Anxiety mediated the relationship between bullying victimization and internet addiction in adolescents, and family support moderated the relationship

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Abstract

Objective This study aims to discuss anxiety in mediating role between bullying victimization and adolescent internet addiction, and the moderating role of family support between bullying victimization and adolescent anxiety.

Methods A cross-sectional study was conducted in 5 provinces of China by convenience sampling from February to March 2024. A total of 1395 participants (599 boys and 796 girls) with an average age of 15.86 ± 0.74 years were included in the final analysis. Subjective data on bullying victimization, internet addiction, anxiety, and family support were collected and analyzed. A moderated mediation model was constructed.

Results After controlling for age and gender, bullying victimization was found to be a significant predictor of internet addiction ($\beta = 0.130$, $p < 0.001$). Anxiety has a complete mediating effect between bullying victimization and adolescent internet addiction. Specifically, bullying victimization significantly predicted adolescent anxiety ($\beta = 0.264$, $p < 0.001$). anxiety significantly predicted adolescent internet addiction ($\beta = 0.417$, $p < 0.001$). Family support alleviated the relationship between bullying victimization and anxiety ($\beta = -0.032$, $p < 0.05$).

Conclusions Bullying victimization can predict internet addiction through anxiety in adolescents, and family support can alleviate the predictive relationship between bullying victimization and adolescent anxiety. It is suggested that guardians should provide adequate support to adolescent bullying victimization in order to reduce the negative impact of bullying victimization on adolescents and prevent the occurrence of internet addiction.

Keywords Bullying victimization, Internet addiction, Anxiety, Family support, Adolescents

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Introduction

As adolescents enter puberty, they face various physiological, psychological, and social adaptation changes [1]. Confronted with these transformations, adolescents often exhibit heightened sensitivity to emotions [2–4], due in part to the incomplete development of brain structures responsible for emotional regulation [2, 4, 5]. Consequently, the activation of brain regions during emotional processing is intensified [4], which, coupled with their limited capacity for emotion regulation, frequently results in the experience of negative affect such as anxiety [6, 7]. Studies have found that anxiety is a common negative emotion affecting the mental health of adolescents [8, 9]. A large-scale meta-analysis found that the peak period of anxiety increase in adolescents is at the age of 14.5 [10]. Another meta-analysis found that the global prevalence of clinical anxiety exceeds 20% [11]. A study in the United States found that adolescent anxiety increased from 34.1% in 2012 to 44% in 2018 [12]. The study in China found that the detection rate of anxiety reached nearly 25% [13]. If not intervened, anxiety can bring a series of negative psychological and behavioral consequences to individuals, including early departure from the education system, poor adaptability, poor social relationships, reduced life satisfaction, poor coping skills, increased chronic stress, high mortality rates, and substance dependence [14–18]. Therefore, exploring the causes of adolescent anxiety, the subsequent harms of anxiety, and the protective factors of anxiety should be of great concern to today's society.

Bullying victimization is a significant factor contributing to anxiety in adolescents. It refers to individuals being repeatedly exposed to intentional and unpleasant verbal, social relationship or physical actions, or other indirect behaviors such as social exclusion, in situations where power dynamics are imbalanced. This includes behaviors such as verbal abuse, defamation, ridicule, exclusion, hitting, kicking, and pushing [19]. With the evolution of the digital age, such behaviors have extended to online environments [20]. Because victims of bullying experience long-term and repeated negative actions against them, and are often unable to defend themselves [21]. Bullying victimization brings a series of negative emotional experiences to adolescents [22–24], and they may worry about experiencing bullying victimization again [25, 26], often falling into anxiety [27, 28]. The study found that the incidence of bullying victimization among adolescents in Shandong Province of China is about 12% [29], while the national data found that the proportion reached 20.8% [30], and the differences between age and gender [29, 31]. Studies have found a significant positive correlation between bullying victimization and adolescent anxiety [32], and

the probability of adolescents experiencing anxiety after bullying victimization is 4–18 times that of adolescents who have not experienced bullying victimization [27]. At the same time, longitudinal studies have also found that bullying victimization can significantly predict adolescent anxiety [33]. This may be related to the experience of bullying victimization resulting in difficulties in identifying and describing feelings, resulting in negative emotions not being effectively alleviated and released, leading to more anxiety [34].

