

# Poor sleep in concurrent users of alcohol, khat, and tobacco smoking in community-dwelling Ethiopian adults

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## Abstract:

**BACKGROUND:** Polysubstance dependence, stress, and sleep disturbances are inter-related by shared physiological pathways. No study has investigated the relationship between sleep and concurrent use of alcohol and khat.

**OBJECTIVES:** The aim of the study was to assess the effect of the concurrent use of alcohol and khat as well as concurrent alcohol, khat, and tobacco smoking on sleep patterns.

**METHODS:** A sample of community-dwelling adults ( $n = 339$ , age =  $25.5 \pm 5.7$  years, body mass index =  $22.0 \pm 2.2$  kg/m<sup>2</sup>) from Mizan-Aman, Ethiopia, participated in a cross-sectional study. Semi-structured tool for sociodemographics, substance use habit, and the Pittsburgh Sleep Quality Index (PSQI) were used. The difference in sleep patterns among substance use groups, i.e., nonusers, alcohol use only, concurrent alcohol and khat use, and concurrent alcohol, khat and tobacco smoking was assessed.

**RESULTS:** The poorest sleep quality was found among concurrent users of alcohol, khat, and tobacco smoking (PSQI global score =  $8.2 \pm 2.4$ ), followed by concurrent users of alcohol and khat (PSQI global score =  $7.3 \pm 2.9$ ) ( $F(3,335) = 23.64$ ,  $P < 0.001$ ). There were significant differences in the PSQI component score of sleep quality  $\chi^2(3) = 159.09$ ,  $P < 0.001$ , the PSQI component score of sleep latency  $\chi^2(3) = 128.09$ ,  $P < 0.001$ , and the PSQI component score of sleep disturbances  $\chi^2(3) = 37.69$ ,  $P < 0.001$  between substance use groups.

**CONCLUSION:** Concurrent use of alcohol, khat as well as alcohol, khat, and tobacco smoking was associated with poor sleep. Sleep disturbances in this group need management to avoid the prospective development of psychosocial disturbances in polysubstance users.

## Keywords:

Addition, chat, insomnia, polysubstance, smoking, substance abuse

Polysubstance dependence and abuse are not uncommon across the globe.<sup>[1-4]</sup> Evidence indicates a high prevalence of polysubstance use in alcoholics and khat chewers.<sup>[2,5-8]</sup> Khat use involves chewing tender young leaves of *Catha edulis*, an evergreen shrub grown in high altitude regions of East Africa and South Western Arabian Peninsula. Two alkaloids found in khat leave, i.e., cathinone and

cathine have stimulant activity similar to amphetamines.<sup>[9,10]</sup> The global consumption of khat is continuously increasing with migrant populations from *C. edulis* growing regions settling in Europe, Australia, and America.<sup>[9]</sup> Concurrent use of khat and tobacco is common in areas where *C. edulis* is cultivated.<sup>[2,5-8,11]</sup> Khat and alcohol are frequently used concurrently in East African countries including Ethiopia.<sup>[2,11]</sup> Moreover, khat has been found to be the entry point for both tobacco smoking and alcohol use.<sup>[12]</sup> Concurrent use of khat and tobacco smoking

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is implicated in adverse psychophysiological responses such as poor verbal learning, delayed recall deficits, reduced cardiovascular stress response and increased negative mood, and increased fat mass index.<sup>[5,7,8,11]</sup>

