

Attention-Deficit/Hyperactivity Disorder and Nicotine Dependence in Adults

Erişkinlerde Dikkat Eksikliği ve Hiperaktivite Bozukluğu ve Sigara Bağımlılığının Klinik Özellikler Açısından İlişkisinin Araştırılması

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ABSTRACT

Introduction: The aim of this study is to assess clinical characteristics and smoking profiles of individuals diagnosed with attention-deficit/hyperactivity disorder (ADHD) and compare their nicotine dependence status with healthy controls for better understanding the mutual and complex relationship between ADHD and smoking.

Methods: We included the following participants in the study: 40 adults with the diagnosis of ADHD, 40 participants who visited the smoking cessation polyclinic without any psychiatric disorders, and 40 healthy controls. A sociodemographic data form, Wender Utah Rating Scale (WURS), Adult ADD/ADHD Diagnosis and Evaluation Inventory, and Fagerstrom Nicotine Dependence Test (FNBT) were administered to the participants.

Results: Mean age of the ADHD, nicotine dependence, and control groups was 28.68±7.22, 34.17±8.60, 33.70±7.45 years, respectively. Percentages of females and males were 27.5% and 72.5% in the ADHD group, 50% and 50% in the nicotine dependence group, 47.5% and

52.5% in the control group. The attention-deficit scores in the ADHD, nicotine dependence, and control groups were 21.18±5.05, 7.23±3.96, 4.75±2.65, respectively (p=0.001), whereas the hyperactivity scores were 7.3±5.84, 6.43±4.2, and 3.58±2.27, respectively (p=0.001). The related features scores were 56.53±12.96, 24.30±13.93, and 13.13±6.11, respectively (p=0.001), whereas the WURS scores were 61.88±12.69, 23.03±16.07, 11.90±8.15, respectively (p=0.001). FNBT scores in ADHD and nicotine dependence groups were 5.83±2.11 and 6.20±2.74, respectively (p=0.495).

Conclusion: Considering the argument of ADHD being an independent risk factor for nicotine dependence, we think the co-occurrence of the smoking addiction and ADHD symptoms in the context of dopamine dysregulation is important in the clinical setting. Treatment modalities and of preventive strategies should be considered while keeping this in mind.

Keywords: Smoking addiction, adult attention-deficit hyperactivity disorder

ÖZ

Amaç: Bu çalışmanın amacı DEHB ile sigara kullanımı arasındaki karşılıklı ve karmaşık ilişkinin daha iyi anlaşılması için DEHB tanısı alan bireylerin sigara kullanım profilleri ile sigara bağımlılığı bulunan bireylerin DEHB belirtilerinin sağlıklı kontroller ile karşılaştırılmasıdır.

Yöntem: Araştırmaya, DEHB polikliniğinde takip edilen 40 erişkin DEHB hastası, sigara bırakma polikliniğine başvuran, ek psikiyatrik hastalığı olmayan, sigara bağımlılığı bulunan 40 katılımcı ve 40 sağlıklı kontrol çalışmaya alınmıştır. Katılımcılara Sosyodemografik Veri Formu, Wender-Utah Değerlendirme Ölçeği (WUDÖ), Erişkin DEB/DEHB Tanı ve Değerlendirme Envanteri, Fagerstrom Nikotin Bağımlılık Testi (FNBT) uygulanması planlanmıştır.

Bulgular: Grupların yaş ortalaması DEHB: 28,68±7,22, sigara bağımlılığı: 34,17±8,60, kontrol grubu: 33,70±7,45 idi. Kadın ve erkek yüzdeleleri DEHB grubunda sırasıyla %27,5; %72,5, sigara bağımlılığı grubunda sırasıyla %50; %50, kontrol grubunda ise %47,5; %52,5 idi. Dikkat eksikliği puanı DEHB, sigara bağımlılığı ve kontrol gruplarında sırasıyla

21,18±5,05, 7,23±3,96, 4,75±2,65'ti (p=0,001). Hiperaktivite puanı sırasıyla 7,3±5,84, 6,43±4,2, 3,58±2,27'ti (p=0,001). Dikkat eksikliği ile ilişkili özellikler puanı sırasıyla 56,53±12,96, 24,30±13,93, 13,13±6,11 idi (p=0,001). WUDÖ puanları sırasıyla 61,88±12,69, 23,03±16,07, 11,90±8,15 idi (p=0,001). FNBT puanları ise DEHB ve sigara bağımlılığı gruplarında sırasıyla 5,83±2,11, 6,20±2,74 idi (p=0,495).