In addition, anxiety can lead to subsequent negative behaviors in adolescents, and internet addiction is one of them. According to general strain theory [35], due to the individual's need to regulate negative emotions, coupled with the virtual and convenient characteristics of the network [36], individuals facing negative emotions may choose to use the internet for emotional regulation and escape [37, 38]. When an individual develops excessive, problematic, and compulsive immersion in social behaviors in the online world, this behavior gradually develops into internet addiction [39, 40]. Studies have found a significant positive correlation between anxiety and adolescent internet addiction [41, 42], and anxiety can significantly predict adolescent internet addiction [42–44], and the same prediction is also found in longitudinal studies [45, 46]. Therefore, based on the above evidence, this study hypothesized that anxiety mediates the relationship between bullying victimization and Internet addiction in adolescents.

Fortunately, family support may reduce the predictive effect of bullying victimization on adolescent anxiety. A longitudinal study conducted in Australia over 6 months found that family support not only reduces the persistence of bullying victimization but also lessens the psychological distress caused by bullying [47]. Studies have found that family support is an important predictor of adolescent bullying victimization [48], and it can significantly "offset" the subsequent adverse psychological and behavioral consequences of bullying victimization in adolescents [49, 50]. This effect has also been observed in studies focusing on single-parent family structures [51]. On the other hand, family function reduces the symptoms of anxiety in adolescents [52], family support can reduce the negative impact of anxious adolescents [53], and support from mothers is particularly important for the mental health and resilience of adolescents [54]. At the same time, family support has a significant negative predictive effect on adolescent social anxiety [55], the higher the degree of family support, the lower the level of anxiety in children and adolescents [56]. Therefore, we assume that family support can significantly regulate the relationship between bullying victimization and adolescent anxiety.

The current study explores the intricate relationship between bullying victimization, anxiety, and internet addiction among adolescents, with a particular focus on the moderating role of family support. It aims to investigate how experiences of bullying can precipitate anxiety, which may then escalate into internet addiction, and how family support might mitigate these psychological outcomes. By examining these dynamics, the study seeks to contribute to the development of effective interventions to protect and promote the mental health of adolescents in the face of bullying and its aftermath. Therefore, this study constructs a moderated mediation model, with bullying victimization as the independent variable, internet addiction as the dependent variable, anxiety as the mediating variable, and family support as the moderating variable, to construct the moderated mediation model shown in Fig. 1.

Method

Participants

Prior to initiating the survey, a preliminary estimate of the required sample size was calculated using Kendall's formula, which takes into account the number of variables in the study. According to this formula, the sample size should be 5–10 times the number of study variables [57]. To mitigate potential response loss from the online questionnaire, an additional 30% was added to the estimated sample size. Thus, the formula used for sample size calculation was: $n = 10 \times$ number of variables/$(1-30\%)$. This calculation yielded a minimum required sample size of 286 participants. This study employed a convenience sampling method to recruit 1,677 middle school students from six schools in Shandong, Hebei, and Hunan provinces of China in February 2024. Prior to this, the study had been approved by the Ethical Committee of the College of Biomedicine at Jishou University. The study utilized an online electronic questionnaire distributed through class groups, with the first page of the questionnaire detailing the study's survey content, data anonymity, confidentiality, and usage destination. Participants could generally complete the electronic questionnaire in about 15 min. Informed consent was obtained online from all participants and their guardians. The study was conducted in accordance with the provisions of the Declaration of Helsinki.

