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THE IMPACT OF NICOTINE AND CAFFEINE COMSUMPTION ON MENTAL HEALTH AND SLEEP QUALITY: A PSYCHOLOGICAL ASSESSMENT USING DASS-21 AND SLEEP QUALITY SCALE

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Abstract

The present study investigated the impact of nicotine and caffeine consumption on mental health and sleep quality among individuals using a psychological assessment approach. Using a psychological evaluation technique, the study investigated into the effects of nicotine and caffeine usage on mental health and sleep quality in people. The Depression Anxiety Stress Scale (DASS-21) and Sleep Quality Scale were used to collect data. A cross-sectional design was used, with individuals drawn from a variety of demographic backgrounds to assure representativeness. The study proposed favourable associations between nicotine usage and symptoms of sadness, anxiety, and stress, as well as coffee consumption and similar mental

health outcomes. Furthermore, unfavourable correlations were predicted between nicotine and caffeine use and sleep quality. The effect of nicotine usage on mental health and sleep quality was predicted to be larger than that of caffeine consumption.

Keywords: *Sleep Quality Scale, Nicotine consumption, Caffeine consumption, DASS-21, Stress, Anxiety, depression.*

Introduction

There exists a significant relationship between lifestyle and criterion-based indicators of sleep quality and quantity. However, findings suggests that if the previous day, caffeine and nicotine consumption had a considerable relationship with the impulsive acts and negative experiences after awakening, and mood experiences varying across the day. In military medicine, research on the consumption of caffeine and nicotine is seen as one of the relevant domains due to the multitude of populations who suffer from sleep abnormalities and mental disorders.

In everyday life and particularly, in the military environment, there exists an elevated level of stress, fatigue, and pressure from the social and environmental side. It has been shown that the lifestyle and physical/mental health status, particularly sleep disorders, can be strongly influenced by the dietary and habitual intake of substances such as caffeine and nicotine. Potential content is investigated in military personnel on the segue between lifestyle, caffeine and nicotine consumption patterns, oneiric activity, sleep quality, and mental health status. In this sense, given the established link between mental/physical health and sleep, sleep quality could serve as a criterion-based symptom for poor mental health.

Non-adherence to sleep and lifestyle recommendations often result in disturbances in mental health leading to various psychological and physical complications (Moran, 2012).

Vol. 2, Issue 5 May 2024 ISSN: 2584-0142

Previous research studies have demonstrated that caffeine and nicotine contribute to poor sleep quality and disturbed mental health, which alters the psychophysiological circulation. The experimental study conducted the midnight caffeine consumption altered the quality of sleep by increasing the stage of arousal. It was also revealed that the nicotine consumption around bedtime reduced the sleep quality, periods of deep sleep and prolonged the time to sleep (Upadhyay et al., 2020). A group of soldiers participated in the research and went through the screening phase with an insomnia assessment and PSG. In the first half of the experiment, the results of caffeine and nicotine consumption were determined. The second half was dedicated to the investigation of the sensory gating functioning and emotional dysregulation among people who had the experience of awakening and had shown a significant change between morning ad night time values in the answering questionnaire (Kweon et al., 2022).

The Effects of Nicotine on Mental Health and Sleep Quality

Nicotine is a potent stimulant present in cigarettes, cigars, smokeless tobacco products, and nicotine replacement therapies (Gu et al., 2022). These nicotine products are usually used by those addicted to nicotine in an effort to enhance their mood and relieve sensations of intense anxiety stemming from nicotine cravings (Choi, 2020). Nicotine consumption and addiction are associated with a broad array of negative health implications/liabilities, including the adoption of poor-quality sleep patterns and sleep disorders (Luong et al., 2023). For this reason, many individual struggling with nicotine addiction that want to stop nicotine consumption opt to abstain from nicotine products in the afternoon and evening—common periods/scenarios related to the emergence of typical acute insomnia symptoms. Thus, several efforts at understanding and elucidating the direct effects of nicotine on sleep in the scientific literature have focussed on nicotine's impact on sleep, cognitive function and mood.

