

Personality Traits and Non-Suicidal Self-Injury in Adolescents: The Role of Depressive Symptoms as an Explanatory Mechanism

Celia Gabardón , & Esther Calvete 

University of Deusto (Spain)

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Corresponding author:

Esther Calvete

(esther.calvete@deusto.es)

Abstract

Non-suicidal self-injury is a highly relevant issue during adolescence. The main objective of the present study was to determine whether there is a relationship between three personality traits (neuroticism, extraversion, and effortful control) and non-suicidal self-injury in adolescents and whether depressive symptoms act as an explanatory mechanism. A total of 747 adolescents aged 13 to 18 years (50.9% girls) participated in the study. Participants completed measures assessing non-suicidal self-injury (frequency and automatic and social reinforcement functions), personality traits, and depressive symptoms. Results from regression models showed that high levels of neuroticism and low levels of extraversion and effortful control were associated with higher levels of depressive symptoms, which in turn were related to a higher frequency of non-suicidal self-injury and greater use of these behaviors for automatic and social reinforcement functions. These associations were invariant for boys and girls. The findings may inform preventive interventions targeting non-suicidal self-injury in adolescents.

Keywords: non-suicidal self-injury; extraversion; neuroticism; effortful control; depression.

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Rasgos de personalidad y autolesiones no suicidas en adolescentes: el papel de los síntomas depresivos como mecanismo explicativo

Resumen

Las autolesiones no suicidas son un problema de gran relevancia en la adolescencia. El objetivo principal del presente trabajo fue determinar si existe relación entre tres rasgos de personalidad (neuroticismo, extraversión y control esforzado) y las autolesiones no suicidas en adolescentes y si los síntomas de depresión actúan como variable explicativa. Participaron 747 adolescentes de edades comprendidas entre los 13 y los 18 años (50.9% chicas), los cuales completaron medidas de autolesiones no suicidas (frecuencia y funciones de reforzamiento automático y social), personalidad y síntomas depresivos. Los resultados de los modelos regresivos mostraron que niveles altos de neuroticismo y bajos en extraversión y control esforzado se asociaban con más síntomas depresivos, y estos a su vez con mayor frecuencia de autolesiones no suicidas y uso de estas con funciones de reforzamiento automático y social. Estas asociaciones fueron similares en chicos y chicas. Estos resultados pueden informar a las intervenciones preventivas de autolesiones no suicidas en adolescentes.

Palabras clave: autolesiones no suicidas; extraversión; neuroticismo; control esforzado; depresión.

Non-suicidal self-injury has been described as the deliberate act of inflicting physical harm on oneself without the intention of ending one's life (Nock et al., 2006). The results of the meta-analysis conducted by Gillies et al. (2018) showed that non-suicidal self-injury occurs mainly between the ages of 13 and 17. This has been attributed to adolescents' difficulties regulating intense emotions, in addition to incomplete neurological development and the social context in which they function. This meta-analysis also revealed that the global prevalence of self-injury in adolescents was 16.9%, with an upward trend over the years and higher rates among girls than among boys. Recently, a study reported 17,915 non-suicidal self-injury hospitalizations of youth aged 10–24 between 2018 and 2023 (López-Cuadrado et al., 2025). Although various methods of self-injury exist, multiple studies have shown that cutting is the most common (Reinhardt et al., 2025). In addition to the suffering caused by non-suicidal self-injury entails, it also constitutes an important risk factor for subsequent suicide attempts (Whitlock et al., 2013).

Numerous models have been proposed to explain the development and maintenance of non-suicidal self-injury. Most emphasize that such behaviors can be understood as maladaptive emotional regulation strategies, that is, as a way of relieving intense negative emotions such as anger, sadness, anxiety, or emotional emptiness (McKenzie & Gross, 2014). Supporting this view, a meta-analysis by Wolff et al. (2020) found that individuals with difficulties managing their emotions were three times more likely to engage in self-injury.

Similarly, self-injurious behaviors may also occur with the aim of self-punishment or of expressing distress to others (Esposito et al., 2023; Hafferty et al., 2019; Klonsky et al., 2015). Finally, individuals may engage in self-injury to influence their social environment, for example, as a way of seeking attention or expressing needs that they are unable to verbalize (Klonsky et al., 2015).

