ORIGINAL PAPER

Evaluation of depression, anxiety and insomnia in people living with HIV/AIDS in India

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Abstract

Introduction: Mental disorders are quite common in association with human immunodeficiency virus (HIV). Mental disorders are more prevalent in people living with HIV/AIDS (PLWHA) than the general population. The aim of this study was to evaluate depression, anxiety and insomnia in PLWHA and its correlation with socio-demographic factors and cluster of differentiation-4 (CD4) count.

Material and methods: This was a cross sectional study conducted in Pt. BD Sharma PGIMS, Rohtak on 500 PLWHA in India. Hospital Anxiety and Depression Scale-Depression (HADS-D), Hospital Anxiety and Depression Scale-Anxiety (HADS-A) and Pittsburgh Sleep Quality Index (PSQI) scale were used to assess depression, anxiety and insomnia respectively in PLWHA. Five groups were designed on the basis of CD4 count: Group A (< 100 cells/µl), Group B (100-199 cells/µl), Group C (200-349 cells/µl), Group D (350-499 cells/µl) and Group E (> 500 cells/µl).

Results: Prevalence of anxiety, depression and insomnia was found to be 59.6%, 61.2% and 56.4% respectively. Males had higher prevalence of depression and insomnia which are 64.2% and 57.4% respectively, whereas female had higher prevalence of anxiety (63%). There was a positive correlation between each score i.e. HADS-A, HADS-D and PSQI scale. There was a weak negative correlation between CD4 and each score.

Conclusions: Despite higher prevalence, psychiatric illnesses remains underdiagnosed most of the time. Thus clinicians at the anti-retroviral therapy centre should screen these patients for depression, anxiety and depression for improvement in morbidity and mortality in PLWHA.

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Key words: HIV, AIDS, depression, anxiety, insomnia, sleep disturbance.

Introduction

Human immunodeficiency virus (HIV) infection is one of the infectious diseases that has been studied a lot since its first clinical recognition. The end stage of the disease is known as acquired immunodeficiency syndrome (AIDS) [1]. According to UNAIDS (Joint United Nations Programme on HIV/AIDS), the total number of PLWHA was estimated to be 38 million globally with 1.7 million newly infected in 2019 [2]. In India, according to National AIDS Control Organisation (NACO) report 2017, the total number of PLWHA was around 2.14 million at the end of 2017 [3].

PLWHA has a high burden of social problems, somatic symptoms and impaired quality of life that may lead them to increased risks of psychiatric disturbances. Psychiatric manifestations are more common in HIV patients compared to other sexually transmitted disease. There is wide range of psychiatric manifestations in HIV which include cognitive deficit, psychosis, mania, depression, anxiety disorders,

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suicide, bereavement and substance abuse. Occasionally acute psychotic symptoms may be the presenting symptom of HIV or associated opportunistic infections such as tuberculoma, toxoplasmosis and cryptococcal meningitis. HIV infected individuals are at high risk of suicide in the period immediately after diagnosis with HIV, especially if they have a past psychiatric history [4-6].

By 2017, in India 197.3 million (14.3%) people were suffering from mental disorders. Mental disorders contributed 4.7% of the total disability-adjusted life year (DALYs). Mental illnesses were the most common cause of years lived with disability (YLDs) in India, causing 14.5% of the total YLDs. Depression (33.8%) and anxiety (19.0%) contributed most to DALYs due to mental disorders [7].

Overall, depression with anxiety is the most common psychiatric/psychological illness. Depression is a chronic medical condition that affects mood, thought and physical health. Its general features include lack of energy, low mood, lack of sleep, decreased appetite, anhedonia and decreased self-esteem [8]. It is the most common psychiatric morbidity in HIV patients. Prevalence of depression in HIV patients ranges from 7.2% to 71.9% [9]. Anxiety is anticipation of future threat [10]. Anxiety was defined by David Barlow as "a future-oriented mood state in which one is ready or prepared to attempt to cope with upcoming negative events" [11]. Anxiety disorders include panic disorder, agoraphobia, social phobia, specific phobia and generalized anxiety disorder [12]. Prevalence of anxiety in HIV patients ranges from 4.5% to 82.3% [9].

Depression and anxiety in HIV can cause reduction in CD4 cell counts and increase HIV viral loads, poor adherence to ART, substance abuse, poor physical functioning, poor interpersonal relationship leading to poor quality of life, suicidal risk, occupational and financial impairment causing economic related issues and overall increased morbidity and mortality [13-18].

Insomnia is insufficiency in both quality of sleep and quantity of sleep and it is most common symptom in general practice after pain [19]. Prevalence of sleep disturbance in HIV people is around 10-50% [5]. Insomnia can also lead to poor quality of life, anxiety, depression, occupational loss and cognitive deficit [19].

Early diagnosis and evaluation of mental health and psychiatric related illnesses in HIV patients is important since its influence on quality of life, morbidity and mortality rates is well known. It was found that after treating these issues there is an increase in number of hours worked per week [20]. Most of the time these symptoms remain unidentified by the primary care physician and thus remain undiagnosed. Getting an early diagnosis and finding various factors influencing these conditions can help in improving their mental, financial, social and physical well-being. There is existing literature with quite a few number of studies assessing the prevalence of anxiety, depression and sleep problems altogether in PLWHA with variable results. There is a paucity of such data from developing countries such as India, especially from northern India. Hence the present study was undertaken.

