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The Effect of Acupuncture Intervention on Sleep Quality among Students: A quasi-experimental study

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ABSTRACT: Poor sleep quality is common among adolescents and can impair cognitive function, physical health, mental health, and academic achievement. Acupuncture and acupressure are non-pharmacological therapies that can be used to improve sleep quality because they are safe, effective, and have minimal side effects. This study aims to analyse the effect of acupuncture intervention on sleep quality among students in Central Lampung, Lampung Province, Indonesia. This study used a quasi-experimental design with a pretest-posttest two-group design. A sample of 80 respondents was selected using simple random sampling and divided into acupuncture (n=40) and acupressure (n=40) therapy groups. The intervention was given in 10 sessions. Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI). Data were analysed using Paired Sample t-test and Independent Sample t-test with a 95% confidence level (α=0.05). Acupuncture therapy reduced PSQI scores from 13.13±2.604 to 9.48±2.276 with a mean difference of 3.650 ($p<0.001$). Acupressure therapy reduced PSQI scores from 11.93±2.464 to 9.80±1.924 with a mean difference of 2.125 ($p<0.001$). After the intervention, there was no significant difference between the groups ($p=0.492$). Acupuncture and acupressure were both effective in improving sleep quality, but acupuncture showed a greater change in scores.

KEYWORDS: acupuncture, acupressure, adolescents, PSQI, sleep quality.

INTRODUCTION

Sleep quality is crucial for adolescents because it is related to physical and mental health, cognitive function, concentration, memory, motivation, and academic achievement. Sleep deprivation is a significant health problem in the adolescent population (Uccella et al., 2023). In Indonesia, sleep disorders remain quite high, with 43% of respondents experiencing sleep disorders. A total of 69.8% of respondents reported that approximately 15% to 35% of adolescents and adults experience sleep disorders. The majority of adolescents also have sleep quality below 63%, with sleep-wake transition disorders being a common disorder (Solehah et al., 2025). Poor sleep quality is also found in various countries. Studies in Spain, Iceland, and Estonia indicate that poor sleep quality occurs in 44% of adolescent boys and 53% of adolescent girls. As many as 68% of adolescent boys and 69% of adolescent girls do not meet the recommended sleep duration of 8 to 10 hours per day (Galan-Lopez et al., 2021). In Nepal, the prevalence of poor sleep quality among adolescent students reached 39.1% (Gautam et al., 2021). This data indicates that sleep disorders in adolescents are not only a local problem but also a global health concern.

Poor sleep quality is characterized by difficulty initiating sleep, insufficient sleep duration, decreased sleep efficiency, and impaired sleep continuity and effectiveness. This condition can lead to fatigue, irritability, emotional disturbances, decreased cognitive function, and reduced daily performance (Nelson et al., 2022). In adolescents, sleep disorders can also impair physical and mental health. Impacts include fatigue, decreased immunity, anxiety, depression, irritability, behavioural disorders, and decreased concentration and academic achievement (Rahma et al., 2023). The high prevalence of sleep disorders in adolescents is influenced by several factors, such as hormonal changes, lifestyle, environment, and electronic media usage habits. Late-night television viewing, cell phone and laptop use, and excessive social media activity can disrupt sleep and worsen adolescent sleep patterns (Chumayroh, 2020; Woran et al., 2021). Insomnia is one of the most common sleep disorders, with approximately 10% to 20% of the global population experiencing poor sleep quality (Putri et al., 2021). The National Sleep Foundation also reports that

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approximately 60% of children under 18 complain of daytime fatigue and 15% feel sleepy at school. In Indonesia, the prevalence of insomnia among adolescents in urban areas reaches 38%, while in suburban areas it reaches 37.7% (Tyas, 2022).

Sleep disorders can be treated through pharmacological and non-pharmacological therapies. Pharmacological therapy can help improve sleep, but the use of sleeping pills can cause side effects, such as oversleeping, dizziness, and difficulty concentrating the next day. Therefore, non-pharmacological therapy is an important alternative for adolescents. According to Hayat et al. (2021), insomnia can be treated with pharmacological and non-pharmacological approaches. Non-pharmacological therapies include sleep hygiene, sleep restriction, relaxation therapy, stimulus control therapy, and complementary therapies such as acupuncture and acupressure (Sari et al., 2021). Several previous studies have shown that acupuncture improves sleep quality. Verma et al. (2022) stated that acupuncture combined with moxibustion, aromatherapy, acupressure, and herbs has been shown to be effective in treating insomnia. Xu et al. (2019) explained that acupuncture can regulate neurotransmitters such as norepinephrine, serotonin, dopamine, acetylcholine, and GABA, as well as reduce glutamate levels. Cao et al. (2020) found that stimulation of the Neiguan (PC6) to Waiguan (TE5) points improved sleep quality compared to *Estazolam*. Ye et al. (2023) also reported that the Baihui (GV20), Neiguan (PC6), Shenmen (HT7), and Taichong (LR3) points significantly improved insomnia. Furthermore, a decrease in the Pittsburgh Sleep Quality Index (PSQI) score after therapy indicated a significant improvement in sleep quality (Ningtyas et al., 2022).

