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ORIGINAL RESEARCH

The Influence of Depression, Anxiety, and Stress on Ageism Among Undergraduates: Mediating Roles of Life Satisfaction, Gratitude, and Prosociality

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Background: The rapid growth of the global aging population highlights the need to address ageism and promote social inclusiveness. While considerable research has explored the impact of perceived ageism on older adults' mental health, limited attention has been given to how negative mental health factors—such as depression, anxiety, and stress (DAS)—influence ageist attitudes among younger populations, along with the psychological mechanisms underlying this relationship.

Purpose: This study first investigates the prevalence of ageism among undergraduates and its variation across certain socio-demographic factors at the research site. It then examines the predictive effects of depression, anxiety, and stress (DAS) on ageism, accounting for these socio-demographic factors. Finally, the study explores how DAS influences ageism both directly and indirectly through life satisfaction, gratitude, and prosociality.

Design and Settings: A cross-sectional study conducted at 11 higher education institutions in Jiangxi, China.

Participants: A total of 1,213 undergraduates participated in the study between July and August 2024. Following data cleaning, 1174 responses were included for analysis.

Methods: Data were collected using online questionnaires. *T*-tests and ANOVA assessed socio-demographic differences in ageism, and regression analysis examined DAS's predictive effects. Structural Equation Modeling (SEM) explored the pathways linking DAS to ageism via mediators.

Results: A moderate level of ageism was observed, with significant variations across socio-demographic factors like academic year, physical health, and contact with older adults. Depression and stress directly predicted ageism, while anxiety had indirect effects via depression and stress. DAS—as a composite construct—indirectly affected ageism via life satisfaction, gratitude, and prosociality.

Conclusion: Educational interventions should not only target the reduction of ageist attitudes but also address the underlying mental health conditions that fuel these biases. Promoting life satisfaction, gratitude, and prosociality, along with fostering meaningful intergenerational interactions, will be crucial for developing more effective strategies to combat ageism.

Plain Language Summary: Our study investigated how psychological factors like depression, anxiety, and stress (DAS) affect undergraduates' attitudes toward older adults, particularly ageism—a form of prejudice against older individuals. While previous research has often focused on how ageism negatively impacts older adults' mental health, few studies have looked at whether the mental health of young people plays a role in shaping these attitudes.

To investigate this, we surveyed undergraduate students from 11 higher education institutions in Jiangxi Province, China. We examined how DAS is related to ageist attitudes and whether positive traits, such as life satisfaction, gratitude, and prosociality (the tendency to help others), could lessen the negative influence of DAS on ageism.

Our findings show that students with higher levels of depression, anxiety, or stress are more likely to hold negative views about older adults. However, positive traits like gratitude, life satisfaction, and prosociality—as well as meaningful interactions with older adults—appear to soften or reduce the harmful effects of DAS on ageism.

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These results suggest that improving mental health, fostering positive traits, and facilitating quality interactions between young and older generations could be effective strategies for reducing ageism. This research has important implications for educational programs aimed at promoting respect and empathy across generations.

Keywords: mental health, ageism, life satisfaction, gratitude, prosociality, undergraduates

Introduction

Background

In the context of global population aging, the demographic landscape is undergoing a significant transformation, marked by a rapidly increasing proportion of older adults. [1] The World Health Organization (WHO) projects that by 2030, one in six individuals globally will be 60 years or older. By 2050, the population aged 60 and above is expected to double to 2.1 billion, while the number of individuals aged 80 and above is projected to triple between 2020 and 2050, reaching a total of 426 million. This demographic shift is anticipated to be especially pronounced in low- and middle-income countries, which are expected to host two-thirds of the global population aged 60 years and older by 2050. [1,2] For instance, China, classified by the World Bank as an upper-middle-income country for 2024–2025, is undergoing a significant demographic transformation. [3,4] By 2023, the population aged 60 and above in China reached nearly 297 million, constituting 21.1% of the total population, and this figure is projected to rise to approximately 40% by 2050. [4,5] These trends underscore the urgent need to raise social awareness, enhance the well-being of older adults, and foster intergenerational inclusion to support social stability, particularly in developing countries.[6–8]

However, one significant barrier to achieving these goals is ageism. First conceptualized by Butler, ageism refers to prejudice or discrimination against individuals based on their age,[9] with older adults being particularly vulnerable to its effects.[10] In contemporary society, ageism is pervasive, manifesting in various forms such as negative stereotypes, derogatory language, and exclusionary practices and policies that disadvantage older adults.[11,12] Research consistently shows that perceived ageism negatively affects older adults' mental and physical health, leading to reduced life satisfaction and impaired cognitive and physical performance.[7,13–15] As societies continue to age, the persistence of ageist attitudes exacerbates social divisions and marginalizes older individuals, thereby undermining efforts to promote inclusive and cohesive communities.[12] Therefore, addressing ageism is not only critical for improving the lives of older adults but also essential for ensuring the sustainability of global efforts to foster inclusive societies.[16,17]

The UN Decade of Healthy Ageing (2021–2030), a global collaboration launched by the United Nations to improve the lives of older adults, their families, and communities, identifies combating ageism as one of its central goals. This objective places a particular emphasis on transforming societal attitudes towards age and aging.[17] Other key areas of action include the promotion of age-friendly environments and the improvement of integrated and long-term care services for older adults.[17] However, the WHO's 2021–2023 Progress Report provides a sobering evaluation of the collaboration's progress.[18] While some positive strides have been made, such as a more than 20% increase in countries adopting anti-ageism legislation, less than one-third of nations report having the necessary resources to effectively implement these areas of action.[19] This gap is particularly concerning for low- and middle-income countries, where the majority of the world's aging population will reside by 2050.[19]

Addressing ageism requires a comprehensive approach that integrates policy, educational, and psychological interventions, as it is deeply entrenched in individual perceptions and societal structures.[12,20,21] Educational strategies informed by educational psychology provide a promising framework for developing interventions that complement economic and policy efforts to reduce ageist attitudes and beliefs.[14,21,22] This is especially important for low- and middle-income countries experiencing rapid population aging, where limited economic and policy resources constrain their capacity to adapt effectively to demographic shifts and address ageism in society.[12,18]

Through the lens of educational psychology, understanding the factors that contribute to the development of ageist attitudes is crucial for addressing these biases effectively. Research should move beyond examining common socio-demographic variables to investigate the deeper psychological mechanisms that underlie ageist attitudes and influence

how individuals perceive and interact with older adults.[21–23] By uncovering and addressing these latent causes, targeted interventions can be designed to challenge and transform ageist beliefs, fostering more inclusive attitudes across society.

