



Short Sleep Duration and Correlates among Sero-positive HIV Patients in Nigeria, West Africa

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Authors' contributions

This work was carried out in collaboration between all authors. Author ROS designed the study, wrote the protocol and wrote the first draft of the manuscript. Authors LOO and SIL managed the literature searches. Author SAA analyzed of the study. Authors AGS and BSO wrote the discussion. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: Short sleep duration is a salient issue because it is a major public health concern and has more wide-reaching problems among HIV/AIDS patients. Short sleep duration was said to be associated with lower CD4 count, higher viral load values, depression, high blood pressure, high body mass index and disease progression. It was also documented that patients receiving

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efavirenz had shorter duration of deep sleep. Incidentally there is paucity of data in Nigeria to support these claims hence the need to investigate.

Methods: Four hundred HIV zero-positive patients were recruited at the HIV clinic of Kwara State Specialist Hospital, Sobi, Ilorin, after institutional ethical approval and informed consent was obtained. Blood pressure was measured. Classification of hypertension was made according to the seventh report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of high blood pressure (JNC-7). Body Mass Index was calculated as (kg/m²). The Patient Health Questionnaire (PHQ-9) was administered to the respondents to screen for depressive symptoms. The Pittsburgh Sleep Quality Index (PSQI) was used to assess sleep duration. The respondents were categorized into four groups viz, sleeping more than 7 hours, 6-7 hours, 5-6 hours and less than 5 hours. Subjects with <5hrs are poor sleepers while those with >7hrs were good sleepers.

Results: Four hundred HIV-infected patients were recruited with a mean age of 39yrs (SD 9). Eighty four (21%) were male, while 316 (79%) were female. The mean body mass index was 22.0 (SD 4.6), mean present CD4 count was 339.0 (SD 180.6). One hundred and eighty three respondents (45.8%) slept less than 5 hours, while 58 (14.5%) sleep more than 7hours. Short sleep was commoner in the age group 31-40 73(39.9%), among the female 145(79.2%) and those that were married 103(56.7%), and those with non-formal education 84(45.9%). Traders 80(43.7%) had highest number than other occupation. Short sleepers of less than 5 hours were prone to high blood pressure; higher body mass index and depression. This was statistically significant. The lower the CD4 count, the more the short sleep duration observed among the respondents. Patients receiving HAART containing efavirenz had shorter duration of deep sleep.

Conclusion: Almost half of the respondents were poor sleepers with associated high blood pressure and increased body mass index (BMI). Both effects of the virus and antiretroviral drugs may cause short sleep duration. Health providers managing HIV positive patients, need to take complaints of short sleep duration seriously, because they can indicate an increased risk for low CD4 counts, high viral load, depression, high blood pressure and increase body mass index. There is the need for targeting efforts to improve short sleep duration for the majority of adults living with HIV/AIDS and tailoring appropriate interventions.

Keywords: Short sleep duration; HIV positive patients; Nigeria; West Africa.

1. INTRODUCTION

Sleep naturally restores body functions including immune system. Short sleep duration interferes with normal physical, mental and emotional functioning and had been reported in HIV-infected individuals since the 1980's [1,2].

The amount of time spent sleeping is called sleep duration [3,4]. Short sleep is when sleep hours is less than or equal to 5 hours per night [5]. Short sleep duration (<5 hours) has been associated with lower reports of self-rated overall health than normal (>7hours) [6]. It has also been associated with low socioeconomic status [7]. National sleep foundation found out that adults need 7 – 9 hours of sleep [8].

Short sleep duration is common in HIV-infected patients [9]. These abnormalities are more frequent in subjects receiving efavirenz. Vivid dreams, difficulties in falling asleep, and/or numerous night awakenings are frequently reported by patients after beginning Efavirenz

medication [10]. The first United States National Health and Nutrition Examination Survey (NHANES-1) reported that short sleep duration was associated with a 60% increased risk of hypertension [11]. Cross sectional studies from USA [12-15], France [16], Japan [17], Canada [18,19], Spain [20], Germany [21], and the United Kingdom [22] found significant association between short sleep and obesity. Short sleep was also found to be associated with lower CD4+ T-cell counts and higher viral load [23]. Our aim was to determine the prevalence of short sleep duration among HIV patient on HAART and to evaluate the associated factors.

