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Effects of Loneliness and Subjective Well-Being on Depression in Female Adolescents: A Longitudinal Moderated Mediation Model of the Parental Relationship

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Objective Adolescent depressive symptoms are increasingly recognized as a global concern for youth mental health. Female adolescents consistently report higher levels of depressive symptoms than their male counterparts, yet the psychological mechanisms underlying depressive symptoms remain insufficiently understood. Our longitudinal study examined the relationship between loneliness and depressive symptoms in female adolescents and investigated the mediating effect of subjective well-being (SWB) and the moderating influence of the parental relationship.

Methods Data were drawn from the Korean Study of Adolescent Health, a longitudinal study on adolescent mental health. The sample included 104 female high school students (mean age=15.33 years) who completed self-report surveys at three time points between April 2022 and July 2023. Measures assessed loneliness, SWB, depressive symptoms, and relationships with mothers and fathers. Mediation and moderated mediation analyses were conducted using SPSS PROCESS (Models 4 and 14), controlling for age, socioeconomic status, and baseline depressive symptoms.

Results Mediation analyses indicated that SWB fully mediated the longitudinal association between loneliness and depressive symptoms. Loneliness predicted lower SWB, which subsequently predicted more depressive symptoms. Moderated mediation analysis revealed that maternal, but not paternal, relationship quality significantly moderated the SWB-depressive symptoms link. The indirect effect was significant only among adolescents reporting stronger maternal relationships.

Conclusion These findings underscore the importance of SWB in the link between loneliness and depressive symptoms among female adolescents and highlight the protective role of a positive maternal relationship. The results have implications for targeted prevention and intervention strategies to enhance emotional well-being in female adolescents. **Psychiatry Investig 2026;23(1):142-153**

Keywords Mental health; Mother-child relations; Father-child relations; Quality of life.

INTRODUCTION

National and international reports[1,2] indicate that adolescent depression rates have increased steadily and pose a significant threat to the mental health of young people. Adolescence is a critical developmental period characterized by multiple psychosocial challenges, including identity formation, academic pressures, and social integration, that collectively increase vulnerability to psychological distress, such as depressive symptoms.[3] Depression in adolescence is associated with severe social and educational impairments, increased risk of substance misuse and self-harm,[4-6] and long-term adverse consequences for mental and physical health.[7] Of particular concern, female adolescents experience prevalence rates of depressive symptoms that are up to three times higher than their male counterparts.[8,9] This gender disparity is observed across diverse

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cultural contexts and time periods, suggesting a robust global pattern of gender differences in adolescent depression.

Gender differences in adolescent depression are also evident in South Korea. Over the past decade, female adolescents in South Korea have consistently reported higher rates of depressive symptoms than their male counterparts, with prevalence differences ranging from 13% to nearly 20%.[10] Even more alarming is that approximately one in three adolescent females reported seriously considering suicide and making a plan, a rate nearly twice as high as that of adolescent males.[11] Given these persistent gender disparities, targeted research is needed to understand and identify risk factors related to the developmental and psychosocial characteristics of female adolescents.

In addition to depressive symptoms, heightened levels of loneliness among adolescents worldwide have received increasing attention, particularly in the aftermath of the coronavirus disease-2019 pandemic.[12] Loneliness has emerged as a crucial psychological factor in adolescent mental health, strongly associated with the onset and persistence of depression.[13,14] This trend is especially pronounced among female adolescents, who report higher levels of loneliness and depression than their male peers.[15,16] While female adolescents generally have larger social networks and greater social participation,[17,18] paradoxically, their heightened sensitivity to interpersonal dynamics and greater emphasis on social connectedness make them particularly vulnerable to the mental health consequences of poor social relationships and loneliness.[19-21] Such social sensitivity may be exacerbated in competitive, comparison-oriented societies such as South Korea, where adolescents frequently engage in social comparisons to evaluate their relative status within peer groups.[22] In this context, female adolescents often feel excluded or left behind, which intensifies feelings of inadequacy and loneliness and may contribute to a negative self-concept and increase the risk of depression.[23-25] Consequently, loneliness may disproportionately undermine female adolescents' psychological well-being[26] and increase their vulnerability to depressive symptoms.

