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The mediating role of resilience between executive function and non-suicidal self-injury in Indonesian adolescents

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ABSTRACT

Adolescence is characterized by significant biological, psychological, and social changes, that bring challenges that may lead to maladaptive behaviors, such as non-suicidal self-injury (NSSI). Executive function and resilience are the factors that can affect NSSI behavior by promoting adaptive responses to challenges. Executive function supports emotional regulation and problem-solving, while resilience helps adolescents cope with stress. This study aims to explore how resilience mediates the relationship between executive function and NSSI. The Teenage Executive Function Inventory, Cognitive Flexibility Scale, Child and Youth Resilience Measure-Revised, and Deliberate Self-Harm Inventory were used in this study. Two hundred and eleven adolescents participated, consisting of 104 males and 107 females (SD = 0.501), aged 12-18 years (SD = 1.424). Data analysis was conducted using Hayes Macro Process Mediation Analysis. Results indicate resilience partially mediates the relationship between overall executive function and NSSI. However, resilience fully mediates the relationship between executive function dimensions separately—working memory, inhibitory control, and cognitive flexibility—and NSSI. These findings underscore the importance of resilience and executive function in understanding NSSI behavior among adolescents. Moreover, resilience and executive function can be considered by practitioners and parents as key targets for interventions aimed at preventing and reducing the prevalence of NSSI.

Introduction

Adolescence is marked by significant changes in biological, psychological, and social development as individuals transition from childhood to adulthood. During this time, not only do family factors influence daily life, but adolescents also begin to view peer groups and other social relationships as important for acceptance (Geldard et al., 2016). In this transitional stage, adolescents may encounter new family, social, and individual challenges (Krapić et al., 2015; Marotz & Allen, 2016).

With the transitions and changes being experienced, also the adjustments to new developmental stages, the problems faced during adolescence can feel more intense and may lead to issues such as psychosomatic symptoms, anxiety, and stress (Nugroho et al., 2023;

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Xie et al., 2020). Compared to adults, adolescents are more vulnerable to experiencing negative emotions with greater intensity and more frequent negative moods, especially during early adolescence (Dumitrescu, 2015). The various changes during this stage often result in emotional instability, uncommunicativeness, argumentativeness, and impulsivity. As adolescents struggle to cope with these challenges, they may seek maladaptive ways to regulate their emotions, such as substance use (Abidin et al., 2025), social withdrawal (Putri et al., 2022), and non-suicidal self-injury (Hidayati et al., 2023). Non-suicidal self-injury (NSSI), is often used as a mechanism to alleviate emotional distress. Unfortunately, NSSI is commonly found to begin during adolescence (Agarwal et al., 2020).

NSSI is defined as behavior that is direct, intentional, and socially disapproved, causing harm to one's body tissue without the intent to commit suicide (Nock, 2010). NSSI is very common and is more prevalent in adolescents than in other age groups (Kądziela-Olech et al., 2014; Morgan et al., 2017). Several studies have shown that the age at which individuals first engage in NSSI ranges from 12 to 24 years old, which is included in the range of adolescent age (Hidayati et al., 2022; Kądziela-Olech et al., 2014; Kaligis et al., 2021; Sabrina & Afiatin, 2023).

The factors influencing NSSI behavior can be categorized into two factors: (1) individual factors (e.g., biological aspects, emotional regulation, self-regulation, psychiatric disorders) and (2) environmental factors (e.g., childhood maltreatment, disrupted emotional relationships) (Cipriano et al., 2017; Gratz, 2006). On the biological aspect, NSSI may be influenced by specific neural pathways that affect an individual's involvement in self-injury, one of which is the neural pathways connected to executive function. Executive function is cognitive processes that play a vital role in goal-directed behavior. These processes include the ability to effectively plan actions, keep track of progress, and organize various tasks. Together, these skills facilitate structured and purposeful behavior, allowing individuals to navigate complex situations and make informed decisions (Diamond, 2013). The executive function consists of three dimensions—working memory (e.g., recalling past experiences and considering different possible outcomes before responding), inhibitory control (e.g., pausing and assessing when facing stressful situation to choose a more appropriate response), and cognitive flexibility (e.g., explore alternative solutions, and remain open to new ideas when facing failures)—that plays a crucial role in shaping adolescent behavior as well as their emotional and social competence. These abilities allow adolescents to be more flexible in responding to environmental conditions, assessing risks, and prioritizing tasks.

