

Worry Related Sleep Disturbance and Noctcaelador: Investigating the Role of Personality Characteristics

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Abstract

Previous exploratory research found that worry related sleep disturbance (WRSD) was related to noctcaelador, a personal affinity for the night sky. However, this finding remains unexplained. To understand the possible role of personality characteristics, 167 university students completed measures of noctcaelador, WRSD, general worry, and personality characteristics. Mediation analyses suggested that WRSD may relate to noctcaelador both directly and indirectly through personality characteristics involving hypomanic-like activity. Based on the results and previous studies it was surmised that one possible link between WRSD and noctcaelador is increased cognitive activity. The results and suggestions for future research are discussed.

Keywords: Noctcaelador; Night sky; Sleep disturbance; Worry; Personality; Hypomania

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1. Introduction

Noctcaelador is described as a personally significant affinity and bond with the night sky (Kelly, 2003a, 2026a). Among broad-band personality domains, the construct is related to Openness to Experience of the Big Five factors, and the Feeling function of Jung's personality typology (Kelly, 2004a, 2025a). Among narrow-band individual differences measures, noctcaelador is related to intellectual and artistic interests (Kelly, 2021), rational and alternative-seeking coping strategies (Idris, 2018), and travel to engage in stargazing (Tapada et al., 2023). The construct is also associated with feeling more connected to nature (Barnes & Passmore, 2024), less existential well-being (Kelly, 2026b), more creativity (Kelly & Kelly, 2026), and more appreciation of urban nightscapes (Gao & Zhu, 2025).

Development of noctcaelador appears to be reciprocal with exposure to the night sky. For instance, increases in noctcaelador have been found after guided exposure to night sky imagery (Kaufman et al., 2026). Yet, a felt connection with the night sky also relates to more powerful experiences when observing night sky images (Martens et al., 2026) and to more plans to view the night sky in the relatively near future (Kelly, 2006). One theoretical model of noctcaelador suggests that individuals with lower well-being who have a more permeable psychological structure are likely to feel calmer and more "whole" when watching the night sky, facilitating noctcaelador (Kelly, 2019a; Kelly & Daughtry, 2026a). The noctcaelador-night sky watching relationship may indicate long-term patterns tracing to childhood (Blair, 2018; Colantonio, et al., 2021).

Other research indicates that noctcaelador is related to worry related sleep disturbance (WRSD; Kelly, 2025b). WRSD is described as a metacognitive attribution of sleep disruption to worry (Kelly, 2017). About 40% of adults attribute sleep disruption to worry (Dregan et al., 2013). WRSD is associated with reports of more stress and negative affect and lower life satisfaction and self-esteem (Kelly, 2003b). As would be expected, WRSD is related to both trait worry and insomnia, though it does not appear reducible to either (Kelly, 2017). WRSD has

bidirectional associations with both somatic and cognitive arousal (Bartel et al., 2015; Marquis et al., 2019). It has been proposed that worry may become attributed to worry through a form of the co-variation principle (Kelley, 1972), where worry occurring in proximity with sleep difficulty may become (mis)attributed to it (Kelly, 2003b).

As the two variables seemingly have little theoretical commonality, the relationship between noctcaelador and WRSD is somewhat unexpected. In such cases, it is possible that two variables might share associations through a third variable (Stanovich, 2019). One possible third variable to influence this relationship is sleep length. Both noctcaelador and WRSD are related to decreased habitual sleep length (Kelly, 2002; Kelly & Rose, 2005). However, given small relationships with sleep length for both and the apparent subjective metacognitive nature of WRSD, the influence of sleep length on the noctcaelador-WRSD relationship seems less likely. It is also possible that other adjacent features may influence their relationship. For instance, noctcaelador has been related to worry themes about the world and environment independent of general pathological worry and WRSD (Kelly, 2026d), suggesting anxious personality features may play a role. Yet, noctcaelador is not strongly related to anxiety (Kelly, 2025c, 2025d). Moreover, both noctcaelador and unusual sleep experiences have been associated with schizotypy-like personality processes (Kelly, 2025d; Koffel & Watson, 2009; Kelly & Daughtry, 2026b). However, the undetermined relationship between WRSD and schizotypy makes the latter an exploratory but less promising third variable. WRSD and noctcaelador variables also have been related to hypomanic personality features (Weiner, et al., 2021; Kelly, 2025c; 2025d). This 3rd variable seems a more likely influence considering more substantial inter-correlations and theoretical propositions that noctcaelador, WRSD, and hypomanic activity may manifest from permeable psychological structures (Kelly, 2026c; Soffer-Dudek, 2017).

