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Adolescents' eveningness chronotype and cyberbullying perpetration: the mediating role of depression-related aggression and anxiety-related aggression

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ABSTRACT

Recent empirical evidence has indicated a positive relationship between university students' evening-type chronotype and their cyberbullying perpetration (CBP) scores while controlling for gender and Big Five personality dimensions. The aims of the present study were (i) to replicate the results of the aforementioned study with an adolescent sample, and (ii) to examine the mediating role of depression, anxiety, and aggression on the relationship between chronotype and CBP. In order to investigate these aims, 493 high-school students were recruited to complete a survey that included the Reduced Morningness–Eveningness Scale, Short Depression Scale, State-Trait Anxiety Inventory Short Form, Aggression Questionnaire, and Cyberbullying Offending Scale. Results indicated that while females had higher depression and anxiety scores, males scored higher on CBP. Path analysis showed that aggression, depression-related aggression, and anxiety-related aggression fully mediated the relationship between evening-type chronotype and CBP. There were also significant gender differences in the model. Furthermore, physiological factors had an indirect effect on CBP via psychological risk factors and emotion-related negative behaviors.

Introduction

Cyberbullying perpetration (CBP) has been defined as repeated harassment and mistreatment using online contexts or other electronic devices, and perpetrated upon individuals who are unable to defend themselves (Patchin and Hinduja 2015). Scholars have given important attention to this antisocial behavior because of its serious negative impacts. CBP, which affects 20–40% of the young people (Tokunaga 2010), has been shown to associate with different negative outcomes on the victims such as depression, anxiety, stress, suicidal thoughts, and death by suicide in some extreme cases, especially

among females (LeBlanc 2012; Schenk and Fremouw 2012; Tomşa et al. 2013; Kowalski et al. 2014; Munawar et al. 2014; Zalaquett and Chatters 2014; Zsila et al. 2017).

Despite a large body of empirical literature demonstrating the potential risk factors of CBP including depression, anger rumination, adverse childhood experiences, personality disorders, poor sleep quality, cyberbullying victimization, and problematic online use (Campbell et al. 2013; Gámez-Guadix et al. 2016; Kircaburun and Baştug 2016; Zsila et al. 2018; Kircaburun et al. 2018a, 2018b), little research has examined the effects of physiological determinants such as biological rhythm (i.e., chronotype) on CBP. Preliminary empirical evidence suggests that eveningness chronotype may be related to higher CBP among emerging adults (Kırcaburun and Tosuntaş 2018). According to the General Aggression Model (Anderson and Bushman 2002), individual factors have an important role in aggressive behaviors which affect decision-making processes via situational factors. Given that chronotype is an individual difference that impacts individuals' psychological and emotional states (Gau et al. 2007), it may have a direct and indirect role on aggressive behaviors such as CBP.

Chronotype and cyberbullying perpetration

Morningness–eveningness chronotype preferences are important individual differences that have important impacts on individuals' lives (Adan and Natale 2002). While morningness has been associated with higher academic achievement, higher conscientiousness, and lower psychological and emotional troubles (Medeiros et al. 2001; Rahafar et al. 2017), eveningness has been associated with psychological and behavioral problems including emotional instability, depression, and impulsivity (Randler 2008; Hwang et al. 2016; Horne et al. 2018). A recent study reported that, when controlling for gender, Big Five personality traits, and sleep quality, eveningness was a predictor of CBP (Kırcaburun and Tosuntaş 2018). Given that negative factors such as emotional instability, impulsivity, and psychopathology are important determinants of CBP (Erreygers et al. 2016; Kırcaburun and Tosuntaş 2018; Kircaburun et al. 2018a), the eveningness chronotype may be expected to directly associate with higher CBP.

The mediating role of depression and anxiety

Depression and anxiety are two unwanted overlapping psychological and emotional problems that may result in decreased psychological health/wellbeing (Beekman et al. 2002; Wang et al. 2014). Given the psychological and emotional fragility of adolescence, teenagers are more at risk for increased depression and anxiety (Brady and Kendall 1992). Therefore, evening-type students may be affected from their sleep problems more severely because they do not have enough sleep during weekdays (Randler et al. 2016). Although, studies providing experimental evidence are scarce, eveningness is inversely associated with quality and duration of sleep (Horne et al. 2018), and students who have an eveningness chronotype have less sleep than they need and, in turn, may feel more depressed and anxious (Horne et al. 2017, Vardar et al. 2008; Pabst et al. 2009; Horne et al. 2018). However, the relationship between anxiety and chronotype generally becomes non-significant when depression is taken into account (Antypa et al. 2016; Putilov 2018). It has also been demonstrated that elevated levels of

depression and anxiety are associated with CBP (Chen et al. 2017; Varghese and Pistole 2017; Kircaburun et al. 2018b). Adolescents with increased depression and anxiety may become more irritable and impulsive and reflect inner unrest by engaging in higher CBP (Kircaburun et al. 2018b).

