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Influence of Middle School Students' Perception of Parental Care, Intolerance of Uncertainty, and Self-Esteem on Stress

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Abstract

Purpose: This study aimed to examine the relationships among parental care perception (PCP), intolerance of uncertainty (IU), self-esteem, and daily stress responses in middle school students, and to investigate the mediating effects of IU and self-esteem on the association between PCP and daily stress responses. **Research design, data and methodology:** A descriptive survey design was employed. Participants were 159 middle school students aged 14 to under 16 years recruited from City I, Korea. Data were collected using self-report questionnaires, including the Parental Care Perception scale (10 items), the Intolerance of Uncertainty Scale–12 (IUS-12), the Rosenberg Self-Esteem Scale, and the Adolescent Daily Stress Response Scale. Data analyses included t-tests, one-way analysis of variance (ANOVA) with Scheffé post hoc tests, correlation analysis, and hierarchical regression analysis. Mediation effects were tested using PROCESS Macro version 4.1. **Results:** Parental care perception was positively associated with self-esteem and negatively associated with intolerance of uncertainty and daily stress responses. In hierarchical regression analysis, after controlling for gender and parent–child relationship variables, self-esteem emerged as the only significant predictor of daily stress responses. Mediation analyses indicated that intolerance of uncertainty did not mediate the relationship between parental care perception and daily stress responses, whereas self-esteem fully mediated this relationship. **Conclusion:** These findings suggest that adolescents' perceived parental care reduces daily stress responses primarily by enhancing self-esteem. This highlights the central role of self-esteem in adolescent stress regulation. Interventions focused on strengthening self-esteem and promoting supportive parent–adolescent interactions may be effective strategies for managing daily stress among adolescents.

Keywords : Parental care perception; Intolerance of uncertainty; Self-esteem; Stress response; Middle school students

JEL Classification Code : A10, A19, I14, I20, I31

1. Introduction

1.1. Study Design

Adolescence is a developmental period characterized by rapid physical, emotional, and cognitive changes. Emotional experiences and psychosocial environments during this stage play a crucial role in shaping identity,

self-concept, and social–emotional functioning that extend into adulthood (Park & Moon, 2010). Middle school students are exposed to various stressors, including academic competition, changes in peer relationships, and transitions in the school environment. Such stressors may lead to psychological maladjustment, including anxiety, depression, and decreased self-efficacy. As concerns regarding adolescent mental health have gained greater societal attention, the need for integrated and interdisciplinary approaches combining education, healthcare, psychology, and digital health has been increasingly emphasized.

The family is the primary social environment that adolescents encounter, and the parent–child relationship plays a central role in emotional development and socialization processes (Lee, 2017). Parents provide not only physical protection but also emotional support and opportunities for acquiring social skills. The parent–child relationship formed through caregiving experiences has a decisive influence on adolescents' personality development and identity formation (Min, 1990). Therefore, understanding adolescents' emotional stability and stress coping abilities requires consideration of relational factors with parents.

Recent research on parental caregiving has expanded beyond traditional perspectives focusing solely on parenting styles or attachment levels, shifting toward the concept of parental care perception (PCP), which emphasizes how much care adolescents perceive they receive from their parents (Ahn, 2022). PCP consists of ten elements—recognition, participation, sharing, active listening, praise, accompaniment, comfort, instilling hope, forgiveness, and acceptance (Ahn, 2022). This concept encompasses emotional support, parental interest, and empathic interactions demonstrated toward adolescents. These caregiving elements extend beyond simple parenting behaviors and serve as an emotional foundation that helps adolescents perceive themselves as valued individuals.

Previous studies have identified PCP as a significant predictor of adolescents' self-esteem and emotional stability (Choi, 2015). Adolescents who perceive sufficient recognition and support from their parents tend to evaluate their abilities and self-worth more positively and demonstrate more stable coping responses in stressful situations. Conversely, low PCP may lead adolescents to experience deficits in emotional support, increasing vulnerability to anxiety, worry, and heightened stress sensitivity (Choi, 2015). In this regard, PCP should be considered an important environmental and emotional factor in explaining stress responses during adolescence.

