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Caffeine Consumption, Stress Levels, and Sleep Quality Among Students and Young Adults: A Cross-Sectional Study

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ABSTRACT

Caffeine consumption is widely prevalent among students and young adults, particularly in contexts requiring sustained attention, such as academic study and work. While caffeine enhances alertness, its potential effects on stress levels and sleep quality remain a growing concern[1,2]. This cross-sectional descriptive study aimed to examine the relationship between caffeine consumption, stress levels, and sleep quality among 68 participants, including secondary school students, university students, and working-age individuals. Data were collected on demographic characteristics, caffeine consumption patterns, stress levels (0–10 scale), sleep quality (1–4 scale), and self-reported symptoms, and were analyzed using descriptive statistics, correlation analysis, and simple linear regression. The results showed that upper secondary female students exhibited the highest mean stress level (7.02) along with relatively poor sleep quality. A weak negative correlation was observed between stress and sleep quality ($r \approx -0.27$), and regression analysis indicated that increased stress was associated with decreased sleep quality ($\beta \approx -0.23$). Common symptoms following caffeine consumption included palpitations, insomnia, and abdominal discomfort, while coffee consumption was associated with poorer sleep quality compared to tea. These findings suggest that caffeine consumption and stress may jointly contribute to impaired sleep quality, potentially forming a self-reinforcing cycle, highlighting the need for targeted interventions to promote appropriate caffeine use and improve sleep hygiene, particularly among high-risk student populations.

Keywords: *caffeine consumption; stress; sleep quality; students; cross-sectional study.*

1. Introduction

Caffeine is one of the most widely consumed psychoactive substances worldwide, particularly among students and young adults [1] who rely on it to enhance alertness, concentration, and academic performance. In modern educational environments characterized by high academic demands and competitive pressures, the consumption of caffeinated beverages such as coffee, tea, and energy drinks has become increasingly common as a strategy to cope with fatigue and maintain productivity.

Despite its short-term cognitive benefits, growing evidence suggests that excessive or inappropriate caffeine consumption may adversely affect both physiological and psychological health. Caffeine acts as a central nervous system stimulant that can disrupt sleep architecture, delay sleep onset, and reduce overall sleep quality. At the same time, students and young adults frequently experience elevated levels of psychological stress due to academic workload, examinations, and social expectations. Stress itself is known to interfere with sleep by increasing physiological arousal and promoting cognitive hyperactivity, leading to difficulties in initiating and maintaining sleep.

Importantly, caffeine consumption and stress may not operate independently but rather interact in a potentially reinforcing cycle. Individuals experiencing high stress may increase caffeine intake to sustain performance, while caffeine-induced sleep disruption may further exacerbate stress levels through sleep deprivation. This bidirectional relationship may contribute to a self-reinforcing cycle that ultimately impairs sleep quality and overall well-being. However, despite the growing concern, limited research has simultaneously examined the combined effects of caffeine consumption [2,3], stress levels, and sleep quality within a single population, particularly among secondary school students and young adults in real-world settings.

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Therefore, this study aims to investigate the relationship between caffeine consumption, stress levels, and sleep quality among students and young adults using a cross-sectional approach. By identifying patterns and associations among these variables, the findings of this study may provide important insights for developing targeted interventions to promote healthy caffeine consumption, stress management [4], and improved sleep hygiene in high-risk populations [5].

2. Methodology

2.1 Study Design and Participants

This study employed a **cross-sectional descriptive design** to investigate the relationship between caffeine consumption [6]., stress levels, and sleep quality among students and young adults. The design enables the assessment of associations among variables at a single point in time in a real-world setting. Data were analyzed using SPSS version 28 and R version 4.2. Statistical significance was set at $p < 0.05$.

2.2 Participants and Sampling

A total of **68 participants** were included in the study. Participants were drawn from multiple groups, including lower secondary students [7], upper secondary students, university students, and working-age individuals.

A **convenience sampling method** was used to recruit participants who regularly consumed caffeinated beverages such as coffee, tea, or energy drinks [8]. The sample consisted of both male and female participants, with a higher proportion of females, particularly among upper secondary students.

2.3 Data Collection

Data were collected using a **structured self-administered questionnaire**. The instrument was designed to obtain the following information:

- Demographic characteristics (gender, educational level)
- Caffeine consumption patterns (type of beverage, frequency)
- Stress levels [9], measured using a **self-reported numerical scale (0–10)**
- Sleep quality, assessed using a **4-point Likert scale (1 = poor, 4 = good)**
- Self-reported symptoms following caffeine consumption (e.g., palpitations, insomnia, abdominal discomfort)

Participants completed the questionnaire voluntarily, and responses were recorded anonymously.

