

Relationship of chronotype and sleep quality with crime in schizophrenia patients in the high-security forensic psychiatry clinic

Relationship of chronotype and sleep quality with crime in schizophrenia

Burcu Sirlir Emir¹, Aslı Kazgan Kılıçaslan², Sevlr Yıldız³, Osman Kurt⁴

¹ Department of Psychiatry, Elazığ Fethi Sekin City Hospital, Elazığ

² Department of Psychiatry, Bozok University, Yozgat

³ Department of Psychiatry, Binali Yıldırım University, Erzincan

⁴ Department of Public Health, Adiyaman Provincial Health Directorate, Adiyaman, Turkey

Abstract

Aim: It has been reported that schizophrenia (SZ) patients had poor sleep quality and displayed evening chronotype, and certain behavioral differences had been observed between chronotypes. In this study, we aimed to compare chronotype and sleep quality in criminal SZ patients and to examine the correlation of chronotype with crime types.

Material and Methods: Ninety-one criminal SZ patients and 91 healthy controls were included. Participants were administered the Positive and Negative Syndrome Scale (PANSS), Pittsburgh Sleep Quality Index (PSQI), and the Morningness - Eveningness Questionnaire (MEQ).

Results: While 28.6 % of the patient group were evening-, 36.3 % were intermediate- and 35.2% were morning-type, it was seen that 8.8% of the control group were evening-, 31.9% were intermediate- and 59.3% were morning-type, and a significant difference was observed between them ($p < 0.001$). The sleep quality in the patient group was significantly lower than in the control group ($p < 0.001$). In the patient group, the crime rate between 24:00 and 06:00 was found to be significantly higher among evening types compared to other types ($p < 0.001$).

Discussion: Criminal schizophrenia patients are of the evening type compared to the control group and have poor sleep quality. Corrective interventions for sleep and chronotype in SZ patients may change the rates and nature of crimes.

Keywords

Sleep, Schizophrenia, Chronotype, Circadian Rhythms, Crime

DOI: 10.4328/ACAM.21729 Received: 2023-04-15 Accepted: 2023-05-30 Published Online: 2023-06-09 Printed: 2023-09-01 Ann Clin Anal Med 2023;14(9):782-787

Corresponding Author: Burcu Sirlir Emir, Department of Psychiatry, Elazığ Fethi Sekin City Hospital, 23100, Elazığ, Turkey.

E-mail: bsirlir@hotmail.com P: +90 424 606 60 00 F: +90 424 238 76 58

Corresponding Author ORCID ID: <https://orcid.org/0000-0002-3389-5790>

This study was approved by the Clinical Research Ethics Committee of Firat University (Date: 2021-12-16, No: 2021/13-20)

Introduction

The largest diagnostic group among medical conditions, accompanied by sleep-related complaints, consists of mental conditions. An average of 50-80 % of persons with a mental condition have sleep disorders and approximately 50 % of patients with sleep disorders are diagnosed with a mental condition. One of such conditions is schizophrenia (SZ). Depending on the severity of the condition, sleep disorder is seen in approximately 30-80 % of SZ patients [1,2].

Sleep-related complaints since the first drug-free episode in SZ patients, which is a patient group, open to polypharmacy, suggest that patients have sleep problems independently from pharmaceutical treatment [1,2]. Polysomnographic changes, such as poor sleep quality and delay in REM sleep, decrease in REM intensity, and delayed onset of sleep have been observed in SZ patients [1,3]. In SZ patients, it has been shown that bad sleep quality was associated with increased positive and negative symptoms, worsened cognitive performance, decreased quality of life and decreased treatment response [2,4]. One of the physiological concepts, affecting sleep, is the chronotype.

Chronotype is a reflection of the endogenous circadian rhythm of an individual, which defines the time of physiological functions, including sleep. It has been reported that 60 % of adults were of “intermediate type” and the remaining 40 % were of “morning-type” or “evening-type” [5]. Chronotype subgroups, determined to be associated with psychiatric disorders, as well as physical conditions, have been studied in persons, demonstrating substance abuse disorders, anxiety disorders, attention deficit hyperactivity disorder, mood disorders, and it has been found that predominant subtypes were related with diseases [6]. It has been shown that evening-type chronotype was associated with mental conditions, in particular mood disorders (depressive disorders, bipolar disorder), yet a recent meta-analysis, similar to mood disorders, has demonstrated that SZ patients predominantly were of evening type compared to controls, and this could be a risk factor for SZ [7]. In a genomic study with extensive sampling, based on the hypothesis that chronotype could have an effect on the pathophysiology of schizophrenia, it has been shown that possession of morning chronotype was associated with a decrease in the risk of schizophrenia [8].

