



## **The Role of Sleep Quality in the Regulation of Resting Heart Rate of UPI Badminton Athletes**

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### **Keyword**

Sleep quality; athlete  
recovery; resting  
heart rate;  
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### **Abstract**

This study aimed to examine the relationship between sleep quality and resting heart rate among badminton athletes at the Indonesia University of Education (UPI). A quantitative correlational design was employed involving 30 active badminton athletes selected through total sampling; participants were required to be actively training and have competitive experience. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), while resting heart rate was measured in the morning under relaxed conditions before physical activity. Data analysis included descriptive statistics, normality testing and Pearson correlation. The results indicated that the athletes had an average PSQI score of 14.10, reflecting generally poor sleep quality, while the mean resting heart rate was 81.77 bpm. Normality testing showed that the data were normally distributed and suitable for parametric analysis. Pearson correlation analysis demonstrated a significant positive relationship between sleep quality and resting heart rate ( $r = 0.542$ ;  $p = 0.002$ ). These findings suggest that poorer sleep quality is associated with higher resting heart rates.

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## INTRODUCTION

Competitive sports are activities that require optimal physical, physiological, and psychological readiness so that athletes can perform at their best during both training and competition (Fahmi et al., 2023). In the field of modern sports science, an athlete's success is influenced not only by the quality of the training program, but also by the body's ability to recover after undergoing training (Prasanty Kusuma Wardani et al., 2023). The recovery process plays a crucial role in maintaining the body's stability, preventing excessive fatigue, and enhancing physiological adaptation to ongoing exercise.

One of the key factors in an athlete's recovery process is sleep quality (Dahlan & Widanarko, 2022). Sleep is a biological need that serves to restore energy, repair body tissues, regulate hormones, and restore nervous system function (Rahmawati & Farida, 2023). Quality sleep helps the body restore its physiological condition after high-intensity physical activity. Conversely, poor sleep quality can disrupt the body's recovery process, thereby affecting an athlete's physical condition and performance.

Sleep quality plays a crucial role for athletes because the body must adapt to the constant training load (Septianingrum et al., 2024). Adequate, high-quality sleep supports physiological recovery, muscle tissue repair, and hormonal regulation, all of which play a role in exercise adaptation (Nobari et al., 2023). Conversely, sleep deprivation or sleep disorders can lead to fatigue, reduced concentration, mood disturbances, and impaired decision-making during training and competition. In athletes, poor sleep quality can also hinder recovery and adaptation to training, resulting in suboptimal performance improvements. Additionally, sleep disturbances can reduce the consistency of physical performance, such as endurance, reaction speed, and motor coordination, which are essential in the sport of badminton (Doherty et al., 2023). This condition can also increase the risk of injury due to reduced alertness, motor skills, and the body's ability to cope with physical stress during training or competition. Furthermore, poor sleep quality can affect the balance of the autonomic nervous system, which plays a role in regulating various physiological functions of the body, including heart function and heart rate (Pruneti et al., 2024).

In badminton, recovery is essential because the nature of the game requires athletes to perform rapid, explosive, and repetitive movements throughout competitive matches. Badminton players must possess endurance, agility, quick reflexes, and optimal physical conditioning to maintain their performance during both training and matches (Iqba et al., 2025). In addition, the intermittent nature of the game—with alternating periods of high-intensity activity and brief recovery periods—places a significant strain on the neuromuscular, cardiovascular, and metabolic systems (Ardika Prayoga & Ali Hamid, 2024). Compared to sports with more consistent intensity and lower explosive demands, badminton athletes tend to experience greater fatigue accumulation due to short sprints, rapid changes in direction, jumps, and repeated high-speed shots (Liu et al., 2023). These conditions make badminton athletes more susceptible to recovery issues because the body requires more time and better-quality recovery to restore optimal physiological function. If the recovery process does not proceed effectively, fatigue can accumulate from one training session to the next, thereby hindering training adaptation, reducing performance consistency, and increasing the risk of injury.