While ageism is not an inherent characteristic of older adults, but rather a set of prejudices imposed upon them by others, effectively combating it requires targeting the groups most likely to hold and perpetuate these biases—particularly younger individuals.[12,24] Undergraduate students are an important demographic for studying ageism, as their attitudes toward older adults are still evolving, and they are situated in an educational environment that provides unique opportunities for targeted interventions.[20] In China, the relatively uniform educational background among undergraduates, who transition directly from high school to university, reduces potential confounding variables.[25] Moreover, as active consumers and producers of social media content, college students have considerable influence over public discourse, positioning them as key agents for societal change.[26] Tackling ageism within this group could catalyze broader societal changes, fostering a more positive environment for the aging population.

This study aims to investigate the effects of mental health conditions—specifically depression, anxiety, and stress (DAS)—on ageist attitudes among undergraduates. It further explores how life satisfaction, gratitude, and prosociality mediate this relationship. The next sections will detail the study's rationale and theoretical framework.

Theoretical Framework and Research Questions

The common determinants of ageism against older adults have been extensively studied, with the World Health Organization's (WHO) 2021 Global Report on Ageism offering a comprehensive review. This report highlights socio-demographic factors—such as age, gender, education level, and contact experience with older adults—as key determinants for interpersonal ageism. Additionally, psychological factors such as anxiety about aging, fear of death, and certain personality traits have been strongly linked to ageist tendencies.[12]

However, the role of mental health conditions in influencing ageist attitudes among younger individuals has been largely overlooked in prior research. While extensive studies have established the significant impact of perceived ageism on older adults' mental health,[7,13–15] and some research has explored the effects of mental health on self-directed ageism among older individuals,[23] the potential link between younger individuals' mental health and their ageist attitudes has received limited attention.

Given that ageism reflects fundamentally negative attitudes toward others, this study focuses on the impact of negative mental health factors. According to the WHO, mental health conditions encompass disorders, disabilities, and other states of significant distress or functional impairment.[27] Depression, anxiety, and stress (DAS) are three interrelated core components of these conditions.[28–30] Undergraduates are susceptible to these psychological issues, often due to the challenging transition from high school to higher education, academic pressures, and difficulties in social adaptation.[31,32]

Despite the limited research directly linking DAS to ageist attitudes in younger populations, this study hypothesizes potential connections through intermediate variables: life satisfaction, gratitude, and prosociality. These constructs, rooted in educational psychology, are recognized for their influence on interpersonal attitudes and behaviors and were selected based on insights from related psychological literature. Life satisfaction is defined as an individual's conscious evaluation of their life circumstances against self-imposed standards.[33] Studies consistently demonstrate that individuals experiencing higher levels of DAS are more likely to feel uncomfortable in their environment and report lower life satisfaction.[34,35] Gratitude, understood as the tendency to recognize and appreciate the positive aspects of life and the benevolence of others,[36] is often associated with higher levels of life satisfaction.[37–39] Furthermore, individuals with higher levels of gratitude or life satisfaction are more likely to engage in prosocial behaviors.[40–42] Prosociality, characterized by the intentional performance of actions that are socially recognized as benefiting others,[43] is closely linked to increased empathy and altruism.[44,45] These qualities, in turn, serve as protective factors against ageism.[46,47]

Based on these insights, this study hypothesizes that DAS influences ageism both directly and indirectly through its impact on life satisfaction, gratitude, and prosociality. To investigate this relationship in a structured manner, we begin by examining the prevalence of ageism within the sample population and its variation across key socio-demographic factors that were highlighted in previous research. This initial analysis establishes a contextual foundation, illustrating the distribution of ageism and identifying potential socio-demographic factors that may act as confounding variables. Following this, we assess the predictive effects of DAS on ageism while controlling for these socio-demographic factors.

Lastly, we explore whether life satisfaction, gratitude, and prosociality mediate the relationship between DAS (as a composite construct) and ageism. The following research questions (RQs) have been formulated to guide this investigation:

1. What is the level of ageism among undergraduates at the research site, and how does it vary by socio-demographic characteristics?
2. Do depression, anxiety, and stress predict ageism after controlling for socio-demographic variables? Are there any complex pathways underlying this relationship?
3. Do life satisfaction, gratitude, and prosociality mediate the relationship between the combined effects of depression, anxiety, and stress (DAS) and ageism?

In summary, while the general determinants of ageism and strategies for its mitigation have been extensively explored, the influence of negative mental health factors—specifically depression, anxiety, and stress (DAS)—on ageist attitudes among undergraduates remains under-researched. This study seeks to contribute to addressing this gap by examining the direct impact of DAS on ageism, as well as the indirect pathways mediated by life satisfaction, gratitude, and prosociality. The findings may provide deeper insight into how negative mental health factors predispose individuals to ageist tendencies, while positive psychological constructs could help buffer these effects. This knowledge can inform the development of comprehensive educational interventions that incorporate these factors in the fight against ageism.

Methods

Participants and Procedure

Sample Size Planning Based on Power Analysis

Prior to data collection, the required minimum sample size for this study was estimated through power analysis to ensure sufficient statistical power for addressing the research questions. A combination of statistical methods was planned, including independent sample *t*-tests, one-way ANOVA, multiple linear regression, and Structural Equation Modeling (SEM). The power analyses for the first three methods were conducted using G*Power software (version 3.1.9.7).[48,49] For SEM, which is not supported by G*Power, the A-priori Sample Size Calculator for SEM, developed by Daniel Soper, was utilized.[50] This calculator has been recognized in recent studies for its practicality and effectiveness in determining appropriate sample sizes for SEM in medical and psychological research.[51,52]

The power analysis results for each statistical method are presented below:

Independent Sample t-Test

Using G*Power, for a two-tailed independent sample *t*-test with an estimated effect size (d) of 0.5, a significance level (α) of 0.05, a statistical power of 0.8, and an equal allocation ratio (1:1), the minimum required sample size was calculated to be 128 participants (64 per group).

One-Way ANOVA

For one-way ANOVA, with an estimated effect size (f) of 0.25, a significance level (α) of 0.05, a statistical power of 0.8, and five groups (reflecting the demographic variable with the greatest number of categories), G*Power calculated the minimum required sample size to be 200 participants.

Regression Analysis

For multiple linear regression with an estimated effect size (f^2) of 0.15, a significance level (α) of 0.05, a statistical power of 0.8, and 13 independent variables, G*Power indicated a minimum required sample size of 131 participants.

SEM

Using Daniel Soper's calculator, the required sample size for SEM analysis was calculated based on an anticipated

medium effect size of 0.3, a desired statistical power of 0.8, five latent variables, 12 observed variables, and a Type I error rate (p-value) of 0.05.[50] The calculator recommended a minimum sample size of 308 participants.

To account for potential invalid or incomplete responses, estimated at up to 15%, the minimum required sample size was adjusted. Based on the largest sample size requirement among the planned statistical methods (SEM, n = 308), the adjusted minimum sample size was calculated as 363 to ensure sufficient statistical power across all analyses.