Cathinone activates dopaminergic pathways involved in the regulation of sleep.<sup>[8]</sup> Khat use is associated with poor sleep as well as other conditions implicated in precipitating sleep problems, i.e., anxiety, depression, and stress.<sup>[1,7-10]</sup> There is only one study which has investigated sleep problems in cases of polysubstance use of khat and cigarette smoking.<sup>[8]</sup> Concurrent khat and tobacco use were associated with poor sleep quality in Yemeni population.<sup>[8]</sup> However, no study has investigated the relationship between sleep problems and concurrent use of alcohol and khat or concurrent use of alcohol, khat, and tobacco smoking. Such studies are important because sleep disturbances associated with khat use and polysubstance use involving khat are implicated in the development of psychosocial disorders.<sup>[7,8]</sup> Polysubstance use is usually associated with increased stress as well as a reduced stress response.<sup>[7,13]</sup> Further, stress has a bidirectional relationship with sleep disturbances and polysubstance use.<sup>[14,15]</sup> We hypothesized that both concurrent use of alcohol and khat as well as concurrent use of alcohol, khat, and tobacco smoking are associated with adverse sleep measures. Therefore, we conducted this study to assess the effect of the concurrent use of alcohol and khat as well as concurrent alcohol, khat, and tobacco smoking on sleep.

## Methods

A cross-sectional study with a simple random sampling technique for the selection of houses across Mizan-Aman town, Bench Maji Zone, South Nation Nationalities Peoples Republic, Ethiopia was performed. Three Kebeles (the smallest administrative unit of Ethiopia), i.e., Addis Ketema, Hibret kebele, and Kotema kebele, from a total of five kebeles in the city were selected by the lottery method. The list of house owners was obtained from the health professionals working at health posts. A random sampling frame for earmarking households for identification of participants was performed. The source population comprised all households with at least one adult member from the selected kebeles. The study population included eligible adults from the selected households. Only one adult was chosen conveniently from each earmarked household for the study over a period of 2 months in 2016. An initial screening of 650 adults was performed. Adults who fell in any of the four user groups (mentioned below) were included in this study. Persons with reported (self or family members) memory problems, mental disorders as well those with hearing and speech impairments were excluded from the study. This study presents finding

of a sample ( $n = 339$ ; age =  $25.5 \pm 5.7$  years, body mass index =  $22.0 \pm 2.2$  kg/m<sup>2</sup>) consisting of four substance user groups; nonusers of alcohol, khat and tobacco smoking (henceforth referred to as nonusers) ( $n = 63$ ), only alcohol users ( $n = 114$ ), concurrent users of alcohol and khat ( $n = 86$ ), and concurrent users of alcohol, khat, and tobacco smoking ( $n = 76$ ). The sample size was calculated using a single proportion formula ( $n = [(Z [1 - \alpha/2])^2 \times p \times (1 - p)]/d^2$ ) with the assumption that the prevalence of concurrent khat use with alcohol to be 50% (since the prevalence of the concurrent use of alcohol with khat is not known), with a confidence interval of 95%, and a margin of error 5%, and the estimated sample size was 384.<sup>[16]</sup> This may indicate that the study sample ( $n = 339$ ) is slightly lower. However, it may not be out of place to indicate that concurrent users of alcohol with khat as well as concurrent users of alcohol, khat, and tobacco smoking are not common. Informed consent was provided by the participants as per the Helsinki convention. The study was approved by the Human Institutional Ethics Committee of Mizan-Tepi University.

## Measurement criteria

Semi-structured tool for demographics and habit of substance use (nonusers, only alcohol use, concurrent alcohol and khat use, concurrent use of alcohol, khat, and tobacco smoking) were used. The semi-structured tool was a 13-item questionnaire with both 5-open-ended and 8-closed-ended items regarding participants' age, gender, athletic activity, light activity, ethnicity, education, religion, monthly income, parents, and substance use. The age categorization was adopted from the latest Demographic and Health Survey of Ethiopia published in 2016.<sup>[17]</sup> The lowest age group of 15–19 included only those who were adults, i.e., aged >18 at the time of enrollment in the study.<sup>[17]</sup> Alcoholic drinks consisted of both commercially available hard drinks as well as the indigenous forms such as tej, tella, areki, borde, and others. Light activity comprised household chores such as cooking, cleaning, washing clothes, and collecting firewoods. Athletic activity included playing soccer, running, strenuous exercise at home, and gymnasium. The participants comprised the major ethnicities in the region such as Amhara (10.9%), Bench (28.3%), Kaffa (26.5%), Oromo (12.7%), Tigre (1.8%), and others (19.8%). The Orthodox Christians (52.5%) comprised the biggest religious group followed by the Protestant Christians (32.2%). The Pittsburgh Sleep Quality Index (PSQI) was used to assess sleep quality. It is one of the most widely used sleep assessment tool and has been meticulously validated in various demographics including community-dwelling Ethiopian adults.<sup>[10,18-21]</sup> The questionnaire contains 24 items, of which 19 self-reported items are nonlinearly summed to generate scores for seven sleep measures (also known

