

The association of perceived stress and physical activity levels with sleep quality among sports science students

Maylvie^{1abcde}, Gustiana Mega Anggita^{1abcef}, Neni Widiasmoro^{2bdf},
Zahrah Zakiya Ahda^{1cdf}.

¹Department of Sports Science, Faculty of Sports Science, Universitas Negeri Semarang, Semarang, Indonesia

²Department of Health Science, Faculty of Sports Science and Coaching, Sultan Idris Education University, Tanjong Malim, Perak, Malaysia.

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Abstract

Sleep quality among college students is associated with various psychological and behavioral factors, including perceived stress and physical activity levels. Sleep disorders have become an increasingly prevalent health issue in the student population, particularly due to academic stress and lifestyle changes. Sleep quality is determined not only by sleep duration but also by deep sleep phases, which play an important role in physiological recovery, emotional regulation, and cognitive function. This study aimed to examine the associations of perceived stress and physical activity levels with sleep quality among sports science students. A descriptive cross-sectional design was employed involving 186 students selected through a total sampling technique. Data were collected using the Depression Anxiety Stress Scales (DASS), Global Physical Activity Questionnaire (GPAQ), and Sleep Quality Scale (SQS). The findings indicated that perceived stress was significantly associated with sleep quality ($\beta = .447$, $p < .001$), whereas physical activity level was not significantly associated with sleep quality ($\beta = -.059$, $p = .376$). The overall regression model was statistically significant, $F(2,183) = 23.089$, $p < .001$, with $R^2 = .201$. These findings suggest that perceived stress plays a more prominent role than physical activity in explaining variations in sleep quality among sports science students. Therefore, strategies aimed at improving sleep quality in this population may benefit from prioritizing stress management alongside the promotion of healthy lifestyle behaviors.

Keywords: Sports science students, perceived stress, physical activity levels, sleep quality.

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INTRODUCTION

Sleep disorders have become a common health problem across various age groups (F. Wang et al., 2021), especially among college students who often experience academic stress and daily life pressures

Correspondence author: Gustiana Mega Anggita, Universitas Negeri Semarang, Semarang, Indonesia.
Email: mega.anggita@mail.unnes.ac.id



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(Gardani et al., 2022). A study showed that more than 60% of students experience poor sleep quality (Vidovi et al., 2025). Sleep quality has a greater influence on health than sleep duration (Andreasson et al., 2021). Several studies show that the deep sleep phase (slow wave sleep) plays a crucial role in brain recovery, emotion regulation, memory consolidation, and neuroendocrine balance (Denis et al., 2025), so that sleeping for a sufficient duration but with poor quality still poses a risk to mental health (Baglioni et al., 2016).

Physiologically, profound sleep disturbances affect the regulation of important hormones, including cortisol, melatonin, and growth hormone, as well as HPA (Hypothalamic-Pituitary-Adrenal) axis stress hormones, which can lead to cognitive function decline, emotional regulation disorders, and increased stress reactivity in students (Okano et al., 2019). Research evidence shows that sleep quality and consistency are more strongly associated with students' mental health than sleep duration (Bacaro et al., 2024). Poor sleep quality is associated with dysregulation of the HPA axis, which affects both physiological and psychological functions (Faoziyah & Suharjana, 2020; W. Wang et al., 2024).

Stress that is not managed correctly can develop into severe psychological disorders, such as anxiety and depression, and increase the risk of long-term emotional dysfunction (Malykhin et al., 2025). This condition is not only related to psychological well-being but also to cognitive function, motivation, and quality of life (Girotti et al., 2024). Among college students, high levels of stress have been associated with poorer sleep quality and lower engagement in physical activity, both of which are important determinants of students' health and well-being (Liu et al., 2025). In this study, stress is positioned as a key independent variable that may be associated with sleep quality. At the same time, physical activity is considered a related behavioral factor that may also be associated with sleep quality. Understanding these associations is important for explaining variations in sleep quality among students.

Previous research shows that the percentage of mental health problems among medical students is relatively high, with approximately 36.34% experiencing stress, 35.41% experiencing depression, and 40.21% experiencing anxiety (W. Li et al., 2022). In addition, another study reported that approximately 10.76% of students had suicidal ideation in the past 12 months, and 3.44% had attempted suicide at some point in their lives (Paiva et al., 2025). Global data also indicate that psychological stress among students continues to increase and has a widespread impact, with an international scoping review reporting that approximately 76% of students experience moderate to high levels of stress, accompanied by a significant increase in symptoms of anxiety and depression over the past decade (Roy & Biswas, 2025).

