The Effect of Caffeinated Beverages on Sleep Quality in College Students

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ABSTRACT

Objective: Poor sleep quality is considered a global health problem. Considering that caffeine intake contributes to sleep disturbances, we evaluated the relationship between sleep quality and the consumption of caffeinated beverages in college students in Jeddah, Kingdom of Saudi Arabia.

Methods: This was a cross-sectional study conducted with college students aged 18 to 25 years old from both governmental and private colleges in Jeddah, Saudi Arabia. Sleep quality, caffeine intake, and stress exposure were assessed using three validated electronic questionnaires.

Results: A total of 476 college students completed the questionnaire. Sleep quality was found to be poor in 80.7% of students. The prevalence of caffeine intake was as follows: none = 8%, a tolerable amount = 40.5%, and excessive = 51.5%. Of the students who reported excessive caffeine intake, 83.3% had poor sleep quality. The relationship between excessive caffeine intake and poor sleep quality was significant (p = 0.003).

Conclusions: The majority of students had poor sleep quality, and this was correlated with excessive caffeine intake. Our results highlight the importance of raising awareness among students about the factors that may affect sleep quality.

Keywords

Caffeine; Stress; Sleep quality; College students.
INTRODUCTION

Poor sleep quality is considered to be a global health problem. College students are more vulnerable to sleep disorders, which can result in sleep deprivation, the consequences of which include a decreased ability to perform tasks, daytime sleepiness, and fatigue[9]. Moreover, according to a long-term prospective study, insomnia at a young age is a risk factor for subsequent clinical depression and psychiatric distress[10]. Furthermore, poor sleep quality is a well-known side effect of caffeine intake. Caffeine is used by more than 80% of the world’s population, and is commonly found in coffee, tea, caffeinated soft drinks, energy drinks, and chocolates[9]. College students tend to consume coffee and energy drinks to increase wakefulness, overcome fatigue, and enhance cognitive performance, which can subsequently have a significant impact on sleep quality[9]. Overall, poor sleep has negative consequences for academic performance and general wellbeing. In Saudi Arabia, there is an alarming reversed sleep cycle on weekdays and a higher percentage of poor sleep quality among adolescents compared to other countries[11].

In light of the increasing prevalence of sleep disorders among college students and the deleterious effects of excessive consumption of caffeinated beverages, this study evaluated sleep quality in relation to consumption of caffeinated beverages among college students in Jeddah, Kingdom of Saudi Arabia. Furthermore, we evaluated the effect of psychological stress if any on the consumption of caffeinated beverages among this group of students.

MATERIALS AND METHODS

This observational cross-sectional study was conducted with 18 to 25-year-old students in both governmental (King Abdulaziz University, and King Saud bin Abdulaziz University for Health Sciences) and private colleges/universities (Batterjee Medical College, Ibn Sina National College, Al Farabi Medical College, Dar Al-Hekma University, and Eiffat University) in Jeddah, Kingdom of Saudi Arabia. The study was approved by the Institutional Review Board of the Faculty of Medicine, King Abdulaziz University (Reference No. 1288-13), and was conducted in accordance with the ethical standards of the Declaration of Helsinki. Data were obtained from January 1, 2016 to August 1, 2017 using validated, constructed, confidential electronic- and paper-based questionnaires, which contained four main sections. Section 1 collected demographic data, including gender, age, height, weight, university, college major “defined as the main college that students are enrolled in”. Section 2 measured sleep quality using the Pittsburgh Sleep Quality Index (PSQI) [6]. Section 3 measured 24-hour recall of caffeine intake using a validated survey[7], whereby caffeine intake was categorized as none = 0, a tolerable amount = 1-3 cups of caffeinated drinks, and excessive = 4 or more cups[8]. Section 4 measured stress exposure using Dr. Cohen's validated Scales (perceived stress scale)[9].

Statistical Analysis

Data were analyzed using the IBM SPSS Statistics for Windows, Version 21 (IBM Corp., Armonk, NY USA). Qualitative variables were assessed using chi-squared tests of independence. The chi-squared goodness of fit test was used to test for significant differences in distribution[10]. A value of p < 0.05 was considered to indicate statistical significance.

RESULTS

A total of 476 college students entered the study; data from 54 participants were excluded due to incomplete answers. Of the total 476 participants, 82.8% were females and 17.2% were males. The relationship of sleep quality with gender, collage major, and body mass index (BMI) is summarized in Table 1. The distribution of caffeine intake among participants with bad and good sleep quality is shown in Table 2. The majority of participants with bad sleep quality (42.9%) reported excessive caffeine drinking (p = 0.003). A total of 8% of participants reported no caffeine intake, 40% reported a tolerable intake, and 51.5% reported an excessive intake. The types of caffeinated beverages are shown in Figure 1. The association of other variables with caffeine intake is summarized in Table 3.
TABLE 2.
Caffeine intake and sleep quality.