Meanwhile, in modern society characterized by rapid change and intense competition, adolescents are more likely to experience anxiety regarding an uncertain future. In this context, intolerance of uncertainty (IU) may amplify adolescents' stress responses. Individuals who have difficulty tolerating uncertain situations tend to engage in negative anticipation and experience difficulties in emotional regulation, which weakens their ability to cope with stress (Kim & Song, 2016). In contrast, self-esteem, as a psychological protective factor based on positive self-evaluation, enables adolescents with higher self-esteem to demonstrate more stable emotional regulation and effective problem-solving skills even under stressful conditions (Song & Shin, 2020).

Despite these findings, most previous studies have examined relationships among parenting variables, attachment, self-esteem, and stress independently. Research integratively exploring the interrelationships among PCP, IU, self-esteem, and stress remains limited, particularly in middle school students, although several studies have examined related mechanisms in college students (Kim et al., 2025). Accordingly, this study aimed to analyze the effects of PCP on daily stress responses among middle school students and to identify the mediating roles of IU and self-esteem.

1.2. Study Design

The findings may provide foundational evidence for the development of adolescent mental health promotion and stress management programs.

The specific objectives of this study were:

(1) to examine relationships among PCP, IU, self-esteem, and daily stress responses in middle school students;
(2) to analyze the effects of PCP, IU, and self-esteem on daily stress responses; and
(3) to verify the mediating effects of IU and self-esteem in the relationship between PCP and daily stress responses.

2. Research Methods

2.1. Study Design

This study employed a descriptive survey design to examine the effects of parental care perception on intolerance of uncertainty, self-esteem, and daily stress responses among middle school students.

2.2. Participants and Study Setting

Participants were adolescents enrolled in middle schools located in City I. Eligible participants receiv

ed a sufficient explanation of the study purpose and procedures and voluntarily agreed to participate. Incl usion criteria were students aged 14 to <16 years cu rrently enrolled in middle school. Exclusion criteria i ncluded difficulty understanding the study or respond ing to the questionnaire due to language disorders, d evelopmental disorders, or intellectual disabilities, as well as lack of legal guardian consent.

Data were collected over approximately six weeks, from November 2024 to December 15, 2024. The required sample size was calculated using G*Power 3.1. Based on multiple regression analysis with three predictors, a medium effect size ($f^2 = 0.15$), $\alpha = 0.05$, and power ($1-\beta$) = 0.95, the minimum required sample size was 119. Considering a 10% dropout rate, a total of 159 questionnaires were collected. After screening for reliability and consistency, incomplete or inappropriate questionnaires were excluded, and the remaining data were used for analysis.

2.2. Participants and Study Setting

2.3.1 Composition of the Instruments

Data were collected using a structured self-report questionnaire developed based on theoretical frameworks and previous studies. The questionnaire consisted of 5 items on general characteristics, 10 items on parental care perception, 12 items on intolerance of uncertainty, 10 items on self-esteem, and 10 items on daily stress responses.

2.3.2 General Characteristics

General characteristics included gender, academic performance, relationship with parents, and level of interaction with parents.

2.3.3 Parental Care Perception

Parental care perception was measured using a scale originally developed to assess interpersonal caring behaviors in nursing contexts (Yoon, 2005), later revised and shortened for children by Choi (2015). The scale consists of 10 items representing perceived parental caregiving behaviors (recognition, participation, sharing, active listening, accompaniment, praise, comfort, instilling hope, forgiveness, and acceptance). Each item is rated on a 5-point Likert scale (1 = very little to 5 = very much). Higher scores indicate higher perceived parental care. Cronbach's α was .90 in the present study.

2.3.4 Intolerance of Uncertainty

IU was assessed using the 12-item IUS-12 validated by Kim (2010), derived from the original IUS short form (Carleton et al., 2007). The scale includes prospective anxiety (7 items) and inhibitory anxiety (5 items). Items are rated on a 4-point Likert scale (1 = not at all true to 4 = very true). Higher scores indicate greater IU (lower tolerance). Cronbach's α was .78 in this study.

