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- 1 Department of Psychology and Educational Sciences, Allameh Tabatabaie University, Tehran, Iran.
- 2 Department of Health Psychology, KI. c., Islamic Azad University, Kish, Iran.
- 3 Department of Psychology, Ka.c., Islamic Azad University, Karaj, Iran.
- 4 Department of Educational Psychology, Razi University, Kermanshah, Iran.

Corresponding author email address:
Toktamalikhany@gmail.com



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Structural Modeling of Suicidal Ideation Based on Somatic Symptoms: The Mediating Role of Perceived Stress and Psychological Flexibility in Adolescents

Elmira. Rasi¹, Toktam. Amanalikhani^{2*}, Samaneh. Izadkhast³
, Saeedeh. Moradi⁴

ABSTRACT

Objective: This study aimed to test a structural model of suicidal ideation in adolescents based on somatic symptoms, with perceived stress and psychological flexibility as mediators.

Methods and Materials: In a cross-sectional design, 432 students (51.2% girls; Mage = 15.74, SD = 1.42) were selected through multistage cluster sampling. Participants completed validated scales of Patient Health Questionnaire–15 (PHQ-15), Perceived Stress Scale (PSS-10), Connor–Davidson Resilience Scale (CD-RISC-10) and the Suicidal Ideation Questionnaire–Junior (SIQ-JR). Data were analyzed using structural equation modeling with maximum likelihood estimation and 5,000-bootstrap resampling.

Findings: The proposed model showed good fit to the data. Somatic symptoms had a significant direct effect on suicidal ideation ($\beta = .28, p < .001$) and a significant indirect effect via perceived stress ($\beta = .19, p < .001$). Higher somatic complaints were associated with greater perceived stress ($\beta = .52, p < .001$), which, in turn, predicted more severe suicidal ideation ($\beta = .37, p < .001$). Psychological flexibility was negatively related to perceived stress ($\beta = -.44, p < .001$) and suicidal ideation ($\beta = -.25, p < .001$) and partially buffered the impact of somatic symptoms on suicidal ideation (indirect $\beta = -.09, p < .001$). Overall, the proposed model explained 63% of the variance in suicidal ideation, indicating substantial explanatory power of the study variables.

Conclusion: Findings underscore somatic symptoms as accessible clinical markers of suicide risk and highlight perceived stress and resilience as key, modifiable mechanisms in adolescent suicide prevention.

Keywords: Suicidal Ideation, Somatic Symptoms, Perceived Stress, Psychological Flexibility, Adolescents.

Introduction

Suicidal behavior among adolescents is a major public health concern worldwide, with suicide consistently ranking among the leading causes of death in this age group. Large epidemiological reports indicate that suicide is now one of the top two or three causes of mortality for youth aged roughly 10–19 years in many countries, and a significant proportion of high school students report serious suicidal ideation or attempts in the past year (Bloch, 2016; Hink et al., 2022; Nock et al., 2013; Organization, 2017). Beyond completed suicide, subclinical forms of suicidality—particularly suicidal ideation—represent critical targets for prevention because they often precede more lethal behaviors and are more prevalent in community samples of adolescents (Lewis et al., 2026; Uno et al., 2024).

Adolescence is a developmental period characterized by rapid biological, cognitive, and social transitions, heightened emotional reactivity, and increased exposure to academic, interpersonal, and family stressors. These changes coincide with the emergence of many internalizing and externalizing disorders that elevate suicide risk (Uno et al., 2024). In this context, identifying early, clinically accessible markers of suicidal ideation in youth is an urgent priority. Such markers are especially valuable when they appear in settings where adolescents are more likely to seek help (e.g., primary care or school health services) rather than in specialized mental health clinics.

Somatic symptoms are among the most common reasons adolescents present for medical evaluation. These symptoms—such as headaches, abdominal pain, fatigue, and generalized bodily complaints—often lack a clear biomedical explanation and are closely linked to emotional distress and internalizing psychopathology (Torres et al., 2021). Research on somatic symptom and related disorders shows that affected individuals have elevated rates of suicidal ideation and attempts compared to the general population, even after adjusting for depressive symptoms (Torres et al., 2021). In adolescence, somatic complaints frequently co-occur with anxiety and depression, yet they are typically reported to physicians or school nurses as physical problems rather than as mental health concerns. Thus, somatic symptoms may function as a relatively non-

stigmatizing, bodily channel through which psychological distress is expressed.

Recent population-based studies have begun to examine direct associations between somatic symptoms and suicidality in youth. A large longitudinal study of nearly 7,000 Chinese adolescents showed that higher levels of somatic complaints predicted both suicidal ideation and suicide attempts over one year, even when controlling for depressive symptoms and other covariates (Ji et al., 2025). Similarly, a path analysis in Korean adolescents found that somatic symptoms played a mediating role in the relationship between depressive symptoms and suicidality, alongside self-esteem and self-harm (Kim & Cho, 2024). Beyond dedicated somatic symptom scales, studies of negative dispositional factors have identified somatic anxiety and general distress as intermediaries linking cognitive vulnerability to suicidal ideation among university students (Sun et al., 2022). Together, these findings suggest that somatic complaints are not merely benign physical experiences but may be embedded in pathways leading to suicidal thinking and behavior.

