



Research article

The relationship between autistic traits and the stress of social isolation: Development of an explanatory model

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ABSTRACT

Background: Social isolation can be particularly challenging for individuals with high autistic traits who struggle with social interactions. The COVID-19 pandemic led to increased isolation, exacerbating stress for those who may have difficulty in connecting with others. This study aimed to explore the relationship between autistic traits and stress associated with social isolation.

Methods: A sample of 1597 Chinese adults completed measures of autistic traits, the stress of social isolation, psychological inflexibility and core self-evaluation, during an epidemic prevention and control period of COVID-19 in Chongqing, China. Measures included the Autism-Spectrum Quotient, Coronavirus Stress Measure, Acceptance and Action Questionnaire-II, and Core Self-Evaluation Scale.

Results: Autistic traits were positively correlated with the stress of social isolation, which was mediated by the chain effect of core self-evaluation and psychological inflexibility. Individuals with high autistic traits reported significantly higher stress than individuals with low autistic traits.

Limitations: This was a cross-sectional study, which limits causal inference. In addition, data were self-reported, which may cause methodological effects. Finally, this study was conducted during China's quarantine policy and external validation of the findings is required.

Conclusions: Autistic traits are positively associated with the stress of social isolation. Autistic traits affected core self-evaluation first, and psychological inflexibility subsequently, leading to the stress of social isolation. Individuals with high autistic traits tended to experience higher levels of stress during pandemic quarantines. The findings provide useful evidence for developing interventions and implementing preventive measures to reduce stress in individuals with high autistic traits and autism spectrum disorder.

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1. Introduction

The Coronavirus disease of 2019 (COVID-19) and the fight against the epidemic have had a broad impact on Chinese society [1]. Quarantines [2,3] and other methods used to avoid infection with COVID-19 have disrupted people's lifestyles. The decrease in social interaction resulting from social isolation has negatively impacted people's physical and mental health [4,5], and people report generally feeling stressed [3,6–8]. Stress can be described as an adaptive mechanism that tends to emerge through various reactions when there is an imbalance in both the internal and external environment [9]. When individuals encounter sudden crises or undergo significant life changes, they frequently exhibit a range of stress-related reactions, including anxiety, irritability, and physical tension [9,10]. The stress associated with the COVID-19 epidemic is due to the fear of viral infection and the collateral negative psychological and practical effects of measures taken to prevent the spread of the virus [11]. Studies have shown that the overall incidence of stress during the COVID-19 epidemic ranged from 8.1% to 81.9% [6], and it has also been reported that this stress resulted in mild to severe psychosocial problems including depression [12], somatization [13], and anxiety [14–16].

Individuals with autism spectrum disorder (ASD) usually show persistent deficits in social communication and social interaction in many environments, display repetitive behavioral patterns and have narrow interests and activities [17,18]. Symptoms in individuals with ASD are not one or the other, but exist along a continuum from normal to autistic in the general population [19], which can be measured by the Autism-Spectrum Quotient [20]. Individuals exhibiting elevated scores on the Autism-Spectrum Quotient (AQ) yet not meeting the clinical diagnostic criteria for ASD in their behavioral performance are commonly identified as individuals with high autistic traits [21]. As individuals with high autistic traits and individuals with ASD have similar behaviors, such as impaired social communication skills, social interaction skills, and stereotyped cognitive styles [22,23], it is possible that individuals with high autistic traits experience stress similar to individuals with ASD.

Previous studies have shown that individuals with ASD were more susceptible to stress during the COVID-19 epidemic, and reported higher levels of stress than their non-ASD counterparts [24] due to mandated social isolation [25,26]. Understanding the relationship between autistic traits and the stress of social isolation is critical to develop effective prevention and intervention strategies to assist individuals with high autistic traits or ASD manage their stress. Although previous research has shown that autistic traits in the general population can positively predict their stress [27,28], there have not been any studies of the relationship between autistic traits and the stress of social isolation in the general population. Therefore, the purpose of this study was to explore the impact of autistic traits on the stress of social isolation associated with COVID-19.