Sustained stress among students is often followed by maladaptive behavioral changes, leading to a decrease in motivation to engage in regular physical activity (Ram et al., 2020; Lepping et al., 2023). Physical activity is an activity closely related to physical and mental health (Anggita et al., 2021). Lack of physical activity can worsen stress responses by reducing physiological stimulation that helps regulate stress hormones, particularly cortisol, as well as neurotransmitters associated with mood (Kandola et al., 2019). This condition creates a negative cycle, where stress increases sedentary behavior, while low physical activity further increases stress levels and vulnerability to mental health disorders (Schuch et al., 2018). Based on several studies, physical activity has been shown to reduce perceived stress and improve sleep quality (Ye et al., 2022). Global analysis results show a consistent pattern: the higher the physical activity, the fewer sleep problems students tend to experience, and the lower the prevalence of stress compared to less active groups (Moussa-Chamari et al., 2024).

Therefore, physical activity may act as a protective factor that mitigates the association between stress and sleep quality, highlighting the importance of examining these variables simultaneously (Zhu et al., 2025; Moussa-Chamari et al., 2024). Previous studies have shown that physical activity is positively associated with sleep quality among college students

(Faoziyah & Suharjana, 2020). In contrast, perceived stress is a strong predictor of decreased sleep quality (Y. Huang et al., 2024). Other studies also report that physical activity can reduce stress levels and depressive symptoms, which, in turn, can interfere with sleep quality (Xu et al., 2025).

Previous studies have primarily examined the relationships between perceived stress and sleep quality, and between physical activity and sleep quality, mostly using a bivariate approach. These studies indicate that higher stress levels are associated with poorer sleep quality, while higher levels of physical activity tend to be associated with better sleep outcomes. However, these relationships have generally been analyzed separately, and limited research has examined the simultaneous association of perceived stress and physical activity with sleep quality within a single model. Furthermore, studies focusing specifically on sports science students, particularly in the Indonesian context, remain limited.

Therefore, this study aims to examine the association between perceived stress, physical activity levels, and sleep quality among sports science students in Indonesia using multiple linear regression analysis. By addressing this gap, this study contributes to the literature by examining the simultaneous association of perceived stress and physical activity with sleep quality within a single analytical model, particularly in the context of sports science students in Indonesia. In addition, this study provides empirical evidence on the relative roles of stress and physical activity in explaining variations in sleep quality, which may inform the development of more targeted interventions.

METHOD

This study used a cross-sectional research approach conducted between September and October 2025 among undergraduate students enrolled in the Sports Science Program at Semarang State University (UNNES). A cross-sectional design was selected to examine the associations between perceived stress, physical activity levels, and sleep quality at a single point in time. The study population consisted of 186 students, all of whom were invited to participate through a total sampling

technique. A total of 186 respondents completed the questionnaire, resulting in a 100% response rate. The respondents were students enrolled in semesters 1, 3, 5, and 7. The demographic characteristics indicated that 74.7% of respondents were male and 25.3% were female, with a mean age of 19.74 years ($SD = 1.44$). The inclusion criteria comprised active undergraduate students in the Sports Science Program who agreed to participate and completed the questionnaire. Respondents who submitted incomplete questionnaires or duplicate responses were excluded from the study.

Data collection was conducted using a web-based questionnaire developed through Google Forms and distributed via students' WhatsApp groups. Participants required approximately 8–10 minutes to complete the questionnaire. To prevent duplicate submissions, each participant was allowed to submit the questionnaire only once through a restricted-response setting. In addition, all questionnaire items were configured as mandatory fields to ensure data completeness. Prior to participation, all respondents received information regarding the study objectives and provided informed consent electronically.