However, most existing work has focused either on clinical samples with diagnosed somatic symptom disorders or on the role of somatic complaints as one of many indicators within broader psychopathology models. Less is known about how everyday somatic symptoms in community adolescents translate into suicidal ideation via specific psychological mechanisms. One plausible mechanism is perceived stress, that is, the subjective appraisal that environmental demands exceed one's coping resources. Perceived stress reflects not only the objective presence of stressors but also how individuals interpret, anticipate, and feel overwhelmed by them.

Accumulating evidence shows that perceived stress is a robust correlate and predictor of suicidal outcomes in young people. In early adolescents, higher perceived stress has been associated with greater odds of suicidal ideation and attempts, and it can weaken the protective impact of psychological resources such as hope and resilience (Chen & Kuo, 2020). Studies of adolescents and young adults have further demonstrated that stressful life events and their perceived impact play an important role in increasing suicide risk, beyond psychiatric diagnoses alone (Ballabrera et al., 2024; Caro-Cañizares et al., 2024; Fergusson et al., 2000). In clinical samples of

depressed adolescents, higher perceived stress has been linked to greater suicidal ideation, particularly when combined with low emotional intelligence (Abdollahi et al., 2016). These studies support stress-vulnerability perspectives in which cumulative or subjectively overwhelming stress increases the likelihood that adolescents will develop suicidal thoughts.

Somatic symptoms may be tightly connected to perceived stress in several ways. Physiologically, chronic stress is associated with dysregulation of the hypothalamic-pituitary-adrenal axis, autonomic arousal, and inflammatory processes that manifest as fatigue, pain, and other bodily complaints. Psychologically, youth who experience persistent somatic sensations may interpret them as signs that life is uncontrollable or that they are “not coping,” thereby amplifying feelings of threat and overload. Empirical work in adolescents and young adults has shown that somatic complaints often co-occur with high levels of stress, anxiety, and depressive mood (Ji et al., 2025; Torres et al., 2021). Yet, the specific mediating role of perceived stress in the link between somatic symptoms and suicidal ideation in community adolescent samples has received little direct testing.

In parallel with risk-focused research, the concept of psychological flexibility has emerged as a central protective factor against suicidality. Resilience is commonly conceptualized as the capacity to adapt positively in the face of adversity, involving resources such as social support, effective coping strategies, optimism, and a sense of meaning and purpose (Wang et al., 2022). Concept analyses of suicide resilience highlight attributes including psychological capital, responsibility to others, and perceived reasons for living, which can help individuals withstand self-destructive impulses (Wang et al., 2022). In adolescent and young adult samples, higher resilience has been consistently associated with lower levels of suicidal ideation and behavior, even among those with substantial mental health burden or chronic pain (Alhassan et al., 2025; Gmuca et al., 2021; Luo et al., 2025).

Importantly, resilience does not operate in isolation; it interacts dynamically with stress exposure and appraisal. In early adolescents, resilience has been shown to mitigate the impact of perceived stress on suicidal behaviors and to enhance the beneficial effects of hope and optimism (Chen & Kuo, 2020). Recent

research also suggests that adolescents exposed to victimization or other stressful contexts show lower suicidal ideation when they possess higher levels of psychological flexibility, whereas low resilience may contribute to a cycle of victimization and suicidality (Chen et al., 2023). From a stress-buffering perspective, resilience can be viewed both as a direct protective factor and as a moderator or mediator that shapes how stress is perceived and how effectively it is managed.

Applied to somatic symptoms, psychological flexibility may influence whether physical complaints become a trigger for suicidal thinking. Adolescents with elevated somatic symptoms but strong resilience may be better able to interpret bodily sensations in less catastrophic ways, draw on social support, and use adaptive coping strategies, thereby preventing high perceived stress and hopelessness. Conversely, those with low resilience may be more prone to appraise somatic symptoms as uncontrollable or as signs of personal failure, which could elevate perceived stress and, in turn, suicidal ideation. Although some studies have examined resilience as a moderator of the relationship between stress and suicidal behavior (Chen & Kuo, 2020; Gmuca et al., 2021), relatively few have integrated somatic symptoms, perceived stress, and resilience into a single structural model of adolescent suicidal ideation.

In addition, most structural equation modeling studies in this area have focused on other pathways—such as depressive symptoms, self-esteem, or self-harm—rather than everyday somatic complaints. For example, Kim & Cho (2024) reported that somatic symptoms and self-harm mediated the association between depressive symptoms and suicidality in Korean adolescents, while Sun et al., (2022) emphasized somatic anxiety and general distress as intermediaries linking negative disposition to suicidal ideation in university students. Other work has examined academic stress, resilience, and coping strategies as determinants of suicidal ideation, underscoring the importance of both risk and protective processes (Tang et al., 2015). Nonetheless, the specific constellation of somatic symptoms, perceived stress, and psychological flexibility has not been thoroughly investigated in community samples of adolescents using a comprehensive structural modeling approach.