2.3.5 Self-Esteem

Self-esteem was measured using the Rosenberg Self-Esteem Scale (Rosenberg, 1965) translated and adapted by Jeon (1974). Items are rated on a 4-point Likert scale (1 = strongly disagree to 4 = strongly agree). Items 3, 5, 8, 9, and 10 are reverse-scored. Higher scores indicate higher self-esteem. Cronbach's α was .86 in this study.

2.3.6 Stress

Daily stress responses were measured using the Adolescent Daily Stress Response Scale developed and validated by Bae and Kim (2014). The scale consists of 27 items across behavioral (6 items), emotional (8 items), and physical (13 items) stress responses. Items are rated on a 3-point Likert scale (1 = not at all to 3 = often). Scores were calculated as mean values across items; higher scores indicate higher stress responses. Cronbach's α was .90 in this study.

2.4. Ethical Considerations

Participants received a detailed explanation of the study purpose and procedures, confidentiality, voluntary participation, and the right to withdraw without disadvantage. Written informed consent was obtained prior to participation. Questionnaires and consent forms were sealed in opaque envelopes and stored securely. Identification codes were assigned to prevent personal identification. Electronic data were stored on a password-protected computer. All data will be destroyed after study completion in accordance with applicable personal information protection regulations.

2.5. Data Analysis

Frequency analysis was conducted for demographic characteristics. Differences in key variables by general characteristics were examined using independent t-tests and one-way ANOVA, with Scheffé post hoc tests.

Correlation and multiple regression analyses were used to examine relationships and predictors. Mediation analyses were performed using PROCESS Macro v4.1 (Hayes, 2013).

3. Results

3.1. General Characteristics of the Participants

The general characteristics of the participants are presented in <Table 1>. A total of 159 middle school students participated in the study, of whom 91 were male (57.2%) and 68 were female (42.8%). Regarding academic performance, 43 students (27.0%) reported high achievement, 91 students (57.2%) reported average achievement, and 25 students (15.7%) reported low achievement, with the majority indicating an average level of academic performance.

In terms of relationships with parents, 116 students (73.0%) reported having a good relationship with their parents, while 43 students (27.0%) reported an average relationship, indicating that most participants perceived their relationships with parents positively. Regarding the level of interaction with parents, 85 students (53.5%) reported good interaction and 74 students (46.5%) reported average interaction, suggesting that more than half of the participants perceived their interactions with parents as positive.

Table 1 : General Characteristics of the Participants

Category		Frequency (n)	Percentage (%)
Gender	Male	91	57.2
	Female	68	42.8
Academic Achievement	High	43	27.0
	Average	91	57.2
	Low	25	15.7
Parent Relationship	Good	116	73.0
	Fair	43	27.0
Communication with Parents	Good	85	53.5
	Fair	74	46.5
Total		159	100.0

3.2. Analysis of Study Variables

3.2.1. Descriptive Statistics of Variables and Differences According to General Characteristics

The overall trends of parental care perception, intolerance of uncertainty, self-esteem, and daily stress responses examined through descriptive statistics are presented in <Table 2>. Prior to data analysis, the normality of the measured variables was examined. As shown in <Table 2>, skewness values were less than ±3 and kurtosis values were less than ±8, indicating that all variables satisfied the assumptions of normality.

Table 2 : Descriptive Statistics and Normality Tests of the Measured Variables

Variables	Min	Max	Mean	SD	Skewness	Kurtosis
Perception of Parental Care	1.10	5.00	3.67	.78	-.68	.58
Intolerance of Uncertainty	1.33	3.67	2.42	.46	-.26	-.05
Self-Esteem	1.30	4.60	2.93	.55	.08	-.23
Daily Stress Response	1.04	2.70	1.55	.34	1.04	.90

The score ranges were as follows: perception of parental care (1–5), intolerance of uncertainty and self-esteem (1–4), and stress response (1–3).