Material and methods

This was a cross sectional study carried out on 500 patients attending the Antiretroviral Treatment centre, PGIMS, Rohtak between November 2018 to April 2020. HIV seropositive patients confirmed by ELISA/Western blot test, aged between 18 and 70 years, on ART more than 6 months were included in the study. Patients with known cases of any psychiatric illness taking regular medications for psychiatric illness, pregnant and lactating mothers, presence of non-HIV/AIDS related malignancy, chronic kidney and liver disease prior to diagnosis of HIV, patients with an altered sensorium or severe cognitive impairment affecting communication were excluded from study.

After due consideration of inclusion and exclusion criteria, 500 subjects were recruited. Pre-informed written consent was obtained from all the patients. The study was approved by the institutional ethics committee and also by the Haryana AIDS Control Society (HACS), India. Study participation was voluntary and anonymous. Information about the study and consent was also provided in the questionnaire.

A detailed history and clinical examination, radiological and biochemical investigation including CD4 count was performed. Basic socio-demographic details and clinical history of the participant and other factors relating to his/her disease that may possibly affect quality of life or cause psychological stress were evaluated. The study population was divided into five groups on the basis of CD4 count: Group A – CD4 < 100 cells/mm^3, Group B – CD4 100-199 cells/mm^3, Group C – CD4 200-349 cells/mm^3, Group D – CD4 350-499 cells/mm^3 and Group E – CD4 ≥ 500 cells/mm^3.

Each patient was subjected to the Hospital Anxiety and Depression Scale (HADS) questionnaire along with Pittsburgh Sleep Quality Index (PSQI) questionnaire [21, 22]. Scores for anxiety, depression and insomnia were calculated. HADS is a set of questionnaires which was designed to evaluate depression and anxiety. It consists of 14 items (7 for depression and 7 for anxiety), each with four responses scoring 0-3, with 3 indicating a maximum response. Each subscale (depression and anxiety) can score between 0 and 21. Scores less than 7 indicate normal, scores of 8-10 mild, 11-15 moderate and scores of 16 or more indicate severe anxiety/depression [21]. PSQI is a set of questionnaires designed to assess the quality and pattern of sleep. It consists of 19 self-rated items combined to form a 7 "component" score, with each component having a score on a rating scale of 0-3 points, with 0 indicating no difficulty and 3 indicating severe difficulty. Then the scores of each component are added to calculate a "global" score with a range of 0-21. A global score of more than 5 indicates poor sleep quality [22].

Table 1. Basic sociodemographic characteristics of study population (*N* = 500)

Parameter	*n* (%)
Gender	
Male	294 (58.8)
Female	200 (40.0)
Transgender	6 (1.2)
Marital status	
Married	324 (64.8)
Widow(er)	86 (17.2)
Unmarried	78 (15.6)
Divorced	8 (1.6)
Live in relationship	4 (0.8)
Residence	
Urban	136 (27.2)
Rural	364 (72.8)
Religion	
Hindu	485 (97.0)
Muslim	9 (1.8)
Sikh	3 (0.6)
Christian	3 (0.6)
Education	
Illiterate	81 (16.2)
Primary School	193 (38.6)
Secondary School	177 (35.4)
College and above	49 (9.8)
Occupation	
Housewife	187 (37.4)
Skilled worker	109 (21.8)
Semiskilled worker	64 (12.8)
Agricultural	60 (12.0)
Unemployed	49 (9.8)
Unskilled worker/Labourer	30 (6.0)
Government employee	1 (0.2)
Income (Rs/month)	
< 2000	56 (11.2)
2000-5000	177 (35.4)
5001-20 000	226 (45.2)
> 20 000	41 (8.2)
Socio-economy status*	
Upper	26 (5.2)
Upper middle	75 (15.0)
Lower middle	255 (51.0)
Upper lower	110 (20.0)
Lower	44 (8.8)
Risk factors	
Heterosexual	461 (93.5)
Men who have sex with men	20 (4.0)
Intravenous drug user	6 (1.2)
Blood transfusion	2 (0.4)
Commercial sex worker	3 (0.6)
Trucker	39 (7.9)
Mother to child transmission	4 (0.8)
Others	6 (1.2)
Treatment (on ART)	
First line	494 (98.8)
Second line	6 (1.2)
Treatment regimen	
TLE	429 (85.8)
ZLN	54 (10.8)
Others	17 (3.4)
CD4 count (in cells/mm^3)	
< 100 (Group A)	13 (2.6)
100-199 (Group B)	40 (8.0)
200-349 (Group C)	122 (24.4)
350-499 (Group D)	115 (23.0)
≥ 500 (Group E)	210 (42.0)
Opportunistic infection	
Present	139 (27.8)
Absent	361 (72.2)

Table 1. Cont.

**Modified Kuppuswami Scale*

Also many socio-demographic and biochemical factors were correlated with depression, anxiety and insomnia score in PLWHA.

Statistical analysis

SPSS version 23 was used for data analysis. Descriptive statistics were analysed in the form of means/standard deviations and medians/interquartile ranges (IQRs) for continuous variables, and frequencies and percentages for categorical variables. Group comparisons for continuously distributed data were made using the independent sample *t*-test when comparing two groups. If data were found to be non-normally distributed, an appropriate non-parametric test in the form of the Wilcoxon test was used. The χ^2 test was used for group comparisons for categorical data. If the expected frequency in the contingency tables was found to be < 5 for > 25% of the cells, Fisher's exact test was used instead. Linear correlation between two continuous variables was ex-

plored using Pearson's correlation (if the data were normally distributed) and Spearman's correlation (for non-normally distributed data). Statistical significance was set at $p < 0.05$.

