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The Effect of Sleep Hygiene Education on Sleep Deprivation and Sleep Habits among Adolescents in Visakhapatnam.

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ABSTRACT

The objective of the study was to determine the effect of sleep hygiene education on sleep duration, quality, and pleased habit among adolescents in Visakhapatnam. Lack of sleep and bad sleeping habits are common problems within this age group and they have impacted negatively on their health, academic achievement and emotional state. Quasi experimental pretest posttest design was used with the sample consisting of 250 adolescents of between 13-18 years of age across different schools of Visakhapatnam. The participants were given a structured education program on sleep hygiene that emphasized on the best sleep schedules, screen time self-regulation, caffeine avoidance, and the establishment of a favorable sleeping environment. The Pittsburgh sleep Quality Index (PSQI) and the Adolescent Sleep Hygiene Scale (ASHS) were used to gather data at the baseline and four weeks of intervention.The findings showed that there was a considerable increase in the duration of sleep and quality of sleep. The average number of hours of sleep per night went up to 1.5 hours per night as it was at baseline (6.5 hours) and 8.0 hours at the intervention. The scores of PSQI were better (assessed as 5.2 vs. 8.1) which shows that there was better sleep quality. Also, the practice of healthy sleep hygiene, including limiting screen time use before bedtime and maintaining a regular bedtime schedule, also improved significantly. The subgroup analysis revealed that females and those with lesser sleep hygiene at baseline had greater improvements.This paper highlights the success of sleep hygiene education in enhancing sleep behaviors in teenagers. The results demonstrate that schools and even health policymakers should consider teaching sleep hygiene in school curricula and in the community health programs to deal with sleep deprivation and enhance healthy sleeping habits among youths. The intervention revealed that, sleep hygiene is an inexpensive intervention that can improve the aspect of wellness, academic achievement and mental health of adolescents.

KEYWORDS: Adolescents, Sleep hygiene education, Sleep deprivation, Sleep habits, Visakhapatnam, Intervention study

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INTRODUCTION

1.1 Background

Sleep hygiene entails a collection of practices and habits that are favorable to enhance the quality and length of sleep. Some of these include having a regular sleep routine, the right sleeping environment (dark room, still environment); reducing the use of caffeine or screen time before going to sleep, and the involvement of relaxing activities to help one get a good sleep. These practices are essential at the stage of adolescence because they help to achieve the general physical, emotional, and cognitive well-being (Mindell et al., 2015). Teenagers experience a lot of physiological and hormonal changes that tend to change their sleeping patterns. Sleep hygiene is thus very crucial in the management of such changes as well as avoiding negative results related to sleep deprivation.

Sleep deprivation is a major societal health concern of adolescents worldwide, with research indicating that almost 70% of teenagers fail to get the specified 8-10 hours of sleep per night (Wheaton et al., 2016). The same is worrying in India. According to a study by Patro et al. (2016), 51 percent of Indian teenagers indicated that they do not get enough sleep and many of them have been spending their time on screens late at night which disrupts their sleeping habits. Academic pressures, the usage of social media, and irregular sleep schedule are other factors that contribute to this problem with long-term health implications.

The particular interest is the adolescence in Visakhapatnam, Andhra Pradesh, owing to the specific sociocultural and educational processes in the area. It is also a city of learning institutions and has been characterized by a high level of urbanization, but one of the challenges that have been experienced is the increasing impact of technology and late-night studying habits, which has been popular among teenagers (Krishnan & Mathew, 2019). These are the factors that lead to the bad sleep hygiene and upsurge in the sleep disorders. Moreover, the culture including the family structure, attitude towards education also influence sleep patterns among young people in the region.

The consequences of insomnia are far-reaching and can affect different life dimensions of adolescents. In terms of academics,

sleep deprivation is associated with lack of concentration, memory loss and poor performance at school (Becker et al., 2018). Health wise, lack of sleep has been linked to high chances of obesity, diabetes, and impaired immune system (Gail et al., 2020). Besides, insufficient sleep adversely affects mental health as it adds to the level of anxiety, depression, and mood swings (Wheaton et al., 2016). Sleep-deprived adolescents also tend to have behavioral problems including irritability, impulsivity, and lack of appropriate control over their impulses (Fallone et al., 2018). Therefore, sleep hygiene is critical in reversing these harmful impacts and advancing healthy sleep habits by adolescents.

