

THE EFFECT OF CAFFEINE CONSUMPTION ON ACADEMIC STRESS, QUALITY OF LIFE AND COGNITIVE REAPPRAISAL AMONG UNIVERSITY STUDENTS

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ABSTRACT

The present study examined the effect of caffeine consumption on academic stress, sleep quality, and cognitive reappraisal among university students in Pakistan. A quantitative, cross sectional research design was employed with a sample of 300 university students (M = 150, F = 150) drawn from public and private universities in the Federal and Punjab regions of Pakistan using a non-probability purposive sampling technique. Academic stress was measured using the Perception of Academic Stress Scale (Bedewy & Gabriel, 2015), sleep quality was measured using the Pittsburgh Sleep Quality Index (Buysse et al., 1989), and cognitive reappraisal was measured using the cognitive reappraisal, subscale of the Emotion Regulation Questionnaire (Gross & John, 2003). Daily caffeine consumption was recorded through a self-constructed demographic information sheet and categorized into three groups: no caffeine consumption, one cup per day, and two or more cups per day. The findings revealed significant differences across caffeine consumption groups in all three study variables. Students who consumed no caffeine reported the highest academic stress, while students consuming two or more cups per day reported the poorest sleep quality and the lowest cognitive reappraisal. Post hoc analyses confirmed that higher caffeine consumption was significantly associated with lower cognitive reappraisal and poorer sleep quality, while moderate consumption of one cup per day was associated with lower academic stress relative to no consumption. The findings highlight caffeine consumption as a meaningful lifestyle variable associated with students' psychological functioning and sleep, with implications for health promotion and wellbeing programs in university settings in Pakistan.

1. INTRODUCTION

Caffeine is the most widely consumed psychoactive substance in the world, predominantly ingested through beverages such as tea, coffee, and energy drinks (Nehlig, 2010). Among university students, caffeine consumption is particularly prevalent, often used as a tool to manage fatigue, sustain attention during long study hours, and cope with the demands of academic life (Mahoney et al., 2019). In the context of Pakistan, tea consumption, locally referred to as chai, is deeply embedded in cultural and social routines, making caffeine intake a normative and frequent behavior among students across all socioeconomic backgrounds (Waqas et al., 2015). While caffeine can offer short term benefits such as increased alertness and reduced perception of fatigue, its physiological

effects on sleep are well documented and potentially detrimental (Nehlig, 2010). Caffeine acts primarily by blocking adenosine receptors in the brain, thereby inhibiting the buildup of homeostatic sleep pressure and delaying the onset of sleep (Borbély et al., 2016). When consumed in the hours before bedtime, caffeine has been shown to significantly disrupt sleep onset, reduce total sleep duration, and impair sleep quality, all of which have consequences for students' daytime functioning and psychological wellbeing (Medic et al., 2017).

Sleep quality, understood here as the subjective adequacy and restorativeness of an individual's nightly sleep, is closely intertwined with psychological functioning in university students (Buysse et al., 1989). Poor sleep attributable to caffeine related disruption may carry downstream consequences not only for cognitive performance but also for emotional regulation, given that adequate sleep is understood to be a prerequisite for the prefrontal cortical activity needed for deliberate, effortful emotion regulation strategies such as cognitive reappraisal (Mauss et al., 2013). Cognitive reappraisal, as conceptualized within Gross and John's (2003) process model of emotion regulation, involves actively reinterpreting the meaning of a situation to reduce its emotional impact. It is an antecedent focused, adaptive strategy that requires cognitive resources and executive functioning, both of which are sensitive to the effects of sleep deprivation and physiological arousal (Aldao et al., 2010; Mauss et al., 2013). High caffeine intake, particularly when it disrupts sleep, may therefore indirectly impair students' capacity for cognitive reappraisal by depleting the cognitive and neurobiological resources upon which this strategy depends.