Results

Total 500 patients were included in the study with male preponderance (58.8%). The mean age (years) was 36.24 ± 10.01 with the majority in the age group of 21-50 years (87.2%) and married (64.8%) and residing in rural area (72.8%). The majority of patients were Hindu (97%). Mean time on ART (months) was 51.91 ± 37.81. Patients were categorised according to the World Health Organization (WHO) Asian body mass index (BMI) classification. Mean BMI (kg/m^2) was 21.30 ± 3.33. Half of patients (50.4%) had normal BMI. 20.2% of patients were in the underweight category. A major risk factor was being heterosexual. Most patients were on 1st line ART (98.8%) and the majority on a TLE based regimen (85%) which is recommended as the preferred 1st line regimen as per NACO guidelines.

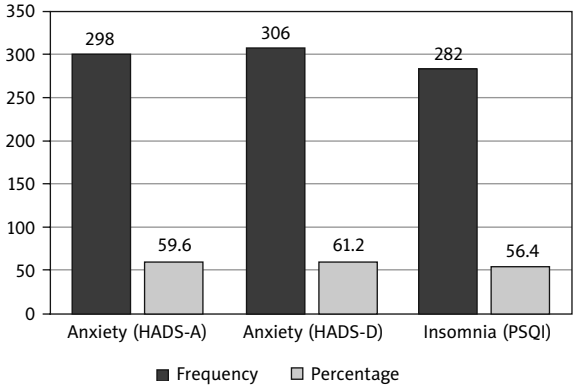

Figure 1. Prevalence of anxiety, depression and insomnia among study population

The majority (n = 210) had a CD4 count: ≥ 500 cells/mm^3. Mean CD4 counts of the study groups A, B, C, D and E were 70.62 ± 17.21, 163.88 ± 28.74, 275.61 ± 40.65, 423.29 ± 43.34 and 728.53 ± 216.38 respectively. 139 (27.8%) pa-

Table 2. Mean anxiety, depression and insomnia scores in each group

CD4 count (cells/mm^3)	HADS-A, mean ± SD	HADS-D, mean ± SD	PSQI score, mean ± SD
Group A < 100 (n = 13)	9.85 ± 2.91	10.00 ± 3.06	7.85 ± 3.44
Group B 100-199 (n = 40)	9.80 ± 3.28	10.18 ± 2.86	6.00 ± 2.48
Group C 200-349 (n = 122)	9.21 ± 3.35	9.71 ± 2.84	5.96 ± 2.58
Group D 350-499 (n = 115)	8.48 ± 3.02	8.78 ± 3.36	5.58 ± 2.64
Group E > 500 (n = 210)	7.49 ± 3.12	7.72 ± 3.09	5.12 ± 2.68
Overall population	8.38 ± 3.27	8.71 ± 3.21	5.57 ± 2.69
p-value	< 0.001[1]	< 0.001[1]	< 0.001[1]

[1]*Kruskal-Wallis test*

Table 3. Prevalence of anxiety, depression and insomnia scores in each group

Parameter/Grade	CD4 counts (in cells/mm^3)					Total (n = 500)
	Group A < 100 (n = 13)	Group B 100-199 (n = 40)	Group C 200-349 (n = 122)	Group D 350-499 (n = 115)	Group E > 500 (n = 210)	
Depression						
No	3 (23.1%)	5 (12.5%)	20 (16.4%)	38 (33.0)	128 (61.0)	194 (38.8%)
Mild	6 (46.2%)	16 (40.0%)	56 (45.9%)	45 (39.1%)	47 (22.4%)	170 (34.0%)
Moderate	3 (23.1%)	17 (42.5%)	45 (36.9%)	29 (25.2%)	32 (15.2%)	126 (25.2%)
Severe	1 (7.7%)	2 (5.0%)	1 (0.8%)	3 (2.6%)	3 (1.4%)	10 (2.0%)
Anxiety						
No	2 (15.4%)	9 (22.5%)	36 (29.5%)	43 (37.4%)	112 (53.3%)	202 (40.4%)
Mild	5 (38.5%)	13 (32.5%)	39 (32.0%)	46 (40.0%)	69 (32.9%)	172 (34.4%)
Moderate	6 (46.2%)	17 (42.5%)	45 (36.9%)	24 (20.9%)	26 (12.4%)	118 (23.6%)
Severe	0 (0.0%)	1 (2.5%)	2 (1.6%)	2 (1.7%)	3 (1.4%)	8 (1.6%)
Sleep						
Present	11 (84.6%)	29 (72.5%)	88 (72.1%)	72 (62.6%)	82 (39.0%)	282 (56.4%)
Absent	2 (15.4%)	11 (27.5%)	34 (27.9%)	43 (37.4%)	128 (61.0%)	218 (43.6%)

tients had opportunistic infections in which 20.0% of the patients had candidiasis and 11.6% of the patients had tuberculosis. Basic socio-demographic parameters are presented in Table 1.

Prevalence of anxiety, depression and insomnia was 59.6% (298/500), 61.2% (306/500) and 56.4% (282/500) respectively (Figure 1). Mean anxiety, depression and insomnia scores in study population were 8.38 ± 3.27, 8.38 ± 3.27 and 5.57 ± 2.69 respectively (Table 2). 34.4% had mild, 23.6% had moderate and 1.6% had severe grade of anxiety. 34.0% had mild, 25.2% had moderate and 2.0% had severe grade of depression (Table 3 and Figure 2). Males had higher prevalence of depression and insomnia, 64.2% and 57.4% respectively, whereas females (63%) had higher prevalence of anxiety (Table 4).

