



Cybervictimization and college students' sleep quality: The mediating role of rumination and the moderating role of self-compassion

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Abstract: The present study examined the association between cybervictimization and sleep quality among university students, focusing on the mediating role of rumination and the moderating role of self-compassion. Participants were 932 students (mean age = 19.74 years; 53.76% female). They completed self-report questionnaires assessing cybervictimization, rumination, self-compassion, and sleep quality. The results from mediation-moderation analysis showed that cybervictimization was positively associated with poorer sleep quality. Rumination mediated this relationship, suggesting that university students exposed to cybervictimization were more likely to engage in repetitive negative thinking, which in turn associated with worse sleep outcomes. Furthermore, self-compassion moderated the relationship between cybervictimization and rumination: the association of cybervictimization on rumination was weaker among students with higher levels of self-compassion. Interventions targeting rumination reduction and self-compassion enhancement may be effective strategies for improving sleep health among students facing cybervictimization.

Keywords: cybervictimization; rumination; self-compassion; sleep quality

Introduction

Sleep quality is a critical indicator of both physical and psychological well-being, yet poor sleep has become increasingly prevalent among university students. Empirical evidence suggests that nearly half of university students report suboptimal sleep quality, which is associated with impaired cognitive functioning, reduced academic performance, and heightened risks of psychological distress and physical health problems (Schmickler et al., 2023; Zhang et al., 2024b). University students are navigating a developmental period marked by intensive academic demands, identity formation, and psychosocial adjustment. Therefore, understanding the factors that influence sleep quality is important for both individual health and public health.

Simultaneously, the widespread adoption of digital technologies has transformed patterns of social interaction among young adults. While online platforms provide opportunities for communication, learning, and information sharing, they also expose users to adverse experiences such as cybervictimization. Unlike traditional forms of bullying, cybervictimization is characterized by anonymity, a lack of temporal and spatial boundaries, and the potential for widespread exposure, which collectively amplify its psychological impact (Tektaş & Kaçmaz, 2025). These unique features make cybervictimization a pervasive and potentially harmful stressor for students' mental health.

Previous research has identified several psychosocial determinants of sleep quality among university students, including interpersonal relationships, emotional states, psychological resilience, and stressful life events

(Zhang et al., 2025a; Zhao & Zhang, 2024). Among these, stressful life events are particularly influential, as they often elicit strong negative emotions and physiological arousal, thereby disrupting sleep regulation. In the digital era, cybervictimization represents a novel and increasingly prevalent form of stressful experience, inducing fear, anxiety, and insecurity, along with increased physiological arousal (Calvete et al., 2026). Consistent empirical findings indicate that exposure to cybervictimization is associated with poorer sleep quality across diverse student populations (Chen & Zhu, 2023).

Rumination as a mediator

Beyond its direct influence, the underlying psychological processes linking cybervictimization to impaired sleep quality deserve closer scrutiny. Rumination—a maladaptive cognitive-emotional style characterized by repetitive, intrusive, and self-focused thoughts about negative experiences—has been consistently identified as a central mechanism connecting stressful events to adverse mental health outcomes (Mehmood et al., 2025; Zhan et al., 2026). Unlike traditional stressors, cybervictimization often occurs in a public, pervasive, and uncontrollable online context. This makes it more difficult for individuals to disengage mentally. University students exposed to such experiences may repeatedly replay the event, question their own reactions, and anticipate further social consequences. As a result, they may become trapped in a cycle of perseverative rumination (Liu et al., 2025). This proposed mechanism is consistent with recent longitudinal evidence. For instance, Fang et al. (2024) demonstrated that cybervictimization influences sleep quality through a

sequential mediation pathway involving rumination and anxiety. While this chain mediation model highlights the complexity of underlying mechanisms, it does not clarify whether rumination independently functions as a proximal cognitive mechanism in the link between cybervictimization and sleep.

From the perspective of the cognitive model of insomnia, excessive cognitive arousal constitutes the core mechanism in the onset and maintenance of sleep disturbances (Harvey, 2002). Rumination exemplifies this form of intrusive cognition, heightening vigilance toward negative cues and sustaining emotional arousal during the pre-sleep period. Such hyperarousal disrupts the normal transition to sleep and contributes to difficulties including prolonged sleep onset, restless or shallow sleep, and frequent nocturnal awakenings (Petak & Maričić, 2025; Wang et al., 2025a). Importantly, longitudinal evidence suggests that rumination not only undermines current sleep quality but also predicts its deterioration over time, thereby increasing the risk of developing chronic insomnia (Takano et al., 2012; Wang et al., 2025b; Yang & Lei, 2025). In this sense, rumination may represent a proximal pathway through which cybervictimization exerts its detrimental associations on sleep quality.

Self-compassion as a moderator

While rumination represents a critical vulnerability pathway, individual differences in self-regulation may buffer or intensify this process. According to the broaden-and-build theory of positive emotions and emotion regulation theory, adaptive regulatory strategies can mitigate the impact of stressors by broadening perspective, reducing cognitive rigidity, and facilitating constructive emotional processing (Fredrickson, 2001; Gross, 1998). Self-compassion—defined as responding to personal failures and setbacks with kindness, self-understanding, and recognition of shared humanity—has emerged as a particularly protective psychological resource (Wang et al., 2025c).