as the PSQI component scores). The scores of these PSQI components are added to yield a global score. This global score is a valid and reliable index of sleep quality for the immediately preceding month.<sup>[18,19,22]</sup> The cutoff score of the PSQI was 5.5.<sup>[10]</sup>

### Statistical analysis

SPSS version 16.0 (SPSS Inc., Chicago, USA) was employed for statistical analysis. Participant characteristics presentation involved the use of descriptive statistics (mean  $\pm$  standard deviation/frequency). One-way analysis of variance (ANOVA) with Tukey corrections for *post hoc* comparison was used for the measurement of differences in the PSQI global scores among four groups of substance use, i.e., nonusers, alcohol users, concurrent users of alcohol and khat, and concurrent users of alcohol, khat, and tobacco smoking. Kruskal–Wallis test followed by Mann–Whitney *post hoc* analysis was used to assess the difference in the PSQI component scores among four groups of substance use. The results for the PSQI component scores of “use of sleep medicine” and “daytime dysfunction” are not shown because of their less sensitivity in Ethiopians.<sup>[10]</sup>

## Results

### Sociodemographic characteristics

Table 1 presents the sociodemographic features of the study population. Most of the participants (84.1%) were <30 years. Most of the participants (71.4%) reported light activity for >1 h/day [Table 1]. Similarly, the majority (59.6%) reported athletic activity for >1 h/day [Table 1].

### Between-group differences

The PSQI global score was significantly different between substance use groups ( $F [3,335] = 23.64$ ,  $P < 0.001$ ) [Table 2]. The PSQI component score of sleep quality ( $\chi^2[3] = 159.09$ ,  $P < 0.001$ ), the PSQI component score of sleep latency ( $\chi^2[3] = 128.09$ ,  $P < 0.001$ ), and the PSQI component score of sleep disturbances ( $\chi^2[3] = 37.69$ ,  $P < 0.001$ ) differed significantly between substance use groups [Table 2].

### Within-group differences

The PSQI global score was significantly higher in concurrent users of alcohol and khat ( $7.3 \pm 2.9$ ,  $P < 0.001$ ) and concurrent users of alcohol, khat, and tobacco smoking ( $8.2 \pm 2.4$ ,  $P < 0.001$ ) compared to both nonuser group ( $4.5 \pm 3.7$ ) and alcohol only user groups ( $5.2 \pm 3.4$ ) [Table 2]. The PSQI component score of sleep quality was significantly higher in concurrent users of alcohol and khat ( $P < 0.001$  and  $P < 0.001$ , respectively) and concurrent users of alcohol, khat, and tobacco smoking ( $P < 0.001$  and  $P < 0.001$ , respectively) compared to both nonusers and alcohol

**Table 1: Participant characteristics**

Characteristics	Mean $\pm$ SD/frequency
Age (years) <sup>#</sup>	
15-19	20 (5.9)
20-24	159 (46.9)
25-29	106 (31.3)
30-34	29 (8.6)
35-39	12 (3.5)
40-44	8 (2.4)
44-49	3 (0.9)
50-54	2 (0.6)
Gender	
Male	307 (90.6)
Female	32 (9.4)
Light activity	
None	76 (22.4)
Up to 1 h/day	114 (33.6)
>1 h/day	128 (37.8)
Athletic Activity	
None	137 (40.4)
Up to 1hr/day	154 (45.4)
>1 h/day	48 (14.2)
BMI (kg/m <sup>2</sup> )	
Underweight	16 (4.7)
Normal	293 (86.4)
Over-weight	30 (8.8)
Ethnicity	
Amhara	37 (10.9)
Bench	96 (28.3)
Kaffa	90 (26.5)
Oromo	43 (12.7)
Tigre	6 (1.8)
Others	67 (19.8)
Religion	
Orthodox Christian	178 (52.5)
Protestants Christian	109 (32.2)
Islam	48 (14.2)
Others	4 (1.2)
PSQI global score	6.3 $\pm$ 3.4
Substance abuse	
Nonusers	63 (18.6)
Alcohol only	114 (33.6)
Concurrent alcohol and khat use	86 (25.4)
Concurrent alcohol, khat, and tobacco smoking use	76 (22.4)

