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Negative parenting style and depressive symptoms among college students: a longitudinal moderated mediation model involving eating disorders, ethnicity and maladaptive cognitive emotion regulation strategies

Ruipeng Wu[1,2,3*†], Yeen Huang[4†], Li Shao[1], Zixuan Guang[1,2], Qiong Niu[1,2], Jingzhe Chen[1,2], Juan Zhou[5], Liji Ge[6] and Shaokang Wang[1,3*]

Abstract

Background Depression is a significant global health concern, particularly prevalent among college students, and can be exacerbated by negative parenting styles. This study investigates the impact of such parenting on depressive symptoms among college students and explores the mediating role of eating disorders (EDs) and the moderating roles of ethnicity and maladaptive Cognitive Emotion Regulation Strategies (CERS).

Methods The longitudinal study was conducted from June to December 2021 and involved 2,993 enrolled students at two Tibetan universities. Data were collected at three time points using validated instruments including the Patient Health Questionnaire-9 for measuring depressive symptoms, the Short Egna Minnen av Barndoms Uppfostran (s-EMBU) for measuring negative parenting styles, the Eating Attitude Test-26 for measuring EDs, and the Cognitive Emotion Regulation Questionnaire for measuring maladaptive CERS. Statistical analyses, including Pearson correlation and moderated mediation models, were conducted using SPSS software.

Results The average age of the participants in the study was 19.8 (SD = 1.3) years, with males accounting for 34.4%, Tibetans and other ethnic groups accounting for 56.8%, and urban students accounting for 29.0%. Negative parenting styles were associated with higher levels of EDs and depressive symptoms. A longitudinal moderated mediation model revealed that EDs significantly mediated the relationship between negative parenting styles and depressive symptoms. Additionally, the impact of EDs on depressive symptoms was moderated by maladaptive CERS, where higher levels of these strategies intensified the relationship, while lower levels mitigated it. Ethnicity had no moderating effect on direct and indirect paths.

†Ruipeng Wu and Yeen Huang contributed equally to this work.

*Correspondence:
Ruipeng Wu
wurp@xzmu.edu.cn
Shaokang Wang
shaokangwang@seu.edu.cn
Full list of author information is available at the end of the article

Conclusions The study indicates that negative parenting styles contribute to depressive symptoms among college students through EDs. Maladaptive CERS amplify the impact of EDs on depressive symptoms, suggesting the importance of addressing these strategies in preventive and therapeutic settings. This research underscores the need for interventions targeting family dynamics and emotional regulation to mitigate depressive symptoms in vulnerable populations.

Keywords Depressive symptoms, Negative parenting styles, Eating disorder symptoms, Cognitive emotion regulation strategies, Longitudinal study

Introduction

Depression ranks among the top five global disease burdens [1], manifesting through mood alterations such as increased sadness or irritability, along with physiological or psychological disturbances like sleep disruption, appetite changes, or decreased libido [2]. The prevalence of depression/depressive symptoms varies across different populations. Estimates suggest that the 12-month prevalence of depression among college students is 25–30% [3]. This demographic is notably vulnerable during the transition from adolescence to adulthood, a period marked by significant psychological sensitivity that may heighten the risk of depression [4].

Depression's impact extends beyond emotional distress, impairing academic performance and cognitive functions such as memory and attention, which can lead to broader social dysfunction [5–7]. Factors contributing to its onset among university students include family separation, adaptation challenges, strained interpersonal relationships, academic pressure, and career planning anxieties [8, 9]. Additionally, parenting styles-encompassing attitudes, behaviors, and parenting methods-significantly influence the onset and progression of depression from an early age [10]. Negative parental behaviors, in particular, have been identified as potent influencers, potentially exacerbating conditions like eating disorders (EDs), which are closely linked to depressive symptoms. China's multi-ethnic cultural context introduces variability in depressive symptoms manifestation due to differences in cultural values, social support systems, and coping strategies. For example, Tibetans are more influenced by traditional Tibetan culture (e.g., Tibetan Buddhist values and collectivist responsibility), while Han Chinese may prioritize social competition and personal achievement. These cultural differences may shape distinct pathways to depressive symptoms [11, 12]. This study aims to comprehensively explore the impact of negative parenting styles on college students' depressive symptoms and examine potential mediating and moderating pathways. The findings could provide a scientific foundation for preventive and therapeutic strategies targeting depressive symptoms in this vulnerable population.

Negative parenting style and depressive symptoms

Family education plays a pivotal role in adolescent physical and psychological development. Global research consistently highlights parenting styles' influence on youth well-being, encompassing parental attitudes, behaviors, and nonverbal communication [13]. Notably, Baumrind in 1967 categorized these into permissive, authoritarian, and authoritative styles, later adding indulgent and neglectful types [14]. Building on this, Perris developed the Parental Rearing Style Questionnaire (Egna Minnen av Barndoms Uppfostran, EMBU) to assess dimensions such as rejection, overprotection, emotional warmth, and favoritism [15]. Parenting styles profoundly affect children's psychological resilience, addictive behaviors, learning motivation, eating habits, life satisfaction, and career values [16–18]. Authoritative parenting, characterized by warmth and discipline, is generally linked to healthier psychological outcomes and lower depression rates among adolescents [10, 19]. Conversely, negative rearing practices like overprotection, harsh control, and rejection correlate with higher levels of anxiety, depression, and suicidality [10, 19]. In China's multi-ethnic context, parenting styles vary across groups. For example, Tibetan students report higher paternal/maternal emotional warmth and stricter punishment compared to Han peers, potentially reflecting Tibetan cultural norms where fathers prioritize child education. Conversely, Han students may face greater academic competition and parental expectations. However, research on ethnic differences in parenting styles remains limited, particularly in culturally distinct regions like Tibet [20].

