



The Effect of Bullying Victimization on Adolescent Non-Suicidal Self-Injury: The Mediating Roles of Alexithymia and Self-Esteem

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Background & Aim: Non-suicidal self-injury (NSSI) in adolescents is a serious public health issue influenced by the interaction of multiple factors. The purpose of this study was to investigate the multiple mediating roles of alexithymia and self-esteem in the association between bullying victimization and NSSI in a sample of Chinese adolescents.

Methods: A survey of 1299 adolescents from two public middle schools in Henan Province, China, was undertaken. Data were collected using the Chinese version of the Delaware bullying victimization scale-student (DBVS-S), the Toronto Alexithymia-20 Scale (TAS-20-C), the Rosenberg self-esteem scale (RSES), and the adolescent self-injury questionnaire. Besides, we performed a structural equation modeling (SEM) with latent variables using AMOS 26.0 to examine the relationship between variables and the mediating effects.

Results: The SEM analysis found that not only can bullying victimization directly impact NSSI, but that alexithymia and self-esteem have a chain mediating effect in the association between bullying victimization and NSSI. This mediating effect contributed 22.47% to the total effect.

Conclusion: These findings validate bullying victimization, alexithymia, and low self-esteem are important variables that affect NSSI among Chinese adolescents. Educators need to implement some prevention and intervention strategies to ameliorate the campus atmosphere and adolescents' mental health aimed at avoiding NSSI behavior in adolescence.

Keywords: bullying victimization, non-suicidal self-injury, alexithymia, self-esteem, adolescents

Introduction

Non-suicidal self-injury (NSSI) continues to be a serious public health issue all over the world, especially among adolescents.¹⁻³ It can be defined as “the deliberate, and culturally or socially unacceptable destruction or injury of a person’s body tissue without suicidal intention”.⁴ The most common NSSI behaviors include self-cutting, self-scratching, self-hitting, biting oneself, etc.^{5,6} Adolescents (aged between 10 and 19 years) are a group of human beings living in transition from childhood to adulthood, who experience rapid physical, cognitive, and psychosocial growth.⁷ Lim et al⁸ performed a meta-analysis and discovered that the 12-month prevalence and lifetime prevalence rates of NSSI among children and adolescents were 19.5% and 22.1%, respectively. There have been reports of higher rates among psychiatric adolescent inpatients, which exceed 40%.⁹⁻¹¹ Non-suicidal self-injury seriously affects the physical and mental health of adolescents as it is associated with greater psychosocial functioning impairment,¹² higher levels of depression and anxiety,¹³ impulsivity,¹⁴ and suicide attempts.¹⁵ Due to rapid physiological and psychological changes, adolescents are most intensely influenced by negative peer relationships.¹⁶ Bullying victimization refers to the experience of being bullied by others and suffering some form of physical or emotional harm.¹⁷ Especially, with the widespread use of the internet, cyberbullying has an increasing impact on the psychological, social and privacy aspects of youth in developing countries.¹⁸ Numerous empirical studies revealed that adolescents who have been bullied are more prone to

exhibit NSSI behaviors than individuals with no experience of bullying victimization.^{19–21} However, little is known about how and under what conditions bullying victimization affects NSSI among adolescents. The acquisition of such information could give a more thorough comprehensive understanding of the probably complicated mechanisms involved in the development of NSSI, which could guide the creation of more effective treatments targeted at preventing and decreasing NSSI among adolescents. Therefore, the purpose of this study is to enrich the research findings by exploring the impact of bullying victimization on adolescents' NSSI and the mediating role of alexithymia and self-esteem in the association between bullying victimization and NSSI.

Bullying Victimization and Non-Suicidal Self-Injury

School bullying has been commonly acknowledged as a severe issue for adolescents worldwide. Bullying refers to an aggressive behavior, in which a perpetrator in a position of power attacks, humiliates, or excludes a relatively powerless victim on purpose and repeatedly.²² Bullying can be physical (eg, hitting, kicking, and pushing), verbal (eg, threatening, intimidating, and teasing), or relational (eg, isolation, social exclusion).²³ Globally, approximately 10–30% of adolescents are victims of bullying.^{24,25} A recent survey conducted in Guizhou, China also reported that 28.34% of middle school students have experienced bullying victimization, 22.59% of them experienced verbal bullying, 12.05% experienced relational bullying, and about 7.54% physical bullying.²⁶ In addition, with the widespread use of mobile phones and the internet, a recent phenomenon known as cyberbullying victimization is also prevalent among adolescents.^{18,27} It is worth noting that bullying victimization has major detrimental impacts on adolescents' physical and mental health that are associated with a series of behavioral and emotional problems including depression,²⁸ anxiety,²⁹ loneliness,³⁰ low self-esteem,³¹ even suicidal ideation,³² etc. The affect-regulation model of NSSI states that NSSI is a maladaptive coping style to deal with adverse emotions caused by the experiences of victimization.³³ For instance, adolescents who are bullied at school can experience a series of negative feelings, such as tension, frustration, and fear,^{34,35} which may lead adolescents to implement NSSI to release emotional stress.³⁶ Several empirical studies also demonstrate that NSSI is more common among adolescents with experiences of bullying victimization compared to adolescents without such experiences.^{19,20,37}

In addition, the interpersonal model of NSSI proposed by Prinstein et al³⁸ considers that negative interpersonal events often precede NSSI, because the experiences could trigger pressures or strain, thereby increasing the risk of NSSI. For adolescents, the school is an important place where they engage in interpersonal interactions. After being bullied at school, adolescents may utilize NSSI to help them regain a sense of control and then lessen the adverse emotions caused by being bullied.³⁹ Some research has been conducted to investigate the impacts of bullying victimization on NSSI,^{19,20,37} but the underlying linkages remain unknown. As a result, the purpose of this study was to develop a prospective structural model to analyze how bullying victimization affects NSSI in Chinese adolescents. Hypothesis 1 of this study is that bullying victimization will directly predict the NSSI of adolescents.