Following data collection, an initial data cleaning process was conducted. Only responses where participants answered all questions completely were included in subsequent data processing and analysis. Additionally, data were excluded if completion times were significantly shorter or longer than the average. Responses demonstrating patterned or repetitive answers were also deemed invalid. After excluding invalid data, the final analysis sample of this study included 1,395 participants (599 boys, 796 girls) with an average age of 15.86 years (SD = 0.72).

Measurement tools

Bullying victimization

Bullying victimization was assessed through a single question that provided a detailed definition of bullying: "When an individual repeatedly experiences negative behaviors such as hitting, kicking, pushing, threatening, teasing, insulting, excluding, spreading rumors, or sending hurtful emails or messages by others in a situation of unequal power or status, they are being bullied" [21]. Participants were asked to recall the past 30 days and respond on a five-point scale (0 = never, 1 = once a month, 2 = two to three times a month, 3 = once a week, 4 = several times a week, 5 = almost every day). This tool has been used in previous research [58–62].

Internet addiction

Internet addiction levels among adolescents were measured using a scale revised and validated by Wei Qi [63]. The scale consists of 8 items, rated on a Likert scale from 1 (strongly disagree) to 5 (strongly agree). For instance, one item is "Excessive internet use makes it difficult for me to fall asleep". The sum of the item scores represents the level of internet addiction, with a range of 8 to 40,
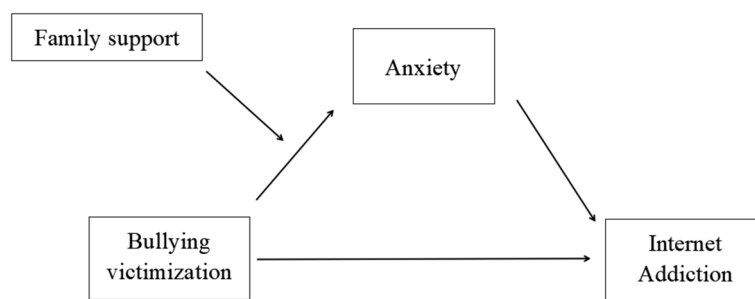

Fig. 1 Modulating mediation hypothesis model

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where higher scores indicate higher levels of addiction. The Cronbach's α for the sample in this study was 0.89.

Anxiety

Anxiety levels among adolescents were assessed using the anxiety subscale of the Depression-Anxiety-Stress Scales revised and validated by Gong Xu and colleagues [64]. The subscale contains 7 items, rated on a Likert scale from 1 (not at all) to 4 (completely). For instance, one item is "I feel short of breath, even without physical exertion". The sum of the item scores represents the adolescents' anxiety level, with a range of 7 to 28, where higher scores indicate higher levels of anxiety. The Cronbach's α for the sample in this study was 0.86.

Family support

Family support was measured using the family support subscale of the Social Support Scale developed by Huang Li and colleagues [65]. The family support subscale includes 4 items, each rated from 1 (strongly disagree) to 7 (strongly agree). For instance, one item is "I can discuss my difficulties with my family". The sum of the item scores represents the level of family support, with a range of 4 to 28, where higher scores indicate higher levels of support. The Cronbach's α for the sample in this study was 0.92.

Statistical analysis

Statistical analysis was conducted using SPSS 26.0 software. Initially, a common method bias test was performed, with a threshold of less than 40% indicating no significant common method bias [66]. Subsequently, descriptive statistics and correlational analysis were performed on the demographic characteristics and main variables of the study participants. The data for the main variables were standardized before further analysis. Finally, to test our hypotheses, we used the PROCESS

macro in SPSS (Models 4 and 7) to examine the relationship between bullying victimization and adolescent internet addiction, explore the mediating role of anxiety, and investigate the moderating role of family support [67]. In this process, 5,000 bootstrap resampling iterations were used to evaluate model fit and estimate the 95% confidence interval (95% CI), ensuring robustness in data analysis [68]. Gender and age were controlled as covariates during the analysis. The significance level was set at $\alpha = 0.05$.

