Depression, Rumination, and Suicide Attempts in Adolescents With Mood Disorders:

Sex Differences in This Relationship

Dianying Liu, MD, PhD; Gang Lei, MD, PhD; Dian Li, MD; Hongdong Deng, MD; Xiang Yang Zhang, MD, PhD; and Yonghui Dang, MD, PhD

Abstract

Background: Sex differences in suicide attempts have been widely recognized across domains such as depression and rumination. The relationship between depression, rumination, and suicide attempts in mood disorders has been studied before; however, how they interact across sexes remains unclear. This study aimed to examine the sex differences in the relationship between depression, rumination, and suicide attempts in Chinese adolescents with mood disorders.

Methods: We recruited 681 adolescents with mood disorders who met ICD-10 criteria for having unipolar or bipolar depression with a current depressive episode at the time of the study and collected demographic and clinical data.

Results: The prevalence of suicide attempts in female adolescents with mood disorders (64.36%) was significantly higher than that in male adolescents with mood disorders (49.47%), with an odds ratio of 1.84 (95% CI, 1.31–2.59). Regression analysis showed that PHQ-9 was independently associated with suicide attempts among male adolescents with mood disorders, while in female adolescents with mood disorders, total scores of PHQ-9 and RRS-10 were independently associated with suicide attempts. Importantly, in female adolescents with mood disorders, the mediating effect of RRS-10 total score on the relationship between PHQ-9 and suicide attempts was significant (standardized $\beta = 0.005$, $P = 0.003$, 95% CI, 0.002–0.008), the mediating effect accounted for 31.25% of the total effect of depressive symptoms on suicide attempts.

Conclusions: Our study suggests that there are sex differences in depression, rumination, and suicide attempts and in the interaction between them in adolescents with mood disorders. These sex differences may have important clinical implications, both for improving strategies to detect suicidal behaviors and for developing better early intervention programs for this population.

J Clin Psychiatry 2024;85(3):23m15136

Author affiliations are listed at the end of this article.

Sex differences in suicidality have been widely recognized.[1,2] Numerous studies have found that suicidal thoughts and behaviors are higher in female adolescents than in male adolescents;[3,4] female adolescents were 1.7 times more likely than male adolescents to have suicidal thoughts and suicide attempts (SAs), but male adolescents were more likely than female adolescents to die by suicide.[5] Sociodemographic variables, genetic vulnerability,[6] and differing gender norms have been suggested as potential factors which may influence sex differences in suicide.[7,8] For example, recent literature suggests that vulnerability to depression may be rooted in a complex combination of genetic traits, normal female hormonal maturation processes, and gender socialization.[9] Furthermore, female adolescents are more vulnerable and have higher levels of guilt, hopelessness, and worse self-esteem than male adolescents when they are frustrated,[10] all of which could lead to an increase in suicidal thoughts or attempts.[9] In addition, aggression and extreme impulsivity are more prominent in male adolescents than in female adolescents, which directly contributes to their vulnerability to death by suicide.[11,12] However, the psychopathological mechanisms influencing sex differences in SAs remain unclear.

Editor's Note
We encourage authors to submit papers for consideration as a part of our Focus on Childhood and Adolescent Mental Health section. Please contact Karen D. Wagner, MD, PhD, at kwagner@psychiatrist.com.

Clinical Points

- The relationship between depression, rumination, and suicide attempts in adolescents with mood disorders has been studied before; however, how they interact across sexes in adolescents with mood disorders remains unclear.
- Among male adolescents with mood disorders, suicide attempts are primarily influenced by depressive symptoms. However, in female adolescents, depressive symptoms not only directly increase the risk of suicide attempts but also indirectly increase the risk of suicide attempts through increased rumination.

Sex differences in the risk factors for SAs may be explained by differences in rates of mental illness, particularly major depressive disorder.[13] In general, female adolescents are twice as likely to experience depression as male adolescents.[14] Further, the association between sex and SAs in adolescents is moderated by depressive symptoms.[13] Previous studies have shown that depressive symptoms are associated with SAs.[15,16] In contrast, a longitudinal study has found that depressive symptoms increased the risk of SAs only in female adolescents.[13] Hence, it is necessary to investigate whether sex differences really exist in the relationship between depression and suicide attempts, as well as the psychological mechanisms that lead to those differences.

Several studies have already indicated that females are more prone to negative cognitive biases.[17,18] Rumination is a typical pattern of negative cognitive responses, which refers to the tendency to repeatedly dwell on negative thoughts and feelings to distressing events.[19,20] Rumination includes 2 principal components: brooding and reflection.[21] Brooding refers to compare one's current situation to another unmet benchmark. In contrast, reflection refers to self-concern with the goal of solving a problem in response to depressed mood.[22] According to Nolen-Hoeksema response style theory,[19,20] ruminant response style prolongs grief, exacerbates negative emotions and negative cognition, increases self-focus on negative events, reinforces psychological distress, limits problem-solving behaviors, and leads to higher feelings of hopelessness and helplessness. Depression and rumination negatively reinforce each other like a snowball and increase suicidal tendencies.[23] In addition, rumination is strongly associated with impulsivity and increases the risk of suicidal behavior by weakening impulse control.[24] Previous studies[19,20] have suggested that females were more inclined to ruminate on their depressive symptoms and distress than males. Given sex differences in rumination may explain differences in the prevalence of depression and suicidality, clinical work should include rumination as part of their assessment of adolescents with depression. Furthermore, our recent study[25,26] has shown that rumination was positively associated with suicide attempts, and it fully mediated the relationship between depression and suicide attempts, but depression did not mediate the relationship between rumination and suicide attempts. Considering the significant sex differences in depression, rumination, and suicidality, it is unclear how they interact across sexes in adolescents with mood disorders.