There are studies, in which differences in terms of psychopathology have been observed between chronotypes. For example, it has been determined that the evening type was more inclined to impulsivity, carelessness, aggressive behavior, crime and social problems [9]. In detailed compilations by Casey et al., an association between the evening type and aggressiveness has been reported. The transformation of chronotype tendency to a strong shift towards evening with the onset of puberty, has been explained by limbic system dominance and the process of maturation of the prefrontal cortex [10]. As a consequence of low executive function, impulsive responses and weak judgment are characteristics that are also observed in SZ patients, and in this sense, they have a similar neurobiological infrastructure with adolescence [7]. What are the chronotype characteristics in SZ patients, who have committed “crimes,” which are indicators of aggressiveness?

Despite the presence of studies in the literature, which have

examined chronotypes and sleep quality in schizophrenia patients and reported different results, to the best of our knowledge, there are no data in the literature concerning chronotypes for forensic psychiatric patients, who have committed a crime. As far as we know, there are no data concerning the time of the day at which the crimes had been committed by these patients. The objective of the study is to compare chronotype and sleep quality in schizophrenia patients, treated in an inpatient setting at High-Security Forensic Psychiatry (HSFP) Clinic with healthy controls and to examine the relationship with the nature and time of crime.

Material and Methods

The study was approved by the Firat University Clinical Research Ethics Committee (Date: 16 December 2021. Number: 2021/13-20). While calculating the sample of the study, the G*Power 3.1.9.2 program was used and the study “Quality of sleep in patients with schizophrenia is associated with quality of life and coping” was taken as a reference [11]. Accordingly, it was determined that at least 70 people, at least 35 with schizophrenia and 35 healthy groups should be reached with a 95% confidence interval and 95% power (Effect size=0.878). Patients, who have been admitted to Elazığ Fethi Sekin City Hospital HSFP Clinic with schizophrenia diagnosis according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) and inpatients who satisfied the study criteria, were included. One hundred and thirty SZ patients were available for study; yet among these, eighteen were excluded due to a change of psychotropic treatment regime within the last 2 months, fifteen were excluded due to accompanying alcohol and substance use disorders, four were excluded due to non-completion of forms, and two due to discharge before completion of forms, and a total of 91 schizophrenia patients were included in the study. Ninety-one healthy controls with no psychiatric conditions according to DSM-5 have been included in the study. In the sleep routine of the clinic, all patients are taken to their rooms at 10:00 in the evening to sleep, and the staff wakes them up at 7 in the morning.

Our study is a descriptive study with case-control nature. The study was conducted in Elazığ Fethi Sekin Hospital HSFP Clinic following ethics committee approval. After a full description of the study, all participants gave written informed consent according to the Helsinki Declaration. Evaluations, structured according to DSM-5, were made by a psychiatry specialist. All participants were administered a socio-demographic data form, the Positive and Negative Syndrome Scale (PANSS), the Pittsburgh Sleep Quality Index (PSQI), the Morningness-Eveningness Questionnaire (MEQ). Questionnaire completion process has taken an average of 30-40 minutes.

The inclusion criteria for patients were age between 18 and 65, schizophrenia diagnosis according to DSM-5 diagnostic criteria, a conviction under the Turkish Criminal Code (TCC), no accompanying psychiatric conditions, continuing hospitalization in HSFP clinic, no cognitive dysfunction and medical obstacles, precluding the completion of form and affecting the distribution of existing psychiatric symptoms (such as dementia, epilepsy, cerebrovascular disease, history of head trauma), no alcohol and substance abuse disorder diagnosis within the last 6 months,

the signed informed consent form, no mental retardation, no changes in psychotropic treatment regime within the last two months, no sleep disorder diagnosis according to DSM-5 (such as sleep terror, parasomnia, sleep paralysis, narcolepsy). Those who received hypnotic drugs in hospitalized patients were not included, but those who took sedative antipsychotic drugs were not excluded.