Academic stress, the psychological strain arising when academic demands are perceived to exceed available coping resources, is another variable that may be influenced by caffeine consumption patterns (Misra & McKean, 2000). Students may consume caffeine as a response to academic stress, particularly as a strategy to extend wakefulness during periods of high workload. However, the relationship between caffeine and academic stress may be more complex, as the physiological arousal produced by caffeine could itself amplify perceived stress in some students, while moderate consumption may provide sufficient alertness to reduce the perception of academic overload (McEwen, 2006). Despite the theoretical and practical relevance of these relationships, empirical research examining how caffeine consumption simultaneously affects academic stress, sleep quality, and cognitive reappraisal within a university student of Pakistan sample remains limited. Identifying these associations is important for informing health promotion programs and student wellbeing services that can account for the role of everyday lifestyle behaviors, such as caffeine intake, in shaping students' psychological and sleep-related functioning. The present study therefore aims to examine the effect of caffeine consumption on academic stress, sleep quality, and cognitive reappraisal among university students in Pakistan.

II. LITERATURE REVIEW

Caffeine Consumption

Caffeine is consumed by the vast majority of university students worldwide, with tea and coffee representing the most common sources of intake, followed by energy drinks among younger student populations (Mahoney et al., 2019; Nehlig, 2010). The pattern of caffeine consumption among university students is shaped by both academic and sociocultural factors: caffeine is frequently consumed to combat the fatigue associated with late night studying, early morning lectures, and the general demands of academic life (Mahoney et al., 2019). In Pakistan specifically, tea drinking is a deeply rooted social practice, and students often consume multiple cups of tea per day as part of both study routines and social interactions, meaning that caffeine intake in this context carries cultural as well as functional significance (Waqas et al., 2015). From a neurobiological perspective, caffeine exerts its effects primarily through competitive antagonism of adenosine receptors in the brain (Nehlig, 2010). Adenosine is a naturally occurring neuromodulator that accumulates in the brain during waking hours and promotes the sensation of sleepiness, a process known as homeostatic sleep pressure. By blocking adenosine receptors, caffeine temporarily prevents the buildup of this sleep pressure, allowing individuals to feel more alert and awake (Borbély et al., 2016). While these effects are beneficial in the short term, they can have significant consequences for sleep quality when caffeine is consumed in the afternoon or evening hours. Research has consistently shown that higher levels of caffeine consumption are associated with poorer sleep outcomes, including longer sleep onset latency, shorter total sleep duration, and reduced sleep efficiency (Medic et al., 2017; Nehlig, 2010). In addition, habitual

heavy caffeine consumption has been associated with elevated physiological arousal and cortisol reactivity, which may have downstream consequences for emotional functioning and psychological stress (McEwen, 2006).

Academic Stress

Academic stress arises when the demands placed upon students by their educational environment, including examinations, assignments, grade expectations, and time pressures, are appraised as exceeding the coping resources available to them (Misra & McKean, 2000). It is one of the most frequently reported psychological concerns among university students globally and is associated with a range of negative outcomes, including anxiety, burnout, and reduced academic performance (Bedewy & Gabriel, 2015). The relationship between caffeine consumption and academic stress is theoretically bidirectional. Students experiencing high academic stress may increase their caffeine intake in an effort to extend productive waking hours, maintain concentration, and manage fatigue arising from stress related sleep disruption (Mahoney et al., 2019). In this sense, caffeine functions as a behavioral coping strategy for academic stress, particularly in cultural settings where tea or coffee consumption is socially normalized as a study aid (Waqas et al., 2015). However, the physiological arousal induced by caffeine, particularly at higher doses, may itself heighten psychological reactivity to stressors, amplifying perceived academic stress rather than reducing it. McEwen (2006) has argued that chronic sleep deprivation resulting from heavy caffeine use constitutes a neurobiological stressor that compounds existing academic pressure, suggesting that for some students, high caffeine consumption may represent a maladaptive coping cycle in which stress drives caffeine use, caffeine disrupts sleep, and sleep disruption further elevates perceived stress the following day.