H1: Eveningness chronotype will be directly associated with CBP and indirectly via depression and anxiety.

The mediating role of aggression

Aggressive individuals can easily become angry and hostile leading to physical and/or verbal aggression (Buss and Perry 1992). Individuals' physiological states and biological markers can affect their aggressiveness (Apter et al. 1990). For example, low blood sugar has been related to elevated levels of aggression among married couples (DeWall et al. 2011). Similarly, the eveningness chronotype and short sleep have been associated with different dimensions of aggression among young adults (Randler and Vollmer 2013) and antisocial behavior problems during puberty (Susman et al. 2007). Moreover, higher aggression among evening-type individuals can be explained by depression and anxiety because depressive and anxious symptoms have also been associated with escalated aggression (Apter et al. 1990; Jeong et al. 2017). Depressed and anxious individuals tend to have lower control over their emotions and behaviors. Consequently, such individuals may experience trouble in controlling aggressive feelings and demonstrate hostile behaviors toward others (Jeong et al. 2017). Also, since depressed and anxious people get irritable more easily because of their increased sensitivity toward external stimuli, they may respond more aggressively to these stimuli (Jeong et al. 2017). Also, it is well established that aggression is related to CBP (İçellioğlu and Özden 2014). CBP is typically separated from aggression with slight differences such as repetition, technology use, and power imbalance principles (Patchin and Hinduja 2015).

H2: Eveningness chronotype will be directly associated with CBP and indirectly via aggression, depression-related aggression, and anxiety-related aggression.

The role of gender

Since the study variables have been shown to be significantly different across genders, the present study further examined the associations between variables differentiating males and females. While depression and anxiety have been reported as being higher among females than males (Lewinsohn et al. 1998; Nolen-Hoeksema and Hilt 2013), males are more prone than females to aggression and CBP (Card et al. 2008; Kırcaburun and Tosuntaş 2018), and there are mixed findings concerning adolescents' chronotype (Randler et al. 2014).

H3: The aforementioned relationships will be stronger among males compared to females.

Methods

Participants and procedure

The participants comprised 493 adolescents (53% male) attending high school in Turkey (mean = 16.56 years, SD = .50). Paper-and-pencil questionnaires were administered by the research team after providing all the necessary information and receiving informed consent from all participants. All students participated in the study voluntarily and anonymously.

Measures

Cyberbullying Offending Scale (CBOS; Patchin and Hinduja 2015): The CBOS was used to assess individual differences in cyberbullying (e.g., *"I spread rumors about someone online"*). The scale comprises nine items on a 5-point Likert scale from 1 = *never* to 5 = *many times*. Because CBP differs from cyber-aggression due to the repetitiveness of the behavior (Patchin and Hinduja 2015), the scale was used in a dichotomized structure via re-coding "never" and "once" as 0, and "a few times", "several times", and "many times" as 1. The Turkish form of the scale previously reported high validity and reliability (Kircaburun et al. 2018b). It also showed good internal consistency in the present study (Cronbach's α = .78).

Short Depression Scale (SDS; Joseph et al. 2004): The SDS was used to assess depressive symptoms of participants. The scale comprises three items (e.g., *"I felt that life was meaningless"*) on a 4-point Likert scale from 1 = *never* to 4 = *often*. The Turkish form of the scale previously reported high validity and reliability (Kircaburun et al. 2018b). It also showed very good internal consistency in the present study (α = .85).

State-Trait Anxiety Inventory Short Form (STAI-SF; Marteau and Bekker 1992): The STAI-SF was used to assess trait anxiety levels of participants. The scale comprises six items (e.g., "I feel calm") on a 4-point Likert scale from 1 = *almost never* to 4 = *almost always*. The Turkish form of the scale previously reported high validity and reliability (Le Compte and Oner 1976). It showed adequate internal consistency in the present study (α = .70).