<table>
<thead>
<tr>
<th>Caffeine Intake</th>
<th>Good Sleep Quality</th>
<th>Bad Sleep Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>7 (1.5%)</td>
<td>31 (6.5%)</td>
</tr>
<tr>
<td>Tolerable Amount</td>
<td>44 (9.2%)</td>
<td>149 (31.3%)</td>
</tr>
<tr>
<td>Excessive</td>
<td>41 (8.6%)</td>
<td>204 (42.9%)</td>
</tr>
<tr>
<td><strong>Total = 100%</strong></td>
<td>92 (19.3%)</td>
<td>384 (80.7%)</td>
</tr>
</tbody>
</table>

TABLE 3.
Caffeine intake in relation to other variables.

<table>
<thead>
<tr>
<th>Caffeine Intake</th>
<th>None</th>
<th>Tolerable Amount</th>
<th>Excessive</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>29</td>
<td>163</td>
<td>202</td>
<td>0.469</td>
</tr>
<tr>
<td>Male</td>
<td>9</td>
<td>30</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>Body Mass Index</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight</td>
<td>3</td>
<td>21</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>25</td>
<td>111</td>
<td>127</td>
<td>0.119</td>
</tr>
<tr>
<td>Overweight</td>
<td>7</td>
<td>28</td>
<td>54</td>
<td></td>
</tr>
<tr>
<td>Obese</td>
<td>2</td>
<td>29</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Major</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health College</td>
<td>10</td>
<td>36</td>
<td>66</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>12</td>
<td>71</td>
<td>88</td>
<td>0.286</td>
</tr>
<tr>
<td>Not Specified</td>
<td>16</td>
<td>86</td>
<td>91</td>
<td></td>
</tr>
<tr>
<td>Stress</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>5</td>
<td>20</td>
<td>21</td>
<td>0.178</td>
</tr>
<tr>
<td>Moderate</td>
<td>29</td>
<td>151</td>
<td>177</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>4</td>
<td>22</td>
<td>47</td>
<td></td>
</tr>
</tbody>
</table>

FIGURE 1.
Distribution of total cups of caffeinated beverages, n=476.
DiscusSion

Poor sleep quality is very common in college students and can be related to biological and social factors. In this study, we documented the demographic and behavioral characteristics of participants in relation to sleep quality. There was a high prevalence of poor sleep quality (80.7%) among college students, with a higher frequency among females (83.3%) than males (16.7%). Students that consumed more caffeinated beverages had poor sleep quality compared with those who abstained from caffeine with a p value of 0.003. Our findings are consistent with prior reports of a higher prevalence of sleep disruption in college students who drink caffeinated beverages. According to the National Coffee Association, 40% of students aged 18-24 years old drink coffee every day, as the demand for coffee in colleges has been increasing.

College students appear to be developing a higher level of dependence on caffeinated beverages to cope with the effect of the reduced hours of sleep. Indeed, this is supported by our finding that the majority of students who suffered from poor sleep quality (42.9%) reported excessive caffeine consumption. This is in keeping with the result of a cross-sectional study in Thailand that reported that students who consumed at least one caffeinated beverage per week had 1.60-fold increased odds of reporting poor sleep quality compared to others [95% CI (1.38-1.86)]. Similarly, in a study conducted in Ethiopia with those who experienced poor sleep quality, 82.3% reported consuming caffeine-containing beverages. Additionally, a randomized double-blinded study in Michigan, USA, found that 400 mg of caffeine intake 6 hours prior to sleep reduced sleep duration by more than 1 hour. In contrast, a cross-sectional study conducted in Peru found no significant association between coffee drinking and poor sleep quality. Moreover, another study in Germany reported that caffeine did not predict a significant adverse effect in the global PSQI score.

The present study revealed that coffee was the most common source of caffeine, as it is one of the most readily available drinks. This is in agreement with previous reports that coffee is the most popular caffeinated beverage. Moreover, the University of New Hampshire reported that 79.9% of their students are coffee drinkers. On the other hand, we found the consumption of energy drinks in our population were relatively low (5%), which is contrary to the high consumption of energy drinks among college students that was reported in Saudi Arabia (71.6%), Thailand (34%), and the USA (51%). Further, caffeinated beverage consumption was significantly higher in females than in males. This finding disagrees with the results of many other studies that have demonstrated that males consume energy drinks more than females. This could be hypothesized by the theory that females in our society, especially in their college years, are more involved in multitasking with college requirements and family commitment. In our study, no significant differences were detected in the total intake of caffeinated beverages between health science college students and other college students.

