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ORIGINAL ARTICLE

Biological Rhythm Disturbances in Drug-Free Adult ADHD Patients

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ABSTRACT

Objective: The aim of study was to examine the biological rhythms in drug-free ADHD patients with healthy controls in a cross-sectional study.

Methods: 50 adult ADHD patients %26 female) between 17 and 42 years old (M=27.76 SD:6.80) and healthy controls (%56.6 female) between 18 and 63 years old (M=31.39 SD:8.12) were recruited from Health Sciences University's Bakirkoy Mental Health Training and Research Hospital. Participants were assessed with clinical interview, Wender-Utah Adult ADHD Rating Scale and the Biological Rhythms Interview of Assessment in Neuropsychiatry (BRIAN).

Results: Adult ADHD patients scored higher on total scores (t=8.75, p<0.001), eating patterns (t=2.55, p<0.001), sleep patterns-social rhythm (t=3.41, p=0.001) and activity levels (t=3.0, p<0.001) in regarding to biologic rhythms. In the BRIAN subdomains; activity levels (t=4.59, p<0.001) and sleep-eating patterns (t=3.62, p<0.001) were also significantly different between the two groups.

Conclusions: Our findings suggested that there was a significant difference between ADHD patients and healthy controls in most dimensions of biorhythm.

Keywords: ADHD, adult, biorhythm, chronotype

INTRODUCTION

As a broad concept, biological rhythms involve various processes such as the regulation of sleep-wake cycle, activity and behavior of the human organism rhythmicity in neuroendocrine and neurophysiological responses, eating patterns, social rhythms, and the regulation of the dominant chronotype (1,2). With the help of these rhythms, we maintain the equilibrium between the endogenous timing system and the external environment. Mood disorders, particularly depressive disorders are known to disturb biological rhythms and have specific effects on sleep (3). Similarly, attention-deficit/hyperactivity disorder (ADHD) has been associated with sleep problems such as increased nocturnal motor activity and instability of the sleep-wake system (4).

Despite several studies which have used polysomnographic methods, only few studies have examined the subjective reports of sleep in adult patients with ADHD (5). Studies revealed that eveningness is correlated with adult ADHD (6–8). Eveningness also was found associated with several internalization and externalization disturbances (9–12). There have been some studies reporting that the sleep disturbances in ADHD are reversed with stimulant medications and melatonin (13,14).

A broad literature demonstrates sleep problems in ADHD patients. However, association of these problems with medications is unclear. For instance, it has been reported that medicated patients demonstrated greater

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severity of sleep disturbance compared to non-medicated patients (15). There are also several reports that medication regulates sleep (16,17). In order to assess various domains of biological rhythms, we compared drug-free ADHD patients with healthy controls in a cross-sectional study.

METHODS

Participants and Procedure

The participants were recruited from general outpatient clinic of Health Sciences University's Bakirkoy Mental Health Training and Research Hospital, who were referred to the Adult ADHD Outpatient Clinic between the January 3rd, 2013 and December 31st, 2013. Two-hundred participants were assessed and 130 of them were diagnosed with ADHD. However, patients who had comorbid bipolar disorder, depression disorder, substance use disorder and personality disorder were excluded. Out of 56 patients who were initially invited, 50 patients (%89.3) agreed to participate. All subjects who fulfilled the inclusion criteria of DSM-IV-TR adult ADHD diagnosis and being drug-naive and had scores above the cut-off score of Wender-Utah Adult ADHD Rating Scale were recruited. ADHD Diagnosis, based on Diagnostic and Statistical Manual and Mental Disorder-IV (DSM-IV) criteria, was made by an experienced, certified psychiatrist who is currently working with adult ADHD patients. Participation in the study was completely voluntary. The volunteers in the control group were invited to the study through brochures describing the study. Psychiatric interviews were conducted with the volunteers who accepted the invitation. After the clinical interview participants who did not take any psychiatric disorder nor had not any chronical physical illness were taken to control group. The scales used in the research were sent online to control group.

Informed consent was obtained from the patients before enrollment with local ethics committee approval for inclusion in the study . IRB approval was granted from the Ethics Committee of Bakırköy Research and Teaching Hospital for Neuropsychiatry (Date: 05.02.2013 No: 254). All of the study procedures were in accordance with the WMA Declaration of Helsinki and local laws and regulations.

Assessments

Wender-Utah Rating Scale (WURS): WURS is used to assess ADHD-related symptoms and include 25 items (18). The Turkish version was reported to be valid and reliable, with a cut-off point of 36 (19).

Biological Rhythms Interview of Assessment in Neuropsychiatry (BRIAN): BRIAN is used to assess biological rhythms in both groups. BRIAN involves 18 Likert-type items evaluating sleep, activities, social rhythm and eating patterns of the users. It has presented a consistent profile of validity and reliability (20). Questions about sleep assess falling asleep, waking up, getting out of bed, feeling rested and switching off at the time of resting. Questions about activity assess difficulties in scheduling and completing activities and sexual activity. Questions about social patterns assess communication and relationship problems, excessive electronic device use, difficulties in synchronizing daily routines and giving attention to significant others. The section for eating pattern asks about skipping meals, scheduling times for meals, eating a regular amount and using stimulants. The final section labeled "predominant rhythm" assesses the general chronotype by asking whether the participant feels more energized for work, more productive in the morning and has his/her day/night cycle reversed. The scale is available online in its English and Portuguese versions at www.pesquisabipolar.com.br.