Psychological inflexibility is defined as “the rigid dominance of psychological reactions over chosen values and contingencies in guiding action.” [29]. Psychological inflexibility involves individuals engaging in counterproductive attempts to manage or evade unpleasant internal or external events through their responses to bodily sensations, emotions, or thoughts [29,30]. Such tendencies have the potential to exacerbate both internal and external negative experiences for the individual [29,30]. Psychological inflexibility can be measured using the Acceptance and Action Questionnaire-II (AAQ-II) [29].

Stress can be addressed by reducing psychological inflexibility [31]. Individuals with high psychological inflexibility tend to approach stressful situations in a rigid and reactive manner rather than in a meaningful, attentive, and value-driven way [32]. Previous studies have shown that psychological inflexibility is a personality characteristic that increases an individual's susceptibility to stress [33], and psychological inflexibility has been shown to have a positive relationship with the stress of COVID-19 [32,34]. At the same time, individuals with ASD frequently display inflexibility and a preference for behaviors governed by rules [35], which can lead to increased psychological inflexibility [36]. Recent research has demonstrated that psychological inflexibility is a strong predictor of stress for individuals with ASD [37]. Individuals with ASD often adhere to specific daily routines and encounter challenges when adapting to changes in their social environment [17,18,35]. These behaviors, indicative of psychological inflexibility, contribute to increased stress levels among individuals with ASD in response to the life changes brought about by COVID-19 [37]. For typically developing children, autistic traits were found to be positively associated with psychological inflexibility [38].

Core self-evaluation encompasses a wide range of traits, including self-esteem, locus of control, self-efficacy, and emotional stability [39]. Core self-evaluation is the most basic bottom-line evaluation that people make of themselves [39], which reflects their beliefs in control, execution, coping, persistence, and success of their lives, as well as a general feeling that one's life will be fine. According to the conservation of resources theory [40,41], people with high core self-evaluation may be less sensitive to the potential effects of stress. Moreover, previous studies have shown that there is a negative correlation between one's core self-evaluation and stress [42]. Individuals with ASD experience social stigma due to social and communication deficits, which also make them more vulnerable to stressors [43]. However, individuals with ASD who possess a strong self-identity may attain higher self-esteem and experience improved mental health [44,45], ultimately leading to an elevated level of core self-evaluation [39]. This, in turn, equips them with greater resilience to stressors [40,41]. Additionally, individuals may also derive positive feelings associated with core self-evaluation through group membership, particularly when they cultivate collective self-esteem, a sense of acceptance within a shared group identity, group cohesion, and recognition of individual talents [46]. Therefore, although autistic traits may have had a negative impact on individuals during the epidemic, individuals with higher core self-evaluation may have felt less stress during the epidemic.

1.1. The present study

According to the stress and coping model [9,10], social isolation caused by COVID-19 may be a significant stressor for individuals with high autistic traits. Therefore, the primary objective of the current investigation was to explore the correlation between autistic traits and the stress of social isolation. Our study focused on a sample of adults gathered amid the COVID-19 epidemic prevention and

control measures. Simultaneously, individuals with high autistic traits may possess limited internal resources, such as core self-evaluation, for coping with stress resulting from social difficulties and may resort to inappropriate coping strategies, such as psychological inflexibility. Therefore, our investigation delved into the mediating influence of core self-evaluation and psychological inflexibility in the connection between autistic traits and the stress of social isolation.

From a statistical standpoint, multiple mediation models offer advantages over simple mediation models by assessing the overall mediation effect size, controlling for one mediating variable (e.g., core self-evaluation), and examining the impact of another mediating variable (e.g., psychological inflexibility). This approach minimizes bias in parameter estimation caused by overlooked variables and additional mediating factors. Additionally, it facilitates the comparison of the relative magnitudes of various mediating effects [47]. From a substantive perspective, multiple mediation models can synthesize existing research, revealing complementary mediation pathways that enhance understanding of complex processes and the mechanisms through which independent variables influence dependent variables.

Although both core self-evaluation and psychological inflexibility may elucidate the connection between autistic traits and the stress of social isolation, the nature of their interaction remains uncertain. This study investigates whether these variables act independently but concurrently (parallel mediating effect) or sequentially (chain mediating effect). While parallel mediation implies independent effects of core self-evaluation and psychological inflexibility on the stress of social isolation, a chain mediation suggests a serial influence where higher core self-evaluation might be linked to lower psychological inflexibility, and both factors collectively impact the stress of social isolation.