2. METHODS

This is a descriptive cross-sectional study conducted among 400 HIV/AIDS patients on Highly Active Anti Retroviral Therapy (HAART) attending the lentiviral clinic of Kwara State Specialist Hospital, Sobi, Ilorin from January to April 2015.

The sample size was estimated using the Leslie Kish's Formular for estimate minimum sample size in health studies [24]. Pretesting was carried out at the Kwara State Civil Service Hospital, using 40 respondents (10% of the sample size) from the HIV clinic.

Institutional ethical approval was obtained. All concerted HIV positive patients above 18 years were recruited. Exclusion criteria include the use of illicit drugs or alcohol, and the presence of acute medical condition that could affect the patients sleep or ability to complete the questionnaire. Weekly, 50 patients were seen on HAART and systematic sampling of odd numbers was used in selecting 25 weekly until a total sample size of 400 was obtained. The patient demographic data was evaluated. Recent laboratory results for CD4 cell count, and current antiretroviral therapy, was obtained from their case records.

Two or more blood pressure measurement separated by a two-minute interval, with the patient either supine or seated, and after standing for at least 2 minutes. Verification in the contra lateral arm was done. The JNC classification was used thus;

Normal $\frac{<120}{<80}$	Pre-hypertensive $\frac{120 - 139}{80 - 89}$
Stage 1 $\frac{140 - 159}{90 - 99}$	Stage 2 $\frac{>160}{100}$

Body weight was measured with subjects bare-footed and expressed in kilograms (kg) to the nearest 0.1 kg and the corresponding height expressed to the nearest centimeters. The international classification of body mass index (BMI) (kg/m^2) was used as follows; severe thinness <16.00 , moderate thinness $16.00 - 16.99$, mild thinness $17.00 - 18.49$, normal range $18.50 - 24.99$, pre-obese $25.00 - 29.99$, obese class I $30.00 - 34.99$, obese class II $35.00 - 39.99$, obese class III ≥ 40.00 .

The patients Health Questionnaire (PHQ-9) is a brief, 9-items patients report depression assessment tool. It was specifically developed for use in primary care general medical settings. Psychometric evaluation of the PHQ-9 reveal a sensitivity ranging from 62% to 92% and specificity between 74% – 88%. Respondents who scored one and more were assessed clinically for depression. Scoring and level of depression was assessed viz: (1-4) Minimal depression, (5-9) Mild depression, (10-14)

Moderate depression, (15-19) Moderately severe depression, and (20-27) Severe depression. Some direct depression care, such as care support, coordination, case management, and treatment was embarked on [25].

The Pittsburgh Sleep Quality Index (PSQI) was used to assess sleep duration. Psychometric properties have demonstrated good reliability internal consistency 0.89, test retest reliability 0.85 and good construct validity for the English language version. The respondents were categorized into three groups namely: Sleeping more than 7 hours, 5-7 hours and less than 5 hours. Subjects with <5 hrs are poor sleepers while those with >7 hrs were good sleepers.

The data were analyzed using the epidemiological information (Epi-info) 2005 software package. The 2 by 2 contingency tables were used to carry out Chi-square test and to find out the level of significance and values less than 0.05 were regarded as statistically significant.

3. RESULTS

Table 1 shows the socio-demographic factors of the respondents. Four hundred HIV-infected patients were recruited with a mean age of 39yrs (SD 9). Eighty four (21%) were male, while 316 (89%) were female.

Table 2 shows the association between sleep duration and socio-demographic factor. One hundred and eighty three respondents (45.8%) slept <5 hours, while 58 (14.5%) sleep >7 hours. A significant number of the respondents who sleep for < 5 hours 149 (81.4%) had depression.

Fig. 1 shows the stages of hypertension among the respondents.

74% had normal blood pressure and 21% were in the pre-hypertensive stage while only 2% and 3% were in the stages 1 and 2 respectively.

Fig. 2 shows the sleep duration among the respondents. One hundred and eighty three (45.8%) were poor sleepers, while 58 (14.5%) were good sleeps.

Table 4 shows the association between present CD4 count and sleep duration. The lower the CD4 count, the more the short sleep duration. Those who sleep < 5 hours had significantly low CD-4 count.