The self-determination theory (SDT) provides a valuable theoretical framework for examining the mechanisms that link social disconnection to psychological well-being. SDT posits that relatedness, autonomy, and competence each play a fundamental role in psychological well-being.[27] In particular, when relatedness—the need to feel connection and a sense of belonging with others—is unmet, individuals experience heightened vulnerability to negative emotional states, including depressive symptoms.[28,29] Given the pivotal role of social connectedness in adolescent mental health, loneliness can be viewed as a disruption to the need for relatedness that increases susceptibility to negative emotional states.[30]

Building on this perspective, previous research supports a cross-sectional association between adolescent loneliness and depressive symptoms.[31,32] However, the directionality and underlying mechanisms of this relationship remain debated. While some longitudinal studies suggest that preexisting depressive symptoms may predict subsequent loneliness,[33,34] others report reciprocal or even nonsignificant associations, potentially due to differences in study designs.[16,33]

Extensive research has sought to explain the inconsistencies in the relationship between loneliness and depression by examining potential mediators.[35,36] Among these, subjective well-being (SWB) is particularly relevant for explaining the pathway that links loneliness to depression, especially in adolescence.[37,38] SWB refers to individuals' cognitive and affective evaluations of their lives and includes life satisfaction and positive affect.[39] Widely recognized as a critical indicator of mental health, SWB has been associated with reduced psychological distress in adolescents.[40] Because adolescents are especially attuned to social cues and peer acceptance,[41] their sense of well-being may be closely tied to feelings of loneliness, which may shape their vulnerability to depressive symptoms.[42,43] This tendency is more pronounced for female adolescents, who are more socially oriented and sensitive to interpersonal stressors.[20,44] Compared with their male counterparts, female adolescents generally report lower SWB and exhibit stronger associations both between loneliness and SWB and between SWB and depressive symptoms.[42] Among South Korean female high school students, SWB, particularly happiness and life satisfaction, has emerged as one of the strongest predictors of depressive symptoms.[45] Thus, loneliness may indirectly lead to depressive symptoms by negatively impacting adolescents' SWB.

Given adolescents' heightened vulnerability to psychological distress and social challenges,[46] researchers have actively examined protective factors, such as social support, that may mitigate these risks.[47] Parental relationships have been studied extensively in the context of adolescent mental health and have consistently emerged in meta-analyses as a significant protective factor.[48] Indeed, parental-related variables frequently appear to be strong determinants of mental health outcomes, particularly by buffering against depression.[48,49] Parental relationships not only act as protective factors against depression but also contribute significantly to adolescents' SWB.[50,51] Supportive parent-child interactions foster emotional stability and a greater sense of life satisfaction, which are essential components of SWB.[52,53] Conversely, unsupportive parental relationships may weaken SWB, thereby indirectly increasing the risk of depressive symptoms.

Despite the well-documented parental influence on adolescent well-being, few studies have examined how different aspects of maternal and paternal relationships may uniquely

contribute to adolescents' mental health. Moreover, existing research suggests that same-gender parental influence may play a more pronounced role in shaping emotional regulation and psychological resilience,[54] with maternal relationships often playing a stronger role in adolescents' mental health.[55] However, relatively few studies have compared the effects of fathers and mothers. To address this gap, the present study investigates the moderating effects of paternal and maternal relationships on the link between SWB and depression.

The current study

This study investigates the longitudinal relationship between loneliness and depressive symptoms among female high school students by examining SWB as a mediator and parental relationships (paternal and maternal separately) as moderators. Using a three-time-point longitudinal design, we explore whether earlier loneliness is linked to later depressive symptoms through SWB to clarify the directional patterns of these constructs. By considering both mediating and moderating factors within a longitudinal framework, this study aims to provide a comprehensive understanding of factors contributing to depressive symptoms in female adolescents. Furthermore, while prior studies have explored similar associations, relatively few have considered female adolescents within Eastern cultural contexts, where interpersonal variables such as loneliness and parental relationships may have increased relevance. Thus, this study offers a culturally sensitive perspective to enrich the current understanding of depressive symptoms in female adolescents.

Loneliness and depression are subjective experiences influenced by individual perceptions and cognitive evaluations.[56] Given their developmental characteristics of exhibiting heightened self-focus and sensitivity to social interactions, female adolescents tend to be particularly vulnerable to perceived social isolation and emotional distress.[25] Because SWB reflects life satisfaction and emotional well-being, its mediating role helps to explain how loneliness contributes to depressive symptoms. Moreover, South Korea's collectivist cultural context tends to emphasize social belonging and interpersonal harmony, which makes social bonds crucial in mental health.[57-59] Female adolescents in this society may be more susceptible to the negative effects of loneliness and exhibit stronger associations between loneliness and SWB than males.[15,26] Therefore, we hypothesize that SWB mediates the relationship between loneliness and depression in Korean female adolescents such that more loneliness leads to lower SWB, which in turn predicts more depressive symptoms.