Different intermediary models have distinct practical implications. If the validity of the chain mediation model is established, interventions directed towards mediating variables closer to the independent variable may have the potential to disrupt the entire pathway to the dependent variable. Therefore, intervening on proximal mediating variables could be more efficacious than intervening on those farther away. Considering the ambiguity in the association between core self-evaluation and psychological inflexibility, this study conducts exploratory analyses without positing specific hypotheses.

This study adopted the structural equation modeling approach through item parceling strategies [48]. This process entails amalgamating two or more items from the identical scale into a fresh index, enabling the examination of composite scores such as the total score or mean [49].

The hypotheses tested in this study were.

- Hypothesis 1.**
- 1) Autistic traits are positively associated with the stress of social isolation.
 - 2) Psychological inflexibility is positively associated with the stress of social isolation.
 - 3) Core self-evaluation is negatively associated with the stress of social isolation.

- Hypothesis 2.**
- 1) Psychological inflexibility mediates the effect of autistic traits on the stress of social isolation.
 - 2) Core self-evaluation mediates the effect of autistic traits on the stress of social isolation.

Hypothesis 3. Individuals with high autistic traits experience greater stress from social isolation than individuals with low autistic traits (i.e., people without autistic traits).

2. Methods

2.1. Participants

A sample of 1683 college students from three universities in Chongqing province, China, took part in this study. After excluding 86 questionnaires with invalid data or respondents below 18 years old, the final analysis included data from 1597 participants ($Mean_{age} = 19.93$, $SD_{age} = 1.40$, range = 18–26, 62.81% female). Data collection occurred between September 13 and October 7, 2022, during the COVID-19 epidemic prevention and control period in Chongqing, China. Additional characteristics of the entire sample can be found in Table 1.

2.2. Procedure

To comply with the local government's epidemic prevention policy, the data for this study were collected through electronic questionnaires distributed to participants via Survey Star (an online survey distribution website; Changsha Ranxing Science and Technology, Shanghai, China) and WeChat (an online social media platform; Shenzhen Tencent Computer System Co., LTD., Shenzhen,

Table 1
Demographic characteristics of participants.

Variables		N	Percentage
Gender	Male	594	37.19%
	Female	1003	62.81%
Major	Nature science	1077	67.44%
	Social science	520	32.56%

China), and no face-to-face contact was made. The cluster sampling method was adopted. This research was approved by the Chongqing Normal University research ethics committee. All participants had provided informed consent. The ethics committee approved this consent procedure (No.CNU-EDU-20220612-001).

2.3. Measures

2.3.1. Autistic traits

The Mandarin version [50] of the Autism-Spectrum Quotient [20], which is considered a reliable instrument for measuring autistic traits in both clinical and non-clinical populations was used in this study. The Autism-Spectrum Quotient comprises 50 self-report items and measures autistic traits across five subscales: imagination, social skill, communication, attention switching, and attention to detail. Participants were asked to indicate their level of agreement with each item (e.g., “I prefer to do things with others rather than on my own”) using a 4-point scale (1 = *definitely disagree*, 2 = *slightly disagree*, 3 = *slightly agree*, 4 = *definitely agree*). Total Autism-Spectrum Quotient scores range from 50 to 200 [50], with higher scores indicating higher levels of autistic traits. In this study, Cronbach’s α of the Autism-Spectrum Quotient was 0.67.

2.3.2. Stress of social isolation

The Coronavirus Stress Measure [34] was used to measure participants’ levels of stress arising from social isolation during the COVID-19 epidemic. Each item, such as “How often have you felt that you were unable to control the important things in your life due to the COVID-19 epidemic?” was evaluated using a five-point scale ranging from 0 = *never* to 4 = *very often*. Item scores were added to compute an overall total score, with higher scores indicating higher levels of stress. Ye et al. [51] applied the scale to Chinese samples, and the results showed that it had good cultural adaptability, reliability and validity [52]. In this study, Cronbach’s α of the Coronavirus Stress Measure was 0.89.

