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Assessment of the association of bruxism with caffeine consumption and nicotine intake

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Abstract

Introduction: *Caffeine and nicotine are two legal stimulants among the world's most widely used psychoactive substances. The relationship between these popular daily stimulants and bruxism is insufficiently investigated. The evidence on the association between these factors and bruxism is controversial.* ***Aim***: *Our study aimed to investigate the possible association between using the most marketable daily stimulants – nicotine and caffeine, and self-reported bruxism.* ***Material and methods***: *The study included 137 (n=137) participants aged from 30 to 61 years (Mean 47.08±0.59; SD=6.92) – 44.53% (n=61) of participants were male, and 55.47% (n=76) were female. Questionnaires evaluated the relationship between cigarette smoking, caffeine consumption and bruxism.* ***Results***: *Bruxism was associated highly with tobacco use. Smoking appears is more prevalent among bruxers (71.43%). The cigarette smoking was significantly associated with the bruxism (rho (137)=0.327, p <0.001). Consumption of coffee and caffeine containing beverages was not related to the bruxism (rho(137)=-0.096, p >0.05). Chi-square test for independence indicated no significant association between bruxism, caffeine consumption (χ2 (2, n=137)=2.391, p=0.303, phi = 0.132.) and nicotine intake (χ2 (1, n=137)=4.967, p=0.083, ph =0.190.) in terms of gender.* ***Conclusions***: *Based on limited evidence in this study, bruxism was associated positively with nicotine intake. The association between the studied stimulants could not be neglected. However, there is still a necessity for additional evidence. This association should be further assessed in the presence of confounding factors.*

Keywords: ***bruxism, caffeine, nicotine, psychoactive substances, stimulants***

Introduction

Risk factors for sleep bruxism are investigated in many studies, and it was found that cigarette smoking and certain daily stimulants such as caffeine can increase levels of bruxism. Some of the factors closely linked to bruxism are coffee and tobacco. All of these are known to have a high impact on the central nervous system of an individual (1). These substances disrupt the standard mechanisms involved in the initiation and maintenance of healthy sleep. They disrupt some neurotransmitter systems, including acetylcholine, dopamine, gamma-aminobutyric acid, glutamate, norepinephrine, and orexin (2). Caffeine consumption and cigarette smoking can pose a significant public health problem. On the other hand, little is known about their effects on some parafunctional habits such as bruxism.

Caffeine is a stimulant substance found in coffee, tea, cocoa (chocolate), nuts, soft drinks, and energy drinks. Coffee is one of the most popular everyday beverages consumed globally and the most common source of high caffeine (3).

According to the World Health Organization (WHO), daily caffeine intake should not exceed 300 mg (4). Sleep alterations with caffeine use include increased sleep latency, decreased total sleep time, and increased slow-wave sleep. In addition, dependence on caffeine is found to cause poor sleep quality, daytime dysfunction, and increased sleep disturbances. These sleep disturbances caused by caffeine may be due to the ability of the caffeine to antagonize adenosine receptors because adenosine acts as an antagonist of neuronal activity and promotes sleep (5). Caffeine stimulates and triggers muscle activity, which can cause frequent waking periods during the night that can lead to nocturnal bruxism (6,7).

The study of Eurostat showed that the number of smokers in the EU in 2014 ranged from 8.7% in Sweden to 27% in Bulgaria. Smoking is also might be a risk factor for bruxism and affect sleep quality adversely (8). Nicotine, which is the primary psychoactive compound in tobacco, primarily acts on nicotine acetylcholine receptors. Polysomnographic studies show that nicotine increases sleep latency, decreases total sleep time, and decreases slow-wave sleep (9,10). Smoking is associated with sleep-related issues. Some studies pointed out that people using electronic cigarettes are more likely to have less sleep than those who have never used electronic cigarettes (11). Many e-cigarettes contain high amounts of nicotine. While some studies did not find an association, others reported associations between heavy smoking and sleep bruxism (12,13,1).

Other Studies show Neither smoking nor caffeine consumption was associated with sleep or awake bruxism (14).

Aim

Because of this controversial data, the current study aimed to investigate the possible association between caffeine, nicotine, and bruxism.

Materials and methods

Two questionnaires were administered to one hundred thirty-seven (137) respondents randomly selected from different age groups and gender. Data obtained from questionnaires revealed 76 female participants (55.47%) and 61 male participants (44.53%). Age varied widely among respondents, from 29 to 59 years of age (Mean 47.08±0.59; SD=6.92).

The present study investigated bruxism, caffeine consumption, and nicotine intake based on self-report only. A specific questionnaire was applied to determine the level of caffeine consumption, nicotine intake, and

bruxism as follows: The main question was - what of the following options best describes your present smoking (caffeine consumption)? The options were: 1) “never,” “former smoker” “no more than 3 per week”, “more than 3 per day”. The consumption of caffeine options was: “never,” “no more than 5 per week,” and “more than 2 per day”. The cigarette smoking frequency was classified in the following categories: 0 – never, 1 – rarely (no more than 3 per week), 2 – often (more than 3 per day).
The frequency of coffee or caffeine-containing drinks consumption was classified in the following categories: 0 – never, 1 – rarely (no more than 5 per week), 2 – often (more than 2 per day).

