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Research article

Psychopathy and chronotype disposition: the mediating role of depression

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ABSTRACT

This study examined the relationship between dark triad personality traits and chronotype disposition, whilst incorporating the mediating role of anxiety and/or depression after excluding individuals presenting insomnia and/or physiological sleep-disorder symptoms. Members of the general population (N = 453) completed online measures of dark triad personality traits, chronotype, and anxious and depressive symptoms. Psychopathy and Machiavellianism were independently related to an evening chronotype disposition. However, after accounting for age, sex, anxiety and depression, psychopathy and depression remained the only significant predictors of chronotype. Therefore, whilst psychopathy was the strongest predictor of an evening chronotype preference, this relationship is partially mediated by depression. Individuals presenting an evening disposition may display increased psychopathic traits due to greater emotion dysregulation. This is potentially perpetuated by depressive symptoms stemming from a delayed or blunted affective rhythm. Interacting factors (e.g. reduced light exposure) may also contribute to alterations in the biological rhythm amongst evening-types, resulting in a negative feedback cycle. Targeting chronotype and depressive symptoms amongst individuals presenting psychopathic tendencies could increase the efficacy of existing sleep-based interventions for hostile behaviour.

1. Introduction

Normal human sleep can be described as a reversible behavioural state that involves the absence of consciousness, often associated with physical and behavioural dormancy and closed eyes (Carskadon and Dement, 2005). A combination of two interacting processes regulate an individual's sleep/wake cycle: homeostatic regulation; and endogenous control of circadian rhythmicity (Borbély, 1982). Normal sleep is maintained by an effective interaction between these two processes. Here, sleep propensity increases due to prior wakefulness, while an approximately 24-hour biological rhythm is regulated by the suprachiasmatic nucleus in the brain (Borbély, 1982). That said, circadian preference (often referred to as 'chronotype disposition' or 'diurnal preference') demonstrates considerable inter-individual variability (Kerkhof, 1985) based on a person's preferred timing of sleep and waking behaviour, ranging from *morning* to *evening* types (Ellis et al., 2009). Generally, morning-types elicit greater performance in the morning hours, sleeping earlier in the evening, and wake earlier in the morning. Conversely,

evening-types report difficulties in arising early, sleep later in the evening, and greater performance in the late afternoon and evening hours (Fabbri et al., 2007; Goldstein et al., 2007).

Three dimensions make up the dark triad personality traits: Machiavellianism, psychopathy, and narcissism (Jonason et al., 2013). Machiavellian individuals are typically described as being callous, manipulative, and more strategic than impulsive. That said, positive self-presentation remains, with the specific desire to be considered an attractive and charming individual (Jonason et al., 2013; Sabouri et al., 2016). In contrast, individuals with psychopathic traits display limited self-control, impulsive and adventurous behaviour, abnormally orientated affect (i.e. callousness) and interpersonal hostility. Despite this, both traits involve attenuation in levels of empathy (Del Gaizo and Falkenbach, 2008), agreeableness and conscientiousness (Sabouri et al., 2016). Finally, narcissistic individuals are typically egotistic, dominant, self-centred and self-entitled (Jonason et al., 2013; Sabouri et al., 2016).

Jonason et al. (2013) were first to highlight suggestive evidence that an individual's chronotype may be related to the dark triad personality