Hypothesis 1: The longitudinal relationship between loneliness and depressive symptoms was mediated by SWB.

Additionally, parental relationships have been identified consistently as significant factors that influence adolescents' mental health in both cross-sectional and longitudinal studies.[60,61] Korean youth remain highly dependent on their parents, and parental relationships continue to be a critical factor in their well-being and mental health.[62] Therefore, we hypothesize that parental relationships moderate the mediating role of SWB such that stronger parental support weakens the negative impact of loneliness on SWB and depression, whereas poor parental relationships exacerbate this association.

Hypothesis 2: The relationship between SWB and depressive symptoms was moderated by the parental relationship.

Meta-analyses highlight the role of parental relationships in adolescents' mental health, yet research that examines how maternal and paternal relationships independently moderate these associations remains limited. Maternal and paternal relationships may uniquely contribute to adolescents' mental health, making it important to examine their respective roles in moderating adolescents' well-being. In South Korea, mothers often serve as the primary caregivers and play a central role in their children's emotional and psychological development.[63,64] Given that female adolescents may be more emotionally attuned to their mothers, we hypothesize that maternal relationships exert a stronger moderating effect on the link between SWB and depression than paternal relationships do.

Hypothesis 3: The moderating effect of parental relationships was more pronounced for maternal relationships than for paternal relationships for female adolescents.

METHODS

Participants and procedure

We used data from the Korean Study of Adolescent Health (KSAH), an ongoing longitudinal project that investigates the biopsychosocial factors that influence adolescent mental health in Korea. The KSAH followed female students from the start of high school, a critical transition marked by intensified academic pressure and shifting social expectations, and tracked their psychological and social well-being within the Korean sociocultural context. The participants in the present study were recruited from a women's high school in Seoul, Korea. During the 2022–2023 academic year, every incoming student from 10 classes was invited to participate. This study was approved by the institutional review board (IRB) for human subjects at Yonsei University (No. 7001988-202503-HR-1452-19) and conducted according to the Declaration of Helsinki. All participants were informed about the study's purpose and procedures, and informed consent was obtained from both the students and their parents or legal guardians.

Although four waves of data collection were conducted

(Wave 1 in April 2022, Wave 2 in July 2022, Wave 3 in December 2022, and Wave 4 in July 2023), the second wave consisted of only a social network survey and did not include the primary psychological measures used in this study. To minimize confusion and maintain consistency in the measurements across time points, we designated Wave 1, Wave 3, and Wave 4 as Time 1 (T1), Time 2 (T2), and Time 3 (T3), respectively.

The study employed a longitudinal design with data collected across these three time points over an eight-month interval. A total of 148 students completed T1, shortly after entering high school in March; 129 students participated in T2; and 126 students completed T3. Attrition was primarily due to students being absent from school during data collection or opting not to participate. A total of 104 students participated in all three time points with no missing responses and were included in the final analysis.

Self-report questionnaires that assessed demographic information, loneliness, SWB, depressive symptoms, and parental relationships (paternal and maternal relationships) were administered in the classroom after school hours under the supervision of trained research assistants. Completion of the surveys took approximately 40–50 minutes. All participants in this study were female and of Korean nationality with a mean age of 15.33 years at T1 (SD=0.47, range=15–16 years).

Measures

Loneliness

Perceived loneliness was assessed using the UCLA Three-Item Loneliness Scale,[65] which has been widely validated and applied in large-scale population studies. The current study utilized the version that is incorporated into the Korean Child Well-Being Index (KCWI),[66] a nationally representative longitudinal study of Korean children and adolescents' well-being, to compare trends with other OECD countries and identify key issues and solutions. This scale consists of three items that evaluate loneliness-related experiences. Each item is rated on a 3-point Likert scale (1="hardly ever," 2="sometimes," 3="often"). The total score ranges from 3 to 9, with higher scores indicating greater loneliness. Example items include "How often do you feel that you lack companionship?," "How often do you feel left out?," and "How often do you feel isolated from others?" (Cronbach's α=0.83 at T1).

Subjective well-being

SWB was measured using a self-report questionnaire derived from the KCWI,[66] which was developed on the basis of UNICEF's well-being indicators.[67] The KCWI evaluates six key domains: material well-being, sanitation and safety, education, family and friend relationships, health-related behaviors, and SWB. This study used the SWB subscale, which consists of six items that measure school life satisfaction, perceived health status, life satisfaction, and negative thinking. Responses were recorded on a 5-point Likert scale (1="not at all," 2="rarely," 3="sometimes," 4="often," 5="very often"). The sixth item is reverse scored to account for negative framing. The total score ranges from 6 to 30, with higher scores indicating greater SWB. Example items include "I think I am healthy," "I enjoy my school life," and "I am satisfied with my life" (Cronbach's α=0.81 at T2).