Results

Common method bias test

The common method bias test results of this study revealed the presence of two factors with eigenvalues greater than one. the first factor accounted for 30.76% of the total variance, which is below the threshold of 40%, indicating that there is no significant risk of common method bias in this study.

Correlation analysis

The results presented in Table 1 indicate that bullying victimization is significantly positively correlated with anxiety ($r = 0.26$, $p < 0.001$) and internet addiction ($r = 0.13$, $p < 0.001$). Anxiety is significantly positively correlated with internet addiction ($r = 0.43$, $p < 0.001$) and significantly negatively correlated with family support ($r = -0.27$, $p < 0.001$).

Mediation test

The results in Table 2 and Fig. 2 show that bullying victimization can significantly and positively predict adolescent internet addiction ($\beta = 0.130$, SE $= 0.027$, $p < 0.001$). However, when the mediator variable is included, the prediction of adolescent internet addiction by bullying victimization becomes non-significant ($\beta = 0.020$, SE $= 0.026$, $p > 0.05$). Additionally, bullying victimization

Table 1 Correlation analysis

Variables	1	2	3	4	5	6
1 Gender	-					
2 Age	0.02	-				
3 Bullying victimization	−0.04	0.01	-			
4 Internet addiction	0.07**	0.07**	0.13***	-		
5 Anxiety	0.06**	0.06*	0.26***	0.43***	-	
6 Family support	−0.03	−0.08**	−0.26***	−0.28***	−0.27***	-
M	-	15.86	0.16	18.44	12.22	23.53
SD	-	0.72	0.65	6.79	4.52	4.60

*$p < 0.05$

**$p < 0.01$

***$p < 0.001$

Table 2 Tests the mediation model

Outcome variables	Predictive variables	β	SE	t	R^2	F
Internet addiction	Gender	0.150	0.054	2.813**	0.027	12.892***
	Age	0.100	0.037	2.731**		
	Bullying victimization	0.130	0.027	4.909***		
Anxiety	Gender	0.149	0.052	2.868*	0.077	38.868***
	Age	0.081	0.036	2.282*		
	Bullying victimization	0.264	0.026	10.252***		
Internet addiction	Gender	0.088	0.049	1.797	0.188	80.234***
	Age	0.066	0.034	1.970*		
	Bullying victimization	0.020	0.026	0.785		
	Anxiety	0.417	0.034	16.573***		

*$p < 0.05$
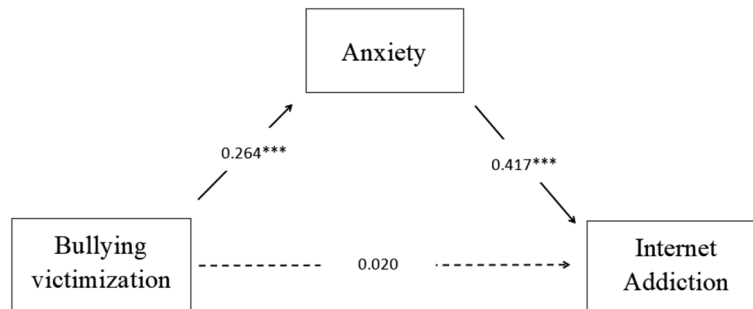
**$p < 0.01$

***$p < 0.001$

Fig. 2 Mediation model (***$p < 0.001$)

Table 3 Path analysis of mediation model

Mediation model paths	Effect size	SE	Bootstrap 95% CI	Proportion of mediating effect
Total effect	0.130	0.027	0.078, 0.182	
Direct effect	0.020	0.025	−0.030, 0.069	
Total indirect effect	0.110	0.018	0.079, 0.149	84.615%

significantly and positively predicts adolescent anxiety (β = 0.264, SE = 0.026, $p < 0.001$), and anxiety significantly and positively predicts adolescent internet addiction (β = 0.417, SE = 0.034, $p < 0.001$). The proportion of the mediation path is detailed in Table 3.

