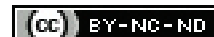Original Article

Sleep Hygiene Intervention and its Effectiveness in Reduction of Insomnia and Obesity among Undergraduate Medical Students

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ABSTRACT

Introduction: Adequate amount and quality of sleep is the basic need for any human. Children and adolescents requires atleast eight to nine hours of sleep per night. Insomnia results in both mental and physical health consequences, diminished productivity, accident proneness, increased medical utilisation and elevated risk of psychiatric disorders. Sleep hygiene intervention is a behavioral intervention to improve sleep quality.

Aim: To determine the effectiveness of sleep hygiene intervention programme in reduction of insomnia and obesity among undergraduate medical students.

Materials and Methods: This interventional study was conducted at Tagore Medical College and Hospital, Chennai, India, January 2019 to May 2019, among 602 undergraduate medical students. Study was conducted in two phases, in phase 1, participants were surveyed for Insomnia Severity Index (ISI) scoring and Body Mass Index (BMI). Those with ISI scores between 8-21 and BMI ≥ 30 kg/m^2 were eligible for phase 2. In phase 2 using, stratified random sampling total 100 subjects, 50 each for control and intervention group was selected. Periodical sleep hygiene intervention was given for intervention group, insisting to follow 10 simple non pharmacological behavioral measures. Follow-up assessment of weight (kg) and ISI scoring was done. Paired t-test, repeated measures Analysis of Variance (ANOVA) and Bonferine Posthoc test was done to identify the statistical significance using Statistical Package for Social Sciences (SPSS) version 20.0.

Results: Among the 100 participants in phase II, 29 were females in both control and intervention group. The prevalence of Subthreshold insomnia 289 (48%) was higher. Over 4 month period comparison, intervention group had better reduction in weight {(62.48±10.62 kg to 51.48±6.88 kg) vs (61.58±10.35 kg to 62.48±10.66 kg)} and insomnia severity (13.70±3.62 to 10.34±2.43) vs (12.56±3.78 to 13.70±3.63) than control group.

Conclusion: Simple non pharmacological intervention seems to have greater benefits in improving sleep hygiene and reducing obesity.

INTRODUCTION

Sleep is one of the basic physiological need of every human being, though the circadian rhythm of the sleep is being controlled by the pacemaker in brain lots of other external factors which are modifiable, are considered to be the major influencing parameter [1,2]. Adequate sleep is important to carry out even the routine activity in a most efficient way, children and adolescents requires atleast eight to nine hours of sleep per night [3-6]. Inspite of the fact that there is a high prevalence of insomnia which is associated with significant morbidity, it remains unrecognised and untreated, partly due to several barriers to assessment [7]. Insomnia results in both mental and physical health consequences, diminished productivity, accident proneness, increased medical utilisation, and elevated risk of psychiatric disorders [8-11]. Various research studies have also proved that insufficient sleep is independently associated with a higher risk of obesity [12,13].

There are various validated scales for identification of participants with insomnia and most of them are in the form of patient self-reported questionnaire [14]. The commonly used instruments for screening the people for insomnia are Insomnia Severity Index (ISI), which is a subjective self reporting 7-item questionnaire to determine the severity of insomnia. It is a 5-item liker questionnaire with a maximum of 28 score [11,15], the Pittsburgh Sleep Quality Index, a scale designed for measuring quality of sleep among clinical population over a month interval. It is a 19-item questionnaire a score of more than 5 indicates poor sleep quality [16] and the Athens Insomnia Scale, which was designed based on International Classification of Diseases-10 (ICD-10) criteria, for sleep difficulty quantification [15,17].

In order to help the people with mild to moderate level of insomnia, a practice developed in late 1970's pertaining to behavioral and environmental measure is termed sleep hygiene [7]. Various published articles have proved positive outcomes of sleep quality with the help of, proper sleep hygiene [18-20]. Studies have also suggested that interventional measure to improve sleep quality is the need of hour and its effectiveness should also be assessed [9,21].

