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Caffeine Consumption, Sleep Patterns, and Psychological Well-Being Among Grade 12 Students: A Mixed-Methods Pilot Study

G.Sai Madhurima[1], Satya Sri Marapala[2]
Oakridge International School, Hyderabad, Telangana, India

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Abstract- Background: Caffeine is widely consumed to improve alertness and reduce perceived fatigue. However, caffeine consumption may interfere with sleep, potentially affecting daytime concentration and psychological well-being. These concerns are relevant to Grade 12 students, who may experience substantial academic demands.

Objective: To examine the associations between caffeine-consumption patterns, self-reported sleep characteristics, and psychological experiences among Grade 12 students.

Methods: A school-based, cross-sectional mixed-methods study was designed for Grade 12 students aged under 18 and 18 years. The proposed study combines an anonymous questionnaire assessing caffeine consumption, sleep duration, sleep-onset latency, perceived sleep quality, daytime sleepiness, and academic stress with semi-structured interviews exploring students' experiences. Quantitative data was analyzed using descriptive statistics and appropriate comparative tests, while interview data was analyzed thematically.

Keywords: Caffeine; adolescent sleep; sleep quality; sleep duration; academic stress; psychological well-being**.**

I. Introduction

Sleep is essential for cognitive functioning, emotional regulation, physical health, and learning. For adolescents, adequate sleep is particularly important because of ongoing development and the academic demands associated with senior secondary education. Students in Grade 12 often balance examinations, assignments, extracurricular commitments, and decisions about higher education. These demands may contribute to irregular sleep schedules and the use of caffeinated beverages to maintain alertness.Caffeine is a psychoactive substance found in coffee, tea, energy drinks, some soft drinks, and other commonly consumed products. It primarily promotes alertness by blocking adenosine receptors, thereby reducing the subjective sensation of sleepiness. Although this effect can temporarily help a person remain awake, caffeine does not eliminate the underlying physiological need for sleep.Sleep architecture refers to the organization of sleep into non-rapid eye movement (NREM) and rapid eye movement (REM) stages. NREM sleep progresses through lighter stages and deep slow-wave sleep, while REM sleep is associated with distinctive brain activity and dreaming. These stages recur in cycles throughout the night. Sleep quality therefore involves more than total sleep duration; sleep continuity, timing, and stage distribution are also relevant.A systematic review and meta-analysis by Gardiner et al. (2023), incorporating 24 studies, found that caffeine consumption was associated with reduced total sleep time and sleep efficiency, increased sleep-onset latency, and changes in the distribution of lighter and deeper sleep. The magnitude of these effects varied with factors including caffeine dose and timing. However, findings from a predominantly broader research literature cannot automatically be assumed to apply

identically to every adolescent population.Caffeine consumption may also have psychological implications. Some consumers report improved alertness or perceived concentration, whereas others experience nervousness, restlessness, or difficulty sleeping. Sleep disruption may be associated with daytime fatigue, reduced attention, and difficulties regulating mood. These relationships may be especially relevant during examinations, when academic stress can independently influence both caffeine consumption and sleep Despite the relevance of these issues, caffeine consumption should not be considered in isolation. Study schedules, screen exposure, stress, individual sensitivity, and existing sleep habits may influence the observed relationship between caffeine and sleep.The present study therefore proposes a mixed-methods investigation of caffeine consumption, self-reported sleep characteristics, and psychological experiences among Grade 12 students in a school setting.

1. Research Objectives

The study aims to:

- Describe the sources, frequency, approximate quantity, and timing of caffeine consumption among participating Grade 12 students.
- Examine associations between caffeine-consumption patterns and self-reported sleep duration, sleep-onset latency, and perceived sleep quality.
- Explore the relationship between caffeine consumption and self-reported daytime alertness, concentration difficulties, and psychological experiences.
- Investigate how examination pressure and study routines may influence caffeine use and sleep.
- Integrate survey findings and interview themes to identify implications for student sleep-health education.

2. Research Questions

The investigation addresses four questions:

- What are the caffeine-consumption patterns among the participating Grade 12 students?
- Is later-day caffeine consumption associated with differences in self-reported sleep-onset latency and sleep duration?
- How do students describe the perceived effects of caffeine on alertness, concentration, and emotional well-being?
- How do academic workload and examination-related routines influence caffeine consumption and sleep habits?

Hypothesis: Caffeine consumption may be associated with longer sleep-onset latency and that greater consumption may be associated with shorter self-reported sleep duration.

II. Materials And Methods

1. Study Design And Setting

The study is based on a cross-sectional mixed-methods design involving an anonymous questionnaire and semi-structured interviews.

The survey intended to collect quantitative information about caffeine consumption and self-reported sleep and daytime experiences. Follow-up interviews explored students' experiences in greater depth.

The study is observational. Participants were not instructed to consume caffeine, alter their usual intake, or restrict their sleep.

