



Eating disorders among middle school students in a Chinese population: Prevalence and associated clinical correlates

Sihong Li¹, Lintong Song¹, Mireille Twayigira, Tianqing Fan, Xuerong Luo^{*}, Yanmei Shen^{**}

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

ARTICLE INFO

Keywords:

Eating disorders
Chinese middle school students
Risk factors
Prevalence

ABSTRACT

Introduction: Eating disorders are regarded to be associated with many psychological and behavioral problems. Moreover, adolescence has been reported to be the key period for developing eating habits, and eating disorders typically emerge in adolescence and early adulthood. This study aimed to investigate the prevalence of eating disorders and explore the associated factors among adolescents in Hunan province, China

Methods: A total of 1610 middle school students from Hunan province, China, were enrolled in this study. The participants were aged from 11 to 16 years old. The following data were collected: demographic variables, Body Mass Index (BMI), suicidal behaviors, non-suicidal self-injury, depression, anxiety, stress (depression - anxiety - stress scale, DASS-21), childhood trauma (Childhood Trauma Questionnaire, CTQ), symptoms of social anxiety (Social Anxiety Scale-Adolescents, SAS-A), and eating problems (Eating Attitudes Test, EAT-26).

Results: The estimated prevalence of eating disorders was 8.9%. Compared with participants without eating disorders, participants with eating disorders were more likely to be at a younger age, obese and overweight, and have a history of non-suicidal self-injury, suicidal ideation, suicidal plans, suicide attempts, emotional abuse, physical abuse, emotional neglect, and physical neglect; more likely to experience stress, anxiety or depression as well as have high scores of social avoidance and distress related to general social contexts. Anxiety, emotional neglect, physical neglect, obesity, and overweight were still significant in the binary logistic regression model after controlling for confounding factors. Additionally, younger age, emotional abuse, physical abuse, stress, anxiety, depression, social avoidance, and distress related to general social contexts were significantly correlated with the EAT-26 scores in correlation analysis

Conclusions: Eating disorders are quite common among middle school students. Moreover, eating disorders are associated with younger age, non-suicidal self-injury, suicidal ideation, suicide attempts, stress, anxiety, depression, emotional abuse, physical abuse, emotional neglect, physical neglect, social avoidance, and distress related to general social contexts and BMI. This study provides a reference for school counselors and clinicians in the prevention and treatment of eating disorders.

1. Introduction

Eating disorders (ED) are characterized as a group of symptoms including abnormal eating behavior and related mental disorders, accompanied by weight change and/or physiological dysfunction (Santomauro et al., 2021). In DSM-5, eating disorders are divided into five main types, namely anorexia nervosa (AN), bulimia nervosa (BN),

binge eating (BED), and other specified feeding and eating disorders (OSFED), and unspecified feeding and eating disorder (UFED) (Qian et al., 2021). Eating disorders have been regarded to be associated with many psychological and behavioral problems, such as internalized emotional problems (anxiety, depression, etc.) and externalized behavioral problems (aggression, illegal behaviors, etc.) (Friborg et al., 2014; Grucza et al., 2007; Micali et al., 2017; E. Stice, Onipede and Marti,

^{*} Corresponding author. : National Clinical Research Center for Mental Disorders, and Department of Psychiatry, The Second Xiangya Hospital of Central South University, Changsha, 410011, Hunan, China.

^{**} Corresponding author. : National Clinical Research Center for Mental Disorders, and Department of Psychiatry, The Second Xiangya Hospital of Central South University, Changsha, 410011, Hunan, China.

E-mail addresses: luoxuerong@csu.edu.cn (X. Luo), ymshen@csu.edu.cn (Y. Shen).

¹ Sihong Li and Lintong Song contributed equally to this work.

2021). It is worth noting that adolescence has been reported to be the key period for developing eating habits (Schaumberg et al., 2019), and eating disorders typically emerge in adolescence and early adulthood (Harrison, 2003). Furthermore, it has been reported that the peak period for the onset of eating disorders is in adolescence (Hudson et al., 2007), suggesting that if research was broadly implemented among adolescents, it could improve the condition of eating disorders. Meanwhile, it is therefore very likely that the transition in and out of adolescence is associated with a greater risk for eating disorders and the change of age plays an important role in the process of eating disorders (Jahrami et al., 2019). Therefore, it is of great significance to study the prevalence and risk factors of eating disorders in adolescents to better understand and prevent related health problems.