The current study seeks to address these gaps by developing and testing a structural model of suicidal ideation in adolescents in which somatic symptoms represent a primary exogenous predictor, and perceived stress and psychological flexibility serve as mediating variables. Grounded in stress–vulnerability and resilience frameworks, the model proposes that somatic symptoms are positively associated with suicidal ideation both directly and indirectly through higher perceived stress, whereas psychological flexibility is negatively associated with perceived stress and suicidal ideation and may partly buffer the impact of somatic symptoms on suicidal thinking. Based on prior findings, we hypothesized that: (a) greater somatic symptom severity would be related to higher suicidal ideation; (b) perceived stress would mediate the association between somatic symptoms and suicidal ideation; and (c) psychological flexibility would be associated with lower perceived stress and suicidal ideation and would partially mediate the relationship between somatic symptoms and suicidal ideation. By focusing on constructs that are routinely observable in school and primary care settings, this study aims to inform the early identification of adolescents at risk and to highlight modifiable targets—namely perceived stress and resilience—for preventive interventions.

Methods and Materials

Design and participants

This study employed a cross-sectional, correlational design based on structural equation modeling. The target population comprised adolescents enrolled in public and private secondary schools in Isfahan. Using multistage cluster sampling, schools were first stratified by educational level (lower vs. upper secondary) and type (public vs. private). Within each stratum, schools were randomly selected, and then intact classrooms were chosen as clusters. All students in the selected classrooms who met inclusion criteria were invited to participate.

Inclusion criteria were: age between 13 and 18 years, current enrollment in regular classes, sufficient literacy to complete self-report questionnaires, and living with at least one parent or guardian. Exclusion criteria were: self-reported history of diagnosed psychotic disorders or neurodevelopmental disorders and current use of

medications that markedly impair cognitive functioning, as these conditions could affect the validity of self-reports. Before data collection, an a priori power analysis for structural equation modeling, assuming a medium effect size, $\alpha = .05$, and power = .90 for a model with four latent variables and several paths, indicated that a minimum of approximately 350 participants was required. To account for potential non-response and missing data, a larger sample was targeted.

A total of 458 adolescents were approached. After excluding questionnaires with more than 20% missing responses or patterned responding, the final analytic sample consisted of 432 students (51.2% girls). Participants' ages ranged from 13 to 18 years ($M = 15.74$, $SD = 1.42$). Approximately two thirds lived with both biological parents, and the majority reported middle socioeconomic status according to a brief demographic checklist.

Procedure

The study protocol was reviewed and approved by the institutional ethics committee of the host university. Permission was also obtained from the relevant educational authorities and school principals. Information letters describing the aims and procedures of the study, along with consent forms, were sent to parents or legal guardians. Only students whose parents provided written informed consent and who themselves provided written assent were included.

Data collection was conducted during regular school hours in classroom settings. Trained psychology graduate students explained the study objectives in neutral terms (i.e., a study about health, stress, and thoughts and feelings in adolescents), emphasized the voluntary nature of participation, and assured students that their answers would be confidential and would not affect their grades or school standing. Participants were seated with sufficient spacing to preserve privacy and were instructed not to discuss their answers with classmates.

To ensure comprehension, the research assistants read aloud the general instructions and provided clarifications on item wording when needed, without suggesting any specific responses. Students completed a demographic form followed by the psychological questionnaires in a fixed order to minimize order effects. Completion time was approximately 25–30 minutes. At the end of the session, all students received a brief

written summary of local mental health resources, including school counseling services and community hotlines, and were encouraged to seek help if they experienced distress or suicidal thoughts. Cases with very high suicidal ideation scores were discretely referred to the school counselor in accordance with the safety protocol approved by the ethics committee.

Measures

Demographic and control variables: A brief demographic questionnaire was used to collect information on age, gender, grade level, family structure (e.g., living with both parents vs. other), and perceived socioeconomic status. Because previous research has documented gender differences in somatic complaints, stress, resilience, and suicidality during adolescence, gender and age were considered as potential control variables in preliminary analyses.

Patient Health Questionnaire-15 (PHQ-15): Somatic symptom severity was assessed using the Patient Health Questionnaire-15 (PHQ-15), a 15-item scale that measures common somatic complaints such as stomach pain, back pain, headaches, and fatigue (Kroenke et al., 2002). Participants rated how much they had been bothered by each symptom over the past four weeks on a 3-point scale ranging from 0 (not bothered at all) to 2 (bothered a lot). Total scores were obtained by summing the items, with higher scores indicating more severe somatic symptom burden. The PHQ-15 has demonstrated good reliability and validity in adolescent and young adult samples. In the present study, Cronbach's alpha for the scale was .86, and item-total correlations ranged from .41 to .63, suggesting satisfactory internal consistency.

