



## Assessing the Effect of Caffeinated Beverages on Sleep Quality, Sleep Pattern among College Students of Selected SJM Institutions, Chitradurga

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### ABSTRACT

**ABSTRACT:** Caffeinated drinks like coffee and energy drinks help many college students feel awake. However, relying on these beverages can lead to poor sleep and disrupted patterns, especially when students sacrifice sleep for academics. It's important for adults to get 7 to 9 hours of sleep each night for good health, as caffeine can negatively impact sleep quality. **Objectives:** This study aims to evaluate the consumption patterns of caffeinated beverages, their effect on sleep quality and patterns, and withdrawal symptoms among college students. It also seeks to raise awareness through structured education on the negative effects of excessive caffeine consumption. **Materials and Methods:** This is an analytical cross sectional study. It was conducted at selected SJM institutions, Chitradurga. The study was carried for a period of six months. **Results:** A questionnaire was distributed among 350 college students from SJM Institutions, Chitradurga. Of the participants, 57.7% were aged 18-20 years, 40.2% were aged 21-23 years, and 2% were aged 24-34 years. The sample included 45.7% males and 54.28% females. Among the participants, 75.4% consumed caffeinated beverages daily, 61.24% reported poor sleep quality, and 72.14% had inconsistent sleep patterns, with 57.1% going to bed after midnight. Statistically significant relationships were found between the amount of caffeinated beverage consumed and overall sleep quality ( $p=0.001$ ), the timing of caffeine consumption and hours of sleep ( $p=0.000$ ), and waking up refreshed with daily caffeine intake ( $p=0.001$ ). **Conclusion:** The present study accentuates the impact of excessive caffeine consumption on sleep quality and sleep pattern. Despite more than half consume caffeinated beverages on a daily basis, moderate consumption was reported. However, consumption of caffeinated beverages was associated with poor sleep quality and sleep pattern among the college students.

**Keywords:** Caffeine consumption, Sleep quality, Sleep pattern

### INTRODUCTION:

Caffeine is found in a variety of beverages and foods, including coffee beans, tea leaves, cocoa beans, kola nuts, and other plants. A majority of those surveyed consume caffeinated drinks, with coffee, tea, soft drinks, and energy drinks accounting for 98% of all caffeinated drinks consumed. Most college students, for instance, use caffeine to feel more alert, enjoy the flavour, interact with others, boost their physical energy, enhance their mood, and reduce stress.<sup>1</sup>

Caffeine is a methylxanthine derivative that acts as a central nervous system stimulant, which is a widely used psychoactive and cognitive enhancer all over the world. It exerts various pharmacological and physiological effects. Within an hour of oral ingestion, caffeine is absorbed and distributed to all body parts, even to the placenta and blood-brain barrier. The most prominent mechanism that explains the stimulatory activity of caffeine appears to be the antagonism of adenosine receptors in the brain, which normally cause drowsiness when activated.<sup>2</sup>

Caffeine has been shown have both positive and negative behaviour as well as cognitive and health effects depending on the amount consumed. Therefore, excessive consumption can lead to dependence, disturbance in sleep quality and pattern.<sup>3</sup>



Sleep is an essential component of the daily biological cycle that supports good health and excellent physical performance. Sleep requirement differs from person to person, an average of 7 – 9 hours of sleep per night is recommended for adults. Sufficient sleep has been positively related to good academic performance and enhanced memory. Inadequate sleep has been shown to negatively impact the nervous, endocrine and immune systems and can increase the risks of cardio metabolic disturbances, such as alteration of metabolism and body composition. The repercussions of compromising on sleep can be severe as sleep deprivation and unhealthy sleep hygiene can result in, loss of cognitive functions, poor academic performance and so on.<sup>5, 12</sup>

College students frequently experience sleep issues and more than half of them have poor sleep quality. They are particularly prone to sleep disturbances due to increased academic and social expectations, irregular schedules and other factors. Caffeine when taken in ample amounts up-to 6 hours prior bedtime can significantly disrupt sleep. This is because it is a neurotransmitter calming hormone and prevents melatonin (neurohormone that regulates sleep) secretion. The disturbance in melatonin secretion leads to disruption of sleep wake cycle.<sup>7, 11</sup>

The ease of obtaining caffeinated beverages and their positive portrayal in media often leads to excessive consumption, affecting sleep quality and patterns. Overconsumption (400 mg or more) can cause agitation, anxiety, and sleep issues. In today's fast-paced academic environment, college students often use caffeine to combat sleep deprivation. This study aims to explore the impact of caffeine intake on students' sleep health, offering insights for educators, health professionals, and policymakers. It will also raise awareness about the negative effects of excessive caffeine consumption and promote healthy intake practices among SJM Institutions, Chitradurga students.

