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The association between expressive suppression and anxiety in Chinese left-behind children in middle school: serial mediation roles of psychological resilience and self-esteem

Tingting Qu^{1†}, Qiwen Gu^{2†}, Huan Yang^{1,3}, Chennan Wang¹ and Yuping Cao^{1*}

Abstract

Background Left-behind children (LBC) have become a special population to be concerned due to the negative consequences of parental absence during their physical and psychological development in China. Expressive suppression (ES) is a response-focused emotion regulation and may be frequently used by LBC to suppress their emotions resulting in different forms of internalizing problems. The objective of the present study was to investigate the role of ES as an emotion regulation strategy on anxiety in Chinese left-behind children in middle school (LBC-MS) by considering the mediating role(s) of psychological resilience and self-esteem.

Methods 820 middle school students aged between 12 and 17 years from a middle school in Xiangtan, Hunan Province, participated in the study. Screen for Child Anxiety Related Emotional Disorders (SCARED), Emotion Regulation Questionnaire (ERQ), Resilience Scale for Chinese Adolescents (RSCA), and Rosenberg Self-Esteem Scale (SES) were administered. Variables measured using the above scales in left-behind children in middle school (LBC-MS) and non-left-behind children in middle school (non-LBC-MS) were compared, and descriptive statistics were used to present the overall characteristics. Then the PROCESS macro of SPSS was used to conduct regression-based statistical mediation for the data of 211 left-behind children.

Results This study revealed that LBC-MS had higher anxiety and ES scores and lower psychological resilience and self-esteem scores than non-LBC-MS ($P_s < 0.01$). ES was found positively associated with anxiety in LBC-MS and negatively associated with psychological resilience and self-esteem ($P_s < 0.05 - 0.01$). Specifically, both psychological resilience and self-esteem significantly mediated the association between ES and anxiety, accounting for 7.50% and 10.68%, respectively, of the total associations. Moreover, psychological resilience and self-esteem had a chain mediating effect between ES and anxiety in LBC-MS.

[†]Tingting Qu and Qiwen Gu contributed equally to this work.

*Correspondence:

Yuping Cao
caoyp001@csu.edu.cn

Full list of author information is available at the end of the article



Conclusion The findings indicated that LBC-MS in China may frequently engage in the use of ES which correlated with higher level of anxiety. Psychological interventions should be dedicated to this underserved group. Intervention approaches that improve emotion regulation strategies (i.e., decrease the use of ES) and increase psychological resilience and self-esteem may help to alleviate anxiety in LBC-MS.

Keywords Left-behind children in middle school, Anxiety, Expressive suppression, Psychological resilience, Self-esteem

Introduction

Tremendous economic and industrial development facilitated rapid urban expansion and labor demand in various industries in the last 30 years in China, many “peasant workers” had to migrate from the countryside to different major cities for jobs leaving their children at home to be taken care of by their grandparents, other relatives, or one single parent. Left-behind children (LBC) generally refers to the children who are minors (under age 18) and live without their parents or with only one parent since these parent(s) leave home to seek for better-paid jobs [1]. Compared to the non-left-behind children (non-LBC), LBC may suffer from more health problems such as cardiovascular disease, digestion problems, and lack of access to free vaccines, and LBC were found 2.14 more times to suffer from mental health problems than non-LBC such as conduct problems, anxiety and depression, a greater rate of school absence and poor academic performances and psychological safety [2, 3]. These researchers further pointed out that within the limited time of communication between LBC and their parents, there is a significant insufficient care on LBC’s mental world rather than their physical health and academic performances which result in a variety of mental health and behavioral problems. There were more than 69 million children who had left-behind experience in China in 2015, and this increasing population has drawn the attention of many mental health researchers to explore LBC’s mental health status [4]. During the adolescent period (i.e., when teenagers who are usually in the age between 12 and 18 years old and going through puberty), middle school students enter a unique human development period where an array of major developments take place such as puberty and the formation of moral values and may demand a large amount of attention and care from their caregivers.

Parental absence has detrimental effects on children’s development in terms of physical and psychological health, school and academic performance, personal behavioral control, perception of social support, and long-term life quality and satisfaction [5]. This lack of resources and support in their growth makes the LBC population special in the way they are disadvantaged during development. Many previous studies in China have focused on the significant negative effect of parental absence and its contribution to social anxiety symptoms particularly in LBC across different age groups [6–8].