Table 1. Socio-demographic variables of the respondents

Variables	Frequency	(%)
Age group		
≤ 25	28	(7.0)
26 – 35	140	(35.0)
36 – 45	148	(37.0)
46 – 55	56	(14.0)
>55	28	(7.0)
Total	400	(100.0)
Sex		
Male	84	(21.0)
Female	316	(79.0)
Total	400	(100.0)
Ethnicity		
Hausa	24	(6.0)
Yoruba	304	(76.0)
Others	72	(18.0)
Total	400	(100.0)
Religion		
Christianity	76	(19.0)
Islam	324	(81.0)
Total	400	(100.0)
Marital status		
Married	212	(53.0)
Single	32	(8.0)
Divorced	8	(2.0)
Separated	68	(17.0)
Widow	72	(18.0)
Widower	8	(2.0)
Total	400	(100.0)
Educational level		
Non formal	168	(42.0)
Formal	232	(58.0)
Total	400	(100.0)
Occupation		
Trader	188	(47.0)
Civil Servant	68	(17.0)
Self Employed	84	(21.0)
Unemployed	56	(14.0)
Student	4	(1.0)
Total	400	(100.0)
Alcohol intake		
Never	60	(15.0)
Former	340	(85.0)
Total	400	(100.0)
Smocking status		
Current	364	(91.0)
Never	20	(5.0)
Former	16	(4.0)
Total	400	(100.0)

Table 5 shows the association between Highly Active Anti Retroviral Therapy (HAART) and

sleep duration. Patients receiving HAART containing efavirenz had shorter duration of deep sleep.

4. DISCUSSION

In this study, the prevalence of short sleep duration among the HIV positive patients was 45.8%, similar to 46% documented by Crum-Cianflone and co-workers [26] by the infectious diseases society of America, but lower than 59.4% reported by Adewole and co-workers [27] in Obafemi Awolowo Teaching Hospital, Ile-Ife, Nigeria.

The prominent age group with short sleep duration was 31-40 years, similar to 31-50 years reported by Bastos and colleagues [28]. Those with non-formal education had short sleep duration than those with formal education. Crum-Cianflone [26] found out that fewer years of education was associated with sleep duration.

Short sleepers of less than 5 hours were prone to high blood pressure. Recent data reported that short sleepers were at increased risk for hypertension [29-30]. Additionally, women who slept <7 hours were at increased risk of stroke [31]. Short sleepers were also prone to myocardial infarction [32].

Many studies had shown the relationship between short sleep duration and obesity [33,34]. Cross-sectional studies conducted in adults from Canada [35], France [36], Germany [37], Japan [38], UK [39], and USA [40], shown significant associations between short sleep and obesity. Short sleep duration was associated with increase weigh gain and body mass index. This was similar to the longitudinal analysis observed where sleep duration of <7 hours were associated with increased risk of weight gain. Also similar to another study where the odds ratio for sleep duration predicting obesity was 0.50, and every extra hour increase of sleep duration was associated with a 50% reduction in risk of obesity [41]. Studies in France [42] and Canada [33] also attested to these.

There had been inconsistent reports on the relationship between CD4 cell count and poor sleep quality. Some studies [43,44] had not found any relationship whilst others had confirmed that sleep disturbances were independently related to immune status [45,46]. We noted a significant association between short sleep duration and lower CD4 count. The

immune system is directly linked to the psyche by a complex network of nerves, hormones, and neuropeptides. This network of specific physiological pathways allows immune function to have a direct impact on health especially sleep. On the contrary Crum-Cianflone and co-worker did not find any association between short sleep duration and HAART use.

We noted that patients on efavirenz based HAART therapy had short sleep duration. Other earlier studies had also documented a correlation between high blood concentrations of efavirenz and poor sleep pattern [46,47]. Gallego et al. performed ambulatory electroencephalogram monitoring on HIV-infected subjects treated with efavirenz and documented that those receiving

Table 2. Association between sleep duration, blood pressure, body mass index and depression among HIV positive patients

Variables	Sleep duration			Total	Chi-square	P-value
	<5hours	5 - 7hours	>7hours			
Blood pressure						
Normal	133	117	46	296	4.165	0.654
Border Line	40	34	10	84		
Stage 1	3	5	0	8		
Stage 2	7	3	2	12		
Total	183	159	58	400		
Body mass index						
Underweight	22	25	9	56	8.953	0.176
Normal	141	112	35	288		
Over weight	5	6	5	16		
Obese	15	16	9	40		
Total	183	159	58	400		
Depression						
No depression	34	40	11	85	15.200	0.004
Moderate depression	99	101	31	231		
Severe depression	50	18	16	84		
Total	183	159	58	400		