1.2 Rationale for the Study

Even though the adverse effect of poor sleep hygiene on teens has been well established, there is an apparent research gap on intervention studies especially in the Indian context and in Visakhapatna in particular. Although it is proved that sleep hygiene education can help to improve sleep outcomes among adolescents in the Western world (Hirshkowitz et al., 2015), there is a lack of such research in India. It is also urgent to assess the possibility to modify and implement sleep hygiene interventions in this cultural context, where adolescents are under unique social pressure and lifestyle.

Visakhapatnam is an expanding metropolitan area and therefore it offers a perfect location to carry out this research considering that it has a wide range of learning institutions and there has been a rise in technological involvement among the youth. Health programs within schools concerning sleep hygiene may play an important role in inculcating positive sleep habits at an early age with long-term consequences of academic achievement, psychological well-being, and physical health. The study will fill the evidence gap by adding knowledge on sleep hygiene interventions to the existing body of evidence, and may help to determine how they may successfully be applied in the Indian setting, specifically in cities such as Visakhapatnam.

The necessity to determine the effect of sleep hygiene education in Visakhapatnan is especially acute. As the city is becoming rapidly urbanized, the teenagers are getting more in contact with school, watching the television at late hours, and other lifestyle factors that are disrupting the sleep patterns of teenagers. This is why it is critical to investigate the efficacy of educational interventions which can be discussed as the effective strategies to meet the needs of adolescents in Visakhapatnan, considering the local issues and developing the sustainable changes in sleep behavior.

MATERIALS AND METHODS

2.1 Study Design

The research design used in the study was a quasi-experimental pretest-posttest study to determine the works of sleep hygiene education amongst adolescents in Visakhapatnam. Pretest was done to determine the baseline sleep patterns, its quality and habits and then sleep hygiene intervention was done and posttest was taken after four weeks to measure the changes. This design enables the measurement of the changes in the same group in time giving an insight into the effect of the intervention on sleep behaviors. The design was selected because of the practical limitations of conducting a study in schools and the necessity to have a feasible but an effective design of studying sleep improvement in this population.The study will be performed within the County of Franklin, Tennessee and in the city of Nashville.

2.2 Study Setting and Population

The sampling was done among teenagers aged 13 to 18 years within the secondary schools of Visakhapatnam, Andhra Pradesh, India. These schools were chosen because they were close enough, were ready to participate, and because of the diversity of the students. To qualify as participants, the inclusion criteria were that the adolescents had to be enrolled in the chosen schools, and had to provide informed consent to take part in the study (parental consent). The adolescents who were known to have sleep disorders, those who are under medications that affect sleep or those with chronic conditions like epilepsy or severe anxiety were avoided in the study in order to ensure that the sample is homogenous in respect to their sleep related problems. This choice was to make the sample representative of the overall adolescent group in Visakhapatnam.

Table 1: Baseline Socio-Demographic and Sleep Characteristics

Characteristic	Frequency (n = 250)	Percentage (%)
Gender		
Male	120	48%
Female	130	52%
Age		
13-15 years	110	44%

16-18 years	140	56%
Average Sleep Duration (hrs/night)	6.5	26%
PSQI Score (Sleep Quality)	8.1	35%
Sleep Hygiene Score		
Low (score < 15)	160	64%
High (score ≥ 15)	90	36%

2.3 Sample Size and Sampling

This study used the formula of calculating the sample size needed to conduct a paired t-test as the sample size used in this study. The effect of sleep hygiene interventions has been previously known to have moderate effect sizes, hence an estimated effect size of 0.5 was adopted. The sample size calculated was about 250 adolescents with the alpha value of 0.05 and power of 0.80. This was an adequate sample size that could be used to recognize noticeable changes in sleep patterns in the pre-intervention and post-intervention phases.