Negative parenting styles may also indirectly influence depressive symptoms through mediators like EDs. While global studies have explored parenting styles, eating behaviors, and depression, the interplay of these factors in Tibetan culture—and EDs' potential mediating role—requires further investigation.

Mediating role of EDs

Disordered eating (DE), marked by harmful diet- and weight-related attitudes, behaviors, and cognitions, often precedes clinical EDs such as bulimia nervosa, anorexia

nervosa, and binge-eating disorder. Epidemiological data highlight EDs' prevalence among adolescents and young adults, with growing attention to parenting styles' influence on DE [21, 22]. Supportive parental behaviors (e.g., authoritative rearing) correlate with healthier eating habits and lower ED risk in female adolescents, while authoritarian and permissive styles link to negative outcomes [23–26].

Moreover, EDs are significant predictors of depressive symptoms. Longitudinal studies indicate that early disordered eating behaviors and associated body dissatisfaction can lead to depressive symptoms in later life [27, 28]. The impact of parenting styles is pivotal in this context; Negative parenting styles (e.g., overprotection or rejection) may foster DE, thereby increasing depressive symptoms risk. Neurobiological mechanisms suggest parenting styles may influence dopamine secretion, which underpins EDs and depression pathology [29, 30]. However, research on EDs' mediating role in the parenting-depression relationship remains scarce, particularly in unique cultural settings like Tibet. Tibetan residents have a unique regional dietary pattern. Their traditional diet includes high intakes of tsampa, special beverages (sweet tea and yak butter tea), potatoes and yak meat. Of course, such a pattern is closely related to biogeography, folk religious beliefs, local traditions and dietary taboos, and continues to evolve with the development of social economy [31]. The gap underscores the need for further study to understand these dynamics across different cultural backgrounds and inform targeted interventions [32–34].

The moderating role of maladaptive Cognitive Emotion Regulation Strategies (CERS)

Emotion regulation significantly impacts mental health, particularly through CERS which are linked to various psychopathologies like depressive symptoms and EDs [35]. Garnefski's framework defines CERS as cognitive methods for managing emotions, categorizing them into adaptive strategies (e.g., positive reappraisal) and maladaptive ones (e.g., self-blame) [36]. While adaptive strategies reduce depressive symptoms risk, maladaptive strategies exacerbate symptoms [37]. For example, cognitive reappraisal moderates stress effects on depression and sleep quality in cyberbullying and COVID- 19 studies [38, 39]. Neuroimaging research identifies shared emotional dysregulation mechanisms in EDs and depression, implicating brain regions like the amygdala, anterior cingulate cortex, and nucleus accumbens [40]. Parenting styles also interact with emotion regulation: negative styles (e.g., authoritarianism) correlate with emotional dysregulation, whereas positive styles (e.g., warmth) show inverse relationships [41]. Emotion regulation strategies mediate links between parental support and depressive symptoms in college students [42], and offspring's emotion regulation can reciprocally affect parental perceptions [41]. Therefore, poor CERS can affect the effects of parenting styles and EDs on depressive symptoms.

The present study

This study aims to investigate the mediating role of EDs in the relationship between negative parenting and depressive symptoms, with additional focus on the moderating role of maladaptive CERS and ethnicity (Fig. 1). Specifically, this study aims to investigate:

1. how negative parenting at time point 1 (T1) predicts depressive symptoms at time point 3 (T3).
2. the mediating role of EDs symptoms at time point 2 (T2) in the relationship between negative parenting at T1 and depressive symptoms at T3.

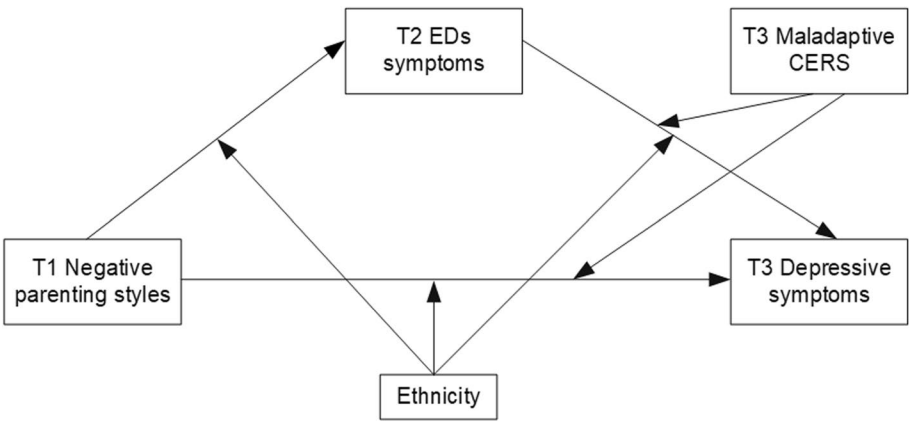

Fig. 1 The conceptual framework of the moderated mediation model. EDs—eating disorders, CERS—Cognitive Emotion Regulation Strategies

3. how the above direct/and indirect paths are moderated by maladaptive CERS and ethnicity.

Using a three-wave longitudinal design and moderated mediation model, we explore these dynamics among students at two Tibetan universities.