2.4 Variables and Measures

- **Independent Variables:**

- Caffeine consumption (type and frequency)
- Stress level

·**Dependent Variable:**

Sleep quality

- **Additional Outcome Variables:**

- Physical and psychological symptoms (e.g., palpitations, insomnia)

2.5 Data Analysis

Data were analyzed using both descriptive and inferential statistical methods.

- **Descriptive statistics** (frequency, percentage, and mean) were used to summarize demographic characteristics, caffeine consumption patterns, and reported symptoms.
- **Pearson correlation analysis** was conducted to examine the relationship between stress levels and sleep quality.
- **Simple linear regression analysis** was performed to assess the predictive effect of stress on sleep quality.

A negative association between stress and sleep quality was identified, indicating that higher stress levels were associated with lower sleep quality scores.

2.6 Ethical Considerations

Participation in this study was voluntary. Informed consent was obtained from all participants prior to data collection. All data were collected anonymously, and no personally identifiable information was recorded. The study adhered to ethical standards for research involving human participants.

3. Results

3.1 Demographic Characteristics

A total of 68 participants were included in this study. The majority were female (61.8%), while males accounted for 38.2%. Most participants were upper secondary students (66.2%), followed by lower secondary students (17.6%), higher education students (11.8%), and working-age individuals (4.4%).

Table 1: Demographic characteristics of participants

Variable	Category	n	%
Gender	Female	42	61.8
	Male	26	38.2
Education Level	Lower Secondary	12	17.6
	Upper Secondary	45	66.2
	Higher Education	8	11.8
	Working Age	3	4.4

3.2 Stress Levels Across Groups

The analysis revealed differences in mean stress levels across participant groups. Upper secondary female students exhibited the highest stress levels (mean = 7.02), while other groups showed moderate levels of stress.

Table 2: Mean Stress and Sleep by Group

Group	Mean Stress (0–10)	Mean Sleep Quality (1–4)
Upper Secondary (Female)	7.02	2.55
Upper Secondary (Male)	4.33	1.33
Lower Secondary (Male)	4.17	3.33
Higher Education (Male)	4.63	1.44
Working Age (Male)	5.00	1.50

Figure 1. Comparison of stress levels and sleep quality across participant groups
Figure 1A. Mean stress levels across participant groups
Figure 1B. Mean sleep quality across participant groups

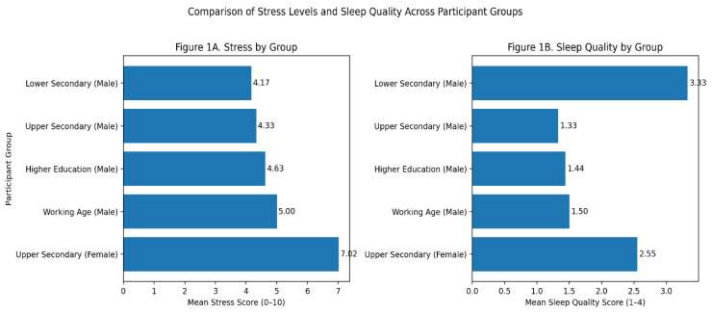


Figure 1A shows that upper secondary female students had the highest mean stress score among all groups. Figure 1B shows variation in sleep quality across groups, with poorer sleep observed in several higher-stress groups.

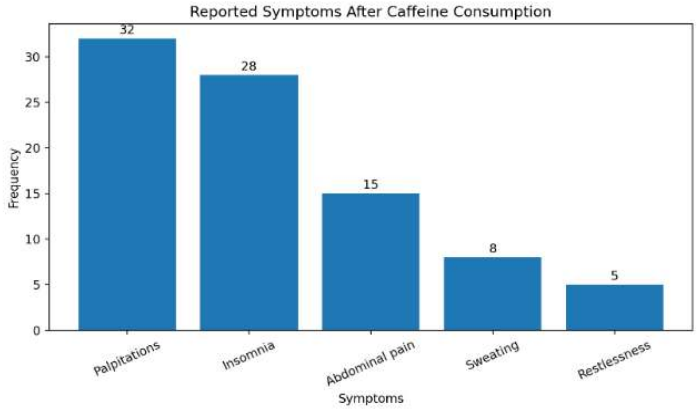
3.3 Reported Symptoms After Caffeine Consumption

Participants reported several symptoms following caffeine consumption, as shown in Table 3 and Figure 2. The most frequently reported symptom was palpitations (32 cases), followed by insomnia (28 cases) and abdominal pain (15 cases). Less common symptoms included sweating (8 cases) and restlessness (5 cases). These findings suggest that caffeine consumption may have noticeable physiological and psychological effects, particularly on the cardiovascular and sleep systems.