Depressive symptoms

Depressive symptoms were measured using the Patient Health Questionnaire-9,[68] a widely used screening tool for evaluating the presence and severity of depressive symptoms. The present study utilized the Korean version.[69] This scale consists of nine items, each rated on a 4-point Likert scale (0= "not at all," 1="several days (2–6 days)," 2="more than half the days (7–12 days)," 3="nearly every day"). The total score ranges from 0 to 27, with higher scores indicating greater severity of depressive symptoms. Example items include "feeling down, depressed, or hopeless," "little interest or pleasure in doing things," and "trouble falling asleep or staying asleep or sleeping too much" (Cronbach's α=0.88 at T1 and T3).

Parental relationship

Parental relationship quality was assessed using a self-report questionnaire adapted from the KCWI.[66] This measure evaluates the quality of parental and maternal relationships separately and assesses aspects such as closeness, communication, and social connectedness. The scale consists of eight items each for paternal and maternal relationships. Responses are recorded on a 5-point Likert scale (1="not at all," 2="rarely," 3="sometimes," 4="often," 5="very often"), with higher scores indicating stronger and more positive relationships with parents. Separate scores were calculated for paternal and maternal relationships. Example items include "My father/mother and I have a good relationship," "My father/mother tries to spend a lot of time with me," and "I can frequently talk or contact my father/mother about important matters" (Cronbach's α=0.86 and 0.78 for paternal and maternal relationships at T3, respectively).

Covariates

The covariates included age, subjective socioeconomic status (SSS), and depressive symptoms at baseline. SSS was measured using the Youth Version of the MacArthur Scale of Subjective Social Status,[70] which is incorporated into the KCWI.[66] The participants rated their perceived family socioeconomic standing within society on a 10-rung ladder with 1 represent-

ing the worst (i.e., those with the least financial resources, lowest education levels, and least prestigious occupations) and 10 representing the best. Baseline depressive symptoms (T1) were controlled to distinguish the effects of loneliness and SWB on T3 depressive symptoms and to reduce spurious associations. Controlling for T1 depressive symptoms accounted for autoregressive effects and ensured that T3 changes reflected the hypothesized mediation model rather than symptom stability over time.[71,72]

Statistical analysis

All statistical analyses were performed using SPSS 25.0 for Windows (IBM Corp.) and the PROCESS macro in SPSS,[73] which is widely used to analyze complex models, including moderated mediation models. To mitigate multicollinearity and improve interpretability, all continuous variables were mean-centered.[74] First, descriptive statistics and correlational analyses were conducted to examine the associations among the main variables. The skewness and kurtosis values for all the variables were assessed and confirmed to be within the acceptable range (skewness ≤|3|, kurtosis ≤|10|),[75] indicating that the data were normally distributed. Second, mediation analyses were performed using the PROCESS macro (Model 4) to assess the mediating effect of SWB on the relationship between loneliness and depressive symptoms, with T1 age, T1 SSS, and T1 depressive symptoms included as covariates. Indirect effects were tested using the bootstrapping method with 5,000 resamples, and effects were considered statistically significant if the 95% confidence interval (CI) did not include zero.[73] Finally, moderated mediation analyses were conducted using the PROCESS macro (Model 14) to examine whether the mediating effect of SWB was moderated by parental relationships (paternal and maternal separately) (Figure 1). The same covariates used in the mediation analysis were included. Simple effects were examined at low (-1 SD) and high (+1 SD) levels of paternal or maternal relationships to further clarify the interaction effects. The index of moderated mediation was used to determine the presence of moderated mediation effects following the same bootstrapping procedures as in the mediation analysis.

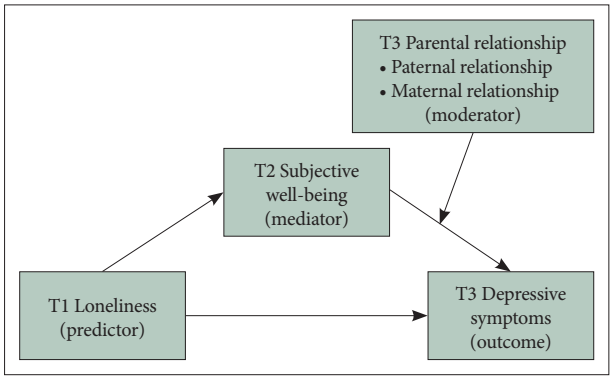

Figure 1. The proposed longitudinal moderated mediation model. Baseline age, subjective socioeconomic status, and depressive symptoms are included as covariates.

