



The Mediating Role of Depression Severity on the Relationship Between Suicidal Ideation and Self-Injury in Adolescents With Major Depressive Disorder

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Objectives: Suicide is the leading cause of death among adolescents in South Korea, and depression and personality profiles have been identified as significant risk factors for self-injurious behavior. This study examined the influence of depressive mood and temperament/character on self-injury in adolescents.

Methods: A total of 116 adolescents (aged 12–18 years) with a primary diagnosis of major depressive disorder (MDD) and their parents were enrolled in this study. The participants were divided into three groups based on adolescent's self-injury frequency, and their Children's Depression Inventory (CDI), Youth Self-Report (YSR), and Temperament and Character Inventory (TCI) scores were compared. Finally, mediation analysis was conducted to investigate the relationship between suicidal ideation and self-injury.

Results: Of study participants, 75.9% answered that they had suicidal ideation, and 55.2% answered that they had engaged in self-injurious behavior in the last six months. There were significant differences in CDI and suicidal ideation among the groups. After adjusting for age and sex, mediation analysis indicated that depressive mood mediated the relationship between suicidal ideation and self-injury.

Conclusion: This study emphasizes the importance of evaluating and managing depressive mood severity in adolescents with MDD as these factors partially mediate the transition from suicidal ideation to self-injury.

Keywords: Depression; Suicidal ideation; Self-injurious behavior.

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INTRODUCTION

Suicide is a serious concern that poses a burden to individuals, families, and the public health system. More than 700000 people die by suicide globally, and it is estimated that more than 20 times as many people attempt suicide [1,2]. The suicide rates in South Korea remain far above those in any other OECD country (23.5 vs. 10.9 deaths per 100000 in the age-standardized death rate in 2020), although the rates have declined since 2011 (31.7 deaths per 100000) [3]. Teenagers also showed particularly high suicide rates. The World Health Organization reported suicide as the second leading cause of death among teenagers aged 10–19 years [3]. From 2017 to 2020, suicide rates of adolescents aged 10–19 years in South

Korea have increased from 4.7 to 6.5 deaths per 100000 population, making suicide a leading cause of death since 2011 [3].

Suicide could result from a combination of genetic liability and a history of early trauma or psychiatric disorders, and it is often triggered by negative life events. With respect to psychological factors, approximately 90% of suicide attempters have more than one psychiatric disorder, with mood disorders being the most common [4]. Foley et al. [5] argued that depression is the most correlated diagnostic factor proximal to suicide attempts among youth and adolescents. Several studies [6,7] have suggested that depressive mood can also activate negative cognition among vulnerable populations, and subsequent dysfunctional outcomes such as suicide attempts may be reactivated by recurrent depressive episodes. Moreover, adolescent depression may impair academic performance and the achievement of important developmental milestones such as autonomy and independence.

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Some studies [8,9] have explored the relationship between adolescents' personality and suicidal behavior (or self-injury). Recent research has focused on differences in the Temperament and Character Inventory (TCI) scores among suicidal adolescents. Novelty seeking (NS), one of the temperament dimensions, is related to the impulsivity of taking risks or displaying exploratory behavior, which was higher in adolescents in the suicidal group than in the non-suicidal group [10]. In a study of qualitative interviews with adolescents who had attempted suicide, the timeframe of suicidal thoughts and actually acting on them did not take more than 10 minutes for impulsive individuals [11]. Bae et al. [12] included non-suicidal self-injury and suicidal attempt groups in their study and reported high levels of NS, harm avoidance (HA), and low self-directedness (SD) in these groups.

Previous research has investigated the differences in the characteristics of adolescent depression [13,14] and temperament/character profiles [10,12] between groups or identified risk factors for self-injury. However, little is known about how such factors affect the transition from suicidal ideation to self-injury among adolescents. Suicidal ideation is a significant risk factor for both suicide and suicide attempts among teenagers. As not all adolescents with suicidal ideation lead to suicide attempts, it is necessary to identify and intervene with relevant risk factors to prevent self-injury.