Moderated mediation test

Table 4 displays the results of the moderated mediation model test. After including the moderating variable of family support, bullying victimization continues to significantly and positively predict adolescent anxiety (β = 0.183, SE = 0.029, $p < 0.001$). Family support

significantly and negatively predicts adolescent anxiety (β = −0.201, SE = 0.027, $p < 0.001$), and the interaction term between family support and bullying victimization significantly and negatively predicts adolescent anxiety (β = −0.032, SE = 0.027, $p < 0.05$). See Figs. 3 and 4 for details.

Discussion

This study elucidates the intrinsic relationship between bullying victimization and adolescent internet addiction, encompassing the mediating role of anxiety and the moderating effect of family support between anxiety and internet addiction. We have considered the anxiety between bullying victimization and internet addiction, as well as the moderator role of family support between adverse experiences and emotions. The findings indicate that bullying victimization and adolescent internet addiction has a significant positive correlation, and anxiety serves as a complete mediator between bullying victimization and adolescent internet addiction. Finally, family support moderates the relationship between bullying victimization and adolescent anxiety. Through these relationships, this study further reveals the underlying

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Table 4 Test of mediating model

Outcome variables	Predictive variables	β	SE	t	R^2	F
Anxiety	Gender	0.129	0.051	2.538*	0.122	38.541***
	Age	0.061	0.035	1.740		
	Bullying victimization	0.183	0.029	6.339***		
	Family support	−0.201	0.027	−7.487*		
	Family support × Bullying victimization	−0.032	0.016	−2.026*		
Internet addiction	Gender	0.088	0.049	1.797	0.188	80.234***
	Age	0.066	0.034	1.970*		
	Bullying victimization	0.020	0.026	0.785		
	Anxiety	0.417	0.034	16.573***		

*$p < 0.05$

**$p < 0.01$
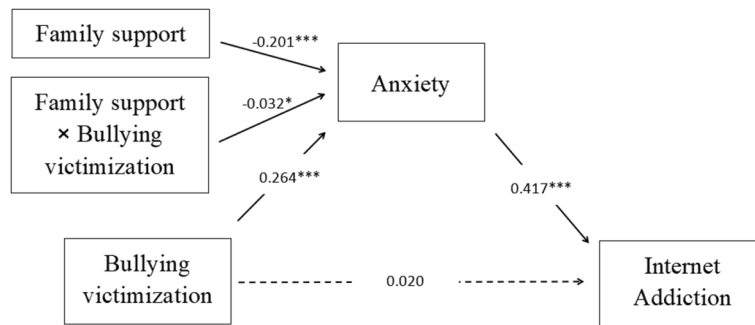
***$p < 0.001$

Fig. 3 Moderated mediating model (*$p < 0.05$; ***$p < 0.001$)