For example, one study suggested the mediating role of loneliness in the relationship between social anxiety and life satisfaction in LBC, in which LBC with higher levels of social anxiety tend to have higher levels of loneliness which decreases their life satisfaction [8]. Dai & Chu reported that LBC had more significant socially avoidant experiences and were more fearful of negative judgments from others compared to non-LBC [6]. Ren & Li revealed that perceived social support plays a moderating and mediating role in the relationship between physical exercise and social anxiety in LBC living in rural areas [7]. To be specific, this paper is aimed to investigate the relationship between emotion regulation strategy, specifically expressive suppression (ES), and anxiety in LBC-MS from four perspectives: the correlation between ES and anxiety, psychological resilience as a mediator between ES and anxiety, self-esteem as a mediator between ES and anxiety, and the chain mediation of psychological resilience and self-esteem between ES and anxiety.

Emotion regulation is usually assessed by two factors: expressive suppression (ES) and cognitive reappraisal (CR) [9]. Determining the effectiveness of an emotion regulation strategy is crucial since one may be beneficial and the other can be detrimental. CR was identified as an antecedent-focused regulation that is beneficial in alleviating a range of problems (e.g., depression, anxiety, and rumination) whereas ES was identified as a response-focused regulation that is associated with higher rates of these problems [10]. ES is defined as the process of suppressing emotions while being consciously emotional active [11]. A large body of literature suggests the use of ES by LBC when facing adversity due to parental absence, lack of social support, and inaccessibility to proper and professional mental health care, especially those LBC who live in rural areas [12, 13]. With all these factors considered, they contribute disproportionately to the development of adolescent psychopathology in LBC. Qu et al. revealed that ES was positively correlated with anxiety and the mediating effect of ES between self-esteem and anxiety in LBC-MS [13]. Thus, it is important to understand which emotion regulation strategy is used in this young population, addressing the harm of ES by increasing the use of CR, and setting preventative measures in advance. Given the possible negative impact of using ES to regulate emotions by LBC-MS, we hypothesized a positive correlation between ES and anxiety.

Resilience (psychological resilience) is usually defined as the ability to effectively cope with and adapt to stressful life experiences in the broad literature. Different models of psychological resilience (e.g., compensatory, challenge, and protective), positive effects on negative outcomes and valuable positive psychological assets for resilient individuals were previously studied [14]. Psychologically resilient individuals may possess a collection of assets that are beneficial for coping with emotional distresses when facing persistent stressors [14]. Psychological resilience may have a direct effect that counteracts the influence of a risk factor or act as a moderator that reduces the effect of a negative outcome. High psychological resilience is associated with lower rates of depression and anxiety in a variety of conditions in people across different ages (e.g., natural disasters, global pandemic, parental absence) [15, 16]. Regarding the relationship between emotion control and psychological resilience, studies have shown that improving emotion regulation can improve psychological resilience [17]. Other empirical studies have also shown an inverse correlation between ES and psychological resilience [18, 19]. Thus, we proposed that psychological resilience may play a mediating role between ES and anxiety among LBC.

Self-concept is defined as a multidimensional construct that comprises self-esteem and self-awareness [20]. Self-esteem, which can be described as an individual's feelings or specific evaluation of themselves [21], is an important internal determinant of adolescent behaviors. Previous research has suggested that individuals who regulate their emotions by using CR tend to perceive themselves as more worthy and competent [19]. In contrast, people who frequently use ES to regulate their emotions and tend to hide their emotional expression often find it difficult to cope with adverse life events. This tendency is not conducive to developing a confident and optimistic self-evaluation system, resulting in lower self-esteem. Lower self-esteem is associated with various psychological and behavioral problems, such as anxiety, depression, and violent or high-risk behaviors [22, 23]. Extending to LBC-MS, a special population that lacks a variety of both internal and external resources, parental absence plays a key role in precipitating and perpetuating low self-concept (i.e., low self-esteem) which positively correlates with depression and anxiety [24]. Our former study [13] revealed that LBC-MS have significantly lower self-esteem compared to non-LBC-MS counterparts in the same school, and lower self-esteem positively correlates with anxiety, and they were more likely to experience self-doubt and employ negative coping strategies when encountering stress. Based on the above theories and empirical studies, we postulated that self-esteem mediates the relationship between ES and anxiety among LBC-MS.