Sleep Quality

Sleep quality encompasses the subjective experience of how restorative, uninterrupted, and timely one's sleep is, capturing dimensions such as sleep latency, sleep continuity, and how refreshed an individual feels upon waking, in contrast to simply measuring the total number of hours slept (Buysse et al., 1989). Among university students, sleep quality is widely reported to be poor, with academic pressures, irregular schedules, and lifestyle behaviors including caffeine and technology use identified as primary contributing factors (Hershner & Chervin, 2014). Caffeine's impact on sleep quality operates through two well established mechanisms. The first is adenosine receptor blockade, which delays the physiological onset of sleepiness and can push sleep onset later into the night, effectively reducing total sleep time when students must wake at a fixed hour (Borbély et al., 2016; Nehlig, 2010). The second mechanism involves caffeine's stimulant effects on the sympathetic nervous system, which increases heart rate and physiological arousal in a manner that is incompatible with the parasympathetic dominance required for sleep onset and maintenance (McEwen, 2006). Medic et al. (2017) demonstrated that caffeine consumed within six hours of bedtime significantly reduced total sleep time and sleep quality in adults, findings that are directly relevant to the late-night study patterns common among university students who consume caffeine to extend their study hours. The cumulative effects of caffeine related sleep disruption over time can contribute to chronic sleep debt, daytime fatigue, and impaired cognitive and emotional functioning, all of which are particularly detrimental in an academic context.

Cognitive Reappraisal

Within the process model of emotion regulation proposed by Gross and John (2003), cognitive reappraisal is defined as an antecedent focused regulatory strategy in which an individual reinterprets the meaning or significance of a potentially emotion eliciting situation in order to alter its emotional impact before a full emotional response has developed. It is considered one of the most adaptive emotion regulation strategies, associated with lower levels of negative affect, greater psychological wellbeing, and more effective coping with chronic stressors such as academic pressure (Gross & John, 2003). The successful deployment of cognitive reappraisal requires intact executive functioning, working memory capacity, and prefrontal cortical activity, all of which are sensitive to the effects of sleep deprivation (Mauss et al., 2013). When caffeine consumption disrupts sleep quality, the resulting sleep deficit may impair the cognitive resources necessary for deliberate reappraisal, leaving students more vulnerable to maladaptive emotional responses to academic stressors (Aldao et al., 2010; Mauss et al., 2013). Beyond the indirect pathway through sleep, heavy caffeine consumption may also directly interfere with cognitive reappraisal through its effects on physiological arousal. Elevated cortisol and sympathetic nervous system activity associated with high caffeine intake can increase emotional reactivity and reduce cognitive composure, both of

which are antithetical to the deliberate, thoughtful process of reappraisal (Aldao et al., 2010; McEwen, 2006). This suggests that habitual heavy caffeine consumption may impair cognitive reappraisal both directly, through heightened arousal, and indirectly, through the sleep disruption it produces.

Rationale of the Study

Although the individual relationships between caffeine consumption and sleep quality, and between sleep quality and emotion regulation, have been examined in the existing literature, comparatively little research has simultaneously investigated the associations between daily caffeine consumption, academic stress, sleep quality, and cognitive reappraisal within a single student sample in a non-Western cultural context such as Pakistan. Given the cultural prevalence of tea consumption, the intensity of academic stress in the universities of Pakistan, and the established neurobiological mechanisms through which caffeine affects sleep and psychological functioning, such an investigation is both theoretically warranted and practically important. The present study addresses this gap by examining how groups of students defined by their daily caffeine consumption differ in their levels of academic stress, sleep quality, and cognitive reappraisal.

Research Question

- Is there a significant effect of daily caffeine consumption (no caffeine, one cup per day, and two or more cups per day) on academic stress, sleep quality, and cognitive reappraisal among university students in Pakistan?