Three instruments were used to measure the study variables. Perceived stress was measured using the stress subscale of the Depression Anxiety Stress Scales (DASS-42), consisting of 14 items assessed on a four-point Likert scale ranging from 0 (never) to 3 (almost always). Total scores were obtained by summing all item responses, with higher scores indicating higher levels of perceived stress. Based on established guidelines, stress levels were categorized as low (0–18), moderate (19–25), and high (≥ 26) (Lachman et al., 2025). The instrument demonstrated good internal consistency in the present study (Cronbach's $\alpha = .874$).

Physical activity levels were assessed using the Global Physical Activity Questionnaire (GPAQ) developed by the World Health Organization (WHO). The instrument measures physical activity across work, transportation, and leisure domains (Gurau et al., 2025). The collected data

were converted into MET-minutes per week and classified according to WHO recommendations. In the present study, the GPAQ demonstrated acceptable internal consistency (Cronbach's $\alpha = .622$).

Sleep quality was assessed using the Sleep Quality Scale (SQS). Overall sleep quality scores were obtained by summing responses across all items, with higher scores indicating poorer sleep quality (Aglaia et al., 2025). The instrument demonstrated good internal consistency in the current study (Cronbach's $\alpha = .810$).

This study received ethical approval from the Ethics Committee of the Faculty of Medicine, Universitas Negeri Semarang (UNNES) under Approval No. 277/KEPK/FK/KLE/2026. Participation was voluntary, informed consent was obtained from all participants before data collection, and all responses were collected anonymously to ensure confidentiality.

All data were analyzed using SPSS Statistics version 26 with a significance level of .05. In this study, sleep quality was treated as the dependent variable, whereas perceived stress and physical activity levels served as independent variables. Prior to hypothesis testing, several regression assumptions were examined. Residual normality was assessed using the Kolmogorov–Smirnov test. Linearity was evaluated using ANOVA on Deviation from Linearity. Multicollinearity was assessed using tolerance and Variance Inflation Factor (VIF) values, while independence of errors was examined through the Durbin–Watson statistic. Homoscedasticity was evaluated through residual analysis to ensure constant error variance. After all assumptions had been examined, a multiple linear regression analysis using the Enter method was conducted to examine the associations between perceived stress and physical activity levels and sleep quality, with all independent variables entered simultaneously into the regression model.

RESULT

Table 1. Demographic Characteristics of Respondents

Variabel	Category	Frequency (n)	Percentage (%)
Gender	Male	139	74.7%
	Female	47	25.3%
Total		186	100

Table 1 presents the demographic characteristics of the respondents. A total of 186 students participated in this study. The majority of respondents were male ($n = 139$, 74.7%), while 47 respondents (25.3%) were female. These findings indicate that the sample was predominantly male, reflecting the gender distribution of students in the Sports Science Program.

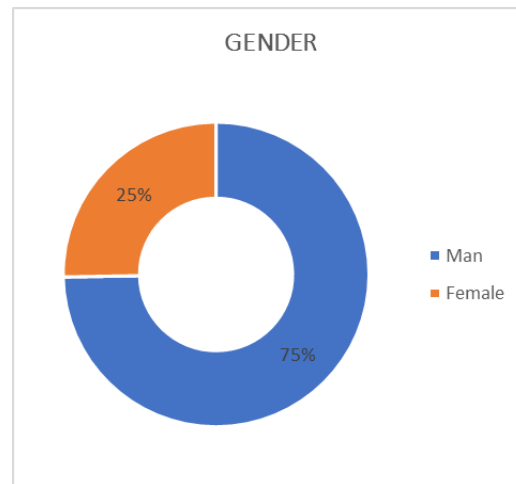


Figure 1. Distribution of Respondents by Gender and Age

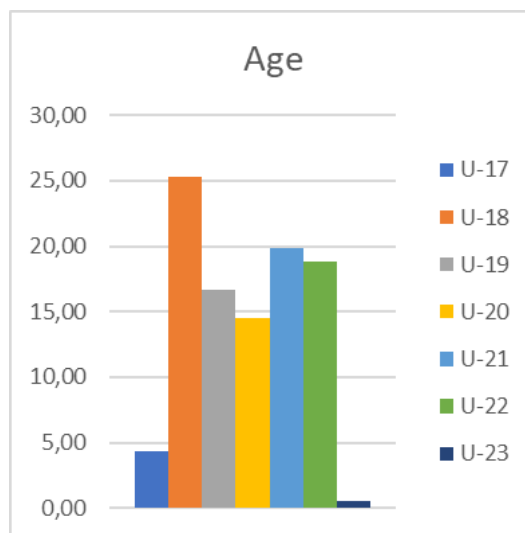


Figure 2. Demographic Data Results for the Age of Respondents

Figure 2 presents the age distribution of the respondents. The participants were aged 17-23 years, with the majority aged 18. The mean age of the respondents was 19.74 years ($SD = 1.44$), indicating that most participants were in the late adolescent to early adulthood stage.