Vol. 2, Issue 5 May 2024 ISSN: 2584-0142

A review by Hughes and Hatsukami (1986) and an update by Smits and Boeckshi (2006) described that nicotine serves a dual purpose, stimulating the arousal system when consumed during period of no exposure to nicotine, and helps to alleviate sleeping difficulties that accompany nicotine withdrawal. Holden et al. (2004) focused on "craving" or "withdrawal" symptoms during abstinence from smoking and found that craving for a cigarette, irritability and restlessness often serve as main triggers or influencers of sleep latency (SL) and poor sleep quality. Johnson et al. (1990) assessed smoking habits, sleep architecture, and subjective sleep quality among young adults with a history of childhood conduct problems and found that cigarette smokers displayed a multitude of sleep deficits when compared to their non-smoking peers.

The Effects of Caffeine on Mental Health and Sleep Quality

Epidemiological and clinical evidence was not definitive enough to consider the association between caffeine content and MDD in a meta-analysis of caffeine source utilization for those 18 and older. The current study identified a significant negative association between caffeine content and depression in patients for those ages 20 and up. Sugar-sweetened beverage intake, smoking status and alcohol intake, while included in some previous reports and surveys, were not included in this study for adjusting covariates, potentially impacting the results. Caffeine and caffeine metabolite turnover are influenced by systemic metabolic conditions including aging, BMI, renal function, and other chronic conditions not completely controlled for or assessed in NHANES that could impact the interpretation the results. Sleep patterns also were not assessed on days of consumed caffeine.

In animal stroke models, for example, it has been proposed that caffeine metabolism or the induction of relevant liver enzymes leads to sphingosine 1-phosphate receptor blockade, protecting cell membranes during stroke. Another animal model for CNS aging reveals the

Vol. 2, Issue 5 May 2024 ISSN: 2584-0142

protective advantages of daily caffeine intake in neurons "purging" specific damaged proteins and cellular organelles. This protective effect of caffeine appears to be directly related to the observed reduction in both beta-amyloid and tau hyperphosphorylation vehicle-treated transgenic rodent brains at the completion of the experimental period. Adenosine is produced and accumulates in the brain in response for increased neuronal or synaptic energy needs and can modulate stress, sleep, mood, and anxiety-producing systems in the prefrontal cortex, amygdala, thalamus, hypothalamus, hippocampus, and brainstem. Adenosine's inhibitory effects on excitatory neurotransmitter release have made for its functions in liminal brain and spinal centres is studied. The Throop experiment could be considered a model for the relationship between caffeine and major depressive disorder, caffeine induces an excitatory over inhibition by adenosine blockade in this structure. Homeostatic advertisement of initial sleep drive and adenosine levels is thrown off balance by caffeine as it accumulates, leading to extended wakefulness.

Caffeine (1,3,7-trimethylxanthine) is an alkaloid of the purine family and is found in more than 60 plants, including Central and South American species of coffee, the tea bush Camellia sinensis, yerba mate, and other species (Rostami et al., 2020). It is the most commonly consumed psychoactive drug in the world. The biological half-life among healthy adults has been reported to be about 2.5 to 4.5 h, depending on the individual. Because of the long caffeine half-life, adenosine receptor blocking can last several hours, and repeated caffeine consumption can lead to accumulation and contribute to negative health outcomes. Research had shown that increased caffeine content in the body negatively affects the risk of depression (Bao et al., 2022).

Vol. 2, Issue 5 May 2024 ISSN: 2584-0142

The Combined Impact of Nicotine and Caffeine on Mental Health and Sleep Quality

Consuming nicotine and caffeine every 2 hours, most days, or on a weekly basis is associated with an increase in time expended awake during the night, and delayed sleep timings. A sub-group of 14.1% of individuals consumed nicotine and caffeine at this frequent interval. These individuals were regularly consuming caffeine above the tenth percentile within 2 hours of bedtime (341 mg/ 951 mL^1), adding to the evidence of the potential of a combined acute pharmacological effect pre-bed (Nouri & Tupper, 2024).