Sonuç: Sigara bağımlılığı ve DEHB semptomlarının birlikteliğinin klinik açıdan değerlendirmelerde önemli olduğunu düşünüyoruz. DEHB ve sigara bağımlılığında dopaminerjik sistemdeki düzensizlikler ve tedavide kullanılan ilaçların aynı sistem üzerine etkili olması her iki bozukluk için benzer etyolojiyi düşündürmektedir. Erişkin dönemde de devam ettiği bilinen DEHB ve sigara bağımlılığı ilişkisinin ileride bu konuda yapılan araştırmalarla daha iyi anlaşılacağını umuyoruz.

Anahtar kelimeler: Erişkin dikkat eksikliği hiperaktivite bozukluğu, sigara bağımlılığı

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INTRODUCTION

Attention-Deficit/Hyperactivity Disorder (ADHD) is a neuropsychiatric condition that usually has a childhood onset and often persists in adulthood, with prevalence rates ranging from 2%-6% (1). Compared to the general population, individuals with ADHD are at increased risk for early smoking initiation, higher smoking prevalence, and lower quitting rates (2,3,4,5,6,7). Many factors, ranging from genetic linkage to psychological and social vulnerabilities, have been hypothesized to play role in the co-occurrence of ADHD and smoking (8). Variants of genes involved in the dopaminergic and serotonergic neurotransmission and metabolism are suggested to involve in the pathogenesis of both disorders (8,9,10,11,12,13,14,15).

Attention-Deficit/Hyperactivity Disorder subtypes such as (i) predominantly inattention, (ii) predominantly hyperactivity/impulsivity, and (iii) combined inattention and hyperactivity/impulsivity demonstrate distinct characteristics of psychiatric comorbidities (16). Evidence are present regarding nicotine improves attentiveness and decreases deficits in dopaminergic function related to inattention problems, executive dysfunction especially inattention, and therefore implying these as some of the factors to promote smoking in adolescents and young adults, prevailing both for ADHD diagnosed or individuals without a diagnosis of ADHD (17,18,19,20). Nicotine patch administration to a sample of nonsmoking adolescents clinically diagnosed with ADHD has been shown to improve cognitive/behavioral inhibition with an effect comparable to methylphenidate (21). Gehricke et al. (22) found out that nicotine alone (administered by patch), in combination with stimulant medication, decreased inattention symptoms while increasing impulse control in a sample of clinically diagnosed adults with ADHD (23). Therefore, the hypothesis that smoking represents a form of self-medication against the ADHD symptomatology among adult smokers has significant validity (24). On the other hand, the impact of hyperactivity/impulsivity as a distinct phenomenon was shown to be more pronounced than the concept of inattention over smoking outcome and prediction of various tobacco use measures, such as initiation, progression to regular smoking, nicotine dependence and increased tendency to relapse (16).

Although studies have focused on the relationship between clinical symptoms of ADHD and smoking, little is known about the effect of ADHD symptoms on the development of nicotine dependence. A recent prospective study has found out that children with ADHD were significantly more likely to exhibit nicotine dependence (ND) at 28 years of follow-up than their non-ADHD peers (25). In another study, clinically diagnosed ADHD adolescents were apparently more likely to be nicotine dependent than non-ADHD controls (26). However, there were no differences with regard to ND between the inattentive/hyperactive subtypes of ADHD in both studies (23). It is also suggested that ADHD medications such as methylphenidate, atomoxetine, and dextroamphetamine may be capable to decrease withdrawal symptoms in smokers with ADHD (7).