With the increasing attention paid to eating disorders in recent years, more and more studies investigating the prevalence of EDs have emerged. A meta-analysis including thirty-three studies in 2021 reported the pooled lifetime and 12-month prevalence of eating disorders to be 0.91% and 0.43%, respectively, and in addition, the prevalence in western countries was significantly higher than that in Asia for any type of eating disorder (Qian et al., 2021). However, the epidemiological data from China is still limited (Thomas et al., 2016).

Previous studies have shown that eating disorders are often comorbid with many physical problems such as being overweight and psychological problems, such as childhood maltreatment, negative emotions, and even suicidal behaviors (Jones et al., 2020).

The prevalence of overweight (Li et al., 2009) among children and adolescents has increased steadily over the past decades. Moreover, BMI was associated significantly with eating disorder symptoms among all adolescents. This direct association previously has been reported by numerous studies (Bas et al., 2008; Fairburn et al., 1998; Striegel-Moore et al., 2005). More importantly, both overweight and eating disorders among youth children are serious public health concerns due to their high prevalence and adverse effects on psychosocial and physical health (Herzog et al., 1992; Johnson et al., 2002; Strauss et al., 1985; Zipfel et al., 2000). In response to this ‘rise tide of weight-related disorders, overweight and eating disorder researchers have begun calling for collaboration between the fields to address these disorders (Neumark-Sztainer, 2003).

The association between childhood maltreatment and eating disorders had been discussed in several studies. As early as 1994, Rorty, Yager, and Rossotto found parental abuse in childhood increased the likelihood of lifetime comorbid disorders and personality pathology among bulimic patients (Rorty et al., 1994). Furthermore, later studies pointed out the prevalence of all types of CM appeared to be two to fourfold higher in EDs patients than in healthy controls (Rind et al., 1998; Romans et al., 2001; Rorty et al., 1994). Specifically, at least two meta-analysis suggested a consistent association between CM and more severe clinical and functional characteristics of EDs (Caslini et al., 2016; Guillaume et al., 2016; Molendijk et al., 2017). These findings indicated that childhood maltreatment might play an important role in eating disorders.

Also, earlier research in Germany revealed that eating disorder symptoms are strongly associated with symptoms of anxiety and depression in early adolescence, and in addition, they suggested that comorbidity with anxiety or depression in eating disorders is associated with more severe ED symptoms, worse prognosis, and disease burden (Bulik, 2002). Previous studies have also shown that eating disorders and suicidal behaviors are closely related (Azorin et al., 2010). Moreover, eating disorders show stronger relations to mortality, and suicide attempts than other psychiatric disorders such as schizophrenia, major depression, and bipolar disorder (Crow and Smiley, 2012). A study in Florida in the United States showed the Eating disorder subtype was independently associated with suicidality, and the findings highlighted the importance of including suicide risk assessment in the standardized assessment of eating disorders (Bodell et al., 2013; Treasure, 2011).

Although there have been several studies conducted on the

epidemiology and risk factors of eating disorders around the world, few studies have explored the epidemiology and risk factors of eating disorders in China, especially in adolescents (Thomas et al., 2016). Thus, the main objectives of this study were to investigate the prevalence of eating disorders and to explore the associated factors among adolescents in Hunan province, China.

2. Methods

2.1. Subjects

The study used a cross-sectional design. 1785 students whose age range is 11–16 years old from a junior high school in Changsha, Hunan Province, were selected as the target participants with a cluster sampling method. All the students participating in the study were screened in November 2020. The participants in the study needed to meet the following inclusion criteria: (a) junior high school students aged from 11 to 16 years old; (b) without a severe physical disorder which made them unable to participate in the study; (c) able to understand and finish filling the questionnaires; and (d) willing to sign a formal consent to participate.

The questionnaires were released online through WeChat, a Chinese social media platform. Students filled the questionnaire at home with a mobile phone, before that, the school teachers received systematic training on how to send the questionnaire, how to provide guidance and how to provide help when students have difficulty in filling the questionnaire. The students were provided guidance on how to fill the questionnaires and how to seek for help at school by school teacher to make sure that they know how to seek for help, especially questions on family history of mental health disorder.

All students were told that the study was completely voluntary; they could choose to participate or not, and they could choose to withdraw from the study at any time. A total of 1785 students were eligible to the study, but 55 students refused. 120 students were excluded due to not meeting the inclusion criteria or incomplete data, a total of 1610 students were enrolled and included in the final analysis. The response rate was 90.2%.

2.2. Clinical measures

The demographic variables of the participants including sex, age, nationality, single child, physical disorder history, mental disorder history, and family history of mental disorders (FHMD) were collected.