The mean scores of the study variables were as follows: parental care perception (M = 3.67), intolerance of uncertainty (M = 2.42), self-esteem (M = 2.93), and daily stress responses (M = 1.55). Differences in parental care perception, intolerance of uncertainty, self-esteem, and daily stress responses according to participants' general characteristics are presented in <Table 3>.

First, parental care perception showed statistically significant differences according to academic performance, relationship with parents, and level of interaction with parents. Students with high academic performance (M = 3.89) reported significantly higher parental care perception than those with low academic performance (M = 3.41; $p < .05$). Additionally, students who reported a good relationship with parents (M = 3.92) showed significantly higher parental care perception than those reporting an average relationship (M = 3.00; $p < .001$). Similarly, students with good interaction with parents (M = 4.07) reported significantly higher parental

care perception than those with average interaction (M = 3.21; p < .001).

Intolerance of uncertainty differed significantly according to relationship with parents (p < .05). Students who reported an average relationship with parents (M = 2.56) demonstrated significantly higher intolerance of uncertainty compared to those who reported a good relationship with parents (M = 2.37).

Self-esteem showed significant differences according to gender, academic performance, relationship with parents, and level of interaction with parents. Male students (M = 3.02) reported significantly higher self-esteem than female students (M = 2.81; p < .05). Students with high academic performance (M = 3.18) reported significantly higher self-esteem than those with average (M = 2.89) or low academic performance (M = 2.63; p < .001). In addition, students who reported a good relationship with parents (M = 3.04) demonstrated higher self-esteem than those reporting an average relationship (M = 2.62; p < .001). Similarly, students with good interaction with parents (M = 3.11) reported higher self-esteem than those with average interaction (M = 2.72; p < .001).

Daily stress responses showed significant differences according to gender, relationship with parents, and level of interaction with parents. Female students (M = 1.64) reported significantly higher stress responses than male students (M = 1.49; p < .01). Students who reported an average relationship with parents (M = 1.68) showed higher stress responses than those reporting a good relationship (M = 1.51; p < .01). In addition, students with average interaction with parents (M = 1.62) demonstrated higher stress responses than those with good interaction (M = 1.49; p < .05).

Table 3 : Differences in Perception of Parental Care, Intolerance of Uncertainty, Self-Esteem, and Stress Response by General Characteristics

Variables		Perception of Parental Care	Intolerance of Uncertainty	Self-Esteem	Stress Response
Total		3.67±.78	2.42±.46	2.93±.55	1.55±.34
Gender	Male	3.66±.80	2.43±.43	3.02±.56	1.49±.29
	Female	3.68±.75	2.41±.49	2.81±.52	1.64±.38
	t(*p*)	-.15	.26	2.41*	-2.66**
Academic Achievement	High[a]	3.89±.57	2.33±.43	3.18±.50	1.52±.29
	Average[b]	3.64±.82	2.45±.46	2.89±.52	1.59±.36
	Low[c]	3.41±.83	2.47±.49	2.63±.55	1.49±.32
	F(*p*)[+]	3.24*(c<a)	1.08	9.47*** (c, b<a)	1.26
Relationship with Parents	Good	3.92±.61	2.37±.47	3.04±.51	1.51±.32
	Average	3.00±.78	2.56±.41	2.62±.52	1.68±.37
	t(*p*)	7.85***	-2.44*	4.53***	-2.92**
Communication with Parents	Good	4.07±.53	2.37±.45	3.11±.52	1.49±.30
	Average	3.21±.76	2.48±.47	2.72±.51	1.62±.37
	t(*p*)	8.09***	-1.56	4.76***	-2.44*

*** p<.001, ** p<.01, * p<.05, [+]Scheffe test

3.2.2. Relationships Among Parental Care Perception, Intolerance of Uncertainty, Self-Esteem, and Stress Responses

The correlations among parental care perception, intolerance of uncertainty, self-esteem, and daily stress responses are presented in <Table 4>.