## **MATERIALS AND METHODS :**

### **Study site and participants:**

This study was conducted at selected SJM institutions, Chitradurga. (SJM College of Pharmacy, SJM Institute of Nursing Science, SJM Institute of Technology) The study was carried for a period of six months. The study population included 350 participants who met inclusion criteria.

### **Ethical approval:**

1. The study was approved by the Institutional Ethical Committee of SJM College of Pharmacy, Chitradurga district. Vide No: SJMC/03/2022-23

2. Statement of informed consent: Informed consent was obtained from all individual participants included in the study.

### **Data collection and study procedure:**

Questionnaire based survey was conducted among college students of selected SJM Institutions, Chitradurga (SJM College of Pharmacy, SJM Institute of Nursing Sciences, SJM Institute of Technology), The study was started after obtaining the consent from Institutional Ethical Committee (IEC). The principals from each selected institutions were encountered to obtain permission for conducting the study in the respective institutions. After obtaining informed consent, subsequent to approval and validation the self-designed questionnaire was distributed among college students of selected SJM Institutions, Chitradurga district, Karnataka for a period of six month. An analytical cross sectional study was carried out. Participation was entirely voluntary, with no monetary or non-monetary incentives offered. Data was collected from 350 college students after obtaining written informed consent. The participants were between ages 18-34 years. Data was collected by the investigators and confidentiality was maintained during the data collection process.

**TOOLS FOR ASSESSMENT:** There were three tools used in the current study as follows:

**Tool 1:** Description of Demographic Variables It comprised of items such as name, age, gender, and course enrolled in.

**Tool 2:** Questionnaire for Caffeine consumption pattern It consists of 12 questions to assess the caffeine consumption pattern among the college students.

**Tool 3:** Questionnaire for Sleep Quality and Sleep Pattern It consists of 7 questions to assess the sleep quality and 6 questions to assess the sleep pattern.



### STATISTICAL ANALYSIS :

All the data was entered, tabulated in Microsoft Excel and analysed using SPSS version 28 software. Descriptive statistics using frequencies and percentage distributions were used for demographics, caffeine consumption pattern and sleep quality and patterns. Analytical statistics was carried out using Chi square test to measure the association between sleep quality, sleep pattern and consumption of caffeinated beverages.

### RESULTS

**Table 1: Baseline Characteristics of Study Participants**

Variables	Frequency(350)	Percentage (%)
<b>Age in years</b>		
• 18-20	202	57.71
• 21-23	141	40.29
• 24-34	7	2
<b>Gender</b>		
• Males	160	45.7
• Females	190	54.3
<b>Course</b>		
• Pharmacy	103	29.4
• Nursing	132	37.7
• Engineering	115	32.9

### Section I (Caffeine consumption pattern):

**Table 2 : Caffeine consumption pattern**

Variables	Frequency(350)	Percentage(%)
<b>Type of caffeinated beverage consume</b>		
• Coffee only		
• Tea only	52	14.85
• Energy drinks only	75	21.41
• Soft drinks only	10	2.85
• Chocolate or cocoa based products only	9	2.6
• All the above	7	2
• None	4	1.14
• Combination of different caffeinated beverages	15	4.3
<b>TOTAL</b>	<b>178</b>	<b>50.85</b>
<b>Specific reasons for consuming caffeine</b>		
• To wake up and feel more alert (Option a)	35	10
• To boost productivity and concentration or enhance physical performance (Option b)	43	12.29
• Habit/societal norms or boredom (Option c)	32	9.14
• Taste preference (Option d)	41	11.71
• Multiple reasons (Combination of mentioned motivations)	184	52.57
• No response	15	4.29
<b>TOTAL</b>	<b>350</b>	<b>100</b>



