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ORIGINAL STUDY

Effect of caffeine consumption on the sleep quality among undergraduate students – sectional study

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Abstract

Background: Caffeine is a common component in the modern diet, and its popularity is fueled by both its reputation as a stimulant and its flavor. The study was conducted on undergraduate students to assess the patterns of sleep quality and investigate the degree to which poor sleep quality is connected with the consumption of caffeine and other stimulants by any means.

Methodology: This cross-sectional study was carried out on 550 undergraduate students from various institutes in Karachi, Pakistan.

Results: After elimination, a total of 416 participants participated in the research with a slightly higher percentage of men (272) than women (144) in it. The average PSQI global score (SD) for the male participants was 6.32 (3.170), and 68.6% of them scored >5, indicating poor sleep. 84 undergraduate students had not consumed caffeine of which 46 participants had poor sleep while 38 had good sleep quality (45.2%) It shows a significant association between caffeine consumption on sleep quality (p-value=0.05) whereas for female students, there is no correlation (P-value > 0.05).

Conclusion: This study shows that the majority most undergraduate students have bad sleep quality, which has been correlated with consuming too many beverages high in caffeine. The results are in line with earlier studies that show college students who drink caffeinated beverages have a higher prevalence of sleep disruption.

Keywords

Sleep, students, caffeine, quality, undergraduate



Introduction

Caffeine-based drinks are used very frequently in our routine. Caffeinated beverages such as coffee, tea, energy drinks, and soft drinks are easily available and consumed by teenagers. Caffeine can also be available in pill or tablet form^{1,2}.

The amount of caffeine is found very engaging for teenagers but over-use of this product may affect the sleep quality of an individual¹. Caffeine extends the awareness and attention of an individual³, due to its stimulatory effect on the nervous system⁴.

Given that it is a common component in the modern diet, caffeine's popularity is fueled by both its reputation as a stimulant and its flavor (Desbrow and Leveritt's research)⁵. Pharmacologically, caffeine is an antagonist of the adenosine-receptor. As a result, it would seem that caffeine's performance benefits are mostly brought on by its activation of adenosine receptors.

It mostly affects A1 and A2A receptors, which are connected to sleep, arousal, and cognitive functions in the brain⁶. Numerous negative health consequences have been associated with factors such as lack of sleep and heavy caffeine intake. Worldwide, undergraduate students frequently use caffeine and other stimulants. In our research, we have looked at the impact of caffeinated drinks on undergraduate students' sleep quality. We carried out this study on 550 students to assess the patterns of sleep quality and investigate the degree to which poor sleep quality is connected with consumption of caffeine and other stimulants by any means⁷.

Individual differences exist in how much sleep each body perceives. To maintain optimal health, individuals need to sleep for 7 hours or more every night. In individuals with poor health outcomes, poor quality of sleep has been closely linked to decreased average sleep duration and excessive morning sleepiness, as a result, it hurts academic performance, attitude, and social intelligence. Individuals have been involved in

many research works looking at caffeine use and its impact on sleep. The investigations revealed that caffeine consumption one to three hours before bedtime reduces sleep duration and quality as well as increases the time it takes for sleep to start. Lowering the amount of deep sleep can also affect the pattern of sleep⁸.

The experimental design of these investigations, however, neglected the effects of a person's regular caffeine consumption on sleep patterns⁹.

Methodology

In this cross-sectional study, which was carried out in Karachi, Pakistan, undergraduate students from various institutes participated. To minimize incomplete responses, the survey was adjusted to 416 respondents. However, 448 replies were received, and all of them were included. Students with psychological illnesses and those who had ongoing medical issues affecting their quality of sleep were eliminated. Additionally, students who were not enrolled in any undergraduate studies were also eliminated.

Before using the tools, the purpose of the study was described to each student. To earn their assurance and trust, oral consent was received from each student to participate in the study after they were assured that the information collected would be kept private.