The novelty of the study is that, the behavioral measures were developed for the study purpose after expert validation. Medical undergraduates who are often at risk of insomnia were planned to be assessed. Hence, the study was planned to assess the prevalence of insomnia using ISI scale and to identify if non pharmacological behavioral intervention could improve sleep hygiene and has some effect on obesity reduction. The objective of present study was to determine the effectiveness of sleep hygiene intervention programmed in reduction of insomnia and obesity among undergraduate medical students.

MATERIALS AND METHODS

This interventional study was conducted among medical undergraduates of Tagore Medical College Hospital, Chennai, Tamil Nadu, India, from January 2019 to May 2019. The Institutional Ethical clearance was obtained (Ethical clearance number: ECR/1122/TMCH/INST/TN/RR-20).

Inclusion criteria: All the MBBS students (first year to final year), during the specified study period willing to participate in both the phases of study were considered eligible for phase I. Those students who have obtained ISI score between 8-21 and having Body mass Index (BMI) ≥ 30 kg/m^2 [22] was considered eligible for phase II.

Exclusion criteria: Those students who were not able to participate even after three attempts or not attended any one or more of the intervention session was excluded, however in the present study no such participants were there, hence all of them were included.
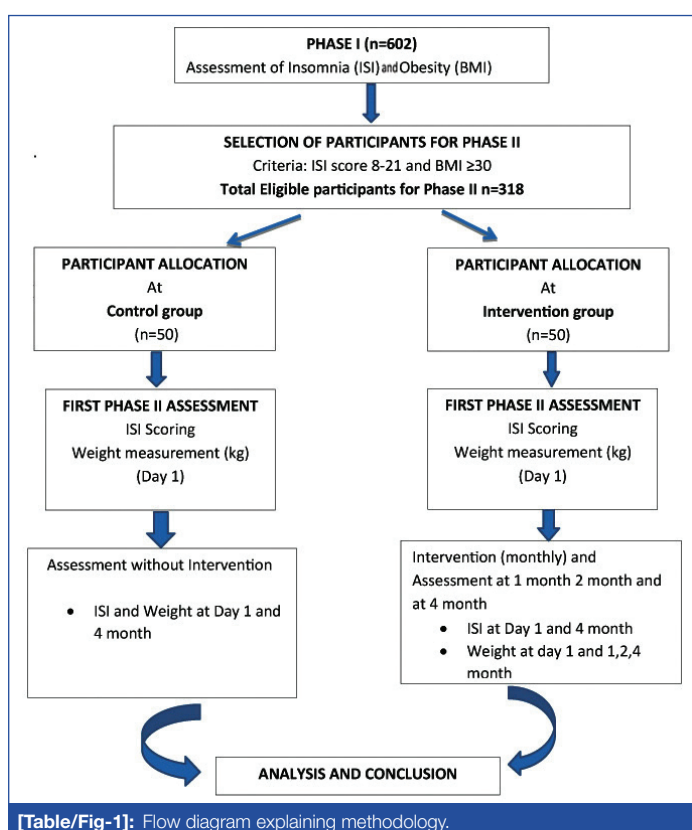
Phases

The study was conducted in 2 phases:

Phase I: A total of 602 students were involved for Phase I. In phase I, level of insomnia and obesity was assessed by using Insomnia Severity Index (ISI) scale and calculation of Body Mass Index (BMI) respectively [11,15,21].

The effectiveness of the program was assessed by measuring the ISI score and weight periodically.

Phase II: In the phase II, the effectiveness of sleep hygiene intervention program was planned by assigning them in two groups namely intervention and control group. Gender and academic year was used (i.e equal number of male to female and academic year was considered to be assigned in control and intervention group) in assigning them into two groups by stratified random sampling method [Table/Fig-1].

[Table/Fig-1]: Flow diagram explaining methodology.

Total 100 participants were divided equally in each group:

• Intervention group (50)
• Control group (50)

Procedure

A total of 602 participants were eligible for Phase I, hence all of them were included. In the phase I, Insomnia Severity Index (ISI) scale was used to assess the level of insomnia.

ISI scoring [11,15]:

• Absence of insomnia: 0-7
• Subthreshold insomnia: 8-14
• Moderate insomnia: 15-21
• Severe insomnia: 22-28

Students with severe insomnia was referred to Psychiatrist for further evaluation and medical intervention.