Age was not found to be statistically significant for HADS-A and PSQI ($r = 0.0$; $p = 0.931$ and 0.3; $p = 0.487$ respectively) but was statistically significant for HADS-D ($r = 0.1$; $p = 0.025$). Time on ART (month) was not found to have any statistical significance for score of any of the scales HADS-A, HADS-D and PSQI ($p > 0.05$). There was a weak negative correlation between BMI (kg/m^2) and HADS-A, HADS-D and PSQI, having r values of –0.09, –0.09 and –0.06 respectively, but statistically significant for HADS-D ($p = 0.045$) only.

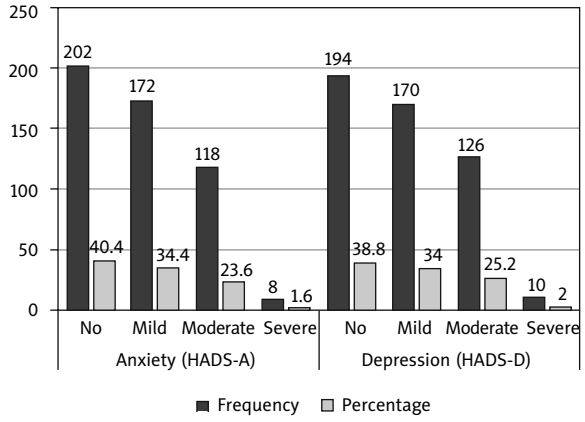

Figure 2. Prevalence of grade of anxiety and depression among study population

There was a moderate positive statistically significant correlation ($p < 0.001$) between HADS-A Total and HADS-D and PSQI score, $r = 0.48$ and $r = 0.44$ respectively. It means for every 1 unit increase in HADS-D, the HADS-A Total increases by 0.52 units and for every 1 unit increase in PSQI Global Score, the HADS-A Total increases by 0.50 units. Also a moderate positive statistically significant correlation ($p < 0.001$) was observed between PSQI Global Score and HADS-D, $r = 0.43$. It means for every 1 unit increase in PSQI Global Score, the HADS-D increases by 0.48 units (Figure 3).

There was a statistically significant correlation negative ($p < 0.001$) between CD4 count and various scales, i.e. HADS-D, HADS-A and PSQI scale, $r = –0.37$, –0.3 and –0.24 respectively. It means for every 1 unit increase in HADS-D, CD4 count decreases by 24.85 units. Also for every 1 unit increase in HADS-A Total, the CD4 count decreases by 20.35 units and for every 1 unit increase in PSQI Global Score, the CD4 count decreases by 17.40 units (Figure 3).

In our study HADS D was statistically significantly associated with age (years), education, treatment, BMI (kg/m^2), opportunistic infections, TLC (/mm^3), lymphocytes (%), serum calcium (mg/dl), serum albumin (g/dl), AG ratio, Mantoux test, erythrocyte sedimentation rate (ESR; mm/hr), and CD4 count (/mm^3) (Table 5).

HADS-A was statistically significantly associated with income, education, occupation, socio-economic status, risk factors: heterosexual, men who have sex with men (MSM), systolic BP (mmHg), diastolic BP (mmHg), opportunistic infections, hepatitis C, serum creatinine (mg/dl), serum calcium (mg/dl), total protein (g/dl), serum albumin (g/dl), HCV, ESR CD4 count (/mm^3) (Table 5).

Table 4. Gender-wise prevalence of depression, anxiety and insomnia

Parameter/Grade	Male	Female	Transgender	Total
Depression				
No	105 (35.7%)	85 (42.5%)	4 (66.7%)	194 (38.8%)
Mild	109 (37.1%)	61 (30.5%)	0 (0.00%)	170 (34.0%)
Moderate	72 (24.45%)	52(26.0%)	2 (33.33%)	126 (25.2%)
Severe	8 (2.7%)	2 (1.0%)	0 (0.00%)	10 (2.0%)
Anxiety				
No	124 (42.2%)	74 (37.0%)	4 (66.7%)	202 (40.4%)
Mild	98 (33.3%)	73 (36.5%)	1(16.7%)	172 (34.4%)
Moderate	68 (23.1%)	49 (24.5%)	1 (16.7%)	118 (23.6%)
Severe	4 (1.4%)	4 (2.0%)	0 (0.00%)	8 (1.6%)
Sleep				
Present	169 (57.5%)	111 (55.5%)	2 (33.3%)	282 (56.4%)
Absent	125 (42.5%)	89 (44.5%)	4 (66.7%)	218 (43.6%)