On the other hand, psychological resilience and self-esteem are both important psychological qualities and protective factors. As we mentioned above, psychological resilience and self-esteem may each play a single mediating role between ES and anxiety in LBC-MS. However, it is still unclear how these protective factors, like psychological resilience and self-esteem, when both are considered as mediating roles, mediate the pathway through which ES's impacts on anxiety. Previous studies have found that psychological resilience can positively predict self-esteem, and self-esteem mediates the relationship between psychological resilience and mental health of medical personnel [25]. Therefore, we proposed that the relationship between ES and anxiety may be mediated first through psychological resilience and then through self-esteem in addition to the two single mediating effects.

As previous studies noted the peculiarity and sensitivity of the adolescent period in combination with the status of being left behind, younger LBC may be more susceptible to experiencing depression and anxiety [26]. Due to the varied definitions and different age groups of LBC studied in the broad literature, LBC-MS refers to the left-behind children in middle school who are underage (younger than or equal to 18 years old) and live without both of their parents in our study. Although the association between ES and anxiety has been examined in previous literature, the mechanisms underlying this the association remain largely unknown. Only a few studies have examined the interaction between ES, psychological resilience, and self-esteem. Psychological resilience and self-esteem are well-documented protective factors against various mental health problems [27]. Our present study aimed to elucidate the relationships between these protective factors and how one correlates with the other between ES and anxiety, and addresses the serial mediating effect of psychological resilience and self-esteem in LBC-MS. Furthermore, differences in emotion regulatory mechanism between LBC-MS and non-left-behind children in middle school (non-LBC-MS) will be compared. It may provide additional insights for better preventative measures and interventions against psychological problems in LBC-MS in China.

Materials and methods

Participants and procedure

Using convenience sampling method, 820 middle school students at a middle school in Xiangtan city, Hunan Province, in southern China, answered surveys via computers at their school. The survey response rate was of 91.95%. A total of 754 valid surveys were collected and then we classified the students as LBC-MS or non-LBC-MS by asking the question, "Did one or both of your parents migrate to another place because of work for at least

6 months?”. On the basis of the answer to this question, we categorized 221 of the 754 students (29.31%) as LBC-MS, all of whom were enrolled in this study.

The age range of LBC-MS is 12–16 years ($M_{age}=13.63$, $SD_{age}=0.92$), and the age range of non-LBC-MS is 12–17 years ($M_{age}=13.76$, $SD_{age}=0.90$). Among LBC-MS, 105 (47.51%) were male and 116 (52.49%) were female; 82 (37.10%) were only child and 139 (62.90%) were non-only child. 71 children (32.13%) had divorced parents. The evaluation of parental relationship and family economic status for LBC-MS were classified into 5 categories: “excellent”, “good”, “average”, “poor”, and “very poor”, with the numbers of 77 (34.80%) and 16 (7.20%), 72 (32.60%) and 42 (19.0%), 51 (23.10%) and 145 (65.6%), 13 (5.90%) and 12 (5.40%), 8 (3.60%) and 6 (2.7%) respectively.

The survey was conducted during class time and participants consented to participate in the study. Participants were informed that the survey questions would assess their emotion regulation strategy, psychological resilience, self-esteem and anxiety, and the survey answers will remain anonymous and confidential. Informed consents from the adolescents and their legal guardians were obtained before participant agreed to join the study. This study was approved by the Institutional Review Board (IRB) of the Second Xiangya Hospital of Central South University in Changsha city, Hunan Province, China.

Measures

The general screening questionnaire

The General Screening Questionnaire was self-designed by the researchers and consists of questions regarding sex, age, being an only child, family structure and family economic condition, and parental relationship, etc.

The screen for child anxiety related emotional disorders

The Screen for Child Anxiety Related Emotional Disorders (SCARED) was designed by Birmaher in 1997 and edited in 1999 using 41 items to screen anxiety disorders for children and adolescents aged between 9 and 19 years old [28]. Su et al. assessed the reliability and validity of SCARED in China and established norms of SCARED for Chinese children and adolescents living in urban areas [29]. A 3-point scale was used in this questionnaire ranging from 0 to 2 where 0 means “not true”, 1 means “sometimes true”, and 2 means “often true”. The higher the cumulative rated score is, the more anxious an individual is. Individuals whose score is greater than or equal to 23 are considered for anxiety disorders. The Cronbach’s α coefficient for this questionnaire was 0.95, representing high reliability.

The emotion regulation questionnaire

The Emotion Regulation Questionnaire (ERQ) consists of 10 items assessing cognitive reappraisal (CR) and

expressive suppression (ES) where 4 items were developed for ES and 6 items were developed for CR [9, 30].