Nevertheless, 58.9% of health science college students in this study were excessively dependent on caffeine. A cross-sectional study in South Africa, where the study reported that 93.6% of medical students are consuming caffeine, mainly for academic purposes. Interestingly, our study showed that students who had excessive caffeine intake were more likely to experience moderate and high levels of perceived stress (Table 3). This result is in line with a study conducted in Australia. Adding to that, a study which was conducted in USA found to have a positive correlation between students’ perceived stress and energy drink consumption. On the other hand, studies in the United Kingdom and Puerto Rico reported no association between the consumption of caffeinated beverages and stress. However, our observational study could not determine cause and effect, i.e., whether the excessive consumption of caffeine was to overcome stress or whether high caffeine consumption caused high stress levels.

With regards to sleep quality in relation to demographic variables (BMI and major), underweight students had the highest percentage of poor sleep quality (89.65%), followed by students that were obese (81.81%), overweight (80.89%), and who had a normal BMI (78.32%). According to a study conducted in Arizona, USA, with 515 college students, 51% of participants were overweight and experienced poor sleep quality. However, another study concluded that it is difficult to determine if sleep disturbances contribute to obesity or obesity contributes to sleep disturbances. Finally, we found that 93% of medical students had poor sleep quality, while 90% of students from other majors had disturbed sleep patterns. Similarly, a study conducted in Brazil with 127 medical students reported that sleep disorders were common among medical students, especially in the early phase of medical school.

Some limitations of the present study should be noted. First, due to the variety of contributing factors, finding a direct cause-effect relationship was not feasible. Second, given the relative scarcity of a proper caffeine assessment tool to explore caffeine consumption, including types of beverages, amounts, and timing of consumption, collecting these data was a challenge. Third, self-administered surveys such as those used in the present study rely on subjective measures, which may be subject to some degree of error; however, we believe that this issue was in part mitigated by our use of a validated questionnaire.

ConclusioN

In conclusion, this study demonstrates that most college students had poor sleep quality, and that this was associated with excessive intake of caffeine-containing beverages. Future studies could aim to investigate the effect of caffeine when taken at different times before sleep, and to identify stressors of poor sleep quality to help in its management. In addition, intervention programs for sleep disturbances in college students should be considered.
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Conflict of Interest

The authors have no conflict of interest.

Disclosure

The authors have not receive any type of commercial support either in forms of compensation or financial for this study. The authors have no financial interest in any of the products or devices, or drugs mentioned in this article.

Ethical Approval

Obtained.

REFERENCES


تأثير تناول المشروبات المحتوية على الكافيين على جودة النوم لدى طلبة الكليات

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المستخلص.

الأهداف: تعتبر جودة النوم السبعة مشكلة صحية عالمية. ونظراً لأن تناول الكافيين قد يساهم في اضطراب النوم، فقد بقيت العلاقة بين
جودة النوم وتناول المشروبات التي تحتوي على الكافيين بين طلاب الجامعات في جدة، المملكة العربية السعودية.
الأساليب: كانت هذه دراسة مستمدة من طلبة الجامعات الذين تراوح أعمارهم بين 18 و 25 سنة من كلية حكومية وخاصة
في جدة، المملكة العربية السعودية. تم تقييم جودة النوم، وتناول الكافيين، والتعرض للإجهاد باستخدام ثلاثة أسباب إلكترونية مصادق
عليها.

النتائج: 47% طالب وطلبة أكل الاستيرون. كانت جودة النوم سبعة لدى 28% من الطلاب. وكان انتشار تناول الكافيين بين الطلاب
على النحو التالي: لا شيء = 28%، كمية مقبولة = 45.0%، والمفرطة = 27%. ومن بين الطلاب الذين أبلغوا عن تناول كميات
مفرطة من الكافيين، كان 39% يعانون من قلة النوم. وتبين أن العلاقة بين الإفراط في تناول الكافيين وسوء جودة النوم كانت كبيرة.

الاستنتاجات: إن غالبية الطلاب يعانون من سوء جودة النوم، وكان هذا مرتبطاً بالإفراط في تناول الكافيين. وبذلك تسلط هذه الدراسة
الضوء على أهمية زيادة الوعي بين الطلاب حول العوامل التي قد تؤثر على جودة النوم.