<sup>#</sup>Age group categorization has been adopted from the Demographic and Health Survey, 2016, Ethiopia, the lowest age group of 15–19 included only those who were adults, i.e., aged >18 at the time of enrollment in the study. Light activity comprised of household chores such as cooking, cleaning, and washing clothes. Athletic activity included playing soccer, running, strenuous exercise at home, and gymnasium. PSQI = Pittsburgh Sleep Quality Index, BMI = Body mass index, SD = Standard deviation

only user groups [Table 2]. The PSQI component score of sleep latency was significantly higher in concurrent users of alcohol and khat ( $P < 0.001$  and  $P < 0.001$ , respectively), and concurrent users of alcohol, khat, and tobacco smoking ( $P < 0.001$  and  $P < 0.001$ , respectively) compared to both nonusers and alcohol only user groups [Table 2].

**Table 2: Sleep disturbances in substance use**

Characteristics	Nonusers (n=63)	Alcohol use only (n=114)	Concurrent alcohol and khat use (n=86)	Concurrent alcohol, khat, and tobacco smoking (n=76)	P
PSQI global score, mean±SD <sup>b,c,d,e</sup>	4.5±3.7	5.2±3.4	7.3±2.9	8.2±2.4	<0.001
PSQI component scores, mean (SE)					
Sleep quality <sup>b,c,d,e,f</sup>	0.4 (0.1)	0.6 (0.1)	1.1 (0.1)	2.3 (0.1)	<0.001
Sleep latency <sup>a,b,c,d,e,f</sup>	0.8 (0.1)	1.2 (0.1)	1.7 (0.1)	2.3 (0.1)	<0.001
Sleep duration <sup>b,d</sup>	1.2 (0.2)	1.3 (0.1)	1.7 (0.1)	1.3 (0.2)	0.091
Habitual sleep efficiency <sup>d,f</sup>	1.3 (0.2)	1.3 (0.1)	1.8 (0.1)	1.3 (0.2)	0.083
Sleep disturbances <sup>a,b,c,e,f</sup>	0.6 (0.1)	0.8 (0.0)	0.9 (0.0)	1.0 (0.0)	<0.001

<sup>a</sup>significant difference between nonusers and alcohol use only, <sup>b</sup>significant difference between nonusers and alcohol with khat use, <sup>c</sup>significant difference between nonusers and alcohol with khat and tobacco smoking use, <sup>d</sup>significant difference between alcohol use only and alcohol with khat use, <sup>e</sup>significant difference between alcohol use only and alcohol with khat and tobacco smoking use, <sup>f</sup>significant difference between alcohol with khat use and alcohol with khat and tobacco smoking use, For <sup>a,b,c,d,e,f</sup> $P < 0.001$  or  $P < 0.05$ . SD = Standard deviation, SE = Standard error, PSQI = Pittsburgh sleep quality index. ANOVA with Tukey correction for *post hoc* comparisons was used for the PSQI global score. Kruskal–Wallis with Mann–Whitney for *post hoc* comparisons was used for the PSQI component scores. The results for the PSQI component scores of “use of sleep medicine” and “daytime dysfunction” are not shown because of their less sensitivity in Ethiopians. The PSQI global scores ranged from 0 to 15, and the PSQI component scores ranged from 0 to 3. ANOVA = Analysis of variances