A 7-point Likert scale was used ranging from 1 to 7 where 1 indicates “Strongly Disagree” and 7 indicates “Strongly Agree”. For this study, only items assessing ES were included and the Cronbach’s α coefficient was 0.71.

The resilience scale for Chinese adolescent

The Resilience Scale for Chinese Adolescents (RSCA) was previously developed by Yueqin Hu and Yiqun Gan to assess resilience in Chinese adolescents and the Cronbach’s alpha was 0.83 in that study [31]. This questionnaire consists of 27 questions assessing resilience through 5 domains: target concentration, emotional control, positive thinking, family support, and interpersonal assistance. Target concentration refers to the ability to stick to goals, make plans, and focus on solving problems in difficult situations; Emotional control refers to the control and adjustment of mood swings and pessimism in difficult situations; Positive cognition refers to a dialectical view of adversity and an optimistic attitude; Family support refers to a tolerant, respectful, and supportive attitude from family members; Interpersonal assistance refers to the fact that an individual can get help or vent emotions through meaningful relationships. The five dimensions reflect the effectiveness of adolescents’ cognition, emotion, behavior, and environment in helping them resist adversity and adapt well in adverse situations [31]. Items were rated on a 5-point scale ranging from 1 to 5 where 0 indicates “Not at All” and 5 indicates “Totally”, and the higher an individual is scored the more resilient an individual is. In this study, the Cronbach’s α coefficient is 0.904.

The rosenberg self-esteem scale

The Rosenberg Self-Esteem Scale (SES) was used to assess self-esteem in this study [32, 33]. This scale consists of 10 items using a 4-point scale ranging from 1 to 4 where 1 indicates “Very Much” and 4 indicates “Not at All”, and the higher an individual is scored indicating the more self-esteemed an individual is. In this study, the Cronbach’s α coefficient is 0.863.

Data analysis

First, SPSS for Windows 26.0 was used for data entry and preliminary statistical analysis, including descriptive statistics and correlation analysis among major variables (IBM, Chicago, IL, USA). Second, Model 6 in PROCESS macro 3.3 was used to conduct a serial mediation analysis [34], and the bootstrap method (sampling repeated 5000 times) was used to construct a 95% confidence interval (CI) for significant testing of mediation effects.

Table 1 Comparison of the key variables between LBC-MS and non-LBC-MS (N= 754)

Variables	Total sample	LBC-MS(n=221)	Non-LBC-MS(n=533)	t(df)	p	Effect size
Anxiety(SCARED)	20.93 ± 14.06	24.10 ± 15.26	19.61 ± 13.33	-4.032(752)	< 0.001	0.313
ES(ERQ)	15.19 ± 4.52	15.86 ± 4.48	14.92 ± 4.52	-2.596(752)	0.010	0.209
Psychological resilience(RSCA)	94.18 ± 17.89	90.06 ± 17.17	95.89 ± 17.91	4.121(752)	< 0.001	0.332
Self-esteem(SES)	30.06 ± 5.48	28.44 ± 5.29	30.73 ± 5.42	5.312(752)	< 0.001	0.428

Note LBC-MS=left-behind children in middle school, Non-LBC-MS=non-left-behind children in middle school, ES=expression suppression
 ± : Values are presented as Mean (M)±Standard Deviation (SD)

Table 2 Correlation analysis between the key variables of LBC-MS (N= 221)

Variables	ES	Psychological resilience	Self-esteem
Anxiety(SCARED)	0.380*	-0.401*	-0.466**
ES(ERQ)	1.000	-0.158*	-0.276**
Psychological resilience(RSCA)		1.000	0.618**
Self-esteem(SES)			1.000

Note LBC-MS=left-behind children in middle school, ES=expression suppression
 *p<0.050, **p<0.010

Results

Common method bias test

Harman’s one-factor test was used to test the common method bias, and exploratory factor analysis (EFA) was conducted for all the questions in the scale [35]. The results showed that there were 20 factors with eigenvalues greater than 1, and the explanatory variation rate of the first factor was 22.71%, which was less than the critical value criterion of 40% [35]. Thus, the common method bias of this study was not serious.

Demographics

754 students aged 12–17 years old (M_{age}=13.72, SD_{age}=0.91) completed our survey, including 221 LBC-MS and 533 non-LBC-MS, 363 males and 391 females. There were no statistically significant differences in average age, sex, and distribution of only child between LBC-MS and non-LBC-MS (P_s>0.050).

Initial analysis

First, the descriptive statistics between the variables are presented in Table 1. Compared to non-LBC-MS, LBC-MS had higher scores of anxiety and ES, and lower scores of psychological resilience and self-esteem, and the differences were statistically significant (P_s<0.010).