There is a limited number of studies investigating the relationship between ADHD and nicotine in our country. Keten et al. (27) also found higher rates of ADHD symptoms in nicotine smokers than in a control group, and proposed that nicotine decreases the symptoms of ADHD. According to our knowledge there are no studies comparing ADHD symptomatology in patients both smoking cessation unit and ND in ADHD unit in our country. Our study is different from other studies in our country because it evaluates the relationship between ND and ADHD in these special units.

Thus the aim of this study is to evaluate symptomatological distinctions among (1) medication-free adults with ADHD (2) smokers (≥ 10 cigarettes daily) who visited clinics for quitting smoking and without having

any other psychiatric disorders, and (3) healthy controls. We also wanted to investigate the impact of ADHD symptoms to the degree of ND. Our study findings will hopefully provide further understanding of the relationship between these two disorders.

METHOD

Participants

(1) ADHD group: Initially, 70 adult patients with ADHD were recruited from patients referred to ADHD clinics. Inclusion criteria were as follows: age 18-65 years, meeting DSM-IV criteria for ADHD as judged by the Adult Clinical Diagnostic Scale (ASRS) version and meeting. The exclusion criteria were as follows: currently having an active psychiatric illness, ongoing treatment for ADHD, major sensorimotor handicaps (e.g., deafness, blindness), inability to follow instructions, and mental retardation.

(2) ND group: Initially, 83 smokers were recruited from patients admitted to a smoking cessation unit. Inclusion criteria were as follows: age 18-65 years, smoking ≥ 10 cigarettes daily. Exclusion criteria were the same with the first group.

(3) Control group: 40 healthy control participants aged 18-65 years were recruited from the hospital staff. Exclusion criteria active smokers apart from other groups' exclusion criteria.

A total of 73 participants were excluded [20 had been undergoing a treatment process for ADHD, 25 had current psychiatric illness (e.g., bipolar disorder, psychosis,) from the ND group, 18 had difficulty following the instructions, 15 from ADHD, 3 from the ND group, 3 had major sensorimotor handicaps from the control group, 7 had inadequate mental capacity from the ADHD group]. Eventually, 40 patients each were included in the ADHD, ND, and control groups. Participants were provided with written informed consent after an investigator's full description of the study protocol. Our hospital's ethics board approved the study protocol.

Measures

A sociodemographic data form: A form provided by the investigator to determine the sociodemographic characteristics e.g., age, education level, and occupation of the participants.

Adult ADD/ADHD DSM-IV-based diagnostic screening and rating scale (ASRS):

ASRS was developed in 1995 by Turgay et al. It is a self-assessment scale completed by individual after they receive due instructions. It includes three sections—the first nine questions evaluate inattention, the second nine questions evaluate hyperactivity/impulsivity, and the third 30 questions evaluate ADHD-related features. All questions were developed according to DSM-IV-based ADHD diagnosis. Turkish validity and reliability was established by Gunay et al. (28).

Wender Utah rating scale (WURS):

WURS was developed by Ward and Wender in 1993 (29). WURS can be used to assess adults for ADHD, and it has a subset of 25 questions related to the diagnosis. It includes five possible responses scored from 0 to 4 points. The validity and reliability of Turkish version WURS was established by Öncü et al. (30), and the cutoff point for diagnosis was defined to be 36.

Fagerstrom for nicotine dependence test (FNDT):

Two self-reported questions were used to assess ND: (i) "On average, how many cigarettes do you now smoke per day?" (responses of ≤ 10 , 11-20, 21-30, and >31 cigarettes, respectively, were coded as 0, 1, 2, and 3), and (ii) "How soon after you wake up do you smoke?" (responses: Within 5 min, 6-30 min, >30 min to 1 h, and >1 h were coded as 3, 2, 1, and 0, respec-

tively). As a result, FNDDT ranged from 0 to 6, with higher scores indicating greater ND (31). The validity and reliability of the Turkish translation of the questions was established by Uysal et al. (32). FNDDT was administered to the ND and ADHD groups.

