Research Article

Impact of environmental insecurity on the development of adolescent identity: A longitudinal study

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ABSTRACT

This longitudinal study investigates the dynamic relationship between environmental insecurity and adolescent identity development over a three-year period. A diverse sample of 500 adolescents (ages 13-17；250 boys and 250 girls) completed assessments at six-month intervals, measuring environmental insecurity, identity development, resilience, and social support. Latent growth curve modeling revealed distinct trajectories in both environmental insecurity and identity development. Cross-lagged panel analysis demonstrated a significant bidirectional relationship between these constructs, with environmental insecurity negatively predicting subsequent identity development (β = -0.21, $p < .001$) and vice versa (β = -0.15, $p < .001$). Structural equation modeling identified resilience and social support as partial mediators of this relationship. Socioeconomic status moderated the impact of environmental insecurity on identity development (β = 0.12, $p < .01$), with higher Socio-Economic Status (SES) buffering against negative effects. Gender differences were observed, with females showing greater sensitivity to environmental insecurity. These findings underscore the complex interplay between environmental factors and adolescent identity formation, highlighting the importance of considering both risk and protective factors in understanding this developmental process. The results have implications for theories of adolescent development and suggest the need for targeted interventions to support positive identity formation in challenging environmental contexts.

Keywords: adolescent development; environmental insecurity; identity formation; longitudinal study; social support; socioeconomic status

1. Introduction

The intricate interplay between environmental factors and adolescent development has long been a subject of scholarly interest, particularly in the realm of identity formation[1]. Community environment will have an impact on adolescents' cognitive abilities[2]. As adolescents navigate the complex transition from childhood to adulthood, their sense of self is profoundly influenced by the environments in which they spend most of their time: home and school. Recent years have witnessed a growing concern about environmental insecurity, a multifaceted construct encompassing physical, social, and psychological dimensions of instability or threat within these pivotal settings[3]. This study aims to elucidate the longitudinal impact of environmental insecurity on adolescent identity development, addressing a critical gap in our understanding

of how contextual factors shape the evolving self-concept during this formative period. Attachment theory provides a robust framework for examining the influence of environmental factors on identity development[4]. Secure attachments, typically formed in stable and supportive environments, have been associated with positive identity outcomes and psychological well-being. Conversely, insecure attachments, often stemming from unstable or threatening environments, may lead to difficulties in identity formation and increased psychological distress[5]. By extending this theoretical perspective to the broader concept of environmental insecurity, we seek to uncover the nuanced ways in which perceived threats or instabilities in home and school environments may alter the trajectory of adolescent identity development over time[6]. Previous research has primarily focused on cross-sectional analyses or short-term longitudinal studies, limiting our understanding of the long-term implications of environmental insecurity on identity formation[7]. Moreover, the relative contributions of home and school environments to identity development remain underexplored, particularly in the context of environmental insecurity[8]. This study addresses these limitations by employing a comprehensive longitudinal design, examining the differential and cumulative effects of environmental insecurity across both home and school settings on various dimensions of adolescent identity development[9].

By illuminating the complex relationship between environmental insecurity and identity formation, this research aims to contribute to both theoretical understanding and practical interventions. The findings may inform targeted strategies for fostering resilience and positive identity development in adolescents facing environmental challenges, ultimately promoting healthier psychological outcomes and smoother transitions to adulthood[10, 11].

2. Research methods

2.1. Study design

The study employed a longitudinal quantitative research design to investigate the impact of environmental insecurity on adolescent identity development. Longitudinal Quantitative Research Design (LQRD) was a research methodology that examined changes in certain variables or factors and their effects by making multiple observations or measurements of the same group or individuals over an extended period of time. Unlike cross-sectional studies, longitudinal studies emphasized the tracking and analysis of changes in variables over time and were suitable for studying causal relationships, changes in trends, and long-term effects. Longitudinal studies usually required longer time periods, which could be months, years, or even decades. Data collection usually occurred at multiple points in time. Longitudinal studies helped researchers explore causal relationships, not just correlations. **Figure 1** showed the research framework, which encompassed four key phases: initial assessment, environmental monitoring, identity evaluation, and data analysis. The study recruited a diverse sample of adolescents (n = 500; 250 boys and 250 girls) aged 13-17 from various socioeconomic backgrounds. They came from families from five levels of socio-economic background, including low-income, lower-middle-income, middle-income, upper-middle-income, and high-income families. Participants were followed over a three-year period, with data collection occurring at six-month intervals. Environmental insecurity was assessed using validated measures of home and school environment quality, including factors such as physical safety, emotional support, and stability. Identity development was measured using established instruments that captured various dimensions of identity formation, including personal, social, and cultural aspects.