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traits. Specifically, chronotype and dark-triad traits appear to be heritable in nature (Hur, 2007; Klei et al., 2005; Vernon et al., 2008). Moreover, an evening chronotype disposition appears to be related to greater impulsivity, risk-taking, sensation-seeking and extraversion and reduced conscientiousness and agreeableness, factors which are also associated with the dark triad traits (Adan et al., 2002; Killgore, 2007; Randler, 2008; Tsaousis, 2010). Evidence also demonstrates an evening chronotype disposition to be associated with increased reports of anxious and depressive symptoms (Antypa et al., 2016; Hidalgo et al., 2009). This is suggested to result from the interaction between the circadian rhythm and behavioural factors leading to an avoidance of early awakenings due to a perception of unfavourable outcomes and negative life outlook (Antypa et al., 2016; Hidalgo et al., 2009; Hasler et al., 2012; Miller et al., 2015). More specifically, reduced exposure to natural light and reduced self-reported arousal feed back to further shift/delay the biological rhythm amongst evening-types (Watts et al., 1983; Terman et al., 2001). This notion is partially supported by symptom reduction following light exposure amongst individuals with depression (Hidalgo et al., 2009). In addition, dark triad traits (i.e., risk taking, novelty seeking and impulsivity) which are also considered to be risk factors for psychopathology (Hsu et al., 2012), are often presented amongst those with an evening chronotype disposition. With that in mind, increased anxious and depressive symptoms appear to be differentially reported amongst those presenting dark triad traits. Recently, Jonason and colleagues (2015) evidenced increased depression in relation to each dark triad trait, however only narcissism was related to increased anxiety. Moreover, both psychopathy and Machiavellianism have been linked with increased reports of anxiety (Czibor et al., 2017; Pennington et al., 2015) and depression (Jonason et al., 2015; Pennington et al., 2015; O'Boyle et al., 2015). Considering these interrelationships, it is plausible that the relationship between chronotype and dark triad traits may be mediated by anxiety and/or depression. However, to date, this proposition has not been explored.

Jonason et al. (2013) determined evening chronotype disposition to be related to greater reports of Machiavellianism, psychopathy and exploitative narcissism. The authors propose that those high in these dark triad traits to experience increased cognitive functioning through the evening which facilitates the aim of outwitting individuals who may perceived them as threatening (Cummins, 1999; Jonason and Webster, 2012). More recently, Rahafar et al. (2017) determined evening chronotypes to be higher in Machiavellianism and psychopathy, but not narcissism, relative to those identifying a morning chronotype preference. Sabouri et al. (2016) examined the relationship between sleep-disruption and the dark triad personality traits in young Iranian adults. Here, increased reports of sleep disturbance were related to Machiavellianism and psychopathy, but not narcissism. Whilst these relationships were replicated amongst a sample of the UK general population using a measure of insomnia symptomology, only psychopathy predicted insomnia symptoms when shared variance between dark triad traits were controlled for (Akram et al., 2018). The authors suggest that disturbed sleep in psychopathic individuals may be explained by the experience of emotion dysregulation which accentuate factors that maintain insomnia (i.e. negatively toned cognitive activity: Harvey, 2002). Relatedly, an individual's chronotype preference in relation to specific dark triad traits could be influenced by symptoms of anxiety and/or depression.

Whilst the aforementioned research remains influential in determining the relationships concerning dark triad traits, chronotype preference, and disturbed sleep, only one study (Akram et al., 2018) accounted for the potential influence of co-occurring physiological sleep disorders (e.g. apnoea, narcolepsy). Moreover, considering the relationship between insomnia and chronotype (e.g., Chan et al., 2014), research should confirm whether an individual's chronotype preference, in the absence of insomnia, remains associated with the dark triad traits. To that end, we further examined the association between chronotype preference and the dark triad traits, whilst incorporating the possible

mediating role of anxiety and/or depression after excluding individuals presenting insomnia and/or physiological sleep-disorder symptoms. Specifically, to determine whether: i) Machiavellianism, psychopathy and narcissism are individually related to chronotype preference in normal-sleepers; ii) which specific trait(s) would be most predictive of chronotype when controlling for age and sex; and iii) confirmed relationships would be mediated by anxious and depressive symptoms. Based on literature to date, we propose that the dark triad personality traits of Machiavellianism and psychopathy personality would be independently related to an evening chronotype preference. Next, considering shifts in chronotype orientation occurring with age (Fischer et al., 2017), we expected age to also hold a degree of predictive value. Finally, we opted to control for an individual's sex after considering its interaction with age in predicting chronotype preference (Fischer et al., 2017; Randler and Engelke, 2019).

2. Method

2.1. Sample and procedure

A cross-sectional online questionnaire-based study was used, which involved the completion of previously validated questionnaires that examined the relationship between dark triad traits, chronotype, and symptoms of anxiety and depression. The Sheffield Hallam University Research Ethics Committee provided approval for the study procedure, and informed consent was provided by all participants.