Height (cms) and Weight (Kg) was measured to calculate the Body Mass Index (BMI). Those with ISI score of 8 to 21 and BMI ≥30

was considered eligible for phase II. Out of 602 participants, 433 became eligible based on ISI grading and 318 became eligible criteria for selection of participants for Phase II:

• ISI score between 8-21
• BMI ≥30 kg/m^2

Out of this, 318 participants, 100 participants were selected for phase II (remaining 218 were excluded for the convenience of the author to impart a proper intervention for a smaller group, however all of them were given health education program regarding the same).

Intervention group received direct face to face, health education (15 minutes/session) through behavioral change communication 4 times i.e, immediately following the allocation of the participants in the intervention group, at day 1 and at the end of 1, 2 and 4 months following the allocation; they were also followed-up through telephonic conversation twice weekly regarding adherence and challenges in following the suggested intervention and necessary guidance was given. The sleep hygiene intervention had 10 simple steps to be followed, developed by the author after extensive literature review and expert validation [Table/Fig-2] [23-26]. Control group received no such intervention. The participants under both intervention and control group was assessed for insomnia and weight (kg) at day 1 and at end of 4 months in both the group apart from the weight (kg) that was measured at the end of 1 month and 2 month also in the intervention group.

S. No.	Sleep hygiene intervention
1	Food has to be consumed 1-2 hours before bed time
2	No fasting/Bungee dinner
3	No excessive fluid intake 1 hour before bedtime
4	No Snacks/Junks/Alcohol/Smoking 2 hours before bedtime
5	No electronic gadget usage i.e. mobile phone, laptop 1 hour before bedtime
6	Lights should be turned off or very dim light immediately after going to bed
7	Avoid planning for next day or future activities on bed
8	Do not see time if the sleep is disturbed in between
9	Maintain regular sleep and wake up time with maximum of ½ hour deviation
10	Avoid noisy environment after going to bed (avoid discussion/arguments/loud songs hearing)

[Table/Fig-2]: Ten simple steps of sleep hygiene intervention.

The sleep hygiene intervention program was considered effective in reducing insomnia, if the ISI score decreases from the baseline, similarly its considered effective in reducing the obesity if there is more decrease in weight in intervention group than the control group [9].

STATISTICAL ANALYSIS

The statistical tests like frequency, paired t-test, repeated measures Analysis of Variance (ANOVA) and Bonferine posthoc test was done to identify the statistical significance using Statistical Package for Social Sciences (SPSS) version 20.0.

RESULTS

Among the initial 602 participants screened for insomnia using ISI, most of them were classified under subthreshold insomnia 289 (48%) followed by 151 (25%), 144 (24%) and 18 (3%) of them under no clinical significant, moderate and severe clinical significant insomnia, respectively.

Among the 100 participants (50 each) allotted in control and interventional group, more number of participants were female (29 in each group) and aged between 20-22 years (26 in each group) having a BMI range of 35-39.9 (kg/m^2) [Table/Fig-3].

The severity of insomnia decreased in intervention group based on the mean ISI score of the participants which was 13.70±3.62 on day 1 compared to 10.34±2.43 at the end of 4 months and this declined insomnia severity over a time period was found to be statistically

Parameters	Control group (n)	Intervention group (n)
Age (years)		
17-19	19	19
20-22	26	26
>22	5	5
BMI (kg/m²)		
30-34.9	19	17
35-39.9	23	21
≥40	8	12
Gender		
Male	21	21
Female	29	29

[Table/Fig-3]: Distribution of participants based on selected socio-demographic parameters (n=100).

significant (p-value=0.0001). In contrast to the pattern of change in insomnia severity level among the intervention group, the control group had higher ISI score of 13.70±3.63 at 4 month compared to 12.56±3.78 at day 1, indicating unfavorable outcome, this difference was also found to be statistically significant (p-value=0.001) [Table/Fig-4].