As depressive mood and personality traits have been identified as risk factors for suicidal ideation and attempts in previous studies, these factors are likely to affect the process from suicidal ideation to self-injury. We hypothesized that depressive mood severity and temperament/character of adolescents contribute to this suicidal process.

METHODS

Participants

This study retrospectively reviewed data gathered from adolescents aged 12–18 years and their parents who visited the outpatient departments of psychiatry at Soonchunhyang University Seoul Hospital and Konkuk University Hospital from January 2014 to August 2021. A total of 350 adolescents and their parents, comprising 113 from Soonchunhyang University Hospital and 236 from Konkuk University Hospital, were recruited; 136 adolescents with a primary diagnosis of major depressive disorder (MDD) were selected based on structured clinical interviews using the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) criteria. Finally, we included 116 participant pairs in the analysis, whereas 20 were excluded because of missing data such as the Child Behavior Checklist (CBCL), Youth Self-Report (YSR), and TCI and having a primary diagnosis other than MDD. This

study was approved by the Institutional Review Boards of Soonchunhyang University Seoul Hospital (2021-09-002) and Konkuk University Medical Center (KUMC 2021-08-033). Informed consent was not required from the participants owing to the retrospective nature of the study design.

Measures

Children's Depression Inventory (CDI)

The CDI is a self-report scale widely used to assess depressive symptoms in children aged 7–17 years by modifying the Beck Depression Inventory. The scale consists of 27 items, and each item is graded from 0 (absence of symptoms) to 2 (definite symptoms), with higher scores indicating more severe depressive symptoms. The items were summed up to obtain a total score ranging from 0 to 54. Our study used the Korean version of the CDI to represent adolescent's depressive mood, which has been reported to have good internal consistency (Cronbach's $\alpha=0.88$).

CBCL and YSR

The CBCL and YSR are parallel instruments developed by Achenbach and Rescorla [15] to evaluate children's emotional and behavioral problems. The CBCL involves a parents' report of their child, whereas the YSR is based on the child's self-report and comprises eight problem behavioral syndrome scales and three competency scales. The Korean versions of the CBCL and YSR were translated and standardized by Oh et al. [16] and their validity and reliability have been previously established. The CBCL and YSR consist of 120 and 119 items, respectively, and the versions for children or adolescents aged 6–18 years were used in this study. Each question was evaluated on a three-point Likert scale of 0 ("never true"), 1 ("sometimes true"), and 2 ("often true").

The participants were asked to answer each item based on their experiences in the last six months. Specifically, we considered CBCL item 91 ("He/She talks about suicide") as 'child's suicidal ideation reported by parents' ('Idea_P') and item 18 ("He/She intentionally harms himself/herself or attempts suicide") as 'child's self-injury reported by parents' ('Inj_P'). Similarly, YSR item 91 ("I think about suicide") was coded as 'child's suicidal ideation reported by child' ('Idea_C') and item 18 ("I harm myself or attempt suicide on purpose") as 'child's self-injury reported by child' ('Inj_C'). Participants who answered "never" in Inj_C were referred to as Group I, "sometimes" as Group II, and "often" as Group III. In this study, we referred to self-injury as a concept that includes both non-suicidal self-injury and suicide attempts.

TCI

The TCI is a self-administered questionnaire developed to evaluate temperament and character dimensions according to Cloninger's unified biopsychological model [17]. Temperament is characterized by its genetic properties as an automatic response to emotional stimulation and is not related to culture or society. In contrast, character reflects differences in self-concept regarding goals and values consciously pursued by individuals as a result of interaction between the family environment and life experience, along with temperament. This comprises four temperaments (NS, HA, reward dependence [RD], and persistence [P]) and three characteristics (SD, cooperativeness [C], and self-transcendence [ST]). Our study used the Korean Junior Temperament and Character Inventory developed for adolescents aged 12–18 years, standardized with acceptable internal consistency (Cronbach's $\alpha=0.65-0.82$) [18]. The test consists of 82 items, with each item scored on a four-point Likert scale ranging from 0 ("do not agree") to 3 ("agree"). Item scores corresponding to each temperament and character were summed and calculated as percentiles.