In addition, the correlation analysis of the key variables in LBC-MS was conducted, as shown in Table 2. ES was significantly positively associated with anxiety level (r=0.380, p<0.010), while significantly negatively associated with psychological resilience (r = -0.158, p<0.050) and self-esteem (r = -0.276, p<0.010). There was a significant positive correlation between psychological resilience

and self-esteem (r=0.618, p<0.010). Psychological resilience (r = -0.401, p<0.010) and self-esteem (r = -0.466, p<0.010) are significantly negatively correlated with anxiety.

Prior to the regression analysis, the variance inflation factor (VIF) of the independent variables was calculated to assess whether there was a high correlation between the different independent variables. Results indicated that all VIF values were below 10, suggesting no significant multicollinearity issues among the predictors.

Serial mediation analysis

After all continuous variables were standardized and used sex, parental relationship, and family economic status as the control variables, Model 6 in PROCESS was used for chain mediation effect testing [34]. The analyses revealed significant associations between ES and low psychological resilience, low self-esteem, and high anxiety. Additionally, psychological resilience and self-esteem were negatively associated with anxiety, and higher psychological resilience corresponded with higher self-esteem (see Table 3).

After adding mediating variables, the direct effect of ES on anxiety was still significant, which indicates that psychological resilience and self-esteem were partial mediators of the relationship between ES and anxiety (see Fig. 1). Moreover, the bootstrap method revealed significant mediation effects of psychological resilience (indirect effect=0.091, SE=0.061) and self-esteem (indirect effect=0.130, SE=0.070), and a significant chain mediation (indirect effect=0.061, SE=0.040); They separately accounted for 7.50%, 10.68%, and 5.01% of the total effect, respectively (see Table 4).

Discussion

This study found that LBC-MS were more likely to use ES as their emotion regulation strategy compared to non-LBC-MS, which is in line with a previous study [12]. The correlational analysis found ES and anxiety are positively correlated indicating LBC-MS who use ES to regulate their emotions are more likely to become anxious. In addition, ES was found significantly inversely correlated with psychological resilience and self-esteem in LBC-MS. However, psychological resilience and self-esteem were positively correlated, in other words, LBC-MS who

Table 3 Serial mediating models between ES and anxiety (N=221)

	Model 1 (Psychological resilience)		Model 2 (Self-esteem)		Model 3 (Anxiety)	
	β	t	β	t	β	t
Sex	-0.031	-0.471	-0.075	-1.444	0.131	2.328*
Parental relationship	-0.211	-3.122**	-0.138	-2.529*	0.109	1.835
Family economic condition	-0.116	-1.719	-0.061	-1.134	0.121	2.080*
ES	-0.158	-2.400*	-0.181	-3.470***	0.274	4.708***
Psychological resilience			0.540	10.097***	-0.170	-2.416*
Self-esteem					-0.210	-2.845**
R ²	0.099		0.447		0.356	
df1	4.000		5.000		6.000	
df2	216.000		215.000		214.000	
F	5.959***		34.691***		19.701***	

