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The Impact of Smoking Cigarettes or E-Cigarettes on Sleep Quality: A Literature Review

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Abstract

Smoking is common among adults of all ages. Decades of research have shown that smoking is linked to side effects such as lung cancer. This study aims to systematically review how smoking is linked to sleep.Database searches were done through Web of Science and Google Scholar. A total of 19 peer-reviewed journals were referenced to conduct this literature review. 15 peer-reviewed journals were used for the results. Results demonstrated that smoking was found to be correlated with sleep deprivation in both males and females of all ages. Environmental Tobacco Smoke (ETS) was a source of non-smokers' sleep complaints. Although there are multiple kinds of cigarettes, sleep quality has been shown to be poor regardless of the smoking medium. Ceasing smoking may lead to sleep benefits. Additional research will need to be conducted to further corroborate this statement.

Keywords: smoking, e-cigarettes, young adults, smoking cessation, sleep benefits

The Impact of Smoking Cigarettes or E-Cigarettes on Sleep Quality: A Literature Review

Smoking has been a global public health concern for decades. Smoking can be done in a variety of ways, like with vapes, traditional cigarettes, and pipes to name a few. A dangerous substance found in these cigarettes is nicotine. Nicotine is a drug that was originally considered to be safer than tobacco, but research has shown that this is not the case (Mishra et al., 2015). It has been found to increase the risk of many cancers, like gastrointestinal and cardiovascular cancers (Mishra et al., 2015). Nicotine is an addictive substance compared to the likes of cocaine and heroin, which explains why many people have a tough time quitting the act of smoking (Mishra et al., 2015). Cigarette and e-cigarette smoking have been linked to many health issues, like lung cancer, oral cancer, and stomach cancer (McNamara et al., 2013).

Among the many health consequences linked to and caused by smoking, sleep has become a rising concern. Sleep is imperative for human physiology and is essential for health and overall well-being (Dugas et al., 2017). Poor sleep can lead to a range of adverse issues, like obesity, anxiety, and depression (Colten, 2006). The lack of sleep resulting from smoking can impair cognitive function, affect mood, and decrease daily productivity. Given the hazards of smoking and the dangerous effects of sleep deprivation, understanding their connection may be crucial for public health interventions and improved health outcomes. Populations like adolescents, pregnant women, and those with mental health disorders may be vulnerable to the effects of smoking and lack of sleep. The relationship between sleeping and smoking may be correlated, with both variables affecting each other, rather than a cause-and-effect relationship.

Some studies have explored the link between smoking and sleep. The results seem nuanced; some studies suggest a small association between smoking and sleep, while others state a larger association.

This review aims to evaluate existing literature on how smoking cigarettes and e-cigarettes affects sleep quality. By reviewing the findings reported in other articles, the link between smoking and sleep can be better understood. The goal is to find similarities and differences between the current research papers without the use of specialized software. The objective is to explore, find the link, and suggest interventions for better sleep among smokers.

Methods

The review was performed through a study of multiple journals. The databases used to find articles were through the University of California (UC) Merced Library. Web of Science and Google Scholar assisted with the literature search. Keywords used were “smoking,” “sleeping,” “cigarettes,” “e-cigarettes,” and “young adults.” Not enough data was found with just young adults (ages 18-24), so all ages were included in this study. All research papers utilized were published in English. Limitations include research papers missed due to human error, research published in languages other than English, and publications in inaccessible journals.

The investigation of smoking and sleep has been studied by researchers for a few decades. Early studies from as far back as 30 years ago are still relevant to understanding the relationship between the two variables. By reviewing studies from 20-30 years ago, insight is gained into historical trends in smoking prevalence, sleep habits, and changes in public health interventions. Older studies can help us understand changes in smoking and sleep over time. Newer studies will help us improve our perspective and provide a comprehensive understanding of smoking and sleep.

For the research paper to be included in this study, the study had to have been conducted with cigarettes or e-cigarettes and must have measured sleep outcomes. All the data recorded

were from secondary sources. These papers were selected because they were peer-reviewed and published in reputable journals.