Alexithymia as a Mediator

Alexithymia is an affection regulation deficiency characterized by difficulties in identifying feelings, finding words to express emotions, and distinguishing feelings from physical sensations.⁴⁰ It is distinguished into two types: primary alexithymia (a stable personality trait) and secondary alexithymia (a psychiatric symptom induced by experiencing stressful and traumatic events).⁴¹ For the majority of adolescents, bullying victimization is deemed a traumatic experience.³⁵ In such circumstances, alexithymia symptoms may emerge as a negative reaction to the pressure induced by bullying victimization and can be interpreted as a psychological coping mechanism by which teenagers attempt to suppress negative feelings triggered by bullying victimization. A positive association between bullying victimization and alexithymia has been demonstrated.⁴² Moreover, alexithymia has also been indicated to be a mediator factor between bullying victimization and internalized/externalized problems.⁴³

A cognitive-emotional model of NSSI proposed by Hasking et al⁴⁴ indicated that if individuals have problems in perceiving, understanding, and distinguishing emotions, as well as failing to adopt appropriate emotion regulation strategies, it may lead to self-injurious behavior problems. However, individuals with alexithymia mostly have difficulty in emotional self-regulation; thus, alexithymia is one of the potential risk factors associated with NSSI.⁴⁵ Several studies have revealed that alexithymia is strongly related to self-injury among adolescents,^{46–48} and the severity of alexithymia is

much higher in patients who self-injure frequently (>5 times per year) than in patients who only sometimes self-injure (<5 times per year).⁴⁹ To sum up, adolescents who are bullied are more inclined to develop alexithymia, which can subsequently lead to NSSI behaviors. Therefore, we hypothesized that alexithymia could be a possible mediator between bullying victimization and NSSI among Chinese adolescents (Hypothesis 2).

Self-Esteem as a Mediator

Self-esteem refers to one's overall subjective emotional evaluation of the self-value.⁵⁰ Individuals with high self-esteem are characterized by a positive self-assessment of themselves and a belief in their abilities, whereas individuals with low self-esteem are often self-denying and self-contemptuous.⁵⁰ The self-esteem theory proposed by Crocker et al⁵¹ suggests that self-esteem can be influenced by life events during an individual's socialization, such as the attitudes and judgments of others. Adolescence is a pivotal period for the formation of adolescents' self-esteem. However, being bullied may send a negative message to the victims that they are not accepted by their peers, which results in their incapacity to establish a positive self-assessment. Indeed, some studies demonstrated that bullying victimization is negatively correlated with adolescents' self-esteem.^{31,52–54} Moreover, a meta-analysis containing several longitudinal studies found that bullying victimization can significantly predict low self-esteem.⁵⁵

It has been shown that low self-esteem is a prevalent characteristic of groups with a history of self-injury behavior and that individuals with NSSI behavior have lower self-esteem compared to those without NSSI behavior.⁵⁶ According to the self-punishment model of NSSI,⁵⁷ it is an externalizing behavior for individuals to express their anger toward themselves, yet people with low self-esteem are prone to experience shame, self-blame, and disappointment, thus believing that they should be punished and then leading to NSSI behavior. Self-esteem plays a mediator in the relationship between bullying victimization and aggression behaviors has been reported.⁵⁸ In a word, self-esteem is considered a significant variable in understanding the relationship between bullying victimization and adolescent NSSI. We assumed self-esteem may be a possible mediator between bullying victimization and NSSI among Chinese adolescents (Hypothesis 3).

Alexithymia and Self-Esteem

Although it has been indicated that alexithymia and self-esteem are correlated with bullying victimization and NSSI,^{42,46,59} few studies have examined the chain mediating role of alexithymia and self-esteem on the relationship between bullying victimization and NSSI in adolescents. Self-esteem is an emotional evaluation of one's value, yet the greatest difficulty for people with alexithymia is the identification and appraisal of emotions.⁵⁰ It has been found that the alexithymia level was significantly and negatively correlated with self-esteem in adults.⁶⁰ However, the relationship has not been examined in the adolescent group. Besides, Dong et al's research⁶¹ has demonstrated that self-esteem mediates the association between alexithymia and NSSI, that is, individuals with alexithymia may have a higher risk of experiencing a sense of low self-esteem,⁶² which may lead to NSSI behaviors. Therefore, we hypothesized that the influence of bullying victimization on NSSI is mediated by the chain mediating role of alexithymia and self-esteem (Hypothesis 4).

The Present Study

Based on the literature review above, we proposed a hypothetical model for this investigation (shown in Figure 1). Overall, this current study is conducted to explore the influence of bullying victimization on NSSI in Chinese adolescents and further explore the mediating role of alexithymia and self-esteem to provide some theoretical guidance and empirical support for future research and intervention of NSSI among adolescents.

Methods

Participants and Procedures

A cross-sectional survey of anonymous self-report questionnaires from adolescents at two public middle schools in Henan Province, China was conducted utilizing a convenience sampling method. Both schools were equivalent to one another in terms of the school size, faculty force, student source, and other relevant factors. The age of the participants ranged from 12 to 18 years (Mean = 15.33, SD = 1.51). Table 1 shows the demographic characteristics of the participants.