2. Survey Instrument

A study-specific questionnaire helped to assess:

- Age category and eligibility.
- Caffeinated products consumed during the previous seven days.
- Frequency and approximate serving size of consumption.
- Timing of the last caffeine intake on a school day.
- Reasons for consumption and changes during examinations.
- Usual bedtime, wake-up time, and estimated sleep duration.
- Self-reported sleep-onset latency and perceived sleep quality.
- Night-time awakenings and daytime sleepiness.
- Perceived alertness, restlessness, and concentration difficulties.
- Academic stress and screen use before sleep.

3. Quantitative Data Analysis

Table 1. Frequency and percentage of caffeine consumption

Caffeine consumption category	Frequency (n)	Percentage (%)
After 3:00 PM	10	33.3
At or before 3:00 PM	13	43.3
No caffeine consumption	7	23.3
Total	30	100.0

Of the 30 students, 23 (76.7%) were caffeine consumers, while 7 (23.3%) were non-consumers

Table 2. Descriptive statistics for sleep characteristics

Consumption category	No. of participants	Mean sleep duration (hours)	Mean sleep-onset latency (minutes)
After 3:00 PM	10	6.20	34.0
At or before 3:00 PM	13	6.80	24.0
No caffeine consumption	7	7.20	18.0
Overall	30	6.69	25.9

Here, sleep-onset latency refers to the time a student takes to fall asleep after attempting to sleep.

Variable	Mean	SD	Variance
Sleep duration (hours)	6.693	0.727	0.528
Sleep-onset latency (minutes)	26.867	8.253	68.120
Stress score (1–5)	3.000	1.414	2.000

The primary outcome is self-reported sleep-onset latency.

Secondary outcomes include sleep duration, perceived sleep quality, daytime sleepiness, concentration difficulties, and reported psychological experiences.

Caffeine-consumption groups:

One planned comparison was held between students reporting their last caffeine intake after 3 p.m. and students reporting earlier intake or no caffeine consumption.

These groups were examined separately to avoid obscuring differences between non-consumers and early consumers.

Qualitative data analysis

III. A Thematic Framework

Theme 1: Academic pressure and caffeine consumption

Recorded Response:

"I usually drink coffee when I have exams because I need to stay awake and finish studying."

Students preparing for examinations or completing assignments may consume caffeinated beverages to maintain alertness and extend study hours. This response explains why caffeine use may increase during academically demanding periods.

Theme 2: Perceived sleep disturbances

Recorded Response:

"When I drink coffee/ energy drinks in the evening, I feel active for longer and find it difficult to sleep."

Students consuming caffeine later in the day may report difficulty falling asleep, delayed bedtimes, or reduced sleep duration. The illustrative quantitative dataset showed a longer average sleep-onset latency among late-day caffeine consumers. Interview data helped determine whether students themselves perceive a similar relationship.

Theme 3: Alertness and concentration

Recorded Response:

"Energy drinks help me concentrate initially, but sometimes I feel restless afterward."

Caffeine may be perceived as beneficial for maintaining concentration and reducing tiredness during study sessions. However, students' experiences differ depending on consumption frequency, timing, and individual sensitivity.

Theme 4: Psychological Awareness and behavioral practices

Recorded Response:

"I know consuming energy drinks late may affect my sleep, but I still drink it when I have assignments."

Students recognized the importance of adequate sleep while continuing to consume caffeine during demanding academic periods. Psychological experiences associated with caffeine consumption include restlessness, irritability, and nervousness.

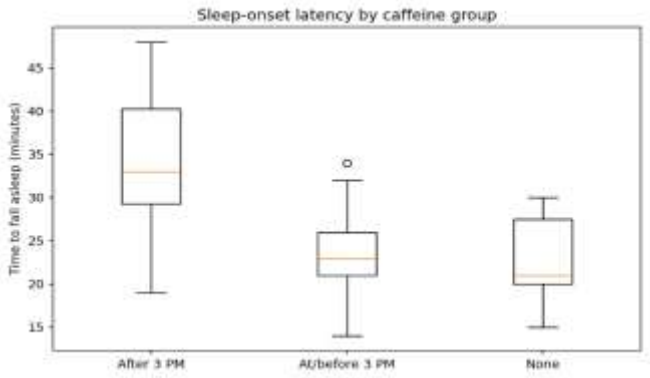
5. Integration With Quantitative Analysis

