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Stress and Sleep Disturbance as Correlates of Cognitive and Somatic Difficulties in Students

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Abstract. Adolescent stress and sleep disruption may affect cognitive and physical functioning. This cross-sectional survey examined stress, sleep disturbance, cognitive difficulty, and somatic symptoms in high school students. After quality screening, 36 of 38 responses were analyzed using composite scales, correlation tests, and multiple regression. All domains correlated positively, and sleep was most strongly related to somatic symptoms ($r = .761$). Stress and sleep were independently associated with cognitive difficulty, whereas only sleep remained associated with somatic symptoms after controlling for stress. Demographic and workload variables showed no reliable associations after multiple-testing correction. Despite the small self-report sample, the findings identify sleep as a useful component of student well-being assessment and support longitudinal studies using objective measures.

Keywords: Adolescent Stress, Sleep Disturbance, Cognitive Difficulty, Somatic Symptoms

1. Introduction

Adolescence is a sensitive period of brain and behavioral development during which increasing academic, social, and family demands may contribute to substantial stress [1]. Repeated or prolonged stress can affect physiological systems involved in adaptation, including the hypothalamic–pituitary–adrenal (HPA) axis. Chronic activation of these systems may contribute to allostatic load and influence neural processes supporting attention, memory, and emotional regulation [2-4]. Stress has also been associated with immune and inflammatory processes that may contribute to fatigue and other physical complaints [5]. Sleep may play an important role within this network of stress-related difficulties. Sleep disturbance is associated with poorer attention, working memory, emotional regulation, and daytime functioning, while stress itself can interfere with sleep [6]. Stress and sleep may therefore represent related but potentially distinct contributors to cognitive and physical difficulties. Despite extensive research on stress and sleep, less is known about how perceived stress, sleep disturbance, cognitive difficulty, and somatic symptoms co-occur in everyday student populations and whether stress and sleep show independent associations with cognitive and physical symptom burden. The present cross-sectional survey study examined relationships among four self-reported domains: stress, sleep disturbance, cognitive difficulty, and somatic symptoms. We hypothesized that greater stress and sleep disturbance would be associated with greater cognitive

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and somatic difficulties and further examined whether stress and sleep showed independent associations with these outcomes when considered simultaneously.

2. Methods

2.1. Participants, survey design, and composite scores

A cross-sectional 35-item questionnaire was completed by 38 students and young adults. Six items assessed demographic and academic characteristics, and 29 items (Q7–Q35) assessed stress, sleep disturbance, cognitive difficulty, and somatic symptoms. Symptom frequency was scored from 0 (Never) to 4 (More than 6 times). Two participants showing complete straight-line responding were excluded, resulting in a primary sample of 36; analyses were repeated with all 38 participants as a sensitivity analysis. Symptom items were grouped a priori into stress (Q7–Q14), sleep disturbance (Q15–Q21), cognitive difficulty (Q22–Q28), and somatic symptoms (Q29–Q35). Composite scores were calculated as the mean response within each domain (range: 0–4), with higher scores indicating greater symptom frequency. Internal consistency was assessed using Cronbach's alpha.

2.2. Statistical analysis

Descriptive statistics were calculated for composite and item-level scores. Associations among the four symptom domains were assessed using Pearson correlations, with Spearman correlations used as a robustness analysis. Selected associations were visualized using linear regression with 95% confidence intervals. Multiple linear regression examined whether stress and sleep disturbance were independently associated with cognitive difficulty and somatic symptoms. Standardized coefficients (β), R^2, adjusted R^2, and HC3 robust standard errors were reported, and variance inflation factors were examined for multicollinearity. Regression models were repeated in the full sample as a sensitivity analysis. Exploratory associations of age, grade, homework time, extracurricular activities, and perceived academic stress with symptom scores were assessed using Spearman correlations. Gender differences were examined using Mann–Whitney U tests. Benjamini–Hochberg false discovery rate correction was applied to exploratory multiple comparisons. All tests were two-sided, with $p < .05$ considered statistically significant.