Parental care perception showed a significant positive correlation with self-esteem (r = .48, p < .01) and significant negative correlations with intolerance of uncertainty (r = −.16, p < .05) and daily stress responses (r = −.28, p < .01). Intolerance of uncertainty was negatively correlated with self-esteem (r = −.39, p < .01) and positively correlated with daily stress responses (r = .23, p < .01). Self-esteem showed a significant negative correlation with daily stress responses (r = −.41, p < .01).

These findings indicate that middle school students who perceived higher levels of parental care tended to have higher self-esteem, greater tolerance for uncertain situations, and lower levels of daily stress responses. In contrast, students with higher intolerance of uncertainty tended to report lower self-esteem and stronger stress responses. Furthermore, students with higher self-esteem demonstrated fewer stress responses, such as emotional outbursts toward others or negative physical reactions under stressful conditions.

Table 4 : Relationships among Perception of Parental Care, Intolerance of Uncertainty, Self-Esteem, and Stress Response

Variables	P	I	SE	SR
P	1.00			
I	-.16*	1.00		

SE	.48**	-.39**	1.00	
SR	-.28**	.23**	-.41**	1.00

** p<.01, * p<.05

P: Perception of parental care; I: Intolerance of uncertainty; SE: Self-esteem; SR: Stress response

3.2.3. Effects of Parental Care Perception, Intolerance of Uncertainty, and Self-Esteem on Stress Responses

Hierarchical regression analysis was conducted to identify factors influencing daily stress responses among middle school students. As control variables, gender, relationship with parents, and level of interaction with parents—variables that showed significant differences in stress responses—were entered in the first step. Parental care perception, intolerance of uncertainty, and self-esteem were entered as independent variables to examine their effects on stress responses. The results of the regression analysis are presented in <Table 5>.

The Durbin–Watson statistic of the regression model ranged from 0 to 4, with values closer to 2 indicating no autocorrelation and satisfying the assumption of independence of residuals. In this study, the Durbin–Watson value was 2.199, indicating that the assumption of independence was met. Variance Inflation Factor (VIF) values ranged from 1.103 to 1.822, all below the threshold of 10, indicating no multicollinearity among the independent variables.

Table 5 : shows the influence of perception of parental care, intolerance of uncertainty, and self-esteem on stress response

Variables	Model 1			Model 2			
	β	t	p	β	t	p	VIF
Gender	.25	3.31	.001	.18	2.43	.016	1.103
Parent–Child Relationship	.20	2.30	.023	.09	1.03	.305	1.591
Communication with Parents	.11	1.27	.207	.01	.11	.916	1.618
Perception of Parental Care				-.09	-.88	.379	1.822
Intolerance of Uncertainty				.10	1.30	.196	1.199
Self-Esteem				-.26	-2.79	.006	1.623
R2	.121			.213			
ΔR^2				.092			
F(p)	7.14(.000)			6.87(.000)			

Dependent Variable: Stress Response, Durbin–Watson = 2.199
Gender (Male=0, Female=1); Parent–Child Relationship (Good=0, Average=1)
Communication with Parents (Good=0, Average=1)

In Model 1, among the control variables, level of interaction with parents did not have a significant effect on stress responses, whereas gender ($\beta = .25$, $p < .001$) and relationship with parents ($\beta = .20$, $p < .05$) significantly predicted stress responses. Specifically, female students were predicted to show higher levels of daily stress responses than male students, and students with an average relationship with parents were predicted to show higher stress responses than those with a good relationship. Model 1 explained 12.1% of the variance in stress responses ($F = 7.14$, $p < .001$).

In Model 2, which additionally included parental care perception, intolerance of uncertainty, and self-esteem, only self-esteem ($\beta = -.26$, $p < .01$) had a significant negative effect on stress responses. Parental care perception and intolerance of uncertainty did not show significant effects. These results indicate that, after controlling for gender, relationship with parents, and level of interaction with parents, students with higher self-esteem were predicted to exhibit lower levels of daily stress responses. Model 2 explained 21.3% of the variance in stress responses ($F = 6.87$, $p < .001$).