Statistical analysis

Frequency and descriptive analyses were performed to

determine the general characteristics of the study sample. Subsequently, differences between the variables of the three groups divided by the child's self-injury reported by child (Inj_C) scores (Groups I, II, and III) were analyzed using chi-square tests for categorical variables and ANOVA or Kruskal-Wallis test for continuous variables. We subsequently conducted post hoc analyses using the Bonferroni test for variables proven to be significant to further elucidate the orderly differences between groups. To evaluate the relationships between adolescent's depressive mood and parent-adolescent reports of adolescent's suicidal ideation or self-injury, we performed Spearman's correlation analysis, as several variables were nonparametric. Finally, a mediation analysis using SPSS macro PROCESS v4.0 (Model 4 with 5000 bootstraps) was performed to evaluate the mediating effect of depressive mood on the relationship between adolescent's suicidal ideation and self-injury. Age and sex were entered as covariates into the mediation model. The effect was considered significant if the 95% confidence interval (CI) did not include zero.

All statistical analyses were performed using IBM SPSS Statistics for Windows version 25 (IBM Corp., Armonk, NY, USA), and statistical significance was set at $p<0.05$.

Table 1. Comparison of demographic and clinical characteristics of participants

| | Total (n=116) | Child's self-injury reported by child (Inj_C) | | | p-value | Post-hoc test |
|---|-------------------|---|--------------------------------|-----------------------------|-----------|---------------|
| | | Never (Group I) (n=52) | Sometimes (Group II) (n=38) | Often (Group III) (n=26) | | |
| Age [†] | 16.0 (14.0, 17.0) | 16.0 (14.6, 17.0) | 16.0 (14.0, 17.0) | 15.0 (14.0, 15.0) | 0.613 | |
| Sex [§] | | | | | 0.003** | |
| Male | 44 (37.9) | 28 (53.8) | 12 (31.6) | 4 (15.4) | | |
| Female | 72 (62.1) | 24 (46.2) | 26 (68.4) | 22 (84.6) | | |
| CDI [‡] | 25.2±8.2 | 21.2±8.1 | 27.3±6.4 | 30.4±7.0 | <0.001*** | I<II=III |
| TCI | | | | | | |
| NS [†] | 45.8 (18.0, 70.8) | 41.1 (18.0, 65.0) | 46.8 (17.7, 78.0) | 55.3 (16.0, 73.8) | 0.796 | |
| HA [†] | 75.0 (50.0, 93.0) | 69.0 (33.8, 90.0) | 79.5 (55.7, 93.0) | 79.5 (57.6, 95.8) | 0.194 | |
| RD [†] | 30.5 (10.0, 60.0) | 39.0 (10.3, 62.1) | 21.8 (10.0, 60.0) | 30.9 (10.1, 54.8) | 0.658 | |
| P [†] | 18.0 (3.0, 53.0) | 27.0 (2.8, 54.0) | 12.5 (2.4, 41.0) | 10.0 (5.0, 49.8) | 0.591 | |
| SD [†] | 18.0 (4.0, 47.7) | 31.8 (7.3, 65.6) | 16.0 (1.7, 30.1) | 11.0 (2.0, 47.6) | 0.043* | I=II=III |
| C [†] | 46.2 (17.0, 76.0) | 46.8 (23.0, 76.0) | 40.0 (13.3, 70.0) | 63.0 (11.5, 81.3) | 0.827 | |
| ST [†] | 15.0 (5.5, 49.9) | 20.1 (6.8, 44.8) | 18.4 (4.9, 50.3) | 12.0 (3.8, 32.1) | 0.383 | |
| Child's suicidal ideation reported by child (Idea_C) [§] | | | | | <0.001*** | |
| Never | 28 (24.1) | 25 (48.1) | 3 (7.9) | 0 (0) | | |
| Sometimes | 46 (39.7) | 19 (36.5) | 22 (57.9) | 5 (19.2) | | |
| Often | 42 (36.2) | 8 (15.4) | 13 (34.2) | 21 (80.8) | | |