Methods

Participants

This longitudinal study collected psychological and behavioral survey data from freshmen and sophomores at two universities in the Tibet Autonomous Region between June and December 2021, with surveys administered to participants every three months. Extensive pre-study communications ensured that student representatives and leaders were well-informed and supportive, facilitating further dissemination of project details to their peers.

The survey was conducted digitally using QR codes in a paperless format, with class leaders coordinating administration in classrooms at scheduled times. The research team remained available to address inquiries, allowing students who missed sessions to complete surveys later through class leaders. Each survey required approximately 20 min to complete, with all participants providing informed consent and being advised of their rights to withdraw at any time. Students engaged in off-campus internships or on leave were excluded from participation. During the baseline survey, a total of 4,885 students were invited to participate, and ultimately, 2,993 respondents successfully completed all three waves in the longitudinal study. All items in the questionnaire were set as mandatory, and outliers were excluded during data analysis. Before the study began, we received approval from the Ethics Committee of Xizang Minzu University and complied with the Declaration of Helsinki.

Measurements

Demographic variables

The collected demographic variables included: sex (male/female), age, ethnicity (Han, Tibetan and other minorities), place of origin (urban/rural), household socioeconomic status (HSS), parental educational levels, smoking, and drinking habits. HSS was assessed through students'subjective evaluation of their family's economic situation, with options including excellent or very good, good, and fair or poor [43]. The categories for parental education levels were: primary school or below, junior high school, high school/technical secondary school, junior college, university or above, and unknown. Smoking and drinking were defined as at least one day of such behavior in the past 30 days [44, 45].

Depressive symptoms

The measurement of depressive symptoms was conducted using the Patient Health Questionnaire- 9 (PHQ- 9), which assesses the frequency of symptoms experienced by participants over the past two weeks. This scale has been used across multiple populations in various countries and is well-validated with good reliability [46]. Each item on the questionnaire is scored from 0 to 3, with a total possible score of 27. Higher scores indicate more severe depressive symptoms. A score exceeding 10 points is considered indicative of depression [46]. In this study, the Cronbach's alpha coefficients for the PHQ- 9 at Time 1 (T1) and Time 3 (T3) were 0.92 and 0.93, respectively.

Negative parenting style

Parenting styles were assessed using the Short Egna Minnen av Barndoms Uppfostran (s-EMBU). Jiang et al. developed the Chinese version of the instrument based on the original scale [15, 47]. The instrument includes both a father version and a mother version, with identical content in both, each consisting of 21 items. The 21 items are categorized into three dimensions: emotional warmth, rejection, and overprotection. Each item is rated on a scale ranging from"never"to"always", corresponding to scores from 1 to 4. The item"My father/mother often allows me to go to places I like without worrying too much"is scored in reverse. This scale has demonstrated good reliability among Chinese populations [47]. In this study, negative parenting styles included parental rejection and overprotection, with higher scores indicating greater perceived negativity in parental rearing. The Cronbach's alpha coefficients for the father and mother versions of the scale in this study were 0.94 and 0.91, respectively.

EDs symptoms

The Eating Attitude Test- 26 (EAT- 26) was used to measure symptoms related to EDs, assessing participants'emotions, cognitions about food, and behaviors through 26 items rated on a six-point scale from"never"to"always"(0 to 5) [48]. According to the literature, scores are converted to a four-point scale, and all item scores are summed, yielding a total score range of 0 to 78, where higher scores indicate more severe EDs symptoms. The scale has shown good internal consistency and reliability [49]. In this study, the Cronbach's alpha coefficients for the EAT- 26 at Time 1 (T1) and Time 2 (T2) were 0.86 and 0.87, respectively.

Maladaptive CERS

The evaluation of CERS was conducted using the Chinese version of the Cognitive Emotion Regulation Questionnaire (CERQ-C) [50]. Originally developed by Garnefski et al. [36], this scale consists of 36 items across nine dimensions. After being localized, the Chinese version of the CERQ-C has demonstrated good reliability and validity. Each item is rated on a five-point scale ranging from"rarely"to"always."The nine dimensions are divided into two categories: adaptive CERS (positive reappraisal, putting into perspective, positive focusing, acceptance, and refocusing on planning) and maladaptive CERS (rumination, self-blame, catastrophizing, and other-blame). In this study, the questionnaire measuring maladaptive CERS was used, with the Cronbach's alpha coefficients at Time 1 (T1) and Time 3 (T3) being 0.90 and 0.93, respectively.

Data analysis

Statistical analysis was conducted using SPSS software version 23.0. Quantitative variables were described using mean ± standard deviation (M ± SD), while qualitative variables were described using frequency counts. Pearson correlation analysis was performed among the four main variables (i.e., T1 negative parenting styles, T2 EDs, T3 depressive symptoms, and T3 maladaptive CERS). Mediation analysis was conducted using model 4 in the PROCESS plugin [51] which tested the mediating role of T2 EDs in the relationship between T1 negative parenting styles and T3 depressive symptoms. A bias-corrected bootstrapping procedure was used to calculate indirect effects, with 95% confidence intervals (CI) employed to determine the significance of the mediation effect. Model 67 was used to examine the moderated mediation model, specifically, whether ethnicity moderated the mediation path and the direct path, and whether T3 maladaptive CERS moderated the latter part of the mediation effect and the direct path. The model also controlled for baseline sex, age, place of origin, family economic status, parental education level, smoking, drinking, EDs, depressive symptoms, and maladaptive CERS. The conditional indirect effects were assessed using the pick-a-point approach [52]. The moderation effect was evaluated by defining ethnicity (Tibetan and other minorities or Han) or two levels of maladaptive CERS: low maladaptive CERS (one standard deviation below the mean) and high maladaptive CERS (one standard deviation above the mean). Finally, we performed a sensitivity analysis. The E-value was calculated to estimate the robustness of the association. The E-value introduced by Vander Weele and Ding represents the minimum strength of association on a hazard proportionality scale, i.e., the assumed confounder is associated with both the exposure and the outcome [53]. The size of the E-value indicates how large the unmeasured confounder is needed to explain the effect estimate. The R package EValue [54] was used to calculate this value.