The current study explored if a broad range of personality features in a nonclinical sample mediate the relationship between noctcaelador and WRSD. Such findings might provide possible mechanisms in the noctcaelador-WRSD relationship for additional investigation. Based on the review above, it was expected that hypomanic personality processes would mediate the relationship between WRSD and noctcaelador. Other possible personality features as mediators were considered exploratory. A measure specifically examining worry also was included as a control variable.

2. Methods

2.1 Participants and Procedure

Study participants included 167 (131 women, 36 men) students recruited from various undergraduate and graduate psychology courses at a small university in the Southern United States to complete a survey including the measures described below. The average age of participants was 22.78 (SD = 3.56). Ethical board approval was obtained. Informed consent was provided prior to survey completion. Surveys were completed anonymously in small group settings. Nominal extra course credit was provided in exchange for participation.

2.2 Measures

2.2.1 Noctcaelador

The 10-item Noctcaelador Inventory (NI; Kelly, 2004b) measures a personally meaningful bond with the night sky including feelings of attachment, enjoyment, and engagement with the night sky, e.g., “Having time to look at the night sky is important to me.” Participants respond using a 1 (strongly disagree) to 5 (strongly agree) scale. Responses are summed with total scores indicating more noctcaelador. Good retest reliability across one month ($r = .88$) and support for validity have been reported (Kelly, 2004b, 2019a; Batey & Kelly, 2005).

2.2.2 Worry Related Sleep Disturbance

The 5-item Sleep Disturbance Ascribed to Worry Scale (SAW; Kelly, 2002) measures WRSD through items reflecting attribution of sleep problems to worry, e.g., “How often can you not get to sleep for several minutes because of worry?” Participants respond using a 0 (never) to 10 (very often) scale. Responses are summed and total scores indicate more attribution of sleep disturbance to worry. Adequate retest reliability across one month ($r = .83$) and validity support have been reported (Kelly, 2003b; Kelly & Forbes, 2004).

2.2.3 General Worry

The Three Item Worry Index (TIWI; Kelly, 2004c) measures general worry, e.g., “How much is worry a problem for you?” Participants respond using a 0 (never) to 10 (very often) scale. Responses are summed and total scores indicate more general worry. Good internal consistency reliability ($\alpha = .91$) and validity support have been reported (Kelly, 2004c).

2.2.4 Personality Characteristics

The 52-item Ausburg Multidimensional Personality Instrument (AMPI; Kelly, 2012a, 2012b) includes 10 brief scales measuring personality characteristics among nonclinical samples, e.g., “At times I am bursting with energy,” and 3 validity scales to examine response tendencies, e.g., “I never talk about people behind their backs.” Given the purposes of this study, only the 10 clinical scales were included in the questionnaire. Each scale includes four items which measure the following: Somatization (attention to physical discomfort), Dysphoria (sadness and meaninglessness), Hystericality (responsibility avoidance and desire to be accepted), Psychodeviance (deviant behavior and disregard for others), Feminine Interests (valuing relationships and feelings), Paranoia (suspiciousness), Anxiousness (stress susceptibility), Schizotypic (nonordinary perceptual experiences), Hypomania (high energy levels), Introversion (socially reserved). Participants respond using a 1 (strongly disagree) to 5 (strongly agree) scale. Responses are summed with higher scores indicating more of each characteristic. Adequate internal consistency reliabilities (α s = .70–.86) and validity support have been reported (Kelly, 2012a; 2013, 2014a, 2014b).