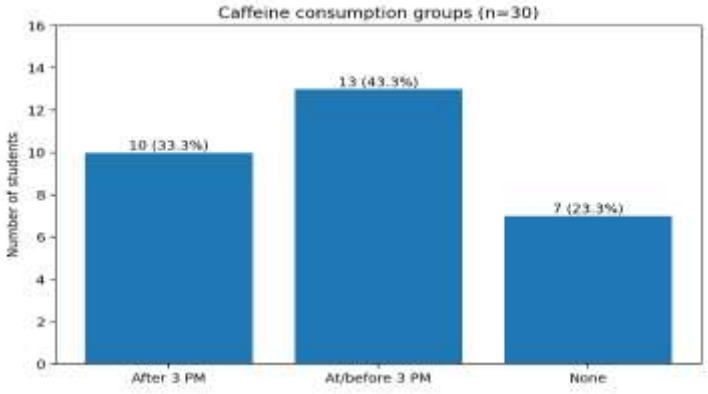
The synthetic quantitative analysis illustrated shorter mean sleep duration and longer sleep-onset latency among students consuming caffeine after 3:00 PM compared with non-consumers. Qualitative interviews provided contextual explanations for these patterns, particularly regarding examination preparation, late-night studying, and perceived alertness.The simulated quantitative analysis of 30 students showed that students consuming caffeine after 3:00 PM had the shortest mean sleep duration (6.20 hours), compared with students consuming caffeine earlier in the day (6.80 hours) and non-consumers (7.20 hours). The proposed qualitative theme of *perceived sleep disturbances* explains this pattern by exploring whether students associate evening caffeine consumption with delayed bedtimes and difficulty falling asleep.

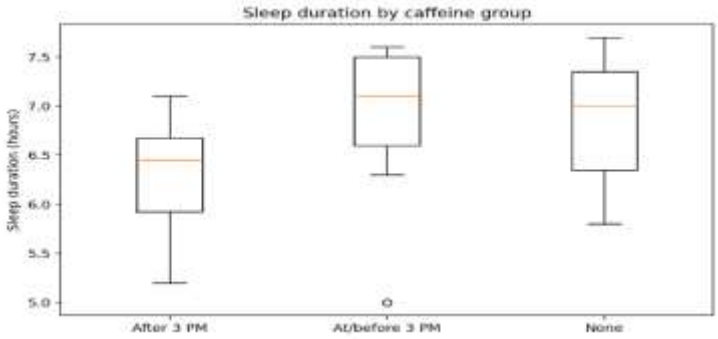
Caffeine Consumption and Sleep-Onset Latency :

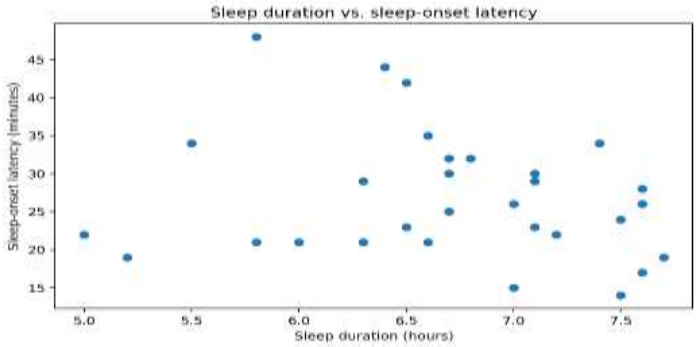
The quantitative data illustrated a mean sleep-onset latency of 34 minutes among late-day caffeine consumers, compared with 24 minutes among earlier consumers and 18 minutes among non-consumers.

IV. Results









1. Strengths

The proposed study combines quantitative and qualitative methods within a group of students. It includes caffeine consumers and non-consumers and considers timing of intake, sleep characteristics, academic stress, and other potentially relevant behaviors.

The study also provides a useful foundation for a larger investigation across multiple groups.

2. Limitations

1. Self-reported caffeine consumption and sleep characteristics are subject to recall error and measurement uncertainty. Serving sizes and caffeine concentrations may vary substantially.

2. Cross-sectional design cannot establish the temporal sequence or causality of observed associations. Students experiencing tiredness may consume more caffeine, rather than caffeine being the sole source of their sleep difficulties.

3. Academic workload, stress, screen use, individual sensitivity, and other factors may influence both caffeine use and sleep.

4. Interviews provide subjective accounts rather than objective measurements of physiological effects.

3. Implications

The findings may help inform discussions about sleep hygiene, caffeine awareness, and study routines among senior secondary school students. Any recommendations will be proportionate to the strength of the evidence and will not imply that all students respond identically to caffeine.

Future studies could recruit larger and more diverse samples, use validated sleep measures, collect prospective sleep diaries, and investigate dose and timing more precisely.

V. Conclusion

For the worked scenario, late-day consumers were assigned shorter sleep duration and longer sleep-onset latency on average than non-consumers.

Caffeine consumption, sleep, and academic routines are relevant to adolescent well-being. This mixed-methods pilot study is designed to examine their relationships among Grade 12 students by combining survey-based measurements with interviews.

The study identified an association between caffeine-consumption patterns and self-reported sleep, as well as students' perceptions of alertness, concentration, and academic pressure. However, an observational survey cannot establish causal effects or directly measure sleep architecture.

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