Data Collection Instruments

Socio-demographic Data Form: It was developed by the authors based on the aim of the study. The form aimed to collect demographic data such as age, marital status, education level, residency, employment, and economic status, and clinical evaluation data such as inpatient treatment anamnesis, smoking or alcohol use.

Morningness-Eveningness Questionnaire (MEQ): MEQ, created by Horne and Östberg [12] is a tool for determining chronotypes, designated as 'morning-type,' 'intermediate' and 'evening-type.' If the score, calculated in the scale is between 16 and 41, this shows 'evening-type' chronotype, if it is between 42-58, the 'intermediate type chronotype' and if it is between 59-86, the 'morning-type chronotype.'

Pittsburgh Sleep Quality Index (PSQI): This is a 19-item self-report scale, developed by Buysse et al. [13] evaluating the sleep quality and disorders in the previous month. Any score above 5 shows poor sleep quality.

Positive and Negative Syndrome Scale (PANSS): This is a 30-item scale, developed by Kay et al. [14] with 7 items related to the positive symptom subscale, 7 items, related to the negative symptom subscale and the remainder 16 to general psychopathology subscale. It is expressed as a total score and varies between 30 and 210.

Data analysis

In the evaluation of findings, provided in the study, SPSS (Statistical Package for Social Sciences) for Windows 22.0 program was used for statistical analyses. In the study, descriptive data have been shown as n, % values in categorical data, and in continuous data, as mean±standard deviation (Mean±SD) values. In the comparison of categorical variables between groups, chi-square analysis (Pearson Chi-Square) was applied. The consistency of continuous variables with normal distribution was evaluated with the Kolmogorov-Smirnov test. When comparing two groups, Student's t-test was used and when comparing more than two groups, the One-Way ANOVA test was used. In order to determine the source of significance, the Tukey test was used as a post-hoc analysis. Significance was considered at a level of $p < 0.05$.

Ethical Approval

Ethics Committee approval for the study was obtained.

Results

A total of 182 participants, including 91 patients and 91 controls, were included in the study. There were no significant differences between the groups with respect to socio-demographic characteristics (other than prevalence of psychiatric conditions (68.1 %), history of suicide (6.6 %) and smoking (67 %)) ($p > 0.05$) (Table 1).

Twenty-one patients (23.1%) had a diagnosis term of less than 5 years, 28 (30.8%) between 5-10 years and 42 (46.2 %)

greater than 10 years; 29 patients (31.9 %) had been admitted to HSFP Clinic for observation and 62 (68.1 %) for protection. While 70 patients (76.9%) had been admitted to HSFP once, twelve (9.9 %) had been admitted twice and 9 (9.9%) had been admitted three or more times, 25 (27.5%) did not have non-HSFP psychiatric hospitalization, 29 (31.9 %) had 1-2 and 37 (40.7%) had 3 or more non-HSFP psychiatric hospitalizations. Twenty-eight patients (30.8%) had committed bodily injury, 9 (9.9 %), sexual offenses, 8 (8.8%) murder, 3 (3.3%) insulting, 23 (25.3 %) other offenses (theft, property damage, intimidation, slander, plunder) and 20 (22%) have committed multiple crimes (Figure 1).

While 28.6 % of the patient group were evening-type, 36.3 % were intermediate and 35.2 % were morning-type, it was seen that 8.8 % of the control group were evening-type, 31.9 % were intermediate and 59.3 % were morning-type and a significant difference was observed between the groups ($p < 0.001$). Accordingly, it can be said that the patient group was the evening-type and the control group was the morning-type. By taking cut-off value according to PSQI, as 5, the good sleep quality in the patient group (39.6 %) was significantly lower than good sleep quality in the control group (75.8%) ($p < 0.001$). Accordingly, the sleep quality in the patient group was lower (Table 2).

It was determined that there was no significant difference among patients' MEQ categories and sleep qualities in terms of PANSS scores ($p > 0.05$). There was no significant difference in terms of PANSS-positive between the MEQ categories in the patient group ($p = 0.381$) (dual p values: evening-mid=0.722; evening-morning=0.851; mid-morning=0.350). There was no significant difference in terms of PANSS-negative between the MEQ categories in the patient group ($p = 0.746$) (dual p-values: evening-mid=0.728; evening-morning=0.872; mid-morning=0.960). There was no significant difference in terms of PANSS-total between the MEQ categories in the patient group ($p = 0.700$) (dual p-values: evening-mid=0.954; evening-morning=0.690; mid-morning=0.839).