Many of the mechanisms mentioned above are integrated into the four-function model developed by Nock and Prinstein (2004), which classifies functions according to the type of reinforcement (positive or negative) and the context (automatic or social). Under automatic reinforcement, self-injury may be used as an emotional regulation strategy, either by reducing intense emotional distress, such as feelings of anger, sadness, anxiety (automatic negative reinforcement), or by seeking pleasurable sensations, for example, feeling something in the absence of emotions (automatic positive reinforcement). Under social reinforcement, the aim of self-injury may be to influence the environment, either to obtain attention, support, or help from others (social positive reinforcement) or to avoid social demands or responsibilities (social negative reinforcement).

In contrast to the numerous studies examining the role of negative emotional symptoms as antecedents of non-suicidal self-injury, research on the role of relatively stable individual characteristics, such as personality traits, remains more limited. Three personality traits are of particular interest in this context: neuroticism (emotional instability), extraversion (positive affectivity), and effortful control. Neuroticism is a fundamental personality trait characterized by a tendency to experience negative affect such as anger, anxiety, irritability, emotional instability, and depression. Individuals high in this trait tend to perceive situations as threatening and to feel overwhelmed

much of the time (Widiger & Oltmanns, 2017). Extraversion, in turn, encompasses sociability, positive affect, energy, stimulation seeking, and interpersonal warmth (Watson et al., 2019). Finally, effortful control refers to the ability to regulate impulses and provide more deliberate responses (Liew, 2012). In this context, Rothbart and Bates (2006) described effortful control as a dimension of self-regulation that includes processes such as attentional focusing, inhibitory control, and activation control. Thus, whilst executive functions involve cognitive processes, effortful control is understood as a temperamental trait (Chae, 2022) that enables more flexible and voluntary behavioral regulation. It is also different from impulsivity and behavioral inhibition, which reflect more automatic and involuntary forms of control (Eisenberg et al., 2009; Nigg, 2017).

Research on the relationship between these personality traits and non-suicidal self-injury is relatively scarce and has focused primarily on neuroticism and extraversion. Several studies have shown that higher levels of neuroticism are associated with non-suicidal self-injury in community samples of adults (Hafferty et al., 2019), university students (Allroggen et al., 2014; Liao et al., 2022), and adolescents (Abdalla et al., 2025; Soyuyigit & Saylan-Çolak, 2025).

With respect to extraversion, a systematic review and meta-analysis found that self-injury is more characteristic of individuals with lower levels of extraversion (Swannell et al., 2014). Subsequent studies have similarly reported that lower levels of extraversion are associated with a higher frequency of non-suicidal self-injury among university students (Allroggen et al., 2014) and adolescents (Abdalla et al., 2025; Soyuyigit & Saylan-Çolak, 2025). In the only longitudinal study examining these variables, Junker et al. (2019), using a community sample of 8,965 Norwegian adolescents, also found that the risk of self-injury was lower among adolescents with higher levels of extraversion.

Research on the role of effortful control in self-injury is more limited, although numerous studies have examined related constructs such as impulsivity. A meta-analysis of 27 studies including both clinical and community samples found that individuals with poorer impulse control reported a higher frequency of self-injurious behaviors (Hamza et al., 2015). Similarly, a longitudinal study including 430 Italian adolescents found that lower levels of effortful control predicted a greater likelihood of non-suicidal self-injury (Esposito et al., 2023). Another study with a community sample of 891 Chinese adolescents also reported a negative association between effortful control and the frequency of non-suicidal self-injury (Xu et al., 2025).

The Role of Depressive Symptoms in the Association Between Personality and Self-Injury

As noted earlier, several theoretical models of non-suicidal self-injury propose that symptoms of emotional distress, including depressive symptoms, act as antecedents of these self-injurious behaviors (Klonsky et al., 2015; Nock & Prinstein, 2004). This view is supported by the results of numerous studies (see Gillies et al., 2018; Wolff et al., 2020 for reviews). Moreover, personality traits are closely related to depression. In this regard, the meta-analysis by Hakulinen et al. (2015) showed that neuroticism and introversion significantly pre-

dicted depressive symptoms. Likewise, effortful control appears to act as a protective factor against depressive symptoms, as it promotes the use of effective coping strategies when dealing with high levels of negative emotion (Gulley et al., 2016).

Depressive symptoms may therefore represent a mechanism linking personality traits to self-injurious behaviors. However, this hypothesis has been examined in only a small number of studies. Liao et al. (2022) found that depressive symptoms helped explain the association between neuroticism and non-suicidal self-injury. Similarly, Abdalla et al. (2025) reported that lower levels of extraversion were associated with a higher frequency of non-suicidal self-injurious behaviors, partly because higher extraversion is associated with lower levels of depressive symptoms.