The PSQI component score of sleep disturbances was significantly higher in concurrent users of alcohol and khat ( $P < 0.001$ ) and concurrent users of alcohol, khat, and tobacco smoking ( $P < 0.001$ ) compared to nonusers [Table 2]. The concurrent users of alcohol and khat had significantly higher scores for two of the PSQI component scores, i.e., for sleep duration ( $P < 0.05$ ) and habitual sleep efficiency ( $P < 0.05$ ) compared to alcohol only users [Table 2]. The concurrent users of alcohol, khat, and tobacco smoking had significantly higher scores for four of the PSQI component scores: for sleep quality ( $P < 0.001$ ), sleep latency ( $P < 0.001$ ), habitual sleep efficiency ( $P < 0.05$ ), and sleep disturbances ( $P < 0.05$ ) than the concurrent users of alcohol and khat [Table 2].

## Discussion

To the best of our knowledge, this is the first study to investigate the relationship between sleep and concurrent use of alcohol, khat, and tobacco smoking. Both the polysubstance user groups, i.e., the concurrent users of alcohol and khat as well as concurrent users of alcohol, khat, and tobacco smoking had poor sleep indicated by the significantly higher readings of the PSQI global scores (as well as the PSQI component score of sleep quality) compared to both nonusers as well as alcohol use only [Table 2]. Previous work on the concurrent use of tobacco and khat had found the habit to be associated with poor sleep in Yemeni population.<sup>[8]</sup> Similar to our study, the PSQI was used in the Yemeni khat users after proper validation.<sup>[8]</sup> We employed the PSQI for sleep evaluation because it had been found to have excellent psychometric characteristics in Ethiopians.<sup>[10]</sup> Polysubstance use involving concurrent khat chewing is associated with primary symptoms of sleep onset insomnia and sleep maintenance insomnia. This is indicated by the significantly higher scores for the PSQI component scores for sleep latency as well as the

PSQI component scores for the sleep disturbances among concurrent khat chewer (both groups) compared to both nonusers as well as alcohol use only groups [Table 2]. Previous works have shown that consumption of khat is associated with increased sleep latency.<sup>[23]</sup> We recently found that the frequency of daily khat sessions was a prominent predictor of increased sleep latency (odds ratio = 2.75, 95% confidence interval: 1.71–4.45) in Ethiopian adults.<sup>[24]</sup>

The concurrent users of alcohol, khat, and tobacco smoking had poor sleep quality, short sleep duration, poor sleep efficiency, and sleep disturbances compared to concurrent users of alcohol and khat. This is indicated by significantly higher values for the PSQI component scores of sleep quality, sleep latency, habitual sleep efficiency, and sleep disturbances in concurrent users of alcohol, khat, and tobacco smoking compared to concurrent users of alcohol and khat [Table 2]. This implies that polysubstance use involving all three substances, i.e., alcohol, khat, and tobacco smoking is more likely to cause symptoms of sleep onset insomnia, sleep maintenance insomnia, and short sleep than those using two of these substances (alcohol and khat). This explains the decreased sleep efficiency and short sleep duration among this group compared to the concurrent users of alcohol and khat. This suggests that the polysubstance use involving khat chewing had a synergistic negative effect on the sleep latency and sleep maintenance. Moreover, this synergism increases with each additional level of polysubstance use. The findings are similar to previous generalizations that the sedative effect of alcohol is replaced by sleep disturbing consequences including increased sleep latency when consumption of alcohol becomes chronic.<sup>[25]</sup> Moreover, sleep problems associated with chronic alcohol use are mostly refractory.<sup>[25]</sup> This may be attributed to the inter-relationship between sleep problems, stress,

and substance use, where each of them re-instate the other.<sup>[7,13,14]</sup>

Future studies investigating the effect of polysubstance use should appropriately address the issue of the acute and chronic use of substances. Substance use may increase sleep problems as well as stress. It is, therefore, likely that all the three factors, i.e., polysubstance use, stress, and sleep are inter-related.<sup>[14]</sup> Stress is implicated in the use of alcohol and other substances.<sup>[15]</sup> Polysubstance use, i.e., concurrent tobacco and khat markedly disrupt the hormonal stress response.<sup>[7,13]</sup> The repeated activation of central and peripheral pathways, including the dopaminergic and adrenergic systems in chronic use, may disrupt stress response.<sup>[7]</sup> This may further aggravate the problem of substance use by increasing propensity to polysubstance use.<sup>[7,13]</sup> Furthermore, the suboptimal stress response as in polysubstance use may further make it difficult for the homeostatic mechanisms to manage the problem of addiction.<sup>[7,13]</sup>