One of the physiological indicators commonly used to monitor the body's recovery is the resting heart rate. The resting heart rate is the number of heartbeats per minute when the body is at rest and not engaged in physical activity (Mulya et al., 2024). The resting heart rate reflects the heart's ability to function and the balance of the autonomic nervous system in regulating bodily functions (Darma et al., 2023). A low resting heart rate in athletes indicates good cardiac efficiency and optimal physical fitness. Conversely, an elevated resting heart rate may be a sign of physiological fatigue, exercise-induced stress, or incomplete recovery.

Sleep quality plays a role in maintaining the body's physiological functions and supporting athletes' recovery, one aspect of which is reflected in resting heart rate (Fritz et al., 2025). Optimal sleep helps maintain the physiological regulation necessary for recovery after exercise, whereas sleep disturbances can hinder this process and affect resting heart rate

(Wibowo & Falaahudin, 2022) Therefore, resting heart rate can be used as one indicator of an athlete's recovery and physical readiness.

Several previous studies have shown that sleep quality is associated with physiological conditions, including heart rate and recovery processes in athletes. Previous research has shown that poor sleep quality is associated with increased heart rate, reduced recovery quality, and decreased athletic performance. However, studies specifically examining the relationship between sleep quality and resting heart rate in badminton athletes remain relatively limited, particularly among student-athletes at the University of Education Indonesia (UPI).

UPI badminton athletes have a demanding schedule, as they must balance academic demands with athletic training. These conditions have the potential to affect the athletes' sleep quality and physiological condition, particularly their resting heart rate, which serves as an indicator of the body's recovery. Based on preliminary observations, some athletes exhibit irregular sleep patterns due to the division of time between training, classes, and other activities. If this condition persists, the body's recovery process may be disrupted, affecting the athletes' physiological condition.

Based on the above discussion, sleep quality is believed to play an important role in regulating the resting heart rate of badminton athletes. Although various studies have shown a relationship between sleep quality and physiological conditions, studies specifically examining the relationship between sleep quality and resting heart rate in UPI badminton athletes remain limited. Therefore, this study was conducted to answer the research question Is there a relationship between sleep quality and resting heart rate in badminton athletes at the University of Education Indonesia (UPI) In line with this research question, this study aims to determine the relationship between sleep quality and resting heart rate in UPI badminton athletes. The results of this study are expected to serve as evaluation material for athlete recovery management and to contribute to the development of sports science, particularly regarding the importance of sleep quality in maintaining physiological condition, physical readiness, and athletic performance.

## **METHODS**

This study employs a quantitative approach using a correlational method. According to (Wei et al., 2025) A quantitative approach was used because the study aimed to collect numerical data, which was then analyzed statistically to determine the relationships between variables. A correlational method was used to determine whether there is a relationship between sleep quality and resting heart rate among UPI badminton athletes. The variables in this study consist of sleep quality as the independent variable and resting heart rate as the dependent variable. This approach was chosen because the study did not involve any specific treatment of the subjects but merely observed the relationship between variables based on naturally occurring conditions.

The population in this study consists of all active badminton athletes at the Indonesia University of Education (UPI). The sampling technique employed total sampling, meaning the entire population was included in the study, comprising 30 respondents. The criteria for research subjects included: (first), active badminton athletes for at least the past five years; (second), still actively training or having participated in internal or external competitions; and (third), willing to serve as respondents in the study.

The instruments used consisted of a sleep quality measurement tool and a resting heart rate monitor. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI) questionnaire, which was used to determine the respondents' sleep quality based on several sleep components. A higher score indicates poorer sleep quality. The PSQI has been widely used in sleep quality research and has good validity and reliability in measuring sleep quality. Meanwhile, resting heart rate is used as an indicator of physiological condition and the body's recovery process in athletes.

