

Habitual caffeine use in psychiatric patients: relationship with sleep quality and symptom severity

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ABSTRACT

Objective: The purpose of this study was to investigate the patterns of caffeine use and the one-month prevalence of caffeine intoxication among psychiatric patients in comparison with healthy controls. **Methods:** Four hundred and one patients with various psychiatric disorders and 150 healthy controls were screened for current (one month) caffeine intoxication according to the Diagnostic and Statistical Manual of Mental Disorders, fourth edition. All participants were asked to complete Pittsburgh Sleep Quality Index (PSQI). The patients were also assessed with the Clinical Global Impression Scale (CGI) to determine symptom severity. **Results:** The amount of daily caffeine consumption was statistically significantly higher in healthy control subjects than in patients. However, the prevalence of caffeine intoxication was greater among patients with a psychiatric disorder (8%) when compared with healthy controls (2.7%). In the patients, the amount of caffeine consumption correlated positively with age, CGI, and PSQI scores, indicating that patients with older age, poorer sleep quality, and more severe pathology consumed higher amounts of caffeine. **Conclusions:** Caffeine intoxication was more prevalent in psychiatric patients than in healthy subjects. The amount of caffeine intake was shown to be associated positively with the severity of pathology and inversely with sleep quality. Further studies are needed to investigate the effect of regulating caffeine consumption on severity of pathology and sleep quality among psychiatric patients. (*Anatolian Journal of Psychiatry* 2016; 17(1):26-32)

Keywords: habitual caffeine use, psychiatric patients, prevalence, sleep quality

Psikiyatri hastalarında kafein kullanma alışkanlığı: Uyku kalitesi ve belirti şiddeti ile ilişkisi

ÖZ

Amaç: Bu çalışmanın amacı, psikiyatri hastalarında kafein kullanımı örüntüsünü ve bir aylık kafein zehirlenmesi yaygınlığını sağlıklı kontrollerle karşılaştırmalı olarak incelemektir. **Yöntem:** Çeşitli tanılara sahip 401 psikiyatri hastası ile 150 sağlıklı gönüllü, bir aylık kafein zehirlenmesi açısından Ruhsal Bozuklukların Tanısal ve Sayımsal El Kitabı, dördüncü baskısına göre tarandı. Tüm katılımcılardan Pittsburgh Uyku Kalitesi İndeksini (PUKİ) doldurmaları istendi. Hastalar, belirti şiddetlerini belirlemek amacıyla Klinik Global İzlenim Ölçeği (KGİÖ) ile değerlendirildi. **Bulgular:** Sağlıklı kontrollerin günlük kafein tüketim miktarı, hastalarınkinden daha yüksekti. Ancak sağlıklı kontrollerle karşılaştırıldığında (%2.7), hastalarda kafein zehirlenmesi yaygınlığı (%8) anlamlı olarak daha fazla bulundu. Hastalar arasında kafein tüketim miktarı ile yaş, KGİÖ ve PUKİ puanları arasında olumlu yönde anlamlı bir ilişki saptandı ki, bu daha yaşlı, daha kötü uyku kalitesine sahip ve belirti şiddeti daha fazla olan hastaların daha fazla kafein tükettiğine işaret etmekteydi. **Sonuçlar:** Kafein zehirlenmesi yaygınlığı psikiyatri hastalarında sağlıklı kontrollerle göre daha yüksekti. Kafein tüketim miktarı hastalık şiddeti ile doğru, uyku kalitesi ile ters olarak ilişkiydi. Psiki-

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Received: November 25th 2014, Accepted: March 11th 2015, doi: 10.5455/apd.173655

Anatolian Journal of Psychiatry 2016; 17:26-32

yatri hastalarında kafein tüketiminin düzenlenmesi ve bunun hastalık şiddetine etkisini araştırarak çalışmalara gereksinme vardır. (*Anadolu Psikiyatri Derg* 2016; 17(1):26-32)

Anahtar sözcükler: Kafein kullanım alışkanlığı, psikiyatri hastaları, yaygınlık, uyku kalitesi