Group	At day 1 (Mean±SD)	At the end of 4 month (Mean±SD)	p-value (paired t-test)
Intervention	13.70±3.62	10.34±2.43	0.0001
Control	12.56±3.78	13.70±3.63	0.001
p-value	0.1267	<0.001	

[Table/Fig-4]: Distribution of participants based on Mean ISI in intervention and control group (50 participants in each group).
p-value <0.05 was considered as statistically significant

There was a weight reduction observed in the intervention group having a change in mean weight from 62.48±10.62 kg on day 1 to 51.48±6.88 kg at the end of 4 months and this reducing pattern of weight change over a period of time was found to be statistically significant (p-value=0.0001). In contrast to the pattern of weight change among the participants of intervention group, the control group had weight gain over a period of 4 months depicting from the mean weight change of 62.48±10.66 kg at the end of 4 months from 61.58±10.35 on day 1, however this difference was not found to be statistically significant (p-value=0.6669) [Table/Fig-5].

Group	At day 1 (Mean±SD)	At the end of 4 month (Mean±SD)	p-value (paired t-test)
Intervention	62.48±10.62	51.48±6.88	0.0001
Control	61.58±10.35	62.48±10.66	0.6669
p-value	0.6688	<0.001	

[Table/Fig-5]: Distribution of participants based on mean weight (kg) in intervention and control group (50 participants in each group).
p-value <0.05 was considered as statistically significant

Thus by using the repeated measures ANOVA with Greenhouse-Geisser correction, the mean scores of weight (kg) were statistically significantly different (df: 1.242, 60.881, f-value=67.812, p-value=0.0001).

The results of Bonferroni posthoc test done to discover which specific means differed are as follows. It was noted that, there was a significant difference in weight (kg) between day 1 with 1 month, 2 month and 4 month after intervention (p-value <0.001) [Table/Fig-6].

Source	Type III sum of squares	Df	Mean square	F-value	p-value	Partial Eta squared
Time Greenhouse-Geisser	106.809	1.242	85.964	67.812	0.0001	0.581
Error (Time) Greenhouse-Geisser	77.178	60.881	1.268			

[Table/Fig-6]: Significance of Mean weight score among the intervention group (n=50).

Posthoc tests using the Bonferroni correction revealed that sleep hygiene intervention elicited reduction in weight (kg) in the intervention group from day 1 to 1 month postintervention (53.88±6.66 kg vs 53.51±6.61 kg respectively), between day 1 to 2 month postintervention (53.88±6.66 kg vs 52.97±6.69 kg respectively), between day 1 to 4 month postintervention (53.88±6.66 kg vs 51.94±6.88 kg respectively) also between the three postintervention period at 1 month, 2 month and 4 month (53.51±6.61 kg vs 52.97±6.69 kg vs 51.94±6.88 kg respectively) and this reduction in weight over time were also found to be statistically significant (p-value <0.005) [Table/Fig-7].

Pairwise comparisons						
Measure: weight						
					95% Confidence interval for difference[b]	
(I) Time	(J) Time	Mean difference (I-J)	Std. error	Significance[b]	Lower bound	Upper bound
Day 1	At 1 month	0.370*	0.092	0.001	0.116	0.624
	At 2 month	0.910*	0.170	0.0004	0.442	1.378
	At 4 month	1.940*	0.222	0.0006	1.329	2.551
At 1 month	Day 1	-0.370*	0.092	0.001	-0.624	-0.116
	At 2 month	0.540*	0.088	0.0003	0.298	0.782
	At 4 month	1.570*	0.154	0.0001	1.147	1.992
At 2 month	Day 1	-0.910*	0.170	0.0004	-1.378	-0.442
	At 1 month	-0.540*	0.088	0.0006	-0.782	-0.298
	At 4 month	1.030*	0.089	0.00001	0.786	1.274
At 4 month	Day 1	-1.940*	0.222	0.0002	-2.551	-1.329
	At 1 month	-1.570*	0.154	0.00001	-1.992	-1.147
	At 2 month	-1.030*	0.089	0.0001	-1.274	-0.786

[Table/Fig-7]: Specific mean weight difference over period of time in intervention group by Bonferroni posthoc test (n=50).
Based on estimated marginal means; *: The mean difference was significant at the 0.05 level;
b: Adjustment for multiple comparisons: bonferroni

DISCUSSION

The present study has identified alarming prevalence of insomnia as identified by Insomnia Severity Index scoring system, those scored ≥8 were considered to have insomnia and it was 74.9%. In another study conducted by Zhang C et al., it was found to be 36.1% and Dragioti E et al., in their study reported that prevalence of insomnia having ISI score of ≥8 was 64.3% this difference could be due to different geographic setting and also the study participants [27,28].