Note ES=expression suppression. * $p < 0.050$, ** $p < 0.010$, *** $p < 0.001$

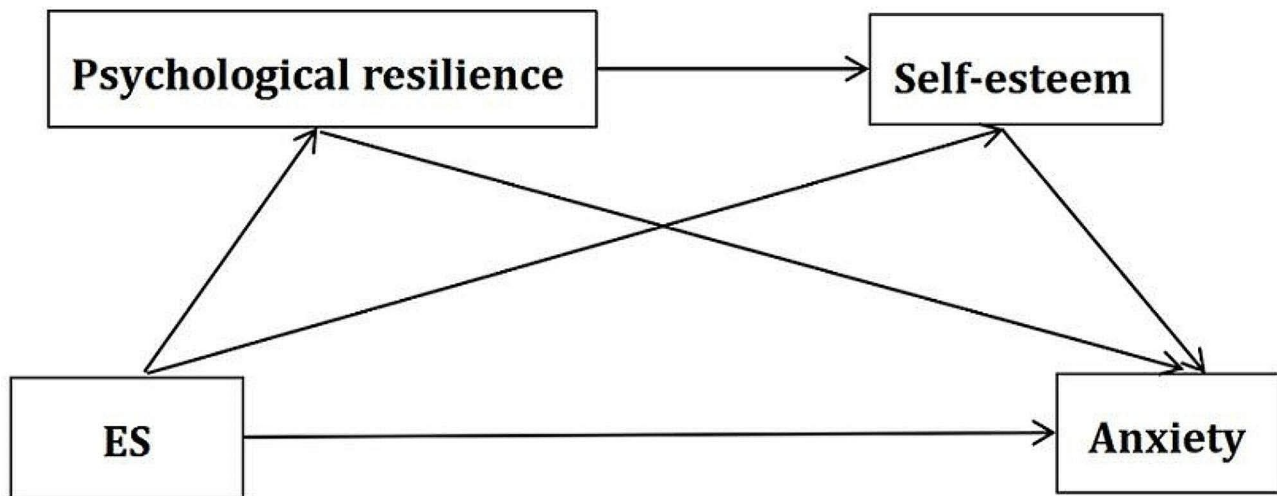


Fig. 1 Serial mediating paths between ES and anxiety. Pathways between variables are indicated by standardized beta estimates. * $p < 0.050$, ** $p < 0.010$, *** $p < 0.001$. ES=expression suppression. Note Specific demographic variables, such as sex, parental relations, and family economic status, were included as covariates in the model but not represented in the Figure for reasons of clarity

Table 4 Serial mediating paths between ES and anxiety (N=221)

	Effect	Boot SE	Boot LLCI	Boot ULCI	Relative effect
Total effect	1.213	0.203	0.813	1.613	
Direct effect	0.932	0.198	0.542	1.322	76.81%
Indirect effect 1	0.091	0.061	0.001	0.231	7.50%
Indirect effect 2	0.130	0.070	0.016	0.293	10.68%
Indirect effect 3	0.061	0.040	0.001	0.157	5.01%
Total indirect effect	0.282	0.116	0.076	0.535	23.20%

Note Direct effect=ES→anxiety

Indirect effect 1=ES→psychological resilience→anxiety

Indirect effect 2=ES→self-esteem→anxiety

Indirect effect 3=ES→psychological resilience→self-esteem→anxiety

LLCI stands for Lower Limit of Confidence Interval

ULCI stands for Upper Limit of Confidence Interval

were more resilient in facing and adapting to adversities were more likely to have a higher self-esteem. Psychological resilience and self-esteem were negatively associated with anxiety respectively. Psychological resilience and self-esteem may buffer an individual’s vulnerability to anxiety [14, 36, 37]. After the continuous variables were standardized and controlling for sex, parental relationship, family economic status, and the effects of psychological resilience and self-esteem, ES remained to have a significant correlation with higher anxiety in LBC-MS, significant single mediating and chain mediating effects of psychological resilience and self-esteem in the relationship between ES and anxiety were also found.

First, we found a significant positive correlation between ES and anxiety in LBC-MS which supports our first hypothesis. A previous study on social anxiety also suggested that individuals who believe expressing their emotions is a personal disadvantage often maintain a

constant fear of losing emotional control through the frequent use of ES [38]. Similarly, in LBC-MS who hold similar beliefs, their social functions and interpersonal relationships can be impaired due to social withdrawal, and the habitual use of ES is positively associated with greater social anxiety [39]. The more an LBC-MS tries to suppress the emotion, the more socially anxious one can be due to exhaustion of positive mental self-regulatory resources. Conversely, individuals who are more socially open are more expressive of their emotions, regardless of whether these emotions are positive or negative. Less social support may contribute to the development of anxiety in various ways, and individuals who use ES may provide and perceive less social support to and from others [40]. A lack of parental modeling in social interaction may predispose LBC-MS to social withdrawal, and parental expectations for them to take care of themselves may further predispose and precipitate LBC-MS for their fears of losing control in various contexts in their daily life. LBC-MS may be more frequently regulate their emotions using ES due to lack of sense of security, understanding from others, and parental support when facing different types of stressors, thus, leading to more increased feelings of abandonment and loneliness [8, 41]. When stressors persist for a prolonged period without intervention, continued maintenance of fear dependent on false beliefs contributes to the development of anxiety in LBC-MS.