The Present Study

Previous research suggests that certain personality traits are involved in the development of both depressive symptoms and non-suicidal self-injury. Given that depressive symptoms are considered an antecedent of self-injury, these symptoms may act as a mechanism linking personality traits and these behaviors.

However, despite the contributions of existing studies, an important gap remains in the literature regarding the role of depression in the relationship between personality traits and non-suicidal self-injury. The studies by Liao et al. (2022) and Abdalla et al. (2025) examined this possibility for neuroticism and extraversion, respectively, but to the best of our knowledge, no study has tested this hypothesis for effortful control. Therefore, the aim of the present study was to examine whether three personality traits (neuroticism, extraversion, and effortful control) are associated with non-suicidal self-injury in adolescents, both directly and indirectly through depressive symptoms.

With regard to the study hypotheses, non-suicidal self-injury was expected to be negatively associated with extraversion and effortful control and positively associated with neuroticism. In addition, these associations were expected to be partially explained by depressive symptoms. Specifically, higher levels of neuroticism were expected to be associated with greater depressive symptomatology, whereas higher levels of extraversion and effortful control were expected to be associated with lower levels of depressive symptoms. In turn, depressive symptoms were expected to be positively associated with non-suicidal self-injury. Given the importance of considering the functions of non-suicidal self-injury in addition to its frequency, both automatic and social reinforcement functions were also examined.

Finally, given that previous research suggests that non-suicidal self-injury is more frequent among girls than among boys, this study explored whether the associations between personality, self-injury, and depressive symptoms were similar in both groups.

Method

Participants

The sample consisted of a total of 747 adolescents, including 367 boys and 380 girls (50.9%), aged between 13 and 18 years ($M = 15.62$ years; $SD = 0.97$). Initially we invited a random

sample of 20 high schools in Bizkaia to participate in the study. Of these, 10 agreed to participate. The participants were students ranging from the second year of compulsory secondary education to the first year of upper secondary education. Socioeconomic status was estimated based on information about parents' occupations and was distributed as follows: 29.9% low, 17.3% lower-middle, 15.2% middle, 17.5% upper-middle, and 20.1% high.

Instruments

Non-suicidal self-injury was assessed using the Functional Assessment of Self-Mutilation scale (FASM; Lloyd et al., 1997; Spanish version by Calvete et al., 2015). The first section describes 10 self-injurious behaviors (e.g., cutting, burning the skin, inserting objects under the nails or skin). Adolescents were asked to indicate how often they had engaged in each behavior during the past year using a five-point scale: 1 (0 times), 2 (1 time), 3 (2–5 times), 4 (6–10 times), and 5 (> 11 times) (Calvete et al., 2022).

In addition, the FASM includes a section assessing the functions of self-injury. In this study, the automatic reinforcement (4 items; e.g., *to relieve the feeling of being numb or empty*) and social reinforcement (16 items; e.g., *to receive more attention from my family and friends*) scales were used. Items are rated on a Likert-type scale ranging from 0 to 3, where 0 = "never," 1 = "rarely," 2 = "sometimes," and 3 = "often." The FASM has demonstrated a solid factorial structure as well as adequate internal consistency, with alpha coefficients reflecting the reliability of its subscales. Test–retest reliability has also been demonstrated, indicating temporal stability in the scores obtained. Cronbach's alpha coefficients for the automatic and social reinforcement scales were .77 and .92, respectively.

Depressive symptoms were assessed using the Spanish version (Calvete & Cardenoso, 1999) of the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977), which consists of 20 items. In this study, the frequency of depressive symptoms during the previous month was assessed using a four-point scale ranging from 0 (rarely or none of the time) to 3 (most or all of the time). The items assess several domains, including the absence of positive affect, negative affect, psychological and somatic symptoms such as irritability and hopelessness, and the quality of interpersonal relationships. The Spanish version of the questionnaire has been widely used with adolescents. Cronbach's alpha coefficient in the present study was .89.

Effortful control (EC) was assessed using the Spanish translation developed by GIPSE (Research Group in Developmental Psychology, University of Murcia, Spain) of the Early Adolescent Temperament Questionnaire–Revised Short Form (EATQ-R-SF; Capaldi & Rothbart, 1992; Ellis & Rothbart, 2001). The EC subscale consists of 10 items that assess attention, inhibitory control, and activation control, including statements such as *"When someone asks me to do something, I do it right away, even if I do not want to do it"* and *"I have difficulty finishing things on time"* (reverse-scored). Participants rate these items on a five-point scale ranging from 1 (almost never) to 5 (almost always). The Cronbach's alpha coefficient in the present study was .56. A factor structure analysis of the scale indicated that the factor loadings of the negatively worded items were very low and contributed to the scale's low internal

consistency. After removing the four negatively worded items, the alpha coefficient increased to .71.