INTRODUCTION

Caffeine is one of the most widely used psychoactive substances worldwide. Caffeine-containing popular beverages include coffee, tea, and cola. Chocolate preparations and cold medicines are also the sources of caffeine. Caffeine acts as a central nervous system stimulator and affects the levels of several neurotransmitters. The effects of caffeine are suggested to occur via phosphodiesterase inhibition. In high doses, caffeine leads to decreased intracellular calcium levels and antagonises adenosine receptors. The first effect of daily caffeine consumption is on adenosine receptors.¹ Caffeine, in low doses, may increase alertness, concentration, exercise tolerance and decrease tiredness. When taken chronically, however, it may cause withdrawal symptoms, cognitive decline, and dysphoria.^{2,3}

It is estimated that 80% of the global population consume caffeine daily. The amount of caffeine consumption and the sources of caffeine may differ across cultures. For instance, while daily caffeine consumption is less than 50 mg in developing countries, it is approximately 400 mg in European countries such as Sweden and England.⁴ The prevalence of caffeine-related disorders is unknown because of frequent use of caffeine.

Despite comprehensive research, there is not a consensus on the health-related consequences of caffeine consumption. Most of the studies are conducted on healthy subjects and the effects of caffeine consumption in patients with psychiatric disorders are rarely described. Caffeine produces its neuropsychiatric effects by blocking adenosine A1 and A2 receptors. Adenosine A1 receptor is found in almost every area of the brain, especially in hippocampus, cerebral cortex, cerebellar cortex, and thalamus. It is suggested that important connections exist between adenosine receptors and dopaminergic system.^{5,6} Given that caffeine may increase dopaminergic activity, it can worsen psychotic symptoms in patients with schizophrenia.⁷

Caffeine in doses over 250 mg can cause intoxication, known as 'caffeinism'. The symptoms of caffeinism are restlessness, irritability, excitement, gastrointestinal malfunctioning, sleep disorders, and psychomotor agitation. The symp-

toms of caffeinism share common features with those of several psychiatric disorders.⁸ Caffeine consumption is linked with anxiety disorders, sleep disorders, and eating disorders and is possibly associated with schizophrenia.⁹ Caffeine-related mania has rarely been described, and the association of caffeine consumption with mania is not clear.¹⁰

We determine that there is not a study on the pattern of caffeine consumption and its effect on sleep quality in psychiatric patients in Turkey. So, in the present study, we aimed to investigate the amount of caffeine consumption and the one-month prevalence of caffeine intoxication among psychiatric patients in comparison with healthy controls, with the examination of the effect of caffeine consumption on the severity of the disorder and sleep quality in these patients.

METHODS

Subjects

Study subjects were 401 patients, [140 with a mood disorder (MD) (110 with unipolar depression, 23 with bipolar I disorder, seven with bipolar II disorder); 165 with an anxiety disorder (AD) (83 with generalised anxiety disorder, 31 with panic disorder, 43 with obsessive-compulsive disorder, eight with social anxiety disorder); 54 with schizophrenia spectrum disorder (SSD) (39 with schizophrenia, 15 with schizoaffective disorder) and 42 with a somatoform disorder (SD) (22 with conversion disorder, 20 with somatization disorder] who were admitted to the Department of Psychiatry of Firat University Hospital and 150 healthy controls who were recruited from hospital staff and the community.

The study complied with the Declaration of Helsinki, and was approved by institutional ethics committee of Firat University. All patients -or their legal representatives- and controls gave informed consent prior to entry into this study.

The inclusion criteria for the patients and control subjects were as follows: 1) absence of a traumatic or organic brain injury, 2) being aged between 18 and 65 years, 3) absence of any physical disease according to complete history, physical examination, and routine blood and urine tests, 4) signing informed consent prior to entry into this study.

Procedure

A detailed psychiatric history was obtained from each patient. An information form was used to obtain sociodemographic information such as age, gender, marital status, and education level. The Structured Clinical Interview for DSM-IV (SCID-I)¹¹ was used to diagnose Axis-I psychiatric disorders. The information about the average amount of daily caffeine consumption and maximum amount consumed on any one day were obtained as well as the amount of average daily consumption of caffeine before the onset of the psychiatric disorder. Caffeine intoxication was determined according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) criteria.⁴ The amount of caffeine consumption was standardised according to DSM-IV-TR.

Measures

The Structured Clinical Interview for DSM-IV (SCID-I): It is a semi-structured diagnostic interview which has been widely used to diagnose lifetime and current DSM-IV Axis-I disorders.¹¹ The SCID-I assesses seven diagnostic clusters (mood disorders, psychotic disorders, alcohol- and substance-related disorders, anxiety disorders, somatoform disorders, eating disorders, and adjustment disorders). Validation of the Turkish version of the SCID-I was conducted by Çorapçıoğlu and Aydemir.¹²

The Clinical Global Impression Scale (CGI): This scale, which is developed by Guy et al.,¹³ is a 3-item questionnaire designed to assess global severity of illness and change in the

clinical condition over time. The CGI consists of three global scales: 1) severity of illness, 2) efficacy index, and 3) global improvement. In the present study, only the 'severity of illness' scale was used.