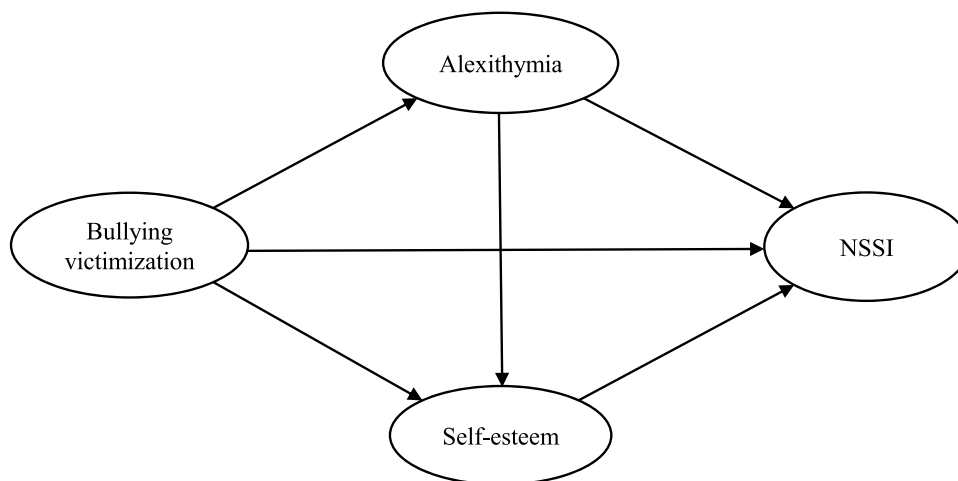


Figure 1 The hypothetical model for this study.

Before beginning the investigation, we informed the objectives, process, and anonymity of this study to the participants. Subsequently, the participants and their guardians were asked to complete the written informed consent. Data collection took place from May to June 2023 and was conducted during regular class hours by trained graduate students with the aidance of the school teachers. It took approximately 20 minutes to complete the paper questionnaire. The initial sample size was estimated by the equation $N = 4U\alpha^2S^2/\delta^2$.⁶³ According to the presurvey, we calculated the standard deviation (S) of the dependent variable (NSSI) was 11.88. Thus, we set the allowable error $\delta = 2.97$, and $\alpha = 0.05$. Based on those numbers, the necessary sample size $N = 4 * 1.96^2 * 11.88^2 / 2.97^2 \approx 246$. Considering potentially useless questionnaires and sampling error, a total of 1400 participants were recruited. Of these, 80 dropped out and 1320 questionnaires were returned with a recovery rate of 94.29%. After excluding 21 questionnaires with incomplete and random answers, a total of 1299 valid questionnaires were recovered; the valid recovery proportion was 92.79%. The studies involving human participants were reviewed and approved by Institutional Review Board of Henan Provincial Key Laboratory of Psychology and Behavior (reference: 20230516001).

Instruments

Alexithymia

The Chinese version of the Toronto Alexithymia-20 Scale (TAS-20-C) was used as a self-report measurement tool of alexithymia in this study.⁶⁴ The 20-item scale measures three main aspects: difficulty in identifying feelings (DIF), difficulty in describing feelings (DDF), and externally oriented thinking (EOT). The scale is rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Reverse-scored items include items 4, 5, 10, 18 and 19. The total score ranges from 20 to 100 points with higher scores indicating more severe alexithymia. The scoring threshold for the TAS-20-C ≥ 61 was classified as alexithymia.⁴ Especially, TAS-20-C has been verified to have satisfactory reliability and validity in Chinese adolescents.⁶⁵ In this study, the Cronbach's α of TAS-20-C was 0.82.

Self-Esteem

The Chinese version of the 10-item Rosenberg self-esteem scale (RSES)⁶⁶ was used to measure participants' self-esteem levels. Each item was rated on a 4-point Likert-type scale format (1 = strongly disagree, 4 = strongly agree). Four items (items 3, 5, 9, and 10) are reverse-scored. After reverse coding the above items, the overall score was between 10 and 40, with higher scores indicating higher self-esteem levels. In the Chinese cultural context, the scale has been validated as a reliable and valid measure when used with adolescent populations.⁶⁷ The Cronbach's α for self-esteem in this study was 0.85.

Bullying Victimization

The Chinese version of the Delaware bullying victimization scale-student (DBVS-S), a self-report assessment tool, was utilized to measure the level of school bullying victimization in adolescents.⁶⁸ The scale is composed of 17 items, including

four subscales: verbal bullying victimization, physical bullying victimization, relational bullying victimization, and cyberbullying victimization. Nevertheless, items 14–17 assessing cyberbullying victimization and used only for middle school students and above. Besides, the item 13 was not scored. The scale is scored on a 6-point Likert scale, with 0 meaning “never” and 5 meaning “every day”. Higher scores indicate higher levels of school bullying victimization. DBVS-S has been confirmed to be appropriate for use in the Chinese adolescent populations.⁶⁸ In the present study, the Cronbach’s α of DBVS-S was 0.94.

Non-Suicidal Self-Injury

NSSI in this study was assessed using the adolescent self-injury questionnaire revised by Yu.⁶⁹ This questionnaire consists of 18 items and measures two aspects of NSSI in each item: the frequency of engaging in NSSI behavior and the degree of bodily injury. The frequency of engaging in NSSI was rated on four levels: never, once, twice to four times, and five times or more, with scores ranging from “0” to “3”, respectively. The degrees of bodily injury were rated on five levels: extremely mild, mild, moderate, severe, and extremely severe, which were scored from “0” to “4”, respectively. The total score was the sum of the products of the score for the two parts (frequency and degree). The higher the overall score, the more severe levels of NSSI were. In the current study, whether the level of NSSI was “0” or not was considered as the standard for judging whether participants have a history of NSSI or not. The questionnaire has been used by past studies in measuring NSSI among Chinese adolescents and shows excellent reliability and validity in the populations.⁷⁰ In the present study, the Cronbach’s α of NSSI was 0.94.