Poor executive function is linked to difficulties in impulse control, meaning adolescents with impaired executive function might have a harder time resisting the urge to engage in self-injurious behavior when faced with stress. Furthermore, executive function is crucial for problem-solving and social cognition. Deficits in executive function may make it harder for adolescents to navigate social challenges effectively, increasing reliance on NSSI as a maladaptive coping mechanism (Wang et al., 2023). However, studies linking executive function with NSSI have not yielded consistent results. Some neuropsychological studies from Asian and Western countries do report differences between these groups (Fikke et al., 2011; Wang et al., 2023; Zhou et al., 2024). On the other hand, some other studies report no differences in executive function between adolescents who engage in NSSI and those who do not (Hamza et al., 2015; Janis & Nock, 2009). Meanwhile, studies linking executive function with NSSI remain very limited in South East Asia countries. These gaps and inconsistencies suggest that additional factors may be necessary to fully explain the relationship between executive function and NSSI.

Stressful situations or decreased adaptive coping skills are often responsible for NSSI and subsequent suicidal behavior (Guan et al., 2012). Individuals need to possess resilience

to exhibit adaptive behaviors when facing challenging situations. Thus, resilience plays a role in providing protection in various ways, such as self-improvement, coping styles, and family cohesion (Bloom & Holly, 2011; Khan & Ungar, 2023). A meta-analysis shows an individual's executive function plays a role in shaping their resilience (Mecha et al., 2024). Individuals with better working memory, help in contextual adaptation, ensuring focus on relevant information during adversity, and enhances problem-solving effectively. Executive function also helps to build good resilience by preventing rumination and excessive emotional distress, allowing for better emotional stability in adversity through good inhibitory control. It also allows individuals to shift between different perspectives and reduces emotional distress. Thus it enhances the ability to adapt to unpredictable or adverse events, leading to better stress recovery through good cognitive flexibility (Mecha et al., 2024; Samuelson et al., 2020).

Furthermore, resilience helps adolescents prevent maladaptive behaviors when facing stressful situations by restoring psychological balance. It enables them to stay calm, overcome challenges, and develop better emotional regulation, reducing the likelihood of using NSSI as an emotional escape. Resilience also fosters a sense of meaning, strength, and realistic goal-setting, encouraging healthier coping strategies and making self-injury a less appealing option (Zorobi et al., 2024). Also, structural brain regions, primarily in the right prefrontal area, indicate that mechanisms related to executive control are also involved in mechanisms that build resilience (Burt et al., 2016). Considering the external factors accompanying adolescent life, having positive relationships with peers during adolescence is associated with positive psychosocial adjustment. Additionally, adolescents cannot be separated from family influence. Positive family environments, closeness, and attachment to family are also associated with better emotional development, greater resilience, and less involvement in high-risk activities (Backes & Bonnie, 2019; Dumitrescu, 2015). Therefore, despite facing risk factors and challenging situations, individuals with good resilience can balance their situations with more adaptive responses (Pearce & Davis, 2021).

In building strategies to help individuals develop good resilience, planning, self-regulation, and adaptability to change are essential. Adapting to change and stress requires internal factors within the individual that align with executive function, including inhibitory control, working memory, and cognitive flexibility. Executive function strengthens individual resilience and creates a protective layer that helps individuals face everyday challenges (Diamond, 2013). Previous studies have shown mixed results regarding the relationship between executive function and non-suicidal self-injury (NSSI). To address this inconsistency, this study explores the mediating role of resilience in the executive function and NSSI relationship, a mechanism that has not been fully examined in prior research. Additionally, most studies on executive function, resilience, and NSSI have been conducted in Western contexts, with limited research focusing on adolescents in Southeast Asia, particularly Indonesia. Given that cultural differences may shape emotional regulation, coping mechanisms, and the protective role of resilience, this study aims to fill this gap by examining Indonesian adolescents. By doing so, it will contribute to a more comprehensive understanding of the cognitive and resilience processes involved in NSSI behavior. Therefore, this study will examine the role of resilience as a mediator between individual executive function and NSSI behavior.

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Method

Participants

This study comprised 211 participants, 104 males and 107 females (*SD* = 0.5), aged 12-18 years (*SD* = 1.42). The participants were students from junior high schools and senior high schools residing in the Jakarta, Bogor, Depok, Tangerang, or Bekasi areas in Indonesia.