Data collection was conducted through the completion of a questionnaire. Sleep quality data were obtained by having respondents complete a questionnaire based on their sleep conditions. Meanwhile, resting heart rate measurements were taken in the morning after

waking up and before engaging in physical activity. Respondents were instructed to remain in a relaxed condition before the measurement. Resting heart rate was assessed using a smartwatch in the morning immediately after waking up, and the recorded value was expressed in beats per minute (bpm).

The data obtained were then compiled and analyzed using the Statistical Package for the Social Sciences (SPSS). Data analysis was conducted using descriptive statistics, normality tests and Pearson's correlation tests to determine the relationship between sleep quality and resting heart rate among UPI badminton athletes.

## RESULTS AND DISCUSSION

**Tabel 1.** Demographic Profile of Responden

| Characteristic | Category (Age) | Frequency (n) | Percentage (%) |
|----------------|----------------|---------------|----------------|
| Age            | 18             | 3             | 10,0           |
|                | 19             | 7             | 23,3           |
|                | 20             | 5             | 16,7           |
|                | 21             | 6             | 20,0           |
|                | 22             | 8             | 26,7           |
|                | 24             | 1             | 3,3            |
|                | Average        | 20,43         | -              |
| <b>Total</b>   |                | <b>30</b>     | <b>100</b>     |
| Gender         | Male           | 20            | 66,7           |
|                | Female         | 10            | 33,3           |
| <b>Total</b>   |                | <b>30</b>     | <b>100</b>     |

Based on the results of data collection from 30 respondents, a demographic profile of the respondents was obtained based on age and gender. Regarding age, the group was dominated by 22-year-olds, with 8 people (26.7%), followed by 19-year-olds (7 people, 23.3%), 21-year-olds (6 people, 20.0%), 20-year-olds (5 people, 16.7%), and 3 respondents aged 18 (10.0%). Meanwhile, respondents aged 24 were the smallest group, with 1 person (3.3%). The calculation results show that the average age of the respondents is 20.43 years, indicating that the majority of respondents fall into the early adulthood category. Based on gender, the majority of respondents were male, totaling 20 people (66.7%), while female respondents numbered 10 people (33.3%). These results indicate that participation in this study was dominated by male athletes rather than female athletes.

**Tabel 2.** Descriptive Analysis

|                    | N  | Minimum | Maximum | Mean  | Std. Deviation |
|--------------------|----|---------|---------|-------|----------------|
| PSQI               | 30 | 4       | 21      | 14.10 | 4.971          |
| Heart Rate         | 30 | 68      | 98      | 81.77 | 8.419          |
| Valid N (listwise) | 30 |         |         |       |                |

Based on the results of the descriptive statistics, the number of respondents in this study was 30 UPI badminton athletes. The sleep quality variable, measured using the Pittsburgh Sleep Quality Index (PSQI), had a minimum score of 4 and a maximum score of 21, with a mean of 14.10 and a standard deviation of 4.971. These results indicate that, on average, the respondents had relatively poor sleep quality, as higher PSQI scores indicate progressively worse sleep quality. Additionally, the standard deviation value indicates variation in sleep quality among the study participants. For the resting heart rate variable, the minimum value was 68 bpm and the maximum was 98 bpm, with a mean of 81.77 bpm and a standard deviation of 8.419. This average falls within the category of relatively high resting heart rate for an athlete, as athletes generally have lower resting heart rates due to physiological adaptation to training. This condition may indicate that some respondents have not yet achieved optimal physical recovery or are influenced by other factors such as fatigue and sleep quality. Variations in resting heart rate data also indicate differences in physiological conditions

among individual athletes. Overall, the research data show that there are variations in sleep quality and resting heart rate among UPI badminton athletes.