Members of the general population were targeted through advertisements presented on social media outlets, research participation forums, and students from several Northern UK universities. Data collection took place during the fall months of 2017. The survey was delivered using the Qualtrics online data collection platform (Qualtrics, Provo, UT). 732 participants started the survey, and 672 respondents provided complete data for all measures. Where relevant, course credit was provided on completion. Participants who reported conducting shift work, a central nervous system disorder, sleep interfering medication use, previously experiencing a significant head injury or sleep disorder symptoms (e.g. insomnia/hypersomnia, sleep disordered breathing) were excluded from analysis ($n = 219$). This resulted in a final sample of 453 participants (mean age = 23.96 ± 11.08 , range 18–76, 75% female; 69% student) who were entered into the analysis. The Insomnia Severity Index (Bastien et al., 2001) and SLEEP-50 (Spoomaker et al., 2005) confirmed absence of sleep/wake disorder symptoms (see 'Measures' for details).

2.2. Measures

The Short Dark Triad questionnaire (SD3: Jones and Paulhus, 2014) examined the presence of the dark triad traits. The measure is comprised of 27-items in total, with 9-items for each subscale which determines each levels of Machiavellianism, psychopathy and narcissism. Items are scored on a 5-point likert scale which range from 1 (disagree strongly) to 5 (agree strongly). Each subscale is scored by averaging the nine items (Jones and Paulhus, 2014). Previous assessment and validation of the scale evidenced clear factor structure and internal consistency (Cronbach's $\alpha = .75$ for Machiavellianism; $.72$ for psychopathy, $.73$ for narcissism: Jones and Paulhus, 2014). Internal consistency (Cronbach's α) for the present sample was: $.83$ for Machiavellianism, $.77$ for psychopathy, and $.72$ for narcissism.

The 19-item Morningness–Eveningness Questionnaire was used to examine participants orientation of chronotype preference (MEQ: Horne & Östberg, 1976), which asks about the timing and schedule of sleep (e.g. "If you got into bed at 11 PM, how tired would you be? (0 = not at all tired; 5 = very tired). Total scores range between 16–86, and higher scores indicate a greater preference for morningness. In contrast, lower scores indicate a disposition for eveningness. Items are summed to form an index of chronotype. A good level of internal consistency was yielded

(Cronbach's α of .74).

Symptoms of anxiety and depression were assessed using The Hospital Anxiety and Depression Scale (HADS: Zigmond and Snaith, 1983), consisting of 14 items (seven for both anxiety and depression) scored between 0-3, with a maximum score of 21 on both subscales. Higher scores on each subscale represent greater anxiety and depression, with ≤ 7 indicating a normal case; 8-10: borderline abnormal case; 11-21: abnormal case. Both subscales demonstrated good internal consistency (Cronbach's α of .87 for anxiety, and .78 for depression).

The Insomnia Severity Index was administered to confirm the absence of insomnia symptoms (ISI: Bastien et al., 2001). Seven items, rated on a 5-point likert scale, examine self-reports of symptom severity over the past two-weeks. Item scores are summated, creating a total score which ranges from 0-28. Higher scores indicate greater presentation of insomnia symptoms, with ≤ 7 indicating: no insomnia; 8-14: subthreshold insomnia; 22-28: moderately clinical insomnia; 22-28: severe clinical insomnia. Internal consistency (Cronbach's α) in the current sample was .87. Participants yielding a score of ≥ 8 were excluded from analysis.

Subscales of the SLEEP-50 (Spoomaker et al., 2005) confirmed the absence of: sleep disordered breathing, sleepwalking, narcolepsy, restless legs syndrome/periodic limb movement, and circadian rhythm disorder. For the current purpose, the insomnia (assessed by the ISI) and sleep hygiene (not a sleep disorder) subscales were removed. Participants rate the extent to which each statement (i.e. item) applies to the past month (e.g. "I am told that I snore": 0 = not at all, 4 = very much). Total scores of: ≥ 15 indicate apnea; ≥ 7 sleepwalking; ≥ 7 narcolepsy; ≥ 7 restless legs syndrome/periodic limb movement; and ≥ 8 a circadian rhythm disorder. The presence of a sleep disorder based on these cut-off scores determined the aforementioned participant exclusion.

2.3. Statistical analyses

correlational analyses (Pearson's bivariate) examined the relationship between chronotype, anxiety, depression and each dark triad subscale. Next, these were followed by hierarchical linear regression analyses (using the enter method), with chronotype disposition as the outcome variable, to determine whether dark triad traits associated with chronotype were mediated by anxiety and depression after controlling for age and sex. Specifically, age and sex were entered as predictors in step-1; SD3 subscales in step-2; and anxiety and depression in step-3. Significance was considered at the $P < .05$ level.