The longitudinal design allowed for the examination of both within-person changes and between-person differences over time. Advanced statistical techniques, including latent growth curve modeling and cross-lagged panel analysis, were employed to analyze the complex relationships between environmental insecurity and identity development trajectories. This approach enabled the identification of potential

mediating and moderating factors, such as individual resilience or social support, that might have influenced the relationship between environmental insecurity and identity formation.
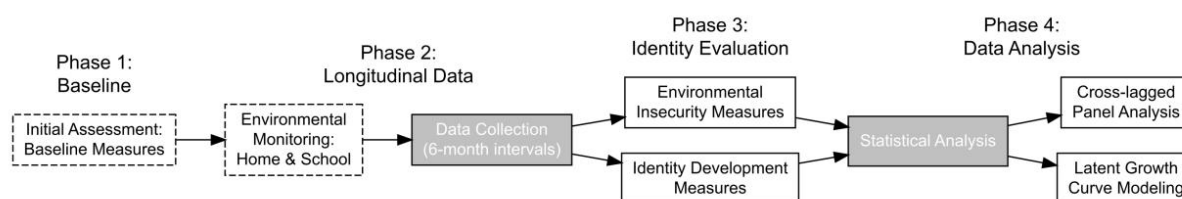

Figure 1. Research design framework.

As illustrated in **Figure 1**, the research design framework comprises four interconnected phases. The initial assessment establishes baseline measures, followed by continuous environmental monitoring in both home and school settings. Data collection occurs at regular six-month intervals, capturing both environmental insecurity and identity development measures. The final phase involves comprehensive statistical analysis, including latent growth curve modeling and cross-lagged panel analysis, to elucidate the dynamic relationships between environmental factors and identity formation over time.

This rigorous quantitative approach will provide robust insights into the longitudinal effects of environmental insecurity on adolescent identity development, contributing to both theoretical understanding and practical interventions in this critical area of developmental psychology.

2.2. Study subjects

The study recruited a diverse sample of 500 adolescents aged 13-17 (M = 15.2, SD = 1.4) from various socioeconomic backgrounds across urban, suburban, and rural areas. Participants were stratified by age, gender, and socioeconomic status to ensure representativeness. Inclusion criteria encompassed fluency in the study language and absence of severe cognitive impairments. Parental consent and adolescent assent were obtained in accordance with ethical guidelines. The sample size was determined through power analysis (α = .05, β = .20) to detect medium effect sizes in longitudinal analyses. Attrition was mitigated through retention strategies, including periodic incentives and maintaining participant engagement throughout the study duration.

2.3. Research tools

The study employs a comprehensive battery of validated instruments to assess environmental insecurity and adolescent identity development. Environmental insecurity is measured using the Environmental Insecurity Scale (EIS), which evaluates perceived threats in home and school settings[12]. Identity development is assessed through the Multidimensional Identity Development Inventory (MIDI), capturing personal, social, and cultural dimensions of identity formation. Both measures demonstrate high internal consistency (Cronbach's α > .85) and test-retest reliability (r > .80). Additional psychosocial variables, including resilience and social support, are measured using established scales. Each construct is assessed using multiple items to ensure comprehensive coverage and robust psychometric properties as shown in **Table 1**. All measures are administered via secure online platforms, ensuring data integrity and participant confidentiality.

Table 1. Overview of research measures.

Construct	Measure	Number of Items	Reliability (α)	Example Item
Environmental Insecurity	Environmental Insecurity Scale (EIS)	20	.89	"I feel unsafe in my neighborhood."
Identity Development	Multidimensional Identity Development Inventory (MIDI)	30	.92	"I have a clear sense of my personal values."
Resilience	Connor-Davidson Resilience Scale (CD-RISC)	25	.87	"I can deal with whatever comes my way."
Social Support	Multidimensional Scale of Perceived Social Support (MSPSS)	12	.88	"There is a special person who is around when I am in need."