The BRIAN has been translated into Turkish by Aydemir et al. (21) and the Turkish version has been reported to have satisfactory psychometric properties. The original version of the BRIAN has three factors: I. eating patterns; II. sleep patterns-social rhythm and III. activity levels. The Turkish version of the BRIAN has three dimensional factorial structure involving daily activities, sleep/eating patterns and interpersonal relations. Confirmatory factor analysis of the Turkish version of the BRIAN has revealed very good model fit (CFI=0.93, RMSEA=0.07). In addition to the comparisons of original

factor structure, we also compared factor scores of the Turkish version of the BRIAN between two groups.

Statistical Analysis

In order to compare biorhythm disturbance; total disturbance score, sleep patterns, eating patterns, activity levels and interpersonal relations score of ADHD patients with that of healthy controls, we implemented independent samples student t-test. Two-tailed significance tests ($p<0.05$) are reported throughout.

RESULTS

The patients (n=50, %26 female) were between 17 and 42 years old (M=27.76 SD:6.80). The controls (n=53, %56.6 female) were between 18 and 63 years old (M=31.39 SD:8.12).

In terms of biologic rhythms; adult ADHD patients scored higher on total scores (t=8.75, $p<0.001$), eating patterns (t=2.55, $p<0.001$), sleep patterns-social rhythm (t=3.41, p=0.001) and activity levels (t=3.0, $p<0.001$).

In terms of the factor structure derived from the psychometric study of the Turkish version of the BRIAN; activity levels (t=4.59, $p<0.001$) and sleep-eating patterns (t=3.62, $p<0.001$) were also significantly different between the two groups. Interpersonal domains did not differ significantly between the two groups (t=1.22, p=0.28). These data are presented in Table 1.

DISCUSSION

Our findings suggested that subjects with ADHD might have biorhythm problems particularly experienced in their daily activities, eating patterns, and social rhythms. These findings were consistent with previous studies indicating circadian rhythm and sleep problems as evident in patients with ADHD. The fact that ADHD is associated with biorhythm problems seems to imply a link between the two. Research on circadian rhythm and circadian preference (chronotype) in adult ADHD is rapidly growing (22,23). Various sleep problems in patients with ADHD are not infrequent (24). sleep and wakefulness cycle may be influenced by working and holiday day schedules (25). These sleep disturbances do not result from attention deficit or hyperactivity per se, but rather arise from an impaired circadian rhythm. In adult ADHD, the severity of symptoms was correlated with eveningness, and light therapy ameliorated scores of neuropsychological scales (8,26). In adults, it was reported that eveningness is correlated with ADHD (6–8). Adult patients with ADHD with delayed sleep have less quality of sleep, difficulties to initiate sleep and difficulty to get up in the morning (27). This may lead to chronic sleep problems and these sleep problems lead to problems to get up early for school, family life or work (28).

Circadian rhythm disruption or a delayed circadian rhythm, may be a mechanism linking ADHD symptoms to obesity. In humans, releasing of sleep and appetite hormones display approximately twenty four hour circadian rhythms (29,30). Disturbances of these rhythms cause sleep disorders and disrupted eating patterns, among others (31,32). As shown on these studies; we also were able to determine a striking difference in total biorhythm disturbance score between patients with adult ADHD and healthy controls. This result underscores the need for assessing sleep characteristics and components of biorhythm in evaluating patients with ADHD. Scores on one of the factors derived from the Turkish adaptation of the BRIAN, interpersonal relations did not differ between

Table 1: Differences in the biological rhythms interview of assessment in neuropsychiatry between adult patients with attention-deficit/hyperactivity disorder and healthy controls

	ADHD		Control subjects				
	Mean	SD	Mean	SD	t	P*	Cohen's d
Total score	61.16	9.06	52.02	9.17	8.75	<0.001	1
Sleep patterns/social rhythm	26.93	4.42	23.7	4.32	3.41	<0.001	5.61
Eating patterns	11.51	2.92	8.96	2.99	2.55	<0.001	0.86
Activity levels	14.53	3.09	11.52	3.28	3.0	<0.001	0.94

*Two tailed student t test; SD: Standard Deviation

two groups. This factor grouping consists of two items about sexual activity and communication with significant others. This factor group has been particularly associated with mood disorders (21).

This study has certain limitations. First, a possible bias in that the samples were non-contemporaneously recruited. It was based on self-reports and was also cross-sectional in design, not allowing inference on causality. We did not group the patients according to the subtype of ADHD, which might have yielded additional information. The study is further limited by its relatively small sample size. However, this study has adequate power to identify the differences in circadian rhythm problems between the ADHD and the control group.

CONCLUSIONS

In conclusion, our results supported and extended previous findings by showing that there was a significant difference between ADHD patients and healthy controls in almost every dimension of biorhythm disturbances. Sleep and biorhythm might be of value in evaluating adult patients with ADHD. Future studies might focus on further clarification of this association.

Ethics Committee Approval: IRB approval was granted from the Ethics Committee of Bakırköy Research and Teaching Hospital for Neuropsychiatry (Date: 05.02.2013 No: 254).

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