Participants

This study employed a cross-sectional survey design conducted between July and August 2024 at 11 higher education institutions (HEIs) in Jiangxi province, China. The survey was administered via the Chinese online platform "Survey Star", and the questionnaire link was distributed to undergraduate students through class groups on popular online messaging apps in China (WeChat and QQ). The distribution process was facilitated by student counselors known to the researchers, with no involvement of power dynamics. To promote voluntary participation, no compensation or monetary incentives were provided, minimizing the risk of the survey being shared with individuals outside the target population for financial gain. The estimated time for each participant to complete the online questionnaire was 10–15 minutes.

A total of 1213 participants completed and submitted the questionnaire online. Data cleaning was conducted for two primary purposes: first, to ensure the quality of completion, and second, to confirm that all participants were current undergraduate students, excluding graduates or postgraduate students. Questionnaires were then excluded based on the following criteria: highly consistent responses indicating low engagement, or selection of the option "I am a postgraduate student, or I have already graduated" in response to the question about current academic status. After applying these criteria, 39 questionnaires were removed, resulting in a final sample of 1174 valid responses for data analysis.

Ethical Considerations

Formal ethical approval for this study was obtained from the Scientific Research Department of Jiangxi Science & Technology Normal University (Reference No. HREC113182024062104) prior to data collection. The study adhered to the ethical principles outlined in the Declaration of Helsinki. During data collection, a consent form was provided alongside the questionnaire, detailing the research purpose, target population, information on the researchers, and an assurance of participants' right to withdraw from the study at any time. The survey was entirely anonymous, not requesting any personal identifiers such as names, and participation was voluntary, free from any power dynamics.

Data Collection Tool

The questionnaire consisted of two sections. The first section focused on assessing the key psychological variables of interest, including depression, anxiety, stress (DAS), ageism, life satisfaction, gratitude, and prosociality. The second section collected participants' socio-demographic information.

Measurement Instruments

Depression, Anxiety, and Stress

Participants' levels of depression, anxiety, and stress were assessed using the Depression Anxiety Stress Scales-21 (DASS-21).[53,54] The Chinese version of the DASS-21, translated and validated for use with Chinese populations,[55] was applied in this study, with minor wording adjustments for clarity based on pilot testing. The DASS-21 contains 21 items measuring negative emotional symptoms, with participants rating each symptom on a 4-point Likert scale ranging from 0 (never) to 3 (most or all of the time). The scale is divided into three subscales—depression, anxiety, and stress—each comprising seven items. Following established scoring guidelines,[54] subscale scores were multiplied by two to calculate the final scores, with higher scores indicating greater severity of the symptoms measured. In this study, Cronbach's α values were 0.908 for Depression, 0.876 for Anxiety, and 0.899 for Stress.

Ageism

Ageism was assessed using the Chinese version of the Fraboni Scale of Ageism (FSA).[56,57] This version consists of 22 items, with responses recorded on a 4-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree), where

higher scores reflect stronger ageist attitudes toward older adults. The FSA contains reverse-coded items, which were scored according to established guidelines.[56] This reverse scoring procedure was also applied to other scales used in the study, where applicable, and will not be reiterated in the following sections for brevity.

Although the Chinese FSA includes three sub-dimensions,[56] we report only the overall Cronbach's α of 0.890, as the internal consistency of the proposed sub-dimensions was not sufficiently reliable (with α values of 0.687, 0.753, and 0.836). In this analysis, we operationalized ageism using the total FSA score rather than separating it into sub-dimensions. In the SEM analysis, item parceling was applied to construct the latent ageism variable, as described in the subsection "Item Parceling Methods for Latent Variables.

Life Satisfaction

Life satisfaction was measured using the Satisfaction With Life Scale (SWLS),[33] a unidimensional scale consisting of five items rated on a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). Higher total scores reflect greater self-perceived life satisfaction. In this study, the SWLS demonstrated a Cronbach's α of 0.942.

Gratitude

Gratitude was measured using the Gratitude Questionnaire-6 (GQ-6),[58] a unidimensional scale which is widely used to capture individual differences in the tendency to experience gratitude in daily life. The GQ-6 consists of six items, each rated on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree), with higher scores reflecting a stronger disposition toward gratitude. In this study, the original six-item scale demonstrated suboptimal internal consistency (Cronbach's $\alpha = 0.709$). To enhance reliability, two items (Items 3 and 6) were removed based on item-total statistics. The revised four-item scale showed a substantial improvement in internal consistency, with a Cronbach's α of 0.933.

Prosociality

Participants' prosociality was measured using the Prosocial Behavioral Intentions Scale,[59] a four-item, unidimensional tool assessing their intentions to engage in prosocial behaviors that benefit others and contribute positively to society. Responses were recorded on a 7-point Likert scale, ranging from 1 (definitely would not do this) to 7 (definitely would do this), with higher scores indicating stronger prosocial intentions. In this study, the scale showed a Cronbach's α of 0.906.

Socio-Demographic Factors

This study included 10 factors to capture participants' socio-demographic characteristics. For clarity, concise terms (in parentheses) are provided for factors with longer names and will be used throughout the paper: "Gender", "Age", "whether the participant is the only child in the family (Only-child)", "current academic year of undergraduate study (Academic Year)", "Physical Health", "the frequency of receiving care from older family members, such as grandparents, during childhood (Care-receiving)", "the frequency of co-residence with older people, such as grandparents, when living at home (Co-residence)", "the frequency of providing care for older people (Care-giving)", "the frequency of recent personal contact with older people (Contact Frequency)", and "self-perceived quality of recent interactions with older people (Contact Quality)". Each of these factors was measured using a single-item question tailored to its specific content.

Analytical Methods and Results

A combination of statistical methods was employed to address the study's research questions (RQs). Descriptive statistics, independent sample *t*-tests, ANOVA, and regression analyses were conducted using SPSS (version 19). Structural Equation Modeling (SEM) was initially tested in R (version 4.3.3) and cross-validated in AMOS (version 26), which also facilitated model visualization. The following sections outline the analytical approaches and results for each RQ.

Analyses and Results for RQ1

Analytical Approaches for RQ1

RQ1 examines the level of ageism among the sampled students and explores how this level varies across different socio-demographic factors. To address this question, descriptive statistics were first calculated to provide an overview of the variables of interest (Table 1). Independent sample *t*-tests were employed to analyze differences in ageism based on

Table 1 Descriptive Statistics for Key Variables of Interest (N = 1174)

Factor	Mean	SD	Possible Range	Item	α
Depression	7.779	8.748	0–42	7	0.908
Anxiety	7.388	8.019	0–42	7	0.876
Stress	9.525	9.092	0–42	7	0.899
Ageism	43.602	9.934	22–88	22	0.890
Life Satisfaction	21.393	6.955	5–35	5	0.942
Gratitude	20.300	5.740	4–28	4	0.933
Prosociality	19.807	5.176	4–28	4	0.906

Notes: Item = number of items included in this scale; α = Cronbach's alpha.
Abbreviation: SD, standard deviation.

socio-demographic factors with two categories, while one-way ANOVA with Bonferroni correction was used for factors with more than two categories. The analysis reported t/F values, p-values, and post-hoc results (Table 2).