Second, this study examined the mediating mechanism of psychological resilience in the relationship between ES and anxiety, and further reveals that the use of ES is associated with higher levels of anxiety in LBC-MS. Consistent with our second hypothesis, psychological resilience plays a mediating role between ES and anxiety in LBC-MS. Psychological resilience is commonly defined as the ability to adapt and maintain a positive mental state in the face of adversity and can be further divided into internal and external resilience. Internal resilience involves the use of one's internal assets to buffer the effects of adversity (e.g., self-efficacy) and external resilience involves the use of external resources to ameliorate the impact of adversity (e.g., social and family support) [16, 42, 43]. The reason why ES can affect anxiety by reducing psychological resilience may be that the negative emotional experiences weaken individuals' ability to actively use and distribute internal and external resources to adapt to adversity in the face of stressors, which leads to the reduction of psychological resilience and ultimately leads to various psychological imbalance problems [44]. This result indicated that ES, a maladaptive emotion regulation strategy, is significantly associated with certain areas of resilience [19]. In addition, in LBC-MS, it is possible that both internal and external resilience may not be fully developed due to parental

absence in terms of guidance and modeling in response to adversities. Greenberg et al. proposed that psychological resilience is a protective factor to reduce maladaptive outcomes under risk conditions, and these scholars also identified three categories of protective factors which are individual, quality of the child's relationships, and environmental factors [45]. Given limited resources and unadvanced education system in the less developed areas where LBC-MS reside, compared to other major cities in China, it is possible that these LBC-MS cannot access learning for emotion regulation strategies and support from their curriculum or from their parents and neighborhoods result in pessimistic interpretations of aversive stimuli and poor adaptability.

Third, in this study, self-esteem was found to mediate the relationship between ES and anxiety in LBC-MS. LBC-MS with lower self-esteem were more frequently employed ES and were more likely to be anxious in response to adversities. This finding was also shown in the young adults in the UK [46]. Compared to non-LBC-MS, LBC-MS are more likely to have lower self-esteem due to parental absence and poor parent-child relationships and communication, which result in more inferior feelings and unsuccessful establishment of social connections. They may also improperly use social support during stressful situations that lead to abusive relationships and low self-esteem. Mouatsou & Koutra illustrated in their study in Greek emerging young adults that frequent use of CR is associated with higher self-esteem, on the other hand, frequent use of ES is associated with lower self-esteem [19]. Moreover, our previous study suggests that LBC-MS with lower self-esteem have increased anxiety [13]. In LBC-MS who use ES, their emotions may be hidden and perceived as a psychological burden and these individuals carry this burden psychologically as part of their self-concept creating inconsistency between inner experience and outer expression, thus, result in low self-esteem and anxiety problems [9].

Moreover, LBC-MS with lower self-esteem may have poor self-evaluation system and feel less optimistic and incompetent in the face of adversity, thus, more likely to adopt maladaptive emotion regulation strategy and further exacerbate anxiety. In person with secure type of attachment style, anxiety may be buffered through their relationship with their parents. Terror management theory (TMT) suggested children's successful establishment of secure attachment and high self-esteem during the infantile period with parents may buffer the negative effect of anxiety [16, 36–47]. This is accomplished through the socialization process by living up to the cultural world values and elevate to immortality, thus, diminishing the threats of anxiety [48, 49]. However, the deficient parent-child interaction and unsuccessful secure type of attachment style in LBC-MS may lead

to the development of low self-esteem and poor mental health. These conditions may further be precipitated and perpetuated by daily and other types of stressors.

Finally, this study revealed a chain-mediated pathway of psychological resilience and self-esteem between ES and anxiety in LBC-MS, which may add to our understanding of the relationship between ES and anxiety. It was proven that frequent use of ES is linked to decreased psychological resilience and self-esteem, and increased anxiety symptoms, and psychological resilience and self-esteem were positively correlated in LBC-MS. Mouatsou & Koutra illustrated that individuals may have greater adaptation and feel more self-worthy and competent by reappraising the meaning of the stressful situations, which contribute significantly to both development of psychological resilience and self-esteem [19]. In LBC-MS, they might not acquire the reinterpreting skill prior the occurrence of stressful stimuli, thus, end up with poor adaptation and become less resilient. The positive correlation between psychological resilience and self-esteem is also consistent with a study in Australian young adults. Benetti & Kambouropoulos supported the notion that psychologically resilient individuals tend to use positive affect to “bounce back” from aversive stressful experiences, and this “bounce back” using positive affect, a significant mediator, in turn promoted development of high self-esteem, which allows individuals to cope effectively to those challenging stressors [50]. However, it is obvious that LBC-MS may have more negative affect which have been prominently studied such as depression and anxiety [19, 51]. Thus, anxiety can be triggered by the inability to “bounce back” through the use of positive emotions or failure to establish the healthy attachment type proposed by TMT as an anxiety-buffer.