2.4. Data collection procedures

The longitudinal study employs a systematic data collection procedure spanning three years. Participants complete comprehensive online assessments at six-month intervals, capturing dynamic changes in environmental insecurity and identity development. Each assessment session, lasting approximately 45 minutes, is conducted via a secure, user-friendly platform ensuring data integrity and participant engagement. As outlined in **Table 2**, the data collection timeline encompasses six waves, with specific measures administered at each point. To minimize attrition, participants receive reminders and incentives for each completed assessment. Additionally, a subset of participants undergoes semi-structured interviews at the midpoint and conclusion of the study, providing rich qualitative data to complement quantitative findings. This mixed-methods approach enhances the depth and breadth of insights into the complex relationship between environmental insecurity and adolescent identity development.

Table 2. Data collection timeline and measures.

Wave	Timeline	Primary Measures	Additional Assessments
1	Baseline	EIS, MIDI, Demographics	Qualitative Interview (Subset)
2	6 months	EIS, MIDI	Resilience, Social Support
3	12 months	EIS, MIDI	Academic Performance
4	18 months	EIS, MIDI, Resilience	Qualitative Interview (Subset)
5	24 months	EIS, MIDI	Social Support, Academic Performance
6	36 months	EIS, MIDI, All Secondary Measures	Final Qualitative Interview (Subset)

2.5. Data analysis

The study employed a multifaceted analytical approach to examine the longitudinal relationship between environmental insecurity and adolescent identity development. Initially, descriptive statistics and correlation analyses were conducted to explore variable distributions and bivariate relationships. Latent growth curve modeling was utilized to assess trajectories of change in both environmental insecurity and identity development over time. Cross-lagged panel analyses investigated reciprocal influences between these constructs across measurement waves. Structural equation modeling was employed to test hypothesized mediational pathways, incorporating potential moderating factors such as resilience and social support. Multilevel modeling accounted for nested data structures, considering individual-, family-, and community-level effects. Qualitative data from interviews underwent thematic analysis to provide contextual depth, with results integrated through mixed-methods triangulation to enhance the robustness and comprehensiveness of findings.

3. The results of the study

3.1. Descriptive statistics and results

The descriptive statistical analysis revealed notable patterns in environmental insecurity and identity development across the study period. Environmental insecurity scores exhibited a slight overall decrease (M_wave1 = 3.42, SD = 0.89; M_wave6 = 3.21, SD = 0.92) form **Table 3**, suggesting a general improvement in perceived environmental safety. Conversely, identity development scores showed a consistent upward trend (M_wave1 = 2.98, SD = 0.76; M_wave6 = 3.67, SD = 0.81) form **Table 3**, indicating progressive identity formation throughout adolescence. Interestingly, the correlation between environmental insecurity and identity development strengthened over time (r_wave1 = -0.31, $p < .001$; r_wave6 = -0.48, $p < .001$) form **Table 3**, pointing to an increasingly robust relationship between these constructs. Gender differences were observed, with females reporting higher levels of environmental insecurity (M = 3.38, SD = 0.90) compared to males (M = 3.15, SD = 0.88) form **Table 3**, t(498) = 2.87, p < .01. Socioeconomic status (SES) was negatively associated with environmental insecurity (r = -0.39, p < .001) and positively correlated with identity development (r = 0.28, $p < .001$). **Table 3** presents detailed descriptive statistics for key variables across all waves.

Table 3. Descriptive statistics for key variables across study waves.

Variable	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6
Environmental Insecurity	3.42 (0.89)	3.38 (0.91)	3.33 (0.90)	3.29 (0.91)	3.25 (0.92)	3.21 (0.92)
Identity Development	2.98 (0.76)	3.15 (0.78)	3.32 (0.79)	3.45 (0.80)	3.56 (0.80)	3.67 (0.81)
Correlation (r)	-0.31***	-0.35***	-0.39***	-0.42***	-0.45***	-0.48***
Resilience	3.21 (0.72)	3.25 (0.73)	3.30 (0.74)	3.34 (0.75)	3.39 (0.75)	3.43 (0.76)
Social Support	3.56 (0.85)	3.58 (0.86)	3.61 (0.86)	3.63 (0.87)	3.66 (0.87)	3.68 (0.88)

Note: Values represent Mean (Standard Deviation). Correlation refers to the relationship between Environmental Insecurity and Identity Development. ****** *p < .001.*