Prevalence of and Socio-Demographic Variation in Ageism

Table 1 presents the descriptive statistics for the key variables of interest. The mean level of ageism was 43.602 (SD = 9.934) on a scale of 22 to 88, reflecting a moderate level of ageism within the sample.

Table 2 provides statistical information on socio-demographic factors, including their frequencies and how they relate to differences in ageism levels. The results indicate that participants in higher academic years, those with poorer physical health, those with infrequent experiences of receiving care from older family members during childhood, those with

Table 2 Differences in Ageism by Socio-Demographic Factors

Demographic Factors	N (%)	Ageism	
		Mean ± SD	*t* / *F*, *p* and post-hoc
Gender			*t* = 1.115
Male	385 (32.8%)	44.083 ± 10.688	*p* = 0.265
Female	789 (67.2%)	43.368 ± 9.543	
Only-child			*t* = 0.222
Yes	179 (15.2%)	43.754 ± 10.669	*p* = 0.824
No	995 (84.8%)	43.575 ± 9.802	
Academic Year**			
Year 1[a]	691 (58.9%)	42.632 ± 9.894	***F* = 5.404**,
Year 2[b]	285 (24.3%)	44.968 ± 9.597	***p* = 0.001****
Year 3[c]	167 (14.2%)	44.976 ± 10.190	**a < b, a < c**[1]
Year 4 or higher[d]	31 (2.6%)	45.258 ± 10.405	
Physical Health**			
Poor[a]	41 (3.5%)	48.683 ± 12.340	***F* = 20.401**,
Fair[b]	475 (40.5%)	45.326 ± 9.168	***p* < 0.001****
Good[c]	493 (42.0%)	42.966 ± 9.989	**a > c, a > d**
Excellent[d]	165 (14.1%)	39.279 ± 9.559	**b > c > d**
Care-receiving**			
Rarely[a]	160 (13.6%)	45.119 ± 11.914	***F* = 7.374**,
Occasionally[b]	374 (31.9%)	45.032 ± 9.756	***p* < 0.001****
Frequently[c]	326 (27.8%)	42.715 ± 9.593	**a > d**
Constantly[d]	314 (26.7%)	42.048 ± 9.050	**b > c, b > d**

(*Continued*)

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Table 2 (Continued).

Demographic Factors	N (%)	Ageism	
		Mean ± SD	t / *F*, *p* and post-hoc
Co-residence**			
Rarely[a]	286 (24.4%)	45.266 ± 10.367	**$F = 5.786$**,
Occasionally[b]	372 (31.7%)	43.831 ± 10.124	**$p = 0.001$****
Frequently[c]	227 (19.3%)	43.335 ± 9.824	**a > d**
Constantly[d]	289 (24.6%)	41.872 ± 9.052	
Care-giving**			
Rarely[a]	375 (31.9%)	45.213 ± 10.406	**$F = 5.633$**,
Occasionally[b]	584 (49.7%)	43.002 ± 9.321	**$p = 0.001$****
Frequently[c]	173 (14.7%)	42.855 ± 9.899	**a > b, a > d**
Constantly[d]	42 (3.6%)	40.643 ± 12.207	
Contact Frequency**			
Rarely[a]	297 (25.3%)	45.700 ± 10.087	**$F = 9.265$**,
Infrequently[b]	243 (20.7%)	44.440 ± 9.488	**$p < 0.001$****
Occasionally[c]	279 (23.8%)	42.523 ± 9.653	**a > c, a > d, a > e**
Frequently[d]	260 (22.1%)	43.123 ± 9.855	**b > e**
Regularly[e]	95 (8.1%)	39.379 ± 9.917	**d > e**
Contact Quality**			
Terrible[a]	28 (2.4%)	47.821 ± 13.984	**$F = 40.117$**,
Poor[b]	64 (5.5%)	50.422 ± 8.992	**$p < 0.001$****
Fair[c]	466 (39.7%)	46.116 ± 9.277	**a > d, a > e**
Good[d]	490 (41.7%)	41.865 ± 8.890	**b > c > d > e**
Excellent[e]	126 (10.7%)	36.659 ± 10.100	
Age [2] (N = 1157)		*M* ± *SD*: 19.745 ± 1.288 Range: 17–30	$p = 0.576$ $\beta = 0.016$

Notes: 1. The notation like "a < b" in the table indicates significant differences identified through ANOVA with Bonferroni correction. Only statistically significant comparisons are displayed, while non-significant differences are not shown. 2. Age was treated as a continuous variable; therefore, the mean, SD, and range (minimum to maximum) are reported. Differences in ageism by age were examined using regression analysis, with the standardized coefficient (β) and p-value provided. 3. Bold text indicates variables with significant results ($p < 0.05$) and their corresponding statistically significant values. 4. **$p < 0.01$.

limited co-residence with older individuals, those with minimal caregiving experience for older adults, those with infrequent recent contact with older individuals, and those with a lower self-perceived quality of interaction with older adults exhibit higher levels of ageism. Gender, only-child status, and age did not significantly influence ageism levels.

Given the significant variation in ageism across these socio-demographic factors—and their potential confounding effects—the next section examines the impact of DAS on ageism, controlling for these variables.

Analyses and Results for RQ2

Analytical Approaches for RQ2

RQ2 investigates the predictive effects of DAS on ageism, as well as the complex pathways underlying this relationship. A multiple linear regression analysis was first conducted, with ageism as the dependent variable and depression, anxiety, stress, along with all socio-demographic factors, as independent variables (Table 3).

Following the regression analysis, a Structural Equation Model was developed to perform a mediation analysis. This analysis utilized the bootstrapping method with 5000 iterations and bias-corrected confidence intervals (BCCI) to further explore the pathways between depression, anxiety, stress, and ageism.

Table 3 Regression Analysis: Predictive Effects of DAS on Ageism

Variables	B	SE	*β*	*t*	*p*	VIF
(Constant)	54.551	4.618		11.813	< 0.001	
Depression**	0.191	0.057	0.169	3.360	**0.001****	3.904
Anxiety	0.031	0.069	0.025	0.457	0.648	4.766
Stress**	0.200	0.060	0.184	3.358	**0.001****	4.637
Gender	0.849	0.550	0.040	1.543	0.123	1.047
Only-child	0.271	0.709	0.010	0.382	0.702	1.024
Academic Year	0.523	0.360	0.044	1.453	0.147	1.400
Physical Health	−0.336	0.377	−0.026	−0.891	0.373	1.272
Care-receiving	−0.634	0.331	−0.065	−1.915	0.056	1.759
Co-residence	−0.192	0.313	−0.021	−0.615	0.539	1.871
Care-giving	−0.213	0.385	−0.017	−0.554	0.580	1.383
Contact Frequency	−0.171	0.236	−0.022	−0.728	0.467	1.436
Contact Quality**	−2.628	0.348	−0.224	−7.554	**< 0.001****	1.348
Age	−0.185	0.229	−0.024	−0.808	0.419	1.361
Dependent Variable: Ageism Model Summary: $F = 30.451$, $p < 0.001$, $R = 0.507$, adjusted $R^2 = 0.249$, SE = 8.581						

Notes: 1. B = Unstandardized Coefficient; *β* = Standardized Coefficient. 2. Bold text highlights statistically significant results ($p < 0.05$) and the corresponding independent variables. 3. **$p < 0.01$.
Abbreviations: SE, standard error; VIF, variance inflation factor.

