

Effect of Caffeine Consumption on Sleep Quality of Health Professionals of Multan

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Abstract

Objective: Objective of this study was to evaluate effects of caffeine intake on sleep quality of health professionals of Multan

Material and Method: This study was accompanied in pharmacology department of Bakhtawar Amin Medical and Dental College. Total 300 participants were equally divided in 03 groups: low caffeinated, moderate caffeinated and high caffeinated groups using caffeine intake questionnaire. Their sleep was evaluated using Pittsburgh sleep quality index. Data was entered on SPSS and scrutinized using chi square and post hoc tuckey tests.

Results: Mean of sum Pittsburgh sleep quality score of low caffeinated, moderate caffeinated and severe caffeinated was 10 ± 3.184 , 27 ± 3.373 , and 37.93 ± 3.383 respectively. Intergroup comparison revealed with a p value of <0.01 all the time that depicts there are significant difference of sleep quality in all three groups.

Conclusion: Health professional that had no or low caffeine intake had better sleep as compared to professionals with moderate and severe caffeine daily intake. Similarly Moderate caffeine intake professionals had better sleep quality as compared to one who had daily high caffeine intake habits.

Key words: Caffeine intake, Health professional, Sleep quality

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Introduction

Caffeine, chemically known as 1,3,7-trimethylxanthine, is the most consumed psychoactive substance in the world. Mostly, it is obtained from cocoa plant. Human body degrades caffeine into metabolites by specific hepatic enzyme system labelled as “Cyp P450”. It has a half-life of about 2-10 hours in adult. The approximate global daily consumption of caffeine is 76mg. Caffeine containing products like tea, coffee, energy drinks as well as chocolates are consumed variably at national as well as global levels.¹ Data suggests

that doctors and medical students have to exert extra effort beyond their mental threshold and physical health to cope with exams stress as well as excel in their career. Doctors and surgeons usually use caffeine to reduce fatigue, enhance alertness, improved performance and long-term memory.² But prolonged use of highly caffeinated products leads to addiction and intoxication.

Multiple clinical and experimental observations advocate adverse effects of caffeine consumption behavior on sleep pattern like marked reduction of duration of sleeping period, increase frequency of awakening during sleep period.³ So, it is the need of time to study the relation between sleeping behavior and caffeine consumption in humans. Also estimate the safety window for caffeine consumption. A peaceful sleep is a blessing of God and is necessary for maintaining health at optimal condition. An adult human must take a sleep for not less than seven hours on daily basis.⁴

In addition to the recommended sleep period the quality of sleep should also be considered. Quality of sleep is measured by “parameters like latency to sleep initiation, sleep maintenance and feeling fresh and relaxed upon awakening”.⁵ Caffeine is found stimulatory in nature

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when its action is observed on neuronal tissue like central nervous system. Caffeine effect is associated with its interaction with adenosine receptor. Caffeine blocks the binding site on A2A adenosine receptor A2A.⁶ There are many neurotransmitters that play key role in sleep, like melatonin, orexin and dopamine. Melatonin is a sleep inducer released by pineal gland under darkness or at night by retina while orexin is a peptide that remains at high levels at day times. Drug developers play with these physiological agents by enhancing or antagonizing their effects to produce a new drug like ramelteon and suvorexant. Neurotransmitter like dopamine production and release pattern are influenced by adenosine. Rise in dopamine levels (in corpus striatum) are associated with awakening and alertness of brain and vice versa for sleep. Caffeine increases dopamine receptors availability in the striatum.⁷ Adenosine acts as an autonomous regulator of circadian clockwork by suppressing retino-hypothalamic tract activity in suprachiasmatic nucleus. Suprachiasmatic nucleus is a primary circadian pacemaker which is responsible for fluctuating sleep depth. Caffeine is an antagonist at binding site of adenosine, it produces a hype in neuronal cells of suprachiasmatic nucleus.^{8,9} People consume caffeine is the form of black tea and coffee. Person consumes caffeine in between 195 to 390 mg per day remains mentally alert and free from sleep deprived symptoms. However, when levels of caffeine cross the threshold of 400 mg it produces palpitations, tachycardia and also change the sleeping behavior.¹⁰ Quality of sleep is drastically decline after excessive quantity of caffeine is consumed in one shot specially when going to bed.^{11,12} On the other no such worse impact on sleep quality has been observed in habitual heavy caffeine consumers specially during day time. This study is designed to evaluate the relation between quality of sleep and caffeine consumed by personals of health department.