3. Results

3.1. Stress-related difficulties were common across domains and measured with good-to-excellent internal consistency

After data-quality screening, 36 of 38 responses were retained; two were excluded for complete straight-lining, including one completed in 40 seconds. Mean composite scores were 2.05 (SD = 0.87) for stress, 2.14 (SD = 1.17) for sleep disturbance, 2.12 (SD = 1.02) for cognitive difficulty, and 1.87 (SD = 0.96) for somatic symptoms. Scores showed substantial individual variability across the 0–4 scale (Figure 1A). Item-level profiles indicated that difficulties were distributed across each domain (Figure 1B). Frequently endorsed items included anxiety about future plans, academic performance, or career goals (Q12); daytime sleepiness or low energy (Q18); sleeping less than planned (Q21); and physical tiredness despite adequate rest (Q35). All composite scales showed good-to-excellent internal consistency: Cronbach's α was .832 for stress, .917 for sleep disturbance, .909 for cognitive difficulty, and .842 for somatic symptoms (Figure 1C), supporting their use in subsequent analyses.

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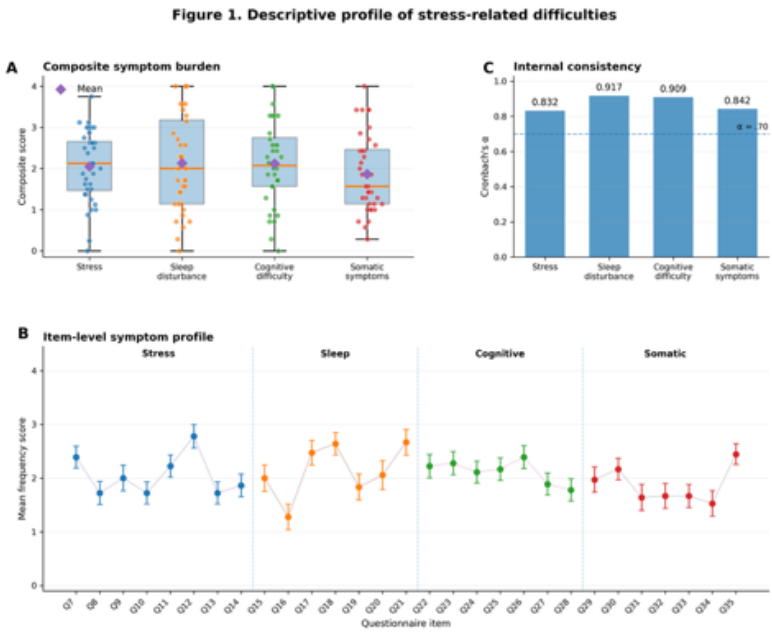

Figure 1. Descriptive profile of stress-related difficulties

(A) Composite scores across four symptom domains (N = 36); points represent participants and diamonds indicate means. (B) Mean item-level frequency scores; error bars indicate SEM. (C) Cronbach's α for each composite scale; dashed line indicates α = .70.

3.2. Stress, sleep disturbance, cognitive difficulty, and somatic symptoms were strongly interconnected

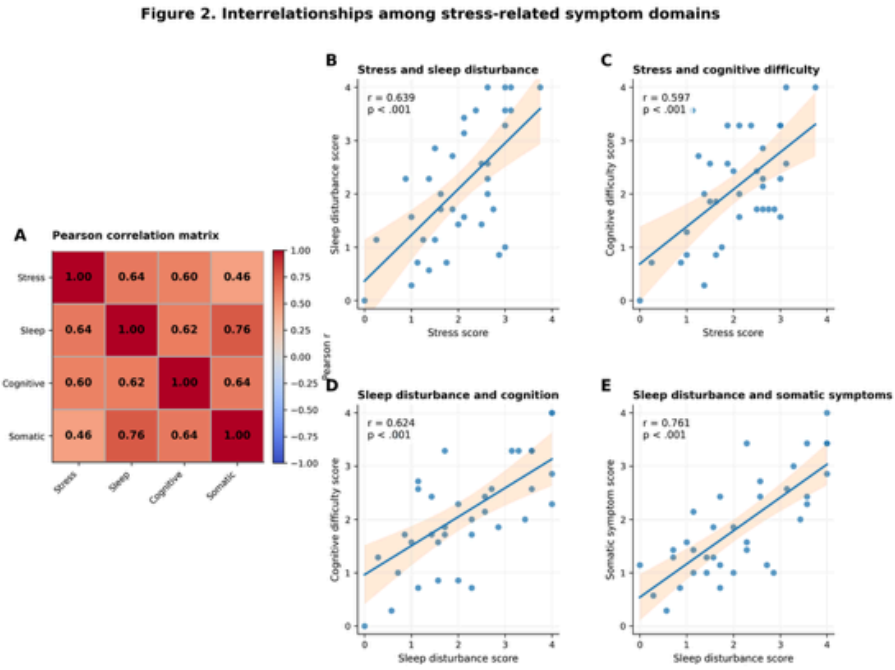

Figure 2. Interrelationships among stress-related symptom domains

(A) Pearson correlation matrix of the four composite scores (N = 36). (B–E) Selected pairwise associations with linear regression fits and 95% confidence intervals. Pearson r and p values are shown.