Statistical analysis

For qualitative variables, the structure indices were calculated and expressed in %. Data were summarized by calculating a descriptive statistical index. The chi-square test was used for two categorical variables. The relationship between variables was analyzed with Spearman’s rank correlation coefficient. A level of $p < 0.05$ was considered statistically significant. SPSS software (version 20; IBM, Tokyo, Japan) was used for all statistical analyses.

Results

The distribution of nicotine intake and the presence of bruxism are given below (Table 1). Smoking appears to be more prevalent among bruxers (62.6%). A significant association and positive coefficient were found (rho (137) = 0.327, $p < 0.001$), which shows that intake of nicotine increased the possibility of bruxism presence. Applying Cohen's guidance (Cohen, 1988), the magnitude of the effect is medium.

Table 1. Distribution of nicotine intake and its association with bruxism

Bruxism						Correlation coefficient
		Never	Rarely	Often	Total	
smoke	Never	58	7	3	68	Spearman’s Rho=0.327 p <0.001
		85.3%	10.3%	4.4%	100.0%	
	Rarely	18	4	1	23	
		78.3%	17.4%	4.3%	100.0%	
	Often	26	1	19	46	
		56.5%	2.2%	41.3%	100.0%	
	Total	102	12	23	137	

Consumption of coffee and caffeine-containing beverages was not related to bruxism (Table 2). A significant association was not found (rho (137)=-0.096, $p > 0.05$) between caffeine consumption and increased possibility of bruxism presence.

Table 2. Distribution of caffeine consumption and its association with bruxism

Bruxism						Correlation coefficient
		Never	Rarely	Often	Total	
caffeine	Never	5	0	2	7	Spearman's Rho=-0.096 p >0.05
		71.4%	0%	28.6%	100.0%	
	Rarely	31	5	9	45	
		68.9%	11.1%	20.0%	100.0%	
	Often	66	7	12	85	
		77.6%	8.2%	14.1%	100.0%	
	Total	102	12	23	137	

The results for distribution by gender of the caffeine consumption and cigarette smoking are shown below (Table 3). Chi-square test for independence (with Yates Continuity Correction) indicated no significant association between bruxism, caffeine consumption ($\chi 2$ (2, n = 137) = 2.391, p = .303, phi = .132.) and nicotine intake ($\chi 2$ (1, n = 137) = 4.967, p = .083, phi = .190) in terms of gender.

Table 3. Association between bruxism, caffeine consumption, and nicotine intake according to gender.

Variables	Category	Gender		p
		Male	Female	
		n=61	n=76	
Nicotine	Never	30	38	0.083
	Rarely (<3 per week)	6	17	
	Often ((>2 per day)	25	21	
Caffeine	Never (0 per day)	4	3	0.303
	Rarely (<5 per week)	16	29	
	Often (>2 per day)	41	44	

Bruxism was more frequent among cigarette smokers in men (68.4%) and women (56.8%). Caffeine intake was more frequent in the group with bruxism (66.5% of the female and 73.5% of the male).

Discussion

Nicotine is a chemically active substance that may be associated with motor activity (15). Sleep and awake bruxisms are masticatory muscle activities during sleep (characterized as rhythmic or non-rhythmic) and

wakefulness (characterized by repetitive or sustained tooth contact or bracing or thrusting of the mandible), respectively (16).

From a systematic review of the data from scientific literature could be concluded that in case-control studies, smoking was moderately positively associated with sleep bruxism (17). Result of the statistical analysis was odds ratio 2.8 and 95% confidence interval 2.2-3.5. Our study supports evidence from these observations.

Conversely, there are controversial results of sleep disorders and tobacco use in scientific researches. In contrast to our results, some studies (9) did not find an association. Others (19,22) reported associations between heavy smoking and sleep bruxism (12,13,1). Other studies pointed out that neither smoking nor caffeine consumption was associated with sleep or awake bruxism (14).

In a cross-sectional study, Cohen A and al. found that sleep quality, sleep time duration, and sleep onset latency was similar among smokers and nonsmokers (18). In another study, there was no significant correlation of smoking status with sleep onset latency and several other measures of sleep quality (19). However, the current study's findings do not support this research.

The review indicates that the most commonly used substances - alcohol, caffeine, and nicotine can significantly affect sleep (20). These sleep disturbances have underlying etiologies attributed to neurobiological alterations caused by substances of use and are usually manifested objectively as polysomnographic changes.

According to a previous study, the odds for sleep bruxism seem to increase almost 1.5 times for people who drank more than 8 cups of coffee per day and more than two times for current smokers (1). The results described in the present study are consistent with these results only for nicotine intake.

In smokers, nicotine accumulates in their bodies during the daytime, decreasing gradually during sleep. In turn, higher levels of smoking, leading to increased levels of nicotine and dopamine release, could be more strongly related to bruxism (21,22).

The increase in caffeine-containing food products has increased the importance of caffeine and its potential cumulative effects on behavior and physiology. Of particular worry is the rate of caffeine intake among populations undergoing a high-stress level. Thus, it is essential to identify the factors that trigger or aggravate bruxism that can be relatively easy management.

Conclusion

Based on limited evidence in this study, bruxism was associated positively with nicotine intake. The association between the studied stimulants could not be neglected. Nevertheless, there is still a need for some additional evidence. Cigarette smoking may be a predisposing factor for developing or aggravating bruxism. This association should be further assessed in the presence of some contributing and personality factors.

Consent for publication

Written informed consents for publication of any associated data and accompanying images were obtained from all patients.

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