Extraversion and neuroticism were measured using the Spanish version (Del Barrio et al., 2006) of the Big Five Questionnaire for children and adolescents (BFQ-NA) developed by Barbaranelli et al. (2003). The extraversion scale (10 items) included contents such as “*I feel happy most of the day*”. The neuroticism scale (11 items) included contents such as “*I feel sad when many things go wrong*”. Responses are rated on a five-point scale ranging from 1 (almost never) to 5 (almost always). The psychometric properties of the Spanish version of the BFQ in children and adolescents is adequate (Carrasco et al., 2005; Martínez et al., 2011). In the present study, the Cronbach’s alpha coefficients were .82 for extraversion and .87 for neuroticism.

Procedure

This study was approved by the Ethics Committee of University of Deusto. Several schools were randomly contacted and invited to participate in the study, and 10 agreed to take part. Prior to data collection, informed consent forms were sent to both adolescents and their parents, and consent from both parties was required. These forms included the necessary information to allow them to decide whether they wished to participate while guaranteeing the confidentiality of the data provided.

Once in their classrooms and before the questionnaires were administered by the researchers, adolescents were informed about the key ethical aspects of the study in order to obtain their agreement to participate. The questionnaires were administered during regular class time. The participation rate was 74%, largely due to the requirement for parents active informed consent.

Statistical Analysis

Missingness was examined. The percentages of missing values were 6% for depression, 6.7% for BFQ-NA, 7% for the EATQ, and 0.66% for the FASM. As Little’s Missing Completely at Random (MCAR) test was not statistically significant, $\chi^2(19) = 18.19$, $p = .510$, we used full information maximum likelihood (FIML) to handle missing data. Path analysis with Mplus-9 was used to test the hypotheses. Two main models were estimated. The first model included non-suicidal self-injury frequency as the outcome, with paths from the three personality traits (extraversion, neuroticism, and effortful control) to depressive symptoms and non-suicidal self-injury frequency, and from depressive symptoms to non-suicidal self-injury frequency. The second model focused on non-suicidal self-injury

functions and included paths from the personality traits to depressive symptoms and to both types of reinforcement functions (automatic and social), as well as paths from depressive symptoms to the reinforcement functions. The non-suicidal self-injury variables showed high levels of kurtosis, so they were transformed using a square root transformation. Age was included in the models as a covariate.

Subsequently, model invariance across boys and girls was examined. To this end, each of the two main models was first estimated simultaneously for boys and girls, allowing the regression paths to differ across subsamples. Next, models were estimated imposing invariance constraints on the paths.

Although the models were estimated using the full effortful control scale, given its low internal consistency, sensitivity analyses were conducted by repeating all analyses with a version of the scale without the negatively worded items.

Model fit was evaluated using RMSEA (root mean square error of approximation), CFI (comparative fit index), TLI (Tucker–Lewis fit index), and SRMR (standardized root mean square residual). RMSEA values between .02 and .05 indicate good fit, whereas values between .05 and .08 indicate acceptable fit. CFI and TLI values between .95 and .99 indicate very good fit, and values between .90 and .95 indicate acceptable fit. Finally, SRMR values below .08 indicate adequate model fit (Little, 2024). For the invariance analyses, models were compared based on changes in CFI, using the criterion proposed by Cheung and Rensvold (2002), according to which invariance is supported when $\Delta CFI < .01$.

Results

Descriptive Analyses

Table 1 presents the means, standard deviations, and correlation coefficients among the variables. The correlation between neuroticism and depressive symptoms was particularly high.