Data Analyses

Statistical analyses were conducted with the software packages for SPSS version 25.0 and AMOS version 26.0. Firstly, we used Harman’s single-factor test to calculate common method bias (CMB). And, descriptive statistics were performed using frequencies and percentages for the categorical variables, or means and standard deviations for age and other continuous variables. Second, Chi-square tests (for classified variables) or Mann–Whitney *U*-test (for continuous variables) were performed to explore the differences in demographic characteristics and variables among the two groups (NSSI group and non-NSSI group) of adolescents. We used the sum score of the NSSI questionnaire to categorize the presence of NSSI or not (0 = non-NSSI, ≥ 1 = NSSI). Third, the Pearson correlation analysis was applied to determine the correlation of the research variables. Furthermore, binary logistic regression was utilized to examine the risk factors for NSSI among adolescents and calculate the adjusted odds ratios (OR) and 95% confidence intervals (CIs). Finally, a structural equation model (SEM) was performed to examine the chain-mediating effect of alexithymia and self-esteem in the relationship between bullying victimization and NSSI. Based on the prior item parceling strategies,⁷¹ we used the “item-to-construct balance” method to pack the items of self-esteem. The multiple median analysis was performed using 5000 bootstrap samplings. The 95% CIs that did not include 0 were considered significant effects. The *P*-values were bilateral, below 0.05, and statistically significant.

Results

Common Method Bias Test

Since the data of this study originated from self-reports, common method bias may exist. Thus, we used the anonymity of personal information and forward and reverse scoring methods to reduce the common method bias in this study. In addition, Harman’s single-factor test⁷² was used to test the common method bias. The test findings showed that the initial eigenvalues of 18 factors were greater than 1, and the first component explained 20.52% of the total variance, which was significantly less than the critical criterion of 40%.⁷² Hence, this study did not have any significant common method bias.

Sample Characteristics

Table 1 shows the demographic characteristics for both the NSSI group ($n = 475$, 36.6%) and non-NSSI group ($n = 824$, 63.4%). Of the 1299 participants, there were 607 (46.7%) males and 692 (53.3%) females aged 12–18 years old (mean: 15.33 ± 1.51 years). At the time of data collection, there were 566 (45.1%) junior middle school students (grades 7, 8, 9), and 733 (54.9%) high middle school students (grades 10, 11, 12). The results of the Chi-square test showed high middle school students were more inclined to be involved in NSSI than participants of junior middle school ($p = 0.03$). Besides,

Table 1 The Demographic Characteristics of Participants

Variables	Total participants	NSSI		Z/ χ^2	p
	(n = 1299)	Yes (n = 475, 36.6%)	No (n = 824, 63.4%)		
Age	15.33(1.51)	15.25(1.54)	15.38(1.49)	-1.31	0.19
Gender					
Male	607(46.7%)	218(45.9%)	389(47.2%)	0.21	0.65
Female	692(53.3%)	257(54.1%)	435(52.8%)		
Grade					
Junior middle school	566(45.1%)	188(39.6%)	378(45.9%)	4.86	0.03
Senior middle school	733(54.9%)	287(60.4%)	446(54.1%)		
Only children					
Yes	72(5.5%)	31(6.5%)	41(5.0%)	1.38	0.24
No	1227(94.5%)	444(93.5%)	783(95.0%)		
Left behind status					
Yes	858(66.1%)	337(70.9%)	521(63.2%)	8.01	0.01
No	441(33.9%)	138(29.1%)	303(36.8%)		
Residence					
Village	766(59.0%)	267(56.2%)	499(60.6%)	2.35	0.13
Town	533(41.0%)	208(43.8%)	325(39.4%)		
Accommodation type					
Boarding student	371(28.6%)	131(27.6%)	240(29.1%)	0.35	0.55
Commuting student	928(71.4%)	344(72.4%)	584(70.9%)		
Academic performance					
Excellent	432(33.3%)	150(31.6%)	282(34.2%)	1.02	0.6
Good	565(43.5%)	210(44.2%)	355(43.1%)		
Poor	302(23.2%)	115(24.2%)	187(22.7%)		
Family structure					
Two-parent families	1145(88.1%)	415(87.4%)	730(88.6%)	1.22	0.54
Single-parent families	104(8.0%)	43(9.1%)	61(7.4%)		
Reorganized families	50(3.9%)	17(3.5%)	33(4.0%)		
Father's educational level					
Junior middle school and below	796(61.3%)	282(59.4%)	514(62.4%)	2.03	0.36
Senior middle school	394(30.3%)	147(31.0%)	247(30.0%)		
College and above	109(8.4%)	46(9.6%)	63(7.6%)		
Mother's educational level					
Junior middle school and below	929(71.5%)	336(70.7%)	593(72.0%)	0.37	0.83
Senior middle school	294(22.6%)	109(23.0)	185(22.5%)		
College and above	76(5.9%)	30(6.3%)	46(5.5%)		

more than half of the participants ($n = 858$, 66.1%) have the experience of left-behind (eg, adolescents whose one or both parents working outside the hometown and are staying behind in their hometowns for more than half a year). It is worth noting that the incidence of NSSI was significantly higher among left-behind adolescents than among adolescents accompanied by their parents ($p = 0.01$). Additionally, the majority of the participants are non-only children ($n = 1227$, 94.5%) and come from villages ($n = 766$, 59.0%). Among the commuting students, 37.1% of them ($n = 344$) engaged in NSSI, but there was no significant difference between the prevalence of NSSI among commuting and boarding students ($n = 131$, 35.3%). Moreover, the majority of parents have only junior middle school and below education. 88.1% of the participants' family structures are two-parent families ($n = 1145$), 8.0% of the participants live in single-parent families ($n = 104$), and 3.9% of the participants' families are reorganized families ($n = 50$). Overall, there was no significant difference in age, gender, only child/non-only child, residence, accommodation type, academic performance, family structure, or the educational level of parents between the NSSI groups and non-NSSI group, but participants in high middle school or left-behind adolescents were more prone to engage in NSSI ($p < 0.05$).

