ORIGINAL RESEARCH

ASSOCIATION BETWEEN DAILY TEA CONSUMPTION AND SLEEP QUALITY: A CROSS-SECTIONAL ANALYTICAL STUDY

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Abstract

Background: Sleep quality is a critical determinant of physical and mental health, and dietary factors such as caffeine intake from tea may influence sleep patterns. Evidence on this association in the Indonesian population remains limited despite the high prevalence of both tea consumption and poor sleep quality. This study aimed to investigate the relationship between daily tea consumption and sleep quality among Indonesian adults.

Methods: A cross-sectional correlational study was conducted from January to March 2022 using an online survey. A total of 104 adults aged 18–64 years with low stress levels (Perceived Stress Scale score ≤13) were included. Tea consumption was assessed by frequency and quantity (cups/day), while sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI). A global PSQI score >5 indicated poor sleep quality. Data were analyzed using Spearman's rank correlation, with significance set at $p < 0.05$.

Results: Most participants were female (61.5%), aged 20–49 years, with 40.4% consuming ≥3 cups of tea daily. Poor sleep quality was reported by 72.1% of respondents. A significant positive correlation was found between daily tea consumption and PSQI score ($r_s = 0.528$, $p < 0.001$), indicating that higher tea intake was moderately associated with poorer sleep quality.

Conclusions: Higher daily tea consumption is significantly associated with poorer sleep quality among Indonesian adults. These findings underscore the need for public health initiatives to raise awareness about caffeine-containing beverages and their potential effects on sleep.

Keywords: tea consumption, sleep quality, caffeine, Pittsburgh Sleep Quality Index, Indonesian adults

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Introduction

Sleep is a fundamental physiological necessity that profoundly influences physical, emotional, and cognitive health.[1] Inadequate sleep disrupts immune function, increases the risk of chronic conditions such as cardiovascular disease, diabetes, and obesity, and impairs

cognitive functions, mood regulation, and motor coordination. Moreover, chronic sleep disturbances are associated with higher rates of depression, anxiety, and decreased productivity, particularly among working-age adults and the elderly.[2–5] Among vulnerable populations such as older adults, shift workers, and individuals with comorbidities, poor sleep quality exacerbates existing health burdens and compromises quality of life.

Globally, the burden of sleep disturbances has intensified over recent years, particularly among older adults. A comprehensive systematic review by Du et al. , which analyzed 64 studies involving 181,224 older adults during the COVID-19 pandemic, reported that 47.1% experienced poor sleep quality, 40.8% had short sleep duration, and 21.2% exhibited insomnia symptoms.[6] In Indonesia, Petzer et al. reported that among 31,432 individuals aged ≥15 years, 33.3% experienced sub-threshold insomnia and 11.0% met criteria for clinical insomnia.[7] Similarly, Alfian et al. analyzed data from 22,024 respondents, revealing that 42.9% reported sleep disturbances, including 3.0% severe, 16.5% moderate, and 23.3% mild cases.[8]

Despite the growing prevalence of sleep disturbances, public awareness of modifiable lifestyle factors such as tea consumption remains limited. Tea is one of the most commonly consumed beverages in the world and contains several bioactive compounds, including caffeine, theobromine, L-theanine, and catechins.[9] Caffeine, a known stimulant, acts as an adenosine receptor antagonist and may delay sleep onset and reduce total sleep time.[10] In contrast, L-theanine, an amino acid found predominantly in green tea, has been shown to promote relaxation and improve subjective sleep quality in some studies.[11,12]

Due to the combination of these compounds with differing mechanisms of action, the effects of tea consumption on sleep remain highly variable and, in some cases, controversial. A study by Yong Tian et al. demonstrated that habitual tea consumption, particularly daily intake (6–7 days per week) in small amounts (<10 g per day) was significantly associated with improved sleep quality among Chinese adults.[13] Conversely, other studies have suggested potential adverse associations. For instance, Kleiser et al. reported that short sleep duration was correlated with higher intake of black tea, highlighting a possible negative relationship between certain types or amounts of tea and sleep quality.[14] Despite these contradictory findings, most existing studies have been conducted in East Asian or Western populations, with limited evidence from Southeast Asia, particularly Indonesia, where tea consumption is deeply embedded in cultural practices and the prevalence of poor sleep is high. Understanding this relationship in the Indonesian context is crucial for developing culturally relevant public health recommendations. Therefore, this study aimed to investigate the association between habitual tea consumption and sleep quality among Indonesian adults.