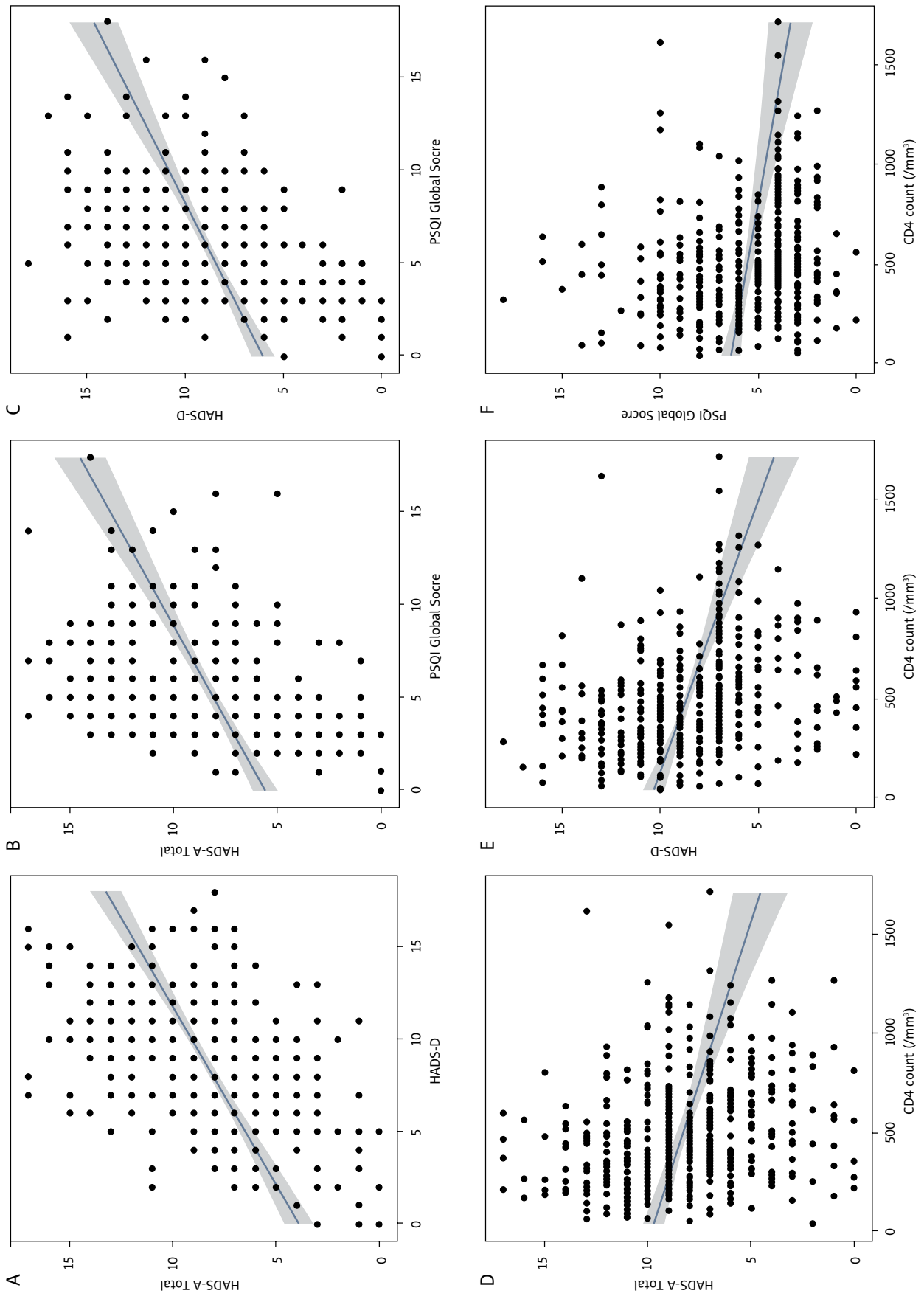

Figure 3. Correlation of different scales with each other and CD4 count

Table 5. Correlation between parameters and anxiety, depression and insomnia scores

Parameters	HADS-D Total		HADS-A Total		PSQI Global Score	
	Mean ± SD	*p*-value	Mean ± SD	*p*-value	Mean ± SD	*p*-value
Gender		0.254[1]		0.207[1]		0.352[1]
Male	8.83 ± 3.19		8.26 ± 3.31		5.64 ± 2.71	
Female	8.57 ± 3.19		8.63 ± 3.16		5.52 ± 2.68	
Transgender	7.33 ± 4.72		6.33 ± 3.83		4.33 ± 2.25	
Residence		0.956[2]		0.943[2]		0.567[2]
Urban	8.54 ± 3.44		8.25 ± 3.64		5.52 ± 2.89	
Rural	8.77 ± 3.12		8.43 ± 3.12		5.59 ± 2.62	
Religion		0.258[1]		0.127[1]		0.802[1]
Hindu	8.71 ± 3.21		8.40 ± 3.29		5.56 ± 2.67	
Muslim	9.78 ± 2.86		7.22 ± 2.28		5.00 ± 2.29	
Sikh	5.33 ± 2.89		6.33 ± 2.08		6.33 ± 3.06	
Christian	9.00 ± 2.65		10.67 ± 0.58		8.00 ± 6.08	
Income		0.573[1]		0.018[1]		0.222[1]
< 2000	9.20 ± 3.52		9.36 ± 3.43		5.79 ± 2.43	
2000-5000	8.66 ± 2.82		8.46 ± 2.93		5.67 ± 2.83	
5001-20000	8.69 ± 3.24		8.30 ± 3.33		5.54 ± 2.53	
> 20000	8.34 ± 4.08		7.17 ± 3.69		5.10 ± 3.25	
Education		0.014[1]		0.009[1]		0.439[1]
Illiterate	9.11 ± 3.08		8.81 ± 3.41		5.75 ± 2.96	
Primary School	9.15 ± 2.94		8.91 ± 3.07		5.64 ± 2.47	
Secondary School	8.32 ± 3.46		7.79 ± 3.26		5.40 ± 2.88	
College and above	7.69 ± 3.16		7.76 ± 3.43		5.63 ± 2.38	
Occupation		0.800[1]		0.033[1]		0.449[1]
Housewife	8.64 ± 3.26		8.58 ± 3.19		5.58 ± 2.81	
Skilled worker	8.66 ± 3.34		7.75 ± 3.31		5.74 ± 2.70	
Semi-Skilled worker	8.94 ± 3.38		8.98 ± 3.01		5.86 ± 2.90	
Agricultural cultivator	8.85 ± 3.06		8.15 ± 3.51		5.13 ± 2.60	
Unemployed	8.82 ± 3.00		8.86 ± 3.52		5.47 ± 2.53	
Unskilled worker/Labourer	8.43 ± 2.81		7.87 ± 3.01		5.30 ± 1.88	
Governmet employee	5.00 ± 0		8.00 ± 0		8.00 ± 0	
Socioeconomic Status		0.056[1]		0.005[1]		0.062[1]
Upper	9.12 ± 3.70		7.23 ± 2.90		5.50 ± 2.80	
Upper middle	8.31 ± 3.23		8.25 ± 3.70		5.35 ± 2.94	
Lower middle	8.42 ± 3.13		8.19 ± 3.25		5.33 ± 2.41	
Upper lower	9.09 ± 3.33		8.65 ± 3.21		6.04 ± 3.12	
Lower	9.91 ± 2.73		9.82 ± 2.39		6.34 ± 2.52	
Marital status		0.772[1]		0.800[1]		0.802[1]
Married	8.68 ± 3.17		8.25 ± 3.20		5.60 ± 2.68	
Widow(er)	8.80 ± 3.27		8.65 ± 3.59		5.74 ± 2.84	
Unmarried	8.50 ± 3.21		8.53 ± 3.23		5.14 ± 2.22	
Divorced	10.00 ± 3.25		8.62 ± 1.69		6.25 ± 4.20	
Live-in relationship	10.00 ± 5.16		10.25 ± 4.57		7.25 ± 4.72	