Tan E et al., developed a sleep hygiene Intervention program named F.E.R.R.E.T (an acronym for the categories of Food, Emotions, Routine, Restrict, Environment and Timing) which included three sleep hygiene specific rules to be followed for attaining proper sleep hygiene among children and adolescent in their study [23]. In the present study authors have adopted a ten simple steps to be followed which was provided to the participants in the form of behavior change communication.

The present study reported that there was a reduction in obesity among the intervention group compared to control group, having a mean weight change from 62.48±10.62 kg on day 1 to 51.48±6.88 kg at the end of 4 months. Similar to the present study findings, Tan E et al., also reported reduction in weight following sleep hygiene intervention programmed compared from baseline to 20 weeks postintervention [23].

Gipson CS et al., conducted a text message intervention program to promote sleep hygiene which showed improvement in sleep quality however it was not statistically significant [24]. The present study also have the component of intervening mobile phone and other electronic gadgets while going to bed, however was not individually assessed.

Based on the study findings of Brown FC et al., varying sleep schedule, environmental noise, worrying while falling asleep lead to poor sleep quality. In our present study, all these parameters were considered while developing the ten simple steps of sleep hygiene intervention program and the effectiveness was assessed by reduction in ISI score from base line to postintervention status, which was found statistically significant, thus indirectly incoherence with the Brown FC et al., study findings [25].

Zhou ES et al., in their study, reported that there was a significant reduction in mean ISI score from baseline to 12 weeks following interventional measure to promote sleep hygiene from 17.1 to 11.2 (p-value=0.0001) [26]. This was similar to the present study findings which also reported the reduction of ISI score from 13.7 on day 1 to 10.4 at the end of 4 months and this difference was found to be statistically significant (p-value=0.0001).

Limitation(s)

In the present study, there was only subjective measurement of insomnia level. Separate behavioral factor influence in level of insomnia was not assessed. Control group was not assessed with same frequency as intervention group.

CONCLUSION(S)

Simple non pharmacological intervention seem to have greater benefits in improving sleep hygiene and reducing obesity, was evident by reduction in severity of insomnia level and weight over a period of time. Hence, such behavior change communication based sleep hygiene intervention programmed should be provided on regular basis to achieve maximum benefit. This 10 step intervention can be tried among school children to know the benefits among them and to reduce the level of obesity in school children, which is almost a threat to their health in future.

REFERENCES

[1] Dewald JF, Meijer AM, Oort FJ, Kerkhof GA, Bogels SM. The influence of sleep quality, sleep duration and sleepiness on school performance in children and adolescents: A meta-analytic review. Sleep Medicine Reviews. 2010;14(3):179-89.

[2] Vidyashree HM, Patil PP, Moodnur V, Singh D. Evaluation and comparison of sleep quality among medical and yogic students- A questionnaire based study. National Journal of Physiology, Pharmacy and Pharmacology. 2013;3(1):71-74.

[3] National Sleep Foundation: Sleep in America Poll. 2006. http://wwwsleepfoundation.org/article/sleep-america-polls/2006-teens-and-sleep.

[4] Carskadon MA. Patterns of sleep and sleepiness in adolescents. Pediatrician. 1990;17:05-12.

[5] Mercer PW, Merritt SL, Cowell JM. Differences in reported sleep need among adolescents. J Adolesc Health. 1998;23:259-63.

[6] Galland BC, Taylor BJ, Elder DE, Herbison P. Normal sleep patterns in infants and children: A systematic review of observational studies. Sleep Med Rev. 2012;16:213-22.

[7] Irish LA, Kline CE, Gunn HE, Buysse DJ, Hall MH. The role of sleep hygiene in promoting public health: A review of empirical evidence. Sleep Medicine Reviews. 2015;22:23-36.

[8] Zhang J, Xu Z, Zhao K, Chen T, Ye X, Shen Z, et al. Sleep habits, sleep problems, sleep hygiene, and their associations with mental health problems among adolescents. J Am Psychiatr Nurses Assoc. 2018;24:223-34.