**Tabel 3.** Normality Test

|            | <b>Kolmogorov-Smirnov</b> |    |      | <b>Shapiro-Wilk</b> |    |      |
|------------|---------------------------|----|------|---------------------|----|------|
|            | Statistic                 | df | Sig. | Statistic           | df | Sig. |
| PSQI       | .138                      | 30 | .151 | .975                | 30 | .133 |
| Heart Rate | .064                      | 30 | .200 | .973                | 30 | .626 |

Based on the results of the normality tests using the Kolmogorov-Smirnov and Shapiro-Wilk tests, the significance values for the sleep quality variable (PSQI) were 0.151 in the Kolmogorov-Smirnov test and 0.133 in the Shapiro-Wilk test. Meanwhile, the resting heart rate variable had a significance value of 0.200 in the Kolmogorov-Smirnov test and 0.626 in the Shapiro-Wilk test. The significance values for both variables were greater than 0.05, indicating that the research data are normally distributed. These results indicate that the sleep quality and resting heart rate data meet the assumption of normality, so parametric statistical analysis can be used in this study. Thus, Pearson's correlation test can be conducted to determine the relationship between sleep quality and resting heart rate in UPI badminton athletes.

**Tabel 4.** Correlation Test

|            |                     | <b>PSQI</b> | <b>Heart Rate</b> |
|------------|---------------------|-------------|-------------------|
| PSQI       | Pearson Correlation | 1           | .542              |
|            | Sig. (2-tailed)     |             | .002              |
|            | N                   | 30          | 30                |
| Heart Rate | Pearson Correlation | .542        | 1                 |
|            | Sig. (2-tailed)     | .002        |                   |
|            | N                   | 30          | 30                |

Based on the results of the Pearson correlation test, a correlation coefficient (Pearson Correlation) of 0.542 was obtained between sleep quality (PSQI) and resting heart rate in UPI badminton athletes. The significance value (Sig. 2-tailed) of 0.002 is less than 0.05, indicating a significant relationship between sleep quality and resting heart rate. A correlation value of 0.521 indicates that the relationship between the two variables is moderate in strength and positive in direction. This positive relationship indicates that the higher the PSQI score—or the poorer the athletes' sleep quality—the higher their resting heart rate tends to be. Conversely, the better the athletes' sleep quality, the lower and more stable their resting heart rate tends to be. These findings suggest that sleep quality plays a role in the body's physiological condition, particularly in regulating resting heart rate as an indicator of athlete recovery. Furthermore, the results of this study indicate that poor sleep quality can affect the body's recovery process, causing physiological activities during rest to be less than optimal. This condition can lead to an increase in resting heart rate among athletes. Thus, sleep quality is an important factor that must be considered in maintaining the recovery and performance of UPI badminton athletes.

In addition to being influenced by sleep quality, an athlete's resting heart rate can also be affected by other factors such as training intensity, fatigue levels, academic stress, daily activity patterns, nutritional intake, and the athlete's psychological state. According to (Arnando et al., 2024) Badminton athletes engage in high-intensity training that requires optimal recovery to maintain stable physiological conditions. If the recovery process does not proceed properly, the body will experience increased physiological activity, as indicated by an elevated resting heart rate. Therefore, resting heart rate can serve as a simple indicator for monitoring an athlete's physical readiness and recovery status.

The results of this study also indicate that sleep quality plays a crucial role in maintaining the balance of the autonomic nervous system in athletes. Adequate, high-quality sleep helps increase parasympathetic nervous system activity, which plays a role in the body's

recovery process and in lowering the resting heart rate. Conversely, poor sleep quality can lead to an overactive sympathetic nervous system, resulting in a higher resting heart rate (Lee & Hur, 2022). This situation can lead to a decline in athletes' physical readiness for training and competitions. According to (Bunn & Easley, 2025) In the context of competitive sports, monitoring sleep quality can be a key strategy in an athlete's recovery program. Coaches and athletes need to pay attention to sleep patterns as part of physical condition management, since good sleep quality not only supports physical recovery but also helps maintain concentration, mood, and athletic performance. Thus, optimizing sleep quality can be a way to maintain the stability of an athlete's physiological condition and support the achievement of peak performance.