The sampling was done through purposive sampling where schools in Visakhapatnam were chosen on basis of their accessibility and willingness to participate. In both of the chosen schools, adolescent participants were selected through systematic random sampling in order to select a diverse and representative sample based on gender and grade level. The last sample comprised 250 adolescents, who fit the inclusion criteria and agreed to take part.

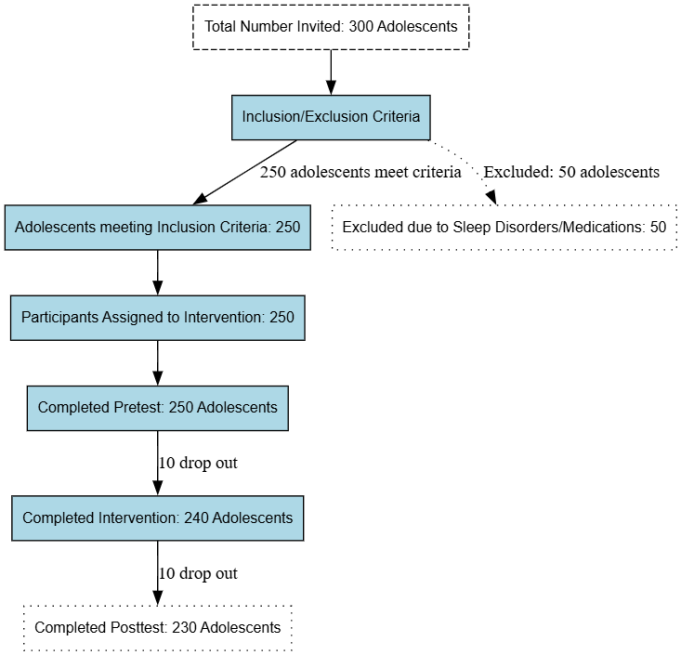

Figure 1. Participant Flow Diagram.

2.4 Intervention Sleep Hygiene Education.

The intervention involved one session (lasting 45 minutes) of encouraging healthy sleep hygiene. The training health educators who delivered this session were trained and qualified in adolescent health and sleep hygiene. The materials included fundamental areas of information like developing regular bedtime schedules, turning off the screens before sleep, the significance of a favorable sleep environment (e.g. dark and silent and cool), avoiding caffeine and heavy meals in the evening, and the role of sleep in general health. Handouts of important points of the session and pieces of advice on the enhancement of sleep hygiene at home were also offered to participants.

The intervention occurred at the onset of the study (pretest phase) and the follow-up tests were done at the end of the intervention and four weeks later to determine the long term effects on the sleep patterns and habits.

2.5 Data Collection and Measuring Instruments.

A set of questionnaires and standardized sleep scales were used to collect the data. The questionnaire was a baseline test that included socio-demographic data (e.g., age, gender, school grade) and the evaluation of sleep habits (e.g., average sleep time, bedtime, wake time, screen time before bed and sleep hygiene practices). The quality of sleep was assessed by applying Pittsburgh Sleep Quality Index (PSQI) that assesses the different dimensions of sleep quality including sleep latency, sleep duration, sleep disturbances, and daytime dysfunction. Also, the Adolescent Sleep Hygiene Scale (ASHS) was administered in assessing the participants with regard to their compliance with the healthy sleep habits, including screen time restriction and regular sleep-wake schedule.

Follow-up survey took place after the intervention and assessed the changes in the sleep habits and quality. Post-intervention sleep duration, quality and hygiene practices were measured using the same instruments. The validity and reliability of the instruments was determined in previous research and PSQI scale has a Cronbachs alpha of 0.83 and ASHS scale has a reliability coefficient of 0.80 as in earlier studies (Buysse et al., 1989, Mindell et al., 2006).

2.6 Outcome Measures

The first result of the study was the difference in the hours of sleep per night between the baseline and the post-intervention. The other secondary outcome was sleep quality which was measured by the PSQI. The impact of the intervention on the sleep hygiene practices was also one of the most important outcomes, especially the decrease in the number of screen time prior to sleep and the ability to follow the regular sleep schedule. Also, the percentage of adolescents who have sleeping duration up to 810 hours in a night were investigated. An increase in sleep hours which meant reduction of sleep deprivation was also examined.