2.3 Statistical Analyses

SPSS v. 32 for Windows was utilized for analyses. Preliminary examinations of gender differences were examined using independent samples t-tests. Pearson product moment correlation coefficients were calculated to examine relationships with age. Pearson correlations were calculated for AMPI scales and noctcaelador, WRSD, and general worry. Correlation coefficients were considered small, medium, or large if they reached .10, .30, and .50, respectively (Cohen, 1988). Model 4 of Hayes’ PROCESS macro v. 4.2 for SPSS (Hayes, 2022) was used to examine AMPI scales as parallel mediators in the relationship between noctcaelador (outcome variable) and WRSD (predictor). PROCESS uses regressions and bootstrapped confidence intervals (CIs) to determine significance. Bootstrapped CIs not including “0” are considered significant. Bootstraps with 10000 resamples were used. Standardized betas (β) are presented to allow effect size comparisons. Findings were significant if $p < .050$ (two-tailed).

3. Results

Psychometric properties of scales are presented in Table 1. Coefficient alpha reliability of three AMPI scales was lower than the conventional .70 (see Table 1). While this may be expected for brief scales assessing broad dimensions (Cortina, 1993), an alternative strategy of using average inter-item correlations was used to examine these scales’ reliability. According to Clark and Watson (2019), an average inter-item correlation of at least .15 is considered adequate and would result in higher coefficient alphas in longer scales. The average inter-item correlation for Hypomania, Feminine Interests, and Psychodeviance, were .22, .29, and .34, respectively indicating adequate reliability for exploratory analyses.

Table 1: Scale Psychometric Properties

Variable	M	SD	α
Noctcaelador	28.14	8.51	.92
WRSD	18.20	11.01	.90
Worry	18.53	6.93	.96
Somatization	9.95	3.41	.72
Dysphoria	8.97	3.20	.74
Hystericality	11.10	3.40	.76
Psychodeviance	8.92	2.92	.67
Feminine Interests	12.16	2.81	.61
Paranoia	10.34	3.38	.73
Anxiousness	12.84	3.46	.75
Schizotypic	8.77	3.75	.80
Hypomania	12.37	2.98	.52
Introversion	11.29	3.95	.83

Note: WRSD = Worry related sleep disturbance.

Significant preliminary gender differences were found for worry, with women scoring higher than men, $t = 3.00$, $p < .003$. Men scored significantly higher than women on Dysphoria, Psychodeviance, and Schizotypic, t s > 1.98 , p s $\leq .049$. Age was not significantly correlated with any variable, r s $< .13$, p s $\geq .105$. As such, only gender was included as a sociodemographic control variable in multivariate analyses.

As presented in Table 2, noctcaelador was significantly correlated with WRSD, worry, and AMPI Schizotypic and Hypomania scales, though relationships were generally small. Strong correlations were found between WRSD and worry, as well as for both WRSD and worry with Anxiousness. Hypomania significantly correlated with WRSD but not general worry.

Table 2: Correlations of Noctcaelador, Worry, and WRSD with AMPI scales

Variable	Noctcaelador	WRSD	Worry
WRSD	.23**		
Worry	.17*	.61**	
Somatization	.11	.23**	.22**
Dysphoria	-.10	.24**	.28**
Hystericality	.13	.15	.14
Psychodeviance	.08	.17*	.07
Feminine Interests	-.05	-.08	-.13
Paranoia	.09	.13	.16*
Anxiousness	.08	.49**	.65**
Schizotypic	.20**	.06	.00
Hypomania	.28**	.19*	.08
Introversion	-.05	.07	.17*

Note: N = 167. *p < .050, **p < .010. WRSD = Worry related sleep disturbance; AMPI = Ausburg Multidimensional Personality Instrument.

Full regression results from PROCESS analyses are presented in Table 3. The full model accounted for a significant 22.6% ($p < .001$) of the variance in noctcaelador. WRSD (positively), Dysphoria (negatively), Schizotypic, and Hypomania scores (positively) independently related with noctcaelador.

Mediated (indirect) relationships of WRSD and noctcaelador through AMPI scales are presented in Table 4. As shown in the table, though the standardized beta was small, the only AMPI scale that significantly mediated WRSD and noctcaelador was Hypomania.

Table 3: Full Regression Model Predicting Noctcaelador

Variable	β	p
WRSD	.19	.042
Somatization	-.01	.863
Dysphoria	-.33	<.001
Hystericality	.06	.497
Psychodeviance	.03	.787
Feminine Interests	-.08	.314
Paranoia	.06	.512
Anxiousness	-.15	.164
Schizotypic	.27	.003
Hypomania	.20	.017
Introversion	.00	.987
Worry	.18	.108
Gender	.08	.373

$R^2 = .226$, $F = 3.43$, $p < .001$

Note: WRSD = Worry related sleep disturbance. Gender: 1 = men, 2 = women.