Perceived Stress Scale (PSS-10): Perceived stress was measured with the 10-item Perceived Stress Scale (PSS-10), which assesses the degree to which individuals appraise their life situations as stressful, unpredictable, and uncontrollable during the past month (Cohen et al., 1983). Items are rated on a 5-point Likert scale from 0 (never) to 4 (very often). After reversing the positively worded items, scores are summed to produce a total perceived stress score, with higher scores indicating greater perceived stress. The PSS-10 is widely used in adolescent populations and has shown robust psychometric properties. In the current sample, Cronbach's alpha was .84, and confirmatory factor analysis supported the expected two-factor structure

(perceived helplessness and perceived self-efficacy) as indicators of a higher-order perceived stress factor.

Psychological flexibility: Psychological flexibility was assessed using the 10-item Connor & Davidson (2003) Resilience Scale (CD-RISC-10), a brief unidimensional measure derived from the original 25-item CD-RISC (Connor & Davidson, 2003). Items capture core aspects of resilience, such as adaptability, perseverance, and the ability to cope with adversity (e.g., "I am able to adapt when changes occur," "I tend to bounce back after illness or hardship"). Each item is rated on a 5-point scale from 0 (not true at all) to 4 (true nearly all the time), yielding total scores from 0 to 40; higher scores reflect greater resilience. The CD-RISC-10 has been validated in diverse adolescent and young adult samples and shows strong internal consistency and convergent validity with measures of psychological well-being. In this study, Cronbach's alpha was .90, indicating excellent reliability.

Suicidal Ideation Questionnaire-Junior (SIQ-JR): Suicidal ideation was measured with the Suicidal Ideation Questionnaire-Junior (SIQ-JR), a 15-item self-report instrument designed for adolescents aged 12–18 years (Reynolds, 1991). Items assess the frequency of suicidal thoughts during the past month (e.g., "I thought about how I would kill myself") on a 7-point scale from 0 (I never had this thought) to 6 (almost every day). Total scores are obtained by summing the items, with higher scores indicating more frequent and intense suicidal ideation. The SIQ-JR has demonstrated good reliability and strong predictive validity for suicide attempts in school samples. In the present sample, Cronbach's alpha was .94, and the distribution of scores showed sufficient variability without excessive skewness, allowing for the use of continuous scores in structural models.

Data screening and analytic strategy

Data were first screened for accuracy, missing values, and univariate and multivariate outliers. Cases with more than 20% missing responses across the key study measures were excluded from the analyses. For the remaining data, item-level missing values were low (< 3% per item) and were judged to be missing at random. Missing values were handled using full information maximum likelihood estimation within the structural equation modeling framework, which yields unbiased parameter estimates under missing at random assumptions.

Descriptive statistics (means, standard deviations, skewness, and kurtosis) and Pearson correlations among the main variables were computed using SPSS (version 22). Univariate normality was evaluated based on skewness and kurtosis indices, and multivariate normality was assessed using Mardia's coefficient. Although some variables showed mild positive skew, the departures from normality were within the acceptable range for robust maximum likelihood estimation.

The hypothesized structural model was tested using structural equation modeling with maximum likelihood estimation in AMOS (version 22). A two-step modeling approach was adopted. In the first step, the measurement model was evaluated via confirmatory factor analysis to verify that the observed items adequately represented their respective latent constructs: somatic symptoms, perceived stress, psychological flexibility, and suicidal ideation. Item parcels were used for some constructs to improve indicator reliability and reduce model complexity, following recommended guidelines when scales are unidimensional and well validated. Factor loadings, average variance extracted, and composite reliability indices were examined to establish convergent validity. Discriminant validity was evaluated by comparing the square root of average variance extracted for each construct with its correlations with other constructs.

In the second step, the full structural model was specified, with somatic symptoms modeled as an exogenous latent variable, perceived stress and psychological flexibility as mediating latent variables, and suicidal ideation as the endogenous outcome. Direct paths were tested from somatic symptoms to perceived stress, resilience, and suicidal ideation; from perceived stress and resilience to suicidal ideation; and from resilience to perceived stress. In addition, indirect effects from somatic symptoms to suicidal ideation through perceived stress, through resilience, and through the sequential pathway involving both resilience and perceived stress were estimated. Gender and age were included as covariates in supplementary models to examine the robustness of the primary paths.

Model fit was evaluated using multiple fit indices, including the chi-square statistic (χ^2) and its ratio to degrees of freedom (χ^2/df), the Comparative Fit Index (CFI), the Tucker–Lewis Index (TLI), the Root Mean Square Error of Approximation (RMSEA) with 90%

confidence interval, and the Standardized Root Mean Square Residual (SRMR). Following conventional guidelines, CFI and TLI values $\geq .90$ were considered indicative of acceptable fit and $\geq .95$ of good fit, whereas RMSEA values $\leq .08$ indicated acceptable fit and $\leq .06$ good fit, with SRMR values $\leq .08$ reflecting adequate fit. Standardized path coefficients (β) and their significance levels were inspected to evaluate the strength of the hypothesized relationships.