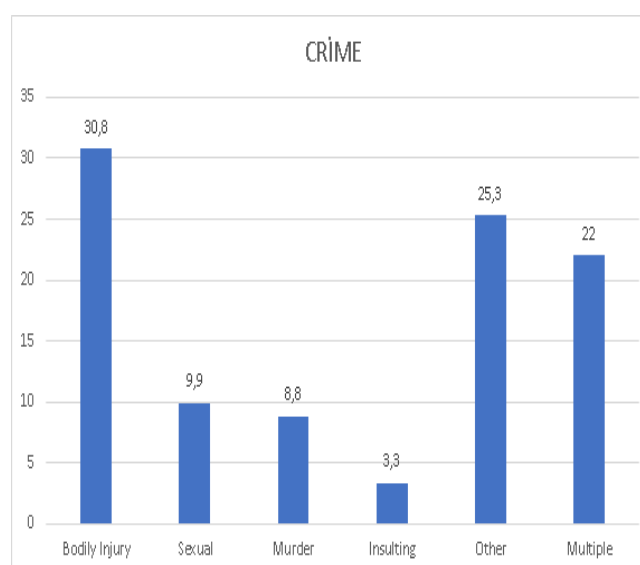


Figure 1. Crime distribution among patients.

Table 1. Comparison of general characteristics of patient and control groups.

		Patient (n=91)		Control (n=91)		Total (n=182)		p*
		Frequencies	%	Frequencies	%	Frequencies	%	
Age, Mean±SD		38.1±13.3		38.6±12.0		38.4±12.6		0.788**
Marital Status	Single	56	61.5	52	57.1	108	59.3	0.472
	Married	23	25.3	30	33.0	53	29.1	
	Divorced	12	13.2	9	9.9	21	11.5	
Educational Status	Secondary School and Lower	63	69.2	56	61.5	119	65.4	0.548
	High School	18	19.8	22	24.2	40	22.0	
	University	10	11.0	13	14.3	23	12.6	
Place of Residence	Village/Town	38	41.8	33	36.3	71	39.0	0.447
	City	53	58.2	58	63.7	111	61.0	
Economic Status	Low	46	50.5	36	39.6	82	45.1	0.291
	Medium	37	40.7	43	47.3	80	44.0	
	High	8	8.8	12	13.2	20	11.0	
Employment Status	Working	33	36.3	42	46.2	75	41.2	0.175
	Not Working	58	63.7	49	53.8	107	58.8	
Additional Organic Condition	Yes	21	23.1	15	16.5	36	19.8	0.264
	No	70	76.9	76	83.5	146	80.2	
Active psychiatric treatment	Yes	62	68.1	0	0.0	62	34.1	<0,001
	No	29	31.9	91	100.0	120	65.9	
History of suicide	Yes	15	16.5	6	6.6	21	11.5	0.037
	No	76	83.5	85	93.4	161	88.5	
Smoking	Yes	61	67.0	41	45.1	102	56.0	0.003
	No	30	33.0	50	54.9	80	44.0	
Alcohol and/or substance	Yes	21	23.1	13	14.3	34	18.7	0.128
	No	70	76.9	78	85.7	148	81.3	

SD: standard deviation, Mean: mean

Table 2. Comparison of MEQ and sleep qualities of patient and control groups.

		Patient (n=91)		Control (n=91)		p*
		Frequencies	%	Frequencies	%	
MEQ category	Evening-type	26	28.6 ^a	8	8.8 ^b	<0,001
	Intermediate	33	36.3 ^a	29	31.9 ^a	
	Morning-type	32	35.2 ^a	54	59.3 ^b	
PSQI Sleep Quality	Good	36	39.6	69	75.8	<0,001
	Poor	55	60.4	22	24.2	

*Chi-square test was performed. a,bThe group from which the difference originates; MEQ: Morningness-Eveningness Questionnaire, PSQI: Pittsburgh Sleep Quality Index

Table 3. Comparison of MEQ categories of patients depending on their crimes, time from diagnosis and hospitalization numbers.