Results

The search list provided many articles regarding the assessment of cigarettes or e-cigarettes and their relation to sleep deficits. However, for the purposes of this paper, only 15 journal articles were selected.

Many journals reported a correlation. *Table* 1 below concisely reports the findings of each journal reviewed. Note that the table is organized by year of publication, not in alphabetical order.

Table 1: Summary of Findings from 15 Peer-Reviewed Journals

Author and Source #	**Year Published**	**Location**	**Participants and Correlation Reported**	**In-Text Citation**
Wetter & Young	1994	The study was conducted in a work setting in Dane County, Wisconsin.	The survey was conducted with 3,516 adults. Smoking was associated with a tough time falling asleep and waking in males and females. Females were found to feel excessively sleepy during the daytime and males tended to have disturbing dreams.	(Wetter & Young, 1994)
Rapp, K., Buechele, G., & Weiland, S. K.	2007	32 Nursing Schools in Southwest Germany	A prospective study was conducted on 500 nursing students. 82% were female and the median age of participants was 19.9 years. Sleep was positively associated with quitting smoking Out of the 500, 53 students quit smoking.	(Rapp et al., 2007)

Conway, S., Roizenblatt, S., Palombini, L., De Castro, L., Bittencourt, L., Silva, R. S., & Tufik, S	2008	The study was done in the Department of Psychobiology at Universidade Federal de São Paulo, Brazil.	Data from 3,718 participants, ages 30-70, were collected. Results showed that current and former smokers who had smoked greater than 15 packs per year were associated with poorer sleep quality. Smokers had a decreased oxygen saturation. These effects were not influenced by BMI, age, and gender.	(Conway et al., 2008)
Okun, M. L., Levine, M. D., Houck, P. R., Perkins, K. A., & Marcus, M. D	2011	This study took place at the University of Pittsburgh in Pennsylvania, USA.	The participants consisted of 322 women between the ages of 18-65 who smoked 10+ cigarettes per day. They were enrolled in a smoking cessation program. The association between sleep and smoking was not significant as overall sleep quality did not change much in the group. Sleep was not a predictor of quitting smoking. Women who stopped smoking reported slightly better sleep quality after 3 months.	(Okun et al., 2011)
Jaehne, A., Unbehaun, T., Feige, B., Lutz, U., Batra, A., & Riemann, D	2012	The participants were from hospitals in Freiburg, Tübingen, and Winnenden. These are all cities in Germany.	44 smokers consisting of 29 men and 15 women were compared to 44 matched, non-smoking individuals. A polysomnographical analysis was done. Results showed that smokers slept less, had more sleep apnea, higher sleep latency, and more rapid eye movement.	(Jaehne et al., 2012)
McNamara, J. P. H., Wang, J., Holiday, D., Warren, J. Y., Paradoa,	2013	This study was conducted using the National Health and	Adults that were 20 years old and above were studied. They were	(McNamara et al., 2013)

M., Balkhi, A. M., Fernandez-Baca, J., & McCrae, C. S		Nutrition Examination Survey (NHANES). Participants were found all over the United States.	compared to nonsmokers. Results demonstrated a less total sleep, longer sleep latency, difficulty falling and maintaining sleep, and waking up earlier than intended.	
Krishnan, V., Dixon-Williams, S., & Thornton, J. D	2014	Literature Review of articles published in English through MEDLINE, a national library consisting of medical journals.	The study found that there is a plausible link between smoking and Obstructive Sleep Apnea (OSA). Smoking cessation appears to improve sleep.	(Krishnan et al., 2014)
Dugas, E., Sylvestre, M., O'Loughlin, E., Brunet, J., Kakinami, L., Constantin, E., & O'Loughlin, J.	2016	This study took place in Montreal, Canada	1,294 students from the 7th grade were recruited. When they reached the age of 24, they were asked to self-report on a questionnaire. It was found that 36% of the participants experienced poor sleep quality with a relevant association of the mean number of cigarettes smoked per month.	(Dugas et al., 2017)
Riehm, K. E., Rojo‐Wissar, D. M., Feder, K. A., Mojtabai, R., Spira, A. P., Thrul, J., & Crum, R. M	2019	Participants were found in the United States.	9,588 adolescents were studied in an observational, cross-sectional study. 6.3% used e-cigarettes, 3.0% used combusted cigarettes, and 5.0% used both kinds. 85.7% did not use either product. Results found that the use of cigarette products was associated with a higher chance of reporting sleep issues.	(Riehm et al., 2019)
Brett, E. I., Miller, M. B., Leavens, E. L. S., Lopez, S. V., Wagener, T. L., & Leffingwell, T. R.	2019	These participants were in the Midwest.	This study was conducted on 1,664 undergraduate students from a midwestern university (not specified). These	(Brett et al., 2019)