Pittsburgh Sleep Quality Index (PSQI): The PSQI¹⁴ was used to measure sleep disturbance over the previous month. It consists of 19 items evaluated over seven domains that include subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleep medications and daytime dysfunction. Greater scores show worse sleep quality. Turkish version of PSQI was validated by Agar-gun et al.¹⁵

Statistical Analysis

Statistical Package for Social Sciences software (SPSS 18.0, Chicago, IL, USA) was used for analysis. Descriptive parameters were shown as mean±standard deviation or in percentages. Continuous variables were analyzed by Student t test or analysis of variance (ANOVA). Chi-square test was used to analyze the differences in categorical variables between groups. Pearson's correlation tests were used to evaluate the association between the amount of caffeine consumption and other continuous variables. A p value of <0.05 was considered statistically significant.

RESULTS

The education level of the control group was

Table 1. Sociodemographic characteristics of the patients and healthy comparison subjects

	Controls (n=150) %		Patients (n=401) %		MD (n=140) %		AD (n=165) %		SSD (n=54) %		SD (n=42) %	
Age (years)	36.3±12.8		35.5±13.3		36.0±12.7		34.5±14.2		36.8±11.6		35.8±13.6	
Gender												
Female	86	57	251	63	88	63	110	67	19	35	34	81
Male	64	43	150	37	52	37	55	33	35	65	8	19
Marital status												
Single	49	33	172	43	59	42	68	41	32	59	13	31
Married	93	62	207	52	71	51	91	55	17	32	28	67
Divorced	8	5	22	5	10	7	6	4	5	9	1	2
Education level												
5 years	31	21	167	42	61	44	60	36	20	37	26	62
8 years	15	10	42	10	11	8	14	9	11	20	6	14
11 years	38	25	127	32	46	33	60	36	15	28	6	14
>13	66	44	65	16	22	15	31	19	8	15	4	10

AD: anxiety disorders; MD: mood disorders; SD: somatoform disorder; SSD: schizophrenia spectrum disorder
* $\chi^2=25.46$, $p<0.001$; † $\chi^2=20.31$, $p=0.009$; ‡ $\chi^2=50.32$, $p<0.001$

higher than that of the patient group ($\chi^2=50.32$, $p<0.001$).

Sixty-five percent of the patients with SSD were male, whereas 81% of those with SD were female, and the difference was statistically significant ($\chi^2=25.46$, $p<0.001$). Fifty-nine percent of the patients with SSD were single ($\chi^2=20.31$, $p=0.009$) (Table 1).

The amount of daily caffeine consumption was significantly higher in healthy control subjects than in all patients ($p=0.032$) and in patients with AD ($p=0.007$). The patients with SSD consumed

statistically significantly more caffeine daily when compared with patients with AD ($p=0.001$) and those with a SD ($p=0.026$). The amount of maximum caffeine consumption was significantly higher in controls than in all patients ($p=0.017$) and in patients with AD ($p=0.004$). The amount of maximum caffeine consumption was statistically significantly higher in patients with SSD than in patients with an AD ($p=0.003$) and in those with SD ($p=0.023$). There was no difference between disorder clusters in respect to the amount of caffeine consumption before the onset of the disorder (Table 2).

Table 2. The amount of caffeine consumption in patients and controls (mg/day)

	Daily consumption* Mean±SD	Maximum consumption† Mean±SD	Daily consumption before the onset of the disorder Mean±SD
Control group	208±123	478±183	
Patient group	179±146	433±200	183±158
Mood disorders MD	188±151	447±208	203±184
Anxiety disorders AD	155±136	401±181	159±138
Schizophrenia spectrum dis.	243±153	526±217	220±152
Somatoform disorder	158±138	398±183	157±132

* $F=4.62$ controls and patients, $p=0.032$; SSD and AD, $p=0.001$; SSD and SD, $p=0.026$;

† $F=5.76$ control and patients, $p=0.017$; SSD and AD, $p=0.003$; SSD and SD, $p=0.023$

Daily caffeine consumption was higher in men (226 ± 157 mg) than in women (150 ± 132 mg) ($F=26.21$, $p<0.001$). Male patients consumed statistically significantly more caffeine daily before the onset of the disorder when compared with female patients (217 ± 152 mg, vs 162 ± 159 mg) ($F=11.32$, $p=0.001$). The amount of maximum caffeine consumption was statistically significantly higher in male patients (512 ± 195 mg/day) than in female patients (386 ± 188 mg/day) ($F=40.28$, $p<0.001$).