3. Results

Mean scores for the final sample were as follows: MEQ, 41.43 ± 8.36 ; Machiavellianism, 2.78 ± 0.71 ; psychopathy, 2.09 ± 0.60 ; Narcissism, 2.51 ± 0.57 ; Anxiety 7.38 ± 4.08 ; and Depression 3.88 ± 2.97 . Morning chronotype preference was negatively related to Machiavellianism ($r = -.13, p = .006$) and psychopathy ($r = -.18, p = .001$) but not narcissism ($r = -.01, p = .85$). Considering this, only the subscales of Machiavellianism and psychopathy were entered into the regression analysis. Moreover, chronotype was also negatively related to anxiety ($r = -.14, p = .004$) and depression ($r = -.19, p = .001$). See Table 1 for all other correlations.

The outcomes of the regression analysis demonstrated that, after

Table 1
Descriptive statistics and correlation matrix for MEQ, Dark Triad subscales and HADS.

	Mean	SD	1	2	3	4	5	6
1. MEQ	41.43	8.36	-	.01	-.13**	-.18**	-.14**	-.19**
2. Narcissism	2.51	0.57	-	-	.28**	.43**	-.15**	-.14**
3. Machiavellianism	2.78	0.71	-	-	-	.48**	.20**	.30**
4. Psychopathy	2.09	0.60	-	-	-	-	.09	.17**
5. Anxiety	7.38	4.08	-	-	-	-	-	.57**
6. Depression	3.88	2.97	-	-	-	-	-	-

Note: * Sig at $< .05$, ** $< .01$.

MEQ, Morningness Eveningness Questionnaire.

controlling for age and sex (step1: 12% variance: see Table 2), psychopathy but not Machiavellianism significantly predicted chronotype disposition (step2: 14% total variance explained). However, after adding anxiety and depression, psychopathy and depression remained the only significant predictors of chronotype (step 3: 15% total variance).

3.1. Depression as a mediator between psychopathy and chronotype

Psychopathy scores were independently entered into the PROCESS macro as to further examine the mediating effects of depression. The results from the mediation analyses are presented in Table 3.

Here, as illustrated in Table 3, significant direct effects were reported was between psychopathy and chronotype disposition. Moreover, a significant indirect effect of psychopathy on chronotype was observed via depression, whereas no indirect effect of chronotype on psychopathy was observed. Therefore, whilst psychopathy appears to be the strongest predictor of an evening chronotype preference, this relationship appears to be partially mediated by depression. (see Fig. 1)

4. Discussion

This study explored the relationship between chronotype preference and the dark triad personality traits amongst a UK sample of normal-sleepers. Additionally, the meditational role of anxious and depressive symptoms were examined. These outcomes provide additional evidence that particular dark triad traits are associated with an evening chronotype preference. Specifically, psychopathy and Machiavellianism were independently related to a preference for eveningness. Whilst these associations were somewhat modest, these outcomes are nevertheless in line with recent research amongst German students, evidencing those with an evening chronotype disposition reporting greater levels of psychopathy and Machiavellianism, but not narcissism, compared to those identifying a morning chronotype preference (Rahafar et al., 2017). Here

Table 2
Linear regression analyses with chronotype disposition as the dependent variable; age, sex, Machiavellianism, psychopathy, anxiety and depression as predictors.

Predictors	R ²	β	t	Sig.
Step 1	.12			
Age		.35	7.82	.00**
Sex		.04	0.95	.35
Step 2	.14			
Age		.33	7.37	.00**
Sex		-.01	-.15	.88
Machiavellianism		-.06	-1.13	.26
Psychopathy		-.11	-2.16	.03*
Step 3	.15			
Age		.31	7.03	.00**
Sex		.00	-.04	.97
Machiavellianism		-.02	-.42	.68
Psychopathy		-.11	-2.08	.04*
Anxiety		-.01	-.15	.88
Depression		-.12	-2.14	.03*

Note: * Sig at $< .05$, ** $< .01$.

Table 3
Examination of depression as a mediator between psychopathy and chronotype.