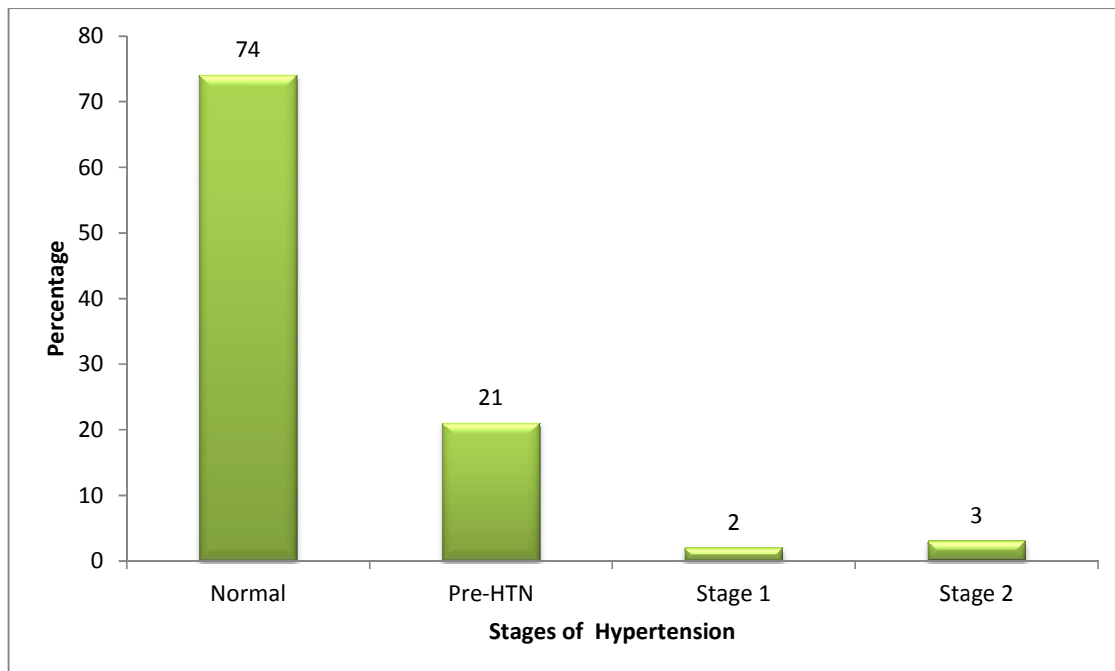


Fig. 1. Stages of hypertension among the respondents

efavirenz had shorter duration of deep sleep. Also, efavirenz plasma levels were significantly higher in patients with insomnia [48]. It had been suggested that a direct inhibition of serotonergic hypothalamic pathways by efavirenz may explain this. This could be attributed to the presence of the defective CYP2B6 G516T variant allele known to be common in black Africans, which causes a variation in the rate of efavirenz metabolism thereby significantly increasing the likelihood of the occurrence of sleep disturbance. This contrast with the report of Crum-Cianflone [26], where no significant associations between those on efavirenz containing regimen was found.

In this study, short sleepers of less than 5hours were prone to depression. This was similar to Crum-Cianflone [26] observation as well as other studies [49,50]. Sleep deprivation has effects on several domains of psychological health, including socialization, mood and stress. An increased stress response had been shown, including increased basal activity of neuroendocrine stress systems, elevations of the sympathetic nervous system, altered hypothalamic-pituitary-adrenal axis function, and increased stress reactivity [51].