3.2.4. Mediating Effects of Intolerance of Uncertainty and Self-Esteem in the Relationship Between Parental Care Perception and Stress Responses

As shown in the results presented in <Table 5>, among parental care perception, intolerance of uncertainty, and self-esteem, only self-esteem had a significant negative effect on stress responses, whereas parental care perception and intolerance of uncertainty did not show significant direct effects.

However, as indicated by the correlation analysis in <Table 4>, all three variables—parental care perception, intolerance of uncertainty, and self-esteem—were significantly correlated with daily stress responses. Based on these findings, it can be inferred that parental care perception and intolerance of uncertainty may influence daily stress responses indirectly through self-esteem.

Therefore, this study further examined whether parental care perception and intolerance of uncertainty exert their effects on stress responses through the mediating role of self-esteem.

3.2.5. Mediating Effect of Intolerance of Uncertainty in the Relationship Between Parental Care Perception and Stress Responses

To examine the mediating effect of intolerance of uncertainty in the relationship between parental care perception and stress responses, a simple mediation analysis using PROCESS Macro Model 4 proposed by Hayes (2013) was conducted, along with bootstrapping. In the bootstrapping analysis, mediation effects were considered statistically significant if the 95% confidence interval did not include zero.

As shown in <Table 6>, the total effect of parental care perception on stress responses was −.121, with a confidence interval ranging from −.187 to −.054, which did not include zero, indicating statistical significance. The total effect consists of direct and indirect effects. The direct effect of parental care perception on stress responses was −.108, with a confidence interval of −.174 to −.042, which did not include zero, indicating statistical significance. However, the indirect effect through intolerance of uncertainty was −.013, with a confidence interval of −.036 to .002, which included zero, indicating that the indirect effect was not statistically significant.

These findings indicate that parental care perception does not indirectly influence stress responses through intolerance of uncertainty. Thus, intolerance of uncertainty did not serve as a mediator in the relationship between parental care perception and stress responses among middle school students.

Table 6 : Mediating Effect of Intolerance of Uncertainty in the Relationship between Perception of Parental Care and Stress Response

Path	B	SE	t	p	LLCI	ULCI
Perception of Parental Care → Intolerance of Uncertainty	-.093	.047	-1.985	.049	-.185	.000
Perception of Parental Care → Stress Response	-.108	.033	-3.222	.002	-.174	-.042
Intolerance of Uncertainty	.141	.056	2.501	.013	.030	.253
→ Stress Response						
Bootstrapping Analysis Results for Mediating Effect Verification						
Model	Effect	SE	LLCI	ULCI		
Total Effect (X→Y)	-.121	.034	-.187	-.054		
Direct Effect	-.108	.033	-.174	-.042		
Indirect Effect	-.013	.010	-.036	.002		

3.2.6. Mediating Effect of Self-Esteem in the Relationship Between Parental Care Perception and Stress Responses

The mediating effect of self-esteem in the relationship between parental care perception and stress responses is presented in <Table 7>. The total effect of parental care perception on stress responses was −.121, with a confidence interval of −.187 to −.054, which did not include zero, indicating statistical significance.

When the indirect effect through self-esteem was included, the direct effect of parental care perception on stress responses was −.047, with a confidence interval of −.118 to .025, which included zero and was not statistically significant. In contrast, the indirect effect through self-esteem was −.074, with a confidence interval of −.117 to −.039, which did not include zero and was statistically significant.

The presence of a significant indirect effect alongside a non-significant direct effect indicates that self-esteem fully mediates the relationship between parental care perception and stress responses. In the mediation model, parental care perception had a positive effect on self-esteem, while self-esteem had a negative effect on stress responses. These findings suggest that higher perceived parental care enhances self-esteem, which in turn reduces stress responses among middle school students.