This study has several limitations that should be noted. One of them is that gender was not controlled for as a covariate in the analysis, even though the study sample consisted of 20 male athletes and 10 female athletes. Physiological differences between men and women have the potential to influence resting heart rate, and thus may be a factor affecting the relationship between sleep quality and resting heart rate. Therefore, future research is recommended to analyze this relationship separately by gender or to include gender as a covariate in the analysis, for example using ANCOVA, so that more accurate results can be obtained and the effect of sleep quality on resting heart rate can be described more specifically.

## CONCLUSION

Based on the results of a study conducted on UPI badminton athletes, it was found that sleep quality has a significant relationship with resting heart rate. The results indicate that the athletes' average sleep quality tends to be poor, while their average resting heart rate is relatively high for athletes. Correlation test results show a positive relationship with moderate strength between sleep quality and resting heart rate. This suggests that the poorer the athletes' sleep quality, the higher their resting heart rate tends to be. These findings also indicate that sleep quality plays a role in regulating resting heart rate as an indicator of athletes' physiological condition and recovery. Quality sleep helps the body's recovery process function more optimally, leading to a more stable resting heart rate. Therefore, sleep quality is a critical factor that must be addressed to support the recovery and performance of UPI badminton athletes.

## REFERENSI

- Ardika Prayoga, M., & Ali Hamid, M. (2024). Hubungan stretching dengan kejadian shoulder pain pada anggota Club Persatuan Bulutangkis Putra Jember. *Jurnal Penelitian Ilmiah Multidisiplin*, 8(7), 114–122.
- Arnando, M., Syafruddin, Okilanda, A., Sasmita, W., Saputra, M., Sepriadi, Zulbahri, Amra, F., Wulandari, I., & Ahmed, M. (2024). The influence of agility training on the badminton athletes' ability. *International Journal of Human Movement and Sports Sciences*, 12(2), 245–253. <https://doi.org/10.13189/sai.2024.120210>
- Bunn, J. A., & Easley, D. (2025). Monitoring considerations for the female athlete. *Strength and Conditioning Journal*, 47(3), 88–96. <https://doi.org/10.1519/ssc.0000000000000904>
- Dahlan, A., & Widanarko, B. (2022). Analisis kecukupan tidur, kualitas tidur, dan olahraga dalam memulihkan kelelahan akut dan kronis pada pekerja migas-X. *Prepotif: Jurnal Kesehatan Masyarakat*, 6(1), 842–851. <https://doi.org/10.31004/prepotif.v6i1.3099>
- Darma, Y., Samodra, T. J., Yosika, G. F., Gandasari, M. F., & Wati, I. D. P. (2023). Pengaruh pemberian minuman yang berbeda terhadap denyut nadi pemulihan setelah melakukan aktivitas fisik. *Jurnal Kejaora (Kesehatan Jasmani dan Olah Raga)*, 8(1), 45–53. <https://doi.org/10.36526/kejaora.v8i1.2444>
- Doherty, R., Madigan, S., Nevill, A., Warrington, G., & Ellis, J. G. (2023). The impact of kiwifruit consumption on the sleep and recovery of elite athletes. *Nutrients*, 15(10), Artikel 2274. <https://doi.org/10.3390/nu15102274>
- Fahmi, K., Sarmidi, S., & Fauzan, L. A. (2023). Ketersediaan sarana prasarana dalam mendukung olahraga prestasi Madrasah Aliyah Negeri se-Kabupaten Tapin. *Stabilitas: Jurnal Pendidikan Jasmani dan Olahraga*, 4(2), 160–169. <https://doi.org/10.20527/mp.v4i2.1940>
- Fritz Garcia, M., Naufal Faqihuddin, A., Ihsan, M. A., Febrian, M., Wicaksono, G., Sadewa, R., Pamungkas, A., Jevanicha, S. A., & Febriansyah, W. (2025). Perbedaan olahraga pagi dan malam terhadap kualitas