Personality and Non-suicidal Self-injury Frequency

First, we estimated the model for non-suicidal self-injury frequency. This model showed excellent fit indices: $\chi^2(1, N = 747) = 2.03$, RMSEA = .037 [.000, .112], CFI = .997, TLI = .972, SRMR = .009. The unstandardized and standardized coefficients are shown in Table 2, and Figure 1 displays the paths that were statistically or marginally significant. As shown in the model, all three personality traits were significantly associated with depressive symptoms. The associations were negative for extraversion and effortful con-

Table 1. Means, Standard Deviations and Correlations Among Variables

Variable	M	SD	1	2	3	4	5	6	7
1. Extraversion	35.73	7.18	—						
2. Neuroticism	25.89	8.29	.15**	—					
3. Effortful control	3.29	.50	.24**	-.27**	—				
4. Depressive symptoms	15.73	9.92	-.16**	.52**	-.29**	—			
5. Self-injury frequency	2.25	4.11	-.08*	.18**	-.14**	.24**	—		
6. Automatic reinforcement	.21	.48	-.09*	.18**	-.13**	.31**	.65**	—	
7. Social reinforcement	.18	.40	-.13**	.12**	-.11**	.21**	.56**	.75**	—

Note. M = mean; SD = standard deviation. * $p < .05$, ** $p < .01$.

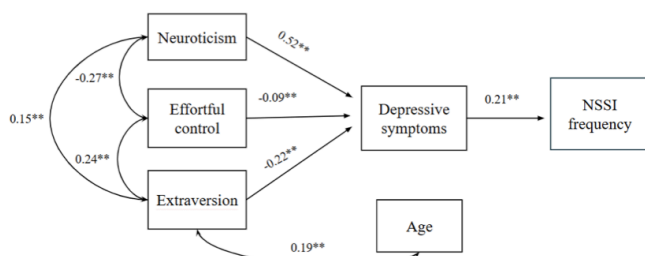
Table 2. Model for Non-Suicidal Self-Injury Frequency

	<i>B</i>	<i>SE</i>	<i>Beta</i>	<i>t</i>	<i>p</i>	95% Confidence Interval	
Non-suicidal self-injury frequency							
Extraversion	-0.002	0.008	-.015	-0.32	.747	-0.02	0.01
Neuroticism	0.012	0.007	.082	1.78	.076	0.00	0.03
Effortful control	-0.134	0.096	-.056	-1.40	.161	-0.32	0.05
Depressive symptoms	0.025	0.006	.210	4.29	< .001	0.01	0.04
Age	0.016	0.039	.013	0.40	.692	-0.06	0.09
Depressive symptoms							
Extraversion	-0.296	0.05	-.215	-5.99	< .001	-0.39	-0.20
Neuroticism	0.627	0.047	.523	13.43	< .001	0.54	0.72
Effortful control	-1.843	0.691	-.093	-2.67	.008	-3.20	-0.49

Table 3. Model for Non-Suicidal Self-Injury Functions

Non-suicidal self-injury functions	<i>B</i>	<i>SE</i>	<i>Beta</i>	<i>t</i>	<i>p</i>	95% Confidence Interval	
Automatic reinforcement							
Extraversion	-0.002	0.002	-.039	-0.95	.341	-0.01	0.00
Neuroticism	0.001	0.002	.019	0.41	.683	0.00	0.01
Effortful control	-0.039	0.029	-.048	-1.33	.183	-0.10	0.02
Depressive symptoms	0.012	0.002	.285	5.32	< .001	0.01	0.02
Age	-0.021	0.014	-.05	-1.50	.133	-0.05	0.01
Social reinforcement							
Extraversion	-0.005	0.002	-.101	-2.29	.022	-0.01	0.00
Neuroticism	0.002	0.002	.056	1.11	.265	0.00	0.01
Effortful control	-0.022	0.027	-.029	-0.81	.421	-0.08	0.03
Depressive symptoms	0.008	0.002	.205	4.03	< .001	0.00	0.01
Age	-0.005	0.013	-.014	-0.42	.675	-0.03	0.02
Depressive symptoms							
Extraversion	-0.297	0.050	-.215	-0.30	< .001	-0.40	-0.20
Neuroticism	0.627	0.047	.524	0.63	< .001	0.54	0.72
Effortful control	-1.852	0.692	-.093	-1.85	.007	-3.21	-0.50

Figure 1. Model for Non-Suicidal Self-Injury Frequency

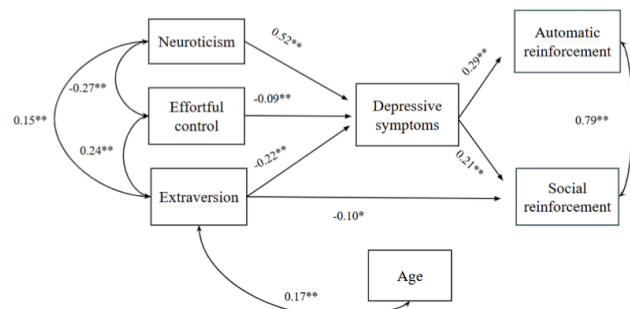


Note. * $p < .05$, ** $p < .01$.

control and positive for neuroticism. Depressive symptoms, in turn, were significantly associated with non-suicidal self-injury frequency. In addition, neuroticism showed a marginally significant direct association with non-suicidal self-injury frequency.

