

Negative Affect and Impulsivity in Adolescents with Non-Suicidal Self-Injury: The Moderating and Mediating Roles of Perceived Social Support

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Background: Negative affective states and impulsivity have been found to be closely associated with non-suicidal self-injury (NSSI), but how negative affect contributes to impulsivity in NSSI adolescents and the role of perceived social support remain unclear.

Methods: In Study 1, the Barratt Impulsiveness Scale (BIS-11) was administered on 225 NSSI adolescents and 225 healthy volunteers to determine the characteristics of impulsivity in the patients. In Study 2, 102 of the patients were randomly selected to further complete the Zung Self-rating Anxiety Scale (SAS), Zung Self-rating Depression Scale (SDS), and Multidimensional Scale of Perceived Social Support (MSPSS) to clarify the relationships between negative affect, perceived social support, and impulsivity in these patients.

Results: In Study 1, NSSI adolescents scored higher than volunteers on almost all factors of BIS-11 except for Cognitive Instability. In Study 2, Support from significant others mediated the association between SAS and BIS-11 Self-control. Moreover, Support from significant others and family moderated the prediction of SAS score on their BIS-11 Cognitive Complexity.

Conclusion: Compared to healthy adolescents, NSSI individuals were more impulsive, while perceived support from family and significant others prevented the anxious NSSI adolescents from lower cognitive complexity. Therefore, more social support should be available to NSSI adolescents with high anxiety to reduce their risk of self-harm due to high impulsivity.

Keywords: adolescents, impulsivity, negative affect, non-suicidal self-injury, perceived social support

Introduction

Non-suicidal self-injury (NSSI) refers to the deliberate infliction of harm upon one's own body through self-inflicted destruction of tissues (eg, cutting or burning oneself) for socially unacceptable reasons in the absence of suicidal intent.¹ It is one of the strongest predictors of future suicide attempts.² Often, NSSI starts in the early teens and can persist for several years.³ An earlier review showed that although the cultural context, causes and meanings of NSSI differ between individuals in developing and developed countries, the prevalence of NSSI is essentially the same.⁴ However, a more recent meta-analysis reported a female predominance of NSSI among adolescents in North America and Europe, and comparable rates among male and female adolescents in Asia.⁵ During 2010–2021, the global prevalence of NSSI among adolescents in a nonclinical sample was 22.0% over lifetime and 23.2% during the previous 12 months.⁶ While in a psychiatric clinical sample, up to 40–60% of the adolescents exhibited NSSI.⁷ In recent years, this condition has demonstrated a trend towards younger age, with 5.1–24% of the patients reporting self-injury before the age of 11–13 years⁸, which greatly increases the likelihood of accidental injuries and is linked to high psychiatric comorbidity.⁹

Evidence suggests that impulsivity plays an important role in adolescent self-harming behaviors. The Integrated Motivational-Volitional Model posits that impulsivity serves as a proximal volitional moderator of self-harming

behaviors, facilitating the translation of intention into action,¹⁰ this is particularly evident among adolescents¹¹ and patients diagnosed with certain affective disorders.¹² From a life history theory perspective, individuals who grow up in threatening environments are more likely to be impulsive, to have more distressing and provocative experiences,¹³ and to engage in more impulsive behaviors,¹⁴ including recurrent NSSIs in the context of emotional dysregulation.¹⁵ Furthermore, different dimensions of impulsivity lead to variable self-harm risks. For example, a systematic study has shown that emotional impulsivity is associated with the initiation of self-harm, cognitive impulsivity is associated with the maintenance of self-harm, and behavioral impulsivity is most relevant to self-harm under negative emotional conditions.¹⁶

Further evidence indicates that individuals with heightened negative affect are more likely to engage in impulsive behavior, and the goal of relief from negative affect may drive impulsive actions for short-term gain over long-term objectives.¹⁶ For instance, in individuals with anorexia nervosa, depression and anxiety were found to be related to attentional impulsivity;¹⁷ Similarly, in patients with ankylosing spondylitis, depression was correlated with non-planning impulsivity.¹⁸ Furthermore, research has demonstrated that negative affect, particularly depression and anxiety symptoms, exerts a significant influence on NSSI.^{19–22} Difficulties in emotion regulation and depression act as mediators in the relationship between the behavioral inhibition/ activation system and adolescent NSSI behaviors.²³ Nevertheless, it should be noted that not all adolescents with negative affect have high levels of uncontrolled impulsivity and related NSSI behaviors.