III. METHOD

Participants

The present study employed a quantitative, cross-sectional research design to examine the effect of caffeine consumption on academic stress, sleep quality, and cognitive reappraisal among university students. The sample consisted of 300 university students (150 male, 150 female) drawn from public and private sector universities in the Federal and Punjab regions of Pakistan. A non-probability purposive sampling technique was used to recruit participants. The age range of participants was 18 to 25 years ($M = 22.12$, $SD = 2.15$), corresponding to the developmental period of emerging adulthood (Arnett, 2000). Inclusion criteria required that participants be full-time enrolled undergraduate or postgraduate university students, aged between 18 and 25 years, able to read and comprehend English, and willing to provide informed consent. Students with a self-reported history of psychiatric or sleep disorders, those currently using prescribed sleep medication, and part-time students were excluded from the study. With regard to daily caffeine consumption, 23.7% of participants reported no caffeine consumption, 33.3% reported consuming one cup of a caffeinated beverage per day, and 43% reported consuming two or more cups per day.

Measures

A self-constructed demographic information sheet recorded daily caffeine consumption. For the purposes of the present study, caffeine consumption was assessed through the question: "How many cups of caffeinated beverages (tea, coffee, energy drinks) do you consume per day?" and categorized into three groups: no caffeine consumption, one cup per day, and two or more cups per day. [I] Academic stress was assessed using the Perception of Academic Stress (PAS) Scale, developed by Bedewy and Gabriel (2015). It comprises 18 items distributed across three subscales: academic expectations, workload and examinations, and academic self-perception. Each item is rated on a 5-point Likert scale from 1 (Strongly Disagree) to 5 (Strongly Agree), with items 1 through 5 reverse-coded. Total scores range from 18 to 90, with higher scores reflecting greater perceived academic stress. Internal consistency of the scale has been reported as satisfactory, with Cronbach's alpha values between .70 and .85 (Bedewy & Gabriel, 2015). [II] Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), a 19 items self-report instrument developed by Buysse et al. (1989). The PSQI evaluates sleep across seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Each component is scored from 0 to 3, and the seven component scores are summed to yield a global score ranging from 0 to 21. Higher global PSQI scores indicate poorer sleep quality. The instrument demonstrates good reliability, with an internal consistency of $\alpha = .83$.

reported in its original validation study (Buysse et al., 1989). **[III]** Cognitive reappraisal was assessed using the cognitive reappraisal subscale of the Emotion Regulation Questionnaire (ERQ), developed by Gross and John (2003). The ERQ consists of 10 items in total, with 6 items comprising the cognitive reappraisal subscale and 4 items comprising the expressive suppression subscale. The cognitive reappraisal subscale items are rated on a 7-point Likert scale ranging from 1 (Strongly Disagree) to 7 (Strongly Agree), with total subscale scores ranging from 6 to 42. Higher scores reflect more frequent use of cognitive reappraisal as an emotion regulation strategy. The subscale has demonstrated good internal consistency, with Cronbach's alpha values reported between .79 and .84 (Gross & John, 2003).

Procedure

Data were collected through a combination of in person questionnaire distribution and an online survey link administered across public and private universities in the Federal and Punjab regions of Pakistan. Participants were informed about the purpose of the study and were assured that participation was voluntary, anonymous, and confidential, with the option to withdraw at any point without consequence. Written informed consent was obtained from all participants prior to data collection. Completed questionnaires were screened for eligibility and completeness before being included in the final analysis.

IV.RESULTS

To examine differences in academic stress, sleep quality, and cognitive reappraisal across daily caffeine consumption groups (no caffeine, one cup per day, two or more cups per day), a one-way analysis of variance (ANOVA) was conducted. Post hoc comparisons were carried out using the Hochberg procedure. The results are presented in Tables 1 and 2.

Table I: Socio-demographic characteristics of participants (N = 300)

Variables	%
Caffeine Consumption	
None	23.7
One cup per day	33.3
Two or more than 2 cups per day	43

Note. % = Percentage

Table 1 presents the socio-demographic characteristics of the study participants. The results revealed that the 43% of them had two or more cups of caffeine daily, 33.3% one cup, and 23.7% none.