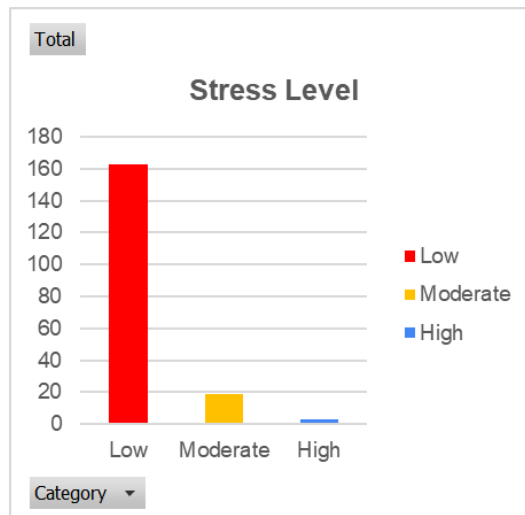


Figure 3. Distribution of Respondents' Stress Levels

Figure 3 presents the distribution of respondents' stress levels. The majority of participants were categorized as having low stress levels ($n = 163$, 87.63%), followed by moderate ($n = 19$, 10.21%) and high stress levels ($n = 4$, 2.16%). The mean stress score was 11.10 ($SD = 6.16$), indicating that overall stress levels were relatively low.

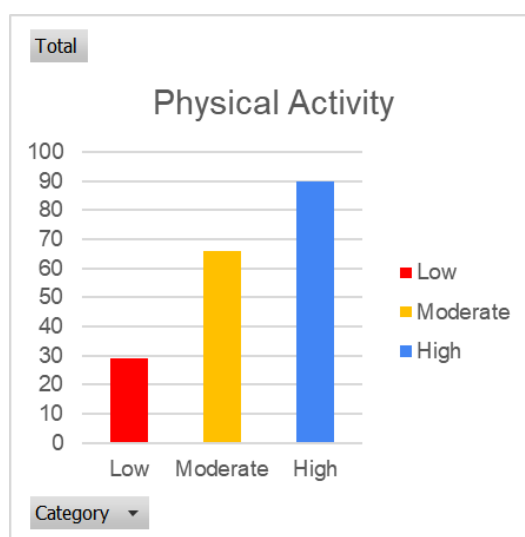


Figure 4. Distribution of Respondents' Physical Activity Levels

Figure 4 shows the distribution of respondents' physical activity levels. Most participants were classified in the high category ($n = 90$, 48.38%), followed by moderate ($n = 66$, 35.48%) and low ($n = 30$, 16.14%). The mean physical activity level was 4946.95 ($SD = 7041.01$) MET-minutes/week, indicating substantial variation among respondents.



Figure 5. Distribution of Respondents' Sleep Quality

Figure 5 presents the distribution of respondents' sleep quality. The majority of participants reported poor sleep quality ($n = 131$, 70.44%), followed by moderate ($n = 30$, 16.12%) and good sleep quality ($n = 25$, 13.44%). The mean sleep quality score was 32.47 ($SD = 9.40$), indicating that overall sleep quality was in the poor range.

Table 2. Data Normality Test

Normality Test	N	Llabel	Description
Kolmogorov–Smirnov	186	.200	Normal

Based on the Table above (Table 2), the normality test was conducted on the regression residuals using the Kolmogorov–Smirnov test. The result shows an Asymp. Sig. (2-tailed) value of $0.200 > 0.05$, indicating that the residuals are normally distributed. Therefore, the assumption of residual normality in the multiple linear regression model $Y = a + b_1X_1 + b_2X_2 + e$ is satisfied.