Data are shown as n (%) for sex, mean±standard deviation for CDI, and median (interquartile range) for the other variables. * $p<0.05$; ** $p<0.01$; *** $p<0.001$; [†]Kruskal-Wallis test; [‡]ANOVA (analysis of variance); [§]chi-square test. A post hoc test was performed using the Bonferroni's test. Idea_C, Child's suicidal ideation reported by child; Inj_C, Child's self-injury reported by child; CDI, Children's Depression Inventory; TCI, Temperament and Character Inventory; NS, novelty seeking; HA, harm avoidance; RD, risk dependence; P, persistence; SD, self-directedness; C, cooperativeness; ST, self-transcendence

RESULTS

Among the 116 adolescent-parent pairs included in this study, 44 (37.9%) were male and 72 (62.1%) were female, with a median (interquartile range) age of 16.0 (14.0, 17.0). Among the adolescent participants, 88 (75.9%) answered that they had suicidal ideation and 64 (55.2%) answered that they had self-injurious behavior in the past six months. The number of adolescents in Groups I, II, and III was 52 (44.8%), 38 (32.8%), and 26 (22.4%), respectively, and the differences in variables between these three groups are shown in Table 1. There were no group differences in age and TCI, excluding SD, whereas the proportion of sex ($p=0.003$) and Idea_C ($p<0.001$), as well as CDI ($p<0.001$) and SD ($p<0.043$) scores, were significantly different between the groups. Post-hoc analyses revealed that there were no significant differences in CDI between Groups II and III ($p<0.290$), but there were significant group differences between Groups I and II ($p<0.001$) and Groups I and III ($p<0.001$). However, differences

Table 2. Spearman's correlations of variables compared to depressive mood of child (CDI)

| Spearman's rho coefficient | Parent's report | | Child's report | |
|--------------------------------|-----------------|-----------|----------------|-----------|
| | Idea_P | Inj_P | Idea_C | Inj_C |
| Depressive mood of child (CDI) | 0.025 | 0.265 | 0.417 | 0.358 |
| p-value | 0.739 | <0.001*** | <0.001*** | <0.001*** |

*** $p<0.001$. Idea_P, Child's suicidal ideation reported by parents; Inj_P, Child's self-injury reported by parents; Idea_C, Child's suicidal ideation reported by child; Inj_C, Child's self-injury reported by child; CDI, Children's Depression Inventory

Table 3. Total, direct, and indirect effects of depressive mood on the relationship between Idea_C and Inj_C

| Effect | β | SE | 95% CI |
|-------------------------|---------|-------|-------------|
| Total effect | 0.581 | 0.081 | 0.421–0.740 |
| Direct effect (c') | 0.486 | 0.091 | 0.306–0.666 |
| Indirect effect (a × b) | 0.095 | 0.049 | 0.008–0.202 |

SE, standard error; CI, confidence interval; Idea_C, Child's suicidal ideation reported by child; Inj_C, Child's self-injury reported by child

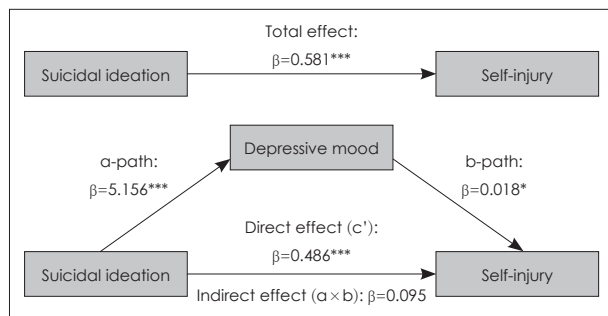


Fig. 1. The mediating effect of depressive mood on relationships between suicidal ideation and self-injury reported by child. Age and sex were adjusted as covariates. * $p<0.05$; *** $p<0.001$.

in SD were not significant among the groups.