Comparison Analyses

The Mann–Whitney *U*-tests were conducted to compare the scores of bullying victimization, alexithymia, and self-esteem between the NSSI group and non-NSSI group (Table 2). Firstly, compared to the non-NSSI group, participants with NSSI behaviors have significantly higher scores on the total scale of bullying victimization and each subscale of it ($p < 0.001$). Secondly, 30.6% of participants ($n = 398$) had severe alexithymia and 53.52% of them ($n = 213$) had ever intentionally injured themselves in the last year, which was significantly higher than those without alexithymia (29.08%). In addition, the NSSI group scored significantly higher than the non-NSSI group on the TAS-20 total scale ($Z = -8.766$, $p < 0.001$) as well as on the subscales “difficulties identifying feelings” ($Z = -9.402$, $p < 0.001$), “difficulties describing feelings” ($Z = -6.520$, $p < 0.001$), and “externally oriented thinking” ($Z = -3.539$, $p < 0.001$). Lastly, compared to the non-NSSI group, the NSSI group scored significantly lower in self-esteem ($Z = 10.769$, $p < 0.001$).

Correlation Analysis

The mean, standard deviation, and correlation coefficient of the variables in this study are shown in Table 3. The results indicated that bullying victimization had a significantly positive association with alexithymia ($r = 0.24$, $p < 0.01$) and NSSI ($r = 0.39$, $p < 0.01$), but had a significantly negative association with self-esteem ($r = -0.26$, $p < 0.01$). Besides, alexithymia had a positive association with NSSI ($r = 0.23$, $p < 0.01$) and self-esteem ($r = -0.45$, $p < 0.01$). We also found self-esteem was significantly negatively associated with NSSI ($r = -0.29$, $p < 0.01$).

Risk Factors for NSSI

To examine the risk factors of NSSI, binary logistic regressions using the “Enter” method were conducted. As shown in Table 4, grade, bullying victimization, alexithymia, and self-esteem, were risk factors for NSSI. According to the findings

Table 2 The Intergroup Comparison of Bullying Victimization, Alexithymia, and Self-Esteem

Variable	Total sample	NSSI		Z/ χ^2	p
	(n = 1299)	Yes (n = 475)	No (n = 824)		
Bullying victimization	9.71(12.18)	13.13(14.77)	7.73(9.87)	-8.411	<0.001
Physical victimization	2.09(3.24)	2.89(3.94)	1.62(2.65)	-7.442	<0.001
Verbal victimization	4.08(4.24)	5.29(4.94)	3.38(3.61)	-7.465	<0.001
Relational victimization	2.56(3.55)	3.55(4.32)	1.99(2.86)	-7.709	<0.001
Cyberbullying victimization	0.98(2.93)	1.40(3.57)	0.74(2.45)	-5.245	<0.001
Alexithymia	55.27(10.38)	58.44(10.532)	53.45(9.847)	-8.766	<0.001
Yes	398(30.6%)	213(44.8%)	185(22.5%)	71.081	<0.001
No	901(69.4%)	262(55.2%)	639(77.5%)		
Difficulty in identifying feelings	19.81(5.95)	21.84(6.17)	18.65(5.49)	-9.402	<0.001
Difficulty in describing feelings	14.69(3.39)	15.47(3.45)	14.24(3.27)	-6.520	<0.001
Externally oriented thinking	20.77(2.87)	21.13(2.914)	20.56(2.817)	-3.539	<0.001
Self-esteem	28.33(5.02)	26.37(5.01)	29.46(4.67)	-10.769	<0.001

Table 3 | Bivariate Correlations Among Variables in This Study (n = 1299)

Variables	1	2	3	4
1 Bullying victimization	1.00			
2 Alexithymia	0.24**	1.00		
3 Self-esteem	-0.26**	-0.45**	1.00	
4 NSSI	0.39**	0.23**	-0.29**	1.00
M	9.71	55.27	28.33	4.59
SD	12.18	10.38	5.02	11.71

Note: ** $p < 0.01$.

Table 4 | Risk Factors for NSSI (n = 1299)

	B	SE	Wals	p	OR	95% CI	
						Lower	Upper
Grade	0.356	0.128	7.790	0.005	1.428	1.112	1.834
Left behind	0.262	0.134	3.851	0.050	1.300	1.000	1.689
Alexithymia	0.021	0.007	9.309	0.002	1.021	1.008	1.035
Self-esteem	-0.104	0.015	50.406	0.000	0.901	0.876	0.927
Bullying victimization	0.026	0.006	21.368	0.000	1.026	1.015	1.037
Constant	0.192	0.672	0.082	0.775	1.212		

of the study, adolescents in senior middle school had a risk of NSSI that was 1.428 times greater than adolescents in junior middle school (OR = 1.428, $p = 0.005$, 95% CI = 1.112–1.834). A one-unit increase in the bullying victimization scores increased the odds of engaging in NSSI by 1.026 times (OR = 1.026, $p < 0.001$, 95% CI = 1.015–1.037). Besides, a one-unit increase in the alexithymia scores increased the odds of participating in NSSI by 1.021 times (OR = 1.021, $p = 0.002$, 95% CI = 1.008–1.035). A one-unit increase in the self-esteem scores reduced the odds of engaging in NSSI by 9.9% (OR = 0.901, $p < 0.001$, 95% CI = 0.876–0.927).