Statistical Analysis

Statistical Package for the Social Sciences, version 16.0 (SPSS Inc.; Chicago, IL, USA) for Windows was used for statistical analysis. Means, frequencies, and standard deviations were determined. The Kolmogorov-Smirnov test was used to determine whether the data were normally distributed. One-way analysis of variance (ANOVA) was used to determine the differences among the three groups. When there were significant differences among the groups, the Tukey test was employed to perform post hoc comparisons between two groups at a time. Pearson correlation was used for relationships among the variables. A p value of <0.05 was considered as statistically significant.

RESULTS

Forty adult ADHD patients, 40 ND individuals, and 40 healthy controls were included into the study. Mean ages in the ADHD, ND, and control groups were 28.68±7.22, 34.17±8.60, and 33.70±7.45 years, respectively. There was statistically significant difference among the groups in terms of age (p=0.003). Tukey honestly significant difference (HSD) analysis showed that mean age of the ADHD group was statistically less than that in others (p:0.006; p:0.013, respectively). The number of single individuals in the groups was 23, 14, and 13, respectively. The number of single individuals in the ADHD group was significantly greater than in others (p:0.044). The number of married individuals was 10, 22, and 27, respectively. The number of married individuals was significantly lower in the ADHD group than in others (p:0.001). The number of divorced and widowed individuals in the groups was 17, 4, and 0, respectively. The number of divorced and widowed individuals in the ADHD and ND groups were significantly greater than that in the control group (p:0.013). The education level in the ND group was less than that in others. The number of primary school graduates in the groups was 1, 10, and 1, respectively.

The number of primary school graduates in the ND group was statistically higher than that in others (p:0.001). The number of university-educated individuals in the groups was 28, 13, and 27, respectively. The number of university-educated individuals in the ND group (p:0.001). The number of employed patients in the ADHD and ND groups was 26 and 28, respectively. There was statistically no difference between the ADHD and ND groups in terms of employment status (p>0.05). The number of job hopping in ADHD was statistically greater than the others (p:0.001). The frequency of disciplinary punishment in school in the groups was 17, 7, and 0, respectively. The frequency of disciplinary punishment in school was statistically greater in the ADHD group than in others, whereas it was higher in the ND group than in the controls group (p:0.001; Table 1, 2).

The number of judicial prosecution in the groups was 15, 5, and 0, respectively. The number of patients with history of judicial prosecution was statistically greater in the ADHD group than in the control group (p:0.001). The number of judicial punishments in the ADHD group was statistically greater (p:0.001) than that in others, but there was no statistically significant difference between the control and ND groups (p>0.05). The number of judicial punishment of ADHD remained higher among others after controlling for age [OR (95% CI: 4.882 (1.434, 16.624), p:0.011]. The number of traffic fine in groups was 22, 10, and 7, respectively. The number of traffic fine in the ADHD group was statistically more than that in others (p:0.001). The number of traffic penalty of ADHD remained higher among others after controlling for age [OR (95% CI: 5.512 (1.852, 16.409), p:0.002]. The number of substance use in groups was 10, 0, and 0, respectively. Substance abuse in the ADHD group was statistically more prevalent than that in others (p:0.001). The number individuals with family history of psychiatric disorders in the groups was 15, 4, and 3 respectively. Familial history of psychiatric disorder in the ADHD group was statistically higher than that in others (p:0.001). The number of familial history of psychiatric disorders of ADHD remained higher among others after controlling for age [OR (95% CI: 6.408 (1.749, 23.473), p:0.005; Table 3].

