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Variation in subjective sleep measures and its impact on sleep quality

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Abstract

Sleep is mysterious and one of the important physiological events necessary for our body and the proper functioning of the brain. Insufficient sleep is known to adversely affect overall health, which in turn may have negative impact on our actions or behaviour. The development of the concept of sleep health has highlighted the importance of sleep assessment at population, population subset or individual level. Most of the general people are not aware of this concept of sleep health. Poor sleep quality, if kept unchecked may lead to insomnia. The present study deals with the subjective analysis and variations in/of sleep variables including sleep quality in a group of randomly selected 26 Indian individuals of 20-60 years age group. To fulfill the objective of this study two subjective tools viz. sleep diary and sleep questionnaire were used to assess sleep variables such as sleep latency, sleep efficiency, total sleep time, total time spent in bed, consecutively for two weeks. Though most of the sleep variables assessed did not show sex specificity, a significant difference was found in the sleep latency between the male and female participants of the sample. Women were found to have poorer sleep quality than the male participants. Some of the sleep variables may show sex specificity in a subset of population and sleep latency may be one of such variable.

Keywords: Sleep, sleep variables, subjective sleep, sleep assessment, and sleep latency

Introduction

Sleep– wake cycle has been shown to be affected by factors including anxiety or stress, body ache, medicines, drinks like alcohol, our life style; sleep environment, excessive light etc to which modern societies are exposed (Young el al., 2008). All these factors can influence various aspects of sleep cycle and accordingly affect our waking time and alertness. Sleep deprivation studies in animals and human highlight the importance and necessity of sleep. Loss of sleep, especially rapid eye movement sleep may induce oxidative stress in brain (Hippolide et al., 2002). Poor sleep quality or sleeping for less time may hamper both physical and mental health (Prendergast et al., 2015). Since the year 2014, there has been growing interest in the relationship between sleep and health (Czeiler, 2015, Irwin et al., 2016). Short sleep duration has been reported to be associated with diseases like hypertension, coronary heart diseases, diabetes, obesity etc. while long sleep duration is known to have negative impact on our health and working capability [Gallicchio and Kaleson 2009).

Poor environmental conditions resulting from polluted environment and our work pressure are now becoming major threats to our health and sleep (Troynikav et al., 2018) and we are forced to live under such conditions. Most of general public is not aware of the fact that such conditions are strongly capable of causing adverse changes in our sleep patterns resulting in disturbed/fragmented sleep or in poor quality sleep.

Poor quality sleep greatly reduces our work efficiency besides other effects on our health (Buysse (2014). Insufficient or less sleep is now one of the most significant life style factors. Good sleep health is characterized by subjective satisfaction, appropriate timing, adequate duration, high efficiency and sustained alertness during waking hours (Hyyppa and Kronholm, 1989). Sleep has been measured both objectively and subjectively (Kushida et al., 2001). Though the studies dealing with the objective measurement of sleep provides accurate and precise data, subjective assessment sleep methods are not less important (Iwasaki et al., 2010). Subjective assessment of sleep can be performed using sleep questionnaires and sleep logs or sleep diaries. Despite the lack of a standardized format, the sleep diary has been regarded as the gold standard for the subjective sleep assessment. Such studies are rarely performed in normal sleepers among Indian population or in population subset. The present study was conducted on a small sample of participants to investigate the sleep parameters subjectively in a randomly selected population subset. It further aims to highlight the importance of subjective sleep assessments at population or individual level which is at times more feasible than objective studies.

Method

Participants

Participants were called for a formal interview before recruiting the participants for the present study. A total of 30 participants agreed to participate and were randomly selected for the study. All of these participants had no history of sleep disorders and thus were taken as suitable sample for the present study. Out of 30 selected participants, 4 participants were not included in this study as they either failed to respond to our study thereafter or were uncooperative, Therefore, this study was continued with the rest 26 participants, 10 (38%) of which were males and 16(61 %) were females. Participants were given all the instructions related to the study and were asked to follow the instructions with extreme care. None of them were taking any medication for having normal sleep. Demographic characteristics of the sample of participants in the study are given in table 1.