These results suggest that the inclusion of modules improving emotion regulation strategies, reinforcing psychological resilience and self-esteem in prophylactic and therapeutic programs may be beneficial to improving the mental health in LBC-MS. Tam et al. launched one of the first pilot studies on the effectiveness of a resilience-based intervention program in China and incorporated this program into regular school hours targeting mental health problems that LBC have (e.g., depression) [52]. In that study, the resilience-based intervention program lasted 6 weeks and 80 minutes per session and incorporated context-specific content for LBC (e.g., setting positive expectations about migration, improving self-efficacy via cultural adaptation, and facilitating social connection with others). In addition to those programs, it may be necessary to advance the education system. Huang et al. suggested that schools to provide individual or group counseling to students, and that teachers to be trained to become competent in engaging in positive day-to-day communication with students, which may facilitate

positive interpersonal, resilience, and self-esteem development [51]. Thus, the combined benefits of external and internal resilience through these programs may offset the deleterious effects of risk factors and other negative and traumatic events.

In addition to the principles of previous research on psychological resilience and self-esteem intervention programs aimed at such as increasing parent-child and peer interaction and advancing education system, factors such as dosage effect and cultural adaptation should be considered. First, it needs to be considered whether the duration of the intervention programs is long enough to detect its effectiveness in LBC-MS. Furthermore, many programs were created by nonnative scholars. Thus, programs that are culturally adaptive such that incorporating eight core Taoist principles in the Chinese Taoist Cognitive Psychotherapy (CTCP) may become especially effective due to the nativity of the religion and the level of understandability when implemented for sufficient duration and tailored to specific contexts by decreasing ES, increasing psychological resilience and self-esteem [53]. Although CTCP was especially effective in treating generalized anxiety disorder (GAD) in adult, given the continuing development of LBC-MS, these programs may be beneficial for long-term mental health for LBC-MS [53].

Limitations and future directions

Several limitations need to be acknowledged in this study. First, the study was designed to use a cross-sectional survey where the sample size is limited and inability to follow up with the sample, generalizability is concerned outside of the sample characteristics. Future studies should note the nature of cross-sectional study design, increase the sample size, and diversify the sample population. Second, the survey used in this study was self-reported where recall biases and errors might occur, so future studies should acknowledge the nature of the self-report survey. Additionally, anxiety was assessed cumulatively including somatic and panic, generalized anxiety, separation anxiety, social anxiety, and school anxiety. Further studies may need to specify which anxiety accounts for the highest anxiety level in LBC-MS and provide treatment and intervention accordingly. Finally, the variables assessed in this study were psychological, and variables like socioeconomic status and environmental factors were not considered, future studies should consider roles of those factors when assessing mental health.

Conclusion

This study explored the relationship between ES and anxiety, and found single mediation, and serial mediation of psychological resilience and self-esteem in LBC-MS in China. This is the first study considering the role(s) of two protective factors when mediating the relationship

between ES and anxiety in LBC-MS. The direct effect of ES and anxiety and indirect mediating effect of psychological resilience and self-esteem between ES and anxiety in LBC-MS were found. Many aspects about mechanism of emotion regulation and psychological coping strategy in LBC-MS in China were addressed. Additional mental health resources and school intervention need to be in place for better prevention and intervention for this group.

Abbreviations

LBC	Left-behind children
LBC-MS	Left-behind children in middle school
ES	Expressive Suppression
CR	Cognitive Reappraisal
CI	Confidence Interval

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Author contributions

Tingting Qu: data curation and analysis, writing original draft preparation. Qiwen Gu: writing original draft preparation. Huan Yang: designing questionnaire. Chennan Wang: collecting the data. Yuping Cao: study design, supervision, and paper editing. All authors read and approved the final manuscript.

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Data availability

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

Declarations

Ethics approval and consent to participate

All subjects' teachers or parents signed written informed consents prior to the study. The study was approved by the Institutional Review Board (IRB) at the Second Xiangya Hospital of Central South University in Changsha city, Hunan province, China.

Consent for publication

The adolescents and their teachers provided their written informed consent to participate in this study.

Competing interests

The authors declare no competing interests.

Author details

¹Department of Psychiatry, National Center for Mental Disorders, National Clinical Research Center for Mental Disorders, The Second Xiangya Hospital of Central South University, Changsha, Hunan 410011, China

²Department of Psychology, University of Washington, Seattle, WA 98195, USA

³Department of Psychiatry and Clinical Psychology, The Seventh Affiliated Hospital, Sun Yat-Sen University, Shenzhen, Guangdong 518107, China

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