Acupressure has also been shown to potentially improve sleep quality through pressure on specific points without using needles. This therapy can affect melatonin and serotonin levels, which play a role in the sleep cycle. Frequently used points include Neiguan (P6), Zusanli (ST36), Hegu (LI4), Yintang (Extra1), and the auricular point. Mohammadi et al. (2025) explained that approximately 48% of schoolchildren use acupressure, with these points being the most frequently targeted. Carotenuto et al. (2013) also found that acupressure for 6 months in 25 adolescents with psychophysiological insomnia improved sleep efficiency and slow wave representation without reported side effects. Based on a preliminary survey using the PSQI questionnaire at the study site, of 210 students, 132 experienced poor sleep quality. Therefore, this study was conducted to analyze the differences in sleep quality between acupuncture and acupressure therapy in students.

METHODS

This study used a quasi-experimental design to analyse the differences in sleep quality between acupuncture and acupressure therapy in high school students in Central Lampung, Lampung Province, Indonesia. The study was conducted in April 2026 with an accessible population of 132 students experiencing sleep difficulties. A sample of 80 students was selected using simple random sampling, then divided into two groups: 40 students in the acupuncture therapy group and 40 students in the acupressure therapy group. The independent variables in this study were acupuncture and acupressure therapy, while the dependent variable was sleeping quality. Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI), which includes subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. A PSQI score of less than 5 indicates good sleep quality, while a score of more than 5 indicates poor sleep quality.
Data were collected directly by completing the PSQI questionnaire before and after the intervention. The intervention was given 10 sessions with a frequency of 2 to 3 times per week. The acupuncture group received therapy at the MS1 ISNSA point according to the protocol, while the acupressure group received pressure stimulation at certain points according to the procedure. The collected data were examined, coded, tabulated, and then analysed by univariate and bivariate analysis. Normality tests were performed using the Kolmogorov-Smirnov test and homogeneity tests using Levene's Test. Differences in sleep quality before and after the intervention were analysed using the Paired Sample t-test, while differences between the acupuncture and acupressure groups were analysed using the Independent Sample t-test at a 95% confidence level or $\alpha = 0.05$. This study has obtained ethical clearance from the Research Ethics Committee of the Universitas Lampung, Indonesia, with number 1831/UN26.18/PP.05.02.00/2026.

RESULTS

Respondent Characteristics

This study involved 80 respondents divided into two groups: 40 respondents in the acupuncture therapy group and 40 respondents in the acupressure therapy group. Respondent characteristics included gender and age. Based on Table 1, both groups, namely the acupuncture group and the acupressure group, were dominated by female respondents (72.5% vs. 67.5%). Based on age,

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the majority of respondents in both groups were 16 years old (45% vs. 42.5%). These results indicate that the characteristics of respondents in both groups were relatively comparable.

Table 1. Respondent Characteristics (n=80)

Variable	Acupuncture (n=40)		Acupressure (n=40)	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Gender				
Male	11	27.5	13	32.5
Female	29	72.5	27	67.5
Age				
15 years	5	12.5	8	20
16 years	18	45	17	42.5
17 years	14	35	11	27.5
18 years	3	7.5	4	10

Sleep Quality Scores Before and After Intervention

Sleep quality scores were measured using the PSQI before and after the intervention. Based on Table 2, the acupuncture group had an average pretest PSQI score of 13.13 with a standard deviation of 2.604. After acupuncture therapy, the average PSQI score decreased to 9.48 with a standard deviation of 2.276. This 3.65-point decrease in score indicates an improvement in sleep quality after acupuncture therapy. In the acupressure group, the average pretest PSQI score was 11.93 with a standard deviation of 2.464. After acupressure therapy, the average PSQI score decreased to 9.80 with a standard deviation of 1.924. This 2.13-point decrease in score indicates an improvement in sleep quality after acupressure intervention.