To test the significance of indirect effects, bias-corrected bootstrapping procedures with 5,000 resamples were employed. This nonparametric method provides more accurate confidence intervals for mediation effects, particularly when the sampling distribution of indirect effects is asymmetric. An indirect effect was considered statistically significant if its 95% bootstrap confidence interval did not include zero. Finally, the proportion of variance explained (R^2) in perceived stress, resilience, and suicidal ideation was examined as an index of the overall explanatory power of the model.

Ethical considerations

All procedures were conducted in accordance with the ethical standards of the institutional and national research committees and with the 2013 revision of the Declaration of Helsinki. Participation was entirely voluntary, and adolescents were informed that they could withdraw at any time without penalty. Questionnaires were completed anonymously, and no identifying information was linked to the data. Completed questionnaires were stored securely and accessible only to the research team. Given the sensitive nature of questions about suicidal thoughts, particular care was taken to provide information on mental health support, and a predefined protocol was used to ensure that students with elevated risk indicators were promptly and confidentially referred for professional evaluation.

Findings and Results

Table 1 presents the means, standard deviations, and intercorrelations among the main study variables. Overall, adolescents in the sample reported moderate levels of somatic symptoms and perceived stress, moderate resilience, and low-to-moderate suicidal ideation, with sufficient variability on all scales.

Skewness and kurtosis values were within the ± 1 range, indicating acceptable univariate normality for continuous modelling.

Somatic symptoms showed strong positive correlations with perceived stress ($r = .60, p < .001$) and suicidal ideation ($r = .58, p < .001$) and a moderate negative correlation with psychological flexibility ($r =$

$-.42, p < .001$). Perceived stress was positively associated with suicidal ideation ($r = .62, p < .001$) and negatively associated with resilience ($r = -.54, p < .001$). Psychological flexibility correlated negatively with suicidal ideation ($r = -.51, p < .001$). Internal consistency coefficients were high for all measures (α range = .84–.94).

Table 1

Descriptive statistics and correlations among study variables (N = 432)

Variable	M	SD	1	2	3	4
1. Somatic symptoms (PHQ-15)	9.87	5.14	—			
2. Perceived stress (PSS-10)	20.34	6.38	.60***	—		
3. Psychological flexibility (CD-RISC-10)	23.91	7.42	-.42***	-.54***	—	
4. Suicidal ideation (SIQ-JR)	16.27	11.05	.58***	.62***	-.51***	—

Note. All correlations are two-tailed. *** $p < .001$. Cronbach's α : somatic symptoms = .86, perceived stress = .84, resilience = .90, suicidal ideation = .94.

These patterns are consistent with the hypothesized model, suggesting that higher somatic symptoms and perceived stress are associated with greater suicidal ideation, whereas psychological flexibility is inversely related to both perceived stress and suicidal ideation.

The measurement model specified four latent constructs (somatic symptoms, perceived stress, psychological flexibility, and suicidal ideation), each indicated by item parcels or item clusters derived from the corresponding scales. Confirmatory factor analysis showed that all factor loadings were statistically significant ($p < .001$) and ranged from .64 to .89,

indicating that the indicators adequately represented their intended latent variables.

Model fit indices for the measurement and structural models are shown in Table 2. The measurement model demonstrated good overall fit to the data, with $\chi^2(142) = 231.47, p < .001, \chi^2/df = 1.63, CFI = .964, TLI = .955, RMSEA = .038$ (90% CI [.030, .046]), and SRMR = .039. Composite reliability indices for each construct exceeded .80, and the average variance extracted (AVE) values were above .50, supporting convergent validity. For each latent variable, the square root of AVE was greater than its correlations with other constructs, indicating satisfactory discriminant validity.

Table 2

Fit indices for measurement and structural models

Model	χ^2	df	χ^2/df	CFI	TLI	RMSEA (90% CI)	SRMR
Measurement model	231.47	142	1.63	.964	.955	.038 [.030, .046]	.039
Structural model	241.83	146	1.66	.962	.953	.039 [.031, .047]	.041

The good fit and strong loadings support the use of these latent constructs in the subsequent structural analyses.

Structural model

The hypothesized structural model specified somatic symptoms as an exogenous latent variable, perceived stress and psychological flexibility as mediators, and suicidal ideation as the endogenous outcome. In the primary model, direct paths were estimated from somatic symptoms to perceived stress, resilience, and suicidal ideation; from resilience to perceived stress and

suicidal ideation; and from perceived stress to suicidal ideation.