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All six Pearson correlations among the four symptom domains were positive and significant (r = .458–.761, all p < .01; Figure 2A). Stress correlated with sleep disturbance (r = .639, p < .001; Figure 2B) and cognitive difficulty (r = .597, p < .001; Figure 2C). Sleep disturbance correlated with cognitive difficulty (r = .624, p < .001; Figure 2D) and showed the strongest association with somatic symptoms (r = .761, p < .001; Figure 2E). Cognitive and somatic difficulties were also related (r = .636, p < .001), whereas the stress-somatic association was more moderate (r = .458, p = .0049). Spearman correlations were similar (ρ = .445–.717), confirming that the pattern did not depend on Pearson correlations alone.

3.3. Sleep disturbance independently predicted both cognitive and somatic difficulties, whereas stress showed an additional independent association only with cognitive difficulty

In multiple regression, stress and sleep disturbance jointly explained 45.6% of the variance in cognitive difficulty (R^2 = .456, adjusted R^2 = .423; Figure 3A,C). With HC3 robust standard errors, both stress (standardized β = .335, p = .022) and sleep disturbance (β = .410, p = .009) remained independently associated with cognitive difficulty. For somatic symptoms, the model explained 58.1% of the variance (R^2 = .581, adjusted R^2 = .555; Figure 3B,C). Sleep disturbance showed a strong independent association (β = .792, p < .001), whereas stress did not after sleep was controlled (β = −.048, p = .783). Multicollinearity was limited (VIF = 1.69). Results were substantively unchanged when all 38 participants were included: cognitive-model coefficients were β = .364 for stress and .409 for sleep, and somatic-model coefficients were β = .006 and .774, respectively (Figure 3D).

Figure 3. Independent associations of stress and sleep disturbance with symptom burden

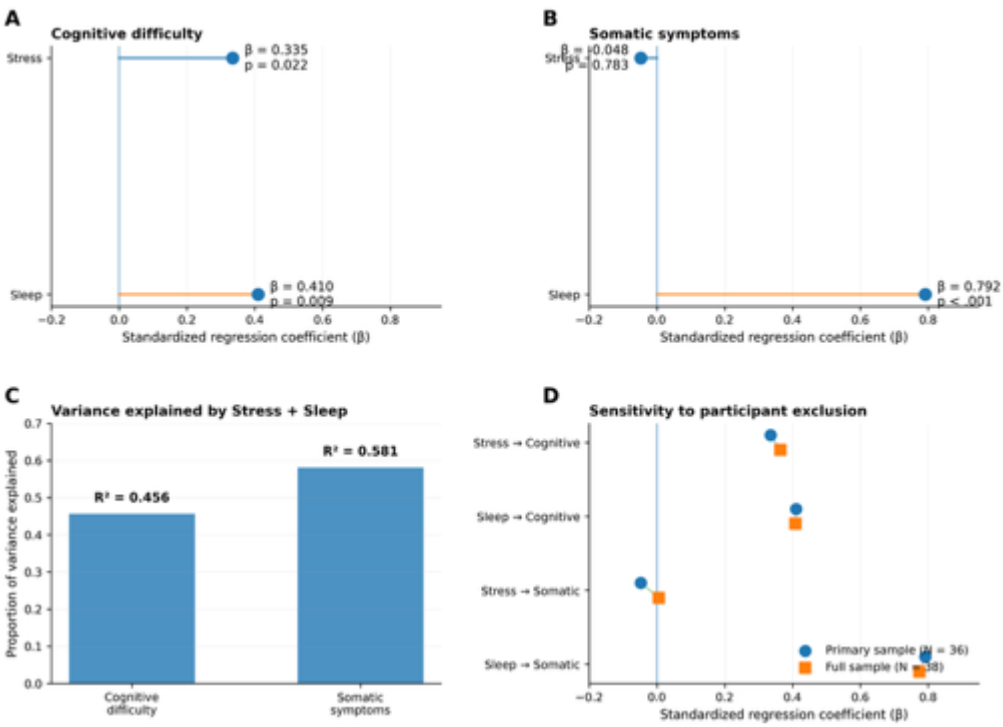

Figure 3. Independent associations of stress and sleep disturbance with symptom burden

(A–B) Standardized regression coefficients (β) for cognitive difficulty and somatic symptoms (N = 36). (C) Variance explained (R^2) by each model. (D) Sensitivity analysis comparing the primary (N = 36) and full (N = 38) samples.