IV	Mediator	DV	Total effect (c path)	Direct effect (c' path)	Total indirect effect	
					Point est.	95% CI
Psychopathy	Depression	Chronotype	-2.4805***	-2.0793**	-.4011*	-.7657, -.1693
Chronotype	Depression	Psychopathy	-0.0159***	-0.0142***	-.0017	-.0033, -.0006

Mediation model, 10,000 bootstrap samples.

Note: * Sig at < .05, ** <.01, *** <.001.

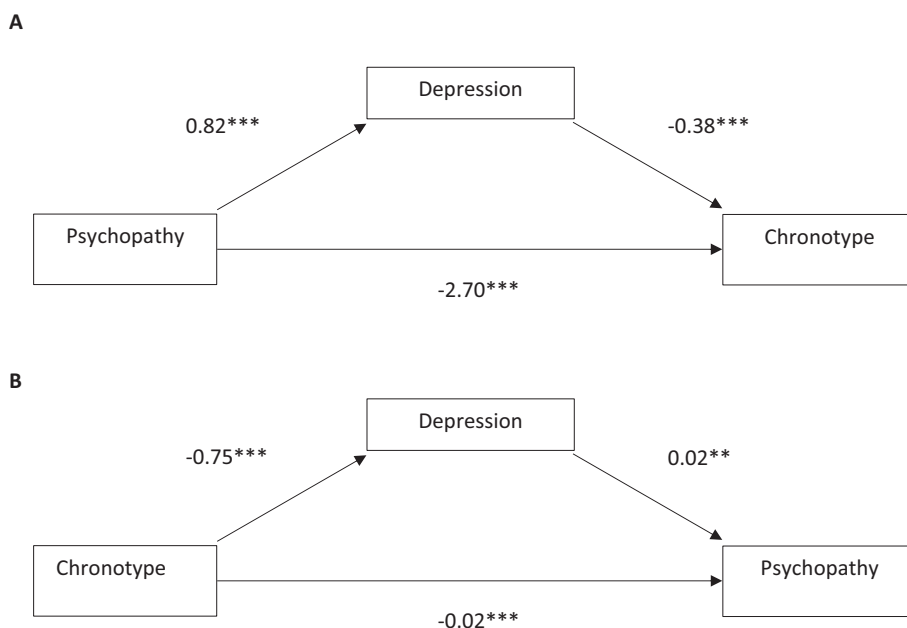


Fig. 1. Mediation models of the effects of (a) psychopathy on chronotype through depression and (b) chronotype on psychopathy through depression (10000 bootstrap samples).

however, whilst Machiavellianism and psychopathy were independently associated with chronotype, regression analysis found psychopathy and age to be the only factors significantly related to an evening chronotype disposition. Moreover, after accounting for anxiety and depression, psychopathy, age and depression remained the only significant factors related to chronotype.

Emotional instability is a common feature in those presenting dark triad traits (Birkás et al., 2016; Muris et al., 2013; Zeigler-Hill and Vonk, 2015). Specifically, whilst psychopathic individuals signify limited emotional control and adaptive coping, Machiavellianism appears to be associated with an effort to regulate emotional reactivity when faced with stress (Birkás et al., 2016). Similarly, those with an evening chronotype commonly report similar trait-like deficits in emotional stability (i.e., risk taking, novelty seeking and impulsivity (Hsu et al., 2012). Considering this, those with a preference for eveningness may inherently display increased psychopathic, but not necessarily Machiavellian, traits due to greater emotion dysregulation which is perpetuated by depressive symptoms stemming from a delay or blunting of the affective rhythm (Antypa et al., 2016; Hidalgo et al., 2009; Hasler et al., 2012; Miller et al., 2015). In contrast, the present outcomes may be reflective of increased proficiency of the evening cognitive system in Machiavellian and psychopathic individuals, which serves as an inherent means of out-think/smartering those who perceive them as a threat (Cummins, 1999; Jonason and Webster, 2012). Here, cognitive processing may peak in the evening because of lower detection risk and greater caution taken, intrinsically acting as a protective factor (Jonason et al., 2013).