Results

Overall description of depressive symptoms in college students at T3

These students consisted of 34.4% males and 65.7% females, with a mean (SD) age of 19.8 (1.3) years. The proportion of Tibetan and other ethnic students was 56.8%. 71.0% of the students were from rural areas. 31.2% of students reported fair or poor HSS. Approximately half of the students report that their parents'level of education is primary school or below. 10.4% and 13.3% of students report smoking and drinking, respectively. The overall prevalence of depressive symptoms was 14.0% at T3. The chi-square or t-test shows differences in the prevalence of depressive symptoms among groups based on the variables sex, HSS, mother's education level, and drinking, as shown in Table 1.

Correlational analysis

Table 2 presents the Pearson correlations and the means and SDs of study variables. Negative parenting style was positively associated with EDs ($r = 0.217$, $p < 0.01$). EDs symptoms was positively associated with maladaptive CERQ ($r = 0.255$, $p < 0.01$) and depressive symptoms scores ($r = 0.289$, $p < 0.01$). Maladaptive CERQ was positively associated with depressive symptoms scores ($r = 0.440$, $p < 0.01$).

Mediation analyses

Regarding the mediating role of EDs in the relationship between negative parenting style and depressive symptoms, we conducted mediation analyses after controlling for baseline sex, age, place of origin, ethnicity, family economic status, parental education level, smoking, drinking, EDs, depressive symptoms, and maladaptive CERS.

As shown in Table 3, negative parenting style directly and positively predicts depressive symptoms ($b = 0.071$, $p < 0.001$) (Model 2), and it also positively predicts EDs ($b = 0.169$, $p < 0.001$) (Model 1), which in turn show a positive relationship with depressive symptoms ($b = 0.040$, $p < 0.001$) (Model 2). The bias-corrected percentile bootstrap method demonstrates that negative parenting style has a significant indirect effect on depressive symptoms via EDs ($ab = 0.007$, 95% CI [0.002, 0.013]), accounting for 8.6% of the total effect size.

Moderated mediation analyses

As shown in Table 3, ethnicity can significantly predict T3 depressive symptoms, but the interaction term

Table 1 Sample characteristics by depressive symptoms at T3 (*N* = 2,993)

Variables	Total	Depressive symptoms		χ^2/t	*p*-value
		NO	YES		
		(*N* = 2,514)	(*N* = 419)		
Sex, n (%)				7.20	< 0.01
Male	1,007(34.4)	839(83.3)	168(16.7)		
Female	1,926(65.7)	1,675(87.0)	251(13.0)		
Age in years, Mean (SD)	19.8(1.3)	19.8(1.2)	19.9(1.4)	− 1.57	0.12
Ethnicity				0.01	1.00
Han	1,267(43.2)	1,086(85.7)	181(14.3)		
Tibetan and other minorities, n (%)	1,666(56.8)	1,428(85.7)	238(14.3)		
Place of origin				0.15	0.70
Urban	852(29.0)	727(85.3)	125(14.7)		
Rural	2,081(71.0)	1,787(85.9)	294(14.1)		
HSS, n (%)					
Excellent or very good	478(16.3)	412(86.2)	66(13.8)	14.17	< 0.001
Good	1,540(52.5)	1,350(87.7)	190(12.3)		
Fair or poor	915(31.2)	752(82.2)	163(17.8)		
Father's education level, n (%)				4.38	0.49
Primary school or below	1,230(41.9)	1,040(84.6)	190(15.4)		
Junior high school	723(24.7)	627(86.7)	96(13.3)		
High school/technical secondary school	437(14.9)	376(86.0)	61(14.0)		
Junior college	178(6.1)	155(87.1)	23(25.4)		
University or above	241(8.2)	213(88.4)	28(11.6)		
Unknown	124(4.2)	103(83.1)	21(16.9)		
Mother's education level, n (%)				15.48	< 0.01
Primary school or below	1,550(52.8)	1,324(85.4)	226(14.6)		
Junior high school	599(20.4)	536(89.5)	63(10.5)		
High school/technical secondary school	347(11.8)	284(81.8)	63(18.2)		
Junior college	148(5.0)	131(88.5)	17(11.5)		
University or above	168(5.7)	142(84.5)	26(15.5)		
Unknown	121(4.1)	97(80.2)	24(19.8)		
Smoking, n (%)				1.72	0.19
No	2,629(89.6)	2,261(86.0)	368(14.0)		
Yes	304(10.4)	253(83.2)	51(16.8)		
Drinking, n (%)				5.53	< 0.05
No	2,542(86.7)	2,194(86.3)	348(13.7)		
Yes	391(13.3)	320(81.8)	71(18.2)		

SD standard deviations, *HSS* household socioeconomic status

Table 2 Descriptive statistics and correlations among the main variables (*N* = 2,993)