Perceived social support has been shown to play a protective role in relation to cognitive and emotional impulsivity as manifested by suicidal ideation in self-harmers²⁴ and behavioral impulsivity such as problematic internet gaming.²⁵ It also serves to safeguard individuals from traumatic events²⁶ and psychiatric symptoms,²⁷ and this function is similar in males and females.²⁸ However, individuals with NSSI typically report less perceived social support than those without NSSI,^{29,30} no matter in a collectivist or individualist culture.³¹ Similarly, in a study of impulsive killing among rural Chinese adolescents with suicidal behavior, high impulsivity patients had less social support compared with low impulsivity patients.³² It is therefore concluded that lower perceived social support may lead to an increase in cognitive, emotional and behavioral impulsivity in NSSI adolescents.

In addition, prior research has identified a strong correlation between elevated perceived social support, particularly from parents and peers, and diminished negative cognitive and emotional strategies, depression levels, and suicidal ideation in young people with major depressive disorder.^{33,34} Meanwhile, a positive correlation has been found between perceived informal social support from family, friends and significant others and positive affect.²⁶ Therefore, higher perceived social support may lead to lower impulsivity in NSSI adolescents by reducing their negative affect, as reported by Lee et al.³⁵ However, one might also be curious about whether negative affect leads to lower perceived social support and therefore to increased impulsivity in NSSI adolescents. The available evidence showed that patients with negative effects such as depression experienced significant social impairments, not only receiving less social support than healthy individuals, but also perceiving themselves as having impoverished social support networks,³⁶ and that those who perceived inadequate social support were less protected from impulsivity.²⁴ Moreover, it is unclear how perceived social support moderates the relationship between negative affect and impulsivity in NSSI adolescents. A study in addiction recovery demonstrated that an ecological momentary intervention targeting perceived social support was effective in reducing impulsivity and enhancing self-regulation.³⁷

The objective of this study was to investigate the role of perceived social support in the relationship between affective states and impulsivity in adolescents with NSSI. Two studies were designed for this purpose. In Study 1, the dimensions of impulsivity were compared in detail between patients with NSSI and healthy adolescents using the 11th revision of the Barratt Impulsiveness Scale (BIS-11). It was hypothesized that, in comparison with healthy adolescents, patients with NSSI would display higher levels of cognitive, emotional, as well as behavioral impulsivity. Study 2 further examined the relationship between negative affect, perceived social support, and impulsivity in adolescents with NSSI. The following hypotheses were put forth: (1) negative affect was positively while perceived social support was negatively associated with their impulsivity, and negative affect negatively their perceived social support; (2) perceived social support acted as a mediator and moderator in the relationship between negative affect and their impulsivity.

Methods

Subjects

In Study 1, 225 Chinese adolescents with a history of NSSI were recruited into the NSSI group from inpatient and outpatient settings in a local top hospital from 1 January to 30 June 2024. Psychiatric diagnoses were made by two psychiatrists (BP and ZL) based on the adolescents' responses to a psychiatric interview (ie, the Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version, K-SADS-PL)³⁸ and ancillary information obtained from medical records and treatment staff. An equal number of healthy volunteers were recruited for the control group (Controls) from five middle schools in Hangzhou. They were excluded if they had a psychiatric disorder (eg, mental retardation, schizophrenia, or autism) that might interfere with the comprehension of task instructions, or if they were in state custody. All the participants completed the BIS-11 test individually in a rest room. The sociodemographic information of the participants in the two groups were showed in Table 1.

Meanwhile, all hospitalised NSSI patients among the Study 1 participants were included in Study 2, totalling 102 NSSI adolescents. They were further given questionnaires (the Zung Self-rating Anxiety Scale, the Zung Self-rating Depression Scale, and the Multidimensional Scale of Perceived Social Support) by two psychiatrists (HL and XW) to assess negative affect in the past week and perceived social support. Their socio-demographic characteristics and BIS-11 scores are shown in Table 2.

The study was conducted according to the principles of the Declaration of Helsinki. Ethical approval for this study was obtained from the Second Affiliated Hospital of Zhejiang University School of Medicine Approval (No: 20240075). After completely describing the study to the participants and their guardians, written informed consent was obtained from all of them.