Aggression Questionnaire (AG; Buss and Perry 1992; Bryant and Smith 2001): The AG was used to assess aggressiveness levels of participants. The 12-item scale has four sub-dimensions including physical aggression (e.g., *"Given enough provocation, I may hit another person"*), verbal aggression (e.g., *"I often find myself disagreeing with people"*), hostility (e.g., *"Other people always seem to get the breaks"*), and anger (e.g., *"I have trouble controlling my temper"*). Each item was rated on a 5-point Likert scale from "1 = *never* to 5 = *always*. The Turkish form of the scale previously reported high validity and reliability (Evren et al. 2011). It also showed good internal consistency in the present study (α = .85).

Reduced Morningness Eveningness Questionnaire (RMEQ; Adan & Almirall, 1991): The RMEQ was used to assess participants' morningness–eveningness levels. The scale comprises five items (e.g., *"Feeling tired in the evening as a result of sleep need"*). The psychometric properties of the Turkish form were tested for the first time in the present study. The Turkish adaptation was carried out via using a standardized back translation process (Beaton et al. 2000). According to reported thresholds (Hu and Bentler 1999), confirmatory factor analysis indicated good fit to the data (χ^2/df = 1.66, RMSEA = .04 CI

90% [.00, .08], CFI = .99, GFI = .98). It showed low internal consistency in the present study (α = .55).

Statistical analysis

In order to test the hypotheses, several analyses were run via using SPSS 23.0 and AMOS 23.0 software. In order to examine mean scores, correlation coefficients between study variables, and gender differences, descriptive statistics, Pearson's correlation test, and *t*-tests were carried out. Furthermore, in order to examine the direct and indirect pathways between study variables, path and mediation analyses were used on a saturated model via the bootstrapping method with 5000 bootstrap samples and 95% bias-corrected confidence intervals. Indirect pathways were examined via using two estimands (Gaskin 2016): one for a to c through b and the other for a to d through b + c.

Results

Descriptive statistics and Pearson's correlation coefficients are shown in Table 1. All study variables were positively correlated with each other. Results of the *t*-tests are presented in Table 2. Female students had higher depression and anxiety scores than males, while males scored higher on CBP. Eveningness chronotype and aggression scores did not differ across gender. In order to test the mediating role of depression, anxiety, and aggression on the relationship between chronotype and CBP, a saturated multiple mediation model was run via using bootstrapping method with 5000 bootstrap samples and 95% bias-corrected confidence intervals (Figure 1).

Path analyses (Figure 2) showed that while controlling for gender and age, the relationship between eveningness and CBP was fully explained via aggression, depression-related aggression, and anxiety-related aggression (β = .17, *p* < .01; CI 95% [.08, .28]). Moreover,

**Table 1.** Descriptive statistics and correlations of the study variables.

	1	2	3	4	5
1. Cyberbullying perpetration	–				
2. Chronotype	.17***	–			
3. Depression	.17***	.14**	–		
4. Anxiety	.20**	.14**	.44***	–	
5. Aggression	.43***	.25***	.38***	.39***	–
M	1.49	17.03	7.19	13.27	31.76
SD	1.90	3.65	3.01	3.37	10.33

** *p* < .01 and *** *p* < .001.

**Table 2.** Comparison of the scores of study variables between males and females.

	Male (N = 264)	Female (N = 229)	*t*-test	Cohen's *d*
Cyberbullying perpetration	1.74 ± 2.19	1.21 ± 1.43	−3.09**	−.03
Chronotype	16.75 ± 3.69	17.36 ± 3.58	1.86	.02
Depression	6.69 ± 2.87	7.78 ± 3.08	4.07***	.04
Anxiety	12.92 ± 3.23	13.68 ± 3.48	2.51*	.02
Aggression	31.95 ± 10.36	31.55 ± 10.32	−.43	−.00

p < .05, **p* < .01, and ***p* < .001
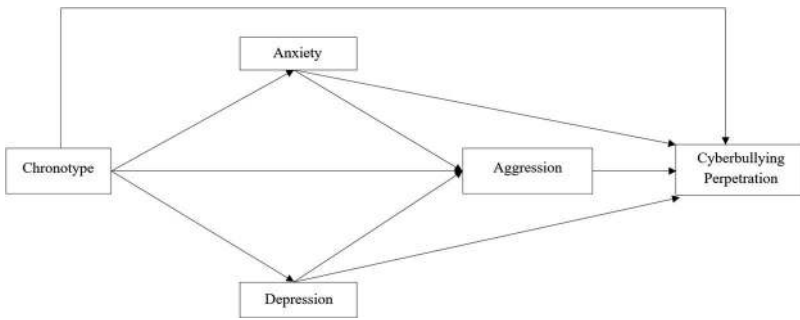
Figure 1. Hypothesized model.