Variables	*Mean*	*SD*	1	2	3	4
1.T1 Negative parenting styles	24.17	5.46	1			
2.T2 EDs	5.19	6.28	0.217**	1		
3.T3 Maladaptive CERS	40.13	10.06	0.191**	0.255**	1	
4.T3 Depressive symptoms	4.86	4.96	0.278**	0.289**	0.440**	1

EDs eating disorders, *CERS* Cognitive Emotion Regulation Strategies

SD standard deviations

** $p < 0.01$

Table 3 Results of moderated regression analyses (Standard Errors in Parentheses; $N = 2{,}993$)

Predictor variable	EDs symptoms		Depressive symptoms	
	Model 1	Model 3	Model 2	Model 4
Intercept	13.048**(4.810)	− 38.061***(4.693)	− 6.789***(1.572)	1.334(1.474)
Control variables				
Age	− 0.078(0.202)	− 0.082(0.202)	0.115(0.066)	0.051(0.062)
Sex	1.863*(0.583)	1.835**(0.583)	− 0.346(0.191)	− 0.459*(0.179)
Ethnicity	− 0.630(0.557)	− 0.653(0.557)	− 0.416*(0.182)	− 0.431*(0.171)
Place of origin	− 0.132(0.670)	− 0.088(0.671)	0.052(0.219)	0.070(0.206)
HSS	− 0.329(0.381)	− 0.337(0.381)	0.139(0.124)	0.112(0.117)
Father's education level	0.057(0.215)	0.047(0.215)	− 0.125(0.070)	− 0.108(0.066)
Mother's education level	0.364(0.219)	0.358(0.219)	0.163*(0.072)	0.139*(0.067)
Smoking	0.317(0.896)	0.374(0.896)	− 0.042(0.292)	0.097(0.275)
Drinking	1.348(0.741)	1.379(0.741)	− 0.104(0.242)	0.012(0.227)
T1 EDs symptoms	0.558***(0.019)	0.559***(0.019)	0.010(0.007)	0.005(0.006)
T1 depressive symptoms	0.319***(0.058)	0.323***(0.058)	0.373***(0.019)	0.336***(0.018)
T1 Maladaptive CERS	0.019(0.032)	0.019(0.032)	0.008(0.011)	− 0.039***(0.010)
Independent variable				
T1 Negative parenting styles	0.169***(0.050)	0.156**(0.051)	0.071***(0.016)	0.056***(0.016)
Mediating variable				
T2 EDs symptoms			0.040***(0.006)	0.030***(0.006)
Moderator variable				
T3 Maladaptive CERS				0.164***(0.008)
Interaction term				0.0009(0.0013)
T2 EDs symptoms ×T3 Maladaptive CERS				0.0013**(0.0004)
T1 Negative parenting styles ×T3 Maladaptive CERS				0.001(0.001)
Ethnicity ×T1 parenting styles		− 0.140(0.089)		− 0.021(0.028)
Ethnicity ×T2 EDs symptoms				0.009(0.009)
R^2	0.351	0.352	0.351	0.345
F	121.643***	113.185***	71.91***	80.972***

EDs eating disorders, *CERS* Cognitive Emotion Regulation Strategies

$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$, Unstandardized regression coefficients are reported

between ethnicity and T1 negative parenting style has no significant predictive effect on T2 ED symptoms and T3 depressive symptoms, and the interaction term between ethnicity and T2 ED symptoms has no significant predictive effect on T3 depressive symptoms. Maladaptive CERS positively predicts depressive symptoms, and the interaction between maladaptive CERS and EDs has a significant interaction effect on depressive symptoms ($b = 0.0013$, $p < 0.01$), but the interaction term between maladaptive CERS and negative parenting style fails to significantly predict depressive symptoms (Model 4). Thus, maladaptive CERS moderates the mediation of EDs in the association between negative parenting styles and depressive symptoms. The bias-corrected percentile bootstrap method shows that maladaptive CERS moderated the indirect effect of negative parenting styles on depressive symptoms, and the moderated mediation index was 0.0002, $SE = 0.0001$, 95% $CI = [0.0001, 0.0005]$.

When the maladaptive CERS level was low (i.e., one *SD* below the mean), EDs significantly mediated the relationship between negative parenting styles and young adult's depressive symptoms, and the mediating index was $ab = 0.0030$, 95% $CI = [0.0005, 0.0068]$. At the same time, when the maladaptive CERS level was high (i.e., one *SD* above the mean), EDs had a significant mediating effect on negative parenting styles and depressive symptoms, and the mediating index was $ab = 0.0067$, 95% $CI = [0.0020, 0.0127]$.

We further employ simple slope analysis to illustrate the moderating effect. As shown in Fig. 2, EDs had a significant positive predictive effect on young adults' depressive symptoms when maladaptive CERS were low (i.e., one *SD* below the mean; $\beta_{simple} = 0.018$, $p < 0.01$). When the level of maladaptive CERS was high (i.e., one *SD* above the mean), the positive predictive