Measures

Zung Self-Rating Anxiety Scale (SAS)

The SAS is a self-report scale with 20 items covering various symptoms of anxiety, including psychological and somatic items, and is scored on a 4-point scale ranging from 1 (none, or a little of the time) to 4 (most or all of the time). The

Table 1 Sociodemographic Characteristics in the NSSI Group (n = 225) and Controls (n = 225)

Sociodemographic Characteristics		NSSI (n, %)	Controls (n, %)	t/U	P
Gender				24,750.00	0.567
Male		47 (20.89%)	51 (22.67%)		
Female		178 (79.11%)	174 (77.33%)		
Age	Mean ± S.D.	15.13 ± 1.92	15.05 ± 1.78	0.43	0.665
	Range	11–19	12–19		
Education level				23,962.50	0.243
Primary school		135 (60.00%)	147 (65.33%)		
Junior high school		90 (40.00%)	78 (34.77%)		
Family structure				23,877.00	0.266
Big family (parents, children and grandparents together)		62 (27.56%)	53 (23.55%)		
Nuclear family (parents and children)		120 (53.33%)	157 (69.78%)		
Single- parents family		27 (12.00%)	8 (3.56%)		
Children “Left-behind”		13 (5.78%)	6 (2.67%)		
Others		3 (1.33%)	1 (0.44%)		

Abbreviation: NSSI, non-suicidal self-injury.

Table 2 Sociodemographic Characteristics and Scores on BIS-11 in Non-Suicidal Self -Injury Adolescents (n =102)

Sociodemographic Characteristics	n (%)	BIS-11	t/F	P
Gender			1.54	0.225
Male	9 (8.80)	136.44±16.61		
Female	93 (91.20)	148.15±22.24		
Age			1.99	0.497
11 ~ 14	32 (31.37)	153.44±23.20		
15 ~ 19	70 (68.63)	144.23±20.95		
Education level			1.57	0.119
Primary school	49 (48.04)	150.65±21.77		
Junior high school	53 (51.96)	143.85±21.89		
Family structure			1.97	0.106
Big family (parents, children and grandparents together)	33 (32.35)	146.00±22.21		
Nuclear family (parents and children)	51 (50.00)	145.14±21.66		
Single- parents family	9 (8.73)	162.00±17.06		
Children “Left-behind”	7 (6.86)	150.00±22.92		
Others	2 (1.96)	110		

Abbreviation: BIS-11, the Barratt Impulsiveness Scale.

higher the score on the SAS, the more obvious the level of anxiety over the past week. The SAS has satisfactory psychometric properties.³⁹ Its Chinese version has been showed to be reliable and valid in previous studies,⁴⁰ including adolescents aged 13–18, with a Cronbach’s alpha of 0.89.⁴¹

Zung Self-Rating Depression Scale (SDS)

The SDS contains 20 self-report items designed to assess one’s subjective depressive level. Each item is scored on a Likert scale ranging from 1 (none, or a little of the time) to 4 (most, or all of the time) according to the frequency of symptoms over the past week.⁴² It has been proven to be reliable and valid in Chinese population,⁴³ and was used in young clinical patients.⁴⁴

Multidimensional Scale of Perceived Social Support (MSPSS)

MSPSS is a self-reported questionnaire that comprises 12 items, which measure the participants’ perceived social support from three informal sources: family, friends, and significant others.⁴⁵ Participants rated their responses on a 7-point Likert scale (from 1 = “very strongly disagree” to 7 = “very strongly agree”). Higher scores indicate higher levels of perceived social support. Its Chinese version has been proven to be reliable and valid in a previous study.⁴⁶

The Barratt Impulsiveness Scale

The BIS-11 comprises 30 self-report items assessing impulsivity. It is scored on a Likert scale (ranging from never = 1 point to very frequently = 4 points). The scale consists of six first-order factors: Attention and Cognitive instability (measuring attentional impulsivity); Motor and Perseverance (measuring motor impulsivity); Self-control and Cognitive complexity (measuring non-planning impulsivity).^{47,48} The Chinese version of the scale was found to be valid and reliable in adolescents.⁴⁹ It has also been employed in patients with suicidal behavior in China, with Cronbach’s alphas for the three BIS subscales were 0.74–0.81 for attempters.⁵⁰

Statistical Analyses

The data was analyzed using IBM SPSS v20.0 and StataMP 18.0. In Study 1, the Student's *t*-test and Mann–Whitney *U*-test were applied to compare the sociodemographic characteristics and the mean BIS-11 scale scores between patients and healthy controls. The effect sizes (Cohen's *d* values) of group comparisons were calculated.