Table 5. Cont.

Parameters	HADS-D Total		HADS-A Total		PSQI Global Score	
	Mean ± SD	*p*-value	Mean ± SD	*p*-value	Mean ± SD	*p*-value
Treatment		0.025[2]		0.291[2]		0.295[2]
First line	8.67 ± 3.21		8.37 ± 3.27		5.56 ± 2.70	
Second line	11.33 ± 1.97		9.67 ± 2.34		6.33 ± 2.25	
Regimen		0.299[1]		0.117[1]		0.277[1]
TLE	8.66 ± 3.15		8.22 ± 3.20		5.45 ± 2.64	
ZLN	8.63 ± 3.62		9.04 ± 3.39		6.09 ± 2.53	
ABCLE	10.17 ± 2.48		10.33 ± 3.78		6.83 ± 3.66	
TLATV/R	11.00 ± 2.00		9.20 ± 2.28		6.60 ± 2.41	
ZLE	8.75 ± 5.50		9.75 ± 5.56		8.50 ± 6.66	
TLLPV/R	13.00 ± 0		12.00 ± 0		5.00 ± 0	
TLN	8.00 ± 0		17.00 ± 0		7.00 ± 0	
Risk factors: heterosexual		0.112[2]		0.029[2]		0.148[2]
Present	8.77 ± 3.16		8.47 ± 3.22		5.62 ± 2.71	
Absent	7.84 ± 3.86		7.16 ± 3.66		4.94 ± 2.55	
Risk factors: MSM		0.072[2]		0.003[2]		0.179[2]
Present	7.30 ± 4.05		6.10 ± 3.19		4.85 ± 3.20	
Absent	8.77 ± 3.17		8.48 ± 3.24		5.61 ± 2.68	
Risk Factors: IDU		0.842[2]		0.799[2]		0.991[2]
Present	8.67 ± 5.20		8.17 ± 3.87		6.00 ± 3.74	
Absent	8.71 ± 3.19		8.38 ± 3.26		5.57 ± 2.69	
Risk factors: blood transfusion		0.173[2]		0.190[2]		0.876[2]
Present	6.50 ± 0.71		6.00 ± 1.41		5.50 ± 2.12	
Absent	8.72 ± 3.22		8.39 ± 3.27		5.58 ± 2.71	
Risk factors: CSW		0.578[2]		0.594[2]		0.539[2]
Present	8.00 ± 2.65		9.33 ± 2.52		4.67 ± 2.08	
Absent	8.72 ± 3.22		8.38 ± 3.27		5.59 ± 2.71	
Risk factors: trucker		0.389[2]		0.118[2]		0.592[2]
Present	9.31 ± 2.83		9.33 ± 3.31		5.77 ± 2.66	
Absent	8.66 ± 3.25		8.30 ± 3.25		5.56 ± 2.71	
Risk factors: MCTC		0.688[2]		0.378[2]		0.966[2]
Present	8.25 ± 2.06		10.25 ± 4.03		5.75 ± 3.20	
Absent	8.72 ± 3.23		8.37 ± 3.26		5.58 ± 2.70	

****Significant at p < 0.05, [1]Kruskal-Wallis test, [2]Wilcoxon-Mann-Whitney U test*

As per our study PSQI global score was statistically significantly associated with opportunistic infections, blood urea (mg/dl), total protein (g/dl), total bilirubin (mg/dl), Mantoux test, CD4 count (/mm^3) (Table 5).

Discussion

Mental disorders are more prevalent in PLWHA than the general population [23, 24]. Regarding psychiatric manifestations among PLWHA, depression, anxiety, sleep related illness and substance abuse are the most prevalent ones. Mental illness itself is a major risk factor of HIV transmission [24, 25]. Overstress in this group leads to lack of proper user of barrier contraception and intravenous drug abuse, makes people with mental illness prone to HIV and increases the risk of disease spread despite knowing their HIV status under the influence of substances or alcohol [25].

Regarding pathophysiology of depression, anxiety and insomnia in HIV patients are not clear. However some researchers assume that depression is complicated by the complex biological, psychological, and social factors associated

with the HIV illness [26]. Studies suggested that there is a role of neurochemical imbalance of monoamines (serotonin, dopamine and noradrenaline) and chronic inflammation in depression. There is increase in levels of inflammatory cytokines, namely IL-1β, IL-6, and TNF-α, in depression. Increased levels of these cytokines activate the hypothalamic–pituitary–adrenal (HPA) axis, which in turn modulates monoamine expression in the CNS, leading to depressive symptoms [27].