Methods

This study employed a cross-sectional correlational design to investigate the

relationship between tea consumption and sleep quality among Indonesian adults. The research was conducted from January to March 2022 through an online survey using Google Forms.

Participants were selected using purposive sampling, with a total of 104 adults aged between 18 and 64 years included in the final analysis. Participants were selected based on clearly defined inclusion and exclusion criteria. The inclusion criteria were adults (both male and female) aged 18 to 64 years who had consumed tea at least once in the past week. Exclusion criteria included individuals with moderate or high stress levels, as measured by the Indonesian version of the Perceived Stress Scale (PSS), and those who consumed more than two cups of coffee daily. Stress levels were classified according to the PSS-10 scoring: low (0–13), moderate (14–26), and high (27–40).[15,16] Only participants with low stress levels (≤13) were included in the final analysis to minimize psychological confounding.

Data collection involved a structured questionnaire divided into four main sections: demographic information, tea consumption patterns, sleep quality, and stress levels. Tea consumption was assessed based on frequency (e.g., 1–3 times per week, 4–5 times per week, daily) and quantity (number of cups per day: 1, 2, or ≥3 cups, where one cup equaled approximately 250–350 mL). Sleep quality was evaluated using the Pittsburgh Sleep Quality Index (PSQI), a validated instrument that measures subjective sleep quality, latency, duration, efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction over the past month. A global PSQI score greater than 5 was categorized as poor sleep quality.[17,18] Stress levels were assessed using the 10-item PSS, a validated tool to measure perceived psychological stress in the past month.

Statistical Analysis

All collected data were tabulated using Microsoft Excel and analyzed using SPSS version 23.0. Descriptive statistics were used to summarize demographic characteristics, tea consumption, and sleep quality data. Normality of distribution was tested, and due to non-normal data, the Spearman rank correlation test was used to assess the relationship between daily tea consumption and PSQI scores. A p-value less than 0.05 was considered statistically significant.

Results

Table 1 presents the demographic characteristics of the 104 adult respondents included in the study. The majority of participants were female (61.5%), and most were within the 20–49-year age range. Regarding tea consumption habits, 40.4% reported consuming three or more cups of tea per day, while 35.6% consumed one cup daily. Sleep quality, measured using the Pittsburgh Sleep Quality Index (PSQI), revealed that 72.1% of respondents had poor sleep quality.

Prior to correlation analysis, a normality test was performed using the Shapiro–Wilk method, which showed that both tea consumption scores and PSQI scores were not normally distributed ($p < 0.05$). Therefore, a Spearman's rank correlation

test was applied. As shown in Table 2, a statistically significant positive correlation was found between daily tea consumption and PSQI score (r_s = 0.528, p < 0.001), suggesting that higher tea intake was moderately associated with poorer sleep quality among Indonesian adults.

Table 1. Demographic Characteristics of Respondents (n = 104)

Subject characteristics	n = 104
Age Group (years)	
19	2 (1.9%)
20-29	32 (30.8%)
30-39	26 (25.0%)
40-49	30 (28.9%)
50-59	13 (12.5%)
60-64	1 (0.9%)
Gender	
Male	40 (38.5%)
Female	64 (61.5%)
Daily Tea Consumption	
1 cup	37 (35.6%)
2 cups	25 (24.0%)
≥3 cups	42 (40.4%)
Sleep Quality	
Good (PSQI ≤ 5)	29 (27.9%)
Poor (PSQI > 5)	75 (72.1%)

Table 2. Spearman's Rank Correlation between Tea Consumption and Sleep Quality (PSQI Score)

Variable	n	r (Spearman)	p-value
Tea consumption	104	0.528	<0.001

Discussion

The primary objective of this study was to investigate the relationship between the amount of tea consumption and sleep quality among adults aged 18–64 years in Indonesia, given that sleep quality is essential for both physical and mental health, and dietary habits, particularly caffeine intake from tea, represent modifiable factors influencing sleep patterns.