Table 1. Sociodemographic variables of the study groups

		ADHD n (%)	ND n (%)	Control n (%)	p
Age	Mean±SD	28.68±7.22	34.17±8.60	33.70±7.45	^a 0.003**
Sex	Female	11 (27.5)	20 (50.0)	19 (47.5)	^b 0.082
	Male	29 (72.5)	20 (50.0)	21 (52.5)	
Marital status	Single	23 (57.5)	14 (35.0)	13 (32.5)	^b 0.044*
	Married	10 (25.0)	22 (55.0)	27 (67.5)	^b 0.001**
	Divorced+widow	7 (17.5)	4 (10.0)	0 (0.0)	^c 0.013*
Education level	Primary (low)	1 (2.5)	10 (25.0)	1 (2.5)	^c 0.001**
	Secondary	3 (7.5)	9 (22.5)	2 (5.0)	^c 0.059
	High	8 (20.0)	8 (20.0)	10 (25.0)	^b 0.822
	College	28 (70.0)	13 (32.5)	27 (67.5)	^b 0.001**
Grade repetition	Yes	20 (50.0)	33 (82.5)	37 (92.5)	^b 0.001**
Employment	Yes	26 (65.0)	28 (70.0)	40 (100.0)	^b 0.001**
Job hopping	None	15 (37.5)	19 (47.5)	28 (70.0)	^b 0.012**
	Occasionally	11 (27.5)	20 (50.0)	12 (30.0)	^b 0.071
	Frequently	14 (35.0)	1 (2.5)	0 (0.0)	^b 0.001**

^aOne-way ANOVA; ^bPearson Chi-Square; ^cFisher-Freeman-Halton Exact Test; **p<0.01; ADHD: adult attention-deficit hyperactivity disorder; ND: nicotine dependence; SD: standard deviation

Inattention scores in the groups were 21.18 ± 5.05 , 7.23 ± 3.96 , and 4.75 ± 2.65 respectively. There was statistically significant difference among groups in terms of inattention scores ($p:0.001$). According to Tamhane T2 test inattention scores were higher in ADHD than the others ($p:0.001$; $p:0.001$). The scores of inattention were higher in the ND group than in the control group ($p:0.005$). There was also statistically significant difference among groups in terms of hyperactivity. The scores of hyperactivity in the groups were 17.73 ± 5.84 , 6.43 ± 4.21 , 3.58 ± 2.27 , respectively. According to Tamhane T2 test hyperactivity scores were higher in ADHD than the others ($p:0.001$; $p:0.001$). The scores of hyperactivity were higher in the ND group than that in the control group ($p:0.001$).

Statistically significant difference was shown among the groups in terms of ADHD-related symptoms ($p:0.001$). The scores of ADHD-related features in groups were 56.53 ± 12.96 , 24.30 ± 13.93 , 13.13 ± 6.11 , respectively. According to Tamhane T2 test ADHD-related symptom scores were higher in the ADHD group than in others ($p:0.001$ and $p:0.001$, respectively). The scores of ADHD-related symptoms were higher in the ND group than in the control group ($p:0.001$). There was statistically significant dif-

ference among groups in terms of WURS scores ($p:0.001$). WURS scores in the groups were 61.88 ± 12.69 , 23.03 ± 16.07 , and 11.90 ± 8.15 , respectively. According to Tamhane T2 test WURS scores in the ADHD group were higher than the others (in order; $p:0.001$; $p:0.001$). The scores of WURS were higher in the ND group than in the control group ($p:0.005$). The scores of FNDDT in the ADHD and ND groups were 5.83 ± 2.11 and 6.20 ± 2.74 , respectively (Table 4, 5).

There was no statistically significant correlation among FNDDT scores and attention-deficit, hyperactivity, related features and WURS scores in either the ADHD or ND groups (ADHD group: $p:0.874$, $p:0.514$, $p:0.341$, $p:0.685$; ND group: $p:0.484$, $p:0.647$, $p:0.256$, $p:0.124$, respectively) (Table 6). There was no statistically significant correlation among FNDDT scores and attention-deficit, hyperactivity, related features and WURS scores even after controlling age ($p>0.05$).