Post-hoc power analyses were conducted to ensure that the models were adequately powered for sample size and effect sizes. A G*Power post-hoc analysis of multiple regression (α=0.05)[76] indicated power estimates exceeding 0.99 for all regression models, with interaction effects achieving a power of 0.91. To further examine power for the indirect effect in the moderated mediation model, a Monte Carlo simulation (1,000 replications, 1,000 bootstraps per replication)[77] was conducted. The estimated power for the index of moderated mediation was 0.84, indicating sufficient power to detect the moderated mediation effect.

RESULTS

Descriptive and correlation analysis

The full descriptive statistics and bivariate correlations are presented in Table 1. Skewness and kurtosis values confirmed that all variables fell within an acceptable range for normality.[75] Correlation analysis revealed significant associations among the key study variables. T1 loneliness was negatively associated with T2 SWB and positively associated with T3 depressive symptoms. Additionally, T2 SWB was negatively correlated with T3 depressive symptoms and positively associated with T3 paternal and maternal relationships, whereas T3 paternal and maternal relationships were negatively associated with T3 depressive symptoms.

Mediation analysis

The results of the longitudinal mediation model are presented in Figure 2. T1 loneliness did not significantly predict T3 depressive symptoms. However, T1 loneliness significantly negatively predicted T2 SWB (β=-0.34, p<0.01), and T2 SWB negatively predicted T3 depressive symptoms (β=-0.28, p<0.01). These findings indicate a full mediation effect because the direct effect of T1 loneliness on T3 depressive symptoms was nonsignificant. The bootstrapping results confirmed that the indirect effect of T1 loneliness on T3 depressive symptoms through T2 SWB was significant (effect=0.29, boot SE=0.13, 95% CI=0.07 to 0.57), accounting for 38% of the total effect. These findings support the mediating role of SWB in this relationship and confirm Hypothesis 1.

Moderated mediation analysis

The longitudinal moderated mediation model results are presented in Table 2 and Figure 3. The interaction effect between T2 SWB and the T3 paternal relationship on T3 de-

Table 1. Descriptive statistics and bivariate correlations between the study variables

Variables	1	2	3	4	5	6	7	8
1. T1 Age	-							
2. T1 Subjective socioeconomic status	<0.01	-						
3. T1 Depressive symptoms	0.12	-0.28**	-					
4. T1 Loneliness	-0.14	-0.32**	0.40***	-				
5. T2 Subjective well-being	-0.03	0.25*	-0.42***	-0.46***	-			
6. T3 Depressive symptoms	0.01	-0.21*	0.61***	0.28**	-0.47***	-		
7. T3 Paternal relationship	0.19*	0.30**	-0.08	-0.34***	0.34***	-0.20*	-	
8. T3 Maternal relationship	0.10	0.17	-0.22*	-0.35***	0.35***	-0.20*	0.30**	-
Mean	15.33	6.06	7.20	4.77	23.80	6.32	21.19	28.29
Standard deviation	0.47	1.51	5.89	1.80	4.06	5.55	5.77	5.00
Skewness	0.75	-0.41	1.10	0.77	-0.77	1.16	0.06	-0.19
Kurtosis	-1.47	0.40	0.84	-0.40	0.38	1.08	-0.44	-0.03

*p<0.05; **p<0.01; ***p<0.001.

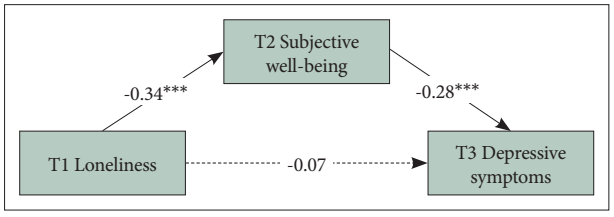

Figure 2. The significant mediation effect of subjective well-being. The standardized regression coefficients of the paths are presented in the figure; the covariates are not shown for clarity. ***p< 0.001.

pressive symptoms was not significant, whereas the interaction effect between T2 SWB and the T3 maternal relationship was significant (β=-0.29, p<0.01). This finding indicates that the maternal relationship moderated the effect of SWB on depressive symptoms (Hypothesis 3).

The bootstrapping results (Table 3 and Figure 4) revealed that the mediating effect of T2 SWB on T3 depressive symptoms was significant only at higher levels of the maternal relationship (+1 SD; effect=0.37, 95% CI=0.09 to 0.72), whereas it was nonsignificant at lower levels of the maternal relationship (-1 SD). The index of moderated mediation for the maternal relationship was significant (index=0.06, 95% CI=0.02 to 0.11), confirming that the strength of the mediation effect depended on the maternal relationship (Hypothesis 2).