2.3.3. Psychological inflexibility

Psychological inflexibility was assessed using the Acceptance and Action Questionnaire-II (AAQ-II) [29]. The questionnaire has seven self-report items answered using a 7-point Likert scale, ranging from 1 = *never true* to 7 = *always true* (e.g., “My painful experiences and memories make it difficult for me to live a life that I would value.”). Upon summing the scores of the items, elevated total scores indicate heightened experiential avoidance and diminished psychological flexibility. Cao et al. [53] translated the Acceptance and Action Questionnaire-II into Chinese and verified the reliability and validity of the Chinese version of the questionnaire in Chinese college students and showed that the Chinese version of AAQ-II has good psychometric indicators. In this study, Cronbach’s α of the Acceptance and Action Questionnaire-II was 0.93.

2.3.4. Core self-evaluation

Core self-evaluation was measured by the Core Self-Evaluation Scale [54]. The scale retained 10 items (e.g., “I am capable of coping with most of my problems”) after revision of the Chinese version by Du et al. [55], and each item was scored using a seven-point scale ranging from 1 = *strongly disagree* to 7 = *strongly agree*. The scale is used to measure an individual’s basic evaluation of themselves and their values, with higher total scores reflecting higher core self-evaluation. The revised Core Self-Evaluation Scale has good reliability and validity in the sample of Chinese college students, which can be used as an effective and practical personality measurement tool [55]. In this study, Cronbach’s α of the Core Self-Evaluation Scale was 0.86.

2.4. Data analyses

Before testing the structural models, preliminary analyses were conducted, including descriptive statistics, internal reliability (α) estimates, and correlation analyses. Point biserial correlation analysis was used to analyze dichotomous and continuous data, while Pearson product-moment correlation analysis was used for continuous data. Tests of normality revealed that the study variables showed no significant deviation from normality (e.g., Skewness < |3.0| and Kurtosis < |10.0|) [56,57].

Next, to scrutinize the mediation model, we employed Mplus 8.3 for structural equation modeling, utilizing a robust maximum likelihood estimator to assess the research model. Simultaneously, standardized regression coefficients were utilized to express the magnitude of association between variable pairs. To assess the significance of the indirect and direct effects, bias-corrected 95% confidence intervals (CIs) were calculated using the bootstrapping procedure [58]. The estimate was considered statistically significant if the 95% CI (based on 5000 bootstrap samples) did not include zero. The adequacy of the model fit was assessed through various common fit indices, including χ^2/df , TLI, CFI, RMSEA, SRMR. Stringent fit criteria were applied, considering values indicative of good fit as $\chi^2/df < 3$ (a more lenient standard with 5), TLI > 0.90, CFI > 0.90, RMSEA < 0.08, and SRMR < 0.08 [59].

Finally, to examine the variation in stress levels associated with COVID-19 in individuals with high autistic traits, two subsets of 160 participants, those scoring within the top 10% and bottom 10% on the Autism-Spectrum Quotient [23,60,61] from the total of 1597 adults were randomly selected and divided into individuals with high autistic traits ($n = 160$) and individual with low autistic traits ($n = 160$) groups. Then, an independent samples t -test was conducted to compare differences in stress levels between the two groups. Meanwhile, independent sample t -tests and χ^2 tests were also used to examine the differences in Autism-Spectrum Quotient scores, age, gender, and study major between the two groups.

3. Results

3.1. Preliminary analysis

The Means, SDs, and Pearson correlations are presented in Table 2. There were significant positive correlations among autistic traits, stress of social isolation, and psychological inflexibility (all p s < 0.001). In addition, core self-evaluation was negatively correlated with Autistic traits, Stress of social isolation, and psychological inflexibility (all p s < 0.001).

3.2. Common method biases test

All the variables in this study were obtained from college students' self-reported data, and there may be a common method bias problem. Therefore, it was necessary to test the common method bias before analyzing the data. The data were tested using Harman's one-factor test, and the results showed that the variance explained by the first principal factor was only 14.59% (far less than the critical standard of 40%) [62–64], so the threat of common method bias was not serious.