Table 1: Demographic characteristics of the sample

N	Age group	Sex		Marital Status		Employment Status		Student
		Male	Female	Single	Married	Employed	Unemployed	
26	20-60 yrs	10	16	12	14	11	15	6

Procedure

On the first day, all participants were asked to answer a questionnaire containing questions during the past month based on Pittsburgh Sleep Quality index (PSQI) to assess sleep quality. The participants were also instructed to maintain a sleep diary based on National foundation Sleep Diary to record their sleep related activities every morning continuously for two weeks i.e. 14 consecutive days as soon as they get out of the bed each day. Participants were instructed to record carefully in their sleep diaries bedtime, time of sleep onset, the number of awakenings after sleep onset, the time they remain awake during that time in minutes, wake time, and the time they actually came out of bed.

Sleep diaries were collected from each participant after two weeks and the sleep variables namely time spent in bed (TIB), total sleep time (TST), sleep efficiency (SE), sleep latency (SL) and total time awake in bed (sum of SL, time spent in waking after sleep onset and time from final waking up to the time of getting out of the bed). SE was calculated using the formula viz. SE= TST/TIB x 100 while SL was calculated based on the self reported bed time and sleep onset time entered by the participants in their respective diaries. The average of each of these sleep variables were calculated in the overall sample and separately for males and females. All the sleep variables were averaged for the entire period of 14 days and separately for each of the two week period. For self reported sleep quality measures, all the participants were asked to rate their sleep quality as very good, fairly good, fairly bad and very bad. Sleep quality score was assessed by PSQI as mentioned earlier.

Statistical analysis

The averages of the sleep variables, TIB and TST were calculated from the self reported entries in the questionnaires. All of the sleep variables are expressed as mean ± SD. Data was analyzed statistically using student's t test. Two group t tests were employed to compare subjective sleep variables between males and females.

Results

The average values of the sleep parameters calculated from the questionnaire and sleep diaries are given in the Table 2 and Table 3 respectively.

Table 2: Mean Sleep parameters as calculated from the questionnaire

Sleep variable	Overall (n=26)	Male (n= 10)	Female (n=16)
Time in bed, TIB	**7.13 ± 0.79**	**7.0 ± 0.80**	**7.22 ± 0.80**
Total sleep time, TST	**6.59 ± 0.93**	**6.60 ± 0.87**	**6.65 ± 0.92**

TIB, TST expressed in hours

Table 3: Averaged Sleep parameters as calculated from sleep diaries for 14 consecutive days

Sleep variable	Overall (n=26)	Male (n= 10)	Female (n=16)
Time in bed, TIB	433.53 ± 43.11	443.7 ± 43.87	427.18 ± 42.79
Total sleep time, TST	389.73 ± 55.84	420.4 ± 58.81	370.56 ± 45.86
Sleep efficiency, SE	87.88 ± 5.81	90 ± 3.01	86.56 ± 6.77
Sleep Latency, SL	18.46 ± 9.83	12.6 ± 2.91**	22.12 ± 10.90**
Total time awake in bed	51.15 ± 19.90	45.5 ± 12.09	54.68 ± 23.18

Time is expressed in minutes

The average total sleep time of the sample was 6.5 hours. Twenty participants out of twenty six reported that they feel refreshed in the morning when they wake up. Ten participants had sleep efficiency that ranged from 75% to 85% while sixteen participants had sleep efficiency above 85 %; most participants (16) rated their sleep quality as fairly good while only eight participants rated their sleep quality as very good. Two participants who reported their sleep to be fairy bad were females. None of them rated their sleep as very bad. No significant sex specific differences was found in TIB, TST, SE and total time spent awake in bed. However, mean of sleep latencies was found to be higher in females than males for the entire study period and this difference was statistically significant (P= 0.01, Table 3: Fig. 1)). Significant differences were observed also when the means of sleep latencies in females were compared to those of the males separately for first ($p \leq 0.001$) and second week ($p \leq 0.05$) of the study period (Fig. 2).