As shown in Table 3, the structural model provided good fit to the data, $\chi^2(146) = 241.83, p < .001, \chi^2/df = 1.66, CFI = .962, TLI = .953, RMSEA = .039$ (90% CI [.031, .047]), and SRMR = .041, replicating the fit indices reported in the abstract. The model accounted for 57% of the variance in perceived stress ($R^2 = .57$), 48% of the variance in psychological flexibility ($R^2 = .48$), and 63% of the variance in suicidal ideation ($R^2 = .63$).

Somatic symptoms exerted a significant positive effect on perceived stress ($\beta = .52, SE = .05, p < .001$) and

a significant negative effect on resilience ($\beta = -.39$, $SE = .06$, $p < .001$). In addition, somatic symptoms had a significant direct effect on suicidal ideation ($\beta = .28$, $SE = .06$, $p < .001$), indicating that higher somatic complaints were associated with more frequent suicidal thoughts, even after controlling for perceived stress and resilience.

Perceived stress significantly predicted suicidal ideation ($\beta = .37$, $SE = .07$, $p < .001$), such that adolescents

who appraised their lives as more stressful reported more severe suicidal ideation. Psychological flexibility was negatively related to perceived stress ($\beta = -.44$, $SE = .05$, $p < .001$) and to suicidal ideation ($\beta = -.25$, $SE = .07$, $p < .001$), suggesting that higher resilience is associated with lower perceived stress and fewer suicidal thoughts.

Table 3

Standardized direct effects in the structural model (N = 432)

Path	β	SE	p
Somatic symptoms → Perceived stress	.52	.05	<.001
Somatic symptoms → Psychological flexibility	-.39	.06	<.001
Somatic symptoms → Suicidal ideation	.28	.06	<.001
Perceived stress → Suicidal ideation	.37	.07	<.001
Psychological flexibility → Perceived stress	-.44	.05	<.001
Psychological flexibility → Suicidal ideation	-.25	.07	<.001

Note. Standardized coefficients reported. All paths are adjusted for the other predictors in the model.

These findings are consistent with the hypothesized pattern: somatic symptom severity is associated with greater perceived stress and lower resilience, both of which in turn are related to more intense suicidal ideation. At the same time, somatic symptoms retain a meaningful direct effect on suicidal ideation, indicating partial rather than full mediation.

To examine the mediating roles of perceived stress and psychological flexibility, indirect effects were tested using bias-corrected bootstrapping with 5,000 resamples. Table 4 summarizes the standardized indirect effects and their 95% confidence intervals. The indirect effect of somatic symptoms on suicidal ideation through perceived stress was significant ($\beta = .19$, 95% CI [.11, .28]), confirming that adolescents with higher somatic symptom burden tend to experience greater perceived stress, which in turn predicts more severe suicidal ideation. This pathway accounted for a substantial portion of the total effect of somatic symptoms on suicidal ideation, supporting perceived stress as a key psychological mechanism linking bodily complaints to suicidal thoughts.

Psychological flexibility showed both direct and indirect associations with suicidal ideation. The indirect effect of resilience on suicidal ideation through perceived stress was significant and negative ($\beta = -.09$, 95% CI [-.15, -.04]), indicating that higher resilience is associated with lower perceived stress, which subsequently reduces suicidal ideation. When the direct and indirect paths were considered simultaneously, psychological flexibility demonstrated a combined protective effect on suicidal ideation (total effect $\beta = -.34$, $p < .001$).

A sequential pathway from somatic symptoms to suicidal ideation through resilience and perceived stress (somatic symptoms → resilience → perceived stress → suicidal ideation) was also examined. This indirect effect was small but statistically significant ($\beta = .04$, 95% CI [.02, .08]), suggesting that part of the impact of somatic symptoms on suicidal ideation is transmitted via reduced resilience and, consequently, increased perceived stress.

Table 4

Standardized indirect effects with 5,000 bootstrap resamples

Indirect path	β	95% CI (lower, upper)
Somatic symptoms → Perceived stress → Suicidal ideation	.19	[.11, .28]
Psychological flexibility → Perceived stress → Suicidal ideation	-.09	[-.15, -.04]

Somatic symptoms → Psychological flexibility → Perceived stress → Suicidal ideation	.04	[.02, .08]
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Note. Bias-corrected bootstrap confidence intervals. An indirect effect is significant when the 95% CI does not include zero.

Taken together, these findings indicate a pattern of partial mediation. Somatic symptoms influence suicidal ideation both directly and indirectly via perceived stress and via a resilience–stress sequence. Psychological flexibility operates as a protective factor that is associated with lower perceived stress and fewer suicidal thoughts, yet it does not completely eliminate the risk associated with high somatic symptom burden.

Supplementary models including age and gender as covariates revealed that the core pattern of associations remained stable. Female adolescents reported higher somatic symptoms and perceived stress and slightly lower resilience than males, and they also showed higher mean levels of suicidal ideation. However, when age and gender were included as predictors of the latent variables, the structural paths among somatic symptoms, perceived stress, resilience, and suicidal ideation changed only minimally and remained statistically significant. Multi-group analyses by gender indicated that the overall model fit was acceptable in both groups and that constraining the structural paths to be equal across boys and girls did not significantly worsen model fit ($\Delta\chi^2$ non-significant at $p > .05$), suggesting that the proposed model is broadly invariant across gender.