For clarity, control variables (gender and age) and correlations among control variables and mediators were not depicted in the figure.
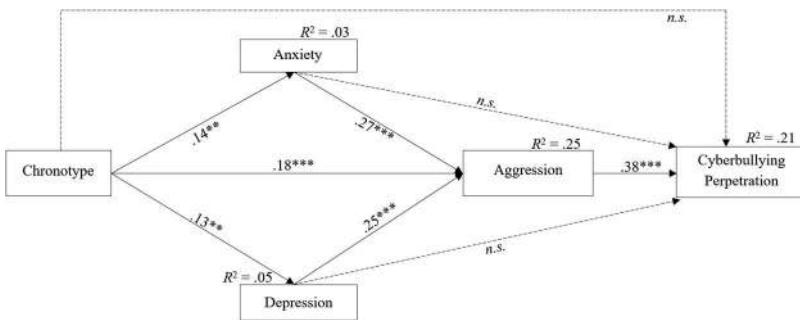
Figure 2. Final model of the significant path coefficients.

For clarity, control variables (gender and age) and correlations among control variables and mediators were not depicted in the figure.

aggression fully mediated the associations of depression ($\beta = .11$, $p < .05$; CI 95% [.01, .22]) and anxiety ($\beta = .15$, $p < .01$; CI 95% [.06, .24]) with CBP. The model predicted 21% of the variance in CBP. Findings indicated that adolescents' physiological and psychological negative states indirectly led to CBP via their emotion-related behaviors (i.e. aggression).

Because of the gender differences in CBP, males and females were separately analyzed using the same model. Results demonstrated that the total effects of study variables were noteworthy only among male adolescents (Table 3). Among males, eveningness, depression, and anxiety were indirectly associated with CBP via aggression. Additionally, anxiety-related aggression was also a mediator between chronotype and CBP. Among females, eveningness, depression, and anxiety were indirectly associated with CBP. However, these indirect effects did not lead to overall significant effects. The model with males explained 24% of the variance in CBP.

Discussion

The present study replicated the findings of a previous study (i.e. Kırcaburun and Tosuntaş 2018) that was carried out with emerging adults. In the present study, using

Table 3. Standardized estimates of the effects on cyberbullying perpetration.

	Effect (S.E.)		
	Total sample	Male	Female
Chronotype → CBP (total effect)	.17**(.05)	.22**(.07)	.12(.07)
Chronotype →CBP (direct effect)	.06(.05)	.09(.06)	.04(.08)
Chronotype → CBP (total indirect effect)	.11***(.02)	.13***(.03)	.08**(.02)
Chronotype → Aggression → CBP	.07***(.01)	.09***(.01)	.05**(.01)
Chronotype → Depression → Aggression → CBP	.01**(.00)	.01(.01)	.01*(.00)
Chronotype → Anxiety → Aggression → CBP	.01**(.00)	.01**(.00)	.01(.00)
Depression → CBP (total effect)	.11*(.05)	.13*(.06)	.10(.08)
Depression → CBP (direct effect)	.02(.05)	.02(.06)	.02(.08)
Depression → Aggression → CBP (indirect effect)	.10***(.02)	.11***(.03)	.07**(.02)
Anxiety → CBP (total effect)	.15**(.05)	.16*(.06)	.14(.08)
Anxiety → CBP (direct effect)	.05(.05)	.09(.06)	.02(.09)
Anxiety → Aggression → CBP (indirect effect)	.10***(.02)	.08**(.03)	.12***(.02)

CBP = cyberbullying perpetration. *$p < .05$, **$p < .01$, and ***$p < .001$

an adolescent sample, results showed that eveningness chronotype was associated with higher engagement in CBP. However, the present study further shows that the relationship between the former and latter can be fully explained by aggression, depression-related aggression, and anxiety-related aggression. Results of the present study are in line with the assumptions of the General Aggression Model (Buss and Perry 1992) that individual differences are important determinants that may lead to aggression, and in turn, CBP.