Table 7 : Mediating Effect of Self-Esteem in the Relationship between Perception of Parental Care and Stress Response

Path	B	SE	t	p	LLCI	ULCI
Perception of Parental Care → Self-Esteem	.337	.050	6.785	.000	.239	.435
Perception of Parental Care → Stress Response	-.047	.036	-1.296	.197	-.118	.025

Self-Esteem → Stress Response	-.219	.051	-4.282	.000	-.320	-.118
Bootstrapping Analysis Results for Mediating Effect Verification						
Model	Effect	SE	LLCI	ULCI		
Total Effect (X → Y)	-.121	.034	-.187	-.054		
Direct Effect	-.047	.036	-.118	.025		
Indirect Effect	-.074	.020	-.117	-.039		

4. Discussion

This study examined the relationships among parental care perception (PCP), intolerance of uncertainty (IU), self-esteem, and daily stress responses among middle school students, with the aim of exploring the roles of these variables in adolescents' emotional well-being and stress management processes. The main findings and their implications are discussed as follows.

First, the mean score for parental care perception among the participants was 3.67, exceeding the midpoint of the scale (3.00), indicating that middle school students perceived receiving sufficient care and attention from their parents. This finding is consistent with previous studies reporting that parental care and support positively influence adolescents' identity formation, emotional stability, and social development (Lee, 2017; Min, 1990; Choi, 2015). As primary attachment figures and sources of psychological support, parents' caring behaviors—such as empathy, attentive listening, encouragement, and emotional responsiveness—play a critical role in the development of adolescents' self-esteem (Ahn, 2022). The positive perception of parental care observed in this study suggests that parental relationships serve as important psychological resources for adolescents and may positively influence self-esteem and stress responses. Future studies may benefit from examining specific dimensions of parental care, such as emotional and economic support, separately.

Second, students with higher parental care perception demonstrated lower stress responses, suggesting that positive parental interactions and emotional support may function as protective factors that buffer stress. These findings emphasize that qualitative aspects of parental care—such as emotional support, trust-based communication, and acceptance—may be more important than mere increases in parental involvement. Future research should further examine the interactive effects of specific parental care components (emotional, economic, and behavioral support) on adolescents' psychological stability and stress responses.

Third, intolerance of uncertainty, which reflects difficulty in enduring uncertain situations, had a mean score of 2.42, slightly below the midpoint of 2.50, suggesting that students demonstrated a moderate level of tolerance for uncertainty. Given that adolescence is a developmental period marked by increasing anxiety and stress related to future uncertainty, effective approaches to enhancing tolerance for uncertainty—such as decision-making skills and stress management training—are needed. Intolerance of uncertainty has been shown to be closely associated with anxiety, depression, impulsivity, and stress responses during adolescence (Kim et al., 2025; Carleton et al., 2007). In contemporary society, characterized by rapid change and competition, adolescents face heightened uncertainty regarding their future (Song and Jo, 2016). Therefore, school-based interventions incorporating cognitive-behavioral therapy (CBT) and emotional regulation training should be developed to help adolescents adaptively cope with uncertainty. Moreover, parental practices significantly influence the development of tolerance for uncertainty, underscoring the importance of parent education programs that encourage supportive responses to failure and ambiguity (Lee and Kim, 2022; Yoo et al., 2020; Hong and Lee, 2018).

Fourth, intolerance of uncertainty did not show a significant direct effect on stress responses in the regression analysis. This may be due to the strong predictive power of self-esteem, which appeared to offset the effects of intolerance of uncertainty. According to Tak, et. al., study, authoritative parenting significantly enhances children's self-esteem, and this increased self-esteem plays a key mediating role in improving their well-being, highlighting the positive link between parenting style and children's emotional development. Additionally, the measurement tool used may not have fully captured intolerance of uncertainty at the developmental level of middle school students, and the relatively low mean score suggests potential limitations in sensitivity. Thus, the non-significant findings should be interpreted cautiously,

considering developmental characteristics, measurement sensitivity, and the relative influence of other psychological factors. Future studies should consider age-appropriate measurement tools and comparative analyses across developmental stages.

