** The major goal of antiretroviral therapy (ART) is immunological recovery and virological suppression. Immunological and virological response in People Living with HIV (PLHIV) receiving ART has to be monitored to assess the treatment response, diagnosing treatment failure and switching antiretroviral therapy. **Aims & objective:** To assess the immunological and virological response to ART among Human Immunodeficiency Virus (HIV) infected individuals. **Material & method:** This is a cross-sectional study including people living with HIV (PLHIV) receiving ART for at least 6 months and was conducted from January 2023 to December 2023. The socio-demographic profile, CD4 count and viral load were analysed. **Results:** 150 patients receiving ART were included in the study with 118 (78.66%) patients had virological suppression and immunological recovery. 7 patients (4.6%) had a virological failure. 25 patients (16.6%) had an immunological failure. The Mean ages of patients were 34.70±12.06 years at diagnosis. The majority of the patients were male 102 (68%). The mean CD4 count at baseline was 304.03±244.08 cells/μL. The mean CD4 count after treatment increased from 304.03 cells/μL to 513.22 cells/μL after 6 months of start of antiretroviral therapy. **Conclusion:** There are optimal CD4 recovery and virological suppression as expected with antiretroviral therapy use. ART regimen adherence is important to decrease the prevalence of ART regimen treatment failure.

**Keywords:** virological failure, immunological suppression, CD4 count, HIV, AIDS

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**INTRODUCTION**

Acquired immunodeficiency syndrome (AIDS) caused by the human immunodeficiency virus (HIV) is a viral infection that attacks the body's immune system, specifically the white blood cells called CD4<sup>+</sup> T cells [1]. This can be made individuals more susceptible to several infections including bacterial, viral, and fungal agents [2]. HIV can therefore cause several health complications including opportunistic infections, oxidative stress, wasting syndrome, as well as malnutrition [3]. Since highly active antiretroviral therapy (HAART) became widely available in industrialized countries, mortality and morbidity among patients living with HIV/AIDS have been substantially reduced [4]. The Joint United Nations Programme on HIV and AIDS (UNAIDS) 90-90-90 targets the goal of achieving viral suppression in 90%

of the patients on sustained Antiretroviral Treatment [5]. Antiretroviral treatment failure continues to be a major global public health issue. Of the total PLHI, more than 46% failed for first line drugs [6-7]. Despite the improved utilization of ART, the issue of drug resistance and subsequent treatment failure is a continuous and challenging public health problem in middle income and low income countries [8-9]. There are groups of people living with HIV with immunovirological discordant responses i.e. suppressed viral load to the undetectable level but still with poor immunological recovery (immunological failure) or good immunological response with detectable viral load (virological failure: viral load >1000copies/mL) [10-11].

## AIMS & OBJECTIVES

The aim of this study was to determine the immunologic and virological status and associated factors among adult PLWHA who were on HAART

## MATERIALS AND METHODS

A hospital-based cross-sectional study was conducted in the department of microbiology in a tertiary care hospital, central India, from January 2023 to December 2023.

### Inclusion criteria

The study participants who were included in this study were: HIV positive patients with at least 6 months of follow-up on HAART, adults. HIV positive individuals with age  $\geq 18$  years old who were voluntary and avail to participate with written informed consent during the survey.

### Exclusion criteria

HIV-positive patients who refuse to take consent, those patients who were seriously sick, unconscious and pregnant women, Corona virus disease-19 (COVID-19) co-infected patients, those who had lost to follow-up, febrile, and transfer in/out cases were excluded

HIV-positive patients who were with complete socio-demographic information (age, gender, educational level, occupation, marital status, residence, and socioeconomic status), clinical data (duration on ART, any prophylaxis initiated, the status of

opportunistic infections, functional status, therapeutic switching, level of ART adherence, body mass index and WHO clinical stage) as well as essential laboratory data upon chart review such as baseline CD4<sup>+</sup> T cell count, Virological and immunological data. The standard registration logbook for ART patients developed by the federal ministry of health was used to develop data abstraction format. Data on CD4<sup>+</sup> T-cells count which was measured at baseline and at six months interval thereafter during regular follow-up visit were collected from medical charts. Immunological status (success or failure) and virological status (success or failure) were recorded.

### Statistical analysis

Data were analysed by using Statistical Package for the Social Sciences (SPSS) 22.0 version (IBM Corporation). Descriptive statistics such as frequency, median, mean and standard deviation were computed for all continuous and categorical variables.

## RESULTS

A total of 150 patients living with HIV were enrolled in the present study.

Majority of the participants (48%) were 40-50 years age group with mean ages of patients were  $34.70 \pm 12.06$ . Most of them (68%) were male, 70% residing in urban area. Maximum no of subjects was married (40%), half of them education up to secondary school level and 52% were underweight.