Table II: Psychometric Properties of Academic Stress, Sleep Quality, and Emotion Regulation Strategies (N = 300)

Variables	α	<i>M</i>	<i>SD</i>	Range		Skewness	Kurtosis
				Actual	Potential		
AS	.76	50.92	9.55	28-84	18-90	.65	1.05
CR	.82	27.41	7.09	6-42	6-42	-.51	.18
SQ	.85	6.45	3.44	0-17	0-21	.56	-.09

Note. *M* = Mean, *SD* = Standard Deviation, α = Reliability, AS = Academic Stress, CR = Cognitive Appraisal, SQ = Sleep Quality

Table 2 represents the psychometric properties of the measures employed in the study on a sample of 300 participants. The findings indicated that the internal consistency of academic stress was .76 (Cronbach's alpha coefficient). Cognitive reappraisal had a good reliability (Cronbach's alpha = .82). Lastly, Cronbach's alpha of the sleep quality was .85, which is a good scale reliability.

Table III: Mean Differences across Caffeine Consumption among Study Variables (N = 300)

Variables	None (n = 71)		One cup (n = 100)		2 and more than 2 (n = 129)		F	p	η^2
	M	SD	M	SD	M	SD			
AS	53.01	11.26	48.81	7.34	51.40	9.68	4.41	.01	.03
CR	28.59	8.71	28.42	4.68	25.98	7.45	4.72	.01	.03
SQ	5.54	3.18	6.45	3.49	6.95	3.47	3.92	.02	.03

Note. M = Mean, SD = Standard Deviation, f = Frequency, p = Significance Level, AS = Academic Stress, SQ = Sleep Quality, CR = Cognitive Reappraisal.

Table 3 represents the mean difference between caffeine consumption across study variables among 300 participants. The findings indicated significant differences in academic stress, $F = 4.41$, $p < .01$, $\eta^2 = .03$. Participants with no caffeine consumption ($M = 53.01$, $SD = 11.26$) reported higher academic stress compared to those consuming one cup ($M = 48.81$, $SD = 7.34$) and two or more cups ($M = 51.40$, $SD = 9.68$). There was also a significant difference in cognitive reappraisal, $F = 4.72$, $p < .01$, $\eta^2 = .03$, with no caffeine ($M = 28.59$, $SD = 8.71$) and one cup per day ($M = 28.42$, $SD = 4.68$) having higher scores than two or more cups per day ($M = 25.98$, $SD = 7.45$). Significant differences were also found in sleep quality, $F = 3.92$, $p < .05$, $\eta^2 = .03$. The participants who drank two or more cups of coffee a day ($M = 6.95$, $SD = 3.47$) experienced a relatively low sleep quality compared to those who did not drink any coffee ($M = 5.54$, $SD = 3.18$). Overall, there was a significant relationship between caffeine consumption and academic stress, cognitive reappraisal, expressive suppression, and sleep quality.

Table IV: Hochberg Post Hoc Analysis of Study Variables across Caffeine Consumption (N = 300)

Groups	Groups		Mean Difference			95% CI	
	I	J	I-J	SE	p	LL	UL
AS	None	1 cup per day	4.204*	1.46	0.01	0.69	7.72
	None	2 cups or more than 2 cups per day	1.619	1.39	0.57	1.73	4.97
	1 cup per day	2 cups or more than 2 cups per day	-2.585	1.25	0.11	5.61	0.44
CR	None	1 cup per day	0.172	1.08	0.99	2.44	2.78
	None	2 cups or more than 2 cups per day	2.607*	1.03	0.03	0.12	5.09
	1 cup per day	2 cups or more than 2 cups per day	2.436*	0.93	0.02	0.19	4.68
SQ	None	1 cup per day	-0.915	0.52	0.23	2.18	0.36
	None	2 cups or more than 2 cups per day	-1.411*	0.50	0.01	-2.62	-0.2
	1 cup per day	2 cups or more than 2 cups per day	-0.496	0.45	0.62	-1.59	0.59