Predictive Effects of DAS on Ageism

Table 3 presents the results of the regression analysis, which examined the effects of depression, anxiety, and stress, alongside all demographic factors, on ageism. Both depression ($\beta = 0.169$, $p = 0.001$) and stress ($\beta = 0.184$, $p = 0.001$) emerged as significant positive predictors of ageism. In contrast, anxiety did not significantly predict ageism ($\beta = 0.025$, $p = 0.648$). Among socio-demographic factors, contact quality was the only significant predictor ($\beta = -0.224$, $p < 0.001$).

Given the close theoretical interrelationships between depression, anxiety, and stress,[28] the non-significant effect of anxiety on ageism raises the possibility that its influence might be masked by the effects of depression and stress. To explore this further, we conducted a mediation analysis using SEM (Model 1, see Figure 1). In this SEM, ageism was treated as a latent construct, with its structure formed through item parceling, as described in the subsection "Item Parceling Methods for Latent Variables." This approach was chosen to ensure consistency, as ageism was treated as a latent construct in all analyses using the SEM methodology.

Indirect Effects of Anxiety on Ageism

Figure 1 shows the mediation analysis (Model 1) exploring anxiety's indirect effects on ageism through depression and stress. The model demonstrated an excellent fit to the data (CFI = 0.999, TLI = 0.997, RMSEA = 0.035, SRMR = 0.008, and AGFI = 0.986).

Table 4 highlights three significant pathways:

1. Anxiety→Stress→Ageism ($\beta = 0.112$, *BCCI* [0.006, 0.025]).
2. Anxiety→Depression→Ageism ($\beta = 0.187$, *BCCI* [0.012, 0.040]).
3. Anxiety→Depression→Stress→Ageism ($\beta = 0.059$, *BCCI* [0.003, 0.014]).

These pathways suggest that anxiety impacts ageism either through stress alone, through depression alone, or via a combined pathway in which anxiety first leads to depression, which subsequently increases stress, ultimately resulting in higher levels of ageism.

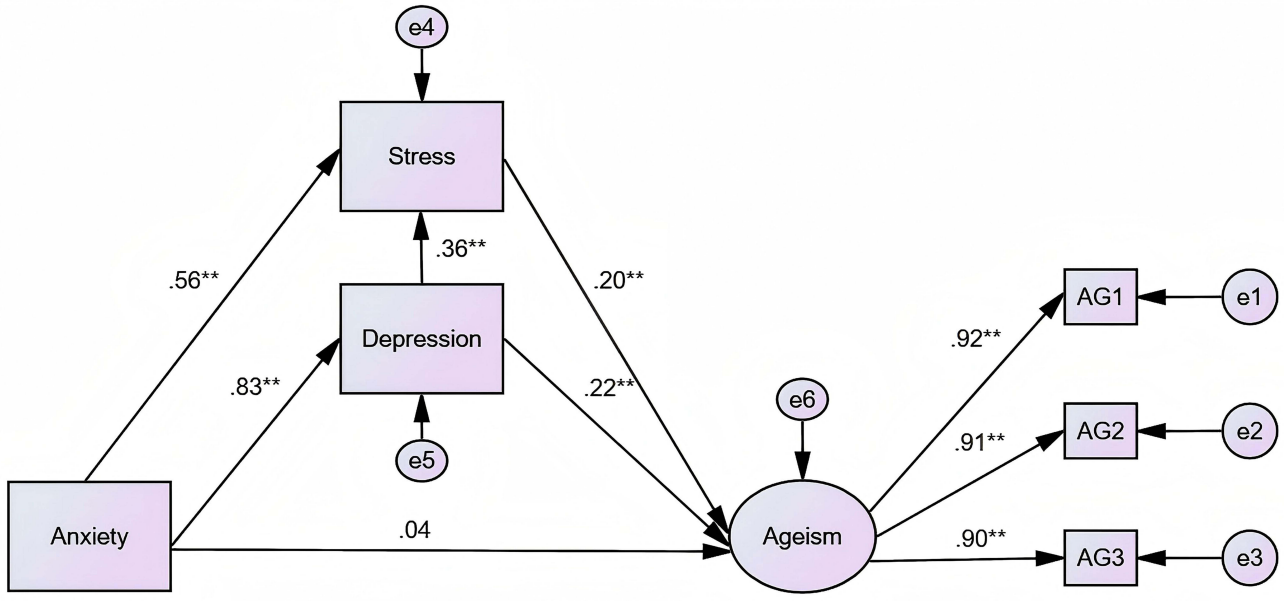

Figure 1 Anxiety's Path to Ageism: Mediation by Depression and Stress (Model 1). Model Fit Summary: $X^2 = 14.597$, $df = 6$, $p = 0.024$, CFI = 0.999, TLI = 0.997, RMSEA = 0.035, SRMR = 0.008, AGFI = 0.986.
Note: All values presented in the figure are fully standardized estimates (β). Significance levels are indicated as follows: $^{**}p < 0.01$.

The total indirect effect accounting for all pathways was significant ($\beta = 0.358$, *BCCI* [0.035, 0.065]), while the direct effect was not ($\beta = 0.037$, *BCCI* [- 0.011, 0.023]), indicating a fully mediated relationship, where anxiety influences ageism only through its effects on depression and stress.

Analyses and Results for RQ3

Analytical Approaches for RQ3

RQ3 investigates the mediating roles of life satisfaction, gratitude, and prosociality in the relationship between DAS as a composite construct and ageism. To explore the complex pathways involved, we constructed a second Structural Equation Model (Model 2, see Figure 2) using bootstrapping with 5000 iterations. Following the two-step approach,[60] we first assessed the measurement model, which comprised five latent variables: DAS, ageism, life satisfaction, gratitude, and prosociality. In this model, DAS was treated as a composite latent construct with three indicators—depression, anxiety, and stress. For the remaining four latent variables, item parceling methods were employed to create their

Table 4 Anxiety's Path to Ageism: Mediation by Depression and Stress

Pathways and Effects	Std. all		BCCI	
	β	*p*	Lower	Upper
Pathways				
Anxiety→Stress→Ageism	**0.112**	**0.002****	0.006	0.025
Anxiety→Depression→Ageism	**0.187**	**< 0.001****	0.012	0.040
Anxiety→Depression→Stress→Ageism	**0.059**	**0.002****	0.003	0.014
Total Indirect Effect	**0.358**	**< 0.001****	0.035	0.065
Direct effect (Anxiety→Ageism)	0.037	0.547	− 0.011	0.023
Total Effect (Direct + Indirect)	**0.395**	**< 0.001****	0.045	0.065

Notes: 1. Bold text indicates effects with statistically significant ($p < 0.05$) Fully Standardized Estimates and corresponding p-values. 2. $^{**}p < 0.01$.
Abbreviations: BCCI, 95% bias-corrected bootstrap confidence interval; Std. all (β), fully standardized estimates.