To the best of our knowledge, no studies have explored whether there are sex differences in the relationship between depression, rumination, and suicide attempts in Chinese adolescents with mood disorders. Therefore, this study aimed to investigate sex differences in the following 3 areas: the prevalence of suicide attempts, risk factors for suicide attempts, and the inter-relationship between depression, rumination, and suicide attempts among adolescents with mood disorders.

METHODS

Subjects and Settings

A total of 681 adolescents with depressive episodes were recruited from the Third People's Hospital (a psychiatric hospital) in Ganzhou, China. The recruitment period was from October 2019 to September 2022. The inclusion criteria were as follows: (1) aged 11–18 years; (2) met the criteria of unipolar or bipolar depression, a current depressive episode as independently determined by 2 experienced psychiatrists and according to the *International Classification of Diseases, Tenth Revision* (*ICD-10*); and (3) had at least 5 years of compulsory education and were able to understand all questionnaires. The exclusion criteria were as follows: (1) patients with physical illness such as infection and/or acute central nervous system disorders; (2) other psychiatric disorders (eg, conduct disorder, mental retardation, attention deficit hyperactivity disorder, and/or schizophrenia); and (3) drug or alcohol addiction or dependence.

The Ganzhou Third People's Hospital Ethics Committee approved this study. All patients and their guardians were aware of the aims of the study and signed an informed consent form. The research was conducted entirely in accordance with the rules of the Declaration of Helsinki issued by the World Medical Association.

Measurement of Sociodemographic Variables

The sociodemographic variables we collected included sex assigned at birth, age, years of education, residence (urban, town, and rural), sibling status, living situation (2-parent families, 1-parent migrated, living

with grandparents, single-parent families, and others), and number of hospitalizations.

Suicide Attempts

Patients were assessed for suicide attempts using the MINI Suicide Scale, which is used widely and has good reliability.[27,28] Item 5 (*Have you attempted suicide in the last month?*) and item 6 (*Have you ever attempted suicide in your lifetime*?) assess whether suicide attempts have occurred in the last month or during the lifetime, respectively. If the answer to either item 5 or item 6 was "Yes," these subjects were classified as having attempted suicide (with SA) subgroup, others were classified as not having attempted suicide (without SA) subgroup. If there were any missing or unclear data related to the patient's suicide, the investigators undertook additional interviews with his or her family to clarify the information.

Depressive Symptoms

Depression severity was measured using a Chinese language version of the Patient Health Questionnaire-9 (PHQ-9), which consists of 9 items. Its reliability has been demonstrated across different countries and ethnic groups.[29,30] It estimated the severity of depression in the past 2 weeks using a 4-point scale. Total score was summed for each item response, with higher total score suggesting more severe depressive symptoms.

Rumination

Rumination was measured using the 10-item version of the Ruminative Response Scale (RRS-10).[19] The form consists of 2 factors: brooding and reflection. The Chinese version of the RRS-10 is widely used and has high internal reliability and good test-retest reliability.[31,32] The instrument's items use a Likert scale which ranges from "1" (almost never) to "4" (almost always). Total score was summed for each item response, with higher total score suggesting a greater preference for the RRS-10 response style.

Data Analysis

IBM SPSS for Windows (version 23.0) and jamovi. (version 1.8) were used for data analysis. Demographic and clinical variables were compared between male adolescents and female adolescents. Bonferroni corrections were used to adjust for multiple comparisons. First, the Shapiro–Wilk test was used to examine the normality of distribution for appropriate variables. Continuous variables were compared between males and females using independent samples *t*-test, and categorical variables were compared using χ^2 tests. Second, to compare sex differences in depressive symptoms and rumination in combined with or without suicide attempts subgroups, we used a 2 × 2 ANOVA, considering subgroup (without SA vs with SA) and sex (male vs female). The main effects of subgroup and sex, as well as the interaction between subgroup and sex, were examined. Third, one-way ANOVA was conducted to compare the clinical characteristics of adolescents with mood disorders across subgroups defined by the absence or presence of suicide attempts (without SA vs with SA), separately for males and females. Bonferroni correction was used to adjust for multiple comparisons. Binary logistic regression (forward stepwise Wald) was used to explore significant factors associated with suicide attempts in male adolescents and female adolescents, separately. Finally, the mediating effect of rumination on the relationship between depression and suicide attempts in female adolescents with mood disorders was evaluated using jamovi. (version 1.8). The PHQ-9 score was set as the independent variable, the RRS-10 total score as the mediating variable, and SAs as the dependent variable. Direct and indirect effects were measured with nonparametric weighting of a bootstrap sample of 5000.[33] A significant effect was defined as 1 that did not include 0 at the 95% CI. *P* values ≤ .05 (two-tailed) were considered to be statistically significant. Cronbach α was used to calculate the internal consistency or reliability of the scales used in this study. The Cronbach α for the MINI Suicide Scale was 0.811, the PHQ-9 was 0.918, and the RRS-10 was 0.928, respectively.