An individual's sex failed to predict chronotype preference in the current study. Previous studies evidence greater tendencies towards

eveningness amongst young males relative to females (Randler, 2011; Vitale et al., 2015). That said, such differences are often minimal, with young adults displaying a similar chronotype preference regardless of sex (Randler, 2011; Vitale et al., 2015). Moreover, sex differences in chronotype preference appears to diminish with age according to recent meta-analytic data (Randler and Engelke, 2019). As such, in relation to sex, our data presents reliable similarities whereby preference remained similar amongst younger and older adults who participated.

Considering inherent age-related changes in circadian rhythmicity and accompanying chronotype preference which occur over the lifespan (i.e. greater evening tendency with adolescence and subsequent shift earlier thereafter), it's perhaps not surprising that age in the present study remained a significant predictor of chronotype alongside psychopathy and depression (Fischer et al., 2017). Considering this, the use of a more comprehensive subjective (i.e. sleep diary) and objective (i.e. actigraphy) assessments of sleep timing and variability would have been beneficial. It is also possible that the current outcomes reflect an inclusion bias such that young adults presenting co-occurring symptoms of antisocial personality disorder in the present sample were more likely to report psychopathic traits. Moreover, the mean age of the sample was relatively low and comprised predominantly of young caucasian female adults, suggesting the outcomes may not be fully generalizable to an older male population. Relatedly, the selective nature of recruitment (i.e. online social media and research participation platforms) may further limit generalisability. Moreover, despite the brief nature of the survey, attention checks may have proved useful in excluding those who: experienced difficulty in concentration; or responded in a random manner. Finally, given the cross-sectional nature of the current data, the outcomes remain

vulnerable to an inflation bias between variables (Podsakoff et al., 2003) and lack of causality and directionally. To that end, longitudinal examination of the current research questions should clarify whether chronotype predicts psychopathic behaviour, or whether the reverse is true. In addition, to reliably account for biological and psychosocial factors potentially influencing sleep timing and variability (e.g. age, sex, socio-demographic and work status, circadian rhythm) when considering the current research question in the future, a well screened more heterogeneous sample should be considered.

Despite these caveats, the present outcomes shed light on the limited research examining the relationship between the dark triad traits and chronotype preference. Here, whilst psychopathy appears to be the strongest predictor of chronotype out of the dark triads, this relationship appears to be partially mediated by depressive symptoms. Further research should clarify the mechanisms behind the mediating role of depression, with a particular emphasis on examining cognitive arousal and emotion dysregulation. Considering sleep-based therapies have proven successful in the reduction of hostile behaviour (Haynes et al., 2006), we highlight the utility of assessing chronotype disposition and depressive symptoms amongst individuals presenting such antisocial personality traits within a clinical setting.

Declarations

Author contribution statement

Umair Akram: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Jodie C. Stevenson, Maria Gardani, Asha Akram, Sarah Allen: Conceived and designed the experiments; Performed the experiments; Wrote the paper.

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Competing interest statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