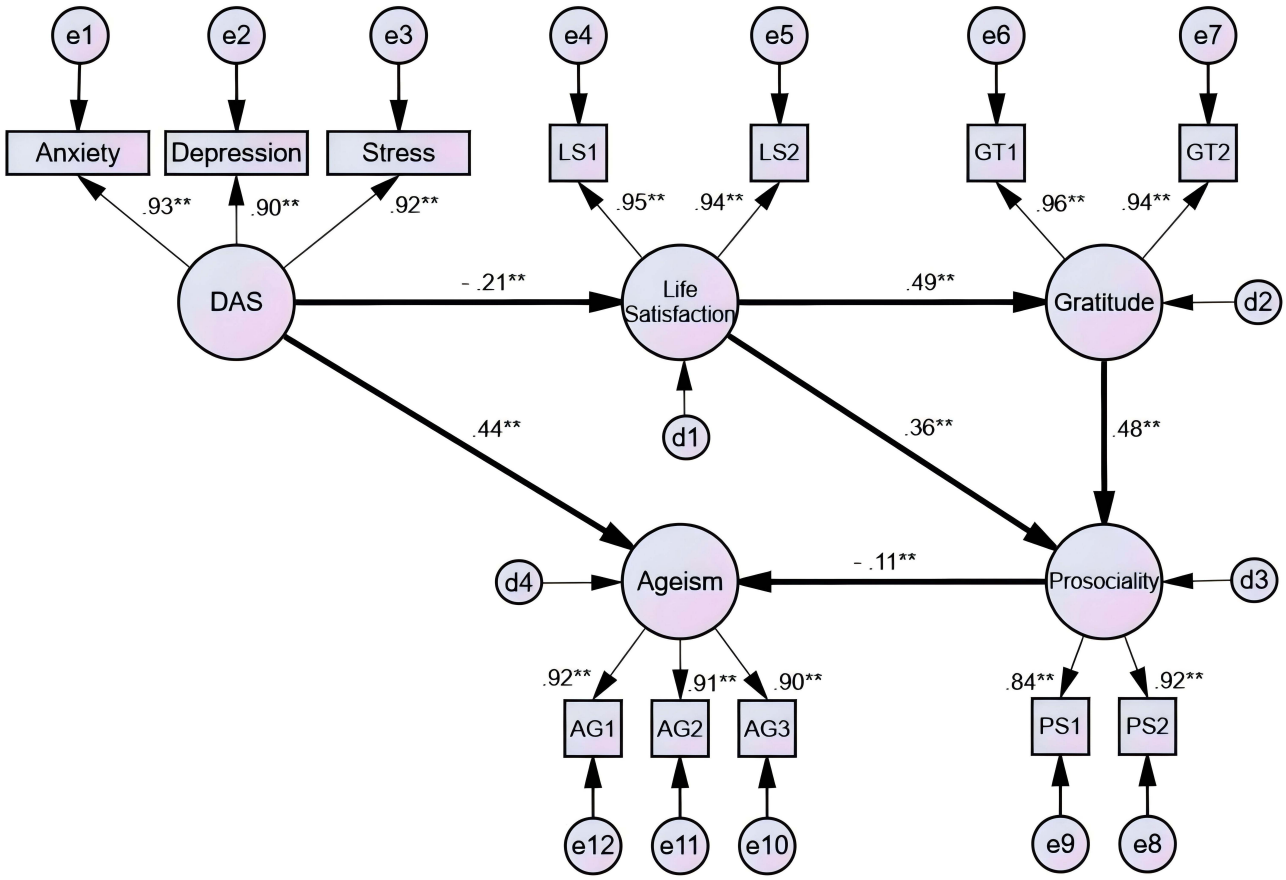

Figure 2 DAS Pathways to Ageism via Mediators (Model 2). Model Fit Summary: $X^2 = 189.265$, $df = 48$, $p < 0.001$, CFI = 0.989, TLI = 0.984, RMSEA = 0.050, SRMR = 0.033, AGFI = 0.956.
Note: All values presented in the figure are fully standardized estimates (β). Significance levels are indicated as follows: $^{**}p < 0.01$.

respective indicators. Once the measurement model demonstrated a good fit, we proceeded to test the structural model to evaluate the hypothesized relationships.

Item Parceling Methods for Latent Variables

The primary focus of this study is on the relationships between latent factors, with item indicators only serving as measurement tools. To simplify the SEM model for the latent variables—"ageism", "life satisfaction", "gratitude", and "prosociality"—we employed item parceling. Following a factor loading balance strategy, we conducted exploratory factor analyses (EFA) and created parcels by pairing high- and low-loading items to achieve balanced loadings.[61,62]

For the theoretically unidimensional constructs— "life satisfaction", "gratitude", and "prosociality"— two parcels were created for each. In the case of "ageism", although the Chinese FSA originally comprises three dimensions (Avoidance, Exclusion, Stereotyping),[56] our internal consistency and EFA results did not support this structure. Therefore, we established three new parcels for ageism, aligning with previous research that has consistently identified a three-factor construct despite variations in item distribution across cultures and contexts.[57,63–65]

Indirect Impact of DAS on Ageism via Mediators

Figure 2 presents the results of the SEM analysis for Model 2, which explores the indirect effects of the combined latent construct of DAS on ageism through three mediators: life satisfaction, gratitude, and prosociality. Prior to testing the structural model, a confirmatory factor analysis (CFA) was conducted to assess the measurement model, which demonstrated an excellent fit to the data (CFI = 0.989, TLI = 0.984, RMSEA = 0.050, SRMR = 0.020, AGFI = 0.955), confirming reliable

Table 5 DAS Pathways to Ageism via Mediators

Pathways and Effects	Std. all		BCCI	
	β	*p*	Lower	Upper
Pathways				
DAS→Life Satisfaction→ Gratitude→Prosociality→Ageism	**0.005**	**0.008****	0.002	0.011
DAS→Life Satisfaction→ Prosociality→Ageism	**0.008**	**0.009****	0.003	0.017
Total Indirect Effect	**0.013**	**0.007****	0.006	0.027
Direct effect (DAS→Ageism)	**0.439**	**< 0.001****	0.412	0.584
Total Effect (Direct + Indirect)	**0.452**	**< 0.001****	0.425	0.597

Notes: 1. Bold text indicates effects with statistically significant ($p < 0.05$) Fully Standardized Estimates and corresponding p-values. 2. **$p < 0.01$.
Abbreviations: BCCI, 95% bias-corrected bootstrap confidence interval; Std. all (β), fully standardized estimates.

measurement of the latent constructs. After verifying the measurement model, the structural model was tested and also demonstrated a strong fit (CFI = 0.989, TLI = 0.984, RMSEA = 0.050, SRMR = 0.033, AGFI = 0.956).