The inclusion of objective sleep assessment by polysomnography may further help in the characterization of underlying mechanisms of this relationship. Other important limitations of this study include nonassessment of the severity of addiction, modest sample size, and predominantly male sample. Nevertheless, this is the first study to assess polysubstance use in khat chewers and should encourage future studies with large sample sizes to assess the relationship between sleep and polysubstance use involving concurrent khat chewing after adjusting for confounders. Another merit of the study includes the use of the PSQI, which has been found to provide a valid measure of sleep quality in the Ethiopians.<sup>[10]</sup>

## Implications

Polysubstance use involving the concurrent use of khat is associated with poor sleep. Sleep is intricately related to the function of various physiological systems<sup>[26]</sup> and fluctuations in the physical microenvironment.<sup>[27]</sup> The health-care systems of the developing societies, which are already under pressure from enormous levels of infectious diseases, may be better placed to strategize prevention and awareness programs to decrease unwarranted sleep problems from polysubstance use. Such programs seem more indispensable because of the lack of awareness about sleep health issues even among the educated population in the developing societies.<sup>[28]</sup>

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## Conflicts of interest

There are no conflicts of interest.

## References

1. Moss HB, Chen CM, Yi HY. Early adolescent patterns of alcohol, cigarettes, and marijuana polysubstance use and young adult substance use outcomes in a nationally representative sample. *Drug Alcohol Depend* 2014;136:51-62.
2. Kassa A, Tadesse F, Yilma A. Prevalence and factors determining psychoactive substance (PAS) use among Hawassa University (HU) undergraduate students, Hawassa Ethiopia. *BMC Public Health* 2014;14:1044.
3. Conway KP, Vullo GC, Nichter B, Wang J, Compton WM, Iannotti RJ, et al. Prevalence and patterns of polysubstance use in a nationally representative sample of 10<sup>th</sup> graders in the United States. *J Adolesc Health* 2013;52:716-23.
4. Staines GL, Magura S, Foote J, Deluca A, Kosanke N. Polysubstance use among alcoholics. *J Addict Dis* 2001;20:53-69.
5. Hoffman R, Al'absi M. Concurrent use of khat and tobacco is associated with verbal learning and delayed recall deficits. *Addiction* 2013;108:1855-62.
6. Nakajima M, Dokam A, Khalil NS, Alsoofi M, al'Absi M. Correlates of concurrent khat and tobacco use in yemen. *Subst Use Misuse* 2016;51:1535-41.
7. al'Absi M, Nakajima M, Dokam A, Sameai A, Alsoofi M, Saem Khalil N, et al. Concurrent tobacco and khat use is associated with blunted cardiovascular stress response and enhanced negative mood: A cross-sectional investigation. *Hum Psychopharmacol* 2014;29:307-15.
8. Nakajima M, Dokam A, Kasim AN, Alsoofi M, Khalil NS, al'Absi M, et al. Habitual khat and concurrent khat and tobacco use are associated with subjective sleep quality. *Prev Chronic Dis* 2014;11:E86.
9. Manzar MD, Salahuddin M, Sony P, Maru TT, Pandi-Perumal SR, Moscovitch A, et al. Sleep disturbances and memory impairment among pregnant women consuming khat: An under-recognized problem. *Ann Thorac Med* 2017;12:247-51.
10. Salahuddin M, Maru TT, Kumalo A, Pandi-Perumal SR, Bahammam AS, Manzar MD, et al. Validation of the Pittsburgh sleep quality index in community dwelling Ethiopian adults. *Health Qual Life Outcomes* 2017;15:58.
11. Girma T, Mossie A, Getu Y. Association between body composition and khat chewing in Ethiopian adults. *BMC Res Notes* 2015;8:680.
12. Reda AA, Moges A, Biadgilign S, Wondmagegn BY. Prevalence and determinants of khat (*Catha edulis*) chewing among high school students in Eastern Ethiopia: A cross-sectional study. *PLoS One* 2012;7:e33946.
13. Lovallo WR. Individual differences in response to stress and risk for addiction. In: al'Absi M, editor. *Stress and Addiction: Biological and Psychological Mechanisms*. Burlington, MA: Academic Press; 2007.
14. Sinha R. Chronic stress, drug use, and vulnerability to addiction. *Ann N Y Acad Sci* 2008;1141:105-30.
15. Brady KT, Sonne SC. The role of stress in alcohol use, alcoholism treatment, and relapse. *Alcohol Res Health* 1999;23:263-71.
16. Tadele N, Habta F, Akmel D, Deges E. Knowledge, attitude and practice towards exclusive breastfeeding among lactating mothers in Mizan Aman town, Southwestern Ethiopia: Descriptive cross-sectional study. *Int Breastfeed J* 2016;11:3.