Note. SE = Significant Error, p = Significance Level, CI = Confidence Interval, LL = Lower Level, UL = Upper Level, AS = Academic Stress, SQ = Sleep Quality, CR = Cognitive Appraisal

* $p < .05$

Table 4 shows the results of Hochberg post hoc analysis of each study variable by caffeine consumption for 300 participants. The results showed that there was a significant difference between the academic stress of participants who reported no caffeine intake and those who reported one cup of caffeine a day ($MD = 4.20$, $p < .05$), with the participants who reported no caffeine intake reporting higher academic stress. When asked about cognitive reappraisal, there was a significant difference between the participants who consumed no caffeine and those who consumed two or more cups per day ($MD = 2.61$, $p < .05$). The same was true for participants who drank one cup per day ($MD = 2.44$, $p < .05$). In terms of sleep quality, participants who drank two or more cups of caffeine per day experienced significantly poorer sleep quality than those who did not drink any caffeine ($MD = -1.41$, $p < .01$). In general, the more caffeine consumed, the lower the cognitive reappraisal and the worse the sleep quality.

V. DISCUSSION

The present study examined the effect of daily caffeine consumption on academic stress, sleep quality, and cognitive reappraisal among university students in Pakistan. It was hypothesized that significant differences would

emerge across caffeine consumption groups on all three study variables. The results provided full support for this hypothesis, with significant ANOVA results obtained for academic stress, sleep quality, and cognitive reappraisal. Regarding academic stress, students who consumed no caffeine reported significantly higher academic stress than those consuming one cup per day. The finding suggests a potentially functional role of moderate caffeine use in managing perceived academic demands, consistent with the view that students turn to caffeine as a behavioral coping strategy when academic pressures are high, and that moderate intake may provide sufficient alertness and cognitive support to reduce feelings of being overwhelmed (Mahoney et al., 2019; Waqas et al., 2015). However, the pattern was not linear: students consuming two or more cups also reported higher academic stress than those consuming one cup, suggesting that heavy caffeine use does not confer the same stress reduction benefit and may instead reflect the compounding effects of caffeine-disrupted sleep on perceived academic pressure (McEwen, 2006).

The finding that students consuming two or more cups per day reported significantly poorer sleep quality than non-consumers are consistent with established neurobiological evidence. Caffeine's primary mechanism of action involves the blocking of adenosine receptors, which slows the accumulation of homeostatic sleep pressure and delays sleep onset (Borbély et al., 2016; Nehlig, 2010). Medic et al. (2017) demonstrated that caffeine consumed within six hours of bedtime significantly shortens total sleep duration and reduces sleep quality, a pattern that is particularly likely among students who consume caffeine later in the day to sustain study sessions. The cultural prevalence of tea consumption at all hours of the day in Pakistan, including late evening, makes this pathway especially relevant in the present context (Waqas et al., 2015). With regard to cognitive reappraisal, students consuming two or more cups per day reported significantly lower reappraisal scores than both non-consumers and those consuming one cup per day. This finding is consistent with two theoretical pathways proposed in the literature. First, the indirect pathway: heavy caffeine use disrupts sleep, and sleep disruption impairs the prefrontal cortical activity required for deliberate, effortful emotion regulation strategies such as cognitive reappraisal (Mauss et al., 2013). Second, the direct pathway: the physiological arousal and elevated cortisol reactivity associated with heavy caffeine intake may reduce cognitive composure and increase emotional reactivity, making the deliberate cognitive effort required for reappraisal more difficult to sustain (Aldao et al., 2010; McEwen, 2006). Together, these pathways suggest that habitual heavy caffeine consumption may meaningfully diminish students' adaptive emotion regulation capacity. Taken together, the findings paint a nuanced picture in which moderate caffeine consumption, one cup per day appears to be associated with the most favorable profile, lower academic stress, moderate sleep quality, and higher cognitive reappraisal while heavy consumption, two or more cups per day is associated with poorer sleep quality and reduced cognitive reappraisal, and no consumption is associated with the highest perceived academic stress. This pattern underscores the importance of examining caffeine as a contextually embedded lifestyle variable rather than treating it simply as harmful or harmless.