- tidur dan denyut nadi basal. *DJS (Dharmas Journal of Sport)*, 8(1), 12–20. <https://doi.org/10.56667/dis.v8i1.125>
- Iqbal, M., Nugroho, S., Rismayanthi, C., Budayati, E. S., Indra, E. N., & Rezha, R. (2025). Effectiveness of interval training method in improving badminton athletes' endurance: A systematic review. *International Journal of Multicultural and Multireligious Understanding (IJMMU)*, 12(1), 340–349.
- Lee, J. A., & Hur, M. H. (2022). The effects of aroma essential oil inhalation on stress, pain, and sleep quality in laparoscopic cholecystectomy patients: A randomized controlled trial. *Asian Nursing Research*, 16(1), 32–40. <https://doi.org/10.1016/j.anr.2021.11.002>
- Liu, Z., Yang, C., Yu, J., Zhao, X., Wu, J., Zhang, Y., Li, J., & Gu, Y. (2023). The effect of muscles fatigue on the knee's kinetics and kinematics characteristics. *Sustainability*, 15(4), Artikel 3029. <https://doi.org/10.3390/su15043029>
- Mulya, N., Rahmawati, N. A., & Rahim, A. F. (2024). Aerobic exercise berpengaruh terhadap denyut nadi istirahat. *Physiotherapy Health Science (PhysioHS)*, 7(2), 142–150. <https://doi.org/10.22179/physiohs.v7i2.38133>
- Nobari, H., Banihashemi, M., Saedmocheshi, S., Prieto-González, P., & Oliveira, R. (2023). Overview of the impact of sleep monitoring on optimal performance, immune system function and injury risk reduction in athletes: A narrative review. *Science Progress*, 106(4), 1–18. <https://doi.org/10.1177/00368504231206265>
- Pruneti, C., Ferrari, S., & Guidotti, S. (2024). A narrative review of heart rate variability as a good index of psychophysical health in athletes and in biofeedback training. *Journal of Clinical Sport Psychology*, 18(4), 412–428. <https://doi.org/10.1123/jcsp.2022-0016>
- Rahmawati, S. I., & Farida, E. (2023). Asupan vitamin D, kualitas tidur dan stamina atlet pencak silat remaja. *Jurnal Ilmiah Permas: Jurnal Ilmiah STIKES Kendal*, 13(4), 1145–1154. <https://doi.org/10.32583/pskm.v13i4.1252>
- Septianingrum, K., Setyadi, F., & Rimawan, D. (2024). Survei kualitas tidur pada atlet bola voli klub Ngawi: Sebuah studi deskriptif. *Indonesian Research Journal on Education*, 4(1), 98–105. <https://doi.org/10.31004/irje.v4i1.486>
- Wardani, P. K., Setiakarnawijaya, Y., Robianto, A., Junaidi, J., Tangkudung, A. W. A., & Wasan, A. (2023). Analisis bibliometrik kajian sport recovery pada skripsi mahasiswa Program Studi Ilmu Keolahragaan Universitas Negeri Jakarta tahun 2011-2022. *Jurnal Segar*, 11(2), 74–85. <https://doi.org/10.21009/segar/1102.05>
- Wei, L., Aman, M. S., Abidin, N. E. Z., & Qian, W. (2025). Exploring the relationship between sports media use, sports participation behavior, and sport commitment: A mixed-methods study using structural equation modeling and qualitative insights. *BMC Psychology*, 13(1), Artikel 145. <https://doi.org/10.1186/s40359-025-02964-x>
- Wibowo, A. T., & Falaahudin, A. (2022). Status VO2 max dan denyut nadi istirahat mahasiswa Program Studi Ilmu Keolahragaan Universitas Mercu Buana Yogyakarta. *Jurnal Pendidikan Jasmani*, 6(1), 44–52.