Table 2. Differences in Sleep Quality Scores (PSQI) between Acupuncture and Acupressure Groups (n=80)

Results	Acupuncture (n = 40)		Acupressure (n = 40)	
	Mean	SD	Mean	SD
Pretest	13.13	2.604	11.93	2.464
Posttest	9.48	2.276	8.80	1.924

Comparison of Sleep Quality between Acupuncture and Acupressure Groups

Comparison of sleep quality between the acupuncture and acupressure groups was analysed using an independent sample t-test. According to Table 3, the pretest score in the acupuncture group was 13.13 ± 2.604, while in the acupressure group it was 11.93 ± 2.464. The statistical test results showed a p-value of 0.037, indicating a significant difference in sleep quality between the two groups before the intervention. The mean difference between the two groups was 1.200, with a 95% confidence interval of 0.072 to 2.328.

After the intervention, the post-test score in the acupuncture group was 9.48 ± 2.276, while in the acupressure group it was 9.80 ± 1.924. The statistical test results showed a p-value of 0.492, indicating no significant difference in sleep quality between the two groups after the intervention. The mean difference between the two groups was -0.325, with a 95% confidence interval of -1.263 to 0.613. These results indicate that the sleep quality of respondents in both groups was relatively comparable after the intervention.

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Table 3. Differences in Mean Sleep Quality between the Acupuncture and Acupressure Groups (n=80)

Variable	Acupuncture (n = 40)		Acupressure (n = 40)		Mean Difference	95% CI	p-value
	Mean	SD	Mean	SD			
Pretest	13.13	2.604	11.93	2.464	1.200	0.072 – 2.328	0.037
Posttest	9.48	2.276	9.80	1.924	-0.325	-1.263 – 0.613	0.492

Changes in Sleep Quality Before and After Intervention

Changes in sleep quality in each group were analysed using a paired sample t-test. Based on Table 4, the acupuncture group experienced a decrease in PSQI scores of 3.650 points with a standard deviation of 1.424. The statistical test results showed a t-value = 16.209, df = 39, and p<0.001. The 95% confidence interval ranged from 3.195 to 4.105. These results indicate that acupuncture therapy provided significant changes in sleep quality. In the acupressure group, PSQI scores decreased by 2.125 points with a standard deviation of 1.090. The statistical test results showed a t-value = 12.325, df = 39, and p<0.001. The 95% confidence interval ranged from 1.776 to 2.474. These results indicate that acupressure therapy also provided significant changes in sleep quality.

Table 4. Difference in Sleep Quality Scores Before and After Intervention

Group	Mean Difference (Δ)	SD	Std. Error Mean	95% CI (Lower–Upper)	t	df	Sig. (2-tailed)
Acupuncture (Pre–Post test)	3.650	1.424	0.225	3.195 – 4.105	16.209	39	<0.001
Acupressure (Pre–Post test)	2.125	1.090	0.172	1.776 – 2.474	12.325	39	<0.001

DISCUSSION

Frequency Distribution of Students' Sleep Quality

This study was conducted on 80 students divided into two intervention groups. The first group was the acupuncture therapy group with 40 respondents, while the second group was the acupressure therapy group with 40 respondents. Sleep quality measurements were carried out using the PSQI instrument before and after the intervention. A higher PSQI score indicates a worsening sleep quality, while a decrease in the PSQI score indicates an improvement in sleep quality. The analysis results showed that the average sleep quality score in the acupuncture group before the intervention was 13.13 ± 2.604. After being given acupuncture therapy, the average score decreased to 9.48 ± 2.276. Thus, there was a decrease in the score of 3.65 points. These results indicate that acupuncture therapy is able to improve the sleep quality of respondents. In the acupressure group, the average sleep quality score before the intervention was 11.93 ± 2.464 and decreased to 9.80 ± 1.924 after the intervention. A decrease in the score of 2.13 points indicates that acupressure therapy also provides improvements in sleep quality.

Descriptively, both groups experienced a decrease in PSQI scores after the intervention. However, the decrease in scores was greater in the acupuncture group than in the acupressure group. This indicates that both therapies have potential as non-pharmacological interventions to improve sleep quality in adolescents, although the effect of acupuncture therapy appeared to be greater. This finding is important because adolescents are an age group vulnerable to sleep disturbances due to biological changes, academic activities, excessive electronic media use, and psychosocial stress. Poor sleep quality can impact learning concentration, cognitive function, academic achievement, emotional stability, and physical and mental health.