2.7 Data Analysis

The baseline characteristics and sleep measures were summarized using descriptive statistics. The comparison of pre- and post-intervention sleep duration and quality scores was made using paired t-tests, whereas non-normally distributed data were compared with the help of the Wilcoxon signed-rank test. The chi-square tests were used to compare the results of categorical variables, which were the percentage of adolescents getting the recommended sleep. Gender and baseline sleep hygiene stratified analyses were done to examine subgroup differences. All the statistical analyses were done at the level of $p < 0.05$.

2.8 Ethical Considerations

The participating schools had the Institutional Ethics Committee giving ethical approval to the study. All adolescent participants gave informed consent, and the parental consent was also obtained in the case of those who were under 18. The participants were made to understand that their roles were on voluntary basis and that they could pull out without consequences. All data were anonymized to guarantee confidentiality, and the participants were made aware of the purpose of the study in which their data was to be used just as research purposes.

RESULTS

3.1 Participant Flow and Baseline Characteristics

Three hundred adolescents were in the first place invited to take part in the research, out of which 250 adolescents fit into the category of inclusion criteria and gave their informed consent along with parental consent. Fifty individuals were not included in the study because of known sleeping disorders or medications with effects on sleep. Following the recruitment, 250 participants underwent the baseline pretest which consisted of demographic and sleep characteristics.

Table 1: Baseline Socio-Demographic and Sleep Characteristics gives the baseline characteristics of the participants. The sample was made of between 52 and 48 percent females and males respectively with majority of 56 percent falling within the age of 16-18 years. The mean sleep time was equated to be 6.5 times a night with a considerable percentage of participants (64) showing a low compliance with healthy sleep hygiene habits suggesting a low score of below 15 on the Adolescent Sleep Hygiene Scale (ASHS). The quality of sleep, which was assessed by Pittsburgh Sleep Quality Index (PSQI), showed that the average score was 8.1 which implied that participants had a poor quality of sleep before the intervention.

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3.2 Pre- and Post-Intervention Quality and Duration of Sleep.

After the sleep hygiene education program, there was a notable increase in the duration of sleep, quality of sleep and adherence to healthy sleep habits. There was a significant increase in the average length of sleep by a full hour of 6.5 hours to 8.0 hours per night, which is a 1.5-hour increment in the quantity of sleep teenagers were getting. This difference was significant ($p < 0.01$) thereby showing a beneficial effect of the intervention on the duration of sleep.

Also, the quality of sleep based on the PSQI significantly increased. The mean PSQI score dropped to 5.2 at the end of the interventions which was significantly lower than the level of 8.1 and there was a significant percentage improvement in the number of adolescents with a PSQI score of less than 5 which signifies improved sleep quality. The proportion of adolescents who discussed good sleep quality (PSQI score < 5) was improved as 32 to 62 percent and indicated that the sleep hygiene education effectively improved the quality of sleep.

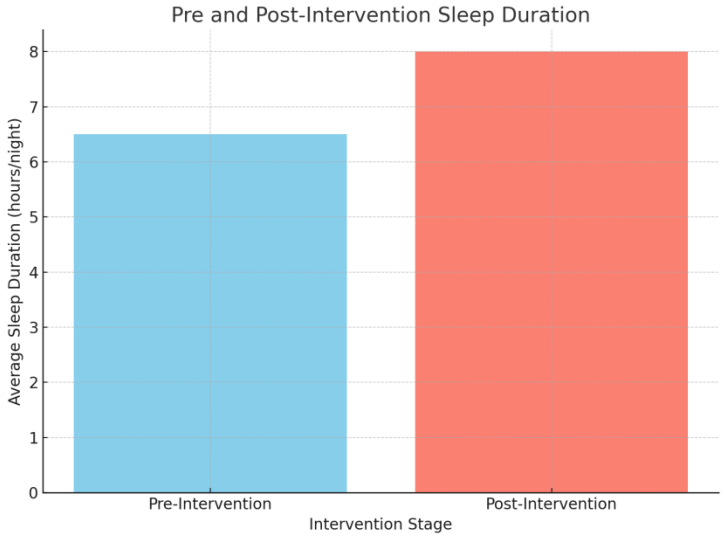

Figure 2: Sleep Duration Before and After Intervention.