As an adaptive emotion regulation strategy, self-compassion promotes timely disengagement from distressing stimuli, encourages balanced and nonjudgmental appraisals, and facilitates recovery from adversity. Individuals high in self-compassion are thus less likely to become ensnared in cycles of perseverative rumination and cognitive hyperarousal. In contrast, those low in self-compassion may remain engaged in maladaptive processing, thereby amplifying the detrimental impact of cybervictimization on sleep (Kang et al., 2025; Yan et al., 2025).

In the present study, we focus specifically on the moderating role of self-compassion in the pathway from cybervictimization to rumination. This focus is grounded in the view that self-compassion primarily operates at the stage of cognitive appraisal and emotional processing of stressors, where it can shape how individuals interpret and respond to adverse experiences. In this sense, self-compassion is theoretically well positioned to influence the extent to which cybervictimization is internalized and transformed into ruminative thinking. Although self-compassion may also be relevant to other pathways within the model (Wang et al., 2024), the current study prioritizes

its role in the cybervictimization–rumination link, given its closer conceptual alignment with early-stage emotional and cognitive processing mechanisms.

Goal of the study

Although cybervictimization is increasingly recognized as a threat to young adults' psychological adjustment, its implications for sleep quality have received comparatively limited systematic attention. In particular, the underlying psychological processes remain unclear. University students face unique academic, developmental, and psychosocial pressures, making them particularly vulnerable to sleep disruption in response to online stress. However, the mechanisms through which cybervictimization translates into impaired sleep, as well as the conditions under which this effect may be attenuated, remain insufficiently understood.

To address these gaps, the present study tested a moderated mediation model examining the association between cybervictimization and sleep quality among university students. Specifically, the study investigated whether rumination mediates this association and whether self-compassion moderates the link between cybervictimization and rumination. We tested the following hypotheses:

- H1: Cybervictimization is positively associated with poorer sleep quality among university students.
- H2: Rumination mediates the association between cybervictimization and sleep quality.
- H3: Self-compassion moderates the relationship between cybervictimization and rumination, such that the association is weaker among individuals with higher levels of self-compassion.

The present study makes several contributions to the literature. First, it examines the association between cybervictimization and sleep quality within an integrated framework, contributing to a more coherent understanding of their relationship. Second, by focusing on rumination as a mediator, the study helps clarify its role in linking cybervictimization to sleep disturbances. Third, it considers self-compassion as a potential moderator, shedding light on individual differences that may influence vulnerability to maladaptive cognitive processing.

Method

Participants and procedure

A convenience sampling method was used in 2025 to collect self-report questionnaires from college students in Shanxi Province, China. Prior to data collection, all participants provided informed consent. The study strictly adhered to the ethical principles outlined in the Declaration of Helsinki and was approved by the Ethics Committee of Shanxi University (Approval No. 20250715). During questionnaire administration, participants were informed about the purpose and procedures of the study, and confidentiality and anonymity of responses were emphasized to ensure authenticity and validity. A total of 960 questionnaires were distributed, and 932 valid questionnaires were returned, resulting in a high valid response rate of 97.08% after the exclusion of those with missing data (i.e., more than 10% of items unanswered) or patterned answering.

Among the valid sample, 501 were female (53.76%) and 431 were male (46.24%), with a mean age of 19.74 years ($SD = 1.01$).

Measures

Cybervictimization

Cybervictimization was assessed using the Brief Cyber-victimization Scale, developed by [Shapka and Maghsoudi, 2017](#) and adapted for Chinese populations by [Xie et al. \(2022\)](#). The scale consists of six items (e.g., "Receiving malicious comments on your online photos or videos") rated on a 5-point Likert scale (0 = never, 4 = always). Higher scores indicate more severe experiences of cyber-victimization. Previous studies have demonstrated good psychometric properties of the Chinese version of the scale among Chinese students ([Liang et al., 2025](#)). In the present study, the Cronbach's α was 0.93.

Rumination

Rumination was measured with the Ruminative Response Scale developed by [Nolen-Hoeksema and Morrow \(1991\)](#) and adapted into Chinese by [Han \(2009\)](#). The scale includes 22 items (e.g., "I often think about why I cannot handle things better"), rated on a 4-point scale (1 = never, 4 = always). Higher scores indicate greater tendencies toward rumination. The Chinese version has been shown to have satisfactory structural validity and reliability among students ([Chen et al., 2024](#)). In the present study, Cronbach's α was 0.90.

Self-compassion

Self-compassion was assessed with the Self-Compassion Scale developed by [Neff \(2003\)](#) and adapted into Chinese by [Chen et al. \(2011\)](#). The scale consists of 26 items (e.g., "When I'm feeling down, I tend to be caring toward myself"), rated on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). Higher scores reflect greater levels of self-compassion. The Chinese version of the SCS has been widely applied in college student samples and has demonstrated sound psychometric properties ([Zhang et al., 2025b](#)). In the current study, Cronbach's α was 0.90.

Sleep quality

Sleep quality was measured with the Pittsburgh Sleep Quality Index, developed by [Buysse et al. \(1989\)](#) and adapted into Chinese by [Liu et al. \(1996\)](#). The scale contains 19 items (e.g., "Difficulty falling asleep within 30 minutes"), the total scores range from 0 to 21. Higher scores indicate poorer sleep quality. The Chinese version of the PSQI has shown good psychometric properties among students ([Yang et al., 2024](#)). In the present study, Cronbach's α was 0.92.