A bootstrapping procedure with 10,000 samples was used to evaluate the indirect association of each personality trait with non-suicidal self-injury frequency through depressive symptoms. The results indicated significant indirect associations for neuroticism (95% Confidence interval: .06; .16), extraversion (95% Confidence interval: -.08; -.02), and effortful control (95% Confidence interval: -.04; -.01).

Figure 2. Model for Non-Suicidal Self-Injury Functions



Note. * $p < .05$, ** $p < .01$.

Personality and Functions of Non-suicidal Self-injury

The model examining non-suicidal self-injury functions (automatic reinforcement and social reinforcement) also showed excellent fit indices: $\chi^2(1, N = 747) = 1.97$, RMSEA = .036 [.000, .112], CFI = .999, TLI = .987, SRMR = .008. This model replicated the same associations between personality traits and depressive symptoms (see Table 3). In addition, depressive symptoms were significantly associated with both reinforcement functions (automatic and social). A statistically significant negative path

from extraversion to the social reinforcement function was also observed.

Bootstrapping analyses confirmed the significance of all indirect associations. Specifically, the indirect association with the automatic reinforcement function through depressive symptoms was significant for neuroticism (95% Confidence interval: .09; .20), extraversion (95% Confidence interval: -.09;

-.03), and effortful control (95% Confidence interval: -.05; -.01). Similarly, the indirect association with the social reinforcement function through depressive symptoms was significant for neuroticism (95% Confidence interval: .06; .16), extraversion (95% Confidence interval: -.07; -.02), and effortful control (95% Confidence interval: -.04; -.004).

Table 4. Differences in Means for the Study Variables by Gender

Variable	Girls <i>n</i> = 380	Boys <i>n</i> = 367	<i>t</i>	<i>p</i>	<i>d</i>
Extraversion	36.91 (6.21)	34.48 (7.90)	4.52	< .001	.34
Neuroticism	27.61 (8.31)	24.07 (7.88)	5.76	< .001	.44
Effortful control	3.34 (.50)	3.25 (.49)	2.35	.019	.18
Depressive symptoms	16.99 (10.52)	14.39 (9.06)	3.49	< .001	.26
Self-injury frequency	1.90 (3.55)	2.62 (4.62)	-2.39	.017	-.18
Automatic reinforcement	0.18 (.46)	0.24 (.50)	-1.65	.100	-.12
Social reinforcement	0.12 (.32)	0.24 (.46)	-4.29	< .001	-.31

Table 5. Gender-Specific Model for Non-Suicidal Self-Injury Frequency

	Girls <i>n</i> = 380					Boys <i>n</i> = 367				
	<i>B</i>	<i>SE</i>	<i>Beta</i>	<i>t</i>	<i>p</i>	<i>B</i>	<i>SE</i>	<i>Beta</i>	<i>t</i>	<i>p</i>
Non-suicidal self-injury frequency										
Extraversion	0.001	0.009	.004	0.07	.944	0.000	0.010	.000	-0.01	.995
Neuroticism	0.008	0.008	.06	0.95	.342	0.021	0.010	.131	2.06	.039
Effortful control	-0.156	0.12	-.072	-1.30	.193	-0.035	0.151	-.013	-0.23	.819
Depressive symptoms	0.028	0.006	.271	4.43	< .001	0.025	0.009	.178	2.80	.005
Age	0.078	0.056	.068	1.40	.161	-0.065	0.069	-.050	-0.94	.346
Depressive symptoms										
Extraversion	-0.298	0.075	-.176	-3.98	< .001	-0.296	0.056	-.258	-5.32	< .001
Neuroticism	0.691	0.058	.545	11.88	< .001	0.515	0.056	.448	9.23	< .001
Effortful control	-1.176	0.983	-.056	-1.20	.231	-2.817	0.903	-.153	-3.12	.002