Materials

The measurement tools used in this study include the Child and Youth Resilience Measure-Revised (CYRM-R), which was adapted into Bahasa Indonesia by Borualogo & Jefferies (2019). This scale measures indications of resilience within social-ecological aspects, reflecting how an individual interacts with their external environment to build resilience in the face of challenges. It consists of 17 statements on a 5-point Likert scale ranging from 1 = not at all to 5 = often. This tool will be scored using a total score, where a higher score indicates greater resilience among participants. The tool has good internal consistency (α = 0.902), indicating its reliability in measuring resilience.

This study used the Teenage Executive Function Inventory (TEXI) (Thorell et al., 2020) to assess the participants' executive functions, which measures the dimensions of working memory and inhibitory control. This instrument includes 20 questions, measured on a 5-point Likert scale ranging from 1 = Strongly disagree to 5 = Strongly agree. This scale was scored in total score for each dimension, inhibitory control, and working memory. The total score of this scale indicates that the higher the score, the worse the capability of participants working memory and/or inhibitory control.

The Cognitive Flexibility Scale (CFS) (Martin & Rubin, 1995) was used to measure the third dimension of executive function, cognitive flexibility. This scale consists of 12 statements, measured on a 6-point Likert scale ranging from 1 = Strongly disagree to 6 = Strongly agree. This scale was reverse-scored, meaning that a higher score indicates poorer cognitive flexibility in participants. The internal consistency of the TEXI working memory dimension (α = 0.76), inhibitory control dimension (α = 0.78), and CFS (α = 0.68) were tested and found to be reliable. The instrument tool was directly adapted by researchers through the process of translation, expert judgment, and readability testing by adolescent samples. To obtain the total executive function score, the scores from the Teenage Executive Function Inventory and the Cognitive Flexibility Scale were combined using the factor score method.

Additionally, to measure NSSI behavior, the Deliberate Self-Harm Inventory (Gratz, 2001) was used. This tool comprises 17 statements that reflect 17 types of non-suicidal self-injury behaviors, measured on a dichotomous scale ("yes" or "no"). The tool aims to assess the history of NSSI behaviors that participants have engaged in throughout their lives up to the time of completing the questionnaire. The final score of this scale will be a yes or no dichotomous score indicating whether the participants have never done any kind of NSSI behavior or have done it at least once in their lifetime. The inventory demonstrates strong psychometric properties, including good internal consistency (α = 0.76).

Procedure

The study was conducted in the recruitment, data collection, and debriefing phase. Ethical approval was already obtained from the Ethics Committee of the Faculty of Psychology at Universitas Indonesia (Approval Number: 250/FPsi.Komite Etik/PDP.04.00/2023). During

the recruitment phase, participants were selected through convenience sampling from junior and senior high schools in Jakarta, Bogor, Depok, Tangerang, and Bekasi. Informed consent was obtained from parents or guardians before any data collection began.

In the data collection phase, participants were briefed on the study's procedures, confidentiality safeguards, and the voluntary nature of their involvement. Participants who consented completed a set of self-report questionnaires via Microsoft Forms in a classroom setting, with researchers present to monitor and assist as needed. The questionnaire took approximately 30–45 minutes to complete, and participants were encouraged to respond honestly with assurances of confidentiality for their responses.

Following data collection, participants received a debriefing that provided additional information on the study's purpose and significance. Psychoeducation was also given on mental health and adaptive coping strategies, with participants provided resources for mental health support if needed.

Data Analysis

The study conducted a mediation effect test of resilience on the relationship between each dimension of executive function and NSSI behavior. Before conducting the mediation test, a point-biserial correlation test was performed to examine the relationship between each dimension of executive function and NSSI behavior, as the NSSI variable is dichotomous. After that, a mediation test was conducted using the PROCESS Procedure for SPSS with Hayes model number 4 to observe the mediation effect of resilience. Additionally, this study examined gender differences in the interaction between variables, using the same analysis but with separate data

Results

The data was collected from 211 participants, consisting of 49.3% male participants and 50.7% female participants (*SD* = 0.50). The age range of the participants in this study was 12-18 years old (*SD* = 1.42), with the majority of participants being 14 years old when the data was collected. Based on the data obtained, there were no missing values in the processed data. It was found that 50.1% of the total participants in this study had engaged in NSSI (Non-Suicidal Self-Injury) at least once in their lives, with the majority of those who had engaged in NSSI being female (63%; *SD* = 0.50). See Table 1.