Data analysis

All analyses were conducted using SPSS 26.0. Harman's single-factor test was first applied to examine potential common method bias. Descriptive statistics and Pearson correlation analyses were then performed to explore the relationships among variables. To test the hypothesized moderated mediation model, the PROCESS macro for SPSS (Model 4 for mediation; Model 7 for moderated

mediation) was employed, with 5000 bootstrap samples and 95% bias-corrected confidence intervals. Gender was included as a covariate in all analyses, as prior research has documented gender differences in both sleep quality and rumination ([Chow et al., 2017](#)), suggesting that it may be relevant to the associations examined in the present study. The analyses were primarily focused on the theoretically specified relationships among cybervictimization, rumination, self-compassion, and sleep quality. To facilitate interpretation and comparability across variables, all continuous variables were mean-centered before analysis, and standardized regression coefficients (β) are reported throughout the mediation and moderation models. Prior to the main analyses, data screening procedures were conducted. Univariate outliers were assessed using standardized z-scores, with values exceeding ± 3.29 considered extreme; no such cases were identified. In addition, skewness and kurtosis were examined to assess normality, with values within acceptable ranges ($|\text{skewness}| < 2$, $|\text{kurtosis}| < 7$) indicating no substantial deviation from normality for most variables.

Results

Common method bias test

Harman's single-factor test was conducted to examine potential common method variance. Principal component analysis revealed 13 factors with eigenvalues greater than 1. The first factor accounted for 21.63% of the variance, which is below the critical threshold of 40% ([Podsakoff et al., 2003](#)). These results suggest that a single factor does not account for the majority of covariance among the measures. However, it should be noted that Harman's single-factor test is limited in its ability to detect common method bias, and therefore cannot be considered a definitive assessment.

Descriptive statistics and correlations

Means, standard deviations, skewness, kurtosis, and correlations among the main study variables are presented in [Table 1](#). Most variables exhibited acceptable distributional properties. However, cybervictimization showed moderate positive skewness and kurtosis, indicating some deviation from normality. This pattern is consistent with prior research suggesting that cybervictimization is typically positively skewed due to its low base-rate nature ([Palermi et al., 2022](#); [Rodríguez-Hidalgo et al., 2025](#)).

Cybervictimization was positively correlated with both poor sleep quality and rumination, while it was negatively correlated with self-compassion. Sleep quality was positively associated with rumination and negatively associated with self-compassion. In addition, rumination was negatively correlated with self-compassion.

Mediating role of rumination in the link between cyber-victimization and sleep quality

To examine the mediating role of rumination in the relationship between cybervictimization and sleep quality, PROCESS macro Model 4 was applied (see [Table 2](#)). Results indicated that cybervictimization was positively associated with rumination ($\beta = 0.39$, $t = 8.48$, $p < 0.001$) and sleep quality ($\beta = 0.26$, $t = 6.32$, $p < 0.001$),

Table 1. Descriptive statistics and correlations

Variables	<i>M (SD)</i>	<i>Skewness</i>	<i>Kurtosis</i>	1	2	3	4
1. Cybervictimization	8.91 (3.25)	2.20	9.38	1			
2. Rumination	36.21 (11.79)	1.02	1.80	0.39**	1		
3. Self-compassion	71.94 (9.17)	0.50	0.08	-0.19**	-0.46**	1	
4. Sleep quality	8.68 (7.00)	1.03	1.30	0.46**	0.61**	-0.27**	1

Note. ** $p < 0.01$.

Table 2. Mediation effect analysis

Path	β	<i>t</i>	<i>p</i>	Bootstrapping 95% CI	
				Lower	Higher
Cybervictimization → Rumination	0.39	8.48	0.000	0.298	0.478
Cybervictimization → Sleep quality	0.26	6.32	0.000	0.181	0.344
Rumination → Sleep quality	0.52	12.18	0.000	0.433	0.600
Gender → Rumination	0.11	1.17	0.241	-0.074	0.293
Gender → Sleep quality	0.21	2.66	0.008	0.054	0.360

Table 3. Path coefficients of the mediation model

Path	Estimate	<i>SE</i>	Bootstrapping 95% CI	
			Lower	Higher
Total effect	0.46	0.04	0.37	0.55
Cybervictimization → Sleep Quality	0.26	0.04	0.18	0.34
Cybervictimization → Rumination → Sleep Quality	0.20	0.03	0.14	0.27

and rumination was also positively associated with sleep quality ($\beta = 0.52$, $t = 12.18$, $p < 0.001$).

Bootstrapping with 5000 resamples showed that both the direct effect of cybervictimization on sleep quality and the indirect effect through rumination were significant, with 95% confidence intervals not including zero (see Table 3). The direct effect (0.26) accounted for 56.52% of the total effect (0.46), while the indirect effect (0.20) accounted for 43.48%. This indicates that nearly half of the association between cybervictimization and sleep quality was explained through rumination, suggesting that rumination constitutes an important pathway linking cybervictimization to poorer sleep quality. These findings are consistent with H1 regarding the direct effect and H2 regarding partial mediation.