In Study 2, Student's *t*-test and one-way ANOVA were used to compare the BIS-11 scores in patients with NSSI who differed in terms of sex, age range, educational levels, and family structures. In addition, Pearson's correlational test was applied to search for relationships among SAS/SDS, MSPSS, and BIS in the NSSI group. Taking the scores of SAS/SDS as independent variables, subscales of BIS as dependent variables, and subscales of MSPSS as mediators or moderators, the effect of perceived social support on the relationship between their negative affect and impulsivity was explored with the Process plug-in in SPSS v20.0 (for the theoretical models, see Figure 1). A *p*-value of less than 0.05 was considered significant. We also conducted a sensitivity analysis of the mediation model using the medsens command in StataMP 18.0, assuming that there was an unobserved continuous confounder that followed a normal distribution and was associated with the mediator and outcome, and we tested how the effects would change if the confounder was included.

Results

Study 1: Impulsivity Characteristics in NSSI Adolescents

Sociodemographic characteristics, such as sex, age range, educational levels, and family structures, were matched between the NSSI and control groups (all *P*s > 0.05) (see Table 1). Upon comparing BIS dimensional scores, patients with NSSI obtained higher scores on BIS-11 Attention (Cohen's *d* = 0.81), Motor (Cohen's *d* = 0.31), Self-control (Cohen's *d* = 0.47), Cognitive complexity (Cohen's *d* = 0.78), as well as Perseverance (Cohen's *d* = 0.40) than controls (see Table 3).

Study 2: Negative Affect, Perceived Social Support, and Impulsivity in NSSI Adolescents

Sociodemographic Characteristics and Correlations Between Factors

No significant difference was found in the BIS score among adolescents with NSSI who differed in terms of sex, age range, education levels, or family structures (all *P*s > 0.05) (see Table 2).

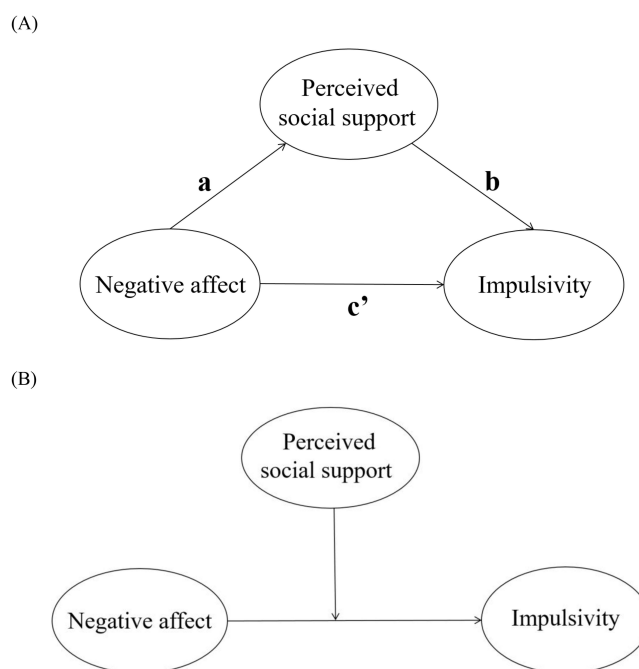


Figure 1 The theoretical (A) mediation and (B) moderation models in this study. Each model consists of 36 sub-models based on the potential mediating and moderating roles of three dimensions of perceived social support between SAS/ SDS and six BIS-11 factors in NSSI adolescents, respectively.

Table 3 Scale Scores (Mean \pm S.D.) of BIS-11 in the NSSI Group (n = 225) and Controls (n = 225)

	NSSI	Controls	t	df	P
<i>BIS-11</i>					
Attention	13.88 \pm 2.85	11.21 \pm 3.68	8.59	444	<0.001
Cognitive Instability	6.61 \pm 1.89	6.83 \pm 1.73	-1.32	445	0.186
Motor	14.67 \pm 4.37	13.46 \pm 3.41	3.26	421	0.001
Perseverance	7.96 \pm 2.07	7.16 \pm 1.91	4.25	444	<0.001
Self-control	15.53 \pm 3.26	13.83 \pm 3.90	4.99	442	<0.001
Cognitive Complexity	12.71 \pm 2.86	10.60 \pm 2.56	8.18	442	<0.001

Abbreviations: BIS-11, the Barratt Impulsiveness Scale; NSSI, non-suicidal self-injury.