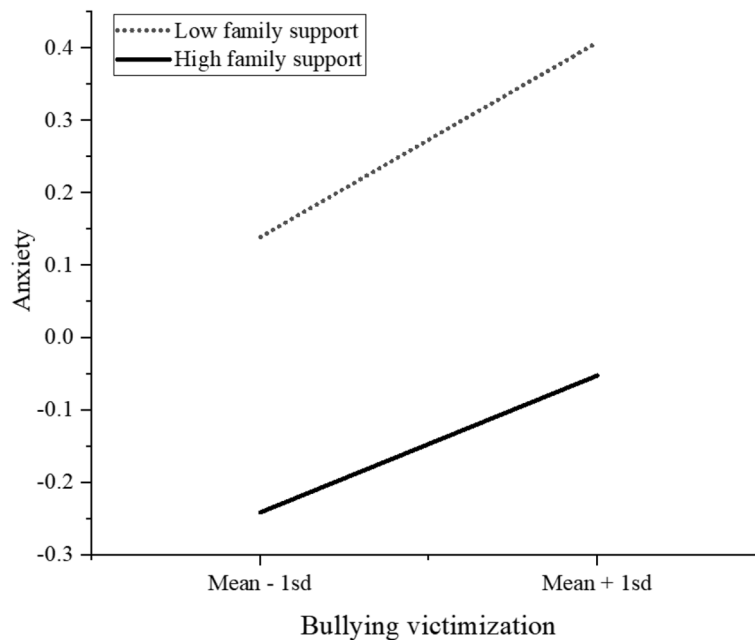**Fig. 4** Simple slope diagram

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psychological mechanisms by which bullying victimization predicts adolescent internet addiction.

In our research, we found that significantly positive relationship between bullying victimization and adolescent internet addiction. Previous studies have found that bullying victimization increases the risk of internet use among adolescents [69], and the incidence of internet addiction is 3 to 5 times higher among adolescents who have experienced bullying victimization [27]. Moreover, bullying victimization significantly predicts adolescent internet addiction [70, 71]. This may be related to the fact that bullying victimization leads to a decreased sense of school belonging [72] which in turn leads to a greater tendency to enter the online world [73]. According to the Life History Strategy Theory [74], individuals adjust their behavior and decision-making based on their environment and personal experiences, tending towards a slow or fast life history strategy after balancing. If the environment is safe and predictable, individuals are more inclined to adopt a slow life history strategy, characterized by focusing energy and resources on survival tasks, maintaining health, learning knowledge and skills, and raising offspring, exhibiting less impulsive behavior and better self-control. Conversely, if the environment is harsh and unpredictable, individuals are more inclined to adopt a fast life history strategy, characterized by focusing energy and resources on reproductive tasks, seeking immediate pleasure or temporary satisfaction, exhibiting higher impulsivity and lower self-control. Combined with the characteristics of bullying victimization, the internet may become an important carrier for impulsive and low self-control individuals to obtain immediate satisfaction [75, 76]. The internet world can temporarily serve as a refuge for bullied adolescents [77, 78], while also allowing them to alleviate negative emotions and derive pleasure [79–81]. When reliance on the internet becomes excessive and uncontrollable, and withdrawal symptoms emerge, behavioral addiction may develop [82]. However, in our study, we found that after including the mediating variable, the relationship between bullying victimization and Internet addiction was no longer significant. Combined with the above theory, it indicates that the relationship between the two may be mediated by other variables (e.g. anxiety).

In this study, anxiety had a complete mediating effect between bullying victimization and Internet addiction in adolescents. Therefore, anxiety is one of the important mediating variables in the prediction of adolescent internet addiction by bullying victimization. Previous studies have found that bullying victimization increases the risk of anxiety in adolescents [24, 28], and adolescents who have experienced bullying victimization are 3 to 18 times more likely to experience anxiety than those who have

not [27, 83]. Longitudinal studies have also found a bidirectional predictive effect between bullying victimization and anxiety [33]. Furthermore, both cross-sectional and longitudinal studies have found that anxiety significantly predicts adolescent internet addiction [42, 43, 45, 46]. According to strain theories, the experience of bullying victimization is a form of stress for adolescents [35]. When facing this stress, adolescents often exhibit feelings of insecurity [84], avoidance behavior, more sedentary behavior [85], and anxiety [86, 87]. Therefore, using the internet often becomes a coping mechanism for adolescents in this negative situation [88], which may lead to the formation of internet addiction. Combined with the above evidence, the results of this study indicate that anxiety mediates between bullying victimization and adolescent internet addiction. Moreover, our study found that family support significantly reduces the predictive effect between bullying victimization and adolescent anxiety. Studies have found that family support promotes children's social skills [89] and the development of healthy psychology [54]. At the same time, family support predicts adolescent anxiety [52] and reduces suicidal ideation [53]. These findings align with family systems theory [90], which posits that interactions within the family system have a significant impact on adolescents' social adaptation and development. Family support, as an integral part of this system, can buffer the psychological stress associated with bullying, thereby reducing anxiety and preventing the development of internalizing problems such as depression. Furthermore, family support contributes to the development of healthy interpersonal relationships and social skills, which may diminish excessive reliance on and addiction to the internet. Based on the above evidence, this study found that family support significantly reduces the predictive relationship between bullying victimization and adolescent anxiety.