**Table 1: Socio-demographic characteristics of the study participants**

Variable	Frequency	Percentage	
Age group	18-24 years	32	21.3%
	25-39 years	19	12.7%
	40-50 years	72	48%
	>50 years	27	18%
Gender	Male	102	68%
	Female	48	32%
Residence	Rural	45	30%
	Urban	105	70%
Marital status	Single	30	20%
	Married	60	40%
	Divorce	54	36%
	Widow	6	4%
Educational status	No formal schooling	20	13.3%
	Primary school	36	24%
	Secondary school	75	50%
	Tertiary school	19	12.7%
BMI (kg/m <sup>2</sup> )	<18.5	78	52%
	18.5–25	43	28.7%
	>25	29	19.3%

Majority of the patients (48%) had CD4 count above 500; the mean CD4 count at baseline was  $304.03 \pm 244.08$  cells/ $\mu$ L. CD8 cell count above 220 in 98.7%. CD4/CD8 ratio between 0.5-2.0 was in 72%. Viral control (undetectable) was found in 73.4%.

Virological suppression found in 78.6%

**Table 2: Immuno-virological status of study participants**

Immuno-virological status	Frequency	Percentage
<b>CD4 cell (cells/<math>\mu</math>L)</b>		
Below 200	6	4%
Between 200-349	27	18%
Between 350-499	45	30%
Above 500	72	48%
<b>CD8 cell (cells/<math>\mu</math>L)</b>		
Below 220	2	1.3%
Above 220	148	98.7%
<b>CD4/CD8</b>		
Below 0.5	40	26.6%
Between 0.5-2.0	108	72%
Between 2.0	2	1.3%
<b>Viremia (copies/mL)</b>		
Viral control (undetectable)	110	73.4%
Low level viremia (40-1000)	33	22%
Virological failure (>1000)	7	4.6%
<b>Virological suppression</b>		
Suppressed	118	78.6%
Not suppressed	32	21.4%
<b>Immunological status</b>		
Suppressed	86	57.4%
Not suppressed	39	26%
Immunological failure	25	16.6%

## DISCUSSION

HAART has been consistently reported to suppress HIV RNA to the level below the limit of detection, and has reduced the risk of clinical progression. Despite these successes, treatment failure due to drug resistance and poor adherence poses a challenge to the ART program. For this reason, the WHO recommends routine VL testing for monitoring ART [12-13].

The magnitude of virological suppression after six months ART was 78.6% in this study, the rate of virological suppression of present study was comparable with the Hassan, et al [14] and Gunda DW, et al [15]. Virological suppression is an important factor in PLHIV health maintenance and plays a great role in the prevention of new HIV cases. Non-suppression of virological treatment is a key challenge for HIV programs, particularly in LMICs.

This study found that educational status, salary/income, ART duration, ART combination regimen, and number of doses missed were associated with virological failure, constant with the Abubakari, et al [16] and Niu D, et al [17].

In our study immunologic suppression was observed among 57.4% of the study participants, similar finding reported by Melku et al [18] and Ojha CR, et al [19], reported immunological suppression were in 52.9% and 62.83% respectively.

In this study, it is noted that there is a discrepancy between the immunological status (57.4%) and the virological suppression (78.6%). The possible reason for discordant result might be late initiation of ART, HIV related depletion of T cells, persistent immune activation and exhaustion of T cell due to microbial

translocation, long-term impact of HIV on thymus function and its output, and lymph node fibrosis [20].

The mean CD4 count at baseline was  $304.03 \pm 244.08$  cells/ $\mu$ L in the current study, in agreement with the H Wasihun, et al [21] and Fozia T. et al [22].

Present study observed the mean ages of patients were  $34.70 \pm 12.06$ , accordance to the Derseh M, et al [23] and Ayele, G., et al [24].

Current study reported that majority of the patients were male, our results correlate with the other studies conducted by Segeral, et al [25] and Demissie, et al [26].

In our study according to Body Mass Index (BMI), most of the participants were undernourished, suggesting that poor nutritional status is a major concern among patients receiving ART. Similar findings were recently reported by Feleke DG, et al [27] and A Aissatou, et al [26].

Those with poor adherence level were three times more likely to develop virological and treatment failure when compared to those with good adherence level.

## CONCLUSION

We have observed discordance immuno-virological response, higher virological suppression as compared to immunological suppression in the study population at six months of HAART follow up. Co-infections, low CD4+ count and WHO clinical stages III/IV were associated factors for immunological, whereas, age at HAART initiation, type of regimen, male gender and poor/fair treatment adherence was associated with the virological discordant response. Therefore, due

attention should be given to the identified factors. Moreover, given evaluation of immuno-virological response is important to address patient treatment outcome, regimen change and patient management..

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