Table 6. Gender-Specific Model for Non-Suicidal Self-Injury Functions

	Girls <i>n</i> = 380					Boys <i>n</i> = 367				
	<i>B</i>	<i>SE</i>	<i>Beta</i>	<i>t</i>	<i>p</i>	<i>B</i>	<i>SE</i>	<i>Beta</i>	<i>t</i>	<i>p</i>
Social reinforcement										
Extraversion	-0.004	0.003	-.070	-1.33	.184	-0.004	0.003	-.070	-1.17	.241
Neuroticism	0.003	0.002	.088	1.38	.166	0.004	0.003	.086	1.37	.169
Effortful control	-0.045	0.034	-.073	-1.32	.187	0.049	0.048	.058	1.01	.311
Depressive symptoms	0.006	0.002	.220	3.54	< .001	0.011	0.003	.247	3.94	< .001
Age	-0.004	0.016	-.014	-0.28	.781	-0.017	0.022	-.039	-0.76	.449
Automatic reinforcement										
Extraversion	-0.001	0.003	-.011	-0.21	.835	-0.033	0.003	-.033	-0.55	.584
Neuroticism	0.001	0.003	.025	0.40	.689	0.051	0.003	.051	0.82	.415
Effortful control	-0.052	0.042	-.067	-1.24	.216	0.003	0.049	.003	0.05	.959
Depressive symptoms	0.012	0.002	.339	5.59	< .001	0.257	0.003	.257	4.10	< .001
Age	-0.027	0.019	-.067	-1.41	.16	-0.047	0.023	-.047	-0.90	.368
Depressive symptoms										
Extraversion	-0.297	0.075	-.175	-3.96	< .001	-0.297	0.056	-.259	-5.33	< .001
Neuroticism	0.693	0.058	.546	11.89	< .001	0.515	0.056	.448	9.23	< .001
Effortful control	-1.209	0.985	-.058	-1.28	.220	-2.814	0.904	-.153	-3.11	.002

Gender Invariance Testing

Table 4 shows that girls scored higher than boys on the three personality traits and on depressive symptoms. Boys scored higher on the frequency of self-injury behaviors and social reinforcement, with small effect sizes. However, there were no statistically significant differences in the proportion of participants who reported engaging in at least one self-injury behavior (45.2% vs. 44.2% for boys and girls, respectively; $\chi^2(1, N = 747) = 0.78, p = .779$). The model for non-suicidal self-injury frequency was estimated simultaneously for boys and girls and showed excellent fit: $\chi^2(2, N = 747) = 3.71, RMSEA = .048$ [.000, .123], CFI = .995, TLI = .956, SRMR = .012. Imposing invariance on the regression paths resulted in a non-statistically significant increase of $\chi^2(7) = 6.57, p = .474$, and a change in CFI of .001 ($\Delta CFI < .01$). These results support model invariance across boys and girls. Table 5 presents the coefficients for each subsample.

The same procedure was followed for the non-suicidal self-injury functions model, which was estimated simultaneously for boys and girls and showed excellent fit: $\chi^2(2, N = 747) = 3.62, RMSEA = .048$ [.000, .123], CFI = .999, TLI = .978, SRMR = .011. Although the path from effortful control to depressive symptoms was not statistically significant for girls, imposing invariance constraints on the regression paths resulted in a non-statistically significant increase of $\chi^2(11) = 15.37, p = .166$, and a change in CFI = .004 ($\Delta CFI < .01$). Therefore, model invariance across boys and girls was assumed. Table 6 includes the coefficients for each subsample.

Sensitivity Analyses

All models were estimated using a shortened version of the effortful control scale in which the negatively worded items were removed. All results remained similar, except for the association between neuroticism and effortful control, which was no longer statistically significant (.013, $p = .762$).

Discussion

The present study examined the association between three key personality traits (neuroticism, extraversion, and effortful control) and non-suicidal self-injury in adolescents as well as the potential explanatory role of depressive symptoms in this relationship. As expected, non-suicidal self-injury was positively associated with neuroticism and negatively associated with extraversion and effortful control. These findings are consistent with previous research reporting a positive association with neuroticism (Allroggen et al., 2014; Hafferty et al., 2019; Junker et al., 2019; Liao et al., 2022) and negative associations with extraversion (Allroggen et al., 2014; Jourdy & Petot, 2017; Junker et al., 2019; Swannell et al., 2014) and effortful control (Esposito et al., 2023). Thus, neuroticism, with its tendency toward emotional distress, may function as a risk factor, whereas extraversion—typically associated with a broader social network and greater emotional support—may act as a protective factor (Junker et al., 2019). Although it has received less attention in previous research, the present findings also highlight a protective role for effortful control (Esposito et al., 2023), which is consistent with the well-established relation-

ship between impulsivity and self-injurious behaviors (Hamza et al., 2015).