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Differences in Sleep Quality Before and After Acupuncture Intervention

The results of the study showed that acupuncture therapy significantly improved students' sleep quality. The average sleep quality score before acupuncture therapy was 13.13 ± 2.604, then decreased to 9.48 ± 2.276 after therapy. There was a decrease in the average score of 3.650 points with a standard deviation of 1.424. This decrease in scores indicates that respondents' sleep quality improved after receiving acupuncture therapy. The results of the paired sample t-test showed a t value of 16.209 with $p<0.001$ and a 95% confidence interval of 3.195 to 4.105. A p value less than 0.05 indicates a significant difference between sleep quality before and after acupuncture therapy. Thus, acupuncture therapy was proven effective in improving students' sleep quality.

These results align with the research of Liu et al. (2020) on the "Placebo Effect of Acupuncture on Insomnia" showed that acupuncture therapy was able to significantly reduce PSQI scores compared to sham acupuncture with a p-value <0.0001. This study proved that acupuncture point stimulation can improve sleep quality, reduce sleep disturbances, and significantly increase sleep duration. In this study, the acupuncture point used was MS 1 International Standard Scalp Acupuncture Nomenclature (ISSA). This point is related to the central nervous system and is thought to influence the increase in neurotransmitters that play a role in regulating sleep and psychological conditions, such as serotonin, noradrenaline, dopamine, neuropeptide Y, and Gamma Aminobutyric Acid (GABA). The increase in these neurotransmitters can help create a relaxing effect, reduce stress, reduce anxiety, and improve overall sleep quality (Behtaj, 2018; Jiao et al., 2015).

Wang et al. (2023) explained that acupuncture can improve sleep quality and prolong sleep time by regulating sleep activity in the brain. Acupuncture also affects sleep structure by regulating three main groups of neurotransmitters: amines, amino acids, and peptides. Furthermore, acupuncture plays a role in modulating immune cytokines, such as interleukins, which are associated with the immune response and the sleep-wake cycle. This mechanism supports physiological improvements in sleep quality. Shergis et al. (2016) stated that acupuncture can interact with the GABA pathway, which functions to inhibit central nervous system activity. GABA is the main inhibitory neurotransmitter in the brain that plays a crucial role in the sleep process. Increasing GABA levels can reduce neuronal activity, making the body more relaxed and more easily entering the sleep phase. This mechanism is similar to the action of several hypnotic drugs, such as benzodiazepines and non-benzodiazepines, which are used to treat insomnia. Furthermore, Lee et al. (2020) stated that acupuncture can increase levels of serotonin, glutamate, GABA, and melatonin, which play a role in regulating the sleep cycle. Acupuncture can also help regulate cortisol production and balance stress-related hypothalamic-pituitary-adrenal axis activity. Based on these mechanisms, the improved sleep quality in the acupuncture group in this study can be explained by acupuncture's effects on the central nervous system, hormonal system, and immune system.

Differences in Sleep Quality Before and After Acupressure Intervention

The results of the study showed that acupressure therapy also significantly improved students' sleep quality. The average sleep quality score before acupressure therapy was 11.93 ± 2.464, then decreased to 9.80 ± 1.924 after therapy. The decrease in score of 2.125 points with a standard deviation of 1.090 indicates an improvement in sleep quality after respondents received acupressure therapy. The results of the paired sample t-test showed a t value of 12.325 with $p < 0.001$ and a 95% confidence interval of 1.776 to 2.474. A p value < 0.05 indicates a significant difference between sleep quality before and after acupressure therapy. Thus, acupressure therapy has been proven effective in improving students' sleep quality.

Acupressure is a complementary therapy derived from the principles of traditional Chinese medicine. This therapy involves applying pressure to specific meridian points without the use of needles. Acupressure is widely used to treat sleep disorders because it is relatively safe, non-invasive, easy to learn, and can be performed independently. Some points frequently used in sleep disorder therapy include Shenmen (HT7), Yintang (EX-HN3), Anmian, Sanyinjiao (SP6), and Neiguan (PC6). Stimulating these points can provide a relaxing effect, calm the nervous system, reduce anxiety, and help improve sleep quality. Furthermore, acupressure can help balance the autonomic nervous system, allowing the body to relax before bed. A more relaxed body can facilitate sleep and reduce sleep disturbances at night.