Effect of combined Narcotism and Caffeine consumption on Sleep Quality

Psychometric assessments can help to capture daily variability in sleep and depressive symptoms and can be direct outcomes of smoking and caffeine consumption with little bias from current health status. Nicotine consumption of the equivalent of four or more cigarettes a day, compared with smoking fewer than four, was associated with higher mean daily depressive symptoms, likely due to acute withdrawal between usual consumption intervals. After adjusting for nicotine, caffeine intake was not associated with depression overall, representative of daily fluctuations. Instead, depression is associated with increased drive or desire for caffeine, most likely reflecting self-medication due to acute withdrawal from caffeine, from diminished euphoria to irritability and dysphoria (Alotaibi et al., 2019).

Mental Health Impact of Cigarettes and Caffeine consumption

Nicotine and caffeine are well-known psychostimulants frequently consumed together in the form of cigarettes and coffee. Nicotine and caffeine can interact with each other, affecting mood and mental states differently than either substance alone. Caffeine is known to interact with the short-term stimulant effects of nicotine. In contrast, nicotine can offset some of

Vol. 2, Issue 5 May 2024 ISSN: 2584-0142

caffeine's effects on mood and sleep, increasing the reward value of caffeine, and leading to more extended use and potential synergistic health risks (Choi, 2020).

METHODOLOGY

Purpose

Today, caffeine and nicotine are commonly used in order to elevate mood and relax. There is significant evidence to suggest that the consumption of nicotine and caffeine can have several effects in the realm of psychological functioning. One area of psychological functioning that has received considerable attention in the past decade is the relation between caffeine consumption and anxiety. The others are relatively unexplored, and it remains unclear what the effects of caffeine and nicotine are on mood and neuropsychological performance, and whether the effects differ as a function of acute administration versus abstinence.

Research Objectives

The study's aims are as follows.

a) To investigate the relationship between nicotine usage and mental health outcomes using the Depression Anxiety Stress Scale (DASS-21).

b) The DASS-21 will be used to investigate the association between caffeine use and mental health outcomes.

c) To evaluate the effect of nicotine usage on sleep quality, which was measured using Choi et al.'s Sleep Quality Scale.

d) To assess the impact of caffeine intake on sleep quality, use the Sleep Quality Scale.

e) To assess the impact of nicotine and caffeine use on mental health and sleep quality.

f) To provide light on the psychological consequences of nicotine and caffeine usage, as well as their impact on general well-being.

Vol. 2, Issue 5 May 2024 ISSN: 2584-0142

Hypothesis

Based on the given aims, the hypotheses for this study are:

- The DASS-21 will reveal a positive link between nicotine usage and symptoms of sadness, anxiety, and stress.
- The DASS-21 will show that caffeine use is positively linked with symptoms of depression, anxiety, and stress.
- Nicotine usage will have a negative correlation with sleep quality, indicating lower sleep results.
- Caffeine use will be adversely related to sleep quality, resulting in worse sleep quality ratings.
- Nicotine usage will have a higher influence on mental health and sleep quality than coffee drinking.
- There will be considerable disparities in mental health outcomes and sleep quality across nicotine, caffeine, and non-users.

Method

The following sample, measures, and procedures were done to study the research objectives.

Sample

A total sample of 100 was collected from NCR, Delhi.

Measures

The following measures were used for the study:

DASS-21*:* The Depression Anxiety Stress Scale (DASS-21) is a set of three self-report scales designed to measure the negative emotional states of depression, anxiety, and stress.

Vol. 2, Issue 5 May 2024 ISSN: 2584-0142

Each of the three DASS-21 scales contains 7 items, which divide the 21 items of the DASS into subscales of 2-3 items with similar content. The DASS-21 is the short form of the DASS and is in the form of a questionnaire, which is a crucial component of the mental health assessment process. The DASS has been translated into many languages and is widely used as a research outcome measure.