Moderating role of self-compassion in the cybervictimization–rumination link

To further examine the moderating role of self-compassion in the mediation model, PROCESS macro Model 7 was employed, with cybervictimization as the predictor, rumination as the mediator, and self-compassion as the moderator. As shown in Figure 1, the interaction term between cybervictimization and self-compassion was significantly associated with rumination ($\beta = -0.09$, $t = -2.05$, $p < 0.05$), indicating that self-compassion moderated the relationship between cybervictimization and rumination, supporting H3.

To further clarify the moderating role of self-compassion, a simple slope analysis was conducted (see Figure 2). The results showed that cybervictimization

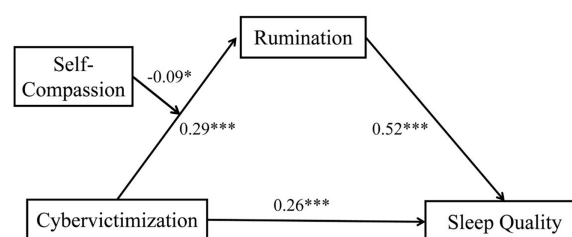


Figure 1. Moderated mediation model of the association between cybervictimization and sleep quality. Note. * $p < 0.05$, *** $p < 0.001$.

was associated with rumination for both college students with low self-compassion (-1 SD; $\beta = 0.38$, $p < 0.001$), and for those with high self-compassion ($+1$ SD; $\beta = 0.20$, $p < 0.01$). Specifically, the strength of this association was reduced by nearly half at higher levels of self-compassion, suggesting a meaningful buffering effect. These findings should be interpreted as statistical associations rather than causal relationships.

Discussion

This study demonstrated that cybervictimization is associated with poorer sleep quality among university students. Rumination partially mediated this association, and self-compassion served as a protective factor by attenuating the impact of cybervictimization on rumination. These findings provide further insights into the psychological mechanisms linking online victimization to sleep disturbances and highlight potential targets for intervention.

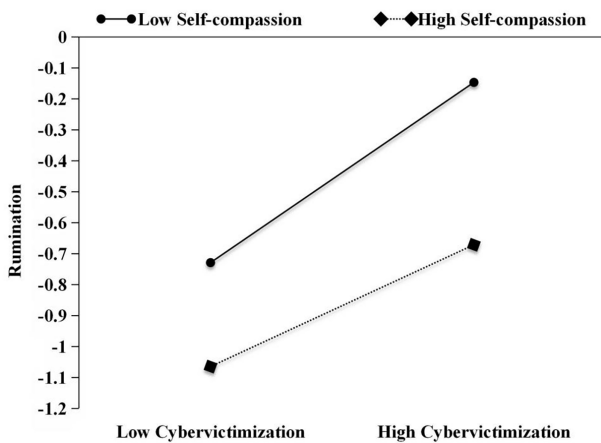


Figure 2. Simple slope analysis

A plausible explanation for the observed relationship between cybervictimization and sleep quality may lie in the pervasive, socially embedded, and difficult-to-escape nature of online stressors. University students' sleep is sensitive to daily interpersonal stressors and emotional fluctuations. Experiences of online hostility or social rejection eliciting negative affect (e.g., anxiety, insecurity, hypervigilance) that may persist into pre-sleep periods (He et al., 2025; Liu et al., 2025). In addition, it is possible that broader cultural and contextual factors shape how such experiences are processed, although these factors were not directly examined in the present study. For example, within the Chinese digital environment, platform-based social networks (e.g., WeChat, QQ) are closely integrated into students' academic and social lives (Guo et al., 2024; Jin et al., 2023). Because these platforms may be embedded within relatively stable and overlapping social networks, online interactions could carry heightened interpersonal salience. Under such conditions, experiences of cybervictimization might be more likely to extend into offline relationships and prolong stress exposure (Chan et al., 2021; Jiang et al., 2025). These interpretations should be regarded as tentative and require empirical verification.

Moreover, experiences of online exclusion or public criticism may threaten individuals' perceived social standing and belonging, triggering sustained concern about others' evaluations (Jiang et al., 2025). Although the present study did not directly assess sensitivity to social evaluation, prior literature suggests that such concerns may be particularly salient in certain sociocultural contexts. These concerns may contribute to sustained cognitive and emotional activation, which interferes with the down-regulation processes necessary for sleep initiation and maintenance (Tao et al., 2022). Taken together, the structural features of the digital environment and culturally embedded sensitivities to social evaluation may jointly contribute to the association between cybervictimization and sleep quality. These interpretations should be considered with caution, as they are not directly tested in the present study.

One contribution of this study lies in isolating rumination as a proximal cognitive mechanism in the association between cybervictimization and sleep quality. According

to the cognitive model of insomnia, maladaptive cognitive processes, including repetitive negative thinking, are central to the onset and maintenance of sleep disturbances (Harvey, 2002; Schmickler et al., 2023; Zhang et al., 2024a). Rumination prolongs cognitive and emotional activation rather than allowing recovery, thereby interfering with sleep initiation and maintenance (Clancy et al., 2020). Consistent with prior research, students reporting higher levels of rumination exhibited longer sleep latency, shallower sleep depth, and more frequent nighttime awakenings (Wang et al., 2025a). Thus, rumination may be one mechanism underlying the association between cybervictimization and sustained pre-sleep arousal. However, given that the direct association between cybervictimization and sleep quality remained significant after accounting for rumination, this mechanism appears to be partial, suggesting that additional pathways may also contribute to this relationship.