DISCUSSION

While previous research has established a close relationship between loneliness and depressive symptoms in female adolescents, the mechanisms underlying this association remain unclear. Given that research has consistently shown that female adolescents are more vulnerable to both loneliness and depression, understanding this pathway is particularly important for this population. The current study extends prior research by examining how loneliness is related to depression over a one-and-a-half-year longitudinal study period among Korean female adolescents with a focus on the mediating role of SWB and the moderating role of parental relationships. Our findings showed that loneliness predicted increased depressive symptoms through SWB, but a direct association between the two was not observed. Moreover, maternal relationships significantly moderated the strength of this mediation. Strong maternal bonds may buffer the negative impact of loneliness by preserving SWB. These findings contribute to a deeper understanding of depressive symptoms in female adolescents by revealing the psychological risk factors that disproportionately affect this population. Additionally, the findings broaden the perspective on mitigating depressive symptoms by identifying protective influences.

Consistent with our hypothesis, the results revealed that loneliness at an earlier time point significantly predicted lower SWB, which in turn increased the risk of experiencing depressive symptoms. This finding suggests that SWB plays a crucial role in explaining how loneliness influences future mental health outcomes. Our findings align with those of previous studies that emphasize the protective role of SWB against adverse mental health outcomes, including depressive symptoms and even long-term risks to well-being such as mortality.[40,78] Given that SWB involves a holistic subjective assessment of pleasurable experiences, life satisfaction, and happiness, its mediating role reinforces the importance of maintaining well-being as a preventive measure against depressive symptoms. Moreover, research on network structures suggests that loneliness and depression are multidimensional and interact through complex psychological pathways.[13,79] These studies indicate that loneliness contributes to depressive symptoms through

Table 2. Moderated mediation analysis

Outcome variables	Model 1 (W: paternal relationship)						Model 2 (W: maternal relationship)					
Predictor variables	B	β	SE	t	LLCI	ULCI	B	β	SE	t	LLCI	ULCI
T2 Subjective well-being												
Constant	9.29	-	11.89	0.78	-14.30	32.89	9.29	-	11.89	0.78	-14.30	32.89
T1 Loneliness	-0.76***	-0.34	0.22	-3.48	-1.20	-0.33	-0.76***	-0.34	0.22	-3.48	-1.20	-0.33
T1 Age	-0.36	-0.04	0.76	-0.47	-1.86	1.14	-0.36	-0.04	0.76	-0.47	-1.86	1.14
T1 Subjective socioeconomic status	0.18	0.07	0.24	0.74	-0.30	0.67	0.18	0.07	0.24	0.74	-0.30	0.67
T1 Depressive symptoms	-0.18**	-0.26	0.07	-2.69	-0.31	-0.05	-0.18**	-0.26	0.07	-2.69	-0.31	-0.05
R^2				0.28						0.28		
F				9.68***						9.68***		
T3 Depressive symptoms												
Constant	15.56	-	15.05	1.03	-14.32	45.44	0.19	-	14.95	0.01	-29.49	29.87
T1 Loneliness	-0.27	-0.09	0.29	-0.94	-0.85	0.30	-0.12	-0.04	0.28	-0.44	-0.68	0.43
T2 Subjective well-being	-0.33	-0.24	0.13	-2.47	-0.59	-0.06	-0.48***	-0.35	0.12	-3.88	-0.73	-0.24
T3 W	-0.09	-0.09	0.09	-1.04	-0.26	0.08	-0.04	-0.04	0.09	0.43	-0.14	0.22
T2 Subjective well-being ×T3 W	0.01	-0.06	0.02	0.69	-0.03	0.05	-0.08**	-0.29	0.02	-3.18	-0.13	-0.03
T1 Age	-0.78	-0.07	0.95	-0.81	-2.67	1.12	0.27	0.02	0.95	0.28	-1.62	2.16
T1 Subjective socioeconomic status	0.03	<0.01	0.31	0.10	-0.58	0.65	-0.02	<0.01	0.29	-0.05	-0.59	0.56
T1 Depressive symptoms	0.51***	0.54	0.09	5.97	0.34	0.68	0.45***	0.48	0.08	5.48	0.29	0.61
R^2				0.44						0.49		
F				10.78***						12.99***		

W represents the moderator. Model 1 examines the paternal relationship as a moderator, whereas Model 2 examines the maternal relationship as a moderator. **p<0.01; ***p<0.001. LLCI, lower limit of the confidence interval; ULCI, upper limit of the confidence interval.