Sleep Quality Scale: The Sleep Quality Scale was developed as a concise way to identify sleep problems in the older adult population. Based on the Presleep Arousal Scale and findings pertaining to sleep in older adults, a 15-item questionnaire was created. The scale uses a Likert format and addresses common sleep disturbances among the elderly including waking up during the night, frequency of awakening, discomfort while sleeping, and bad dreams. The SQS demonstrates good internal reliability with Cronbach's alpha of 0.68. The use of factor analysis found two distinguishable factors measuring sleep quality and sleep comfort. Test-retest reliability was confirmed for the SQS with a moderate correlation. Validity was confirmed by comparing the SQS to other sleep measures and was shown to be suitable for identifying sleep problems in older adults.

Procedure

The form was distributed among the respondents in a soft copy via google forms. The test was administered to a sample of 100 individuals. They filled in a consent form indicating that they have been briefed about confidentiality and about the test. A consent form was signed by every participant and then they proceeded with the questionnaire.

Analysis of Data

The statistical analyses used for this test was Pearson's Correlation and Mediation analysis using SPSS. SPSS is short for Statistical Package for the Social Sciences, and it's used by

Vol. 2, Issue 5 May 2024 ISSN: 2584-0142

various kinds of researchers for complex statistical data analysis. The SPSS software package was created for the management and statistical analysis of social science data.

Results

Table 1: Individuals who consume both caffeine and nicotine.

Correlations

		SQS1	STRESS1	ANXIETY1	DEPRESSION1
SQS1	Pearson Correlation	1	.495*	.125	.590*
	Sig. (2-tailed)		.043	.631	.013
STRESS1	Pearson Correlation	.495*	1	.513*	.851**
	Sig. (2-tailed)	.043		.035	.000
ANXIETY1	Pearson Correlation	.125	.513*	1	.563*
	Sig. (2-tailed)	.631	.035		.019
DEPRESSION1	Pearson Correlation	.590*	.851**	.563*	1
	Sig. (2-tailed)	.013	.000	.019	

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 2: Individuals who do not consume caffeine or nicotine.

Correlations

		SQS2	STRESS2	ANXIETY2	DEPRESSION2
SQS2	Pearson Correlation	1	.377	.263	.457
	Sig. (2-tailed)		.136	.307	.065
STRESS2	Pearson Correlation	.377	1	.802**	.856**
	Sig. (2-tailed)	.136		.000	.000
ANXIETY2	Pearson Correlation	.263	.802**	1	.737**
	Sig. (2-tailed)	.307	.000		.001
DEPRESSION2	Pearson Correlation	.457	.856**	.737**	1
	Sig. (2-tailed)	.065	.000	.001	

**. Correlation is significant at the 0.01 level (2-tailed).

Vol. 2, Issue 5 May 2024 ISSN: 2584-0142

Table 3: t-Test: Paired Two Sample for Means

	SQS1	*SQS2*
Mean	45.8	31.84
Variance	92.41667	227.9733
Pearson Correlation	0.051441	
Hypothesized Mean Difference	0	
df	24	
t Stat	3.993748	
P(T<=t) one-tail	0.000268	
t Critical one-tail	1.710882	
P(T<=t) two-tail	0.000535	
t Critical two-tail	2.063899	

SQS1 stands for Sleep Quality Scale for people who consume caffeine and SQS2 stands for Sleep Quality Scale for people who do not consume caffeine.

Discussion

The study examined the intricate dynamics among sleep quality, stress, anxiety, and depression, taking into account nicotine and caffeine consumption habits and the inverted scoring of the sleep quality scale. Among nicotine and caffeine consumers, worse sleep quality, indicated by higher sleep quality scale (SQS) scores, is linked to increased depression symptoms, underscoring the significance of addressing sleep disturbances in mental health interventions for this group. Stress shows consistent positive correlations with anxiety and depression across both consumer groups, emphasizing the pivotal role of stress management interventions. However, in non-nicotine and caffeine consumers, sleep quality doesn't

significantly correlate with other variables, suggesting alternative influential factors on mental health outcomes in this population, warranting further exploration.