Body Mass Index (BMI) is an international standard commonly used to measure the body fat and health. The formula to calculate BMI is the weight (kg) divided by the square of height (m^2). According to Chinese school-age child and adolescent overweight and obesity screening for BMI classification criteria and Chinese school-age child and adolescent thin screening for BMI classification criteria, Standard age- and sex-specific childhood weight status classifications were used: thin, normal weight, overweight and obesity. The specific classification criteria are presented in supplemental material.

Non-suicidal Self-Injury (NSSI) is defined as intentional, self-inflicted damage to the surface of the body, without the intention to commit suicide (Lloyd-Richardson et al., 2007). In this study, NSSI was measured by the following question: “Have you hurt yourself without aiming to commit suicide in the past year?” If the answer to this question was yes, another question was asked about methods of self-harm used.

In this study, suicidal ideation, suicidal plans, and suicide attempts were measured by the following questions: “Have you ever had thoughts of committing suicide?”, “Have you ever made a plan about how you would commit suicide?” and “Have you ever tried to commit suicide (Shen et al., 2020)?” Further questions about the frequency were asked if the answer was yes.

The Depression Anxiety Stress Scales-21 (DASS-21) was employed to assess participants’ states of stress, anxiety, and depression in the past

seven days (Lovibond and Lovibond, 1995). The DASS-21 includes 21 items of clinical assessment with sub-scales for Depression (DASS-Depression), Anxiety (DASS-Anxiety), and Stress (DASS-Stress), and each sub-scale has 7 items which were rated on a scale from 0 (did not apply to me at all) to 3 ((applied to me very much or most of the time) (Bibi et al., 2020). The cut-off scores were 10 for Stress, 7 for Anxiety and 13 for Depression (Lovibond and Lovibond, 1995). The DASS-21 has been demonstrated to have good internal consistency in clinical populations. The DASS-21 was found to have good internal consistency indices (Cronbach's alpha) of 0.83, 0.80, and 0.82 for the Depression, Anxiety and Stress subscales in China, and 0.92 for the total DASS total, which supported the cross-cultural validity (Wang et al., 2016).

The Childhood Trauma Questionnaire (CTQ) was used to evaluate various forms of abuse and neglect during childhood (Dpb et al., 2003). In this study, 23 items were divided into four sub-scales of Emotional abuse, Emotional neglect, Physical abuse and Physical neglect were used. Each subscale of the CTQ was answered by 5 questions from the questionnaire, which were rated on a scale from 1 (never) to 5 (very often), and the other three items are used as validity evaluation. The cut-off scores were 13 for Emotion abuse, 10 for Physical abuse, 15 for Emotional neglect and 10 for Physical neglect. Internal consistency indices (Cronbach's alpha) of the CTQ was 0.51–0.71 in China (Wen-Qing and Yao, 2005).

The Social Anxiety Scale-Adolescents (SAS-A) was used to measure symptoms of social anxiety for adolescents (Greca and Lopez, 1998). The SAS-A included 13 items with sub-scales for Fear of Negative Evaluation (FNE) (6 items), Social Avoidance and Distress in New Situations (SAD-N) (4 items), and Social Avoidance and Distress-General (SAD-G) (3 items), and each question was rated from 1 (completely not conforming) to 5 (completely conforming) (Cheung et al., 2017; Zhou et al., 2008). Internal consistency and test-retest reliability were appropriate in China, whose Cronbach's alpha internal consistency coefficients were 0.85 (Cheung et al., 2017; Zhou et al., 2008).

The Eating Attitudes Test (EAT-26) was used to assess risks of eating disorders (Garner et al., 1982). The EAT-26 has 26 items and each item was rated from 1 (always) to 6 (never), and all items except the last one were assigned from 0 (original scores 4–6) to 3 (original scores 1), but the last item was assigned from 0 (original scores 1–3) to 3 (original scores 6) (Saleh et al., 2018). Participants were regarded as having eating disorders when they scored more than 20 on EAT-26. The EAT-26 has reasonable psychometric properties of reliability and validity, and it has favorable sensitivity and specificity for eating disorders (Garfinkel and Newman, 2001). In China, The EAT-26 demonstrated to have good internal consistency (Cronbach's alpha = 0.822–0.922) and test-retest reliability (interclass correlation coefficient = 0.817) (Kang et al., 2017).

2.3. Medical ethics

This study protocol was ratified by the Ethics Committee of the Second Xiangya Hospital of Central South University.