To further elucidate the indirect pathway, it is also important to consider how cybervictimization is associated with heightened rumination. University students exposed to cyberbullying often engage in excessive cognitive processing, including revisiting events and evaluating their own responses (Li & Xia, 2024; Luo et al., 2023). Such mental over-engagement may escalate into catastrophic expectations of potential consequences, including reputational damage, academic disruption, or long-term career setbacks. This cycle consumes psychological resources and hinders cognitive disengagement at bedtime, thereby maintaining pre-sleep arousal and linking cybervictimization to poor sleep.

Beyond elucidating the mediating role of rumination, the present study highlights self-compassion as a protective psychological resource between cybervictimization and maladaptive rumination. Specifically, the association between cybervictimization and rumination was weaker among students with high self-compassion and stronger among those with low self-compassion. This pattern suggests that self-compassion operates as a form of psychological armor, shielding individuals from self-blame and repetitive negative thought processes (Wu et al., 2023). High self-compassion enables students to approach adverse experiences with greater kindness and acceptance. This facilitates more balanced appraisal and disengagement from maladaptive rumination. From the perspective of the broaden-and-build theory, such a stance expands cognitive and emotional resources, enhancing adaptive coping and resilience (Fredrickson, 2001). Consistent with emotion regulation theory, self-compassion reduces cognitive perseveration and emotional arousal, thereby mitigating the risk of sleep disruption (Gross, 1998).

Importantly, empirical research indicates that self-compassion can be cultivated through structured interventions, which strengthen mindfulness, acceptance, and adaptive coping strategies. Such interventions enable individuals to observe distressing thoughts without over-identifying with them and to regulate negative affect through reappraisal. They may also disrupt dysfunctional response patterns that maintain cognitive hyperarousal (Neff, 2023). These mechanisms may help explain the buffering effect observed in the current study. By contrast,

individuals with low self-compassion are more prone to harsh self-criticism and repetitive negative thinking, which exacerbate rumination and impair sleep quality (Hevron & Weinbach, 2024).

In sum, the present findings underscore the potential role of rumination in linking the stress of cybervictimization into impaired sleep and identify self-compassion as a key resilience factor. Interventions targeting maladaptive rumination and self-compassion may help mitigate the negative impact of cybervictimization on students' sleep and psychological well-being. Future research could test integrated interventions that combine cognitive and emotion-regulation approaches.

Limitations and future recommendations

Several limitations of this study warrant caution in interpreting the findings. First, the cross-sectional design and single-time data collection limit the ability to establish temporal ordering among variables, precluding causal inference and leaving potential reciprocal relationships unresolved. In addition, only gender was controlled for, and other relevant confounding factors (e.g., anxiety, depressive symptoms, pre-sleep smartphone use, and academic stress) were not assessed, which may have introduced residual confounding. Future research using longitudinal or experimental designs and incorporating a broader range of control variables is needed. Second, the exclusive reliance on self-report measures raises concerns of recall bias and shared method variance. Although Harman's single-factor test was conducted as a preliminary check, it is not sufficient to rule out common method bias. Future research should employ more rigorous procedural and statistical remedies (e.g., multi-source data, temporal separation, or latent method factor approaches) to better address this issue. Third, the sample comprised undergraduates from a single Chinese university, which may limit generalizability across cultural contexts, age groups, or non-student populations. Fourth, cybervictimization was measured in aggregate without distinguishing frequency, type, or perpetrator, which may obscure nuanced effects. Finally, the present study examined self-compassion as a moderator only in the cybervictimization–rumination pathway. Other potential moderation positions (e.g., in the rumination–sleep quality link) were not tested, and future research is needed to evaluate alternative model specifications to provide a more comprehensive understanding of the moderating mechanisms.

Implications for research and practice

Despite these limitations, the findings provide preliminary insights for both clinical practice and campus-based mental health interventions. Theoretically, this study contributes to the literature by clarifying rumination as a proximal cognitive mechanism linking cybervictimization to sleep quality, rather than solely a component within broader sequential mediation models. It further specifies the role of self-compassion as a boundary condition operating at the level of early cognitive–emotional responses, suggesting that its protective function may primarily lie in attenuating maladaptive cognitive processing in response to stressors.

Practically, the findings suggest that addressing maladaptive cognitive processing, particularly rumination, may be relevant when considering support for students exposed to cybervictimization and experiencing sleep difficulties. In addition, self-compassion may represent a potentially relevant psychological resource in this context. However, given the cross-sectional nature of the study, these implications should be interpreted as tentative, and further longitudinal and intervention research is needed before specific applications can be established.

Conclusion

This study examined the relationship between cybervictimization and sleep quality among undergraduates, focusing on rumination as a mediator and self-compassion as a moderator. Results indicate that cybervictimization is associated with poorer sleep quality via rumination, while self-compassion attenuates this association. These findings advance understanding of the cognitive mechanisms underlying this relationship and identify a potential boundary condition.

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Availability of Data and Materials: Data used in this study are available from the corresponding author on reasonable request and with the permission of the Research Ethics Committee (Shanxi University).