Surprisingly, a statistically significant difference is observed in mean SQS scores between caffeine consumers (SQS1) and non-consumers (SQS2), with consumers reporting notably higher scores (SQS1: 45.8, SQS2: 31.84). Despite this difference, a weak positive correlation (r = 0.051) between SQS1 and SQS2 suggests some consistency in sleep quality ratings across both groups. Nonetheless, statistical analysis reveals higher mean SQS scores among caffeine and nicotine users compared to non-users, indicative of worse sleep quality on average. Additionally, users display greater variability in SQS scores, as indicated by higher standard deviations, reflecting a wider range of sleep quality experiences within these groups. The correlations between the variables, including Sleep Quality Scale (SQS), Stress, Anxiety, and Depression, were examined using Pearson correlation coefficients for two distinct groups: individuals who consume nicotine and caffeine (SQS1, STRESS1, ANXIETY1, DEPRESSION1) and those who do not consume nicotine and caffeine (SQS2, STRESS2, ANXIETY2, DEPRESSION2).

For individuals who consume nicotine and caffeine:

There was a significant positive correlation between Sleep Quality Scale (SQS1) and Depression (DEPRESSION1) ($r = .590$, $p = .013$), indicating that higher scores on the sleep quality scale, indicating worse sleep quality, were associated with increased symptoms of depression. Stress (STRESS1) was significantly positively correlated with Anxiety (ANXIETY1) ($r = .513$, $p = .035$) and Depression (DEPRESSION1) ($r = .851$, $p < .001$), suggesting that individuals experiencing higher levels of stress were also more likely to report higher levels of anxiety and depression. Additionally, Anxiety (ANXIETY1) was significantly positively correlated with Depression (DEPRESSION1) ($r = .563$, $p = .019$), indicating that

individuals with higher levels of anxiety were also more likely to experience symptoms of depression.

For individuals who do not consume nicotine and caffeine:

There were no significant correlations found between Sleep Quality Scale (SQS2) and any of the other variables (Stress, Anxiety, Depression) at the conventional significance level ($p < .05$). Stress (STRESS2) was significantly positively correlated with Anxiety (ANXIETY2) ($r = .802$, $p < .001$) and Depression (DEPRESSION2) ($r = .856$, $p < .001$), indicating that individuals experiencing higher levels of stress were more likely to report higher levels of anxiety and depression. Similarly, Anxiety (ANXIETY2) was significantly positively correlated with Depression (DEPRESSION2) ($r = .737$, $p = .001$), suggesting that individuals with higher levels of anxiety were also more likely to experience symptoms of depression.

Conclusion

This study delves into the intricate connections among sleep quality, stress, anxiety, and depression, particularly examining the impact of nicotine and caffeine consumption habits. For nicotine and caffeine consumers, poorer sleep quality is linked to heightened depression symptoms, emphasizing the importance of addressing sleep issues in mental health interventions. Stress consistently correlates with anxiety and depression across both consumer groups, highlighting the need for stress management strategies. However, among non-consumers, sleep quality doesn't significantly relate to mental health, suggesting other factors may be at play. Tailored interventions addressing sleep and stress may benefit consumers. Surprisingly, caffeine consumers reported worse sleep quality, challenging conventional beliefs. This underscores the importance of considering sleep quality in psychological distress,

Vol. 2, Issue 5 May 2024 ISSN: 2584-0142

necessitating tailored interventions across diverse populations. Further research is needed to understand underlying mechanisms and develop targeted interventions.

Vol. 2, Issue 5 May 2024 ISSN: 2584-0142

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Vol. 2, Issue 5 May 2024 ISSN: 2584-0142

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