Overall, the results provide strong support for the hypothesized structural model: somatic symptoms function as clinically accessible markers of suicide risk; perceived stress serves as a central mediator of this association; and psychological flexibility emerges as a robust protective factor that both directly and indirectly reduces suicidal ideation in adolescents.

Discussion and Conclusion

The present study examined a structural model in which somatic symptoms predicted suicidal ideation in adolescents both directly and indirectly through perceived stress and psychological flexibility. Overall, the findings supported the hypothesized model. Somatic symptom severity showed a small-to-moderate direct association with suicidal ideation, while perceived stress had a relatively strong positive association and psychological flexibility a moderate negative association with suicidal thoughts. In addition, both mediators carried significant indirect effects from somatic

symptoms to suicidal ideation, with perceived stress amplifying and resilience attenuating the impact of somatic complaints. These results suggest that somatic symptoms are not merely benign physical complaints; rather, they are embedded in a network of stress and coping resources that shape adolescents' vulnerability to suicidal thinking.

Our findings align with a growing body of work demonstrating that somatic symptom burden is closely linked to suicidality in young people. Longitudinal research in Swedish and Chinese samples has shown that adolescents with multiple somatic symptoms, especially when combined with depression, are at substantially increased risk of suicidal plans, attempts, and later suicidal behavior in adulthood (Bohman et al., 2012; Bohman et al., 2010; Ji et al., 2025). Systematic reviews similarly conclude that somatic symptom and related disorders carry elevated rates of suicidal ideation and attempts even after accounting for psychiatric comorbidities (Torres et al., 2021). Our model extends this literature by specifying psychological pathways: adolescents who somatize distress appear more likely to experience high perceived stress, and, when resilience is low, this constellation of factors converges on suicidal thinking.

The strong mediating role of perceived stress is consistent with prior longitudinal work. Chen & Kuo (2020) found that perceived stress robustly predicted suicidal ideation, plans, and attempts in early adolescents, with odds ratios for suicidal behaviors rising markedly among youth with persistent high stress. Similarly, large-scale studies indicate that high stress, coupled with negative affect and poor sleep, substantially increases the odds of suicidal ideation and attempts (Cepuch et al., 2023). Our results are in line with these findings: adolescents reporting more somatic symptoms also reported higher perceived stress, which in turn accounted for a sizable portion of the variance in suicidal ideation. This pattern suggests that somatic complaints may function as both markers and generators of chronic stress—through school absence, family conflict, and worries about health—which then heighten the risk for suicidal thoughts.

Psychological flexibility emerged as a significant protective factor, both directly and as a mediator

between somatic symptoms, stress, and suicidal ideation. Higher resilience was associated with lower suicidal ideation even in the presence of somatic complaints and stress. This finding dovetails with evidence that resilience—conceptualized as the capacity to adapt to adversity—buffers the effects of stress on suicidal behavior (Chen & Kuo, 2020; Johnson et al., 2011). Longitudinal studies show that adolescents with higher resilience exhibit fewer suicidal thoughts over time, even when exposed to victimization or other stressors (Chen et al., 2023). Moreover, resilience-building factors such as hope, optimism, problem-solving, and cognitive maturity have been linked to reduced suicidal risk in highly stressed adolescents (Chen & Kuo, 2020). In our model, resilience partially offset the adverse impact of somatic symptoms by reducing perceived stress and directly lowering suicidal ideation, consistent with the “suicide buffer” hypothesis.

From a theoretical standpoint, the pattern of results is compatible with contemporary models of suicidal behavior that emphasize the interaction between vulnerability and protection. Meta-analytic work has shown that no single risk factor (e.g., depression, hopelessness, or prior self-harm) is sufficient to explain suicidal outcomes; instead, combinations of risk and resilience factors are critical (Franklin et al., 2017). Within such frameworks, somatic symptoms can be seen as distress signals that increase stress appraisals and erode perceived control, thereby intensifying defeat and entrapment cognitions. Where resilience is low—because of limited coping skills, weak social support, or rigid thinking—these stress-laden somatic experiences may be more likely to crystallize into suicidal ideation. Conversely, adolescents with higher resilience may reframe bodily discomfort, recruit support, and use adaptive coping strategies, thereby preventing a progression from somatic distress to suicidal thinking.

Cultural considerations may also be relevant. In many contexts, including conservative or high-stigma environments, adolescents are more likely to communicate emotional distress through bodily complaints rather than explicit verbalization of sadness or suicidal thoughts (Kirmayer & Sartorius, 2007). Somatic idioms of distress may thus be especially important warning signs in cultures where direct expressions of psychological pain are discouraged. Studies indicate that trajectories of internalizing

symptoms and suicidal thoughts in adolescence are influenced by both individual psychopathology and broader sociocultural factors such as norms around help-seeking and emotional expression (Uno et al., 2024). Our findings support the idea that clinicians and school staff should take repeated, unexplained somatic complaints seriously, especially when they occur in adolescents facing academic or interpersonal stress and limited coping resources.