Table 3: Reported symptoms after caffeine consumption

Symptom	*Frequency*
Palpitations	*32*
Insomnia	*28*
Abdominal pain	*15*
Sweating	*8*
Restlessness	*5*

Figure 2: Distribution of reported symptoms after caffeine consumption



3.4 Relationship Between Stress and Sleep Quality

Table 4: Correlation and regression analysis

Variable	r	β
Stress vs Sleep Quality	-0.27	-0.23

A correlation analysis revealed a weak negative relationship between stress levels and sleep quality (r = -0.27), indicating that higher stress levels were associated with poorer sleep quality. Linear regression analysis further demonstrated that stress negatively predicted sleep quality (β = -0.23), suggesting that an increase in stress level was associated with a decrease in sleep quality score.

4. Discussion

The present study examined the relationship between caffeine consumption, stress levels, and sleep quality among students [17] and young adults [15], yielding several noteworthy findings. Upper secondary female students demonstrated the highest stress levels alongside relatively poorer sleep quality, suggesting that this subgroup may be particularly vulnerable to the combined effects of academic pressure and behavioral factors, including caffeine use. This observation is consistent with previous studies indicating that adolescents, particularly females, report higher perceived stress and are more prone to sleep disturbances.

A key finding of this study is the negative association between stress and sleep quality (r ≈ -0.27) [2,4], with regression analysis further indicating that increased stress levels [5] were associated with decreased sleep quality (β ≈ -0.23). Although the strength of this relationship was modest [13], its direction aligns with established evidence that psychological stress disrupts sleep through heightened physiological arousal and cognitive hyperactivity. Activation of the hypothalamic–pituitary–adrenal (HPA) [10] axis and subsequent elevation of cortisol levels may interfere with both sleep initiation and maintenance.

In addition to stress, caffeine consumption appears to contribute to sleep disruption. As an adenosine receptor [3] antagonist, caffeine reduces sleep pressure and delays sleep onset. Participants who consumed coffee exhibited poorer sleep quality compared to those consuming tea, suggesting that differences in caffeine content and potency may influence sleep outcomes. Moreover, the high prevalence of symptoms such as palpitations and insomnia reflects the stimulatory effects of caffeine on the autonomic nervous system.

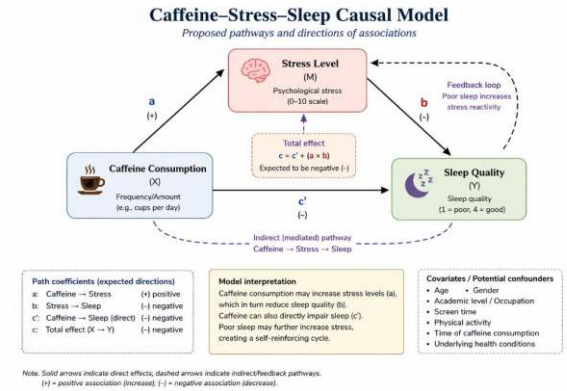
Importantly, these findings support the concept of a self-reinforcing cycle linking caffeine consumption, stress, and sleep disruption[16]. Individuals experiencing elevated stress may increase caffeine intake to sustain performance, while caffeine-induced sleep impairment may further exacerbate stress levels. This bidirectional interaction may contribute to a persistent cycle of sleep deprivation and psychological strain, particularly among high-risk groups such as upper secondary students. This proposed "caffeine–stress–sleep cycle" provides a useful framework for understanding the interaction between behavioral and physiological factors affecting sleep health[11].

However, several limitations should be acknowledged. The cross-sectional design limits causal inference, and the relatively small sample size in certain subgroups may reduce generalizability. Additionally, reliance on self-reported measures may introduce reporting bias. The study also did not control for potential confounders such as caffeine dosage, timing of consumption, screen exposure, or individual sensitivity to caffeine, which may influence both stress and sleep outcomes. These factors may partly explain the relatively weak association observed in this study.

Despite these limitations, this study provides preliminary evidence highlighting the interconnected roles of caffeine consumption and stress in influencing sleep quality among students and young adults. The findings emphasize the need for targeted interventions promoting appropriate caffeine use, stress management, and improved sleep hygiene [18]. Future research should employ longitudinal designs and larger samples to better elucidate causal pathways and strengthen the evidence base.

Based on the findings of this study, a conceptual model is proposed to illustrate the interaction between caffeine consumption, stress, and sleep quality (Figure 3) [14].

Figure 3: Proposed caffeine–stress–sleep causal model illustrating direct and indirect pathways affecting sleep quality



5. Conclusion

This study demonstrates that caffeine consumption and stress levels are jointly associated with reduced sleep quality among students and young adults. While stress showed a negative relationship with sleep quality, caffeine consumption appears to play a complementary role by directly disrupting sleep and potentially increasing physiological arousal. The findings suggest that caffeine and stress may interact in a self-reinforcing cycle, in which increased caffeine intake contributes to sleep disturbance, and poor sleep further exacerbates stress levels. This interaction is particularly evident among high-risk groups such as upper secondary students. Overall, the study highlights the importance of addressing both caffeine consumption and stress management in order to improve sleep quality [19] and promote well-being in this population.

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