Table 1

Description of participants' characteristics

			Sum	Percentage	*SD*
Gender	Male		104	49.30	0.50
	Female		107	50.70	
Age	12		7	3.30	1.42
	13		39	18.50	
	14		83	39.30	
	15		21	10	
	16		37	17.50	
	17		18	8.50	
	18		6	2.80	
NSSI behavior	Ever done	Male	40	36.70	0.50
		Female	69	63.30	
	Never done	Male	64	62.70	
		Female	38	37.30	

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The total score of executive function and the total score on each dimension indicate that the higher the score, the worse the executive function and its dimensions. According to Table 2, the study results show that overall executive function ($r(209) = -0.29$, $p < 0.01$), as well as each dimension of executive function—working memory ($r(209) = -0.23$, $p < 0.01$), inhibitory control ($r(209) = -0.24$, $p < 0.01$), and cognitive flexibility ($r(209) = -0.40$, $p < 0.01$)—has a significant negative correlation with resilience. Given that higher scores on the executive function measures indicate poorer performance, these results indicate that adolescents with greater executive function impairments may have more difficulty adapting to stressors and employing adaptive coping strategies, potentially making them more vulnerable to psychological distress.

Table 2
Correlation between executive function, resilience, and NSSI behavior

	1	2	3	4	5	6	*M*	*SD*
Executive Function	1						0.00	1.00
Working Memory	0.89**	1					0.00	1.00
Inhibitory Control	0.91**	0.68**	1				0.00	1.00
Cognitive Flexibility	0.29**	0.16*	0.18**	1			0.00	1.00
NSSI	0.21**	0.16*	0.18**	0.10*	1		0.52	0.50
Resilience	-0.29**	-0.23**	-0.24**	-0.40**	-0.28**	1	0.00	1.00

*Significance level of p < 0.05; ** significance level of p < 0.01

In contrast, executive function ($r(209) = 0.21$, $p < 0.05$) and its dimensions —working memory ($r(209) = 0.16$, $p < 0.05$), inhibitory control ($r(209) = 0.18$, $p < 0.01$), and cognitive flexibility ($r(209) = 0.10$, $p < 0.05$) has a positive correlation with NSSI. This result indicates that the worse the performance of a person's working memory, inhibitory control, cognitive flexibility, or overall executive function the higher the likelihood of that person engaging in NSSI.

Table 3
The mediation role of resilience between executive function and NSSI behavior

	B	*SE*	CI 95%		*P*
			LL	UL	
X = Executive function					
Executive function → Resilience(a)	-0.29	0.07	-0.42	-0.16	0.00
Resilience→ NSSI (b)	-0.53	0.16	-0.85	-0.22	0.00
Executive function → NSSI (c' - direct effect)	0.32	0.16	0.02	0.62	0.04
Indirect Effect (a × b)	0.15	0.06	0.05	0.30	
X = Working memory					
Working memory → Resilience(a)	-0.23	0.07	-0.36	-0.10	0.00
Resilience→ NSSI (b)	-0.57	0.16	-0.88	-0.25	0.00
Working memory → NSSI (c' - direct effect)	0.23	0.15	0.13	-0.06	0.52
Indirect Effect (a × b)	0.13	0.06	0.04	0.27	
X = Inhibitory control	-0.24	0.07	-0.37	-0.10	0.00
Inhibitory control → Resilience(a)	-0.56	0.16	-0.87	-0.25	0.00
Resilience→ NSSI (b)	0.26	0.15	-0.03	0.56	0.08
Inhibitory control → NSSI (c' - direct effect)	0.13	0.06	0.04	0.27	
Indirect Effect (a × b)					
X = Cognitive flexibility					
Cognitive flexibility → Resilience(a)	-0.40	0.06	-0.52	-0.27	0.00
Resilience→ NSSI (b)	-0.63	0.17	-0.97	-0.30	0.00
Cognitive flexibility → NSSI (c' - direct effect)	-0.04	0.16	-0.36	0.27	0.78

Indirect Effect (a × b)	0.25	0.09	0.11	0.46

Table 3 presents the mediating role of resilience in the relationship between overall executive function, its dimensions separately, and NSSI behavior. The indirect effect of overall executive function was significant (95% CI [0.053, 0.30]). Similarly, the indirect effects of each executive function dimension—working memory (95% CI [0.04, 0.27]), inhibitory control (95% CI [0.04, 0.27]), and cognitive flexibility (95% CI [0.11, 0.46])—also reached significance level. However, the direct effects of working memory (95% CI [-0.13, 0.06]), inhibitory control (95% CI [-0.03, 0.56]), and cognitive flexibility (95% CI [-0.35, 0.27]) were not statistically significant. In contrast, the direct effect of overall executive function was significant (95% CI [0.02, 0.62]).