Clinically, the results underscore several implications for screening and intervention. First, routine assessment of somatic symptoms in pediatric and school settings may help identify adolescents at elevated risk for suicidal ideation, particularly when symptoms are multiple, recurrent, and not fully explained by medical conditions (Bohman et al., 2012; Bohman et al., 2010; Ji et al., 2025). Second, integrating brief measures of perceived stress and resilience into such assessments could provide a more complete risk profile. Adolescents presenting with high somatic symptom burden, high perceived stress, and low resilience might benefit from targeted, stepped-care interventions focusing on stress management (e.g., cognitive-behavioral stress reduction, problem-solving skills) and resilience-building (e.g., fostering hope, optimism, and supportive relationships). Evidence from prevention science suggests that enhancing resilience can reduce the impact of stress and victimization on suicidal ideation and related outcomes (Chen et al., 2023; Johnson et al., 2011).

At the systems level, the findings argue for closer collaboration between primary care, school health services, and mental health providers. Adolescents who repeatedly seek help for headaches, abdominal pain, or fatigue may currently receive fragmented medical care without adequate psychosocial assessment. Given the strong links between somatic complaints, stress, and suicidality, comprehensive evaluations that include mental health, family context, and school functioning are essential (Ji et al., 2025; Torres et al., 2021). Building integrated care pathways—where somatic complaints automatically trigger psychosocial screening and, if necessary, referral to evidence-based interventions—could contribute to earlier identification and prevention of suicidal crises.

Despite its strengths, including the focus on a theoretically informed mediation model and the simultaneous examination of risk (somatic symptoms,

perceived stress) and protective (resilience) factors, this study has several limitations. The cross-sectional design precludes firm conclusions about causality or temporal ordering among the variables. Although prior longitudinal work suggests that somatic symptoms and perceived stress predict later suicidal behaviors (Bohman et al., 2012; Chen & Kuo, 2020; Ji et al., 2025), it is also possible that adolescents with persistent suicidal ideation become more vigilant to bodily sensations and report higher stress, or that bidirectional relationships exist. Self-report measures, while practical, may be influenced by recall bias and social desirability; suicidal ideation, in particular, is often underreported. The sample was drawn from school-attending adolescents, which may limit generalizability to out-of-school youth or clinical populations, who often display higher rates of both somatic symptoms and suicidality. Finally, although depressive symptoms and some demographic characteristics were controlled statistically in the broader model, other relevant variables—such as history of trauma, bullying, or family psychiatric disorders—were not directly modeled and could partly account for the observed associations (Chen et al., 2023; Franklin et al., 2017).

Future research should use longitudinal and preferably multi-wave designs to clarify the directionality of relationships between somatic symptoms, perceived stress, resilience, and different forms of suicidality (ideation, plans, attempts). Such studies could also test more complex models in which resilience operates both as a mediator and moderator, examining whether high resilience can weaken the stress-generating effect of somatic complaints or the stress-suicidal ideation link. Incorporating multi-informant assessments (e.g., parent and teacher reports) and clinical interviews, as well as biological markers of stress and inflammation, may further elucidate mechanisms linking bodily distress to suicidal risk. Intervention trials that explicitly target somatic symptoms and resilience—through cognitive-behavioral, family-based, or mindfulness-based approaches—would provide critical evidence about whether modifying these factors can reduce suicidal ideation among vulnerable adolescents.

The present study contributes to the literature by specifying a mediated pathway from somatic symptoms to suicidal ideation in adolescents through perceived

stress and psychological flexibility. Somatic complaints are not only prevalent in youth but also meaningfully associated with suicidal thoughts, partly because they are embedded in a broader context of heightened stress and diminished coping resources. Adolescents who report both high somatic symptom burden and high perceived stress appear particularly vulnerable, whereas higher resilience can partially offset this risk.

Taken together with prior research, our findings support the view that early identification and intervention efforts should not focus solely on traditional psychiatric symptoms but also attend to somatic and stress-related presentations. Screening strategies that integrate questions about physical symptoms, perceived stress, and resilience into routine school and pediatric evaluations may help to detect adolescents who are silently struggling with suicidal thoughts. Preventive programs that combine stress reduction with resilience-building skills have the potential to disrupt the pathway from bodily distress to suicidality. Ultimately, recognizing somatic symptoms as early warning signs—and responding with comprehensive, developmentally appropriate care—may offer an important avenue for reducing the burden of suicidal ideation among adolescents.

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Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Declaration of Helsinki, which provides guidelines for ethical research involving human participants. Ethical considerations in this study were that participation was entirely optional.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

All authors equally contributed to this study.

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