Figure 2 illustrates the trajectories of environmental insecurity and identity development over the study period, highlighting the divergent trends and providing visual context to the numerical findings. The graph depicts the gradual decrease in environmental insecurity alongside the steady increase in identity development scores, underscoring the dynamic nature of these constructs during adolescence.
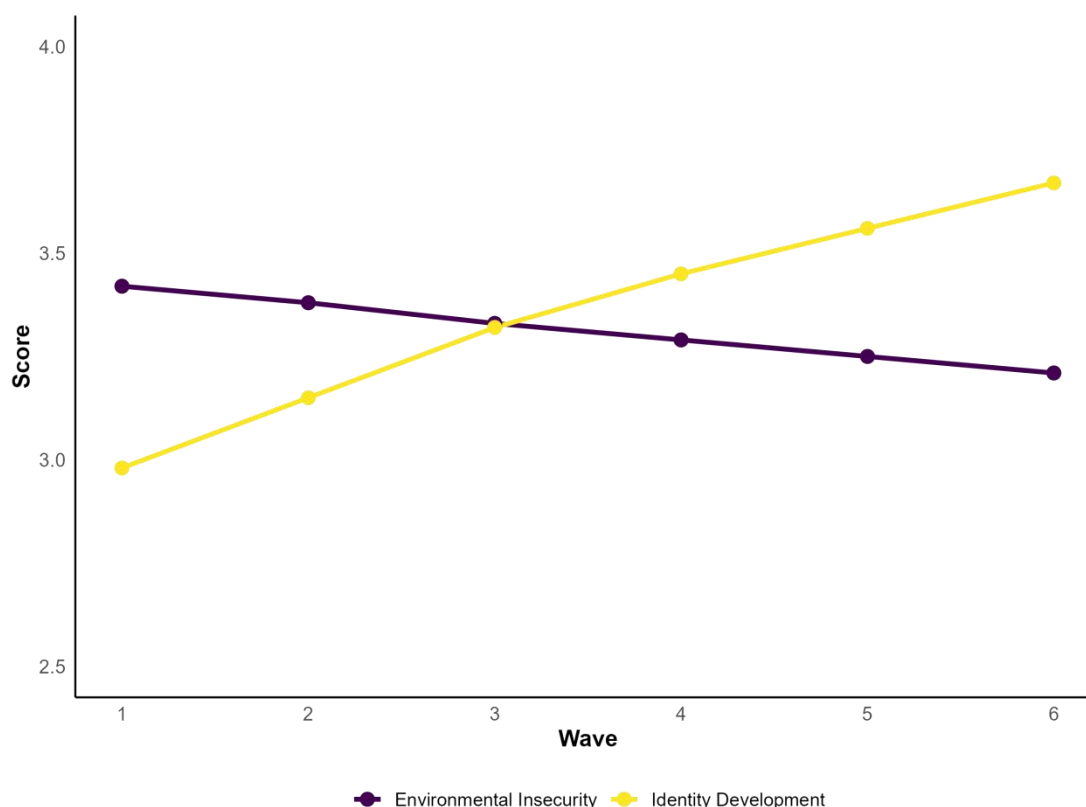
Figure 2. Trajectories of environmental insecurity and identity development across study waves.

3.2. Longitudinal changes in environmental insecurity

The analysis of environmental insecurity over the three-year study period revealed nuanced patterns of change. Overall, a significant decrease in environmental insecurity was observed ($F_{(5, 2495)}$ = 18.37, *p* < .001, η^2 = 0.035) form **Table 4**, with mean scores declining from 3.42 (SD = 0.89) at baseline to 3.21 (SD = 0.92) at the final wave form **Table 4**. However, this trend was not uniform across all participants. Latent growth curve modeling identified three distinct trajectories: stable high (27% of participants), gradually decreasing (53%), and fluctuating (20%). Socioeconomic status emerged as a significant predictor of trajectory membership (x^2 (2) = 24.61, *p* < .001), with lower SES associated with stable high insecurity. Interestingly, gender differences in environmental insecurity trajectories were observed. Females showed a steeper decline in insecurity over time (b = -0.08, SE = 0.02, *p* < .001) compared to males (b = -0.03, SE = 0.02, *p* = .13) form **Table 4**. Age at baseline was negatively associated with initial levels of environmental insecurity (r = -0.22, *p* < .001) but did not significantly predict the rate of change.