In line with H2, eveningness was related to CBP via depression-related and anxiety-related aggression. Eveningness was associated with higher depression and anxiety, and in turn, elevated levels of depressive and anxious symptoms were related to increased aggression. This finding may be explained by the finding that the eveningness chronotype may be associated with sleep quality, and – based on a cross-sectional evidence – poor sleep quality may lead to higher impairments of psychological states (Horne et al. 2018), although this assumption needs to be evidenced experimentally. Another study found that the relationship between eveningness and depression only remained significant among individuals younger than 20 years of age and older than 50 years of age, where the result is likely explained by the circadian instability that is related to depression, anxiety, and eveningness (Matthews 1988; Kim et al. 2010). Adolescence is a period of great change where adolescents' chronotype shifts from morningness to eveningness, and this change can affect students' mood negatively (Kim et al. 2010). Consequently, students high in depression and anxiety are more aggressive because of their sensitivity toward external stimuli and easy irritability (Apter et al. 1990).

As hypothesized (H2), the relationship between eveningness and CBP was mediated by aggression. Adolescents who reported themselves to have higher eveningness were more aggressive, and in turn, elevated levels of aggression were associated with CBP. Empirical literature indicates that individuals' physiological condition influences their psychology, emotions, and behaviors. For example, one study showed that lower plasma cortisol levels of a high-risk community sample of male adolescents were associated with increased aggression, impulsivity, and delinquent behavior (Poustka et al. 2010). Furthermore, an experimental study with married couples found that participants who had lower glucose levels demonstrated greater aggression (Bushman et al. 2014), in

which glucose intake decreased impulsive aggression against provocation (Denson et al. 2010). Indeed, because an individual's physiological state has an important role on their self-control (DeWall et al. 2011), it may be that eveningness can negatively affect adolescents' abilities to control themselves in risky situations and prevent them from demonstrating aggressive behaviors because eveningness has also been shown to increase reactivity toward emotional stimuli which may lead to angry outbursts (Schlarb et al. 2014).

Aggressive individuals in offline contexts are expected to maintain their aggression in online contexts. Especially when considering the provocative and triggering content individuals can be exposed to online. Consequently, aggressive adolescents can act freely because of their anonymity, and can be expected to bully others. Virtual worlds have become anger expression mediums for adolescents who are not able to express themselves in real life offline (İçellioğlu and Özden 2014). Parallel to the H3, these relationships between study variables were significant only among male participants in the present study. This was expected because, compared with females, male adolescents are more aggressive and engage in higher CBP (Card et al. 2008; Kırcaburun and Tosuntaş 2018). Even though females had higher levels of depression and anxiety, males engaged in higher aggression and CBP. It may be that females deal with their negative mood via behaviors other than CBP (e.g. problematic social media use [Kircaburun et al. 2018c]). On the other hand, expressing thoughts and emotions via aggression is more socially acceptable among males (İçellioğlu and Özden 2014), which leads to higher CBP.

The present study is not without limitations. First, the study sample comprised adolescent students from a single Turkish high school. Therefore, generalizability of the results is limited. Future studies should attempt to replicate the findings here by using different age groups from different cultures. Second, the cross-sectional design prevents the drawing of any causal relationships. In order to delineate causality and directions of these relationships, future studies should employ longitudinal designs. Third, the research data were collected via self-report questionnaires in a self-selected sample that are prone to well-known biases and limitations. Future studies should use more in-depth tools such as qualitative or mixed methods among more representative samples. Finally, the scale used for assessing participants' morningness–eveningness preference (rMEQ) had low internal consistency. rMEQ has been noted to have a questionable consistency (see Di Milia et al. 2013 for a review). Therefore, future studies should use more psychometrically sound instruments to survey participants' morningness–eveningness preference.

Despite its limitations, the present study is the first to examine the relationship between chronotype and CBP using different mediators (i.e. depression, anxiety, and aggression). Results demonstrated that the eveningness chronotype was indirectly associated with CBP via aggression, depression-related aggression, and anxiety-related aggression. Consequently, future studies should take the eveningness chronotype into account when considering the effects of depression and anxiety on aggression, and aggressive online behaviors such as cyberbullying.

Disclosure statement

No potential conflict of interest was reported by the authors.

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