**Table 3: Response given by the subjects to questions designated to determine the caffeine consumption pattern**

Questions	Low/less		Moderate		High/More	
	Frequency	Percentage %	Frequency	Percentage %	Frequency	Percentage %
Q. How often do you consume caffeinated beverages? (n=350)	36	10.29	56	16	258	73.71
Q. How many servings of caffeinated beverages do you consume per day on average? (n=350)	31	20	145	71.14	174	8.90
Q. At what time do you usually consume caffeine? (n=350)	15	4.29	99	28.29	236	67.43
<b>Total response n=1050</b>	<b>82</b>	<b>7.81</b>	<b>300</b>	<b>28.57</b>	<b>668</b>	<b>63.62</b>

**Evaluation of withdrawal symptoms**

**Table 4: Response given by the subjects to question: Have you ever tried to reduce or stop caffeine consumption?**

Answer given	Frequency	Percentage (%)
Yes	167	47.71
No	168	48
No response	15	4.29
<b>TOTAL</b>	<b>350</b>	<b>100</b>

**Awareness**

**Table 5: Response given by the subjects to question: Are you aware of any health risks or concerns associated with caffeine consumption?**

Answer given	Frequency	Percentage (%)
Yes	229	65.40
No	121	34.60
<b>TOTAL</b>	<b>350</b>	<b>100</b>

**Table 6: Response given by the subjects to question: Do you have any other observations regarding your caffeine consumption?**

Answer given	Frequency	Percentage (%)
Yes	73	20.90
No	277	79.10
<b>TOTAL</b>	<b>350</b>	<b>100</b>



**Section II (Sleep Quality and Sleep Pattern)**

**Evaluation of sleep quality**

**Table 7: Response given by the subjects to questions designated to evaluate sleep quality.**

Questions	Good sleep quality			Poor sleep quality		
	Frequency		Percentage %	Frequency		Percentage %
Q. Do you wake up during the night? (n=350)	Subjects that responded no	134	38.40	Subjects that responded yes	216	61.60
Q. How long does it take to fall asleep after waking up during the night? (n=216)	Within 5-10 minutes	83	37.70	Within 15 minutes, 30 minutes or longer	133	62.3
Q. Do you wake up feeling refreshed and well rested? (n=350)	Subjects that responded yes	147	42	Subjects that responded no	203	58
Q. How would you rate the overall quality of your sleep? (n=350)	Excellent and good	121	34.6	Fair and poor	229	65.4
Q. Do you experience difficulties falling asleep or staying asleep? (n=350)	Rarely and never	103	29.4	Yes, often and Yes, sometimes	247	70.6
Q. How often do you feel excessively sleepy or fatigued during the day? (n=350)	Occasionally and rarely	103	49.8	Almost every day and several times a week	176	50.2
<b>Total Response n=1966</b>	<b>762</b>		<b>38.76</b>	<b>1204</b>		<b>61.24</b>

**Evaluation of sleep pattern**

**Table 8: Response given by the subjects to questions designated to evaluate sleep pattern.**

Questions	Consistent sleep pattern			Inconsistent sleep pattern		
	Frequency		Percentage %	Frequency		Percentage %
Q. How many hours of sleep do you typically get per night? (n=350)	6-8 hours or more	138	39.4	4-6 hours	212	60.6
Q. At what time do you usually go to bed? (n=350)	9 p.m. – 10 p.m.	40	11.43	11 p.m. or later	310	88.57
Q. On average, how long does it take you to fall asleep? (n=350)	5-15 minutes	118	33.71	30 minutes – 1 hour or longer	232	66.29
Q. Do you have a consistent sleep schedule, going to bed and waking up roughly at the same time each day? (n=350)	Yes, always or most of the time	94	26.86	Sometimes or no, never	256	73.14
<b>Total response (n=1400)</b>	<b>390</b>		<b>27.86</b>	<b>1010</b>		<b>72.14</b>



**Table 9: Response given by the subjects to question: Are you aware of any specific factors that affect your sleep quality?**

Answer given	Frequency	Percentage (%)
Noise	65	18.70
Light/Screen time (mobile/tablet)	75	21.0
Stress	60	17.20
Caffeine	150	43.10
<b>Total</b>	<b>350</b>	<b>100</b>

**Association data**

**Table 10 : Association of waking up feeling refreshed and well rested with the daily intake of caffeinated beverages**

		Q. How many servings of caffeinated beverages do you consume per day on average?								$\chi^2$ value	P value
		None		1-2		3		4 or more			
		N	%	N	%	N	%	N	%		
Do you wake up feeling refreshed and well rested?	Yes	52	75.40%	88	50.60%	6	8.00%	0	0.00%	<b>94.919</b>	<b>0.001</b>
	No	17	24.60%	86	49.40%	69	92.00%	31	100.00%		