Table 5 highlights two significant indirect pathways through which DAS affects ageism:

1. DAS→Life Satisfaction→Gratitude→Prosociality→Ageism (β = 0.005, *BCCI* [0.002, 0.011]).
2. DAS→Life Satisfaction→Prosociality→Ageism (β = 0.008, *BCCI* [0.003, 0.017]).

The main distinction between these pathways is the inclusion of Gratitude in the first, while the second bypasses it. The total indirect effect of DAS on ageism, accounting for both pathways, was significant (β = 0.013, *BCCI* [0.006, 0.027]), alongside a substantial direct effect (β = 0.439, *BCCI* [0.412, 0.584]). These findings highlight the powerful influence of DAS on ageism, both directly and indirectly through life satisfaction, gratitude, and prosociality, with the direct effect being the most pronounced.

Discussion

This study explored the direct and indirect impact of DAS on ageism, considering the influence of socio-demographic factors and the mediating roles of life satisfaction, gratitude, and prosociality. The discussion is structured around the three RQs, with findings presented in corresponding subsections. By integrating insights from this study with existing literature, we aim to demonstrate how these findings contribute to the current understanding of ageism and inform strategies for combating it through targeted educational initiatives.

Prevalence and Socio-Demographic Influences on Ageism

The analysis of RQ1 shows that ageism levels vary across several socio-demographic factors, including "Academic Year", "Physical Health", "Care-receiving", "Co-residence", "Care-giving", "Contact Frequency", and "Contact Quality", but not by "Gender", "Only-child" status, or "Age". Previous studies have reported mixed results regarding the influence of these factors on ageism.[23] Nonetheless, contact quality with older adults has consistently been identified as a key factor in significantly affecting ageist attitudes.[23,66–69] The WHO also highlights that positive, high-quality interaction with older adults serve as a protective factor against ageism.[12] Our findings for RQ2 further support this, showing that, among all the socio-demographic factors examined, contact quality is the only significant predictor of ageism after controlling for DAS. This corroborates Allport's contact theory, which posits that intergroup contact can reduce prejudice across different social groups.[70]

Additionally, our analysis identified a moderate level of ageism among the participants, a finding that partially inconsistent with the WHO's global map of ageist attitudes, which reported a generally low prevalence of ageism in China.[12] This discrepancy may be attributed to differences in sampling: while the WHO's data encompasses the entire population, our study focused specifically on undergraduates. The moderate level of ageism observed within this

demographic is particularly concerning, given its potential detrimental effects on the well-being of older adults and the broader societal implications for intergenerational inclusion and harmony in the context of global aging.[7,13,24]

Educational interventions are critical for reducing ageism and promoting positive attitudes toward older adults.[20] Effective strategies include disseminating accurate information and knowledge to correct misconceptions about aging, teaching critical thinking skills to encourage ongoing reassessment of stereotypes, organizing empathy-building activities, and facilitating meaningful intergenerational contact.[20,71–74]

In practical terms, these strategies can be implemented through various activities. For example, integrating aging courses with service-learning projects offers students both theoretical knowledge and hands-on experience. Role-playing and simulation exercises, where young individuals assume the roles of older adults, can enhance their understanding of aging-related challenges. Additionally, life-story documentaries of older individuals followed by discussions, virtual reality and video game collaborations between younger and older participants, intergenerational sharing sessions, and home-sharing programs where older adults provide housing for college students, are all effective approaches.[46,71–73,75–77] For college students, curriculum-based interventions incorporating these activities are highly recommended.[75]

While direct educational interventions aimed at reducing ageist attitudes among students are essential, addressing the underlying psychological factors that contribute to these biases is equally important. In the following sections, we will discuss the complex relationships between specific psychological factors and ageist attitudes, how these dynamics extend beyond demographic predictors, and potential innovative strategies for combating ageism based on these insights.

Predictive Effects of DAS on Ageism and Underlying Mechanisms

The analysis of RQ2 provides deeper insights into how DAS contribute to ageism among undergraduates. After controlling for socio-demographic factors, depression and stress emerge as significant direct predictors of ageism, whereas anxiety operates indirectly, primarily influencing ageism through its effects on depression and stress. This suggests that, although anxiety may not independently drive ageist attitudes, it plays an important role in the broader psychological interplay that influences ageism. These findings align with research emphasizing the interrelatedness of depression, anxiety, and stress, underscoring the need to approach these factors within a unified framework when considering targeted interventions.[28,78,79]

While there is limited research directly connecting DAS to ageism among undergraduates, insights from related psychological fields provide explanatory value. From the perspective of positive psychology, individuals in a positive emotional state are more likely to engage in empathy, prosocial behaviors, and inclusive attitudes toward out-groups.[80–82] Conversely, individuals experiencing negative affect often exhibit a reduced capacity for empathy and perspective-taking,[83] which may contribute to the development of ageist beliefs.

The significant role of DAS in predicting ageism highlights the importance of addressing mental health issues among undergraduates to reduce ageist attitudes. Intervention studies offer valuable insights into strategies for tackling DAS within this population. A systematic review of prevention programs targeting DAS among college students identified three key practice elements—psychoeducation, relaxation techniques, and cognitive restructuring—that were particularly prevalent in programs demonstrating large effect sizes.[78] Psychoeducation involves providing structured information about the symptoms, development, and potential interventions for mental health issues, along with guidance on available services and resources tailored to individuals' needs. Relaxation techniques, such as muscle relaxation, breathing exercises, and meditation, are designed to achieve physiological calm. Cognitive restructuring focuses on identifying and modifying unhelpful thoughts.[78,84] A four-step approach to cognitive restructuring is commonly recommended, involving the identification of automatic thoughts (ATs), recognizing thinking errors, using disputing questions to challenge ATs, and generating rational responses.[84] Additionally, a review highlighted that mindfulness interventions have the highest level of evidence and effectiveness in simultaneously reducing depression, anxiety, and stress, particularly among nursing undergraduates.[79]

While the direct effects of DAS on ageism provide valuable insights for designing targeted interventions, a more comprehensive approach requires understanding the complex psychological interplay underlying this relationship. In the following section, we delve into the mediating roles of life satisfaction, gratitude, and prosociality, through which DAS indirectly influences ageism, and discuss potential measures for incorporating these factors into more holistic intervention strategies.