Fifth, the mean self-esteem score of 2.93 indicated that participants generally evaluated themselves positively. Self-esteem is a crucial factor influencing academic achievement, interpersonal relationships, and mental health. The finding that higher self-esteem was associated with lower stress responses aligns with previous research identifying self-esteem as a protective buffer against stress (Jeon, 1974; Song and Shin, 2020). Adolescents with higher self-esteem tend to exhibit greater self-efficacy, self-acceptance, and emotional stability, which enhance resilience to stress. This study further confirmed that positive parental care perception contributes to the development of self-esteem. Future research should explore causal pathways using structural equation modeling (SEM) or experimental designs evaluating the effectiveness of self-esteem enhancement programs.

Sixth, the mean score for daily stress responses was 1.55, which is relatively low compared to the reference value of 2.00, suggesting that participants generally adapted well to daily stress. However, low stress scores do not necessarily indicate positive psychological states, as stress may manifest through suppression, internalized anxiety, or avoidance behaviors (Nam and Hong, 2022; Song and Ji, 2020). Additionally, the low mean score may reflect a floor effect, warranting caution in interpretation. Future studies should include samples with diverse stress levels.

Significant differences in stress responses were observed according to gender, relationship with parents, and self-esteem. Female students reported higher stress responses than male students, consistent with previous findings indicating greater emotional sensitivity and social comparison among females (Han and Park, 2024). Students with better relationships with parents and higher self-esteem exhibited lower stress responses, highlighting the buffering roles of emotional support and positive self-evaluation. These findings underscore the need for school-based emotional regulation programs, family-linked counseling interventions, and gender-sensitive psychological support.

Overall, this study demonstrated significant associations among parental care perception, intolerance of uncertainty, self-esteem, and stress responses. Parental care and support play crucial roles in enhancing self-esteem and mitigating stress responses. Given the central role of self-esteem as a mediator, fostering positive self-concept should be a key strategy in adolescent stress management. These findings have important implications for educational and counseling interventions aimed at improving adolescents' emotional well-being.

5. Conclusion and Implications

This study analyzed the effects of parental care perception, intolerance of uncertainty, and self-esteem on daily stress responses among middle school students. By examining how adolescents' perceptions of parental care relate to tolerance for uncertainty, self-esteem, and stress coping, this study provides foundational evidence for understanding adolescents' emotional stability and psychological adaptation.

This study is significant in that it empirically verified the role of parental care perception as a determinant of adolescents' stress responses, extending beyond traditional parenting style or attachment-focused research to emphasize the psychological impact of perceived parental care. Additionally, by identifying intolerance of uncertainty as a potential mediating variable, this study highlighted the importance of psychological tolerance in adolescents' adaptation processes. Furthermore, by integrating self-esteem as a key internal resource, this study confirmed its buffering role in emotional adjustment and stress responses, providing theoretical support for self-esteem-focused counseling and intervention strategies.

From an interdisciplinary perspective, the systematic analysis of emotional and behavioral factors such as parental care perception, intolerance of uncertainty, and self-esteem provides a foundation for the development of integrated emotional support platforms, including digital mental health services and AI-based psychological support systems for adolescents. This study offers academic and practical insights into the convergence of psychology, mental health, education, and digital healthcare.

Based on these findings, several implications are proposed. First, at the educational policy level, integrated adolescent mental health support systems centered on school counselors should be strengthened, including preventive psychological education, regular monitoring of at-risk students, and coordinated family–medical support models. Second, curricula focused on emotional resilience should be implemented to enhance adolescents' abilities to recognize and regulate emotions. Third, adolescent welfare programs should integrate mental health and family support services to promote psychological well-being through improvements in family environments.

In conclusion, this study emphasizes the importance of strengthening emotional support systems linking families, schools, and communities. By elucidating the interactive roles of parental care perception, intolerance of uncertainty, and self-esteem, this research provides strategic directions for improving adolescents' emotional well-being and stress management. Future research should develop comprehensive models incorporating emotional resilience and social support networks to inform adolescent mental health policy and practice.

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