17. Central Statistical Agency (CSA) [Ethiopia] and ICF. Ethiopia Demographic and Health Survey 2016; 2017. Available from: <https://www.dhsprogram.com/pubs/pdf/FR328/FR328.pdf>. [Last accessed on 2018 Apr 14].
18. Mollayeva T, Thurairajah P, Burton K, Mollayeva S, Shapiro CM, Colantonio A, *et al.* The Pittsburgh sleep quality index as a screening tool for sleep dysfunction in clinical and non-clinical samples: A systematic review and meta-analysis. *Sleep Med Rev* 2016;25:52-73.
19. Manzar MD, Moiz JA, Zannat W, Spence DW, Pandi-Perumal SR, Ahmed S, BaHammam. *et al.* Validity of the Pittsburgh sleep quality index in Indian university students. *Oman Med J* 2015;30:193-202.
20. Manzar MD, Zannat W, Hussain ME, Pandi-Perumal SR, Bahammam AS, Barakat D, *et al.* Dimensionality of the Pittsburgh sleep quality index in the collegiate young adults. *Springerplus* 2016;5:1550.
21. Manzar MD, Zannat W, Moiz JA, Spence DW, Pandi-Perumal SR, Bahammam AS, *et al.* Factor scoring models of the Pittsburgh sleep quality index: A comparative confirmatory factoranalysis. *Biol Rhythm Res* 2016;47:851-64.
22. Buysse DJ, Reynolds CF 3<sup>rd</sup>, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh sleep quality index: A new instrument for psychiatric practice and research. *Psychiatry Res* 1989;28:193-213.
23. Lemma S, Patel SV, Tarekegn YA, Tadesse MG, Berhane Y, Gelaye B, *et al.* The epidemiology of sleep quality, sleep patterns, consumption of caffeinated beverages, and khat use among Ethiopian college students. *Sleep Disord* 2012;2012:583510.
24. Manzar MD, Salahuddin M, Maru TT, Dadi TL, Abiche MG, Abateneh DD, *et al.* Sleep correlates of substance use in community-dwelling Ethiopian adults. *Sleep Breath* 2017;21:1005-11.
25. Angarita GA, Emadi N, Hodges S, Morgan PT. Sleep abnormalities associated with alcohol, cannabis, cocaine, and opiate use: A comprehensive review. *Addict Sci Clin Pract* 2016;11:9.
26. Manzar MD, Zannat W, Hussain ME. Sleep and physiological systems: A functional perspective. *Biol Rhythm Res* 2015;46:195-206.
27. Manzar MD, Sethi M, Hussain ME. Humidity and sleep: A review on thermal aspect. *Biol Rhythm Res* 2012;43:439-57.
28. Manzar MD, Hussain ME. Lack of awareness and apathy to sleep health issues. *Indian J Sci Commun* 2014;13:7-10.