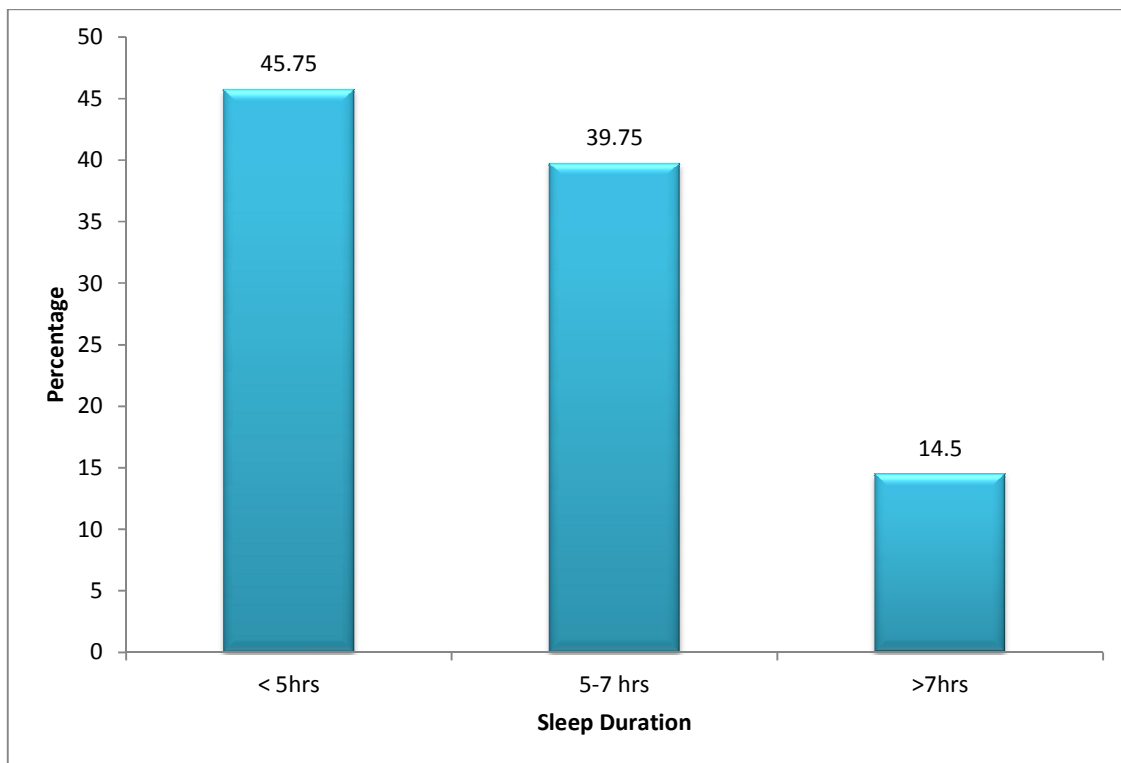


Fig. 2. Sleep duration among the respondents

Table 4. Association between present CD4 count and sleep duration among HIV positive patients

Variables	Present CD4 count				Total	Chi-square	P-value
	<50	50-200	201-500	500-999			
Duration							
< 5hrs	137	27	19	0	183	124.91	< 0.001
5 - 7hrs	120	15	22	2	159		
>7hrs	6	11	33	8	58		
Total	263	53	74	10	400		

Table 5. Association between highly active antiretroviral therapy and sleep duration

Haart	Sleep duration			Total	Chi-square	P-value
	< 5hours	5-7 hours	>7hrs			
Haart						
AZT+3TC+NVP	64	60	15	139	16.676	0.034
TDF+FTC+EFV	72	64	29	165		
TDF+FTC+NVP	47	29	12	88		
ABC+3TC+NVP	0	4	0	4		
AZT+3TC+LPVr	0	2	2	4		
Total	183	159	58	400		

Hack and Mullinton [52], observed optimism-sociability declined in 15% of the respondents over consecutive days of sleep loss. One study investigated risky decision making following sleep deprivation [53] and found that not only was sleep deprivation associated with increased risky behavior.

5. LIMITATION OF THE STUDY

There are few limitation of the study that may reduce the generation of our finding. Like all cross sectional study, it is difficult to establish casual association between dependent and independent variable. Further studies are required to determine the frequency of the genetic polymorphism affecting efavirenz metabolism in the African population. Also the regions in Africa where this detective gene exists need to be defined.

6. CONCLUSION

The results of this study indicate a significant reduction of deep sleep in HIV-infected individuals.

Efavirenz related neurologic effects especially short sleep duration may be explained by alterations in sleep architecture. EEG monitoring may be a helpful tool to detect objective sleep abnormalities in patients complaining of insomnia while receiving efavirenz. Further studies are required to determine the frequency of the genetic polymorphism affecting efavirenz metabolism in the African population. Also the regions in Africa where this detective gene exists need to be defined.

There is a dose-response relationship of short sleep duration and obesity and metabolic consequences. Short sleepers are prone to hypertension and depression.

It is recommended that health professionals make a systematic inclusion of questions regarding sleep when assessing patients with HIV/AIDS. This way, it will be possible to make an early identification of the sleep-related complaints and plan interventions that avoid or minimize the worsening of the complaints and subsequent deterioration of the quality of sleep, which will eventually affect the patients' overall health and quality of life.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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