These findings indicate that each dimension of executive function indirectly predicts NSSI behavior exclusively through the mediating role of resilience, indicating resilience as a full mediator. However, overall executive function predicts NSSI both directly and indirectly through resilience, indicating partial mediation. This underscores the critical role of resilience in mitigating the impact of executive function deficits on NSSI behavior.

Discussion

This study examined the mediating role of resilience in the relationship between executive function, its dimensions, and non-suicidal self-injury (NSSI). The findings indicate that overall executive function correlates with and directly predicts NSSI, with its combined dysfunction exerting a stronger influence on behavior regulation (Wang et al., 2023). Viewing executive function as a single construct captures cumulative deficits across cognitive domains simultaneously, impairing emotion regulation and increasing vulnerability to NSSI as a maladaptive coping strategy. These impairments disrupt impulse control, cognitive flexibility, and the ability to adopt adaptive coping mechanisms, reinforcing NSSI as a repetitive and rigid emotional regulation strategy (Fikke et al., 2011). Furthermore, when resilience is added as a mediating variable, NSSI in adolescents can also be significantly influenced.

Executive function plays a crucial role in building resilience by enhancing cognitive flexibility and problem-solving skills, enabling individuals to adapt more effectively to stressors. It also strengthens resilience by maintaining goal-directed behavior and regulating emotional responses. This ability allows individuals to function effectively under stress, cope with adversities, and remain focused despite psychological distress (Afek et al., 2021; Zhang et al., 2019). Higher resilience can help someone to reduce anxiety and stress when facing stressful situations. Besides that, resilience is also influenced by an individual's surrounding environment such as family and friends that also help someone to regulate negative emotions and enhance adaptive responses to threats (Scult et al., 2017). In children and adolescents, executive function and resilience are interrelated and jointly predict social competence, social support, and adaptive coping strategies that are associated with internalizing and externalizing problems (Martek et al., 2007; Turner et al., 2014; Wei et al., 2022). With good resilience, individuals can have better competence and develop adaptive coping that avoids the idea of doing NSSI behavior.

Since executive function consists of three main dimensions—working memory, inhibitory control, and cognitive flexibility—this study explores the relationship between each dimension and NSSI. However, when each executive function dimension is analyzed separately, the predictive power for NSSI diminishes and cannot significantly predict NSSI. The inability of working memory to predict self-harm in adolescents is possibly due to the complex interplay of cognitive and emotional factors. It indicates that even though working memory is an important cognitive function, it does not itself directly predict self-harming

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behaviors such as NSSI, which are often also influenced by emotional distress and cognitive distortions (Wang et al., 2023). However, when working memory is linked through resilience, NSSI can be significantly predicted. A study indicates that cognitive abilities, including working memory, play a protective role in how individuals respond emotionally to stress. Working memory can buffer against the negative effects of stress, helping individuals maintain a more stable emotional state during challenging times (Baliyan et al., 2021). Good working memory supports resilience by allowing individuals to regulate emotions by assimilating information related to difficult situations, and develop adaptive coping strategies (Weiland et al., 2012). Therefore a person will be less likely to engage in maladaptive coping behavior such as NSSI.