RESULTS

Sex Differences in the Prevalence of Suicide Attempts in Adolescents With Mood Disorders

Among adolescents with mood disorders, the rate of suicide attempts was 64.36% (316/491) for females and 49.47% (94/190) for males. This sex difference was statistically significant (odds ratio [OR] = 1.84, 95% CI, 1.31–2.59; $\chi^2 = 12.67$, $P < .001$) (Table 1).

Sex Differences in Demographic and Clinical Characteristics in Adolescents With Mood Disorders

There were significant sex differences in living situation among adolescents with mood disorders ($\chi^2 = 11.06$, $P = .026$). Compared to male adolescents, female adolescents living in single-parent families were more likely to have mood disorders (corrected *P*s all < .05). In addition, after controlling for living situation, compared to male patients, female patients were younger (15.80 ± 1.53 vs 15.03 ± 1.81, $t = 5.21$, $P < .001$) and scored significantly higher on the PHQ-9 (13.04 ± 7.46 vs 15.63 ± 7.38, $t = -4.09$, $P < .001$), RRS-10 total score (22.11 ± 6.36 vs 24.09 ± 6.53, $t = -3.57$, $P < .001$), brooding (11.45 ± 3.56 vs 12.83 ± 3.78, $t = -4.35$, $P < .001$), and reflection (10.66 ± 3.57 vs

Table 1.

Sex Differences in Demographics and Clinical Characteristics in Adolescents With Mood Disorders[a]

Variable	Male (n = 190, 27.90%)	Female (n = 491, 72.10%)	X^2/t	*P* value
Residence			1.01	.603
Urban, n (%)	33/190 (17.37)	89/491 (18.13)		
Town, n (%)	89/190 (46.84)	246/491 (50.10)		
Rural, n (%)	68/190 (35.79)	156/491 (31.77)		
Sibling status			1.28	.257
Yes, n (%)	29/190 (15.26)	59/491 (12.02)		
No, n (%)	161/190 (84.74)	432/491 (87.98)		
Living situation			11.06	.026
2-parent families, n (%)	111/190 (58.42)[a]	237/491 (48.27)[a]		
1-parent migrated, n (%)	35/190 (18.42)	98/491 (19.96)		
Living with grandparents, n (%)	32/190 (16.84)	83/491 (16.90)		
Single-parent families, n (%)	8/190 (4.21)[a]	44/491 (8.96)[a]		
Others, n (%)	4/190 (2.11)	29/491 (5.91)		
Suicide attempters			12.67	<.001
No, n (%)	96/190 (50.53)[a]	175/491 (35.64)[a]		
Yes, n (%)	94/190 (49.47)[a]	316/491 (64.36)[a]		
No of hospitalizations			0.63	.960
Outpatients, n (%)	13/190 (6.84)	36/491 (7.33)		
1, n (%)	130/190 (68.42)	336/491 (68.43)		
2, n (%)	31/190 (16.32)	71/491 (14.46)		
3, n (%)	9/190 (4.74)	27/491 (5.50)		
≥4, n (%)	7/190 (3.68)	21/491 (4.28)		
Age, mean (SD),y	15.80 ± 1.53	15.03 ± 1.81	5.21	<.001
PHQ-9 score, mean (SD)	13.04 ± 7.46	15.63 ± 7.38	−4.09	<.001
RRS-10 total score, mean (SD)	22.11 ± 6.36	24.09 ± 6.53	−3.57	<.001
Brooding, mean (SD)	11.45 ± 3.56	12.83 ± 3.78	−4.35	<.001
Reflection, mean (SD)	10.66 ± 3.57	11.26 ± 3.49	−1.99	.047

[a]Sex differences were significant, after Bonferroni corrections $P < .05$.
Abbreviations: PHQ-9 = Patient Health Questionnaire-9; RRS = Ruminative Response Scale.

11.26 ± 3.49, $t = -1.99$, $P = .047$). After Bonferroni corrections, sex differences remained significant for age, PHQ-9, RRS-10 total scores, and brooding (all Bonferroni corrected *P*s < .05/6 = .008), while the sex difference in reflection did not remain significant. There were no significant sex differences in residence, sibling status, and number of hospitalizations (all *P*s > .05) (Table 1).

Sex Differences in Depression and Rumination in Patients With and Without Suicide Attempts

A 2-way multivariate analysis of variance showed that there were significant subgroup and sex main effects in depressive symptoms [$F(1, 677) = 33.84$, $P < .001$; $F(1, 677) = 10.61$, $P = .001$], RRS-10 total score [$F(1, 677) = 28.10$, $P < .001$; $F(1, 677) = 7.52$, $P = .006$], and brooding [$F(1, 677) = 28.68$, $P < .001$; $F(1, 677) = 12.44$, $P < .001$], but in reflection, only the subgroup effects [$F(1, 677) = 16.59$, $P < .001$] were significant. In addition, the interaction effect was all not significant (all *P's* > .05).

Further, we analyzed depressive symptoms and rumination in male and female patients separately. In male patients, there were significant differences between patients with and without SA: depressive symptoms [$F(1, 188) = 10.71$, $P = .001$], RRS-10 total score [$F(1, 188) = 7.92$, $P = .005$], brooding [$F(1, 188) = 8.68$, $P = .004$], and reflection [$F(1, 188) = 4.22$, $P = .041$]. In female patients, analysis of covariance showed that there were significant differences in depressive symptoms [$F(1, 489) = 31.47$, $P < .001$], RRS-10 total score [$F(1, 489) = 29.47$, $P < 0.001$], brooding [$F(1, 489) = 29.02$, $P < .001$], and reflection [$F(1, 489) = 18.32$, $P < .001$] between with SA and without SA patients. Furthermore, all of these results passed the Bonferroni-corrected threshold ($\alpha = 0.05/4 = 0.0125$), except for reflection in male patients with SA and without SA (Table 2).