Ethics Approval: A convenience sampling method was used in 2025 to collect self-report questionnaires from college students in Shanxi Province, China. Prior to data collection, all participants provided informed consent. The study strictly adhered to the ethical principles outlined in the Declaration of Helsinki and was approved by the Ethics Committee of Shanxi University (Approval No. 20250715). During questionnaire administration, participants were informed about the purpose and procedures of the study, and confidentiality and anonymity of responses were emphasized to ensure authenticity and validity. A total of 960 questionnaires were distributed, and 932 valid questionnaires were returned, resulting in a high valid response rate of 97.08% after the exclusion of those with missing data (i.e., more than 10% of items unanswered) or patterned answering. Among the valid sample, 501 were female (53.76%) and 431 were male (46.24%), with a mean age of 19.74 years ($SD = 1.01$).

Conflicts of Interest: The authors declare no conflicts of interest.

References

- Buyse, D. J., Reynolds, C. F. 3rd, Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The pittsburgh sleep quality index: A new instrument for psychiatric practice and research. *Psychiatry Research*, 28(2), 193–213. [https://doi.org/10.1016/0165-1781\(89\)90047-4](https://doi.org/10.1016/0165-1781(89)90047-4)
- Calvete, E., Ayala, A., Jiménez-Granado, A., & Orue, I. (2026). Bidirectional associations between cyberbullying victimization, non-suicidal self-injury, and depressive symptoms in adolescents. *Journal of Adolescence*, 98(1), 119–130. <https://doi.org/10.1002/jad.70045>
- Chan, T. K. H., Cheung, C. M. K., & Lee, Z. W. Y. (2021). Cyberbullying on social networking sites: A literature review and future research directions. *Information & Management*, 58(2), 103411. <https://doi.org/10.1016/j.im.2020.103411>
- Chen, R., Hu, Y., Shi, H. F., Fang, Y., & Fan, C. Y. (2024). Perceived chronic social adversity and cyberbullying perpetration among adolescents: The mediating role of rumination and moderating role of mindfulness. *Frontiers in Psychology*, 15, 1376347. <https://doi.org/10.3389/fpsyg.2024.1376347>
- Chen, J., Yan, L. S., & Zhou, L. H. (2011). Reliability and validity of Chinese version of self-compassion scale. *Chinese Journal of Clinical Psychology*, 19(6), 734–736.
- Chen, Y., & Zhu, J. (2023). Longitudinal associations between cybervictimization and adolescent sleep problems: The role of anxiety and depressive symptoms. *Journal of Interpersonal Violence*, 38(3–4), 2806–2827. <https://doi.org/10.1177/08862605221102485>
- Chow, C. M., Homa, J., & Amersdorfer, A. (2017). Gender differences in sleep problems: The mediating role of co-rumination and depressive symptoms. *Personality and Individual Differences*, 108(3), 10–13. <https://doi.org/10.1016/j.paid.2016.11.058>
- Clancy, F., Prestwich, A., Caperon, L., Tsipa, A., & O'Connor, D. B. (2020). The association between worry and rumination with sleep in non-clinical populations: A systematic review and meta-analysis. *Health Psychology Review*, 14(4), 427–448. <https://doi.org/10.1080/17437199.2019.1700819>
- Fang, X., Wang, F., Tian, W., Liao, J., Wei, X., & Lei, L. (2026). How do traditional and cyber victimization affect sleep quality among college students? the chain mediating role of rumination and anxiety. *Journal of Interpersonal Violence*, 41(11–12), 3380–3399. <https://doi.org/10.1177/08862605251338780>
- Fredrickson, B. L. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *American Psychologist*, 56(3), 218–226. <https://doi.org/10.1037/0003-066x.56.3.218>
- Gross, J. J. (1998). The emerging field of emotion regulation: An integrative review. *Review of General Psychology*, 2(3), 271–299. <https://doi.org/10.1037/1089-2680.2.3.271>
- Guo, Y., Cai, S., & Liang, F. (2024). The prevalence of cyberbullying and the association between cyberbullying emotional exhaustion and perception of collective efficacy among Chinese college students. *Journal of Affective Disorders*, 362(1), 145–151. <https://doi.org/10.1016/j.jad.2024.06.113>