References

- Adan, A., Natale, V., 2002. Gender differences in morningness–eveningness preference. *Chronobiol. Int.* 19 (4), 709–720.
- Akram, U., Allen, S., McCarty, K., Gardani, M., Tan, A., Villarreal, D., et al., 2018. The relationship between insomnia symptoms and the dark triad personality traits. *Personal. Individ. Differ.* 131, 212–215.
- Antypa, N., Vogelzangs, N., Meesters, Y., Schoevers, R., Penninx, B.W., 2016. Chronotype associations with depression and anxiety disorders in a large cohort study. *Depress. Anxiety* 33 (1), 75–83.
- Bastien, C.H., Vallières, A., Morin, C.M., 2001. Validation of the Insomnia Severity Index as an outcome measure for insomnia research. *Sleep Med.* 2 (4), 297–307.
- Birkás, B., Gács, B., Csathó, Á., 2016. Keep calm and don't worry: different Dark Triad traits predict distinct coping preferences. *Personal. Individ. Differ.* 88, 134–138.
- Borbély, A.A., 1982. A two process model of sleep regulation. *Hum. Neurobiol.* 1 (3), 195–204.
- Carskadon, M.A., Dement, W.C., 2011. Normal human sleep: an overview. *Princ. Pract. Sleep Med.* 5, 16–26.
- Chan, J.W.Y., Lam, S.P., Li, S.X., Yu, M.W.M., Chan, N.Y., Zhang, J., Wing, Y.K., 2014. Eveningness and insomnia: independent risk factors of nonremission in major depressive disorder. *Sleep* 37 (5), 911–917.
- Cummins, D.D., 1999. Cheater detection is modified by social rank: the impact of dominance on the evolution of cognitive functions. *Evol. Hum. Behav.* 20 (4), 229–248.
- Czibor, A., Szabo, Z.P., Jones, D.N., Zsido, A.N., Paal, T., Szijarto, L., et al., 2017. Male and female face of Machiavellianism: opportunism or anxiety? *Personal. Individ. Differ.* 117, 221–229.
- Del Gaizo, A.L., Falkenbach, D.M., 2008. Primary and secondary psychopathic-traits and their relationship to perception and experience of emotion. *Personal. Individ. Differ.* 45 (3), 206–212.
- Ellis, J., Von Schantz, M., Jones, K.H., Archer, S.N., 2009. Association between specific diurnal preference questionnaire items and PER3 VNTR genotype. *Chronobiol. Int.* 26, 464–473.
- Fabbri, M., Antonietti, A., Giorgetti, M., Tonetti, L., Natale, V., 2007. Circadian typology and style of thinking differences. *Learn. Individ. Differ.* 17 (2), 175–180.
- Fischer, D., Lombardi, D.A., Marucci-Wellman, H., Roenneberg, T., 2017. Chronotypes in the US—influence of age and sex. *PLoS One* 12 (6), e0178782.
- Goldstein, D., Hahn, C.S., Hasher, L., Wiprzycka, U.J., Zelazo, P.D., 2007. Time of day, intellectual performance, and behavioral problems in morning versus evening type adolescents: is there a synchrony effect? *Personal. Individ. Differ.* 42 (3), 431–440.
- Harvey, A.G., 2002. A cognitive model of insomnia. *Behav. Res. Ther.* 40, 869–893.
- Hasler, B.P., Smith, L.J., Cousins, J.C., Bootzin, R.R., 2012. Circadian rhythms, sleep, and substance abuse. *Sleep Med. Rev.* 16 (1), 67–81.
- Haynes, P.L., Bootzin, R.R., Smith, L., Cousins, J., Cameron, M., Stevens, S., 2006. Sleep and aggression in substance-abusing adolescents: results from an integrative behavioral sleep-treatment pilot program. *Sleep* 29 (4), 512–520.
- Hidalgo, M.P., Caumo, W., Posser, M., Coccaro, S.B., Camozzato, A.L., Chaves, M.L.F., 2009. Relationship between depressive mood and chronotype in healthy subjects. *Psychiatry Clin. Neurosci.* 63 (3), 283–290.
- Horne, J.A., Östberg, O., 1976. A self-assessment questionnaire to determine morningness–eveningness in human circadian rhythms. *Int. J. Chronobiol.*
- Hsu, C.Y., Gau, S.S.F., Shang, C.Y., Chiu, Y.N., Lee, M.B., 2012. Associations between chronotypes, psychopathology, and personality among incoming college students. *Chronobiol. Int.* 29 (4), 491–501.
- Hur, Y.M., 2007. Stability of genetic influence on morningness–eveningness: a cross-sectional examination of South Korean twins from preadolescence to young adulthood. *J. Sleep Res.* 16 (1), 17–23.
- Jonason, P.K., Webster, G.D., 2012. A protean approach to social influence: dark Triad personalities and social influence tactics. *Personal. Individ. Differ.* 52 (4), 521–526.
- Jonason, P.K., Jones, A., Lyons, M., 2013. Creatures of the night: chronotypes and the dark triad traits. *Personal. Individ. Differ.* 55 (5), 538–541.