Table 4 Correlations Between Scores on SAS, SDS, MSPSS, and the Subscales of BIS-11 in Non-Suicidal Self-Injury Adolescents (n=102)

		SAS	SDS	MSPSS		
				Support from Family	Support from Friends	Support from Significant Others
SAS	r	—	0.81	−0.43	−0.22	−0.31
	P	—	<0.001	<0.001	0.035	0.002
SDS	r	—	—	−0.51	−0.21	−0.41
	P	—	—	<0.001	0.042	<0.001
BIS-11						
Attention	r	0.33	0.31	−0.15	−0.11	−0.20
	P	0.001	0.002	0.146	0.276	0.045
Cognitive instability	r	0.07	−0.05	0.09	0.01	0.06
	P	0.507	0.645	0.376	0.934	0.595
Motor	r	0.16	0.16	−0.09	0.01	−0.05
	P	0.107	0.107	0.365	0.936	0.663
Perseverance	r	0.25	0.25	−0.15	−0.02	−0.13
	P	0.012	0.011	0.148	0.865	0.191
Self-control	r	0.20	0.32	−0.23	−0.06	−0.29
	P	0.046	0.001	0.026	0.541	0.004
Cognitive complexity	r	0.24	0.23	−0.12	−0.02	−0.10
	P	0.017	0.020	0.241	0.885	0.339

Abbreviations: SAS, the Zung Self-rating Anxiety Scale; SDS, the Zung Self-rating Depression Scale; MSPSS, the Multidimensional Scale of Perceived Social Support; BIS-11, the Barratt Impulsiveness Scale.

The dichotomous correlations are shown in Table 4. SAS and SDS scores were positively correlated with BIS-11 Attention, Perseverance, Self-control, and Cognitive complexity ($P_s < 0.05$). In contrast, MSPSS Support from family was negatively correlated with BIS-11 Self-control; MSPSS Support from significant others was negatively correlated with BIS-11 Attention and Self-control ($P_s < 0.05$). In addition, all the MSPSS subscale scores were negatively correlated with the SAS and SDS scores ($P_s < 0.05$).

Mediating Role of Perceived Social Support in the Relationship Between Negative Affect and Impulsivity

Taking the scores of SAS/SDS as independent variables, the six subscales of BIS as dependent variables, and the three subscales of MSPSS as mediators respectively, the mediation analysis showed that Support from significant others played a fully mediating role in SAS and BIS-11 Self-control ($a = -0.15$, $p < 0.01$; $b = -0.14$, $p < 0.5$; $c = 0.04$, $p > 0.05$; indirect effect = 0.02, 95% CI = $-0.02 \sim 0.09$). Furthermore, sensitivity analysis demonstrated that $Rho = -0.24$ when the average mediation effect was zero (see Figure 2).