Sex Differences in Risk Factors Related to Suicide Attempts in Adolescents With Mood Disorders

After controlling for age and living style, binary logistic regression showed that PHQ-9 was independently associated with suicide attempts in male patients (OR = 1.050, 95% CI, 0.002–0.095, $P = .039$). While, in female patients, the total scores of PHQ-9 (OR = 1.055, 95% CI, 0.023–0.085, $P < .001$) and RRS-10

Table 2.

Two-Way MANOVA Analysis of Depression and Rumination Among Adolescents With Mood Disorders: Comparing Those With and Without SA, Grouped by Sex

Variable	Male (n = 190, 27.90%)[a]		Female (n = 491, 72.10%)[b]		Subgroup *F* (*P* value)	Sex *F* (*P* value)	Subgroup × sex *F* (*P* value)
	Without SA (n = 96)	With SA (n = 94)	Without SA (n = 175)	With SA (n = 316)			
PHQ-9, mean (SD)	11.33 (7.19)	14.79 (7.36)**	13.19 (7.07)	16.98 (7.21)###	33.85 (<.001)	10.61 (.001)	0.07 (.791)
RRS-10 total score, mean (SD)	20.84 (6.20)	23.39 (6.30)**	21.99 (6.44)	25.24 (6.30)###	28.10 (<.001)	7.52 (.006)	0.41 (.523)
Brooding, mean (SD)	10.71 (3.44)	12.20 (3.55)**	11.63 (3.85)	13.49 (3.57)###	28.68 (<.001)	12.44 (<.001)	0.35 (.554)
Reflection, mean (SD)	10.14 (3.47)	11.19 (3.61)*	10.37 (3.29)	11.75 (3.51)###	16.59 (<.001)	1.73 (.188)	0.30 (.584)

[a]Asterisks indicate statistically significant difference in male adolescents with mood disorders, comparing those without SA to with SA. *P < .05; **P < .01.
[b]Pound signs indicate statistically significant difference in female adolescents with mood disorders, comparing those without SA to with SA. ###P < .001.
Abbreviations: MANOVA = multivariate analysis of variance; PHQ-9 = Patient Health Questionnaire-9; RRS = Ruminative Response Scale; SA = suicide attempts.

Table 3.

Binary Logistic Regression Analysis of Determinants of SA in Male and Female Adolescents With Mood Disorders

Male adolescents with mood disorders						Female adolescents with mood disorders					
Predictor	***B***	**Wald**	***P***	**OR**	**95% CI**	**Predictor**	***B***	**Wald**	***P***	**OR**	**95% CI**
PHQ-9	0.07	9.84	.002	1.07	1.03–1.11	**PHQ-9**	0.05	10.45	.001	1.05	1.02–1.08
Constant	−0.87	7.90	.005	0.42		**RRS-10**	0.05	9.15	.002	1.06	1.02–1.09
						Constant	−1.42	13.88	<.001	0.24	

Abbreviations: OR = odds ratio; PHQ-9 = Patient Health Questionnaire-9, RRS = Ruminative Response Scale; SA = suicide attempts.

Table 4.

Analyzing the Mediating Effect of Rumination on the Depression-Suicide Attempt Relationship in Female Adolescents With Mood Disorders

				95% CI				
Effect	**Label**	**Estimate**	**SE**	**Lower**	**Upper**	**Z**	***P***	**% Mediation**
Indirect	a × b	0.005	0.002	0.002	0.008	2.99	.003	31.25
Direct	c’	0.011	0.003	0.005	0.017	3.37	< .001	68.65
Total	c’ + a × b	0.016	0.003	0.010	0.022	5.62	< .001	100.0

(OR = 1.058, 95% CI, 0.021–0.092, P = .002) were independently associated with suicide attempts (Table 3).

The Mediating Effect of Rumination on the Relationship Between Depression and Suicide Attempts in Female Adolescents With Mood Disorders

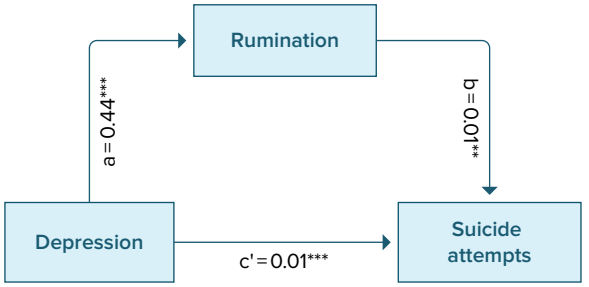
In female patients, after controlling for living style, the mediating effect analysis found a significant indirect effect of rumination on the relationship between depression and suicide attempts (standardized β = 0.005, 95% CI, 0.002–0.008, P = .003). In addition, the direct effect of depression on suicide attempts (standardized β = 0.011, 95% CI, 0.005–0.017, P < .001) was also significant. The mediating effect accounted for 31.25% of the total effect of depression on suicide attempts (Table 4). Path analysis showed the depression positively predicted rumination (a = 0.44, 95% CI, 0.375–0.511, P < .001) and suicide attempts (c′ = 0.01, 95% CI, 0.005–0.017, P < .001), and rumination positively predicted suicide attempts (b = 0.01, 95% CI, 0.004–0.019, P = .002) (Figure 1).