The results of this study align with those of Lee and Kim (2019), who stated that stimulation of the Shenmen (HT7) and Sanyinjiao (SP6) points can increase serotonin and melatonin secretion. Both substances play an important role in regulating the sleep cycle. The study also explained that acupressure can reduce levels of the stress hormone cortisol and increase parasympathetic nervous system activity, making it easier for individuals to enter the sleep phase. Wang et al. (2020) also explained that acupressure can improve sleep quality through peripheral nerve stimulation that affects the sleep regulation center in the brain. Activation of the parasympathetic nervous system can lower heart rate, reduce muscle tension, and increase feelings of comfort and relaxation. These

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mechanisms support a more optimal sleep process. Therefore, the improvement in sleep quality in the acupressure group in this study can be attributed to the relaxation and nervous system regulation effects that occur after acupressure point stimulation.

The Most Significant Intervention in Improving Sleep Quality

Based on the bivariate analysis, acupuncture and acupressure therapy both significantly improved students' sleep quality. This was demonstrated by the results of the paired sample t-test for both groups, which showed a p-value <0.001. This means that both acupuncture and acupressure were effective in improving sleep quality after the intervention. In terms of the magnitude of the change in sleep quality scores, acupuncture therapy demonstrated greater effectiveness than acupressure therapy. The acupuncture group experienced a 3.650-point decrease in sleep quality scores, while the acupressure group experienced a 2.125-point decrease. The t-score for the acupuncture group was also higher, at 16.209, compared to the acupressure group (12.325). A higher t-score indicates a stronger difference between pre- and post-intervention conditions.

The results of the independent sample t-test showed a significant difference in sleep quality between the two groups before the intervention, with a p-value of 0.037. The average pretest score of the acupuncture group was 13.13 ± 2.604, while the acupressure group was 11.93 ± 2.464. The mean difference of 1.200 with a 95% confidence interval of 0.072 to 2.328 indicates that the initial conditions of the two groups were not completely homogeneous. After the intervention was given, the average sleep quality score in the acupuncture group became 9.48 ± 2.276, while in the acupressure group it became 9.80 ± 1.924. The results of the Independent Sample t-test showed a p value = 0.492 with a mean difference of -0.325 and a 95% confidence interval of -1.263 to 0.613. A p value > 0.05 indicates that there was no significant difference between the sleep quality of the acupuncture and acupressure groups after the intervention. This result means that both therapies were able to improve sleep quality to reach a relatively equivalent final condition.

Although the final results of the two groups did not differ significantly, acupuncture therapy still showed a greater change in scores. This result is supported by Wang et al. (2023), who explained that acupuncture has a broader mechanism of action than acupressure. Acupuncture can affect central neurotransmitters that play a role in sleep regulation, such as serotonin, melatonin, and GABA. Acupuncture can also reduce the activity of neurotransmitters associated with stress and hypervigilance, such as norepinephrine and cortisol. Furthermore, acupuncture needle stimulation can activate the parasympathetic nervous system more strongly, resulting in a more relaxed body, a more stable sleep cycle, and improved sleep quality.

Acupuncture is also known to modulate immune cytokines, such as interleukins, and influence the sympathetic-adrenomedullary system and the hypothalamic-pituitary-adrenal axis, which play a role in sleep regulation. Meanwhile, acupressure therapy works through pressure point stimulation, which produces a relaxing effect and increases parasympathetic activity. However, the stimulation intensity of acupressure is relatively lower than that of needle stimulation in acupuncture therapy (Lee & Kim, 2019). Thus, acupuncture and acupressure therapy are both effective in improving students' sleep quality. However, acupuncture therapy is the most significant variable due to its larger mean difference (3.650), higher t-test value (16.209), and more complex physiological mechanisms than acupressure therapy. Therefore, acupuncture therapy can be recommended as a more effective intervention in improving sleep quality in adolescents.

CONCLUSION

Based on the research results and discussion, it can be concluded that there are differences in sleep quality levels before and after acupuncture and acupressure therapy were given to students. The t-test results showed a p value <0.001 in both groups, so that acupuncture and acupressure therapy were proven to have a significant effect in improving respondents' sleep quality. However, acupuncture therapy showed a greater effect than acupressure therapy, indicated by the average change in sleep quality scores of 3.650 in the acupuncture group and 2.125 in the acupressure group. Thus, acupuncture therapy was the most significant intervention in improving sleep quality in the study respondents.

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