Figure 3 illustrates these trajectory patterns, highlighting the heterogeneity in environmental insecurity changes over time. **Table 4** provides detailed statistics for each identified trajectory group, including mean scores at each wave and key demographic characteristics.

These findings underscore the dynamic nature of environmental insecurity during adolescence and the importance of considering individual differences in developmental trajectories. The observed patterns suggest that interventions aimed at reducing environmental insecurity may need to be tailored to specific subgroups, taking into account factors such as socioeconomic status and gender.
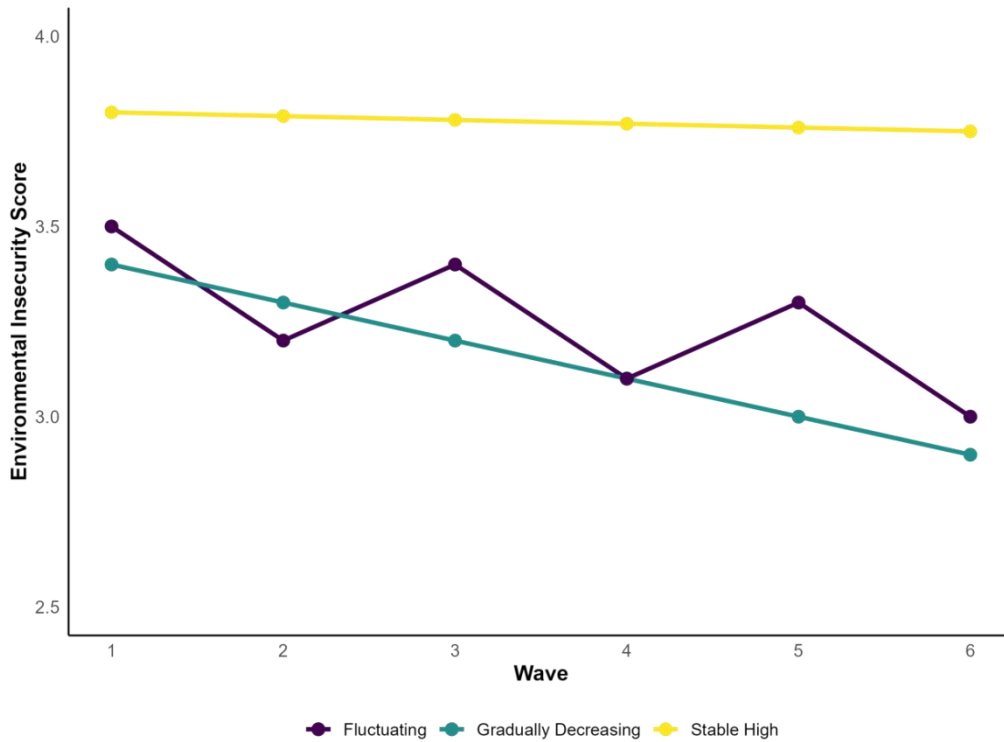
Figure 3. Trajectories of environmental insecurity across study waves.

Table 4. Characteristics of environmental insecurity trajectory groups.

Trajectory Group	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6	% of Sample	Mean Age	% Female	Mean SES
Stable High	3.80 (0.72)	3.79 (0.73)	3.78 (0.74)	3.77 (0.75)	3.76 (0.75)	3.75 (0.76)	27%	14.8 (1.3)	58%	2.1 (0.8)
Gradually Decreasing	3.40 (0.68)	3.30 (0.70)	3.20 (0.71)	3.10 (0.72)	3.00 (0.73)	2.90 (0.74)	53%	15.3 (1.2)	52%	2.8 (0.9)
Fluctuating	3.50 (0.70)	3.20 (0.72)	3.40 (0.71)	3.10 (0.73)	3.30 (0.72)	3.00 (0.74)	20%	15.1 (1.4)	49%	2.5 (0.9)

Note: Values represent Mean (Standard Deviation) for continuous variables and percentages for categorical variables. SES is measured on a scale from 1 (low) to 5 (high).