The amount of daily caffeine consumption in smoker patients ($n=141$, 238 mg) was statistically significantly higher than in non-smoker ones ($n=260$, 146 mg) ($t=5.94$, $p<0.001$). Moreover, the maximum amount of caffeine consumption was also higher in smoker patients (519 mg/day) than in non-smoker ones (387 mg/day) ($t=6.60$, $p<0.001$). The amount of daily caffeine consumption in smoker controls ($n=45$, 258 mg) was statistically significantly higher than in non-smoker ones ($n=105$, 186 mg)

Table 3. The comparison of PSQI scores between patients and controls

PSQI	Patients	Controls	t	p
Sleep quality	1.37±0.86	0.83±0.64	7.91	<0.001
Sleep latency	1.23±1.03	1.04±0.88	2.12	0.034
Sleep duration	1.02±1.17	0.57±0.83	4.99	<0.001
Habitual sleep efficiency	0.69±0.94	0.39±0.73	3.90	<0.001
Sleep disturbance	1.10±0.57	0.97±0.44	2.90	0.004
Use of sleep meds	1.09±1.34	0.23±0.69	9.78	<0.001
Daytime disturbance	0.90±1.06	0.49±0.73	5.14	<0.001
Global sleep quality	7.40±4.63	4.51±3.13	8.39	<0.001

PSQI, Pittsburgh Sleep Quality Index

($t=3.41$, $p=0.001$). The maximum amount of caffeine consumption was also higher in smoker control subjects (545 mg mg/day) than in non-smoker ones (450 mg mg/day) ($t=2.97$, $p=0.003$).

Total PSQI score and all PSQI subscale scores were statistically significantly higher in patients than in comparison subjects (Table 3)

In the patients with a psychiatric disorder, the amount of daily caffeine consumption correlated positively with age ($r=0.122$, $p=0.015$), CGI ($r=0.166$, $p=0.001$) and PSQI ($r=0.158$, $p=0.002$) scores, indicating that patients with older age, poorer sleep quality, and more severe pathology consumed higher amounts of caffeine. Sleep quality, as measured by PSQI, also correlated positively with age ($r=0.260$, $p<0.001$) and severity of the pathology ($r=0.188$; $p<0.001$).

The current, one month, prevalence of caffeine intoxication was greater among patients with a psychiatric disorder (8%) when compared with healthy controls (2.7%) ($p=0.025$).

DISCUSSION

In the present study, we found that age and severity of the disorder were positively correlated with the amount of caffeine consumption in psychiatric patients. Poorer sleep quality was associated with increased severity of the pathology. Caffeine intoxication was more prevalent in patients with a psychiatric disorder when compared with healthy controls.

Ciapparelli et al.¹⁶ have observed that a group of psychiatric patients had mean daily caffeine intake of 281 mg, maximum lifetime caffeine intake of 630 mg/day, and daily average caffeine intake of 338 mg. In our study, mean daily caffeine consumption was 179 mg, maximum daily caffeine consumption was 433 mg, and mean daily caffeine consumption before the onset of the disorder was 183 mg in patients with a psychiatric disorder. The different amounts found in our study and that of Ciapparelli et al.¹⁶ may be due to the cultural differences in caffeine consumption attitudes. The authors¹⁶ found no differences between patients and comparison subjects with respect to daily and maximum caffeine intake. They revealed that maximum amount of caffeine intake was highest in patients with an eating disorder. However, in our study, healthy controls reported higher amounts of daily and maximum caffeine intake when compared with psychiatric patients. Our study sample did not include pa-

tients with an eating disorder which may contribute to divergent results found in two studies.