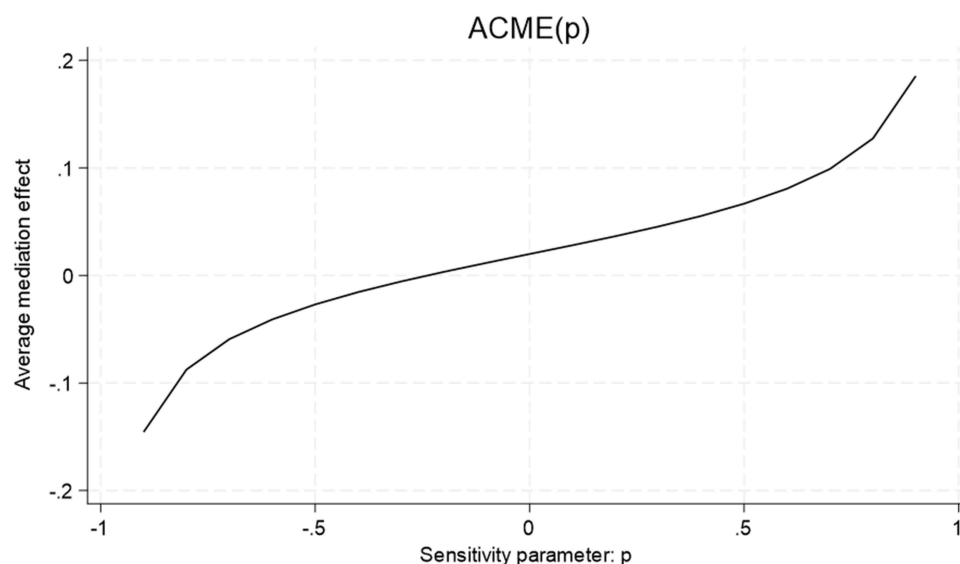


Figure 2 Robustness analysis of intermediation effects.

The Moderating Effect of Perceived Social Support in the Relationship Between Negative Affect and Impulsivity

As shown in Table 5, SAS total score significantly predicted score on BIS-11 Cognitive complexity ($P < 0.05$). The interactions between SAS and MSPSS Support from family as well as Support from significant others on Cognitive complexity were significant ($P_s < 0.05$). These results suggest that support from significant others and family moderated the prediction of anxiety on cognitive complexity (see Figure 3).

Discussion

The social-ecological theory indicates that individual behavior is affected by the social environment and its interaction with it, as well as the interaction among microsystem (such as physical and psychological characteristics of individuals), mesosystem (such as family, neighbors, and co-workers etc), and macrosystem (includes community, country, and culture).⁵¹ Based on published literatures, the psychiatric or psychological risk factors of NSSI included behavioral disorders, personality disorders and depression or anxiety, while good family/friend relationships were most frequently identified as protective environmental or social factors.⁵² Impulsivity has been studied as an aspect of personality and psychopathology for generations.⁵³ The study further explored the characteristics in impulsivity dimensions in adolescents with NSSI, and provided a detailed description of the relationship among negative affect, perceived social support, and their impulsivity. In this study, higher impulsivity and lower perceived social support were observed, and mediating and moderating effects of perceived social support on the relationship between anxiety and some impulsivity dimensions were noted in the NSSI group. These findings supported all our hypotheses.

Table 5 Moderating Effect of Perceived Social Support (Indicated by MSPSS) on the Relationship Between Anxiety (by SAS), Depression (by SDS), and Impulsivity (by BIS-11) in Non-Suicidal Self-Injury Adolescents ($N = 102$)

Independent Variable	β	SE	95% CI	R^2	P
Cognitive complexity					
Anxiety	0.06	0.03	< 0.01, 0.11	0.35	0.027
Anxiety \times Support from family	0.01	< 0.01	< 0.01, 0.02	0.07	0.008
Anxiety	0.05	0.02	< 0.01, 0.10	0.34	0.026
Anxiety \times Support from significant others	0.01	< 0.01	< 0.01, 0.02	0.06	0.014

Abbreviations: SAS, the Zung Self-rating Anxiety Scale; SDS, the Zung Self-rating Depression Scale; MSPSS, the Multidimensional Scale of Perceived Social Support; BIS-11, the Barratt Impulsiveness Scale.