DISCUSSION

The aim of this study is to evaluate whether distinct ADHD symptoms have an impact on presence or severity of ND and whether this effect differed by specific ADHD symptoms (inattention or hyperactivity-impulsivity). In our study, we found out that inattention scores were statistically higher in the ADHD group than in others. The ND and control groups demonstrated a significant difference in scores for hyperactivity, impulsivity and related symptoms, but not those for inattention. FNDDT scores were not correlated with inattention/hyperactivity and related symptoms in both the ADHD and ND groups.

The results of many studies have been interpreted as supporting the view that patients with ADHD might smoke as a self-medication for attentional deficits (33,34). Nicotine may act as a reinforcer for individuals with high levels of inattention symptoms putting account on its positive effects on arousal and attention (35). Contrary to previous study findings which had reported a strong link between inattention symptoms and smoking, our data suggests that there is no significant relationship between ADHD-inattention scores and FNDDT scores. In addition, Lerman et al. (36) suggested that inattention scores were more likely to show a correlation with depressive symptoms; in addition, by emphasizing the high prevalence of smoking in depression, the authors hypothesized an independent mediating effect of depression is much more likely than that of smoking. In our study, comorbidity of depression was an exclusion criterion. When considering the variable of depression independently, it is possible to disregard the relationship between inattention and ND in this current methodology.

In studies that examined the relationship among ADHD symptoms and smoking outcome, prediction of various tobacco use measures, such as initiation, progression to regular smoking or ND, and increased tendency to relapse, more apparent connection was evident in favor of hyperactivity/

Table 2. Pairwise comparison of age (post hoc analysis)

	ADHD/ND	ADHD/Control	ND/Control
Age	0.006**	0.013*	0.960

Tukey HSD Test; * $p<0.05$; ** $p<0.01$; ADHD: adult attention-deficit hyperactivity disorder; ND: nicotine dependence

Table 3. Assessment of criminal and medical characteristics

	ADHD n (%)	ND n (%)	Control n (%)	p
Disciplinary punishment at school	17 (42.5)	7 (17.5)	0 (0.0)	^a 0.001**
Judicial process	15 (37.5)	5 (12.5)	0 (0.0)	^a 0.001**
Penalty	7 (17.5)	0 (0.0)	0 (0.0)	^b 0.001**
Traffic penalty	22 (55.0)	10 (25.0)	7 (17.5)	^a 0.001**
Substance use	10 (25.0)	0 (0.0)	0 (0.0)	^b 0.001**
Family history of psychiatric illness	15 (37.5)	4 (10.0)	3 (7.5)	^a 0.001**
Psychiatric admission	1 (2.5)	3 (7.5)	0 (0.0)	^b 0.322
Psychiatric admission in military duty (n=70)	3 (10.3)	2 (10.0)	0 (0.0)	^b 0.376

^aPearson chi-square; ^bFisher-Freeman-Halton Exact Test; ** $p<0.01$; ADHD: adult attention-deficit hyperactivity disorder; ND: nicotine dependence

Table 4. Comparison of attention-deficit, hyperactivity, related features, WURS and Fagerstrom scores among the groups

	ADHD		ND		Control		p
	Min-Max	Mean \pm SD	Min-Max	Mean \pm SD	Min-Max	Mean \pm SD	
Attention deficit	9.00-29.00	21.18 ± 5.05	0.00-16.00	7.23 ± 3.96	0.00-12.00	4.75 ± 2.65	^a 0.001**
Hyperactivity	7.00-27.00	17.73 ± 5.84	0.00-16.00	6.43 ± 4.21	0.00-11.00	3.58 ± 2.27	^a 0.001**
Related features	28.00-83.00	56.53 ± 12.96	2.00-57.00	24.30 ± 13.93	0.00-30.00	13.13 ± 6.11	^a 0.001**
WURS	30.00-84.00	61.88 ± 12.69	2.00-70.00	23.03 ± 16.07	2.00-44.00	11.90 ± 8.15	^a 0.001**
FNDDT	2.00-10.00	5.83 ± 2.11	1.00-10.00	6.20 ± 2.74	-	-	^b 0.495