Table 3. Results of the Linearity Test between Independent Variables and Sleep Quality

	Variabel	Deviation from Linearity (p)	Description
Sleep quality	Physical activity level	.998	Linear
	Stress level	.351	

Based on the Table above (Table 3), the linearity assumption between the independent variables (X_1 and X_2) and Y was tested using the Deviation from Linearity test. The results show that the significance value of Deviation from Linearity for X_1 is $0.998 \geq 0.05$ and for X_2 is $0.351 \geq 0.05$.

These results indicate that there is no significant deviation from linearity, meaning that the relationships between X_1 and Y , as well as X_2 and Y , are linear. Therefore, the assumption of linearity is satisfied.

Table 4. Multicollinearity Test Results

Variable	Tolerance	VIF
Physical activity level	.999	1.001
Stress level	.999	1.001

Based on the table above (Table 4), the multicollinearity test results showed that all independent variables had tolerance values of 0.999 (> 0.10) and VIF values of 1.001 (< 10), indicating that there was no multicollinearity among the variables.

Table 5. Multiple Linear Regression Analysis Results

Variable	β	Standard Error	B	t	p-value	95% CI
Sleep quality						
Physical activity level	-.059	.000	-7.827×10^{-5}	-.887	.376	[-.000, .000]
Stress level	.447	.101	.682	6.761	< .001	[.483, .881]

Based on the table above (Table 5), the outcomes of the multiple linear regression analysis show that physical activity level does not demonstrate a statistically meaningful influence on sleep quality ($p = 0.376 > 0.05$). The Physical activity did not show a statistically significant association with sleep quality ($\beta = -0.059$, $p = 0.376$). Meanwhile, the stress level shows a significance value of $0.000 < 0.05$. The beta coefficient for stress level ($\beta = 0.447$) indicates that stress level exerts a significant influence on sleep quality. The positive regression coefficient suggests that as students' stress levels increase, their sleep quality becomes poorer.

Table 6. Results of the Influence of Stress and Physical Activity Level on Sleep Quality

Model	R	R ²	Adjusted R ²	F
Physical activity level and stress level predicting sleep quality	.449	.201	.193	23.089

Based on the Table above (Table 6), multiple linear regression analysis was conducted to examine the association between physical activity level, stress level, and sleep quality. The overall model was statistically significant, $F(2.183) = 23.089$, $p < 0.001$, with $R = 0.449$, $R^2 = 0.201$, and adjusted $R^2 = 0.193$, indicating that 20.1% of the variance in sleep quality was explained by the independent variables.

Physical activity level was not a significant predictor of sleep quality ($B = -7.83 \times 10^{-5}$, $SE = 8.80 \times 10^{-5}$, $\beta = -0.059$, $t = -0.887$, $p = 0.376$, 95% CI $[-0.000252, 0.000096]$). In contrast, stress level was a significant positive predictor of sleep quality ($B = 0.682$, $SE = 0.101$, $\beta = 0.447$, $t = 6.761$, $p < 0.001$, 95% CI $[0.483, 0.881]$). Overall, the findings indicate that stress is significantly associated with sleep quality, whereas physical activity shows no significant association in this sample.

DISCUSSION

The present study found that stress was significantly associated with sleep quality among sports science students, indicating that higher levels of perceived stress were associated with poorer sleep quality. This finding is consistent with previous studies reporting that increased stress levels among university students are closely related to sleep disturbances and reduced sleep quality (Pascoe et al., 2019; Huang et al., 2024). Stress is a psychological response that occurs when individuals perceive demands exceeding their capacity (Chen et al., 2025). One possible explanation for this relationship can be understood through the physiological stress response involving the hypothalamic–pituitary–adrenal (HPA) axis, which plays an important role in regulating the body's response to stress and maintaining sleep–wake balance (Dube & Babar, 2024). Physiologically, prolonged stress activates the HPA axis and increases cortisol secretion, which may interfere with the body's relaxation process and reduce sleep quality (Dube & Babar, 2024). These findings support previous evidence suggesting that perceived stress is a significant predictor of sleep quality and may contribute to sleep disturbances among university students (Huang et al., 2024; Malykhin et al., 2025).