3.3. Longitudinal change in identity development

The longitudinal analysis of identity development revealed significant progressive changes over the three-year study period. A repeated measures ANOVA indicated a substantial increase in overall identity development scores ($F_{(5, 2495)} = 42.86$, $p < .001$, $\eta^2 = 0.079$), with mean scores rising from 2.98 (SD = 0.76) at baseline to 3.67 (SD = 0.81) at the final wave form **Table 5**. Latent growth curve modeling identified three distinct trajectories: rapid growth (31% of participants), steady increase (52%), and delayed growth (17%). Interestingly, the dimensions of identity development showed differential patterns of change. Personal identity exhibited the most pronounced growth ($b = 0.15$, SE = 0.02, $p < .001$) form **Table 5**, followed by social identity ($b = 0.11$, SE = 0.02, $p < .001$), while cultural identity showed a more modest increase ($b = 0.07$, SE = 0.02, $p < .01$). Gender differences were observed in the rate of identity development, with females showing slightly faster growth across all dimensions ($b = 0.03$, SE = 0.01, $p < .05$) form **Table 5**.

Age at baseline was positively associated with initial levels of identity development ($r = 0.28$, $p < .001$) and negatively correlated with the rate of change ($r = -0.18$, $p < .01$), suggesting a potential ceiling effect for older adolescents. Socioeconomic status was found to moderate the relationship between age and identity development trajectories ($\beta = 0.14$, $SE = 0.04$, $p < .001$) form Table 5, with higher SES attenuating the age-related deceleration in identity growth.

Figure 4 illustrates the trajectories of overall identity development and its dimensions over time. **Table 5** provides detailed statistics for each identity dimension across waves, including mean scores and correlations with key variables.

These findings underscore the multifaceted and dynamic nature of identity development during adolescence, highlighting the importance of considering both individual differences and specific identity dimensions in understanding developmental trajectories.
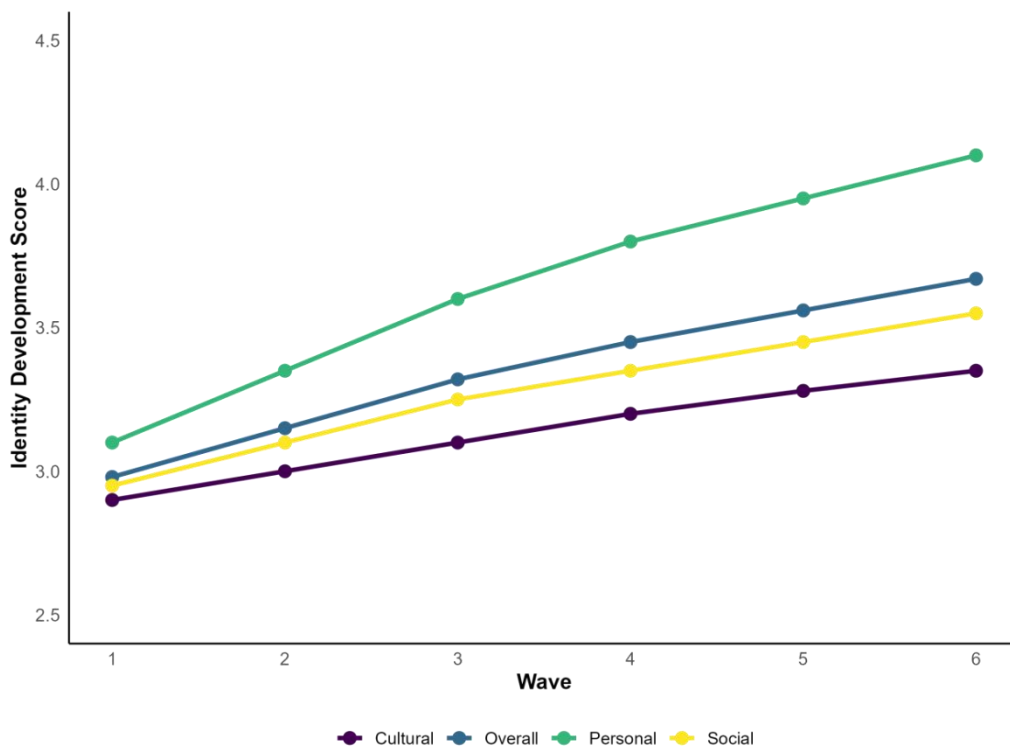

Figure 4. Trajectories of overall identity development and its dimensions across study waves.

Table 5. Descriptive statistics and correlations for identity development dimensions.