3.3. Measurement model

We utilized CFA to assess the fit of the measurement model, which encompassed four latent variables: autistic traits, stress of social isolation, psychological inflexibility, and core self-evaluation. The findings indicated satisfactory data fit: $\chi^2/df = 3.88$, TLI = 0.94, CFI = 0.95, RMSEA = 0.04, SRMR = 0.06. Moreover, all factor loadings on the latent variables demonstrated statistical significance (all p s < 0.01), suggesting a robust representation of the latent factors through their respective indicators.

3.4. Measurement and structural mediation model

In step 1, the effect of autistic traits on the stress of social isolation was first examined using baseline models with age, gender and study major as covariates. The model fitted the data well: $\chi^2/df = 7.50$, TLI = 0.90, CFI = 0.92, RMSEA = 0.06, SRMR = 0.06, suggesting that autistic traits positively predicted the stress of social isolation and explained 4% of the variance.

In step 2, core self-evaluation was added to the baseline model as a mediator. The results showed that the model including this variable demonstrated a good fit: $\chi^2/df = 4.73$, TLI = 0.91, CFI = 0.92, RMSEA = 0.05, SRMR = 0.06. Thus, core self-evaluation mediated the effect of autistic traits on the stress of social isolation. Autistic traits explained 30% of the variance of core self-evaluation and autistic traits and core self-evaluation together explained 8% of the variance in the stress of social isolation.

In step 3, psychological inflexibility was added to the model based on step 2. As depicted in Fig. 1 and Table 3, the structural equation model employed to investigate the connections among autistic traits, stress of social isolation, core self-evaluation, and psychological inflexibility demonstrated a favorable fit with the data: $\chi^2/df = 4.12$, TLI = 0.92, CFI = 0.93, RMSEA = 0.04, SRMR = 0.06. In this model, autistic traits explained 30% of the variance in core self-evaluation, and 45% of the variance in psychological inflexibility was explained by core self-evaluation and autistic traits. A total of 19% of the variance of stress of social isolation was explained by autistic traits, core self-evaluation, and psychological inflexibility.

Analyses of the total indirect effects indicated that core self-evaluation and psychological inflexibility completely mediated the relationship between autistic traits and the stress of social isolation [$\beta = 0.15$, $SE = 0.03$, $p < 0.001$, 95% CI (0.10, 0.20)]. In contrast, upon separate examination, the indirect paths did not demonstrate statistical significance: (a) autistic traits → core self-evaluation → stress of social isolation [$\beta = -0.03$, $SE = 0.03$, $p = 0.295$, 95% CI (-0.09, 0.02)], (b) autistic traits → psychological inflexibility → stress of social isolation [$\beta = 0.02$, $SE = 0.02$, $p = 0.200$, 95% CI (-0.01, 0.05)]. However, the indirect path (c) autistic traits → core self-evaluation → psychological inflexibility → stress of social isolation [$\beta = 0.16$, $SE = 0.02$, $p < 0.001$, 95% CI (0.12, 0.20)] was significant. The findings indicated that the parallel mediating effects of (a) and (b) did not achieve statistical significance, while only the chain mediating effect of (c) demonstrated significance. Consequently, the total effect of autistic traits through two mediating variables of core self-evaluation and psychological inflexibility on stress of social isolation was 0.17.

In addition, core self-evaluation emerged as a full mediator in the association between autistic traits and psychological inflexibility

Table 2
Descriptive statistics and correlations among variables.

Variables	Mean	SD	Correlations					
			1	2	3	4	5	6
1. Age	19.93	1.40						
2. Gender	–	–	–0.01					
3. Major	–	–	0.01	0.26***				
4. Autistic traits	119.52	9.46	0.03	–0.04	–0.05*			
5. Stress of social isolation	1.43	0.81	–0.01	0.13***	0.08***	0.19***		
6. Psychological inflexibility	22.19	8.26	–0.08**	0.03	0.06*	0.33***	0.39***	
7. Core self-evaluation	33.06	6.30	–0.03	–0.05*	0.01	–0.41***	–0.23***	–0.63***

N = 1597. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

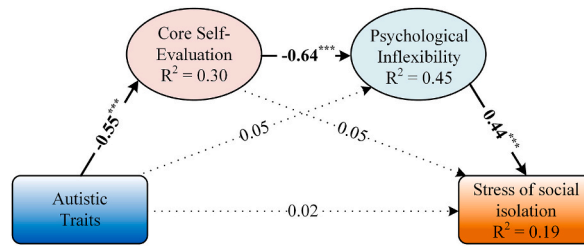


Fig. 1. Structural equation model of the relationships (with standardized coefficients). The respective indicators of each latent variables and control variables were omitted for brevity. The dashed lines indicate paths that are not significant. *** $p < 0.001$.