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3.4. Demographic and workload characteristics showed little evidence of systematic associations with symptom burden

Grade level was not significantly associated with any symptom domain (all $p \geq .142$; Figure 4A); the ≤9th-grade category contained only one participant. Exploratory analyses of age, grade, homework, extracurricular activities, and perceived academic stress likewise showed little evidence of systematic associations (Figure 4B). Homework hours were nominally associated with lower somatic scores ($\rho = -.461$, $p = .0047$), and perceived academic stress with higher stress scores ($\rho = .433$, $p = .0083$), but neither survived FDR correction across 20 tests (both adjusted $p = .0829$). No significant gender differences were detected (Figure 4C). Male participants had descriptively higher means across all domains, but Mann-Whitney tests were nonsignificant after FDR correction (all adjusted $p > .05$). Overall, the strongest and most consistent relationships occurred among the symptom domains themselves, particularly those involving sleep disturbance, rather than with measured demographic or workload characteristics.

Figure 4. Associations of demographic and contextual factors with symptom burden

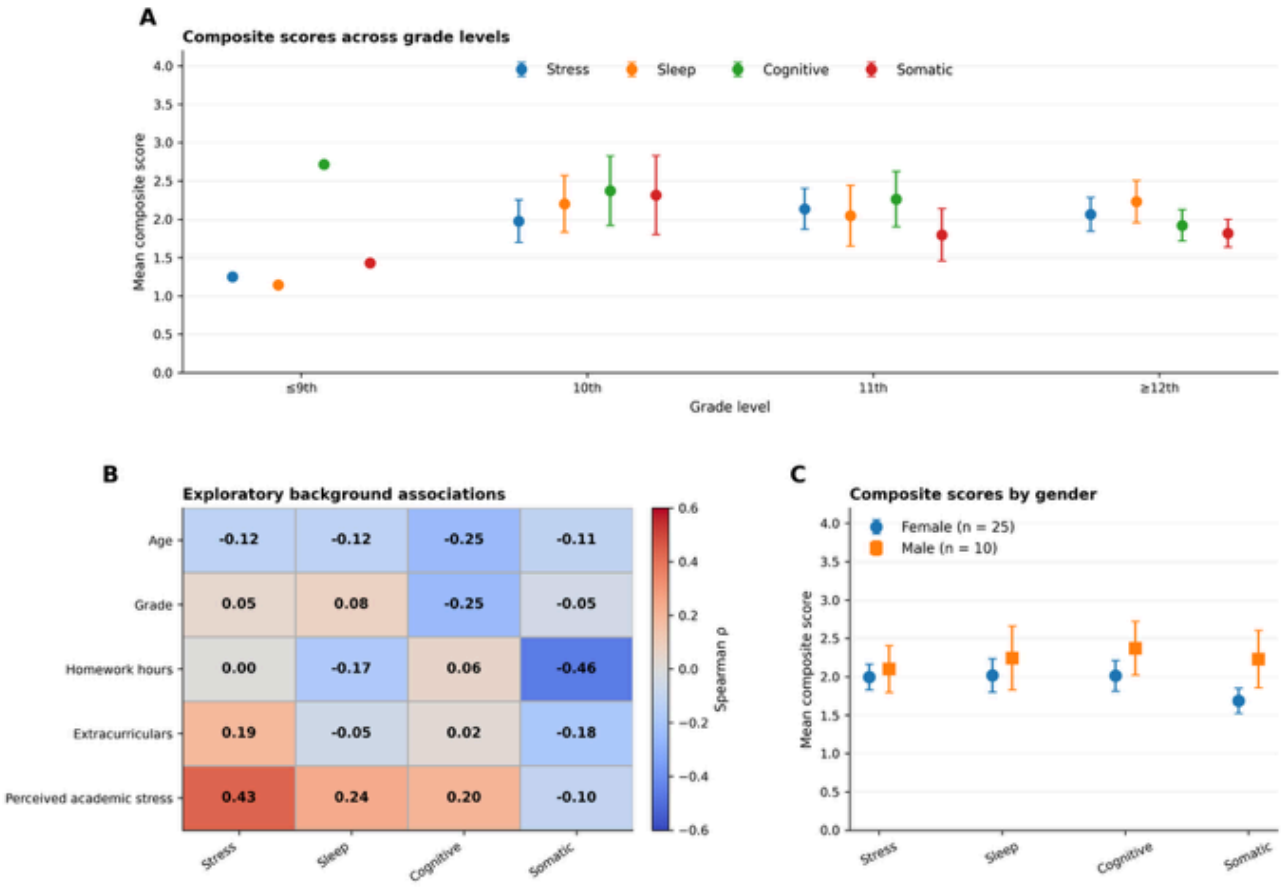

Figure 4. Associations of demographic and contextual factors with symptom burden

(A) Mean composite scores across grade levels. (B) Exploratory Spearman correlations between background factors and symptom scores. (C) Mean composite scores by gender. Error bars in A and C indicate SEM.

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4. Discussion

The positive associations among stress, sleep disturbance, cognitive difficulty, and somatic symptoms suggest that students' difficulties may form an interconnected pattern rather than isolated problems. Stress-related arousal may disrupt sleep, while insufficient sleep may impair attention, working memory, and emotional regulation, making academic demands harder to manage. Cognitive difficulties and fatigue may then increase worry and further disturb sleep. This reciprocal interpretation remains tentative because the cross-sectional data cannot establish direction, and unmeasured influences such as screen use, caffeine, irregular schedules, or mental-health history may affect several domains simultaneously.

Sleep disturbance was especially remarkable across the regression models. Stress and sleep each remained independently associated with cognitive difficulty, consistent with partly distinct routes: sleep loss may reduce alertness and memory consolidation, whereas stress may consume attentional resources through worry and heightened arousal. For somatic symptoms, however, sleep remained strongly associated after stress was controlled, while stress added little explanatory value. This may indicate that sleep is more closely related to fatigue and bodily discomfort, or that the stress–somatic association reflects variance shared with sleep. It does not demonstrate mediation. Moreover, overlap between daytime sleepiness in the sleep scale and physical tiredness