Implications and Significance of the Study

The findings of the present study carry both theoretical and practical significance. Theoretically, they extend the existing literature by demonstrating that daily caffeine consumption is associated not only with sleep quality, as has been well established in biological and clinical research, but also with academic stress and cognitive reappraisal within a single university student sample in Pakistan, thereby situating caffeine consumption within a broader psychological framework that connects lifestyle behavior, sleep, stress, and emotion regulation (Aldao et al., 2010; Borbély et al., 2016; Mauss et al., 2013). Practically, the findings suggest that university health promotion and student wellbeing programs should address caffeine consumption as part of broader sleep hygiene and stress management interventions. Raising students' awareness of the dose-dependent effects of caffeine on sleep and emotional regulation may help them make more informed decisions about their intake, particularly in the afternoon and evening hours when caffeine related sleep disruption is most likely. Counseling services may also consider including psychoeducation about the interaction between caffeine, sleep, and emotion regulation as part of cognitive behavioral approaches to academic stress management (Gross & John, 2003; McEwen, 2006). Furthermore, the findings are particularly relevant in the cultural context of Pakistan, where tea consumption is normative and may not always be recognized by students as a potential contributor to sleep difficulties and reduced emotional regulation capacity. Contextually sensitive health promotion initiatives that acknowledge the cultural significance of tea while providing evidence-based guidance on timing and quantity of consumption may be especially effective in this setting (Waqas et al., 2015).

Limitations and Recommendations

Several limitations of the present study should be acknowledged. First, the cross-sectional design does not permit causal inferences; it is not possible to determine from the present data whether caffeine consumption directly causes differences in academic stress, sleep quality, or cognitive reappraisal, or whether these associations are driven by unmeasured confounding factors. Longitudinal and experimental designs would be required to establish causal directionality. Second, caffeine consumption was assessed via a single self-report item capturing daily quantity without accounting for the timing of consumption relative to sleep, the type of caffeinated beverage consumed, or individual differences in caffeine metabolism. Third, the sample was recruited using a non-probability purposive sampling technique, which may limit the generalizability of the findings to the broader population of university students in Pakistan. Finally, the effect sizes observed were small, indicating that caffeine consumption accounts for a modest proportion of variance in the outcome variables, and that other unmeasured factors likely contribute more substantially to these outcomes. Based on the findings of the present study, it is recommended that universities incorporate caffeine awareness and sleep hygiene education into student health and well-being programs, with particular emphasis on the timing and quantity of caffeinated beverage consumption in relation to sleep. Future research should use objective measures of caffeine intake and sleep quality, such as actigraphy and salivary caffeine assays, to more precisely quantify the dose-response relationship between caffeine and sleep outcomes in student populations. Longitudinal designs examining changes in caffeine consumption, academic stress, sleep quality, and cognitive reappraisal over the academic year would help clarify the direction and stability of these associations. Experimental interventions targeting the reduction of evening caffeine intake, combined with cognitive reappraisal skills training, could provide an evidence base for integrated behavioral interventions addressing both sleep and emotion regulation in university students.

VI. CONCLUSION

The present study investigated the effect of daily caffeine consumption on academic stress, sleep quality, and cognitive reappraisal among 300 university students in Pakistan. The findings revealed that caffeine consumption was significantly associated with all three variables. Students reporting no caffeine consumption showed the highest academic stress, students consuming two or more cups per day demonstrated the poorest sleep quality and the lowest cognitive reappraisal, and students consuming one cup per day showed the most favorable pattern across the three variables. These findings highlight caffeine consumption as a meaningful, modifiable lifestyle variable associated with university students' psychological and sleep related functioning, and underscore the need for caffeine awareness, sleep hygiene education, and emotion regulation support within university wellbeing programs in Pakistan.

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