The amygdala is a site for tempering fear and anxiety. Regarding anxiety, it was thought to be due to dysregulation of mediators such as norepinephrine, serotonin, dopamine, and gamma-aminobutyric acid (GABA), glutamate, adenosine, melatonin and neuroactive steroid, acetylcholine (Ach), cholecystokinin (CCK) and corticotrophin releasing hormone (CRH). Increased levels of serotonin, norepinephrine, Ach, CCK and CRH and decreased levels of GABA, adenosine, melatonin and neuroactive steroid lead to anxiety. Over-stimulation of the sympathetic nervous system mediates most of the anxiety symptoms in HIV patients [28, 29].

Also studies suggest infection such as HIV induces a sleep response via PAMPs which in turn increases pro-inflammatory cytokines such as IL-1 and TNF-α. The IL-1 and TNF-α are responsible for regulation of NREM sleep duration and intensity. These pro-inflammatory cytokines optimize neuronal activity in various areas of the brain such as the hypothalamic preoptic area, locus coeruleus, dorsal raphe nucleus and cerebral cortex and thus regulate NREM sleep duration and intensity. It was supposed that pro-inflammatory cytokines such as TNF-α induce microglial attraction to synapses and thus exert a sleep generating effect [30].

In our study the majority of the patients were male, 294 (58.8%). More than half of the study population were married, 324 (64.9%).

Among the study population of 500, 306 (61.2%) had depression, 298 (59.6%) had anxiety and 282 (56.4%) had poor sleep quality. Prevalence of depression and anxiety in our study was higher than in studies from the western world which by Pappin *et al*., and Wu *et al*. reported that prevalence of depression and anxiety was 25.4%; 50.0% and 30.6%; 36.35% respectively [31, 32]. Our results were consistent with another study conducted in India which showed that prevalence of depression and anxiety was 67.5% and 76.9% respectively [33]. This indicates that prevalence of depression and anxiety in PLWHA is much higher in developing countries as compared to western counterparts.

Among the study group 170 (34%) had mild, 126 (25.2%) had moderate and 10 (2%) had severe depression and 172 (34.4) had mild anxiety, 118 (23.6%) had moderate anxiety and 8 (1.6%) had severe anxiety. A similar study was conducted by Agarwal *et al*. in 50 subjects showing mild, moderate and severe depression in 20%, 8% and 2% respectively whereas mild, moderate and severe anxiety was seen in 14%, 14% and 26% respectively [34]. This discrepancy of findings may be due to variable size of the study sample and use of different scales for analysis of depression and anxiety.

In our study, males had more depression compared to females (64.2% vs. 57.5%), which is not consistent with other studies showing more depression in females than males (47% vs. 30%; and 46.6% vs. 30.2%) [35, 36]. This finding may be due to male preponderance in our study, lack of social support, high level of stress due to financial issues, treatment, social stigma, work place or disease itself in males. However, females had more anxiety as compared to males (63% vs. 57.8%), which is consistent with previous studies showing higher prevalence of anxiety in females than males (73% vs. 40%; and 47.4% vs. 30% respectively) [35, 37].

In our study on the basis of marital status, depression and anxiety are more prevalent in divorcees and widow(er)s, 64.8% and 60.6% respectively, which is comparable to other studies which had observed that depression and anxiety are more prevalent in this subgroup [38, 39]. This is because factors such as social stigma, social neglect, physical and sexual abuse, feeling of loneliness, loss of financial support, loss of loved one, and loss of self-esteem make divorcees and widow(er)s more prone to depression and anxiety. In our study, depression and anxiety were nearly equal in urban and rural areas, which is also consistent with a previous study [39].

In our study depression and anxiety were more frequent in illiterate (66.6%) and primary school educated patients (64.2%), which is similar to previous studies [40-42]. This could be due to low self-esteem, fewer job opportunities, restricted to doing more physical work where risk of trauma and muscular injuries is higher, leading to financial strain, health strain and fatigue. Also they are soft targets for humiliation. All these factors promote anxiety and depression in them.

In our study, anxiety and depression were more frequent in the low earning population than high earning (66%; 66% and 41.4%; 58.5% respectively). Also anxiety and depression were more frequent in the lower socioeconomic group, i.e. 79.5% and 75% respectively, which was comparable with other studies [39, 40, 43, 44]. These findings can be explained based on the fact that low income leads to homelessness, stress, adversity, and decreased ability to cope up with illness, leading to anxiety and depression.

In our study anxiety and depression were more prevalent in semiskilled workers, 75% and 68.7% respectively. Previous studies have shown higher prevalence of anxiety and depression in unemployed/retired patients, 35.33% and 43.77% respectively [45]. This can be explained by higher risk of job insecurity, frustration, feeling of worthlessness, and frequent absenteeism leading to mental illness in semiskilled and unemployed people.

Patients with opportunistic infections had higher prevalence of anxiety and depression, 72.6% and 83.4% respectively in our study, which is consistent with the study by Yousuf *et al.* showing higher prevalence of anxiety and depression in patients with opportunistic infection [46]. In our study prevalence of anxiety and depression in patients with HIV/HCV and HIV/HBV co-infection was 87.5%; 75.0% and 66.6%; 66.6% respectively, which is slightly higher than previous studies [47, 48].