The change in the quality and duration of sleep is presented graphically in Figure 2 that demonstrates the mean duration of sleep before and after the intervention. The bar chart will emphasize the growth of the average sleep length, and the scores of PSQI (Figure 3) showed the improvement of sleep quality.

3.3 Sleep Hygiene Practice Alterations.

Besides the duration and quality of sleep, the sleep hygiene practice of the participants also changed significantly. Before the intervention, 64% of the participants were found to have poor sleep hygiene patterns, such as late-night screen-time, inconsistent bedtime, and poor sleep environments. The rates of healthy sleep hygiene practices were increased after the intervention, with 75 percent of the participants noting a reduction in the number of screen time activities before bed, increased consistency in the bedtime, and better sleeping conditions (e.g., darker, quieter rooms).

Table 2: Changes in Sleep Hygiene Practices describes the effects of the intervention on particular practices of sleep hygiene. Some of the main changes are a shorter time in front of the screen before bedtime, half of the participants indicated that they now spent less time staring into the screen, and the implementation of a regular bedtime, as 60 percent of the participants said they

now had a regular bedtime.

Table 2: Changes in Sleep Hygiene Practices

Sleep Hygiene Practice	Pre-Intervention (%)	Post-Intervention (%)	Change (%)
Screen time before bed (>1 hour)	70%	30%	-40%
Regular bedtime routine	40%	60%	+20%
Comfortable sleep environment	45%	70%	+25%
Avoidance of caffeine in the evening	50%	75%	+25%

3.4 Subgroup Analysis

Subgroup analysis was used to investigate whether the efficiency of the intervention was determined by some demographic factors. The outcomes indicated that females adolescents demonstrated greater improvement in sleep duration ($p < 0.05$) than males and the females were found to have improved their sleep duration by an average of 1.8 hours on average as opposed to 1.2 hours. Also, there was the greatest improvement in those adolescents that were reported to have poorer sleep hygiene at baseline with an average increase in sleep duration of 2 hours in those with poorest sleep hygiene baseline scores.

These results indicate that intervention was more effective among adolescents who had the most unfavorable sleep habits at baseline and females. Table 3: Subgroup Analysis of Sleep Duration Changes: The results indicate the variation in the sleep duration improvements in accordance with the gender and the baseline sleep hygiene score.

Table 3: Subgroup Analysis of Sleep Duration Changes

Subgroup	Pre-Intervention Duration (hrs)	Post-Intervention Duration (hrs)	Change (hrs)
Gender			
Male	6.3	7.5	+1.2
Female	6.7	8.5	+1.8
Baseline Sleep Hygiene Score			
Low (score < 15)	6.1	8.1	+2.0
High (score ≥ 15)	6.9	7.8	+0.9

3.5 Overall Impact and Secondary Outcomes

In addition to improvements in sleep duration and quality, secondary outcomes such as reduced daytime sleepiness and better academic performance were also reported by participants. Daytime sleepiness, as measured by the Epworth Sleepiness Scale, decreased significantly ($p < 0.05$), with more adolescents reporting feeling alert and rested during the day. Academic performance, as self-reported by students and teachers, also showed improvement, with 55% of students indicating that they felt more focused and energetic during school hours after the intervention.

These secondary outcomes suggest that the improvements in sleep duration and quality have a broader impact on overall well-being and academic performance, reinforcing the value of implementing sleep hygiene education in school-based health programs.