Our study found a significant positive correlation between the amount of tea consumed and poorer sleep quality, with r_s = 0.528 (p < 0.001), indicating a strong positive relationship. Among the 104 respondents analyzed, 40.38% consumed three or more cups of tea daily, and 72.12% reported poor sleep quality. These findings are consistent with studies by Tseng et al. who documented a negative impact of tea drinking habit on sleep quality among university students in Taiwan, and Watson et al. who reported that caffeine consumption adversely affects sleep quality in Australian adults.[19,20] The role of tea's caffeine content in sleep disruption is further supported by Hindmarch et al., who found that while tea improved cognitive alertness during the day, repeated consumption into the evening was associated with delayed sleep onset, shorter sleep duration, and reduced sleep quality.[21] In contrast, Choi et al. reported no significant relationship between tea consumption and sleep quality among Korean college students.[22] Further illustrating the diversity of beverage effects on sleep, Hieu et al. conducted a systematic review and meta-analysis on chamomile, finding that although one RCT reported no significant reduction in insomnia severity, chamomile administration significantly improved sleep quality.[23]

The association between tea consumption and poorer sleep quality in this study may be explained by its caffeine content and neurochemical effects. Carrier et al. reported that caffeine can influence

the circadian rhythm, delaying the onset of melatonin secretion and shifting sleep timing, which can impair overall sleep quality.[24] As tea contains caffeine, it is plausible that similar circadian disruptions occur with high tea intake. Camfield et al. demonstrated that caffeine increases cognitive performance and alertness, effects that, while beneficial during the day, may hinder the ability to initiate and maintain sleep when consumption occurs later in the day.[25] Mechanistically, caffeine enhances levels of acetylcholine and dopamine in the brain and acts as an adenosine (A1 and A2A) receptor antagonist, reducing sleep pressure and increasing wakefulness.[26,27] Additionally, caffeine has been shown to suppress melatonin secretion, the hormone responsible for regulating sleep–wake cycles, thereby further contributing to delayed sleep onset and reduced sleep efficiency.[28]

This study has several limitations. Its cross-sectional design prevents determining causality between tea consumption and sleep quality, and reverse causation is possible. Tea intake and sleep quality were self-reported, which may lead to recall bias and mismatch with objective measures. Details on tea type, brewing strength, caffeine content, and timing of consumption were not recorded, limiting interpretation of the physiological effects. Other lifestyle and health factors that may influence sleep were not fully controlled, and the relatively small, single-population sample limits generalizability. Future research should employ longitudinal designs, incorporate objective sleep measurements (e.g. polysomnography or actigraphy), and include detailed assessments of tea type, caffeine content, and timing of consumption to better clarify the causal pathways.

Conclusion

This study demonstrates a significant positive correlation between daily tea consumption and poorer sleep quality among Indonesian adults, suggesting that higher tea intake may adversely affect sleep. The findings highlight the potential impact of caffeine-containing beverages on circadian rhythm regulation and sleep efficiency, particularly when consumed in larger amounts.

Conflict of Interest

The authors declared no conflict of interest.

Acknowledgment

The authors declared no acknowledgment.

Ethical Statement

This study was approved by the Research Ethics Committee of the Faculty of Medicine, Universitas Pelita Harapan, with ethical clearance number 167/K-LKJ/ETIK/II/2022. All participants provided electronic informed consent after receiving a clear explanation of the study's objectives, procedures, and data confidentiality. Participation was entirely voluntary, and no personally identifiable information was collected.

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