Consistent with the second objective of the study, the results also supported the hypothesis that depressive symptoms may help explain the association between the three personality traits and self-injury. Lower levels of extraversion and effortful control, together with higher levels of neuroticism, were associated with greater depressive symptomatology, which in turn was linked to a higher likelihood of engaging in self-injury. The association between personality traits and depressive symptoms observed in this study is consistent with the findings of numerous previous studies (e.g., Gulley et al., 2016; Hakulinen et al., 2015). Likewise, the association between depressive symptoms and non-suicidal self-injury has been widely documented (Bentley et al., 2015; Esposito et al., 2023; Gillies et al., 2018; Hafferty et al., 2019; Subica et al., 2016). The present study extends this literature by demonstrating that depression acts as an explanatory mechanism linking these personality traits to non-suicidal self-injury. To date, this possibility has only been examined in two studies conducted with samples from other countries (Abdalla et al., 2025; Liao et al., 2022).

Whereas most previous studies on the association between personality and non-suicidal self-injury have focused exclusively on the frequency of self-injurious behaviors, the present study also examined the automatic and social reinforcement functions of self-injury. Overall, the pattern of associations was very similar across frequency and both functional indicators. However, unlike the other indicators of self-injury, a statistically significant direct negative association emerged between extraversion and the social reinforcement function. One possible interpretation of this finding is that introverted adolescents may experience greater difficulty obtaining attention and support from others. For adolescents who engage in self-injury, these behaviors may therefore function as a way of obtaining the social reinforcement they need (Junker et al., 2019).

Finally, this study examined gender differences. Although no differences were found in the overall prevalence of self-injurious behaviors, boys reported a somewhat higher frequency of such behaviors than girls, which contrasts with studies reporting higher levels of non-suicidal self-injury among girls than boys (Gillies et al., 2018; Moloney et al., 2024). Moreover, regarding the functions of self-injury, the social reinforcement function was more frequent among boys than among girls, whereas no differences were found for the automatic reinforcement function. This suggests that the emotion regulation function of self-injury is similar for boys and girls, although boys may be more likely to engage in self-injury to obtain social benefits (e.g., attention from others) or to avoid negative social situations (e.g., to avoid having to do something they did not want to do). However, the effect sizes were small, and these differences should therefore be interpreted with caution. Finally, although the path from effortful control to depression was not statistically significant in girls, the overall model examining the associations among the variables were similar for girls and boys, indicating that the pattern of relationships between personality, depressive symptoms, and self-injury did not differ by gender. In other words, the role of personality traits in depressive symptoms and non-suicidal self-injury was similar for boys and girls. Previous studies have also found invariance in the associations between depression and self-injury in adolescent samples (Cal-

vete et al., 2026), and the present study extends this finding to the association between personality and self-injury.

The present study has several limitations. First, its cross-sectional design prevents conclusions about the direction of the relationships among the variables. Future research should replicate this study using a longitudinal design to formally test whether depression acts as a mediating variable between personality and self-injury. The design should include at least three waves (Maxwell et al., 2011). Second, the use of self-report measures may have introduced social desirability or recall biases. Third, the Cronbach's alpha coefficient of the effortful control measure was low. Although we conducted sensitivity analyses in which we replicated all study models using a shortened version of the measure that showed acceptable internal consistency, future research should employ more robust measures of effortful control or even include measures of executive functions. Fourth, although the initial selection of schools was random, only half agreed to participate, meaning that the final sample represents a convenience sample. This limitation should be considered when interpreting the results, particularly with regard to their external validity. Fifth, a high proportion of parents did not return the informed consent form, which prevented their children from participating in the study. It is possible that the families who did not respond may have differed in parenting practices relevant to the study variables, which could have led to a self-selection bias. Finally, the study considered only depression as an explanatory variable in the relationship between personality traits and non-suicidal self-injury. Future research should also examine the role of other relevant variables, such as emotion regulation (Liao et al., 2022), perceived stress, and coping strategies (Kiekens et al., 2015).

In conclusion, the findings of the present study highlight the role of three important personality traits in non-suicidal self-injury among adolescents and the role of depressive symptoms in the relationship between personality and self-injury. These results support the development of preventive and intervention programs targeting adolescents with high levels of neuroticism, low extraversion, or low effortful control. Such programs could focus on strengthening emotion regulation strategies that may help prevent or reduce depressive symptomatology and, consequently, lower the risk of self-injury.

Conflict of Interest

The authors declare no conflict of interest.

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