			students opted for themselves through online recruitment. Results demonstrated e-cigarette usage was correlated with poorer sleep compared to undergraduates that did not smoke.	
Amiri & Behnezhad	2019	Systematic Review of existing literature until December 2018. The location was not specified in the paper. The researchers are Iranian, and they published in a Canadian Journal.	Only prospective study designs were researched in this systematic review paper. It was found that those who smoke were 1.47 times more likely to develop sleep issues than non-smokers.	(Amiri & Behnezhad, 2020)
Veronda, A. C., Irish, L., & Delahanty, D. L.	2019	The location of the study was in the Midwest.	1023 undergraduates enrolled in psychology courses from a large Midwestern university were studied. It was found that greater smoke exposure was positively associated with more sleep quality complaints. Males were also more likely to report higher smoke exposure (first-hand and second-hand).	(Veronda et al., 2019)
Kianersi, S., Zhang, Y., Rosenberg, M., & Macy, J. T	2021	These participants were found in 41 states and U.S. territories.	A cross-sectional study was done. 47% of current smokers and 35% of former e-cigarette smokers reported sleep deprivation. Participants were selected in the age group of 18-24. 18,945 individuals, 52% being male, were observed. The study demonstrated that e-cigarette users were 1.17 times more likely to have sleep deprivation in	(Kianersi et al., 2021)

			comparison to the non-smoking counterparts.	
Merianos, A. L., Jandarov, R., Choi, K., Fiser, K., & Mahabee‐Gittens, E. M	2021	This research took place in the United States.	11,296 students in high school were included in the study and their usage of e-cigarettes in the past 30 days. Overall, 73.4% of adolescents reported poor sleep. E-cigarette users were 1.57 times more likely to report poor sleep.	(Merianos et al., 2021)
Merianos, A. L., Mahabee‐Gittens, E. M., Hill, M. J., Olaniyan, A. C., Smith, M. L., & Choi, K.	2023	This research took place in the United States.	13, 978 U.S. adults between the ages 18-24 were studied. This was a telephone-based survey. Any kind of cigarette user was likely to report poorer sleep.	(Merianos et al., 2023)

Nine studies were conducted in the United States, two in Germany, one in Canada, and one in Brazil. One meta-analysis study was conducted by Iranian researchers but was published in a Canadian journal (Amiri & Behnezhad, 2020).

Veronda et al. (2019) considered ETS, or Environmental Tobacco Smoke, on sleep issues. Veronda et al. (2019) also pointed out that males are more likely to report higher smoke exposure.

Fourteen out of fifteen studies reported that sleep was better for non-smokers than for smokers. Krishnan et al. (2014) reported that smoking cessation may improve sleep. On the other hand, Okun et al. (2011) reported that sleeping insignificantly improved in former female smokers, but the lack of sleep did not indicate a relapse.

Discussion

The reports consistently showed an association between smoking cigarettes and poor sleep quality. This association was seen across different methods of smoking, including regular cigarettes, e-cigarettes, and combustible cigarettes. Regardless of the medium of smoking, any kind of smoking is likely linked to inadequate sleep.