Mediating Effect Analysis

Using Amos 26.0, we built the structural model to examine the association of bullying victimization and NSSI as well as the mediating effects of alexithymia and self-esteem. According to the hypothetical model, bullying victimization was employed as the independent variable, NSSI as the dependent variable, as well as alexithymia and self-esteem as mediating variables, to perform a path analysis. The results of goodness-of-fit indices verified a good fit of the structure model ($\chi^2/df = 2.643$, GFI = 0.984, NFI = 0.986, RFI = 0.981; IFI = 0.991; TLI = 0.988; CFI = 0.991, RMSEA = 0.036, SRMR = 0.026). Additionally, the results showed that all the path coefficients were significant ($p < 0.01$). As presented in Figure 2, bullying victimization could significantly and positively predict alexithymia ($\beta = 0.28$, $p < 0.001$) and NSSI ($\beta = 0.31$, $p < 0.001$) among adolescents, but could negatively predict self-esteem ($\beta = -0.15$, $p < 0.001$). Second,

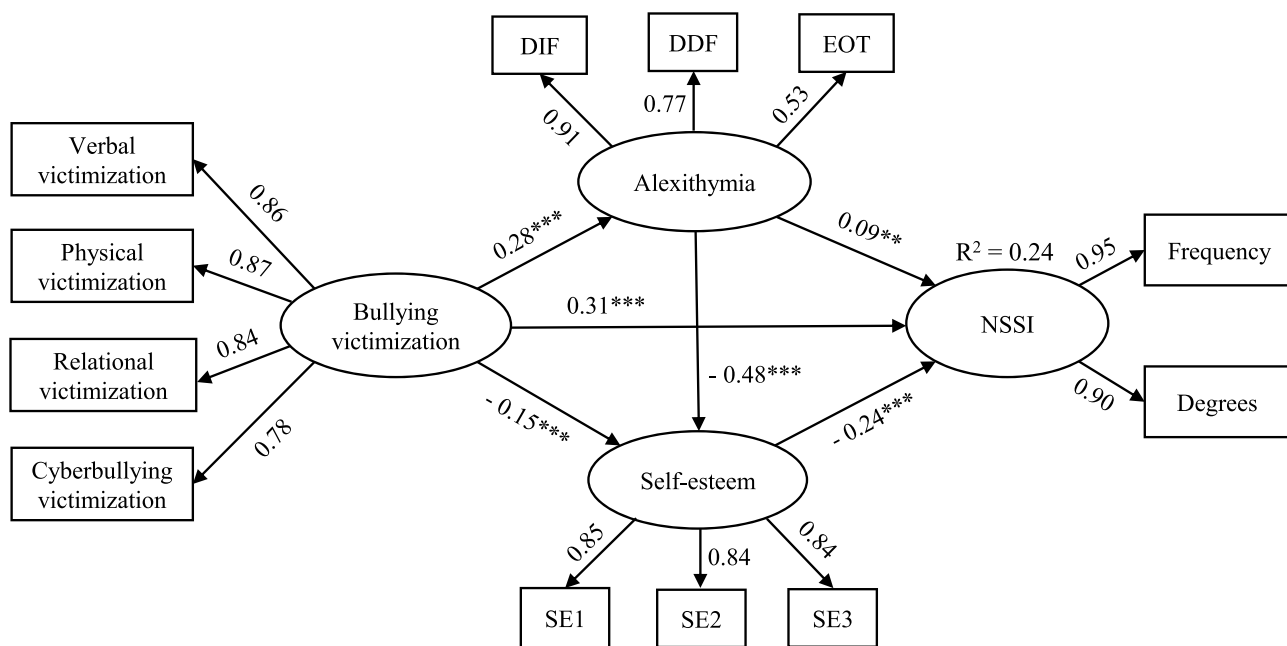


Figure 2 Multiple mediation effects model for bullying victimization predicting NSSI. DIF, difficulty in identifying feelings; DDF, difficulty in describing feelings; EOT, externally oriented thinking; SE1–SE3, three parcels of self-esteem; ** $p < 0.01$, *** $p < 0.001$.

Table 5 | Total, Direct, and Indirect Effects of the Structural Model

Effect	Path	Standardized β	The size of Effect	Boot SE	95% CI
Total	BV→NSSI	0.405			
Direct	BV→NSSI	0.314			
IndA1	BV→Alexithymia→NSSI	0.024	5.93%	0.011	0.004, 0.048
IndA2	BV→SE→NSSI	0.036	8.89%	0.010	0.019, 0.056
IndA3	BV→Alexithymia→SE→NSSI	0.031	7.65%	0.006	0.021, 0.045

alexithymia could significantly and negatively predict self-esteem ($\beta = -0.48$, $p < 0.001$) but could positively predict NSSI ($\beta = 0.09$, $p < 0.01$). Third, the self-esteem could significantly and negatively predict NSSI ($\beta = -0.24$, $p < 0.001$) among adolescents. Additionally, the predictors of NSSI (bullying victimization, alexithymia, and self-esteem) were found that they could explain 24% of its variation ($R^2 = 0.24$).

Finally, to get an understanding of the mediation effects, we conducted a bootstrap method test with the percentile bias correction, drawing 5000 bootstrapping samples and calculating the 95% CI to examine the mediating roles of alexithymia and self-esteem between bullying victimization and NSSI. As shown in Table 5, in the association between bullying victimization and NSSI, the total indirect effect was 0.091, accounting for 22.47% of the total effect (0.405). The results found that the total indirect effect was comprised of three distinct pathways. Specifically, bullying victimization could influence adolescents' NSSI via the mediating effect of alexithymia, via the mediating effect of self-esteem, and via the chain mediating effect of both alexithymia and self-esteem, which were respectively shown in the indirect effects A1, A2, and A3 in Table 5. Furthermore, indirect effects A1, A2, and A3 accounted for 5.93%, 8.89%, and 7.65% of total effect respectively. Because the 95% CI did not overlap with zero, indicating that all indirect effects were significant.