Table 2 shows the correlations between CDI and scores of Idea_P, Inj_P, Idea_C, and Inj_C, where all scores, except Idea_P, were found to be significantly correlated (Idea_P: $\rho=0.025$, $p=0.739$; Inj_P: $\rho=0.265$, $p<0.001$; Idea_C: $\rho=0.417$, $p<0.001$; Inj_C: $\rho=0.358$, $p<0.001$).

Finally, CDI, the independent variable that showed a significant difference among the Inj_C groups in Table 1, was selected as the possible mediating variable. Idea_C significantly affected CDI (a-path; $\beta=5.156$, $p<0.001$), and CDI significantly affected Inj_C (b-path; $\beta=0.018$, $p=0.036$), indicating the mediating effect of CDI on the relationship between Idea_C and Inj_C (Table 3 and Fig. 1). Although the total effect (c-path) in the relationship between Idea_C and Inj_C was $\beta=0.581$ ($p<0.001$), the mediation effect of CDI remained significant even after it was entered into the model, and the direct effect consequently decreased (c'-path; $\beta=0.486$, $p<0.001$). Additionally, an indirect effect was tested using bootstrapping, where the lower and upper limits of the 95% CIs (0.008, 0.202) did not include zero (Table 3).

DISCUSSION

One of the main goals of our study was to explore the risk factors that influence suicidal ideation and self-injury among adolescents. We focused on the severity of adolescents' depressive mood, which was found to differ among the self-injury groups. To understand the mechanisms underlying this factor, we assessed whether depressive mood mediates the relationship between suicidal ideation and self-injury among adolescents. We highlight the following main findings of our study: 1) adolescents' self-reported depressive mood was inconsistent with the parents' reports and 2) depressive symptoms mediate the transition from suicidal ideation to self-injury among adolescents.

First, self-reported depressive mood in adolescents did not correlate with parental reports of adolescents' suicidal ideation. Since Richters et al. [19] reviewed the depression-distortion hypothesis, in which reports on children's emotional, behavioral, and social problems are prone to be distorted, considerations have been made on the factors that cause discrepancies in parent-child reports on such problems. Problem behavior in children and adolescents can be classified as "internalizing" and "externalizing." Internalizing behavior reflects emotional and psychological conditions, including depression, anxiety, somatic symptoms, and suicidal ideation. Studies have revealed that depressive symptoms in mothers [20] and adolescents [21] could contribute to reporting bias.

Conversely, externalizing behavior refers to disruptive,

hyperactive, and aggressive behaviors, including suicidal attempts by adolescents, that negatively respond to the external environment. Adolescents' externalizing behavior has been reported to have less parent-adolescent discrepancy than internalizing behavior [22], suggesting a relative difficulty in detecting suicidal ideation by parents compared to suicide attempts. The results of our study are in line with those of previous studies that reflect the differences between internalizing and externalizing behaviors. There was a lack of significant association between depressive symptoms in adolescents and adolescents' suicidal ideation as reported by parents. Our findings imply that reports of adolescents themselves, rather than those of parents, can provide a better understanding of internalizing problems such as depressive mood in adolescents.

Our results showed that adolescents' depressive mood and suicidal ideation were related to the frequency of self-injurious behaviors. This is consistent with previous studies [13,14,23,24], in which both depressive mood and suicidal ideation of adolescents were found to be correlated with suicide attempts, with a predictive value for future suicidal behaviors in longitudinal studies. However, none of the TCI dimensions revealed significant group differences in self-injury among the subjects. These results were unexpected because several studies have pointed out a relationship between temperament/character profiles and self-injury. Subjects with high HA are viewed as pessimistic, chronically worried, and anxious in unfamiliar situations. In addition, self-injury is known to be correlated with low SD, which is characterized by immaturity, unreliability, and poor coping skills with low impulse control [25]. Meanwhile, high HA and low SD are not simply changes seen in suicidal groups but are also correlated with groups of MDD [26]. It is possible that the scores are affected by a 'scarring effect' that the experience of depressive episodes can impact self-esteem and self-concept, thus elevating HA and lowering SD, even in subjects in the current euthymic state [27]. Therefore, the presence of past depressive episodes may have lowered the differences in the TCI. Future research should investigate the relationships between TCI profiles and teenage suicidality by controlling for the experience of depressive episodes and medication history, or by comparing them with healthy populations.