		Evening-type (n=26)		Intermediate (n=33)		Morning-type (n=32)		p*
		Frequencies	%	Frequencies	%	Frequencies	%	
Crime	Bodily Injury	7	25.0	11	39.3	10	35.7	0.038
	Insulting	0	0.0	2	66.7	1	33.3	
	Sexual Offenses	1	11.1	2	22.2	6	66.7	
	Murder	5	62.5	2	25.0	1	12.5	
	Other	11	47.8	8	34.8	4	17.4	
	Multiple	2	10.0	8	40.0	10	50.0	
Time since schizophrenia diagnosis	<5 years	7	33.3	8	38.1	6	28.6	0.132
	5-10 years	5	17.9	15	53.6	8	28.6	
	>10 years	14	33.3	10	23.8	18	42.9	
Number of hospitalizations in HSFP	Once	20	28.6	26	37.1	24	34.3	0.238
	Twice	5	41.7	5	41.7	2	16.7	
	Thrice or more	1	11.1	2	22.2	6	66.7	

*Chi-square test was performed ; MEQ: Morningness-Eveningness Questionnaire, HSFP: High-Security Forensic Psychiatry Clinic

It was observed that 25 % of patients were convicted for bodily harm, 11.1 % for sex offenses and 62.5 % for murder and 47.8 % for other crimes, and 10 % of those were convicted for multiple crimes and were found as evening-type. There was a significant difference between crimes in terms of chronotype ($p=0,038$). There was no significant difference between the duration of schizophrenia diagnosis ($p=0.132$) and the number of admissions to HSFP ($p=0.238$) in terms of chronotype (Table 3).

In the patient group, the crime rate between 24:00 and 06:00 was found to be significantly higher among evening types (57.7%) compared to intermediate (9.1%) and morning types (6.3%) ($p<0.001$).

Discussion

In our study, it was seen that 36.3% of criminal SZ patients were of intermediate type, consistent with the general population, followed by morning types with 35.2 % and evening types with 28.6%. However, when we compared SZ patients with healthy controls, they had significant evening type. We may say that criminal SZ patients were of evening-type, compared to healthy persons. When evening-type is broadly considered in combination with neurophysiological and environmental factors, it has been generally shown as tendency to impulsivity, aggressive behavior and crime [9]. At the same time, it is reported that evening-type demonstrates intensive psychopathological bias with mediator factors, such as difficulties in mood regulation and disturbed reward pathway and impulsivity [5]. In addition to these, sleep qualities of patients in our study were significantly worse compared to healthy controls. Poor sleep qualities in SZ patients have been previously reported. Independently from relapse and remission phases in these patients, poor sleep quality has been shown both with scales and polysomnographic changes [1,3]. We provided similar findings among SZ patients in HSFP.

As another finding of our study, the presence of evening-type chronotype in 62.5 % of SZ patients who were treated at HSFP Clinic due to murder was striking. It is known that there are phase differences between chronotypes in the secretion of hormones, such as physiological adrenalin, melatonin and cortisol, which play a crucial role in response to stress [15]. Also, neurological, cognitive and behavioral performances vary in individuals depending on chronotypes. Both with this aspect and effects on sleep, chronotype may pave the way for loss of control in emotional reactions. In this respect, chronotype may have a direct effect on "committing a crime." On the other hand, it is known that poor sleep deteriorated stabilization of affection and increased the emotional reaction rate [16]. It has been reported that poor sleep quality was related to hostile and aggressive behavior and aggressiveness and loss of sleep affected prefrontal cortical functionality and could cause mitigation of behavioral reaction inhibition [17]. When all these are considered together, high levels of emotional reactivity may be expected from SZ patients in the study, who have poor sleep quality, together with a neurophysiological deficiency. From this aspect, our study shows promise for future studies, concerning the effects of chronotypes on crimes.

Limitations and Strengths

The strong point of our study is that it is the first study, examining the relationship between chronotypes and crime in SZ patients and the findings can provide inspiration for future studies. Restrictions of our study are the selection of samples from a single center and the inclusion of patients also in the psychotic attack phase. Since sleep quality may also be affected in psychotic attacks, we have to state that this issue must be considered in the results of the study.