Discussion

The purpose of this study was to investigate the risk factors of NSSI and the influence of bullying victimization on NSSI among Chinese adolescents. Moreover, this study expanded on previous studies by further examining the potential chain mediating effect of alexithymia and self-esteem on the relationship between bullying victimization and NSSI. The findings of our survey revealed that 36.6% of participants had engaged in NSSI within the previous year. The result was similar to the findings of Baiden et al (37.0%)⁶ and Xu et al (34.8%)⁷⁰ but higher than the found reported by Esposito et al (15.3%).⁷³ The discrepancy in the NSSI detection rate could be attributed to the use of different measurement instruments or samples.⁷⁴ Given that more than one-third of adolescents (36.6%) engaged in NSSI, additional efforts must be undertaken to clarify why adolescents engage in harmful behavior. This study found that left-behind adolescents were more likely to engage in NSSI, which was by the findings of Huang et al and Wang et al^{75,76} The lack of parental care and emotional support from their parents could be an important reason for this phenomenon. For instance, when left-behind adolescents encounter challenges during their development, it is difficult for them to ask for assistance from their parents, which makes them more likely to have behavioral issues than non-left-behind adolescents, such as self-injury behavior.^{75,77} Thus, schools and other relevant institutions should focus more of their attention on adolescents who were left behind. Furthermore, adolescents attending high middle school had a significantly higher incidence of NSSI than junior middle school students, which was consistent with the previous findings.^{78,79} This could be because senior high school students may be confronted with greater academic pressures and more stressful life events compared to junior middle school students.⁸⁰ More importantly, the result of binary logistic regressions also found that bullying victimization exposure, high levels of alexithymia, and low self-esteem all significantly enhance the likelihood of NSSI among adolescents. Additionally, the SEM confirmed our hypothesis that bullying victimization can not only directly predict NSSI, but also indirectly predict NSSI through three mediating pathways: alexithymia, self-esteem, and the chain mediating of alexithymia and self-esteem. These findings add to an improved comprehension of the underlying mechanisms that develop NSSI behavior among Chinese adolescents.

Firstly, based on the results that were reported herein, it was concluded that bullying victimization could directly predict NSSI among Chinese adolescents, which confirmed Hypothesis 1. Besides, consistent with the findings of prior

evidence, adolescents who experienced bullying victimization were more prone to engage in NSSI behavior.^{19,20,37} As the vulnerability-stress theory proposed,⁸¹ the emergence of individual internalizing and externalizing behavior problems is caused by a combination of preexisting cognitive weakness and environmental hardships, stresses, or adversities. Bullying victimization, as a negative and stressful life event, could predict a series of subsequent adverse psychosocial consequences and behavior disorders among adolescents.^{82,83} Individuals who have a history of bullying victimization might participate in NSSI as a maladaptive coping strategy or as a kind of self-punishment to relieve the stress or tension related to adverse interpersonal events such as bullying victimization.⁸⁴ Therefore, when seeking to reduce the occurrence of NSSI behaviors among adolescents, bullying victimization exposure should be prioritized by school teachers for attention and related prevention strategies.

The second conclusion was that bullying victimization could not only predict NSSI directly but also predict the indirect path of the partially mediating role of alexithymia among adolescents, supporting hypothesis 2 of this study. Some empirical evidence also demonstrated that alexithymia mediates the association between bullying victimization and many internalized/externalized problems.^{43,85,86} This means that adolescents who are exposed to more bullying victimization are more prone to get alexithymia, which is in line with existing studies.^{85–87} One explanation for this finding is that alexithymia is a negative reaction to suppress those adverse emotions caused by bullying victimization. Our present study also found that alexithymia was not only predicted by bullying victimization but also significantly predicted the NSSI among adolescents. The NSSI cognitive-emotional model⁴⁴ indicates that because individuals with alexithymia are not capable of regulating their emotions properly, there could be a relationship between alexithymia and NSSI. In other words, it may be that individuals with alexithymia are unable to implement appropriate strategies for resolving underlying emotional problems to the point that they engage in self-injury in the short term to reduce the state of distress and negative emotions associated with this bullying victimization.²³ Therefore, parents and school teachers should not only take a coordinated approach to decreasing bullying victimization among adolescents; but also provide with an environment that helps adolescents express their emotions, thereby reducing the risk of developing alexithymia and subsequent NSSI behavior among adolescents.

Additionally, this study indicated that bullying victimization predicted NSSI via the indirect path of the partially mediating role of self-esteem in adolescents, confirming hypothesis 3. In other words, the more victimized by bullying, the lower the self-esteem the adolescents have, who are more prone to engage in NSSI behavior, which has a severe negative impact on adolescents' physical and mental health. It has been shown that adolescents who have experienced bullying victimization have more negative self-concepts, such as low self-esteem, negative self-evaluation, and self-contempt, compared with adolescents who have not experienced bullying victimization.^{52,53,59} As stated in the self-esteem theory,⁵¹ self-esteem can be affected by the attitudes and judgments of those around them. Adolescence is an important period for developing self-esteem. Therefore, when subjected to verbal, physical, and social-relational aggression, adolescents may develop a negative self-appraisal of themselves as rejected and isolated, which lowers their self-esteem levels. Besides, concepts associated with low self-esteem, such as self-critical,⁸⁸ feelings of shame,⁸⁹ and self-punishment,⁹⁰ have been indicated as motivations for NSSI. These findings also demonstrated individuals with low self-esteem were more inclined to develop NSSI behavior, consistent with previous findings that the level of self-esteem was negatively correlated with the frequency and severity of NSSI.^{56,91} Adolescents with low self-esteem could pay less attention to their bodies, which can lead to adolescents being unconcerned about physical injuries inflicted on them, elevating their threshold for pain, and thus engaging in NSSI more frequently.⁹² Hooley et al⁹³ researched this topic focusing on the effects of self-esteem-centered intervention on NSSI. Their outcomes of the intervention showed a reduction in NSSI ideation and effectively lowered their pain endurance. Hence, the level of self-esteem is a significant protective factor of NSSI in adolescents, making it an important target for NSSI interventions.