DISCUSSION

To the best of our knowledge, our study provides the first support for sex differences in the relationship between depression, rumination, and suicide attempts in Chinese adolescents with mood disorders. The main findings included (1) female adolescents with mood disorders had a higher prevalence of suicide attempts

Figure 1.

A Model of Rumination's Mediating Effect on Depression and Suicide Attempts in Female Adolescents with Mood Disorders



Statistically significant, $^{**}P < .01$, $^{***}P < .001$.

than males; (2) in male patients, the risk factor for suicide attempts was the severity of depression, while in female patients, the main risk factors for suicide attempts were the severity of depression and rumination; (3) rumination had a mediating effect on the relationship between depression and suicide attempts in females, but not in males.

Sex Differences in the Prevalence of Suicide Attempts in Adolescents With Mood Disorders

We found significant sex differences in the prevalence of suicide attempts (female adolescents 64.36% vs male adolescents 49.47%). This finding is consistent with previous studies which have shown a higher prevalence of suicide attempts in female adolescents.[3,34] For example, a study showed that female adolescents had higher lifetime rates of suicidal thoughts, plans, and attempts than male adolescents.[2] Evidence from a recent survey of the Nationwide Inpatient Sample database in the United States found that female adolescents with unipolar depression and bipolar depression were more likely to have attempted suicide than males (OR 1.13, 95% CI, 1.09–1.16).[35] However, other previous study has shown that male adolescents have a higher suicide mortality rate than females.[11] Similarly, a prior study showed that 76% of those who died by suicide were males.[5] Compared to female adolescents, male adolescents tend to use more lethal suicide methods (ie, firearms, suffocation, poisoning, and hanging).[2] Conversely, female adolescents have higher rates of suicidal thoughts, plans, and attempts,[2] which may be related to biological sex differences or sex-based differences in socialization and gender norms.[17] Morphological studies have found sex differences in several areas of the brain that are important for cognitive processing and emotional responses.[36] A prior magnetic resonance imaging study[37] revealed that the same cognitive task led to unilateral left brain activation in males and bilateral activation in females. These brain activation patterns may imply that female cognitive processing might be more nuanced and less constrained compared to males. Additionally, during challenging situations, females may consider a broader array of factors and strive for balance, potentially leading to a more comprehensive evaluation. Furthermore, cultural values may constrain female adolescents against suicide deaths and male suicide attempts. Nonfatal suicidal behaviors in female adolescents are interpreted as a call for help.[38] Male adolescents, in contrast, would lack the freedom to express frustration or distress through suicide attempts, resulting in more direct suicide mortality.[39,40]

Sex Differences in Depression and Rumination in Adolescents With Mood Disorders

We also found that there were significant sex differences in depressive symptoms in adolescents with mood disorders, as female adolescents had more severe depressive symptoms than male adolescents. This result is consistent with previous findings, which showed that female adolescents were more likely to exhibit typical depressive symptoms, while male adolescents were more likely to exhibit anger, irritability, and alcohol abuse.[41,42] These sex differences may be due to differences in traditional sex and gender norms, as male gender norms stigmatize depression, leading to underestimation of depressive symptoms or underreporting of typical depressive symptoms.[43] Coping styles are another factor that may contribute to sex differences in depressive symptoms and suicide attempts. During periods of depression, males are often observed to avoid addressing the problem directly, instead resorting to coping mechanisms such as alcohol consumption and physical activity. In contrast, females frequently internalize their depressive feelings, engaging in prolonged contemplation about its causes and effects, such as rumination. This approach can potentially exacerbate and prolong depressive symptoms[22,44,45] and increase suicidality.[22,46] Our present study confirmed that female adolescents with mood disorders had a greater tendency to engage in global rumination and brooding than male adolescents, both in the attempted suicide subgroup and the nonattempted suicide subgroup, but there were no sex-based differences in reflection in either subgroup. These results were consistent with Burwell and Shirk findings[47] that brooding, but not reflection, can predict the development of depressive symptoms over time, particularly for female adolescents. In addition, other previous researches have also indicated that females ruminate more than males.[48,49] Differences in coping styles may be another factor contributing to sex differences in suicide attempts among adolescents with mood disorders.

Sex Differences in the Relationship Between Depression, Rumination, and Suicide Attempts in Adolescents With Mood Disorders

Notably, we found significant sex differences in the relationship between depressive symptoms and rumination and suicide attempts in adolescents with mood disorders. In male adolescents with mood disorders, only depressive symptoms predicted suicide attempts in this current study, whereas in female adolescents, depressive symptoms and global rumination were predictors of suicide attempts. Moreover, among female patients, rumination significantly and positively predicted suicide attempts, and rumination partially mediated the relationship between depression and suicide attempts. These results suggest that in female patients, depressive symptoms not only directly increase the risk of suicide attempts but also indirectly increase the risk of suicide attempts by increasing rumination. Thus, these findings indicate the relationship between depression, rumination, and suicide attempts is sex-specific in adolescents with mood disorders. This may be due to the psychological processes that underpin suicidal action are distinct between male and female adolescents. According to the response styles theory of depression,[19,50] females with depression are more likely to engage in rumination than males.[51] The ruminative response style tends to amplify and prolong periods of depression, impair motivation, inhibit instrumental behavior, and lead to poor problem-solving[19,20,50] and suicidality.[52] Furthermore, rumination is also considered cognitive vulnerability that can lead to aggressive behaviors, including aggression against oneself.[53] In addition, there is evidence that rumination mediates the relationship between sex and depressive symptoms, meaning that females reporting more depressive symptoms than males may be explained by their greater tendency to ruminate.[54] In conclusion, sex differences in the relationship between depression, rumination, and suicide attempts may be due to the fact that males and females have different psychopathological mechanisms which drive their responses to depression and suicidal behaviors. These differences need further exploration in the future.