**Table 11: Association of overall quality of your sleep with the daily intake of caffeinated beverages**

		Q. How many servings of caffeinated beverages do you consume per day on average?								$\chi^2$ value	P value
		None		1-2		3		4 or more			
		N	%	N	%	N	%	N	%		
How would you rate the overall quality of your sleep?	Excellent	22	31.40%	19	10.90%	2	2.70%	0	0.00%	<b>148.6</b>	<b>0.001*</b>
	Good	26	31.10%	51	29.30%	1	1.30%	0	0.00%		
	Fair	15	21.40%	44	25.30%	5	6.70%	1	3.20%		
	Poor	7	10.00%	60	34.50%	67	89.30%	30	96.80%		

**Table 12: Association of hours of sleep per night with the time of consumption of caffeinated beverage**

		Q3. How many hours of sleep do you typically get per night?								$\chi^2$ value	P value
		4 hours		5-6 hour		6-7 hours		8 hours or more			
		N	%	N	%	N	%	N	%		
At what time do you usually consume caffeine?	Morning	30	69.8%	94	56.0%	53	53.5%	6	23.1%	72.265	0.000
	Afternoon	18	41.9%	60	35.7%	20	20.2%	7	26.9%		
	Evening	36	83.7%	138	82.1%	76	76.8%	18	69.2%		
	Night	30	69.8%	64	38.1%	15	15.2%	3	11.5%		

**DISCUSSION :**

Among the study population, 97% consume caffeinated beverages which is in concordance with a study in Dharan by Bogati S et al.,2020 where 96% reported consuming caffeinated beverages.<sup>8</sup> Our study found that 7.81% had low caffeine consumption, 28.57% had moderate consumption, and 63.62% had high consumption. Notably, 73.71% of participants consumed caffeinated beverages



daily, consistent with a similar study in Malaysia by Ramakrishna S et al. (2020), where 73.1% of participants reported daily consumption.

Over half of the study population (61.24%) reported poor sleep quality, with most sleeping 5-6 hours per night. These findings align with a study by Vélez JC et al. (2013) in Washington, USA, where more than half of students also had poor sleep quality.<sup>6</sup> While reporting the Sleep Pattern of study participants, 27.86% have a consistent sleep pattern and more than half of the subjects 72.14% had an inconsistent sleep pattern and 57.10% goes to bed after midnight. A previous study conducted in Malaysia by Ngu ST et al., 2017 reported that 88.9% of its study population goes to bed at midnight or later which is a much higher percentile.<sup>27</sup>

This study found a significant association ( $p=0.001$ ) between daily caffeine intake and sleep quality. Most participants consuming four or more caffeinated beverages per day had poor sleep quality, while those who avoided caffeine reported better sleep. This aligns with a study by Al Sharif SM et al. (2018) in Saudi Arabia, where excessive caffeine intake was linked to poor sleep quality in 42.9% of participants.<sup>30</sup>

The withdrawal symptoms reported in this study were headache, negative mood, fatigue and smaller portion of respondents reporting irritability, brain fog and nausea. This report however could not be in conformity with previous studies. In a previous study carried out in the UAE by Kharaba Z et al., 2022, the reported withdrawal symptoms were that of muscle pain, shakiness and difficulty in concentrating. However, this findings were largely associated with the age of the participants.<sup>2</sup>

Our study reveals that poor sleep quality and pattern is common among subjects with excessive caffeine consumption and the motivations for consumption are that of taste preference and to feel more alert and awake. The study's findings aid in highlighting the significance of educating college students from a variety of fields about the quality of their sleep and use of caffeinated beverages in moderation.

## CONCLUSION :

The study findings indicate that daily consumption of Caffeinated Beverage is high among the college students. Poor Sleep Quality and Sleep Pattern is also a common finding in this study. Significant associations were found between the overall sleep quality and amount of Caffeinated Beverage consumed on a daily basis. The motivation behind Caffeinated Beverage consumption mostly remains common which is to feel refreshed, awake and energized. The implications of poor Sleep Quality and Sleep Pattern can have a toll on not only personal well-being; it can also affect academic performances. We urge more public understanding of caffeine's active constituents, as well as their possible negative effects and adverse occurrences. Additional research is advised to assess the factors that influence college student's intake of Caffeinated Beverages, their awareness of the risks associated, and potential interventions to encourage safe usage.

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## CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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