- Jonason, P.K., Baughman, H.M., Carter, G.L., Parker, P., 2015. Dorian Gray without his portrait: psychological, social, and physical health costs associated with the Dark Triad. *Personal. Individ. Differ.* 78, 5–13.
- Jones, D.N., Paulhus, D.L., 2014. Introducing the short dark triad (SD3) a brief measure of dark personality traits. *Assessment* 21 (1), 28–41.
- Kerkhof, G.A., 1985. Inter-individual differences in the human circadian system: a review. *Biol. Psychol.* 20 (2), 83–112.
- Killgore, W.D., 2007. Effects of sleep deprivation and morningness–eveningness traits on risk-taking. *Psychol. Rep.* 100 (2), 613–626.
- Klei, L., Reitz, P., Miller, M., Wood, J., Maendel, S., Gross, D., et al., 2005. Heritability of morningness–eveningness and self-report sleep measures in a family-based sample of 521 hutterites. *Chronobiol. Int.* 22 (6), 1041–1054.
- Miller, M.A., Rothenberger, S.D., Hasler, B.P., Donofry, S.D., Wong, P.M., Manuck, S.B., et al., 2015. Chronotype predicts positive affect rhythms measured by ecological momentary assessment. *Chronobiol. Int.* 32 (3), 376–384.
- Muris, P., Meesters, C., Timmermans, A., 2013. Some youths have a gloomy side: correlates of the dark triad personality traits in non-clinical adolescents. *Child Psychiatr. Hum. Dev.* 44 (5), 658–665.
- O'Boyle, E.H., Forsyth, D.R., Banks, G.C., Story, P.A., White, C.D., 2015. A meta-analytic test of redundancy and relative importance of the dark triad and five-factor model of personality. *J. Personal.* 83 (6), 644–664.
- Pennington, C.R., Cramer, R.J., Miller, H.A., Anastasi, J.S., 2015. Psychopathy, depression, and anxiety as predictors of suicidal ideation in offenders. *Death Stud.* 39 (5), 288–295.
- Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y., Podsakoff, N.P., 2003. Common method biases in behavioral research: a critical review of the literature and recommended remedies. *J. Appl. Psychol.* 88, 879.
- Rahafar, A., Randler, C., Castellana, I., Kausch, I., 2017. How does chronotype mediate gender effect on Dark Triad? *Personal. Individ. Differ.* 108, 35–39.
- Randler, C., 2008. Morningness–eveningness, sleep–wake variables and big five personality factors. *Personal. Individ. Differ.* 45 (2), 191–196.
- Randler, C., 2011. Age and gender differences in morningness–eveningness during adolescence. *J. Genet. Psychol.* 172 (3), 302–308.
- Randler, C., Engelke, J., 2019. Gender differences in chronotype diminish with age: a meta-analysis based on morningness/chronotype questionnaires. *Chronobiol. Int.* 1–18.
- Sabouri, S., Gerber, M., Lemola, S., Becker, S.P., Shamsi, M., Shakouri, Z., et al., 2016. Examining Dark Triad traits in relation to sleep disturbances, anxiety sensitivity and intolerance of uncertainty in young adults. *Compr. Psychiatr.* 68, 103–110.
- Spoormaker, V.I., Verbeek, I., van den Bout, J., Klip, E.C., 2005. Initial validation of the SLEEP-50 questionnaire. *Behav. Sleep Med.* 3 (4), 227–246.
- Terman, J.S., Terman, M., Lo, E.S., Cooper, T.B., 2001. Circadian time of morning light administration and therapeutic response in winter depression. *Arch. Gen. Psychiatr.* 58 (1), 69–75.
- Tsaousis, I., 2010. Circadian preferences and personality traits: a meta-analysis. *Eur. J. Personal.: Publ. Eur. Assoc. Pers. Psychol.* 24 (4), 356–373.
- Vernon, P.A., Villani, V.C., Vickers, L.C., Harris, J.A., 2008. A behavioral genetic investigation of the Dark Triad and the Big 5. *Personal. Individ. Differ.* 44 (2), 445–452.

- Vitale, J.A., Roveda, E., Montaruli, A., Galasso, L., Weydahl, A., Caumo, A., Carandente, F., 2015. Chronotype influences activity circadian rhythm and sleep: differences in sleep quality between weekdays and weekend. *Chronobiol. Int.* 32 (3), 405–415.
- Watts, C., Cox, T., Robson, J., 1983. Morningness-eveningness and diurnal variations in self-reported mood. *J. Psychol.* 113 (2), 251–256.
- Zeigler-Hill, V., Vonk, J., 2015. Dark personality features and emotion dysregulation. *J. Soc. Clin. Psychol.* 34 (8), 692–704.
- Zigmond, A.S., Snaith, R.P., 1983. The hospital anxiety and depression scale. *Acta Psychiatr. Scand.* 67 (6), 361–370.