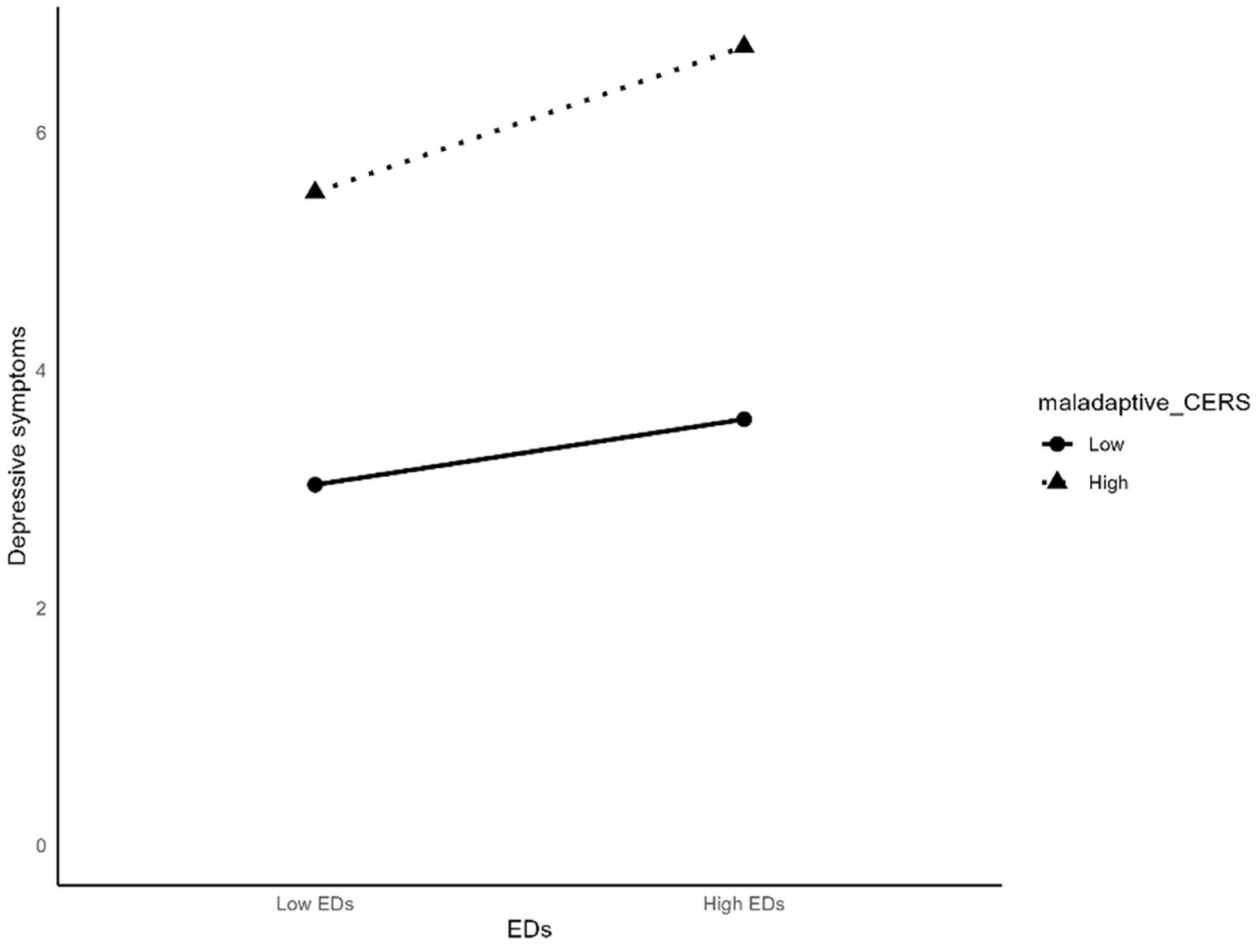

Fig. 2 Maladaptive CERS moderates the effect of EDs on depressive symptoms

effect of EDs on young adults' depressive symptoms increased ($\beta_{simple} = 0.040$, $p < 0.001$).

Therefore, high maladaptive CERS can increase the impact of EDs on young adults' depressive symptoms; low maladaptive CERS can alleviate the impact of EDs on young adults' depressive symptoms; and maladaptive CERS play a moderating role in the relationship between EDs and young adults' depressive symptoms.

Sensitivity analysis

The RR E-value of the association between negative parenting style and depressive symptoms is 1.426, the RR E-value of the relationship between EDs and depressive symptoms is 1.210, and the RR E-value of the relationship between maladaptive CERS and depressive symptoms is 1.462. The results show that the RR value of the assumed unmeasured covariate should be at least the above E-value, and the residual confounders can explain the observed association.

Discussion

Building on previous research, this study employed a three-wave longitudinal survey to explore the relationship between negative parental rearing styles and depressive symptoms among college students in Tibetan universities, with potential mediating and moderating mechanisms. The core finding reveals that EDs mediate the relationship between negative parenting styles and depressive symptoms in university students, with the mediation effect further moderated by the level of maladaptive CERS. However, ethnicity did not moderate the direct or indirect pathways. Consistent with previous study designs, the independent variable (negative parenting styles), the mediating variable (EDs), and the dependent variable (depressive symptoms) were measured at three distinct time points, strengthening causal inferences [55].

This study found that after controlling for basic demographic information, T1 EDs, T1 depressive symptoms, and T1 CERS, negative parenting styles significantly

predict depressive symptoms in university students, consistent with previous research [33, 34, 56–58]. According to cognitive models and the diathesis-stress model, negative parenting styles may impair individual cognition or susceptibility, further increasing their risk of depressive symptoms [59, 60]. Training programs addressing the knowledge, attitudes, and practices related to negative parenting styles are necessary. For example, developing a culturally adapted online platform — integrating multimedia resources (e.g., videos, audio, text) about parenting skills and their mental health impacts — could alleviate depressive symptoms in adolescents [61, 62]. For Tibetan populations, the intervention content should incorporate culturally resonant case scenarios.