Despite the clinical importance of our current study, there were still some methodological limitations. First, because of the cross-sectional design of the present study, the sex differences in suicide attempts, clinical symptoms, and rumination were only descriptive, and no causal inferences could be drawn. Longitudinal data during adolescent development could answer additional questions about how observed sex differences arise and inform future sex-specific interventions, which require additional research in the future. Second, because data on both depressive symptoms and rumination relied on self-report, our findings may have been subject to recall and response bias. Third, our study population was drawn from a psychiatric hospital and had an imbalance of male and female subjects. Future research should aim for a larger, more sex-balanced sample to improve the ecological validity or applicability of the findings to real-world settings. Fourth, we did not explore the relationship between suicide attempts risk, rumination, and depressive symptoms with these gender-related concepts, especially among transgender or gender nonconforming adolescents. Therefore, more work needs to be performed on these particular populations to better identify the triggers. Fifth, the risk of suicide attempts in adolescents with mood disorders is related to other associated risk factors, such as school bullying and parental mental illness,[55] the measurement of which was beyond the scope of the present study. Sixth, adolescents with both unipolar and bipolar depression were included in this study. This may have important implications for both biological factors and cognitive models, which need to be clarified in future studies. Finally, the sample consisted of Chinese adolescents with mood disorders and did not include populations from other countries. The results of the present study may be influenced by differences in culture, and a cross-cultural comparative study should be conducted in the future.

In conclusion, our study confirms sex differences in depression, rumination, and suicide attempts among adolescents with mood disorders. To better understand these sex differences and develop appropriate interventions, future research should explore the potential mechanisms between depression, rumination, and suicide attempts. This requires multidisciplinary research across biology, psychology, and sociology. Biologically, sex differences might stem from variations in hormone levels and neural structures, which could influence emotional responses and coping styles. Moreover, sex-related differences in brain development and neural connectivity could impact adolescents' cognitive and emotional processes. Furthermore, social roles and cultural expectations may influence gender differences. Males and females often develop distinct self-identification and emotional expression methods during socialization. For instance, males often repress emotions, whereas females typically express them verbally. Therefore, preventing suicide in adolescents with mood disorders requires developing sex-specific interventions. For males, interventions should raise awareness of depressive symptoms, promote active help-seeking, and ensure access to professional psychological support. For females, strategies such as cognitive behavioral therapy or mindfulness may be effective in mitigating rumination and reducing the risk of suicide.

Article Information

Published Online: June 19, 2024. https://doi.org/10.4088/JCP.23m15136

Submitted: October 6, 2023; accepted March 27, 2024.

To Cite: Liu D, Lei G, Li D, et al. Depression, rumination, and suicide attempts in adolescents with mood disorders: sex differences in this relationship. *J Clin Psychiatry*. 2024;85(3):23m15136.

Author Affiliations: College of Medicine & Forensics, Xi'an Jiaotong University Health Science Center, Xi'an, China (Liu, Lei, Li, Dang); Ganzhou City Key Laboratory of Mental Health, The Third People's Hospital of Ganzhou City, Ganzhou, China (Liu, Deng); Institute of Psychology, Chinese Academy of Sciences, Beijing, China (Zhang); Department of Psychology, University of Chinese Academy of Sciences, Beijing, China (Zhang).

Corresponding Author: Yonghui Dang, MD, PhD, College of Medicine & Forensics, Xi'an Jiaotong University Health Science Center, Yanta Rd W.76, Xi'an, Shaanxi 710061, China (psydyh@mail.xjtu.edu.cn).

Author Contributions: Liu, Dang, and Zhang designed the study. Deng collected literature and cleaned data. Li and Lei did statistical analysis. Liu wrote the manuscript. Dang reviewed and revised the manuscript.

Relevant Financial Relationships: The authors declare no conflicts of interest.

Funding/Support: This study was supported by the Planning Program of the Health Committee of Jiangxi Province (202312069) and Ganzhou (2022-1-5, 2023-2-053); Grants 81771139 and 81371477 from the CAS Pioneer Hundred Talents Program and the National Natural Science Foundation of China.

Role of the Funders/Sponsors: The funding providers had no role in study design, data analysis, paper submission, and publication.

Ethical Considerations: This study was approved by the Ethics Committee, the Third People's Hospital of Ganzhou City. Informed consent was obtained from each participant or guardian.

Acknowledgments: We want to express special gratitude to the participants for their cooperation and patience in this study. We also thank the medical staff of the Third People's Hospital of Ganzhou City for their help in data collection.

Additional Information: The datasets that support the findings of this study are not publicly available due to ongoing analyses for further publications but are available from the corresponding author (Dang) upon reasonable request.