The prevalence of poor sleep quality in our study was 56.4%, which is comparable with a study showing prevalence of poor sleep quality at 57.65% [49]. Studies by Lee *et al.* and Wu *et al.* also found poor sleep quality in 65% and 60% of PLWHA respectively [32, 50].

Poor sleep quality was observed more in males than females (57.4 vs. 55.5%), which is comparable with a similar study showing that poor sleep quality was more common in males than females (43.3% vs. 42.3%) [51]. However, a study by Gutierezz *et al.* showed higher prevalence in females compared with males (81.4% vs. 65.7%) [52]. This may be due to smaller size in our study, more number of male patients, and different socioeconomic profile.

In our study, divorcees most often had poor sleep quality (62.5%) whereas married people least often had poor sleep quality (53.9%), which was consistent with a previous study showing maximum poor sleep quality in divorcees (68.4%) and minimum in married people (54.0%) [49]. This can explained by unstable relationship, loneliness, fluctuating mood, fear, and lack of support, which lead to disturbed sleep.

In our study poor sleep quality was found more often in primary school educated (114/193; 59.0%), illiterate people (46/81; 56.7%), and unemployed and semiskilled workers (64.0%) than among higher educated and skilled workers. A similar study by Jabbari *et al.* showed that poor sleep quality was more frequent in primary school educated (14/16; 87.5%) and unemployed people (71.8%) [53]. A similar study showed higher prevalence of poor sleep quality in the illiterate (36/49; 73.4%) followed by the primary school educated population (101/164; 61.5%) [49].

In our study, it was found that people with low earnings and low socioeconomic status had more poor sleep quality, i.e. 64.2% and 70.4% respectively, which is consistent with previous studies showing higher prevalence of insomnia in low earning people and low socioeconomic status [54-57].

In our study, a statistically significant positive correlation was observed between all the scores. It is supported by a study by Jabbari *et al.* with 150 PLWHA and 50 non-HIV having depression in 49.33% with mild depression in 19.33%, moderate depression in 19.33% and severe depression in 10.66%, whereas anxiety was noted in 55.33%, being mild in 27 (18%), moderate in 20.67% and severe in 16.67%. There was a statistically significant positive correlation between sleep quality and anxiety and depression with correlation coefficient values of 0.457 and 0.391 respectively. However, no statistically significant correlation was observed between PSQI scores and age, weight, time since diagnosis, time on ART and CD4 count [53]. A similar result was obtained in a study by Dabaghzadeh *et al.* in Iran on 59 patients, with poor sleep in 47.5%. Mean PSQI score was 5.88 ± 4.22. Sleep quality has a significant correlation with depression and anxiety showing a correlation coefficient of r = 0.531 and 0.627 respectively. Also there was a statistically significant correlation between the patients HIV infection stages and PSQI score. But there was no significant correlation between the patients' laboratory data and PSQI [58].

In our study it was found that prevalence of anxiety, depression and sleep disturbances decreases as CD4 count increases. It is supported by a study done by Adeoti *et al.* in Nigeria with 424 HIV positive patients and 429 corresponding age and sex matched control subjects where the observed prevalence of depression, anxiety and insomnia was 39.6%, 32.6% and 49.3% respectively among PLWHA. Prevalence of co-existence of both anxiety and depression in PLWHA was 21.9%. Also it was noted that female gender, illiteracy, being divorced/widowed, unemployed and low income and low CD4 count were associated with depression while factors such as lower age, female gender, low income, presence of insomnia and low CD4 count were associated with anxiety disorder. On bivariate analysis it was found that low income, depression, anxiety disorders, CD4 count and duration on ART were significantly associated with insomnia but on multivariate analysis only depression and CD4 count had a significant association with insomnia [54, 59].

Rodriguez-Estrada *et al.* conducted a study with 367 PLWHA with male preponderance (82.8%) and observed poor sleep quality and depression in 58.9% and 42.0% of patients respectively. Among patients with depressive features 20.7% had mild depression, 13.9% had moderate depression and 7.4% had severe depression. There was a significant positive correlation between poor sleep quality and those who had lived longer with HIV, had longer delays in ART commencement, had poor adherence, had lower CD4 cell counts (< 200 cells/μl), were taking additional medications, had illicit substance use, or had insomnia, sleepiness, and depressive symptoms [60].

A study conducted by Oshinaike *et al.* on 300 PLWHA with female preponderance (70.7%) found that 59.3% had poor sleep quality with a mean PSQI score of 9.2 ± 3.3. Sleep quality was statistically significantly associated with duration since HIV diagnosis, efavirenz based regimen and CD4 cell count. Quality of sleep had no statistically significance association with age, gender, educational qualification, or marital status [61].

Another study done by Agus *et al.* in 35 subjects with 19 males observed mean HADS-A and HADS-D score of 15.286 ± 2.244 for each entity and mean CD4 was 288.171 ± 88.955. There was a significant negative correlation between HADS-A score and CD4 level with a correlation value of r = –0.592, and also a significant negative correlation between HADS-D score and CD4 level with a correlation value of r = 0 [62].

Among all the sociodemographic, clinical and biochemical variables, only opportunistic infection, CD4 count, and serum protein/serum albumin were found to be statistically significantly associated with all three studied psychiatric entities, i.e. anxiety, depression and insomnia. Thus we can decrease the frequency of all three entities altogether by improving CD4 count, alleviating opportunistic infections and improving body build, thus maintaining a proper protein level.

Some limitations must be considered in interpreting the results of our study. The cross-sectional nature of the study prevents us from making any speculations regarding the consistency of this relationship over time.

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Conflict of interest

The authors declare no conflict of interest.

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