After conducting a review of the literature and consulting with field experts, the researchers developed a survey to gather data. The questionnaire covered student demographic information, coffee usage, and its source, sleep quality, including sleep hours, sleep issues, and the nature of sleep using the PSQI index. The survey was then circulated to the students between August and October 2023 via a Google form. Students willingly participated in the research through the provided URL for the survey.

The information was input into the SPSS statistics program for numerical and percentage analysis in tables and graphs, interpretation of the findings, and dissemination.

Result

After elimination, a total of 416 participants took part in the research, with a slightly higher percentage of men (272) than women (144). The vast majority of students claimed to have been in good health, and none of them disclosed any ongoing consumption of psychoactive medications or issues with their psychological health (Table 1).

Figure 2 compares the use of caffeine by men and women on a gender-neutral basis. In the study, 84.7% of women and 77.2% of men had ingested caffeine in some form. Therefore, there was no correlation between gender and caffeine use among undergraduate students (p -value > 0.05) since the P -value of 0.069 was greater than 0.05 (Figure 2).

The average PSQI global score (SD) for the male participants was 6.32 (3.170), and 68.6% of them scored above 5, indicating poor sleep. The average PSQI global score (SD) for the female participants was 6.58 (3.809), and 63.9% of them scored higher than 5, suggesting poor sleep

(Table 2). The scores for the components and the overall PSQI indicated that the quality of sleep decreased as the score increased.

Sleep quality varied significantly with caffeine consumption regardless of gender (Table 3). Out of 416 participants, 332 consumed caffeine, of whom 222 had poor sleep quality (66.9%) while 110 had good sleep quality (33.1%). Among the 84 undergraduate students who had not consumed caffeine, 46 had poor sleep quality (54.8%) while 38 had good sleep quality (45.2%). This showed a significant association between caffeine consumption and sleep quality (p -value < 0.05).

Male and female differences in sleep quality were significant for both the overall index and most of the individual components (Table 4). Compared to their female counterparts, more male students (68.6%) than female students (63.9%) reported having trouble sleeping. For men, there was a significant correlation between caffeine consumption and sleep quality (p -value < 0.05), whereas for women, there was no correlation (p -value > 0.05).

Table 1: Summary of number of male and female students who were caffeine consumers or not.

Gender		Caffeine Consumption		Total	p-value
		No	Yes		
Female	Count	22	122	144	0.069
	% within Gender	15.3	84.7	100.0	
Male	Count	62	210	272	
	% within Gender	22.8	77.2	100.0	
Total	Count	84	332	416	
	% within Gender	20.2	79.8	100.0	

***P value from Chi-square test for categorical variables**

Table 2: Summary of PSQI scores among male and female undergraduate students

*PSQI SCORES	GENDER		TOTAL
	MALE	FEMALE	
1	4	8	12
2	10	12	22
3	32	12	44
4	48	22	70
5	36	14	50
6	28	14	42
7	38	4	42
8	20	14	34
9	20	14	34
10	4	6	10
11	10	6	16
12	6	2	8
13	6	8	14
14	2	6	8
15	4	0	4
16	4	0	4
17	0	2	2
18	0	0	0
19	0	0	0
20	0	0	0
21	0	0	0
TOTAL	272	144	416
MEAN±SEM	6.32 ± 0.192	6.58 ± 0.317	
Std. Deviation	3.170	3.809	

*Score <5 showed good sleep quality while ≥ 5 showed bad quality of sleep

Table 3: Summary of caffeine consumption on sleep quality

Caffeine Consumption	PSQI Interpretation		Total	p-value	
	bad sleep	GOOD SLEEP			
No	Count	46	38	84	0.038
	% within Caffeine Consumption	54.8	45.2	100.0	
Yes	Count	222	110	332	
	% within Caffeine Consumption	66.9	33.1	100.0	
Total	Count	268	148	416	
	% within Caffeine Consumption	64.4	35.6	100.0	