- Han, X. (2009). Chinese version of nolen-hoeksema ruminative responses scale (RRS) used in 912 college students: Reliability and validity. *Chinese Journal of Clinical Psychology*, 17(5), 550–551. <https://doi.org/10.1037/t65937-000>
- Harvey, A. G. (2002). A cognitive model of insomnia. *Behaviour Research and Therapy*, 40(8), 869–893. [https://doi.org/10.1016/S0005-7967\(01\)00061-4](https://doi.org/10.1016/S0005-7967(01)00061-4)
- He, Y., Yang, T., Guo, Q., Wu, S., Liu, W., et al. (2025). Innovative analysis of the interconnected network structure between anxiety and sleep quality among college students. *Psychology Research and Behavior Management*, 18, 607–618. <https://doi.org/10.2147/PRBM.S507074>
- Hevron, H., & Weinbach, N. (2024). Self-compassion and cognitive reappraisal restore female adolescents' body satisfaction and appreciation after appearance-related rumination. *Body Image*, 51(21), 101779. <https://doi.org/10.1016/j.bodyim.2024.101779>
- Jiang, H., Jin, Y., & Yang, Q. (2025). Traditional bullying victimization and cyberbullying perpetration: The role of anger rumination and self-control. *Psychology Research and Behavior Management*, 18, 877–886. <https://doi.org/10.2147/PRBM.S507510>
- Jin, X., Zhang, K., Twayigira, M., Gao, X., Xu, H., et al. (2023). Cyberbullying among college students in a Chinese population: Prevalence and associated clinical correlates. *Frontiers in Public Health*, 11, 1100069. <https://doi.org/10.3389/fpubh.2023.1100069>
- Kang, S., Gu, Q., Qin, W., Liu, S., Xue, Y., et al. (2025). Do college freshmen who engage more in online social comparison tend to be more confused about themselves? The roles of rumination and self-compassion. *Behavioral Sciences*, 15(7), 849. <https://doi.org/10.3390/bs15070849>
- Li, X., & Xia, L. X. (2024). A serial cascade effect of cyber-victimization and hostile rumination on the within-person change of moral disengagement. *Journal of Personality*, 92(6), 1726–1743. <https://doi.org/10.1111/jopy.12920>
- Liang, H., Zhu, F., Li, X., Jiang, H., Zhang, Q., et al. (2025). The link between bullying victimization, maladjustment, self-control, and bullying: A comparison of traditional and cyberbullying perpetrator. *Youth & Society*, 57(3), 379–395. <https://doi.org/10.1177/0044118x241247213>
- Liu, X., Liao, X., & Ni, J. (2026). A cross-sectional study of cybervictimization and non-suicidal self-injury among college students: A moderated mediation model of rumination and resilience. *Archives of Suicide Research*, 30(2), 317–333. <https://doi.org/10.1080/13811118.2025.2513578>
- Liu, X. C., Tang, M. Q., Hu, L., Wang, A. Z., Wu, H. Z., et al. (1996). Reliability and validity of the Pittsburgh sleep quality index. *Chinese Journal of Psychiatry*, 29(2), 103–107. [https://doi.org/10.1016/s0022-3999\(02\)00330-6](https://doi.org/10.1016/s0022-3999(02)00330-6)
- Liu, D., Tian, Y., Liu, M., & Yang, S. (2025). The impact of physical exercise on sleep quality among college students: The chain mediating effects of perceived stress and ruminative thinking. *Psychology Research and Behavior Management*, 18, 361–373. <https://doi.org/10.2147/PRBM.S510207>
- Luo, Q., Wu, N., & Huang, L. (2023). Cybervictimization and cyberbullying among college students: The chain mediating effects of stress and rumination. *Frontiers in Psychology*, 14, 1067165. <https://doi.org/10.3389/fpsyg.2023.1067165>
- Mehmood, A., Xu, S., Siddiqi, S. M., Zhang, L., Huang, G., et al. (2025). Exploration of nonsuicidal self-injury as an addiction-like behaviour in depressed adolescents in the light of the I-PACE model. *Clinical Psychology & Psychotherapy*, 32(5), e70147. <https://doi.org/10.1002/cpp.70147>
- Neff, K. D. (2003). The development and validation of a scale to measure self-compassion. *Self and Identity*, 2(3), 223–250. <https://doi.org/10.1080/15298860309027>
- Neff, K. D. (2023). Self-compassion: Theory, method, research, and intervention. *Annual Review of Psychology*, 74(1),