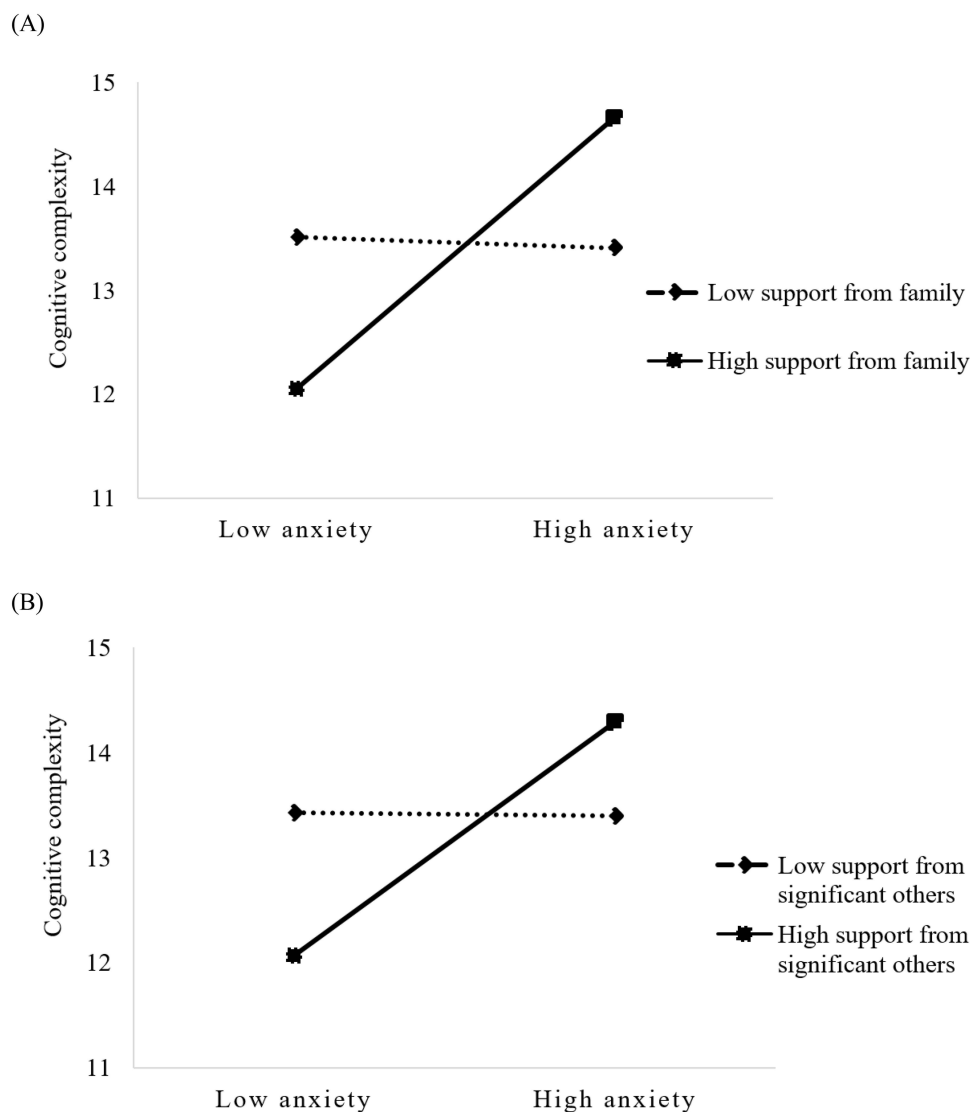


Figure 3 Interactions between anxiety symptom and perceived support from (A) family and (B) others on cognitive complexity of NSSI adolescents.

Impulsivity Characteristics in NSSI Adolescents

In favor of our first hypothesis, adolescents with NSSI obtained higher scores in all the first-order factors of BIS-11 except for Cognitive instability, which suggested that their attentional impulsivity was mainly due to attention bias rather than cognitive instability.^{54,55} These findings were fundamentally consistent with the recent cross-sectional studies on the trend towards higher impulsivity in adolescents with NSSI,^{13,56} and partly explained by the findings of Janis and Nock,⁵⁷ ie, although self-injurers reported higher impulsivity, performance-based measures of impulsivity (including more cognitive processes) failed to detect any difference between NSSI and healthy adolescents.

Correlations Between Negative Affect, Perceived Social Support, and Impulsivity in NSSI Adolescents

Our findings that SAS and SDS scores were positively correlated with factors of BIS-11 revealed close relationships between impulsivity and individual symptoms of depression and anxiety, consistent with several previous reports that negative emotion would enhance the tendency of impulsivity.^{20,58,59} While the subscales of the MSPSS were negatively

related to factors of the BIS-11, the results suggest that perceived social support may be a protective factor for most manifestations of impulsivity and negative affective states in adolescents with NSSI. A previous meta-analysis also reported that high levels of perceived social support prevented suicidal ideation among adolescents with NSSI and depression.⁶⁰ These findings also suggest that early intervention should focus on alleviating affective symptoms and increasing social support.⁶¹

Mediating Role of Perceived Social Support in the Relationship Between Anxiety and Impulsivity