Table 4: Indirect Relationships of Noctcaelador and WRSD Through AMPI Scales

Variable	β	LLCI	ULCI
Somatization	.00	-.04	.03
Dysphoria	-.03	-.10	.03
Hystericality	.01	-.02	.04
Psychodeviance	.00	-.03	.05
Feminine Interests	-.00	-.02	.03
Paranoia	.00	-.02	.03
Anxiousness	-.02	-.07	.01
Schizotypic	.02	-.03	.08
Hypomania	.04	.01	.09
Introversion	-.00	-.02	.02

Note: WRSD = Worry related sleep disturbance. AMPI = Ausburg Multidimensional Personality Instrument; LLCI = Lower limit confidence interval; ULCI = Upper limit confidence interval.

4. Discussion

Consistent with the hypothesis, Hypomania, but not other AMPI scales, mediated the relationship between WRSD and noctcaelador. Given that the bivariate relationship between WRSD and noctcaelador was slightly reduced but remained significant after accounting for other variables in the regression, the results can be considered partial rather than full mediation. This suggests additional variables are needed to explain the relationship between WRSD and noctcaelador. Given the cross-sectional design, mediation in the current study indicates indirect relationships rather than causal paths.

Replicating previous findings, at the bivariate level noctcaelador was related to WRSD, Hypomania, and Schizotypic scales (Kelly, 2025d). Interestingly, in the regression, but not the bivariate level, noctcaelador was negatively related to depressive features. This was consistent with bivariate findings using a longer, well validated measure of depressive personality features (Kelly, 2025c). Conversely, previous research using the AMPI did not find a significant relationship with depressive features. However, regressions were not reported in that study (Kelly, 2025d).

The current results suggest that trait-like hypomanic-like activity, which is characterized by higher energy levels as well as increased and divergent cognitive activity (Kelly, 2014a; 2014b), is related to noctcaelador. Considering previous findings that noctcaelador was related to need for cognition (Kelly, 2005), it is possible that increased cognitive activity is involved in this relationship rather than necessarily a clinical hypomanic syndrome. The partial mediation in the current study implies that if cognitive activity is involved in the relationship between WRSD and noctcaelador, it might be that a more proximal and specific nighttime increase in cognitive activity influences the WRSD-noctcaelador relationship rather than more distal and general trait-like hypomanic activity.

Another possible influence gleaned from previous findings is psychological structure. Previous work found that a permeable psychological structure largely accounted for the relationship between noctcaelador and hypomania and schizotypy (Kelly, 2026c; Kelly & Daughtry, 2026b). By extension, it might be that psychological structure influences the link between noctcaelador and WRSD. Additional study is needed to examine these possibilities.

Limitations of the current study include reliance on a relatively young, mostly female university student sample. This makes generalization to the larger population challenging. Larger, more diverse samples would be useful. Further, the brevity of the AMPI could have limited more nuanced measurement of its constructs. More sophisticated measures including longer scales and experience sampling may provide clearer relationships between variables. Also, longitudinal designs would be useful, particularly in clarifying the mediation analyses. Indeed, worry predicts sleep disturbance longitudinally (McGowan et al., 2016). It would be interesting to examine if increased cognitive activity longitudinally precedes both sleep disturbance and noctcaelador.

Future research, in addition to the above suggestions, might also examine whether metacognition may be involved in noctcaelador. Previous work suggested that changing metacognition about worry and sleep disturbance could be useful in reducing WRSD (Kelly, 2019b). It would be interesting to examine if night sky watching also reduces WRSD given previous findings of relaxation associated with night sky watching (Gankhuu et al., 2023). Future research might attempt to replicate the current findings accounting for psychological structure.

In conclusion, the current study found that hypomanic features partially mediated the relationship between WRSD and noctcaelador suggesting heightened cognitive activity may partly explain the link between attributing sleep difficulties to worry and a meaningful relationship with the night sky. Several methodological shortcomings in the present study limit generalizability to larger populations. Additional research is suggested.

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