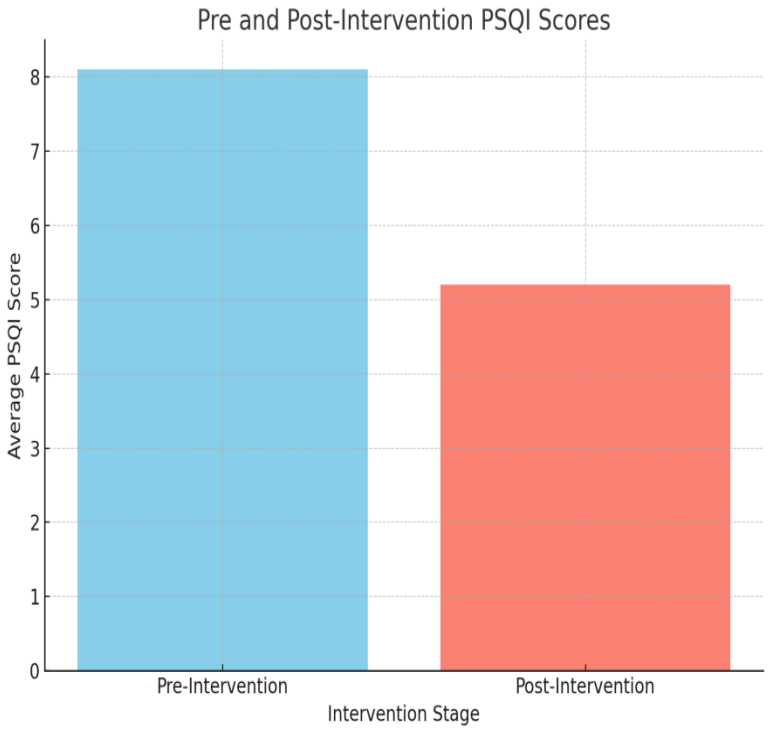

Figure 3: **Pre- and Post-Intervention PSQI Scores**

The improvements in sleep quality and associated outcomes are shown in **Figure 3**, where a clear decrease in PSQI scores is observed post-intervention. This figure highlights the positive change in sleep quality, with participants reporting fewer sleep disturbances, less daytime dysfunction, and better sleep overall.

3.6 Limitations

While the results of the intervention were promising, the study had several limitations. First, the quasi-experimental design lacks a control group, which limits the ability to draw causal conclusions about the effectiveness of the intervention. Second, the study relied on self-reported data for sleep duration and quality, which may be subject to recall bias. Future studies should include randomized controlled trials with objective sleep measurements (e.g., actigraphy) to strengthen the findings.

DISCUSSION

4.1 Key Findings

This paper has shown how sleep hygiene education has a positive impact on the duration, quality, and habit of sleep among teenagers in Visakhapatnam. Participants also exhibited a strong response to the intervention in terms of gaining additional sleep hours per night with an average 1.5 hours per night uppering their sleep duration to a more appropriate 8-10 hours. Also, sleep quality was postponed through the index of the Pittsburgh Sleep Quality where the average score dropped to 5.2, which means that there was a significant improvement in sleep quality. Also, there was an increased compliance with healthy sleep hygiene behaviors, as participants reported that they spent less time on screens before going to sleep, had better bedtime habits, and better sleeping conditions. These results indicate that sleep hygiene education can be a good intervention in a healthier sleeping behavior of adolescents, which is a serious problem in the population of the area.

4.2 Comparison with the Other Studies.

The findings of the current research are consistent with other intervention studies done in India and external countries, and they show that sleep hygiene education has a positive effect on adolescents. As an illustration, Patro et al. (2016) completed a study in southern India and obtained similar findings, as adolescents reported better sleep quality and a longer sleep time, after receiving an education program about sleep hygiene. The sample used in that study was a little smaller (n = 150) though it was also based on urban adolescents as in our case in Visakhapatnam. These two studies demonstrate that interventions that can be used to bring the issue of sleep hygiene can really help to improve the sleep habits of adolescents especially in urban settings where sleep deprivation is high.

A 2024 study in PMC also conducted an investigation of the effects of a sleep hygiene education intervention on adolescents internationally. The research was carried out in the United States and the researchers discovered that sleep hygiene education program led to improvement in duration and quality of sleep, which is in line with the findings of this research. The U.S. study had a large effect size, which was comparable to ours, and its average result was an increase in the average sleep duration of 1.5

hours a night. The approach to the delivery is one of the main differences between the two studies; the U.S. study was delivered digitally, and our study was conducted face-to-face. In the case of the U.S. study, the application of digital tools can offer a more scalable solution, especially in the given situation where digital platforms are popular. Nevertheless, face-to-face meetings as we have shown in our research cannot be underestimated particularly in localities where internet service might not be so common.