References

1. Lewinsohn PM, Rohde P, Seeley JR, et al. Gender differences in suicide attempts from adolescence to young adulthood. *J Am Acad Child Adolesc Psychiatry*. 2001; 40(4):427–434.
2. Nock MK, Green JG, Hwang I, et al. Prevalence, correlates, and treatment of lifetime suicidal behavior among adolescents: results from the National Comorbidity Survey Replication Adolescent Supplement. *JAMA Psychiatry*. 2013; 70(3):300–310.
3. Kann L, McManus T, Harris WA, et al. Youth risk behavior surveillance–United States, 2017. *MMWR Surveill Summ*. 2018;67(8):1–114.
4. Lew B, Osman A, Huen JMY, et al. A comparison between American and Chinese college students on suicide-related behavior parameters. *Int J Clin Health Psychol*. 2020;20(2):108–117.
5. Becker M, Correll CU. Suicidality in childhood and adolescence. *Dtsch Arztebl Int*. 2020;117(15):261–267.
6. Vaquero-Lorenzo C, Vasquez MA. Suicide: genetics and heritability. *Curr Top Behav Neurosci*. 2020;46:63–78.
7. Mandelli L, Serretti A. Gene environment interaction studies in depression and suicidal behavior: an update. *Neurosci Biobehav Rev*. 2013;37(10 Pt 1): 2375–2397.
8. Rhodes AE, Boyle MH, Bridge JA, et al. Antecedents and sex/gender differences in youth suicidal behavior. *World J Psychiatry*. 2014;4(4):120–132.
9. Born L, Shea A, Steiner M. The roots of depression in adolescent girls: is menarche the key. *Curr Psychiatry Rep*. 2002;4(6):449–460.
10. Hu J, Dong Y, Chen X, et al. Prevalence of suicide attempts among Chinese adolescents: a meta-analysis of cross-sectional studies. *Compr Psychiatry*. 2015; 61:78–89.
11. McGirr A, Renaud J, Bureau A, et al. Impulsive-aggressive behaviours and completed suicide across the life cycle: a predisposition for younger age of suicide. *Psychol Med*. 2008;38(3):407–417.
12. Isometsä E. Suicidal behaviour in mood disorders–who, when, and why. *Can J Psychiatry*. 2014;59(3):120–130.
13. Miranda-Mendizabal A, Castellví P, Parés-Badell O, et al. Gender differences in suicidal behavior in adolescents and young adults: systematic review and meta-analysis of longitudinal studies. *Int J Public Health*. 2019;64(2):265–283.
14. Salk RH, Hyde JS, Abramson LY. Gender differences in depression in representative national samples: meta-analyses of diagnoses and symptoms. *Psychol Bull*. 2017;143(8):783–822.
15. Austad G, Joa I, Johannessen JO, et al. Gender differences in suicidal behaviour in patients with first-episode psychosis. *Early Interv Psychiatry*. 2015;9(4): 300–307.
16. Liu J. Need to establish a new adolescent suicide prevention programme in South Korea. *Gen Psychiatr*. 2020;33(4):e100200.
17. Bianchin M, Angrilli A. Gender differences in emotional responses: a psychophysiological study. *Physiol Behav*. 2012;105(4):925–932.
18. Yuan J, Luo Y, Yan JH, et al. Neural correlates of the females' susceptibility to negative emotions: an insight into gender-related prevalence of affective disturbances. *Hum Brain Mapp*. 2009;30(11):3676–3686.
19. Nolen-Hoeksema S, Morrow J. A prospective study of depression and posttraumatic stress symptoms after a natural disaster: the 1989 Loma Prieta Earthquake. *J Pers Soc Psychol*. 1991;61(1):115–121.
20. Morrow J, Nolen-Hoeksema S. Effects of responses to depression on the remediation of depressive affect. *J Pers Soc Psychol*. 1990;58(3):519–527.
21. Pomeau Y, Tran MB. Rumination reconsidered: a psychometric analysis. *Phys Rev E*. 2019;100(6–1):062120.
22. Morrison R, O'Connor RC. A systematic review of the relationship between rumination and suicidality. *Suicide Life Threat Behav*. 2008;38(5):523–538.
23. Buerke M, Galfalvy H, Keilp JG, et al. Age effects on clinical and neurocognitive risk factors for suicide attempt in depression – findings from the AFSP lifespan study. *J Affect Disord*. 2021;295:123–130.
24. Valderrama J, Miranda R, Jeglic E. Ruminative subtypes and impulsivity in risk for suicidal behavior. *Psychiatry Res*. 2016;236:15–21.
25. Liu D, Liu S, Deng H, et al. Depression and suicide attempts in Chinese adolescents with mood disorders: the mediating role of rumination. *Eur Arch Psychiatry Clin Neurosci*. 2023;273(4):931–940.
26. Liu D, Lei G, Deng H, et al. Mediating effect of resilience on the relationship between rumination and suicide attempts in Chinese adolescents with mood disorders. *Gen Psychiatr*. 2024;37(2):e101233.
27. van Vliet IM, de Beurs E. [The MINI-International Neuropsychiatric Interview. A brief structured diagnostic psychiatric interview for DSM-IV en ICD-10 psychiatric disorders]. *Tijdschr Psychiatr*. 2007;49(6):393–397.
28. Li X, Ding S, Lin J, et al. Validation of the Chinese version of the Scale for Suicide Ideation-Worst in adult patients with epilepsy. *Epilepsy Behav*. 2019;101(Pt A): 106586.
29. Na PJ, Yaramala SR, Kim JA, et al. The PHQ-9 item 9 based screening for suicide risk: a validation study of the Patient Health Questionnaire (PHQ)-9 item 9 with the Columbia Suicide Severity Rating Scale (C-SSRS). *J Affect Disord*. 2018;232: 34–40.
30. Gukasyan N, Strain EC. Relationship between cannabis use frequency and major depressive disorder in adolescents: findings from the National Survey on Drug Use and Health 2012–2017. *Drug Alcohol Depend*. 2020;208:107867.
31. Fang X, Wu Z, Wen L, et al. Rumination mediates the relationship between childhood trauma and depressive symptoms in schizophrenia patients. *Eur Arch Psychiatry Clin Neurosci*. 2023;273(5):1085–1094.
32. Liu S, Liu D, Deng H, et al. Effect of rumination on suicide attempts in adolescents with depressive disorder. *Chin J Behav Med Brain Sci*. 2022;31(6):528–533.
33. Nevitt J, Hancock G. Performance of bootstrapping approaches to model test statistics and parameter standard error estimation in structural equation modeling. *Struct Equ Modeling*. 2001;8(3):353–377.
34. Walsh CG, Ribeiro JD, Franklin JC. Predicting suicide attempts in adolescents with longitudinal clinical data and machine learning. *J Child Psychol Psychiatry*. 2018;59(12):1261–1270.
35. Patel RS, Onyeaka H, Youssef NA. Suicidal ideation and attempts in unipolar versus bipolar depression: analysis of 131,740 adolescent inpatients nationwide. *Psychiatry Res*. 2020;291:113231.
36. Goldstein JM, Seidman LJ, Horton NJ, et al. Normal sexual dimorphism of the adult human brain assessed by in vivo magnetic resonance imaging. *Cereb Cortex*. 2001;11(6):490–497.
37. Gore JC. Neuroimaging X. Functional MRI studies of language by sex. *Am J Psychiatry*. 1996;153(7):860.
38. Canetto SS. Meanings of gender and suicidal behavior during adolescence. *Suicide Life Threat Behav*. 1997;27(4):339–351.
39. Murphy GE. Why women are less likely than men to commit suicide. *Compr Psychiatry*. 1998;39(4):165–175.
40. Linehan MM. Suicide and attempted suicide: study of perceived sex differences. *Percept Mot Skills*. 1973;37(1):31–34.
41. Townsend L, Musci R, Stuart E, et al. Gender differences in depression literacy and stigma after a randomized controlled evaluation of a universal depression education program. *J Adolesc Health*. 2019;64(4):472–477.