Furthermore, empirical and theoretical research indicate that family rearing styles, EDs, and depressive symptoms have independent and closely linked relationships [25, 27, 63]. This study integrates negative parenting styles, EDs, and depressive symptoms into a single model, finding that EDs mediate the longitudinal relationship between negative parenting styles and depressive symptoms in university students, with the mediating effect accounting for 8.6% of the total effect. This mediating pathway can be explained from several perspectives. On one hand, parental overcontrol or overprotection may directly manifest in eating behaviors, such as imposing strict adherence to certain eating habits or rules, or restricting the type or amount of food [64]. These severe reactions may further increase the risk of depressive or anxiety symptoms. On the other hand, evidence from attachment theory research shows that parental rearing styles can indirectly cause eating pathology and further mental disorders through attachment-related factors, such as children's emotional competence and emotional responses [65, 66]. Moreover, from a biological perspective, negative rearing styles and adverse childhood experiences may leave an imprint on an individual's peripheral DNA methylation, potentially predisposing them to maladaptive stress response patterns later in life [67]. A case–control study on untreated Han Chinese women with anorexia nervosa (AN) showed that high DNA methylation in the promoter region of the serotonin transporter or 5-Hydroxytryptamine Transporter (5-HTT) encoding gene solute carrier family 6 member 4 (SLC6 A4) might be involved in the pathophysiology of AN, influenced by negative parenting styles such as paternal rejection and overprotection [68]. The mediating effect of EDs in the current study was 8.6%, which, on the one hand, reflects the important role of negative parenting style on depressive symptoms, which is consistent with the importance of parenting style in the family environment on individual psychological development emphasized in the interpersonal acceptance-rejection (IPAR) theory [69]. On the other hand, it also suggests other possible mediating factors in the influence of parenting style on depressive symptoms in young people. For example, in a cross-sectional study conducted by Hu et al., it was found that the subjective well-being in college students played a full mediating role in the relationship between parenting style and depressive symptoms [70]. Future research could further explore the biological mechanisms linking rearing styles, EDs, and depressive symptoms.

To our knowledge, this is one of the few studies and the first to longitudinally explore the mediating mechanism of EDs in the relationship between negative parenting styles and depressive symptoms among college students in Tibetan universities. Previous cross-sectional studies conducted among Arab adolescents have shown that the severity of social anxiety and depressive symptoms mediates the relationship between authoritarian parental rearing styles and EDs, with apparent sex differences [32]. Additionally, research has suggested that EDs may be a risk factor for poor parenting, indicating that children's disordered eating might alter subsequent parenting styles, highlighting the complex relationships among these symptoms [71]. Furthermore, Tibetan populations distributed across different regions of the vast Qinghai-Tibet Plateau (such as agricultural areas, pastoral areas, and towns) may have distinct parenting styles and eating habits, necessitating more in-depth and detailed research [31]. Regardless, the findings of this study could provide theoretical support for potential family-function interventions in the treatment of EDs and further provide a scientific basis for the prevention and treatment of depression in university students.

Moreover, this study employed a longitudinal moderated mediation model and found that the indirect effect of EDs in the relationship between negative parenting styles and depressive symptoms is moderated by maladaptive CERS. The interaction between EDs and maladaptive CERS significantly predicts depressive symptoms. Multiple studies indicate that individuals with EDs are at an increased risk of depressive symptoms, and both may share common physiological mechanisms [68]. Additionally, individuals with EDs may more frequently utilize maladaptive CERS. Specifically, compared to healthy controls, patients with EDs report higher levels of negative beliefs about thoughts concerning uncontrollability and danger, rumination, and worry [72]. Meta-analyses of fMRI neuroimaging confirm that cognitive reappraisal, as a cognitive emotion regulation strategy, and food craving share common activations in certain regions of the brain, including the left lateral prefrontal cortex, dorsomedial prefrontal cortex, bilateral parietal cortices, and right insula [73]. Further evidence from combined neuroimaging and endocrine regulation suggests that

the suppression of leptin levels is related to rumination in emotional regulation, and that the amygdala volume mediates this relationship [74]. The findings of this study show that EDs significantly predict the occurrence of depressive symptoms in university students, and this effect is intensified among those with high levels of maladaptive CERS, while it may be mitigated among those with low levels. Future studies should utilize neuroimaging techniques combined with endocrine regulation to explore the potential neurobiological mechanisms underlying this moderating effect, and should differentiate between variations in cognitive emotion regulation.

The current study did not find a moderating effect of ethnicity (Tibetan and Han) on the direct and indirect paths in the moderated mediation model. However, we found that Tibetan college students had significantly lower depression scores than Han college students, which is similar to a study conducted on a population in southwest China and different from the results of a study from a population in Lhasa, Tibet [75, 76]. The possible reason is that the altitude, region, population and measurement tools used in the surveys are different. In addition, the timing of the survey is crucial. When this study was conducted, students in other provinces in China were more affected by COVID- 19, while the Tibet Autonomous Region, which has a special geographical location and a more dispersed population, has not yet been affected by a large-scale COVID- 19 epidemic. This public health emergency may have different psychological effects on the two populations. Regarding sex, women have more severe ED symptoms than men, which is similar to previous studies [77]. The possible mechanisms involve social, psychological, hormonal and dietary pathology [78].