Indirect Impact of DAS on Ageism via Mediators

The analysis of RQ3 uncovers a nuanced pathway through which DAS influences ageism, mediated by life satisfaction, gratitude, and prosociality. Our findings show that DAS negatively impacts life satisfaction, a relationship well-supported by prior research.[85–87] This diminished life satisfaction is associated with lower gratitude levels, a result similarly observed in the literature.[37–39] Reduced gratitude and life satisfaction further undermine prosocial tendencies, as also noted in previous studies.[40–42] Lower levels of prosociality impair students' ability to empathize with and adopt the perspectives of older adults, thereby exacerbating ageist attitudes.[45–47]

Despite the growing body of literature on these variables, there remains a significant gap in research addressing the entire chain linking DAS to ageism indirectly. By examining these relationships in an integrated model, our study offers novel insights into how DAS affects ageism via these mediators, providing a more comprehensive understanding of the underlying mechanisms. These findings highlight actionable strategies to mitigate the negative effects of DAS on ageism among undergraduates by leveraging the buffering role of positive psychological factors such as life satisfaction, gratitude, and prosociality.

The identified pathways provide a foundation for targeted interventions that integrate mental health support with initiatives fostering positive attributes, addressing not only the symptoms of DAS but also promoting positive psychological traits to combat ageism. Universities, for instance, can embed positive psychology interventions into their degree programs to enhance life satisfaction and foster gratitude. Systematic reviews have shown that interventions focused on character strengths and gratitude are especially effective and have been widely adopted in university settings globally. These programs encourage students to identify and apply their personal strengths in everyday life and engage in activities designed to cultivate gratitude.[39,88]

Gratitude interventions, which are known to enhance both physical and mental health,[36] offer a promising avenue for reducing ageism among undergraduates. For example, research shows that nursing students who engage in gratitude-building activities demonstrated increased well-being and resilience, making them better equipped to provide compassionate care to older individuals.[89,90] Effective approaches, such as journaling to document moments of gratitude, writing gratitude letters, essays, or lists, and participating in group sessions that promote gratitude through interactive and experiential learning, have been suggested to successfully foster gratitude when integrated into curricula.[89,91–93] By incorporating these activities, educational providers can enhance students' gratitude and potentially mitigate the impact of DAS on ageism.

Similarly, prosocial interventions, designed to cultivate behaviors that are socially recognized as benefiting others, have demonstrated significant benefits in promoting mental health and well-being for both givers and recipients.[94,95] Effective interventions typically involve activities that encourage voluntary actions intended to help others, while broadening individuals' understanding of prosocial behavior and enhancing their cognitive problem-solving skills. These interventions also emphasize emotional regulation, empathy building, and fostering a ripple effect, wherein recipients of kindness are inspired to engage in similar acts of generosity.[94,96] By embedding prosocial interventions into both curricular and extracurricular programs, educational providers can create an environment that promotes sustained empathy and prosociality,[96] potentially helping to reduce students' prejudice and negative attitudes toward older adults.

In summary, the findings from the path model provide a novel perspective on mitigating ageism by emphasizing the buffering roles of life satisfaction, gratitude, and prosociality. This approach moves beyond addressing DAS's direct effects and sheds light on the potential of cultivating positive psychological traits to reduce ageist attitudes. By integrating these mediators into a holistic intervention framework, educational institutions can address the mental health challenges faced by undergraduates while simultaneously fostering positive traits, intergenerational understanding, and mutual respect. This comprehensive framework offers actionable pathways to diminish ageism among undergraduates and promote social inclusiveness.

Limitations

The use of item parceling in this study warrants consideration, as prior research has raised concerns that it may mask underlying data issues and inflate fit indices, potentially leading to Type II errors by aggregating both random and systematic errors.[61,97] In this study, item parceling was chosen to focus on relationships between latent constructs rather

than the validation of measurement tools, which is generally considered an acceptable application of this method.[61,98] However, it is important to acknowledge the potential constraints.

Additionally, the cross-sectional design of this study limits our ability to provide detailed information on the duration of participation or any direct observations. The use of a convenience sample of undergraduates from HEIs in a single Chinese province also restricts the generalizability of the findings to broader populations. Furthermore, the reliance on self-reported data introduces potential biases, as participants may have underreported their true attitudes to align with perceived societal expectations.

Future research may address these limitations by employing more diverse and representative samples across different regions and considering alternative SEM methods, such as item-level analyses, to enhance the robustness of findings. Longitudinal studies are strongly recommended to provide deeper insights into the causal pathways between psychological conditions and ageism.

Conclusion

This study sheds light on both the direct and indirect effects of depression, anxiety, and stress (DAS) on ageist attitudes among undergraduates, an area largely overlooked in previous research. Depression and stress emerge as direct predictors of ageism, while anxiety exerts its influence indirectly through its effects on both depression and stress. Among the sociodemographic factors examined, only self-perceived contact quality with older adults remains a significant predictor of ageism after accounting for DAS, highlighting the unique role of intergenerational relationships in influencing ageist attitudes. Furthermore, when considering DAS as a composite construct, it impacts ageism both directly and indirectly via life satisfaction, gratitude, and prosociality, with particularly strong direct effects.

While previous literature has primarily focused on direct interventions for ageism, this study highlights the potential role of mental health factors in influencing ageist attitudes and emphasizes the need to consider these factors in a more holistic approach to combating ageism. Specifically, by investigating less-explored pathways—such as life satisfaction, gratitude, and prosociality—through which DAS influences ageism, this study provides valuable insights for developing innovative interventions within the framework of educational psychology. The findings underscore the critical importance of addressing mental health concerns as part of a comprehensive strategy to combat ageism, particularly among undergraduates. Moreover, they highlight the buffering role of positive psychological factors, such as life satisfaction, gratitude, and prosociality, in mitigating the effects of negative mental health on ageist tendencies. These identified mechanisms offer a meaningful foundation for designing targeted interventions that integrate mental health support with initiatives to foster positive psychological attributes and enhance the quality of intergenerational interactions, providing a more comprehensive approach to reducing ageism.

In conclusion, this study contributes to a deeper understanding of the complex psychological and social mechanisms underlying ageism, offering actionable insights for designing educational interventions to reduce ageism among undergraduates. Effective programs should extend beyond directly addressing ageist attitudes to tackle underlying psychological conditions—such as depression, anxiety, and stress—that perpetuate these biases. Additionally, such interventions should aim to enhance life satisfaction, foster gratitude, promote prosocial tendencies and behaviors, and facilitate meaningful intergenerational engagement. By targeting these areas, these interventions can significantly reduce ageism and contribute to building a more inclusive and empathetic society—a goal of critical importance in the context of global population aging.

Data Sharing Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Disclosure

The authors report no conflicts of interest in this work.

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