Table 3
Standardized effects of autistic traits on the stress of social isolation.

Parameter	Point estimates	SE	p	95% CI _{boot}	
				Lower	Upper
Total effect	0.17	0.04	<0.001	0.09	0.25
Total indirect effect	0.15	0.03	<0.001	0.10	0.20
(a) Autistic traits → Core self-evaluation → Stress of social isolation	-0.03	0.03	0.295	-0.09	0.02
(b) Autistic Traits → Psychological inflexibility → Stress of social isolation	0.02	0.02	0.200	-0.01	0.05
(c) Autistic Traits → Core self-evaluation → Psychological inflexibility → Stress of social isolation	0.16	0.02	<0.001	0.12	0.20
Direct effect	0.02	0.05	0.605	-0.06	0.12

[$\beta = 0.35, SE = 0.03, p < 0.001, 95\% CI (0.30, 0.41)$], and psychological inflexibility completely mediated the relationship between core self-evaluation and the stress of social isolation [$\beta = -0.29, SE = 0.03, p < 0.001, 95\% CI (-0.35, -0.23)$].

It is worth noting that gender ($\beta = 0.10, p < 0.001$) as a control variable, also had a significant effect on the stress of social isolation, with female students having higher stress of social isolation than male students.

3.5. Test of differences

Prior to testing for differences in stress levels between individuals with high autistic traits and individuals with low autistic traits, differences in Autism-Spectrum Quotient scores, age, gender, and study major were examined. As shown in Table 4, the results indicated that the Autism-Spectrum Quotient scores of individuals with high autistic traits were significantly higher than those of individuals with low autistic traits ($t = 57.38, p < 0.001$). However, there were no significant differences in age ($t = 0.04, p = 0.967$), gender ($\chi^2 = 0.24, p = 0.623$), or study major ($\chi^2 = 0.51, p = 0.476$) between the two groups.

Subsequently, differences in the stress of social isolation between the group of individuals with high autistic traits and individuals with low autistic traits were examined. As shown in Fig. 2, the results indicated that the stress levels of individuals with high autistic traits (1.65 ± 0.78) were significantly higher than individuals with low autistic traits (1.14 ± 0.97) ($t = 5.13, p < 0.001, Cohen's d = 0.57$).

4. Discussion

This study analyzed the relationship between autistic traits and the stress of social isolation associated with COVID-19 and extends the literature by exploring the potential mediating roles of core self-evaluation and psychological inflexibility. The results support our hypothesis regarding both the significance and direction of the effect. Autistic traits were positively associated with the stress of social

Table 4
Characteristics of individuals with high autistic traits and individuals with low autistic traits.

Variable	Individual with high autistic traits group (n = 160)	Individual with low autistic traits group (n = 160)	χ^2/t	p
Continuous variables, Mean ± SD				
Autism-Spectrum Quotient scores	134.17 ± 4.35	101.59 ± 5.71	57.38	<0.001
Age	19.88 ± 1.41	19.87 ± 1.29	0.04	0.967
Categorical variables, n (%)				
Gender	Male	45 (28.125%)	0.24	0.623
	Female	115 (71.875%)		
Major	Nature science	110 (68.75%)	0.51	0.476
	Social science	50 (31.25%)		

Independent sample t-test was used for continuous variables and χ^2 test was used for categorical variables.