Implications

The findings of this study are insightful for family educators, student workers, and clinical practitioners. First, our results indicate that identifying negative parenting styles (including parental rejection and overprotection) could serve as a critical target for early intervention to prevent the onset of mental disorders such as EDs and depressive symptoms in offspring. Enhancing parenting skills could offer support and assistance to caregivers; teaching parents positive rearing methods, attitudes, and skills to establish close and harmonious parent–child relationships can promote the healthy development of adolescents'physical and mental health. Second, we found that EDs mediate the relationship between negative parenting styles and depressive symptoms, suggesting that clinical treatment targeting symptoms related to EDs could help alleviate depressive symptoms and prevent the onset of depression. In this process, involving parents in the treatment plan to identify and intervene in rearing styles may yield better results, as the EDs of offspring and the parenting styles of parents are likely to be interrelated [71]. Thirdly, the choice of CERS is also crucial. When students face illnesses or other setbacks, parents, teachers, or doctors should convey positive values and CERS to the children, reducing their use of maladaptive coping strategies (such as catastrophizing, self-blame, blaming others, or rumination) to manage depressive emotions. Fourth, given the finding that female students exhibited higher ED scores, interventions targeting sex-specific needs and experiences related to body image and emotion regulation should be emphasized, especially in educational settings. Finally, mental health policies should recognize and explore ethnic differences in depressive symptom scores, tailoring support systems to reflect the different needs of students from diverse cultural backgrounds. Policymakers could benefit from further research to understand how cultural identity, traditional practices, and community networks contribute to mental health recovery. Tibetan students, who have unique dietary habits, may be at particular risk when transitioning from home life to college life, where dietary changes and social pressures are more pronounced. This cultural shift may lead to higher rates of EDs and emotional disorders, so it is critical to promote personalized dietary patterns, nutritional health, and culturally sensitive emotion regulation strategies among the Tibetan population.

In conclusion, the findings of this study have broad implications for education and mental health interventions. By focusing on the intersection of parenting styles, EDs, CERS, and ethnicity, we can better understand the factors that influence mental health and implement more targeted, culturally relevant strategies to support students'well-being.

Limitations

This study has several limitations. First, the data were collected through self-reported questionnaires, which may be subject to recall bias. Second, our sample was restricted to university students currently enrolled in schools in Tibet, excluding those who are not in school due to reasons such as leaves of absence or internships, thus limiting the representativeness of the population. Considering the cultural differences in parental rearing styles and EDs, future studies should include cross-cultural samples to further explore this topic. Thirdly, although this study employed a three-wave longitudinal design, providing relatively reliable evidence for the conceptual model, the causal relationships between variables remain difficult to determine accurately. Future research should increase the number of follow-up assessments to better explore the dynamic interplay among the variables. Finally, while this study identified significant interaction

effects, the small effect size warrants cautious interpretation for clinical or practical applications. Despite statistical significance, these effects may have limited real-world impact. Therefore, actual interventions should integrate other factors and undergo comprehensive evaluation within clinical contexts. Future research could explore whether more substantial effects emerge across different study designs or populations.

Conclusions

In summary, this study supports the relationship between negative parenting styles and depressive symptoms in university students. Moreover, it explores possible pathways for this relationship. Specifically, EDs mediated the effect of negative parenting styles, while maladaptive CERS moderated the relationship between EDs and depressive symptoms. This study theoretically contributes to elucidating the mechanisms by which negative parenting styles influence depression. Intervention measures for the prevention and treatment of depressive symptoms could consider incorporating early correction of negative parenting styles, alleviation of disordered eating symptoms, and training in positive emotion regulation strategies. Additionally, the interventions should consider the differences in dietary cultures among various ethnic groups.

Abbreviations

EDs	Eating disorders
CERS	Cognitive Emotion Regulation Strategies
EMBU	Egna Minnen av Barndoms Uppfostran
DE	Disordered eating
HSS	Household socioeconomic status
PHQ- 9	Patient Health Questionnaire-9
EAT- 26	Eating Attitude Test-26
AN	Anorexia nervosa
5-HTT	5-Hydroxytryptamine Transporter
SLC6 A4	Solute carrier family 6 member 4

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Authors' contributions

RPW, YH and SKW –designed this study. LS, ZXG, QN and JZ collected the data. RPW and JZC completed the data analysis. YH and LJG interpreted the data. RPW and YH drafted the main manuscript text and completed the revision. All authors reviewed and approved the final version of the manuscript.

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Data availability

The raw data supporting the conclusions of this article are available through the Xizang Minzu University. Contact Ruipeng Wu for access approval.

Declarations

Ethics approval and consent to participate

This study received approval from the Ethics Committee of Xizang Minzu University and complied with the Declaration of Helsinki (No. 2021–10). The patients/participants provided their written informed consent to participate in this study.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

[1]Clinical Medical Research Center for Plateau Gastroenterological Disease of Xizang Autonomous Region, Xizang Minzu University, Xianyang 712082, People's Republic of China. [2]Key Laboratory of High-Altitude Hypoxia Environment and Life Health, School of Medicine, Xizang Minzu University, Xianyang 712082, People's Republic of China. [3]Key Laboratory of Environmental Medicine and Engineering of Ministry of Education, and Department of Nutrition and Food Hygiene, School of Public Health Southeast University, Nanjing 210009, People's Republic of China. [4]School of Public Health and Emergency Management, Southern University of Science and Technology, Shenzhen 518055, People's Republic of China. [5]Internal Medicine Department, the Affiliated Hospital of Xizang Minzu University, Xianyang 712082, People's Republic of China. [6]Pediatrics Department, the Affiliated Hospital of Xizang Minzu University, Xianyang 712082, People's Republic of China.

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