Finally, the severity of depressive symptoms among adolescents mediates the transition from suicidal ideation to self-injury. The relationship between suicidal behaviors and age and sex in adolescents is well known. The prevalence of suicide attempts in adolescence increases through mid-adolescence, then dropping thereafter, and female adolescents tend to have higher rates of suicide attempts than their male peers [28,29]. After adjusting for age and sex in our media-

tion analyses, it is interesting to note that the mediating effect of self-reported depressive mood remained significant. To the best of our knowledge, no study has focused on the mediating effect of depressive mood on the association between suicidal ideation and self-injury in adolescents. It is important to note that the mediating variable, depressive mood, indicates the psychological process underlying the transition from suicidal ideation to self-injury. Depressive symptoms in adolescents are known to differ from those in adults. Because irritability, social withdrawal, and poor concentration are more frequently reported [30], they often have complaints of suicidal ideation while not recognizing a depressive mood. Clinicians should be concerned not to underestimate these depressive symptoms in adolescents, considering that it is one of the modifiable factors in preventing self-injurious behavior if in-time therapeutic intervention is made. Future studies may yield meaningful results by reproducing our results, probably in various groups of participants. Since there are limited studies exploring other possible psychological factors with mediating effects in adolescents, it is necessary to investigate these factors or compare them with parents' reports to better understand the process of consequent self-injurious behavior.

Our study had some limitations. First, due to the cross-sectional nature of our study, the causal relationship between depressive symptoms or temperament/character and suicide risk could not be clearly identified. Second, all measures used in the analyses were based on self-reports, which may be insufficient to reflect objective behavior. Third, our findings cannot be generalized to all adolescents as the participants were recruited from only two hospitals in South Korea. Finally, we could not fully consider the characteristics (e.g., duration and severity) of suicidal ideation and self-injury. Concerning self-injury, item 18 of the CBCL and YSR used in our study includes both intentional suicide attempts and non-suicidal self-injuries. There is evidence that non-suicidal self-injury could be a powerful predictor of suicide attempts, and that suicide attempters tend to have more severe psychological symptoms than patients with non-suicidal self-injury [12], thus leaving possibilities for analyzing heterogeneous patients within groups in our study. However, there are controversies over differentiating the two terms, because they often lack consistency in the intention and fatality of self-injuries.

CONCLUSION

Despite the limitations of this study, we found that depressive symptoms and suicidal ideation in adolescents with MDD were positively correlated with self-injurious behaviors, and that the relationship between suicidal thoughts and behavior

was partially mediated by the severity of depressive mood. To prevent suicide attempts in adolescents with MDD, it is necessary to identify the depressive symptoms and proceed to early treatment.

Availability of Data and Material

The datasets generated or analyzed during the study are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

Author Contributions

Conceptualization: Hong Jun Jeon, Yeon Jung Lee. Data curation: all authors. Formal analysis: Byungjoo Kang, Yeon Jung Lee. Funding acquisition: Byungjoo Kang, Yeon Jung Lee. Investigation: Byungjoo Kang, Hong Jun Jeon, Yeon Jung Lee. Methodology: Byungjoo Kang, Hong Jun Jeon, Yeon Jung Lee. Supervision: Sang-Woo Hahn. Writing—original draft: Byungjoo Kang. Writing—review & editing: Byungjoo Kang, Hong Jun Jeon, Yeon Jung Lee.

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