Our research, while providing valuable insights, is not without its limitations. Firstly, the cross-sectional data employed in this study cannot capture the dynamic relationships between variables over time [91]. The relationships identified are associative, and we cannot definitively assert that bullying victimization causes anxiety, which in turn leads to internet addiction. Longitudinal studies are needed to track the development of these relationships over time and to better understand the direction of effects. Secondly, our data relies on self-reported measures, which are susceptible to biases such as social desirability and recall bias. Future studies could benefit from incorporating objective measures or utilizing multiple informants to enhance the validity of the findings. Thirdly, the use of a single-term measurement for bullying victimization, while beneficial in some respects [92], standardizes the assessment across all dimensions of

bullying. This approach may not fully capture the complexities and varied impacts of different types of bullying victimization [93]. Lastly, our sample, though representative of certain provinces in China, may not fully capture the diversity of experiences across different cultural and geographical contexts. A more diverse and representative sample would strengthen the generalizability of our results. Future research should aim to address these limitations. Longitudinal studies would help elucidate the temporal sequence of bullying victimization, anxiety, and internet addiction, providing a clearer understanding of causal pathways. Additionally, future studies could employ a mixed-methods approach, combining quantitative surveys with qualitative interviews or observations, to gain a more nuanced understanding of the experiences of adolescents. Expanding the sample to include a wider range of geographical and cultural backgrounds would also enhance the external validity of the findings.

The findings of this study have significant practical implications for educators, policymakers, and mental health professionals. By highlighting the mediating role of anxiety, our research underscores the importance of early intervention to address anxiety in adolescents who have experienced bullying. Schools could implement programs that focus on emotional regulation and coping strategies to help students manage anxiety and reduce the risk of internet addiction. The study also points to the protective role of family support, suggesting that strengthening family communication and support systems could be a crucial factor in mitigating the negative effects of bullying victimization. Policymakers can consider these findings when developing policies aimed at reducing bullying in schools and promoting a supportive family environment. Moreover, the integration of these findings into clinical practice could lead to more effective interventions for adolescents struggling with anxiety and internet addiction, ultimately improving their mental health and well-being. In conclusion, while our study provides a foundation for understanding the complex relationships between bullying victimization, anxiety, and internet addiction, it also highlights the need for further research to deepen our understanding and inform practical interventions. By addressing the limitations and building on the findings, future research can contribute to the development of more effective strategies to support the mental health and well-being of adolescents. Looking ahead, future research should consider the role of other potential mediators and moderators, such as self-control, physical activity [93–97], and other negative emotions [98, 99], which may also influence the relationship between bullying victimization and internet addiction.

In conclusion, our study not only expands the current literature by elucidating the complex interplay between bullying, anxiety, family support, and internet addiction but also provides valuable insights for future research and practical applications. By identifying anxiety as a key mediator and family support as a significant moderator, we offer a framework for understanding and addressing the psychological consequences of bullying victimization and the development of internet addiction among adolescents.

Conclusion

This study further reveals the relationship between bullying victimization and adolescent internet addiction, considering the mediating role of anxiety and the moderating effect of family support between bullying victimization and adolescent anxiety. The findings indicate that anxiety has a complete mediating role between bullying victimization and adolescent internet addiction, where family support mitigates the relationship between bullying victimization and adolescent anxiety. It is recommended that guardians promptly identify whether adolescents have experienced bullying victimization and provide timely support to alleviate the adolescents' negative emotions, thereby preventing internet addiction.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12887-024-05348-z.

> Supplementary Material 1.

Declarations

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