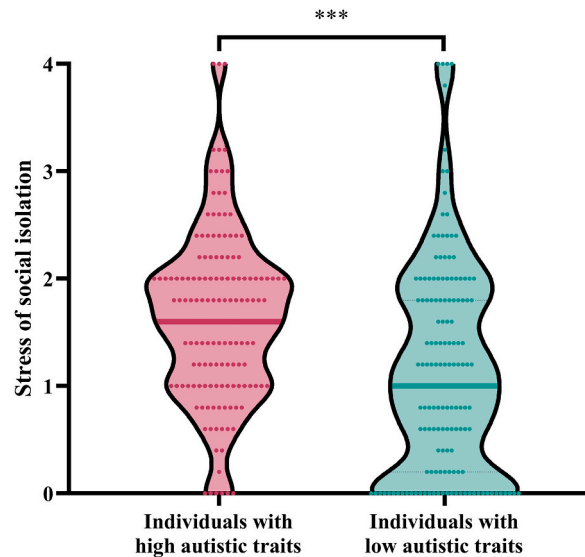


Fig. 2. Differences between the stress of social isolation in individuals with high autistic traits and individuals with low autistic traits. People in the top 10% ($n = 160$) and bottom 10% ($n = 160$) of Autism-Spectrum Quotient scores were divided into individuals with high autistic traits and individuals with low autistic traits. $***p < 0.001$.

isolation. In addition, we found that core self-evaluation and psychological inflexibility mediated the relationship between autistic traits and the stress of social isolation. Our research provides some guidance for the mental health of individuals with high autistic traits during a pandemic.

4.1. The mediating effect of core self-evaluation

In step 2 of model construction, core self-evaluation was added as a potentially mediating variable and results indicated that it completely mediated the relationship between autistic traits and the stress of social isolation. The higher the autistic traits, the lower the core self-evaluation, which may be due to the social and communication barriers caused by the autistic traits [45]. However, higher core self-evaluation can reduce the stress of social isolation [39]. As a higher-order positive human trait construction, core self-evaluation plays a protective role in the relationship between autistic traits and the stress of social isolation [65]. This result is also consistent with the conservation of resource theory, which states that an individual's core evaluation will increase and perceived stress will be reduced if the individual identifies with the group to which he/she belongs, and develops positive feelings from the group [44, 46]. Stress is defined as a relationship between a person and the environment, which is evaluated as being important to the individual, and stress is produced if the individual does not have sufficient resources to meet the demands of the environment [9]. Therefore, improving the core self-evaluation of individuals with high autistic traits may increase their internal resources, improve their quality of life [54], and relieve the stress of social isolation to cope better with the future.

4.2. The mediating effect of psychological inflexibility

When psychological inflexibility was added to the model in the step 3, we found that the direct effect of core self-evaluation on the stress of social isolation was no longer significant, and the negative impact of core self-evaluation on the stress of social isolation was achieved through psychological inflexibility. Psychological inflexibility plays an important role in our model, as it is an important link in the pathway through which autistic traits affect the stress of social isolation. Psychological inflexibility mediated the effect of core self-evaluation on the stress of social isolation and without psychological inflexibility, it may be impossible to explore the true relationship between autistic traits and the stress of social isolation.

Psychological inflexibility is also a hot topic in current mental health research, and it has demonstrated moderate to large associations with depression, anxiety, and stress [66]. Psychological inflexibility has also been shown to have a stable and positive association with the stress of social isolation [33]. During the COVID-19 epidemic, uncertainty was also a risk factor for the mental health of individuals with high autistic traits [67], and high uncertainty coupled with high psychological inflexibility may result in increased stress. These uncertainties can result from disruptions in daily routines caused by COVID-19 quarantine measures [2,3]. Additionally, individuals with ASD may experience a lack of access to familiar support services like speech therapy or psychotherapy due to isolation during the pandemic [67]. This abrupt change can lead to feelings of loneliness and emotional distress, ultimately increasing stress levels [68]. Therefore, reducing psychological inflexibility in individuals with high autistic traits and enhancing their coping abilities may effectively mitigate the stress associated with social isolation in this population.

4.3. The chain mediating effects of core self-evaluation and psychological inflexibility

Core self-evaluation plays an important role in mental health [69]. Core self-evaluations also tend to be closely related to a sense of continued growth and development, a sense of purpose and meaning in life, and satisfaction with relationships [70]. Positive core self-evaluation predict low levels of psychological inflexibility, as individuals with higher self-esteem tend to face changes in more confidently [71]. A recent study has also shown that psychological inflexibility mediates the effect of self-esteem on mental health [71], which is also consistent with our findings. The chain mediating effect of autistic traits → core self-evaluation → psychological inflexibility → stress of social isolation accounted for most of the total effect in our study. Autistic traits affected core self-evaluation first and psychological inflexibility subsequently, thus affecting the stress of social isolation. In this process, core self-evaluation played the role of a protective factor and psychological inflexibility played the role of risk factor and was the key point in this process.