The results of this study also indicated that alexithymia negatively correlated with self-esteem levels in adolescents, which is in line with previous studies.^{42,61} Moreover, we found that alexithymia and self-esteem act as chain-mediating roles in the association between bullying victimization and NSSI among adolescents, which validated hypothesis 4 of this study. A potential explanation is that the biggest difficulty in individuals with alexithymia is the identification and evaluation of emotions,⁹⁴ which may affect an individual's overall subjective emotional appraisal of self-value. One study indicated that people with alexithymia are more inclined to feel shame with themselves,⁹⁵ which exacerbates low

self-esteem and the risk of NSSI behavior.⁶¹ Besides, self-esteem, as a protective psychological resource in the structure of the personality, could mediate the association of several risk factors and NSSI behaviors.^{91,96} For instance, self-esteem served as a buffering variable to reduce the stress sensitizing effect of childhood maltreatment on adolescent NSSI.⁹⁷ This present study demonstrated that bullying victimization could predict alexithymia among adolescent samples, and then alexithymia can predict NSSI by the indirect path of the partially mediating role of self-esteem. Overall, the results of this study provide a further explanation for the psychological mechanism of NSSI in Chinese adolescents and provide a direction for future intervention research.

Implications

The findings suggest that education professionals should develop strategies to decrease school bullying during adolescence within prevention and intervention programs for NSSI behavior. For example, teachers can show students the harm caused by school bullying to the victims and its serious consequences, so that students can understand the dangers of school bullying and school violence. Besides, educators and parents of adolescents need to work together to guide them to be united and friendly, not to be bullies, not to be bystanders, not to be silent bullied. Whenever possible, victims of bullying should travel to and from school in pairs, and if they are bullied at school, they should approach a teacher to resolve the issue or contact the police if necessary. Second, the psychological health education curricula and NSSI intervention programs need to focus more on developing the ability of bullying victims to recognize and express emotions, helping adolescents better understand their own emotions and those of others, and improving their ability to evaluate and cope with those negative emotions, thereby reducing their risk of developing NSSI. Additionally, self-esteem is a construct of society that is heavily influenced by peer relationships during adolescence. Thus, it becomes critical to offer victims of bullying opportunities to socialize with peers, develop healthy peer relationships, and form high-quality friendships that could help them recognize themselves correctly and develop a positive self-evaluation.

Limitation and Future Research Directions

The present study has some limitations. Firstly, this study gathered data solely through self-report questionnaires, which may influence the accuracy of the findings, as some participants may not answer the sensitive questions truthfully. It is possible to enhance the reliability of the findings obtained from future research by utilizing a methodology that combines self-reports with objective indicators. Additionally, because this investigation employed a cross-sectional design, we cannot establish a causal association and provide evidence of a temporal relationship between bullying victimization and NSSI. Therefore, future studies ought to take into account a longitudinal design to further understand the causal and temporal associations between these variables. Furthermore, the results of this study may not be generalizable to adolescents in other areas or different cultural contexts, because it only investigated adolescents from two middle schools in Henan Province, China, and utilized a convenience sampling method. It is necessary to carry out a multicenter study of middle schools in different regions and stratified randomized sampling methods to validate our findings. Finally, in addition to alexithymia and self-esteem, there must be additional variables that influence how bullying victimization and NSSI are related; these factors need to be further explored.

Conclusion

Overall, the present study adds to our understanding of the importance of several pivotal risk factors (bullying victimization, alexithymia, and low self-esteem) in the development of NSSI among adolescents. This present study demonstrated that bullying victimization could not only predict NSSI directly, but also predict the indirect path of the chain mediating effect of alexithymia and self-esteem between bullying victimization and NSSI in adolescents. Therefore, parents, teachers and mental health practitioners should pay more attention to the mental health status of adolescents who are victims of bullying, which can help identify the risk of NSSI. In addition, psychological self-injury intervention strategies in adolescents should focus on developing the ability to recognize and express emotions, improving adolescent self-esteem and self-worth, and nurturing their interpersonal skills, thereby reducing the risk of NSSI in adolescents.

Data Sharing Statement

The datasets supporting the conclusions of this study are available from the corresponding author on reasonable request.

Ethics Approval

The study was conducted in accordance with the Declaration of Helsinki and approved by Institutional Review Board of Henan Provincial Key Laboratory of Psychology and Behavior (reference: 20230516001).

Informed Consent

Written informed consent was obtained from all individual participants and their parents included in the study.

Acknowledgments

Xiajun Guo and Sijia Wu are co-first authors for this study. The authors would like to thank the article editor and anonymous reviewers for their comments and suggestions. Thanks to the school administrators, teachers, and students who actively cooperated with the researchers to collect data.

Funding

This study was funded by Topics for Research in Philosophy and Social Science in Kaifeng (ZXSKGH-2023-1122, ZXSKGH-2023-1905).

Disclosure

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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