Sleep disturbances and lack of sleep could be due to a plethora of reasons. Social media, mental health, education-related stress, and work-related stress are a few factors that may contribute. So, while it was found that there was a correlation to a lack of sleep in smokers, it is possible that there were other factors in the smokers' lives that affected their sleep and not the smoking itself. Some smokers may be partaking in other activities, like drinking and other drugs, that may also contribute to their overall health and their ability to sleep.

The studies reviewed were conducted in the United States, Germany, Canada, and Brazil, which span across three continents: North America, South America, and Europe. Despite cultural and demographic differences between the four countries, the consistency between them is noteworthy and suggests a strong correlation between the two variables. This strengthens the association even further.

The ages studied in all the reports vary. Merianos et al. (2021) studied high schoolers, while Conway et al. (2008) studied individuals between the ages of 30-70. Both observed similar results. Merianos et al. (2021) reported that high schoolers who smoked e-cigarettes were 1.57 times more likely to report sleep disturbances. Conway et al. (2008) reported that individuals who used to smoke or still smoke are more likely to report sleep disturbances. The similarities between the two studies show that age may not be a factor in sleep issues related to smoking.

Multiple studies have mentioned that if someone has a hard time falling asleep, they might smoke when they are awake. The cycle of smoking is reinforced because individuals have a difficult time falling asleep because of smoking, furthering their dependence on cigarettes.

A study published in 2019 did a comprehensive review of smoking on sleep (Patterson & Ashare, 2019). Their study corroborated that sleep deficits are likely to happen in smokers (Patterson & Ashare, 2019).

Okun et al. (2011) were the only study to mention an insignificant change. However, they were specifically looking at if sleep could be a determining factor in relapsing. Essentially, they found that sleeping was not a predictor of quitting smoking. Krishnan et al. (2014) found that stopping smoking may result in better sleep, but Okun et al. (2011) found that sleeping did not necessarily improve. The limitation of the 2011 study is that the women were only followed over a three-month period. It is possible that the sleep may have improved, but it could have taken longer than three months to do so.

Veronda et al. (2019) were the only study to consider ETS. ETS contains many chemicals that are toxic or carcinogenic, including but not limited to ammonia, hydrogen cyanide, toluene, butane, benzene, and carbon monoxide (Rashidi et al., 2020). This was an important consideration because non-smokers may be facing sleep issues disproportionately if they are exposed to people that do smoke.

Conway et al. (2008) mentioned a decrease in oxygen saturation in those who smoked while sleeping compared to non-smokers. This can affect breathing while sleeping; if it's harder to breathe, it may be hard to stay asleep (Conway et al., 2008).

An interesting similarity to note was that Brett et al. (2019) and Veronda et al. (2019) had research that took place at a large university in the Midwest. The university name was not

specified, but the description was the same between the two papers. It is possible that a lot of the research participants overlapped in this study. None of the authors worked on both papers, but this was an interesting coincidence.

Merianos et al. (2023) conducted interviews via the telephone. There could be certain problems with this, as most people may not pick up their phone if an unknown number were to call.

Some studies mentioned that side effects between men and women vary. This outcome calls for additional research and learning. Taking brain scans or lab panels to study the difference between men and women who smoke may provide additional answers.

Conclusions

We conclude that smoking any kind of cigarette is associated with poor sleep quality and that it is expected that those who do not smoke are more likely to get better sleep.

Additional research in this area is called for. Longitudinal studies on the effects of smoking on sleep should be conducted to improve our knowledge of the connection between the two. The studies reviewed had participants who were followed for less than two years. As various kinds of cigarettes are engineered, it is imperative that we conduct studies on them and their effects on sleep. Additionally, the effects of ETS should be studied on non-smokers.

The results encourage further investigations in locations and demographic groups where data was not collected, like in South America, Asia, and Africa. As noted earlier, the data in this study was extracted from only four countries. Further studies of different populations in different locations may provide valuable insight into the relationship between smoking and sleeping.

This study highlights the need to emphasize smoking cessation for health and sleep benefits as well as conducting additional research into the topic.

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