*P value from Chi-square test for categorical variables

Table 4: Summary of the number of male and female students who were caffeine consumers or not with good or bad sleep quality

Gender			PSQI interpretation		P-Value
			bad sleep quality	Good sleep quality	
Female	No	Count	12	10	0.402
		% within Caffeine Consumption	54.5	45.5	
	Yes	Count	78	44	
		% within Caffeine Consumption	63.9	36.1	
	Total	Count	90	54	
		% within Caffeine Consumption	62.5	37.5	
Male	No	Count	34	28	0.046
		% within Caffeine Consumption	54.8	45.2	
	Yes	Count	144	66	
		% within Caffeine Consumption	68.6	31.4	
	Total	Count	178	94	
		% within Caffeine Consumption	65.4	34.6	

***P value from Chi-square test for categorical variables**

Discussion

Poor sleep is a major problem among undergraduate students, and it can be attributed to both biological and social factors¹⁰. The study was conducted on undergraduate students to analyze the effect of caffeine consumption on their sleep quality. The study also showed caffeine consumption among gender-based.

Approximately 68.5% of male students and 63.9% of female students in the study were classified as having bad sleep quality with caffeine consumption. Moreover three-quarters of students reported drinking caffeinated beverages, with poor sleepers showing higher consumption than those with good sleep quality. Our results are in line with earlier studies that show college students who drink caffeinated beverages have a higher prevalence of sleep disruption¹⁰.

The student used multiple types of drinks having different amounts of caffeine. Green tea and black tea are 8 ounces, sweet iced tea is 18 ounces, a Bottle of soda is 12 ounces, large soda is 20 ounces, a Can of soda is 30 ounces, Drip coffee

brewed at home is 8 ounces, Latte from a shop 16-ounce Drip coffee from a shop 16 ounce of caffeine. Similarly different energy drinks have an average of 16 ounces of caffeine¹¹.

Consumption of caffeine is more in female (84.7%) as compared to male (77.2%) undergraduate students same as in previous literature women were significantly more likely to consume any source of caffeine than men¹², in other studies Female students were found to consume more caffeinated beverages than males, with a daily average of 275 mg and 242 mg, respectively¹³, same showed in Spain undergraduate population⁴. This is in keeping with the result of a cross-sectional study in Patagonian Chilean college students¹⁴. Similarly, in a study conducted in Bahrain and Sharjah with those who experienced poor sleep quality¹⁵.

The sleep quality was determined by the PSQI global score. Scores < 5 show good sleep quality while > 5 show bad sleep quality¹⁶. Around, 68.6% of males have scores > 5, and 63.9% of females have similar results. If we see the study regardless of gender 54.8% had bad sleep quality while

45.2% had good sleep quality with no consumption of caffeine whereas with the consumption of caffeine, the result changed into 66.9% bad sleep and 33.1% good sleep quality.

There were some restrictions on how the study could be conducted. First of all, undergraduate students from a private and public university provided the data. As a result, this restricted how broadly the findings could be applied. Second, some respondents might have chosen their responses based on what they believed the researcher wanted rather than what they believed. Additionally, unrelated variables like stress might have had an impact on the dependent variable. Some of the methods that were frequently employed to cut back on caffeine consumption included drug substitution, knowledge and information-seeking caffeine avoidance, and the identification of change-provoking factors. Caffeine withdrawal symptoms, which were commonly accompanied by headaches, weariness, lethargy, and poor energy, might have occurred if use was abruptly halted¹⁷.

Conclusion

In summary, this study shows that the majority most undergraduate students have poor sleep quality, which has been correlated with consuming too many beverages high in caffeine. Future research might look at the effects of caffeine when consumed at various times before bedtime and discover the stressors that contribute to poor sleep quality to manage it. Also, we can further research the other factors that enhance the effect of caffeine in this regard.

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