This study also found that 20.1% of respondents experienced high levels of stress. If this condition persists, its consequences may extend beyond sleep disturbances alone. Prolonged stress among students has been associated with an increased risk of psychological difficulties, including anxiety, depression, and impaired emotional regulation (Malykhin et al., 2025). In general, the psychological burden experienced by students

is not merely a local phenomenon but a global concern affecting student well-being worldwide (Hadi et al., 2025). According to Gardani et al. (2022), stress levels and sleep quality play important roles in students' mental health. They are closely related to cognitive functioning, academic performance, learning motivation, and participation in campus activities. Therefore, the significant association observed in the present study further highlights the importance of understanding stress as a factor related to students' sleep quality.

In contrast to the findings regarding stress, the present study did not identify a significant association between physical activity and sleep quality. This result differs from several previous studies reporting that physical activity is associated with improved sleep quality and reduced sleep disturbances (Ndahimana & Kim, 2017; Riehm et al., 2020; Ghrouz et al., 2019). One possible explanation is that most respondents in this study were sports science students who were already engaged in relatively high, homogeneous levels of physical activity through their academic and training routines. When most participants fall into a similar activity category, the statistical relationship between physical activity and sleep quality may become less detectable. This finding suggests that, within this population, physical activity may not be the primary factor explaining variations in sleep quality.

Although physical activity was not significantly associated with sleep quality in the present study, previous literature indicates that physical activity remains important for both physical and psychological health. Physical activity has been shown to reduce emotional tension, improve self-control, and reduce stress (Riehm et al., 2020). It also plays an important role in preventing non-communicable diseases and supporting overall health through physiological mechanisms such as improved insulin sensitivity and autonomic nervous system regulation (WHO, 2020). Nevertheless, the relationship between physical activity and sleep quality is not always linear because it may be influenced by factors such as activity intensity, duration, and timing (H. Wang et al., 2025; H. H. Huang et al.,

2023). High-intensity physical activity performed close to bedtime, for example, may interfere with sleep onset and reduce sleep quality (Dolezal et al., 2017), whereas appropriately timed activity may improve sleep efficiency (Stutz et al., 2019).

The findings of the present study indicate that stress demonstrated a stronger association with sleep quality than physical activity within the regression model. This result suggests that psychological factors play a more prominent role than physical activity in explaining variations in sleep quality among sports science students. Although previous studies have frequently examined the relationships between stress, physical activity, and sleep quality separately, fewer studies have evaluated both predictors simultaneously within a single analytical model, particularly among students with relatively high levels of physical activity (Kasmadi & Suhadi, 2024). Therefore, the present findings contribute to the existing literature by providing empirical evidence regarding the relative roles of stress and physical activity in explaining sleep quality within this specific population.

Sleep quality may also be associated with factors beyond perceived stress and physical activity; however, these factors were not examined in the present model (Lund et al., 2021; Sejbuk et al., 2022). Consequently, the unexplained variance in sleep quality should be interpreted cautiously. Nevertheless, stress management may represent an important consideration for supporting sleep quality among university students. Understanding the roles of stress and physical activity in sleep quality may inform future strategies to promote student well-being.

Several limitations should be considered when interpreting the findings of this study. First, the cross-sectional design captures respondents' conditions at a single point in time and therefore does not permit causal inferences. Second, all data were collected using self-report questionnaires, which may be subject to response bias, social desirability bias, and common method bias. Furthermore, sleep quality was assessed using self-reported measures rather than objective methods such as actigraphy or physiological assessments, which may provide more accurate

estimates of sleep behavior (B. Li et al., 2024). Future studies are therefore encouraged to employ longitudinal designs, case studies, or controlled experimental approaches, as well as structured physical activity programs and objective sleep measurements, to provide a more comprehensive understanding of the relationships among stress, physical activity, and sleep quality.

CONCLUSION

Based on the findings, it can be concluded that stress level was significantly associated with sleep quality among sports science students, whereas physical activity level was not. The regression analysis indicated that the model explained 20.1% of the variance in sleep quality ($R^2 = .201$), suggesting that factors outside the present model may also contribute to sleep outcomes. The findings further indicate that perceived stress demonstrated a stronger association with sleep quality than physical activity within the current study population. Because this study employed a cross-sectional design, the findings reflect associative relationships and do not permit conclusions regarding temporal or causal relationships. These findings suggest that stress management may be an important aspect of supporting students' sleep quality. Furthermore, the findings are limited to the studied population, and their generalizability should be interpreted cautiously until further studies involving broader populations are conducted.

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