The second dimension, inhibitory control, also cannot significantly predict NSSI. Individuals intentionally engage in self-harm actions not solely due to an inability to resist the presence of a sharp or dangerous item, but because self-injury invokes a rewarding process by alleviating negative emotional states. The coupling between the rewards associated with self-injury and the heightening of reactive inhibition would allow individuals to override their self-preservation instinct (Mirabella et al., 2024). As executive function in general, inhibitory control also cannot independently affect the NSSI behavior among adolescents, but there are factors like other psychological and social factors that play a big role in the development of NSSI behavior (Rodman et al., 2017).This result contradicts previous studies' findings suggesting that inhibitory control in adolescents with NSSI is lower than in normal adolescents (Marotz & Allen, 2016; Mozafari et al., 2022). However, this finding aligns with results from a previous study that initiative self-control is better at predicting engagement in desired behaviors, while inhibitory self-control is more effective at resisting unwanted behaviors (deRidder et al., 2011). Nevertheless, resilience can significantly bridge the relationship between inhibitory control and NSSI. Resilience positively correlates with non-emotional inhibitory control, which enhances resilience in stressful situations (Afek et al., 2021). Good inhibitory control enhances resilience by enabling individuals to maintain goal-directed behavior and regulate emotional responses, allowing for better coping with stress and adversity (Afek et al., 2021). Research also suggests that adolescents with strong social networks that enhance resilience may exhibit better self-control, complicating the relationship between inhibitory control and self-harm behaviors (Thompson, 2020).

The last dimension, cognitive flexibility, also cannot independently predict NSSI in adolescents. Research shows that cognitive flexibility, as currently measured, is not significantly related to a history of NSSI beyond the presentation of specific psychopathology, such as depression. Higher cognitive flexibility may have a protective influence against NSSI by mitigating the effects of stress and psychological pain. However, cognitive flexibility does not appear to be a primary mechanism of change in many NSSI interventions (Chung et al., 2024). In addition, cognitive inflexibility is not significantly related to a history of NSSI behavior, possibly because cognitive inflexibility is triggered as a temporary response to distress rather than as a static cognitive characteristic (Polanco-Roman et al., 2015). However, when resilience is added as a mediator variable, the relationship can significantly predict NSSI. Cognitive flexibility, which involves cognitive appraisal and frontal brain circuits, plays a crucial role in human resilience by reallocating attentional resources between cognitive-emotional regulation and pain perception (Yao & Hsieh, 2019) Cognitive flexibility helps enhance resilience by enabling individuals to adapt their thinking and emotional responses to adversities, facilitating better recovery from stressors (Sünbül, 2020).

Additionally, the results of this study showed that the majority of adolescent participants had engaged in NSSI at least once in their lives. This is consistent with a previous study, which reported that the highest prevalence of NSSI behavior occurs among adolescents (Morgan et al., 2017). Involvement in NSSI is significantly associated with feelings of depression and can be considered a strategy for emotion regulation (Giletta et al., 2012). NSSI also serves as a mechanism for alleviating negative emotions experienced by individuals due to adverse past experiences (Kaess et al., 2013). Furthermore, NSSI is often used as a tool for self-punishment for events or situations that have occurred or actions that the individual has taken (Cipriano et al., 2017).

Among all participants who had engaged in NSSI, the majority were female. This finding is consistent with previous research that argued that females are more likely to disclose their NSSI behavior than males, leading to higher recorded statistics (Bresin & Schoenleber, 2015). Also, the report shows that females reported significantly higher levels of perceived distress than males. NSSI is often used as a coping mechanism for negative feelings associated with depression and anxiety (e.g., sadness, restlessness, feelings of worthlessness), and females are at greater risk of engaging in NSSI because they are more likely to experience these symptoms compared to males (Lutz et al., 2023).

This study has several limitations that should be considered for future research on similar topics. First, the participants in this study were from the Jakarta, Bogor, Depok, Tangerang, and Bekasi areas. Future studies could include a broader range of participants to provide a more comprehensive understanding. Second, the NSSI scale used in this study was dichotomous, which did not allow for an assessment of the severity of participants' engagement in NSSI. Future research should consider using a scale that can measure the severity of NSSI behavior more comprehensively.

Conclusion

Based on this study, only overall executive function could significantly predict non-suicidal self-injury (NSSI) behavior in adolescents. Meanwhile, each dimension separately could not predict NSSI in participants. The role of resilience as a mediator variable is critical in explaining this relationship. Each dimension of executive function separately—working memory, inhibitory control, and cognitive flexibility, could only predict NSSI when resilience is taken into account. Resilience helps bridge the impact of executive function on NSSI by enhancing adolescents' ability to manage negative emotions and respond adaptively to stressful situations. These findings highlight the importance of intervention that targets determinants of resilience and executive function, as well as prevention efforts for NSSI, especially among adolescents who are vulnerable to psychological problems.

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Declarations

Author contribution. The first author contributed to designing the study, collecting data, analysing the results, and writing the article. The second author contributed to directing the research topic, supervising the study, consulting on data analysis, and reviewing the article manuscript.

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