Conclusion

In conclusion, criminal schizophrenia patients are of evening type compared to the control group and have poor sleep quality. Evening-type patients predominantly commit crimes after midnight. A difference was seen between chronotypes in terms of the nature of the crime. Schizophrenia patients, who have committed murder, predominantly have evening chronotype. Chronotype itself may have an effect on crime. However, it must be considered that chronotype is a rhythm, which may be affected by factors, such as age, gender, heredity, and environment [5]. Future studies, involving biological, psychosocial and individual factors, are required. Chronotype-crime relationship in SZ patients, which is poorly known, may provide a new perspective to forensic psychiatry and corrective interventions in these patients, related to sleep and chronotype may allow mitigation of crime rates.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

Funding: None

Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

References

1. Chan MS, Chung KF, Yung KP, Yeung WF. Sleep in schizophrenia: a systematic review and meta-analysis of polysomnographic findings in case-control studies. *Sleep Med Rev*. 2017;32: 69–84.
2. Hofstetter JR, Lysaker PH, Mayeda AR. Quality of sleep in patients with schizophrenia is associated with quality of life and coping. *BMC Psychiatry*. 2005;5(1): 13.
3. Meyer N, Faulkner SM, McCutcheon RA, Pillinger T, Dijk DJ, MacCabe JH. Sleep and circadian rhythm disturbance in remitted schizophrenia and bipolar disorder: a systematic review and meta-analysis. *Schizophr Bull*. 2020;46(5): 1126–43.
4. Ritsner M, Kurs R, Ponizovsky A, Hadjez J. Perceived quality of life in schizophrenia: Relationships to sleep quality. *Qual Life Res*. 2004;13(4): 783–91.
5. Adan A, Archer SN, Hidalgo MP, Di Milia L, Natale V, Randler C. Circadian typology: A comprehensive review. *Chronobiol Int*. 2012;29(9): 1153–75.
6. Taylor BJ, Hasler BP. Chronotype and mental health: recent advances. *Curr Psychiatry Rep*. 2018;20(8): 1–10.
7. Linke M, Jankowski KS. Chronotype in individuals with schizophrenia: A meta-analysis. *Schizophr Res*. 2021;235: 74–9.
8. Jones SE, Lane JM, Wood AR, van Hees VT, Tyrrell J, Beaumont RN, et al. Genome-wide association analyses of chronotype in 697,828 individuals provides insights into circadian rhythms. *Nat Commun* 2019;10(1): 1–11.
9. Gau SS, Shang CY, Merikangas KR, Chiu YN, Soong WT, Cheng AT. Association between morningness-eveningness and behavioral/emotional problems among adolescents. *J Biol Rhythms*. 2007;22(3): 268–74.
10. Casey B, Jones RM, Hare TA. The adolescent brain. *Ann NY Acad Sci*. 2008;1124: 111–26.
11. Hofstetter JR, Lysaker PH, Mayeda AR. Quality of sleep in patients with

schizophrenia is associated with quality of life and coping. *BMC Psychiatry*. 2005;5: 13.

12. Horne JA, Ostberg O. A self assessment questionnaire to determine Morningness Eveningness in human circadian rhythms. *Int J Chronobiol*. 1976;4(2): 97–110.

13. Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res*. 1989; 28(2): 193-213.

14. Kay SR, Opler LA, Lindenmayer JP. Reliability and validity of the positive and negative syndrome scale for schizophrenics. *Psychiatry Res*. 1988;23(1): 99–110.

15. Selvi Y, Beşiroğlu L, Aydın A. Chronobiology and mood disorders. *Psychiatry Interpers Biol Process*. 2011;3: 368-86.

16. Anderson C, Platten CR. Sleep deprivation lowers inhibition and enhances impulsivity to negative stimuli. *Behav Brain Res*. 2011;217(2): 463-6.

17. Yoo SS, Gujar N, Hu P, Jolesz FA, Walker MP. The human emotional brain without sleep—a prefrontal amygdala disconnect. *Curr Biol*. 2007;17(20): R877-8.

How to cite this article:

Burcu Sirlir Emir, Aslı Kazgan Kılıçaslan, Sevler Yıldız, Osman Kurt. Relationship of chronotype and sleep quality with crime in schizophrenia patients in the high-security forensic psychiatry clinic. *Ann Clin Anal Med* 2023;14(9):782-787

This study was approved by the Clinical Research Ethics Committee of Firat University (Date: 2021-12-16, No: 2021/13-20)