^aOne-way ANOVA analysis; ^bStudent t-test; ** $p<0.01$; ADHD: adult attention-deficit hyperactivity disorder; ND: nicotine dependence; WURS: Wender Utah Rating Scale; FNDDT: Fagerstrom nicotine dependence test; Min: minimum; Max: maximum; SD: standard deviation

Table 5. Pairwise comparisons (post hoc analyses)

	ADHD/ND	ADHD/Control	ND/Control
Attention deficit	0.001**	0.001**	0.005**
Hyperactivity	0.001**	0.001**	0.001**
Related features	0.001**	0.001**	0.001**
WURS	0.001**	0.001**	0.001**

Tamhane's T2; **p<0.01; ADHD: adult attention-deficit hyperactivity disorder; ND: nicotine dependence; WURS: wender Utah rating scale

Table 6. Correlation of FNDT scores and attention-deficit, hyperactivity, related features and WURS Scores

	FNDT		Nicotine Dependence	
	r	p	r	p
Attention-deficit	-0.026	0.874	0.114	0.484
Hyperactivity	0.106	0.514	0.075	0.647
Related features	0.159	0.341	0.184	0.256
WURS	0.066	0.685	0.247	0.124

r: pearson Chi-square; ADHD: adult attention-deficit hyperactivity disorder; WURS: wender Utah rating scale; FNDT: Fagerstrom nicotine dependence test

impulsivity, rather than inattention (16,37,38,39,40). However, in our study there was no significant relationship between ADHD impulsivity/hyperactivity scores and Fagerstrom scores. Our diversified findings may be explained by means of the mean age of the ADHD group, which was higher than that in other studies (41). Disruptive behaviors and behavioral disinhibition may be predictors of the onset of smoking behavior. It has been suggested that behavioral disinhibition model might better explain the onset of smoking behavior but not maintenance of smoking (42). Since the relation of ADHD symptoms and smoking might show alterations over time; more severe inattention symptoms may be related to acceleration of ND symptoms in adolescence and deceleration during adulthood (39). Moreover, comorbidity of alcohol dependence was an exclusion criterion in our study, and it is suggested that comorbidity of alcohol dependence might play role in the relationship between ADHD hyperactivity/impulsivity and ND due to the effect of alcohol on impulsivity (2,16). Another dissimilarity of the current study from the previous studies was the criteria based on a history of lifetime regular cigarette use which was defined as smoking ≤ 10 cigarettes per day was distinct from the other studies in which the primary smoking outcome variables were generally defined on the basis of much more infrequent use (e.g., ever tried at least one puff of a cigarette) (41).

It has been shown that single and divorced individuals are more likely to have ADHD (43,44). In our study, the participants divorced and single were more in ADHD than the other groups. We can suggest that individuals with ADHD experience failure in their relationships because symptoms of this condition, which may lead to their inability to sustain their marriage. Usher et al. (44), in a study including imprisoned men, found a relation between having symptoms of ADHD and low education levels. However, in our study, the ND group had less education level than the ADHD group. In Turkey, 8-year education is compulsory. Requirements to complete this education process and criteria used to assess student performance can explain the similarity between the participants with severe symptoms of ADHD and the general population in terms of education. As shown in our study individuals having financial and judicial problems have also been reported to have high scores for ADHD (30).

In terms of methodological limitations, the following aspects need to be taken into account. First there were demographical differences among the ADHD, ND, and control groups. Secondly, the small study sample might have affected the results. The study sample of ADHD with ND but without any comorbidities neither possessing an ongoing treatment might be the strength of the study. Similar studies investigating the relationship between ADHD and smoking has been held with adolescence or childhood population, and adult ADHD has been given less attention overall. In conclusion, we present evidence supporting the notion that attention-deficit and hyperactivity symptoms seen in adult ADHD is not directly related to ND but possibly through a mediating effect of other psychiatric conditions. We recommend the replication of the study with sociodemographic matching.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Bakırköy Prof. Dr. Mazhar Osman Research and Training Hospital for Psychiatry, Neurology and Neurosurgery (05.02.2013 /41340010/4775-259).

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