- 193–218. <https://doi.org/10.1146/annurev-psych-032420-031047>
- Nolen-Hoeksema, S., & Morrow, J. (1991). A prospective study of depression and posttraumatic stress symptoms after a natural disaster: The 1989 Loma Prieta Earthquake. *Journal of Personality and Social Psychology*, 61(1), 115–121. <https://doi.org/10.1037//0022-3514.61.1.115>
- Palermi, A. L., Bartolo, M. G., Musso, P., Servidio, R., & Costabile, A. (2022). Self-esteem and adolescent bullying/cyberbullying and victimization/cybervictimization behaviours: A person-oriented approach. *Europe's Journal of Psychology*, 18(3), 249–261. <https://doi.org/10.5964/ejop.5379>
- Petack, A., & Maričić, J. (2025). The role of rumination and worry in the bidirectional relationship between stress and sleep quality in students. *International Journal of Environmental Research and Public Health*, 22(7), 1001. <https://doi.org/10.3390/ijerph22071001>
- 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. *The Journal of Applied Psychology*, 88(5), 879–903. <https://doi.org/10.1037/0021-9010.88.5.879>
- Rodríguez-Hidalgo, A. J., Camargo, V. S., & Hurtado-Mellado, A. (2025). Cyberbullying based on social stigmas and social, emotional and moral competencies. *Behavioral Sciences*, 15(5), 646. <https://doi.org/10.3390/bs15050646>
- Schmickler, J. M., Blaschke, S., Robbins, R., & Mess, F. (2023). Determinants of sleep quality: A cross-sectional study in university students. *International Journal of Environmental Research and Public Health*, 20(3), 2019. <https://doi.org/10.3390/ijerph20032019>
- Shapka, J. D., & Maghsoudi, R. (2017). Examining the validity and reliability of the cyber-aggression and cyber-victimization scale. *Computers in Human Behavior*, 69(2), 10–17. <https://doi.org/10.1016/j.chb.2016.12.015>
- Takano, K., Iijima, Y., & Tanno, Y. (2012). Repetitive thought and self-reported sleep disturbance. *Behavior Therapy*, 43(4), 779–789. <https://doi.org/10.1016/j.beth.2012.04.002>
- Tao, Y., Hou, W., Niu, H., Ma, Z., Zhang, S., et al. (2022). Centrality and bridge symptoms of anxiety, depression, and sleep disturbance among college students during the COVID-19 pandemic—a network analysis. *Current Psychology*, 43(15), 13897–13908. <https://doi.org/10.1007/s12144-022-03443-x>
- Tektaş, P., & Kaçmaz, E. D. (2025). The mediating role of cyber victimization in the effect of perceived social support on cyberbullying in university students. *BMC Psychology*, 13(1), 1030. <https://doi.org/10.1186/s40359-025-03338-z>
- Wang, Y., Fu, T., Wang, J., Chen, S., & Sun, G. (2024). The relationship between self-compassion, coping style, sleep quality, and depression among college students. *Frontiers in Psychology*, 15, 1378181. <https://doi.org/10.3389/fpsyg.2024.1378181>
- Wang, Y., Wang, X., Wang, Q., Liu, G., Wu, C., et al. (2025a). The role of bedtime procrastination, rumination, loneliness, and positive body image in predicting sleep quality among university students: A sex-specific analysis. *Alpha Psychiatry*, 26(3), 44142. <https://doi.org/10.31083/ap44142>
- Wang, A., Xu, Z., Liu, C., Cao, L., & Wang, F. (2025b). The relationship between childhood maltreatment and insomnia in depressed adolescents: The mediating role of rumination. *Brain and Behavior*, 15(5), e70554. <https://doi.org/10.1002/brb3.70554>
- Wang, Z., Zheng, J., & Wang, X. (2025c). The longitudinal relationship between co-rumination and emotional problems in early Chinese adolescents: The moderating role of self-compassion. *Psychological Reports*, 332941251316439. <https://doi.org/10.1177/00332941251316439>
- Wu, Q., Cao, H., & Du, H. (2023). Work stress, work-related rumination, and depressive symptoms in university teachers: Buffering effect of self-compassion. *Psychology Research and Behavior Management*, 16, 1557–1569. <https://doi.org/10.2147/PRBM.S403744>
- Xie, X., Zheng, H., Ju, K., Xiao, B. W., Liu, J. S., et al. (2022). Examining the validity and reliability of the short form of cyberbullying and cybervictimization (CAV) scale. *Chinese Journal of Clinical Psychology*, 30(5), 1157–1159. <https://doi.org/10.1186/s40359-022-01013-1>
- Yan, Y., Zhou, X., Zhou, J., Chen, Y., Zhang, Y., et al. (2025). The relationship between facial negative physical self and social anxiety in college students: The role of rumination and self-compassion. *Frontiers in Psychology*, 16, 1450174. <https://doi.org/10.3389/fpsyg.2025.1450174>
- Yang, R., Chen, J., Wang, R., Li, D., Hu, J., et al. (2024). The effect of bullying victimization on sleep quality among Chinese medical students: Timing, duration, and patterns. *Journal of Affective Disorders*, 344, 25–32. <https://doi.org/10.1016/j.jad.2023.10.011>
- Yang, S., & Lei, X. (2025). Reciprocal causation relationship between rumination thinking and sleep quality: A resting-state fMRI study. *Cognitive Neurodynamics*, 19(1), 41. <https://doi.org/10.1007/s11571-025-10223-3>
- Zhan, Y., Luo, L., & Hu, X. (2026). Longitudinal associations between violence exposure and cyber aggression in Chinese adolescents: The potential mediating role of negative rumination. *Journal of Adolescence*, 98(1), 131–144. <https://doi.org/10.1002/jad.70046>
- Zhang, Z., Cai, Z., & Meng, Q. (2025a). Negative life events, sleep quality and depression in university students. *Scientific Reports*, 15(1), 21193. <https://doi.org/10.1038/s41598-025-08635-6>
- Zhang, X., Li, R., Liu, L., Zhou, X., Yu, Q., et al. (2025b). From victims to perpetrators: A prospective mediation study of how child abuse and neglect influence cyber aggression via self-compassion and gratitude. *Journal of Family Violence*, 19(3), 75. <https://doi.org/10.1007/s10896-025-00963-5>
- Zhang, J., Li, X., Tang, Z., Xiang, S., Tang, Y., et al. (2024a). Effects of stress on sleep quality: Multiple mediating effects of rumination and social anxiety. *Psicologia, Reflexao E Critica*, 37(1), 10. <https://doi.org/10.1186/s41155-024-00294-2>
- Zhang, S., Liu, X., Chen, J., Yang, H., Chen, J., et al. (2024b). Patterns of sleep quality and its influence factors: A latent class model among students of medical university in Hubei Province. *China Journal of Affective Disorders*, 347(3), 320–326. <https://doi.org/10.1016/j.jad.2023.11.090>
- Zhao, C., & Zhang, Y. (2024). Moderated serial mediation effects of adaptation problems, academic stress, and interpersonal relationships on the sleep quality of early-year university students. *Frontiers in Public Health*, 12, 1476020. <https://doi.org/10.3389/fpubh.2024.1476020>