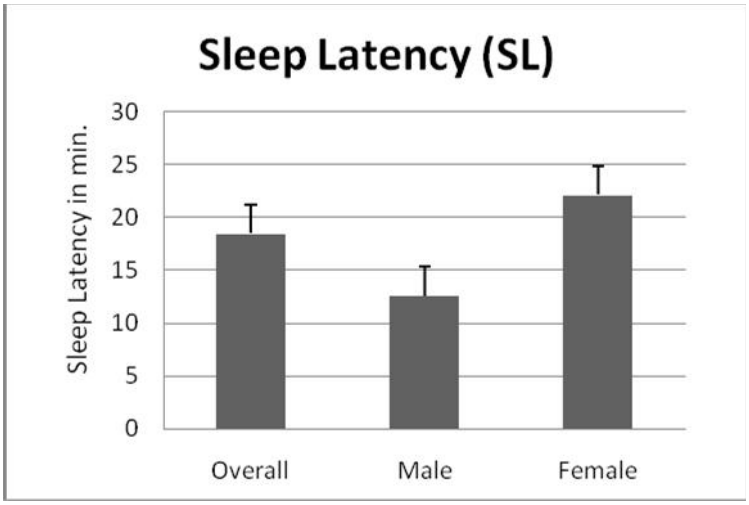

Fig. 1 This figure shows the average sleep latencies in min in the overall sample and in males and females of the sample for the entire period of study.

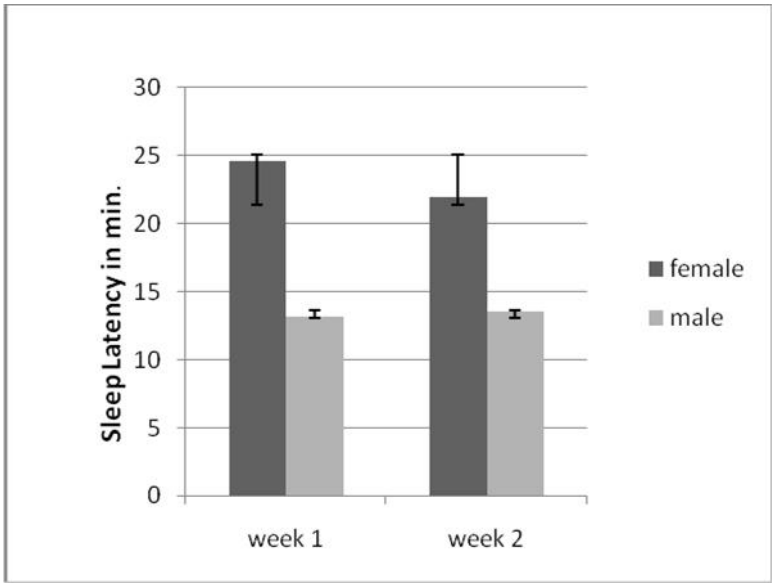

Fig. 2 This figure shows the sleep latencies of males and females in the first and second week of the study.

A high degree of negative correlation was observed between total time spent awake in bed (which includes SL, time spent in awakenings after sleep onset and time spent awake in bed after final awakening) and sleep efficiency (r= -0.946). All other correlations done were not significant.

Sleep quality- Out of 26 participants, 17 had their global PSQI less than or equal to 4 indicating good sleep quality and 9 participants were assessed to have poor quality of sleep. The average of global PSQI reported was 4.23± 2.34(mean ± SD). In overall sample studied, 65.38% of the participants had good sleep quality (17 out of 26) and 34.61% had poor sleep quality (9 out of 26). Among 16 females of the sample, 8 (50%) had good quality sleep and other 8 (50%) had poor sleep quality. The average sleep quality score in female participants was 5.125 ± 2.33 (mean ± SD). While among males, 9 of them had good quality sleep and only one male participant was found to have poor sleep quality i.e. 90 % of the males in the sample had good sleep quality. The average sleep quality score in male participants was 2.888 ± 1.55 (mean ± SD). The difference of average sleep quality scores between females and males was found to be significant statistically (P= 0.0130).