It is worth thinking about how to define one's own position and choose a coping style. When facing the challenges of uncertainty in life, improving one's psychological quality increases feelings of calm [72]. Therefore, the chain mediation identified in this study may be helpful to reduce the stress of social isolation from the perspective of core self-evaluation and psychological inflexibility, providing a reference for mental health workers.

4.4. Differences in the stress of social isolation between individuals with high autistic traits and individuals with low autistic traits

Consistent with previous research [24,25,27,28], individuals with high autistic traits have higher levels of stress than individuals with low autistic traits, which is consistent with our hypothesis. This suggests that individuals with high autistic traits are susceptible to stress in situations of social isolation, highlighting the need for greater attention to the mental health of this population.

4.5. Possible pathways to reduce the stress of social isolation in individuals with high autistic traits

Based on the correlation and mediation results mentioned above, psychological interventions for individuals with high autistic traits might focus on enhancing their core self-evaluation, increasing their sense of group identity, and reducing psychological inflexibility. These findings suggest that interventions aimed at improving self-esteem and fostering a sense of belonging within a group may be beneficial for individuals with high autistic traits. Additionally, reducing psychological inflexibility, or the inability to adapt to new or changing situations, may help these individuals to better manage stress and improve their overall well-being. Furthermore, the transdiagnostic concept underpinning acceptance and commitment therapy is that psychological inflexibility can be reduced [31], providing an operational and effective method to improve the mental health of individuals with high autistic traits. Cognitive behavioral therapy, mindfulness-based stress reduction, or acceptance and commitment therapy may help to reduce psychological distress in individuals with high autistic traits [31,73]. Our results therefore support the stress and coping model [9,10], which suggests that increasing the internal resources of individuals to cope with stress, such as improving core self-evaluation, and optimizing the coping strategies of individuals to cope with stress, such as reducing psychological inflexibility, may be effective ways to reduce the stress of social isolation.

4.6. Limitations and future directions

This study has several limitations. It adopted a cross-sectional design, which constrains the ability to draw causal inferences. Future research might consider employing experimental or longitudinal designs to further examine the proposed model. Second, all data in this study were self-reported, which may cause methodological effects. Behavioral and brain science methods in the laboratory should be used for data collection in the future. In addition, our Autism-Spectrum Quotient showed a relatively low Cronbach's alpha, which may be due to the online survey. Paper questionnaires may be used to make up for this deficiency in the future. Furthermore, it's worth considering the potential benefits of social isolation for individuals with high autistic traits, a topic that could benefit from further exploration in future studies. Finally, this study was conducted during the quarantine policy in China, and therefore the external validity of our findings needs to be further verified.

5. Conclusion

This study found a positive relationship between autistic traits and the stress of social isolation during the COVID-19 pandemic in China. individuals with high autistic traits tended to experience higher levels of stress during the pandemic quarantine. Furthermore, autistic traits affected their core self-evaluation first, and their psychological inflexibility subsequently, leading to the stress of social isolation. These findings provide valuable insights into the mental health of individuals with high autistic traits in isolation during the COVID-19 pandemic.

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Date availability statement

Data associated with this article can be found in the online version at https://pan.baidu.com/s/1ZowPtqWi_VPXhdaKWciYw?pwd=lrzv.

Ethics approval

This research was approved by the Chongqing Normal University research ethics committee. The ethics committee approved this consent procedure (No.CNU-EDU-20220612-001).

CRedit authorship contribution statement

Min Shao: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Shu Luo:** Software, Resources, Investigation, Data curation. **Huiling Qian:** Software, Resources, Investigation, Data curation. **Xiaoran Li:** Software, Resources, Investigation, Data curation. **Zilong Wei:** Software, Resources, Project administration, Investigation, Data curation. **Mingyu Hong:** Software, Resources, Investigation, Data curation. **Junyao Wang:** Software, Resources, Investigation, Data curation. **Xiong Li:** Software, Resources, Investigation, Data curation. **Jing Meng:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.heliyon.2024.e26082>.

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