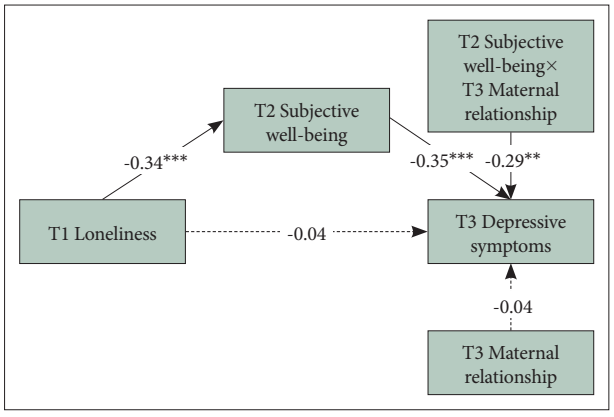

Figure 3. The significant moderating effect of maternal relationship. The standardized regression coefficients of the paths are presented in the figure; the covariates are not shown for clarity. **p<0.01; ***p<0.001.

negative cognitive and emotional styles,[80,81] which aligns closely with the mediating role of SWB observed in the current study. Consistent with previous research,[82,83] our findings show that adolescents who experience heightened loneliness may be more likely to develop negative cognitive appraisals and emotional distress, which may contribute to decreased SWB and, subsequently, increased vulnerability to depressive symptoms.

A direct association between loneliness and depressive symptoms, however, was not observed in the current study, which is inconsistent with prior studies that reported a direct link.[31,36] This discrepancy may reflect variations in the characteristics of the sample, such as sex and developmental stage. Moreover, the observed full mediation suggests that the direct relationship may depend on intermediary psychological factors such as SWB. Prior evidence indicates that adolescent females are particularly attuned to social connectedness and interpersonal relationships,[20,21] which makes SWB particularly salient as a mediator within this demographic. This interpretation aligns with SDT, which posits that when the need for relatedness is unmet, individuals may experience decreased SWB, thereby increasing their vulnerability to negative emotional states such as depressive symptoms.[27,84] Our findings thus support the notion that SWB serves as a critical psychological mechanism through which loneliness impacts depression, which underscores the importance of interventions that target well-being as a protective factor in female adolescents' mental health.

Table 3. Bootstrap indirect effect for the conditional moderated mediation model and index of moderated mediation

T1 Loneliness → T2 Subjective well-being → T3 Depressive symptoms		Effect	Boot SE	LLCI	ULCI
T3 Maternal relationship	-1 SD	0.07	0.12	-0.15	0.31
	+1 SD	0.37	0.16	0.09	0.72
Index of moderated mediation		Index	Boot SE	LLCI	ULCI
T3 Maternal relationship		0.06	0.02	0.02	0.11

SE, standard error; LLCI, lower limit of the confidence interval; ULCI, upper limit of the confidence interval.

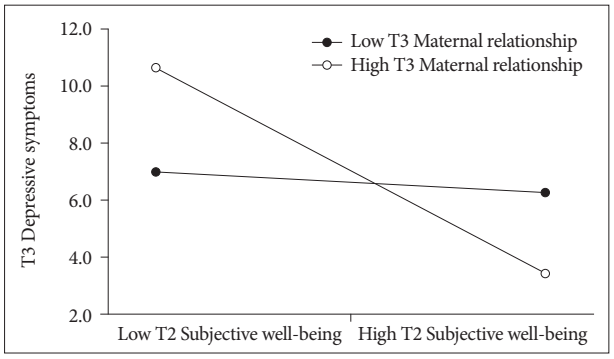

Figure 4. The conditional effect of maternal relationship on the association between subjective well-being and depressive symptoms. Simple slopes are plotted at low (-1SD) and high (+1SD) maternal relationship.

Furthermore, the results of our longitudinal moderated mediation analysis indicate that the maternal relationship plays a key role in moderating the association between loneliness and depressive symptoms by strengthening the protective function of SWB. Specifically, the indirect effect of loneliness on depressive symptoms via SWB was significant for female adolescents who reported high maternal relationship quality. This finding aligns with prior research that emphasizes the role of maternal support in fostering emotional resilience and psychological stability.[85,86] A strong maternal bond may contribute to emotional resilience by reinforcing emotional security and a sense of belonging, thereby mitigating the negative effects of low SWB.[52,53,87] Conversely, female adolescents with weaker maternal relationships may lack this protective emotional support structure, which potentially increases their vulnerability to depressive symptoms.[88] The current study exclusively examined female adolescents, and the stronger influence of maternal relationships observed in our findings may reflect this pattern because adolescents tend to be more influenced by their same-gender parent.[89,90] These findings underscore the potential role of maternal bonds as a key protective factor in female adolescents' mental health and suggest that future interventions could explore ways to enhance this support system.