in the somatic scale may have strengthened their association. The absence of reliable associations with grade, gender, or workload should not be interpreted as evidence that these factors are irrelevant. The small, uneven sample limited power, particularly because the youngest grade category contained only one participant. Homework hours also measured academic burden imprecisely; identical hours may involve different difficulty, time pressure, efficiency, or perceived control. The nominal relationship between more homework and fewer somatic symptoms did not survive multiple-testing correction and may be a chance finding or reflect an unmeasured factor such as time-management ability. Several limitations constrain interpretation. The small, likely self-selected sample reduces precision and generalizability. Reliance on one self-report questionnaire introduces recall bias, response-style differences, and shared-method variance. High Cronbach's alpha values support internal consistency but do not prove that the four scales measured fully distinct constructs. Cross-sectional regression describes conditional associations, not temporal or causal effects; poor sleep may precede daytime difficulties, but those difficulties may also disrupt sleep. The relatively large effect estimates may also be unstable in a small sample.

Future studies should recruit larger, more balanced samples and collect repeated measurements across periods of differing academic demand. Sleep diaries or actigraphy could distinguish perceived sleep difficulty from sleep duration and continuity, while attention or working-memory tasks could complement self-reported cognition. Longitudinal data could test whether sleep changes precede cognitive or somatic symptoms, followed by intervention studies examining whether improved sleep regularity reduces daytime difficulties. Meanwhile, school screening may usefully assess sleep alongside stress, cognitive complaints, and physical symptoms without assuming that sleep is their single cause.

5. Conclusion

This study found that stress, sleep disturbance, cognitive difficulty, and somatic symptoms were closely interconnected in students. Sleep disturbance showed the most consistent pattern: stress and sleep were independently associated with cognitive difficulty, whereas sleep alone remained strongly associated with somatic symptoms after stress was controlled. Demographic and workload

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variables showed no reliable associations after multiple-testing correction. Although the small, self-reported, cross-sectional sample prevents causal conclusions, the results identify sleep as a useful component of student well-being assessment. Larger longitudinal studies with objective measures should test whether sleep problems precede daytime difficulties and whether improving sleep reduces them. Assessing sleep alongside stress, concentration, and physical complaints may help schools recognize struggling students earlier and provide more integrated support rather than treating these experiences as unrelated problems.

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