In our study, patients with a SSD reported higher daily and maximum caffeine intake when compared with those with an AD and SD. Similarly, Rihs et al.¹⁷ have shown that patients with schizophrenia consumed more caffeine than those with anxiety and depressive disorders. Because caffeine may increase dopaminergic activity, it may worsen psychotic symptoms in patients with schizophrenia antipsychotic treatment, being overweight and smoking may lead to excess amounts of caffeine consumption in schizophrenic patients. It might be wise to regulate caffeine intake in patients with schizophrenia^{1,17} although a few studies have claimed that there was no crucial need for such a regulation.^{18,19}

The patients with anxiety disorders tend to consume lower amounts of caffeine and experience higher levels of anxiety following caffeine intake.¹ Paralelly, we found that patients with an AD consumed lower amounts of daily and maximum caffeine when compared with those with a SSD and MD. Caffeine in high doses may induce symptoms mimicking those of anxiety disorders such as restlessness, irritability, excitement, flushing, palpitation, restlessness, and epigastric sensation.²⁰ Caffeine, elevating lactate levels in the brain^{21,22} can also aggregate anxiety.^{20,23} The patients with panic disorder exhibit increased sensitivity to the effects of caffeine, and caffeine may trigger panic attacks.²⁴

Patients with MD were shown to report higher amounts of caffeine consumption than patients with AD, but lower amounts than those with SSD or eating disorder.¹⁶ Similarly, we observed that patients with MD consumed lower amounts of daily and maximum caffeine than patients with SSD, but higher amounts than those with AD. The patients with mood disorders may use caffeine to elevate mood and performance.²⁵ There are case reports of caffeine-induced mania.^{10,26}

We found that male patients consumed higher amounts of caffeine before the onset of the disorder when compared with female patients. Our findings are inconsistent with the study by Hughes et al.²⁷ in which no difference was observed between male and female schizophrenic patients according to caffeine consumption before the onset of the disorder. In our study, there was no difference between men and women with respect to caffeine use after the onset of the disorder.

In our study sample, older age was found to be associated with increased caffeine intake. Johnson-Green et al.²⁸ have shown a similar pattern among college students. In the United States of America, daily caffeine intake is 4 mg/kg in individuals aged between 35 and 49, while that is 2 mg/kg in those aged between 20 and 24.²⁹

There is a strong and significant association between coffee consumption and smoking.³⁰ As well, we observed that both patients and controls who smoked consumed higher amounts of caffeine when compared with non-smoker participants. This may be explained by a common tendency to use these substances.³¹ Increased elimination of caffeine by smokers may be another explanation.³¹ Moreover, studies have shown that caffeine increases the reinforcing effects of smoking.³⁰

Consistent with the previous literature,^{16,32} the amount of caffeine consumption was found to be positively associated with the severity of the pathology. The causal relationship between caffeine intake and symptom severity in psychiatric disorders has not been clearly described. The pattern of caffeine consumption should be carefully queried in patients with a psychiatric disorder.

It is well known that caffeine may negatively affect sleep quality by increasing sleep latency and causing night awakenings.^{33,34} However, there are not many studies investigating the effect of caffeine on sleep quality in psychiatric patients.³⁵ In the present study, patients were found to have poorer sleep quality as compared with healthy controls. In patient group, furthermore, the amount of caffeine consumption corre-

lated positively with global sleep quality score.

One-year prevalence of caffeine intoxication among randomly assigned caffeine users was reported to be 7%.³⁶ Ciapparelli et al.¹⁶ have found that 10.3% of the psychiatric patients fulfilled current DSM-IV intoxication criteria for caffeine. The prevalence of caffeine intoxication in the patient group of our study sample was found to be 8%. Caffeine intoxication rate was higher among patients when compared with healthy controls (2.7%), which is a similar finding to that in the study by Ciapparelli et al.¹⁶ High intoxication rates despite relatively lower amounts of caffeine consumption in psychiatric patients may be due to increased sensitivity to the effects of caffeine and tendency to caffeine intoxication in this patient group.

Despite the relatively large number of participants in the current study, several limitations have to be considered in interpreting our results. First, psychiatric diagnoses were relatively heterogeneous. Second, plasma levels of caffeine could not be measured. Third, other confounding factors that might affect the consumption of caffeine were not assessed.

Our study demonstrates that caffeine intoxication is more prevalent in psychiatric patients than in healthy subjects. The amount of caffeine intake was shown to be associated positively with the severity of pathology and inversely with sleep quality. Therefore, the pattern of caffeine use should be carefully assessed in patients with a psychiatric diagnosis. Further studies are needed to investigate the effect of regulating caffeine consumption on severity of pathology and sleep quality among psychiatric patients.

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