Interestingly, the paternal relationship did not significantly moderate the association between SWB and depressive symptoms, suggesting that maternal influences may play a more prominent role in buffering the effects of loneliness on female adolescents' mental health, at least within the context of this study. This finding is consistent with previous research indicating that maternal relationships are often more central to emotional development during adolescence.[85,91] The influence of mothers may be particularly pronounced in South Korea, where mothers typically serve as the primary caregivers and engage deeply in their children's emotional regulation.[64,92] Furthermore, structural and societal factors may limit opportunities for paternal emotional engagement. Korean fathers are reported to work some of the longest hours among OECD countries.[93] In this context, it may be particularly challenging for fathers to spend sufficient time or devote the emotional resources necessary to impact their daughters' emotional well-being. In support of this notion, previous research has shown that the greater time constraints imposed by longer working hours constitute a major factor that discourages fathers from engaging in childrearing behavior,[94] which in turn may limit fathers' emotional accessibility to their children. Prior studies suggest that maternal and parental figures contribute uniquely to adolescent development by playing different roles in shaping adolescent mental health.[95,96] Future studies could explore whether, in the context of different psychological constructs, paternal bonds also play a significant role in female adolescents' well-being.

This study has strengths as well as several limitations that offer meaningful directions for future exploration. First, while this study focused on parental relationships as key relational factors, peer relationships are also important for adolescents' mental health and may differentially influence their emotional well-being and depressive symptoms. Future research should incorporate peer relationship measures to clarify the distinct and interactive contributions of various social relationships to adolescents' emotional adjustment. Second, reliance on self-reported data introduces the potential for social desirability bias despite its common use in measuring adolescents' psychological well-being. Future studies should incorporate multiple data sources, including data from parents, peers, and teachers. Third, the scales derived from KCWI, although these measures have been widely adopted in national studies, formal validation of this instrument has not been well established. Future research may benefit from employing other psychometric instruments to cross-validate the findings and enhance mea-

surement robustness across studies. Finally, the study sample consisted exclusively of Korean adolescents, which limits the generalizability of the findings to other cultural contexts. Cultural factors may shape the influence of maternal and paternal relationships on adolescents' well-being, and cross-cultural comparisons are needed to determine the broader applicability of these results.

Despite these limitations, the present study contributes to the growing literature on adolescent mental health, particularly among female adolescents, by providing empirical evidence of the relationships among loneliness, SWB, and parental relationships. The results highlight the importance of interventions that increase SWB as a protective factor against depressive symptoms while also emphasizing the unique role of maternal relationships in moderating this association. Although peer relationships are often considered central to adolescents' development, our findings suggest that parental relationships, particularly maternal support, remain crucial protective factors during this period.

Clinical and practical implications

These findings have practical implications for prevention and intervention programs targeting female adolescents at risk for depression. School-based mental health programs could incorporate positive psychology interventions (e.g., gratitude exercises, strength-based activities) to enhance SWB, while parent training programs could teach mothers effective communication and emotional validation techniques to strengthen mother-daughter relationships. Screening protocols that assess loneliness, SWB, and maternal support alongside depressive symptoms may help identify high-risk female adolescents requiring targeted intervention. Integrated approaches combining individual well-being enhancement with family-centered interventions may be most effective in preventing depression among this vulnerable population.

Conclusions

Given the persistently higher prevalence of depressive symptoms among female adolescents, understanding the mechanisms underlying the psychological vulnerability of this population is crucial. The present study revealed that among female high school students, loneliness contributes to depressive symptoms primarily through a reduction in SWB, highlighting a crucial mediating pathway. Additionally, the findings underscore the protective role of a positive maternal relationship in moderating this pathway. By examining risk and protective factors within the developmental and cultural context of female adolescents in South Korea, the current study deepens our understanding of the nuanced mechanisms that contribute to adolescent depression. These findings further emphasize the importance of fostering happiness and life satisfaction as well as supportive maternal relationships to mitigate depressive symptoms in female adolescents.

Availability of Data and Material

The data that support the findings of this study are available upon request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Conflicts of Interest

Min-Hyeon Park, a contributing editor of the *Psychiatry Investigation*, was not involved in the editorial evaluation or decision to publish this article. All remaining authors have declared no conflicts of interest.

Author Contributions

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