42. Breland-Noble AM, Burriss A, Poole HK, et al. Engaging depressed African American adolescents in treatment: lessons from the AAKOMA PROJECT. *J Clin Psychol*. 2010;66(8):868–879.
43. Eggenberger L, Fordschmid C, Ludwig C, et al. Men's psychotherapy use, male role norms, and male-typical depression symptoms: examining 716 men and women experiencing psychological distress. *Behav Sci*. 2021; 11(6):83.
44. Angst J, Gamma A, Gastpar M, et al. Gender differences in depression. Epidemiological findings from the European DEPRES I and II Studies. *Eur Arch Psychiatry Clin Neurosci*. 2002;252(5):201–209.
45. Treynor W, Gonzalez R, Nolen-Hoeksema S. Rumination reconsidered: a psychometric analysis. *Cognitive Ther Res*. 2003;27(3):247–259.
46. Rogers ML, Joiner TE. Rumination, suicidal ideation, and suicide attempts: a meta-analytic review. *Rev Gen Psychol*. 2017;21(2):132–142.
47. Burwell RA, Shirk SR. Subtypes of rumination in adolescence: associations between brooding, reflection, depressive symptoms, and coping. *J Clin Child Adolesc Psychol*. 2007;36(1):56–65.
48. Grabe S, Hyde JS, Lindberg SM. *Body Objectification and Depression in Adolescents: The Role of Gender, Shame, and Rumination*. SAGE Publications; 2007.
49. Muris P, Fokke M, Kwik D. The ruminative response style in adolescents: an examination of its specific link to symptoms of depression. *Cognitive Ther Res*. 2009;33(1):21–32.
50. Nolen-Hoeksema S. Responses to depression and their effects on the duration of depressive episodes. *J Abnorm Psychol*. 1991;100(4):569–582.
51. Rood L, Roelofs J, Bögels SM, et al. The influence of emotion-focused rumination and distraction on depressive symptoms in non-clinical youth: a meta-analytic review. *Clin Psychol Rev*. 2009;29(7):607–616.
52. Miranda R, Nolen-Hoeksema S. Brooding and reflection: rumination predicts suicidal ideation at 1-year follow-up in a community sample. *Behav Res Ther*. 2007; 45(12):3088–3095.
53. Li C, Zhao Q, Dai W, et al. Victims become covert aggressors: gender differences in the mediating effects of rumination on anger and sadness. *J Psychol*. 2021; 155(4):441–456.
54. Jose PE, Brown I. When does the gender difference in rumination begin? Gender and age differences in the use of rumination by adolescents. *J Youth Adolesc*. 2008;37(2):180–192.
55. Li Y, Li P, Yuan M, et al. Social-ecological perspective on the suicidal behaviour factors of early adolescents in China: a network analysis. *Gen Psychiatr*. 2024; 37(1):e101317.