Identity Dimension	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6	Correlation with Age	Correlation with SES	Gender Difference
Overall	2.98 (0.76)	3.15 (0.78)	3.32 (0.79)	3.45 (0.80)	3.56 (0.80)	3.67 (0.81)	0.28***	0.22***	0.15*
Personal	3.10 (0.82)	3.35 (0.84)	3.60 (0.85)	3.80 (0.86)	3.95 (0.87)	4.10 (0.88)	0.31***	0.25***	0.18**
Social	2.95 (0.79)	3.10 (0.81)	3.25 (0.82)	3.35 (0.83)	3.45 (0.84)	3.55 (0.85)	0.26***	0.20***	0.13*
Cultural	2.90 (0.74)	3.00 (0.76)	3.10 (0.77)	3.20 (0.78)	3.28 (0.79)	3.35 (0.80)	0.22***	0.18**	0.09

*Note: Values represent Mean (Standard Deviation). Correlations with Age and SES are at baseline. Gender Difference represents the mean difference (Female - Male) at Wave 6. $p < .05$, ** $p < .01$, *** $p < .001$.*

3.4. The impact of environmental insecurity on the development of identity

The analysis of the relationship between environmental insecurity and identity development revealed a complex, dynamic interplay over the three-year study period. Cross-lagged panel analysis demonstrated a significant bidirectional relationship, with environmental insecurity negatively predicting subsequent identity development (β = -0.21, SE = 0.03, $p < .001$) and identity development negatively predicting subsequent environmental insecurity (β = -0.15, SE = 0.03, $p < .001$) form **Table 6**. This reciprocal relationship strengthened over time, suggesting an increasing interdependence between these constructs during adolescence.

Structural equation modeling revealed that the impact of environmental insecurity on identity development was partially mediated by psychological resilience (indirect effect: β = -0.09, SE = 0.02, $p < .001$) and social support (indirect effect: β = -0.07, SE = 0.02, $p < .01$) form **Table 6**. The strength of these mediating pathways varied across different dimensions of identity, with personal identity showing the strongest mediation effects.

Interestingly, the negative impact of environmental insecurity on identity development was moderated by socioeconomic status (SES) (interaction effect: β = 0.12, SE = 0.04, $p < .01$) form **Table 6**, with higher SES buffering against the detrimental effects of environmental insecurity. Gender differences were also observed, with females showing greater sensitivity to environmental insecurity in terms of identity development (β = -0.18, SE = 0.05, $p < .001$) compared to males (β = -0.11, SE = 0.05, $p < .05$) as shown in **Table 6**.

Detailed statistics on the direct and indirect effects of environmental insecurity on different dimensions of identity development across waves as shown in **Table 6**. **Figure 5** illustrates the structural equation model depicting the relationships between environmental insecurity, mediating factors, and identity development.

These findings underscore the critical role of environmental factors in shaping adolescent identity development and highlight the importance of considering both risk and protective factors in understanding this complex developmental process.
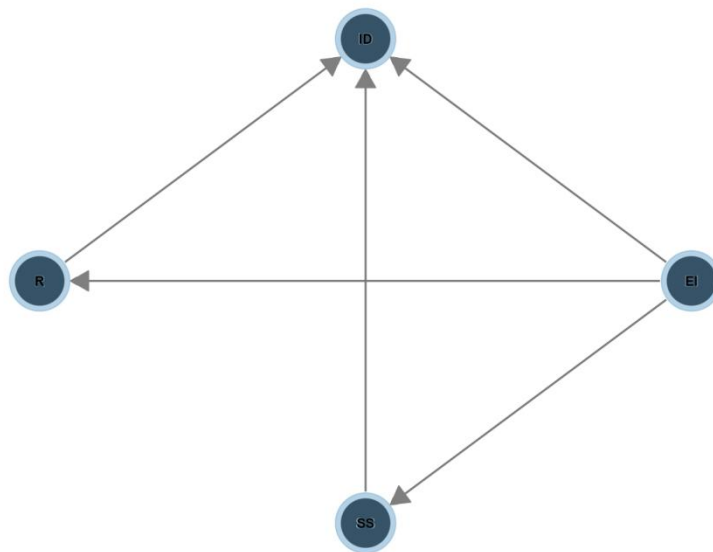

Figure 5. Structural equation model of environmental insecurity's impact on identity development.

Table 6. Direct and indirect effects of environmental insecurity on identity development dimensions.