In spite of these similarities, there exist some context differences. The particular city that we studied is Visakhapatnam, a city in India, where environmental and cultural variables, including late-night studies and increased screen time, are eminent among the teenagers. These aspects can predispose the population to the impact of sleep hygiene education as it was reflected by the high level of changes seen in this study. Moreover, the intervention in our research was comparatively short (four weeks), and the U.S. research applied a six-month follow-up. Greater follow-up times might also be associated with longer lasting effects in the sleep associations and thus the research field should adopt longer durations of follow-ups to determine the long term effectiveness.

4.3 Interpretation and Implications.

Research results of this paper have significant implications to the health of the people of Visakhapatnam especially in educational institutions and community health initiatives. Adolescents in Visakhapatnan, similar to most other cities, are being subjected to academic demands, late-night television viewing, and other environmental conditions that adversely impact sleep. One of the approaches that would help to improve the sleep habits and, consequently, the overall adolescent well-being, is the inclusion of sleep hygiene education as a part of school health programs. Such an intervention is best carried out in schools since a very high number of adolescents can be targeted in a well-organized system.

The findings of the present research indicate that schools of Visakhapatnan ought to put sleep hygiene education into their health-related courses. This may involve enlightening the students on the relevance of sleep, educating them on the best practices of sleep hygiene and giving them resources to assist the students apply this practices in their day to day activities. The role of sleep and the methods of enhancing the quality of sleep could be highlighted by the public health campaigns in the area as well. Moreover, parent-based campaigns may be used to promote healthy sleep patterns in the homes to achieve a more comprehensive approach to sleep health in adolescence.

4.4 Strengths and Limitations

There are a number of strengths of this study. First, the intervention was very well planned, and the objective was clear in terms of teaching the evidence-based sleep hygiene. The 250 adolescents sample will have a strong foundation on which the impact of the intervention can be analyzed. The given study was also restricted in the territory of a specific area, Visakhapatnam which offered great information about sleep habits of the residents of this city. This geographical specific information is critical in learning more about the specific sleeping difficulties of the teens in this region.

Nevertheless, the research has its limitations as well. The short follow-up period of four weeks is one of the primary limitations. Although the study indicated that there were considerable improvements in sleep duration and quality right after the intervention, it remains unclear whether the improvements were maintained in the long run. The extended length of follow-up should assist in establishing the persistence of sleep hygiene education on the sleeping behaviors of adolescents. Further, the study did not have a control group, which does not give us an opportunity to make causal judgments about the efficacy of the intervention. Depending on self-reported information on sleep duration and quality also creates the possibility of reporting bias, with the adolescents over or underreporting their sleep behavior.

4.5 Future Research

Further studies need to be done on the limitations of this study by including a control group, and subjecting the self-reported sleep data to objective data to sleep, like actigraphy so as to confirm the feasibility of the data. Moreover, the sustainability of the impact of the intervention should be estimated through the longer-term studies that have a follow-up period of more than four weeks. Greater geographical coverage, that is, adolescents in other parts of India and other nations, would be useful in establishing whether the results can be generalized. Further studies on the integration of digital health tools, including sleep-tracking apps, may also be considered in the future to offer scalable and accessible solutions to addressing the issue of adolescent sleep hygiene.

CONCLUSION

This research demonstrates the high effect of the sleep hygiene education in enhancing the sleep duration, quality and habits among adolescents in Visakhapatnan. After the intervention, the participants showed a significant increase in duration and quality of sleep and a significant change in the reaction to healthy sleep habits. The results indicate the need to integrate sleep hygiene education in health promotion programs in schools as one of the effective strategies to fight sleep deprivation and ensure better sleep health. Since the problem of poor sleep in adolescents is quite common, schools and health policymakers should make it a priority, making sure that the youngsters learn the skills and knowledge to embrace healthy sleep patterns that will ultimately hurt them positively.

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