[9] Itani O, Kaneita Y, Jike M, Furuya M, Uezono C, Oda F, et al. Sleep-related factors associated with industrial accidents among factory workers and sleep hygiene education intervention. Sleep Biol Rhythms. 2018;16:239-51.

[10] Sarıarslan HA, Gulhan YB, Unalan D, Basturk M, Delibas S. The relationship of sleep problems to life quality and depression. Neurosciences. 2015;20:236-42.

[11] Morin CM, Belleville G, Bélanger L, Ivers H. The Insomnia Severity Index: Psychometric indicators to detect insomnia cases and evaluate treatment response. Sleep. 2011;34(5):601-08.

[12] Koren D, Dumin M, Gozal D. Role of sleep quality in the metabolic syndrome. Diabetes Metab Syndr Obes. 2016;9:281-10.

[13] Taheri S, Lin L, Austin D, Young T, Mignot E. Short sleep duration is associated with reduced leptin, elevated ghrelin, and increased body mass index. PLoS Med. 2004.

[14] Buysse DJ, Ancoli-Israel S, Edinger JD, Lichstein KL, Morin CM. Recommendations for a standard research assessment of insomnia. Sleep. 2006;29(9):1155-73.

[15] Bastien CH, Vallières A, Morin CM. Validation of the Insomnia Severity Index as an outcome measure for insomnia research. Sleep Med. 2001;2:297-307.

[16] Buysse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. Psychiatry Res. 1989;28(2):193-13.

[17] Soldatos CR, Dikeos DG, Paparrigopoulos TJ. Athens Insomnia Scale: Validation of an instrument based on ICD-10 criteria. J Psychosom Res. 2000;48(6):555-60.

[18] Brown FC, Buboltz WC Jr, Soper B. Development and evaluation of the Sleep treatment and education program for students (STEPS). J Am Coll Health. 2006;54:231-37.

[19] Moseley L, Gradisar M. Evaluation of a school-based intervention for adolescent sleep problems. Sleep. 2009,32:334-41.

[20] Bootzin RR, Stevens SJ. Adolescents, substance abuse, and the treatment of insomnia and daytime sleepiness. Clin Psychol Rev. 2005;25:629-44.

[21] Yazdi Z, Loukzadeh Z, Moghaddam P, Jalilolghadr S. Sleep hygiene practices and their relation to sleep quality in medical students of Qazvin University of Medical Sciences. J Caring Sci. 2016;5(2):153-60.

[22] World Health Organization. Obesity and overweight. Fact sheet no 311 January 2015. [cited 2016; Available from] http://www.who.int/ mediacentre/factsheets/fs311/en/.

[23] Tan E, Haleey D, Gray AR, Galend BC. Sleep hygiene intervention for youth aged 10 to 18 years with problematic sleep: A before-after pilot study. BMC Pediatrics. 2012;12:189.

[24] Gipson CS, Chilton JM, Dickerson SS, Alfred D, Haas BK. Effects of a sleep hygiene text message intervention on sleep in college students. J Am Coll Health. 2019;67(1):32-48.

[25] Brown FC, Buboltz WC Jr, Soper B. Relationship of sleep hygiene awareness, sleep hygiene practices, and sleep quality in university students. Behav Med. 2002;28(1):33-38.

[26] Zhou ES, Michaud AL, Recklitis CJ. Developing efficient and effective behavioral treatment for insomnia in cancer survivors: Results of a stepped care trial. Cancer. 2020;126(1):165-73.

[27] Zhang C, Yang L, Liu S, Ma S, Wang Y, Cai Z, et al. Survey of insomnia and related social psychological factors among medical staff involved in the 2019 Novel Coronavirus disease outbreak. Front Psychiatry. 2011;11:306. Doi: 10.3389/fpsyt.2020.00306.

[28] Dragioti E, Levin LÅ, Bernfort L, Larsson B, Gerdle B. Insomnia severity and its relationship with demographics, pain features, anxiety, and depression in older adults with and without pain: Cross-sectional population-based results from the PainS65 + cohort. Ann Gen Psychiatry. 2017;16:15.

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