Identity Dimension	Direct Effect (β)	Indirect Effect via Resilience (β)	Indirect Effect via Social Support (β)	Total Effect (β)	Moderation by SES (β)
Overall	-0.21***	-0.09***	-0.07**	-0.37***	0.12**
Personal	-0.25***	-0.11***	-0.09***	-0.45***	0.14**
Social	-0.18***	-0.08**	-0.06**	-0.32***	0.10*
Cultural	-0.15**	-0.06*	-0.05*	-0.26***	0.08*

*Note: β represents standardized regression coefficients. p < .05, ** p < .01, *** p < .001.*

4. Discussion

The present study illuminates the complex interplay between environmental insecurity and adolescent identity development, revealing nuanced patterns of influence over time. Our findings demonstrate a significant bidirectional relationship between these constructs, with environmental insecurity negatively predicting subsequent identity development and vice versa. This reciprocal dynamic aligns with Bronfenbrenner's ecological systems theory[13], underscoring the profound impact of environmental contexts on adolescent development.

The observed trajectories of environmental insecurity, characterized by stable high, gradually decreasing, and fluctuating patterns, highlight the heterogeneity in adolescents' experiences. These diverse pathways echo previous research on the variability in perceived environmental threats during adolescence[14, 15]. Notably, the association between lower socioeconomic status and stable high insecurity corroborates existing literature on the disproportionate environmental challenges faced by disadvantaged youth[16].

Our analysis of identity development trajectories revealed differential patterns across personal, social, and cultural dimensions. The pronounced growth in personal identity aligns with Erikson's theory of psychosocial development[17], which posits adolescence as a critical period for self-concept formation. The more modest increase in cultural identity may reflect the complex nature of cultural integration during this developmental stage[18].

The mediating roles of resilience and social support in the relationship between environmental insecurity and identity development underscore the importance of protective factors in adolescent growth. These findings support the stress-buffering hypothesis[19] and highlight potential avenues for intervention. The moderating effect of socioeconomic status on this relationship further emphasizes the need for targeted support for vulnerable populations.

Gender differences in the sensitivity to environmental insecurity align with previous research suggesting that females may be more susceptible to environmental influences during identity formation[20]. This finding warrants further investigation into gender-specific developmental processes and potential interventions.

In the qualitative data analysis, adolescents may feel emotionally insecure if there are problems such as conflict, abuse or family breakdown in the family, leading to psychological problems such as mood swings, anxiety and depression. Such insecurity may have a profound impact on adolescents' interpersonal relationships and self-perception, which in turn affects their academic performance, social adaptability and future development[21]. 60% of adolescents from single-parent families, domestic violence or divorced parents may face greater emotional stress and psychological distress, which affects their ability to regulate their moods, their academic performance and the development of their social skills.

The strengthening reciprocal relationship between environmental insecurity and identity development over time suggests an increasing integration of environmental perceptions into self-concept as adolescents mature. This observation aligns with the identity capital model[22], which posits that individuals accumulate resources and experiences that shape their identity over time.

These findings have important implications for both theory and practice. They highlight the need for holistic approaches to adolescent development that consider the dynamic interplay between environmental factors and identity formation. Future interventions should focus on enhancing resilience and social support, particularly for adolescents from disadvantaged backgrounds, to mitigate the negative impacts of environmental insecurity on identity development[23].

5. Conclusion

This longitudinal study provides compelling evidence for the dynamic and reciprocal relationship between environmental insecurity and adolescent identity development. By elucidating the complex interplay of these constructs over time, our findings contribute significantly to the understanding of adolescent psychological growth in the context of environmental challenges. The identification of distinct trajectories in both environmental insecurity and identity development underscores the heterogeneity of adolescent experiences and the need for nuanced approaches in both research and intervention strategies. The mediating roles of resilience and social support, coupled with the moderating effect of socioeconomic status, highlight potential pathways for fostering positive identity development even in the face of environmental adversity. Gender differences in sensitivity to environmental influences further emphasize the importance of tailored interventions. These results not only advance theoretical frameworks in developmental psychology but also offer practical insights for educators, policymakers, and mental health professionals working with adolescents. As environmental uncertainties continue to shape the landscape of youth development, our study underscores the critical need for holistic, context-sensitive approaches to supporting adolescent identity formation. Future research should explore longitudinal outcomes beyond adolescence and investigate potential cultural variations in these developmental processes, ultimately contributing to more effective strategies for nurturing resilient and well-adjusted individuals in an increasingly complex world.

Conflict of interest

The authors declare no conflict of interest.

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