A moderate degree of positive correlation between sleep latency and sleep quality score (r = 0.696291) was obtained in contrast to a moderate degree of negative correlation between sleep efficiency and sleep quality score (r = -0.65816).

Discussion

This study is based on the self reported sleep/wake timings and computed the subjective sleep variables in a small sample of participants with no sleep disorders. The results of this study are consistent with that of other sleep assessment studies. The sleep variables viz. TIB, TST and SE were not found significantly different between males and females. However, the SL was significantly higher in the females than the males for the entire two week period and also separately for each of the two week period. Higher value of SL in females may be because of society pressures in terms of work and responsibilities of women in Indian scenario. The psychotic disturbances such as anxiety and depression or mood fluctuations are known to occur more frequently in women than men and are more vulnerable to insomnia (Nowakowski et al., 2013) or sleep disturbances (Akerstedr et al., 2002).

This study also found that women have poorer sleep quality than men as reported by the other studies. In the present sample, 50% of the women were found to have poor sleep quality. Another study conducted on professional Indian nurses reported 56% of the nurses to have poor quality sleep who use to work at night in the hospitals. A moderate degree of positive correlation obtained between SL and sleep quality score in this study. SE and sleep duration (TST) showed no sex specificity. Thus, higher SL in females with no history of sleep disorders could be the one of the important variation in determining or affecting the quality status of sleep. Sleep quality score (PSQI) equal to 5 or more than 5 defines the sleep quality as 'poor'. Moreover, a negative correlation has been obtained between sleep latency and sleep health (Allen et al., 2018). In other words, decrease in SL will result in the increased health (good health) indicating that improvement in SL may help in achieving good sleep quality. It has been reported that women have poorer sleep quality and sleep health in all those populations assessed for its sleep characteristics. Thus, it is proposed that the increased sleep latency may be one of the factors/variables contributing to poor quality sleep or poor sleep health in women.

Most of the subjective sleep studies have been performed either in sleep disorder patients (Iwasaki et al., 2010) or in older communities (Blackwell et al., 2011) or in children with autism (Alfonso-Alfonso et al., 2019)] and in populations mostly other than Indian population (Dalmases et al., 2015, Shechter and St. Onge, 2014). Few studies have been done either with medical students (Azad, 2015) or in nurses (Mahmood et al., 2014) as participants of Indian origin. Sleep, as seems to be influenced by many environmental and social factors may differ from place to place, person to person.

Though an objective study of sleep variables provides more precise data, it is not practically feasible to objectively measure sleep variables in large populations. Moreover, it has been recommended to use subjective data as an adjunct to objective data in patients of disorders of excessive somnolence [Kushida et al., 2001). Many studies comparing the results of sleep assessment by subjective tools with the objective tools found comparable results, thus justifying the use of subjective tools for assessing sleep to some extent. Subjective sleep studies can also be applied to those individuals who are not suffering from any sleep disorders but are experiencing disturbed or fragmented sleep. An agreement between sleep log/diary and objective tools in young children has also been established (Werner et al., 2008).

Sleeping for adequate time and good sleep health has been reported to be important for living quality life, good health and well being (Patel et al., 2012, Henry et al.,2008). Delayed sleep timing have been associated with low levels of physical activity in normal sleeping adults (Shechter and St. Onge, 2014). Sleep variables may be differently affected in different populations varying from one individual to the other. Thus, this paper suggests the execution of subjective sleep assessment studies at the individual level in the protocol of wellness programs held in clinics and hospitals. It further suggests the conduction of sleep assessment programs to be encouraged in schools and colleges as the students may be the easy targets for sleep disturbances and sleep timing shift due to tough competition in academics these days. The assessment of sleep via subjective means at population or individual level will surely help in planning the strategies for the promotion and improvement of sleep and sleep health in young and middle aged people. Improvement of sleep in elderly people may help them to achieve good sleep health and to age successfully.

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