Material and Methods

This comparative transverse study was conducted in pharmacology department of Bakhtawar Amin medical and Dental college. Approval certificate was taken from ethical review committee of Bakhtawar amin medical and dental college (letter no. 1476-23/E.C/BAMD&C). Study duration was 04 month (Aug-Dec 2023). Sample size was determined by evaluating research work on caffeine consumption in different regions.^{13,14} A total 300 health professional that are working in multan city, between age group of 25-55 years and had a BMI of 18.5-24.9, were part of this study. Health professional

with nicotine addiction or any psychiatric ailments were not part of this study. They were randomly divided in three group (n=100 in each group). Group I was included person with low caffeine intake (60 ± 30 mg/kg) mg/day while group II and group III were classified as moderate (145 ± 25 mg/kg) and high caffeine (350 ± 140 mg/day) intake groups. consumption had been estimated by average daily consumption of tea, coffee, carbonated drinks and chocolates by using Caffeine consumption questionnaire.¹⁵ sleep quality of participants were evaluated by using Pittsburgh sleep quality index (PSQI), a standard questionnaire to evaluate sleep quantity and quality.^{16,17} Data was evaluated using IBM SPSS version 23. PSQI was quantitative parameter that was analyzed through chi square test followed by post hoc tuckey test. The differences between two annotations were considered statistically noteworthy if the p value was identical or less than 0.05 ($p \leq 0.05$).

Results

Mean Age of group I, II and III was 35 ± 0.25 , 37 ± 0.50 and 37 ± 0.33 respectively. BMI of group I was 22.94 while BMI of group II and III was 22.56 and 23.70. when Pittsburgh sleep quality index was evaluated, mean of sum of low caffeinated was lowest with a value of 10 ± 3.184 . This value was quite low than 27 ± 3.373 , a value of mean of moderate caffeinated group. Group III, highly caffeinated group mean score was as highest as 37.93 ± 3.383 . Graphical representation of mean of all three groups is as displayed in diagram 01. Intergroup comparison of sleep quality index depicted p value of < 0.01 all the time that found a gross difference of sleep quality with increasing caffeine intake and this indicates that with the increase in the consumption of caffeine, PSQI scores also increase.

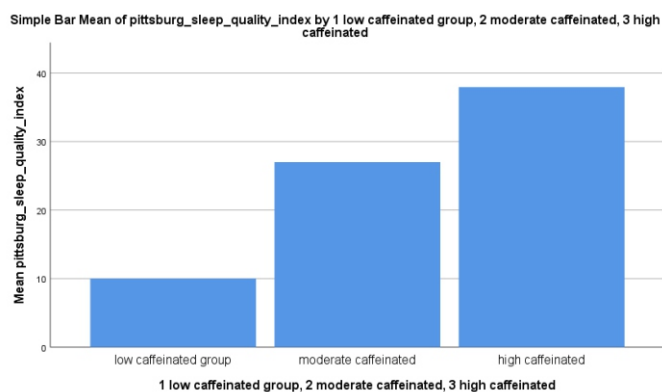


Figure 1: Graphical representation of mean Pittsburgh sleep quality index score

Discussion

Table 1: *Intergroup comparison*

Groups in comparison	P value
I and II	< 0.01
I and III	< 0.01
II and III	< 0.01

Statistics of this study revealed striking high intake of caffeine i.e. above ninety percent, among the health professionals of different disciplines of various hospitals and medical colleges of Multan. It also supports the statistics of regular consumption of caffeine among medical professionals. This observation is in accordance with a study performed in different institute.¹⁸ Another exploration work based on survey conducted. showed intake of caffeine among participants were more than ninety one percent.¹⁹

PSQI scoring system was introduced to in this study and tried to discover the relation between PSQI scores and quantity of caffeine intake. Participants with high caffeine intake showed high PSQI score in comparison to participants with moderate to low caffeine intake. PSQI score for participants with moderate caffeine intake were much high in comparison to low caffeine intake participants. Similar observations were claimed by multiple teams of researchers in 2022.^{20,21} In present study, rise in quantity of caffeine intake relates with surge in value of PSQI score. It also narrated intake of caffeine adverse the quality of sleep pattern among participants like latency to sleep and awaked midnight from a sleep. Even animal model designed to observe the relation between quantity of caffeine consumed and sleep quality showed similar relation in results.²² Similar observations were shared in multiple surveys and studies conducted in different institutes.²³ Multiple mechanisms at molecular level are associated with caffeine that alters sleep patterns among participants. Caffeine pharmacologically antagonizes the adenosine leads to rise in activity of dopamine in striatum. Caffeine also possesses inhibitory effect on retino-hypothalamic tract that is associated with excitatory effect on suprachiasmatic nucleus.^{24,25}

Above discussion shows a direct proportional relation between quantity of caffeine consumption and quality of sleep in participants. A multi-center study in future would provide a much better and bigger picture.

Conclusion

Sleep quality of health professional has direct influence of amount of caffeine they consume. Health professional that no or little caffeine user had better sleep as compared to professionals with moderate and severe caffeine consumption. Likewise Moderate caffeine intake professionals had better sleep quality as compared to one who had daily high caffeine intake routines.

Conflict of Interest: None

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Authors Contribution

BS, NI: Conceptualization of Project

BS, NI: Data Collection

NA, SJ: Literature Search

HMIA, SG: Statistical Analysis

SG, SJ: Drafting, Revision

NA, HMIA: Writing of Manuscript