Our findings further showed mediation effect of MSPSS Support from significant others between SAS and BIS-11 Self-control, which indicated that anxiety reduced perception of support from significant others, and therefore lead to the loss of self-control in NSSI adolescents. Previous study also showed that higher anxiety symptoms were associated with more difficulties in the social domain (including difficulties in forming friendships) and more difficulties with emotional self-disclosure, which impacted significant others in an unaffiliated way and unidirectionally predicted later low social support.⁶² And previous evidence revealed that individuals exposed to trauma with inadequate support from others were more likely to have a limited ability to exercise self-control, which subsequently contributed to impulsivity.⁶³ Our study indicated that decrease in perceived support from significant others beside support from family and friends can also lead anxiety to the risk of self-injury. Notably, the results of the sensitivity analysis suggest there's possibility that confounders affect the robustness of the mediation model. Therefore, further validation of complex mediation models with confounders such as culture, gender, socioeconomic status, education level, etc, is still needed, in consideration of their impact on adolescent NSSI behavior or social support perception.^{52,60,64}

The Moderating Effect of Perceived Social Support in the Relationship Between Anxiety and Impulsivity

The SAS score significantly predicted BIS-11 Cognitive complexity. We also found moderation effect of perceived support from family and significant others in the relationship between anxiety and cognitive complexity. Such results suggested that sufficient perceived support from family and significant others could lead NSSI adolescents with high anxiety levels to higher cognitive complexity, manifested by increased ability to consider multiple possibilities and solutions, which is often associate with reduce of non-planning behaviors. Previous evidence reported that patients with anxiety disorders were more likely to report impulsivity and NSSI than those without.⁶⁵ Another study investigating the relationship between impulsivity, comorbid anxiety and neurocognitive functioning found that anxiety predicted impulsivity and trait anxiety explained 26% of unplanned impulsivity,⁶⁶ which covers cognitive complexity.⁴⁷ There was little evidence of a moderating effect of perceived social support between anxiety and impulsivity in NSSI. However, in a study of migrant mothers only, social support was found to moderate and attenuate the relationship between internet addiction, which is associated with high anxiety, and suicidal ideation.⁶⁷ And perceived social support attenuated the impact of impulsivity on anxiety and other psychiatric symptoms in women with methamphetamine use disorder.²⁷ These findings also highlight the importance of improving perceived social support in anxious NSSI patients, which reduces impulsivity and thus promotes recovery.

Limitations of the Study and Future Directions

The study has several limitations. First, the cross-sectional design cannot explain causal relationships. Therefore, future studies are recommended to establish causal relationships between variables. Second, the sample size of this study, especially in Study 2, was relatively small due to the accessibility and cooperativeness of NSSI adolescents, which might lead to some effects not being detected. Third, it should be noted that the majority of participants in the study were female and from China. This may limit the generalisability of the findings to NSSI adolescents of different gender and

from different cultures. Finally, the study recruited mainly urban middle school students, which limited the exploration of other risk factors, such as low-income and disadvantaged children.

Therefore, a subsequent cross-cultural, multi-centre, and prospective validation with participants from different regions, ethnic groups, and socioeconomic status is recommended, and the influence of culture, gender, socioeconomic status, education level, etc. should be taken as cofounders when validating mediation models in NSSI adolescents. Furthermore, based on the results of the moderating effect of perceived social support, further research can be conducted on how to enhance the support of family and significant others for NSSI adolescents through intervention measures, as well as the long-term effects of such intervention on reducing impulsivity and preventing self-harm behaviours. Moreover, in view of the relationship between negative emotions and impulsivity found, more researches are needed upon whether this connection can be broken through methods such as emotion regulation training, thereby reducing the occurrence of self-harm behaviours.

Conclusions

Higher anxiety led to lower perception of support from significant others in NSSI adolescents, which contributed to their loss of self-control. Whereas more perceived support from family and significant others could improve the ability of those in anxious state to perform complex cognitive activities. These findings further help to understand how micro individual psychological factors, in conjunction with socio-environmental factors (meso family and school support, macro community environment), impact on the behaviour of adolescents with NSSI. In clinical scenarios, psychological interventions such as cognitive-behavioural family therapy and motivational interviewing should be provided to NSSI adolescents with high anxiety, to improve their emotion regulation, subjective social support and reduce their risk of self-harm due to high impulsivity.

Data Sharing Statement

The datasets used and/or analyzed during the current study are available from the corresponding or first author on reasonable request.

Ethics Approval and Consent to Participate

Ethical approval was granted from Ethics Committee of the Second Affiliated Hospital, Zhejiang University School of Medicine (20240075).

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors report no conflicts of interest in this work.

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