2.4. Statistical analyses

In this study, Kolmogorov–Smirnov one-sample test was utilized to assess the normal distribution of continuous data. Since the continuous data (age) was normally distributed, *t*-test was used to compare the average age of participants with and without eating disorders. The scores of BMI, DASS-21, CTQ and SAS-A did not meet the normal distribution; therefore, nonparametric test was used to compare scores of BMI, DASS-21, CTQ, SAS-A, and their sub-scales between ED and controls. The χ^2 test was used for categorical variables comparison (sex, nationality, single child, physical disorder history, mental disorder history, family history of mental disorders (FHMD), and the dimension of BMI, DASS-21, CTQ including their sub-scales). The crude odds ratio (OR) of the categorical variables were calculated by χ^2 test. Binary

logistic regression analysis was employed to identify factors that were independently correlated with eating disorders. Adjusted ORs were calculated by binary logistic regression after controlling for confounding factors (sex, age, nationality, single child). Spearman correlation analysis was conducted to analyze the relationship between different variables. All the statistical analyses were performed using SPSS (Version 23.0; IB.M, Inc., Chicago, IL), and the significance level was set at 0.05.

3. Results

In this study, the estimated prevalence of eating disorder was 8.9%. No statistically significant differences were observed between participants with and without eating disorders in sex, nationality, single child, physical disorder history, mental disorder history, FHMD, the scores of Fear of Negative Evaluation (FNE) and Social Avoidance and Distress in New Situations (SAD-N) of the SAS-A (all $p > 0.05$). Participants with eating disorders were younger than those without ($p = 0.048$, Table 1). Compared with participants without eating disorders, participants with eating disorders were more likely to have higher BMI ($p < 0.001$), history of non-suicidal self-injury ($p < 0.001$, odds ratio (OR) [95% confidence interval (CI)] = 2.324 [1.583–3.411]), suicidal ideation ($p < 0.001$, OR [95%CI] = 1.920 [1.333–2.766]), suicidal plans ($p = 0.045$, OR [95%CI] = 1.619 [1.006–2.607]), suicide attempts ($p < 0.001$, OR [95%CI] = 3.042 [1.899–4.873]), emotional abuse ($p < 0.001$, OR [95%CI] = 3.034 [1.946–4.732]), physical abuse ($p < 0.001$, OR [95%CI] = 3.446 [2.157–5.507]), emotional neglect ($p < 0.001$, OR [95%CI] = 3.220 [2.275–4.558]), and physical neglect ($p < 0.001$, OR [95%CI] = 3.354 [2.368–4.752]); more likely to experience stress ($p < 0.001$, OR [95%CI] = 2.599 [1.832–3.689]), anxiety ($p < 0.001$, OR [95%CI] = 2.633 [1.861–3.724]) or depression ($p < 0.001$, OR [95%CI] = 2.633 [1.861–3.724]) and more likely to have high scores on the social avoidance and distress related to general social contexts (SAD-G) of the SAS-A (all $p < 0.05$, Table 1).

After controlling for confounding factors in the binary logistic regression model, the following variables remained significant: BMI (Wald = 23.111, $p < 0.001$), Anxiety (Wald = 4.664, OR [95% CI] = 1.724 [1.052, 2.825]; $p = 0.031$), Physical neglect (Wald = 12.341, OR [95% CI] = 2.227 [1.425, 3.482]; $p < 0.001$), and Emotional neglect (Wald = 3.925, OR [95% CI] = 1.578 [1.005, 2.479]; $p = 0.048$; Table 2). The adjusted R square for this model was 15.4%. The results of binary logistic regression model showed that higher BMI was a risk factor to eating disorder, especially for overweight (Wald = 6.628, OR [95% CI] = 3.146 [1.279, 7.739]; $p = 0.013$) and obesity (Wald = 14.062, OR [95% CI] = 5.593 [2.275, 13.755]; $p < 0.001$) participants. Moreover, anxiety, physical neglect, and emotional neglect also increased the risk of the eating disorder incidence rate.

Spearman correlation analysis suggested that there was a significant negative correlation between the EAT-26 and age ($r = -0.094$, $p < 0.001$), and positive correlations with Emotional abuse ($r = 0.160$, $p < 0.001$), Physical abuse ($r = 0.143$, $p < 0.001$), Physical neglect ($r = 0.177$, $p < 0.001$), Stress ($r = 0.211$, $p < 0.001$), Anxiety ($r = 0.231$, $p < 0.001$), Depression ($r = 0.173$, $p < 0.001$), FNE ($r = 0.181$, $p < 0.001$), SAD-N ($r = 0.145$, $p < 0.001$) and SAD-G ($r = 0.120$, $p = 0.004$; Table 3, Fig. 1).

4. Discussion

As far as we know, this study is the first of its kind to investigate the prevalence and risk factors of eating disorders in middle school students in Hunan Province with a large sample. This study found that eating disorders are quite common among middle school students (8.9%). Factors including younger age, non-suicidal self-injury, suicidal ideation, suicide attempts, stress, anxiety, depression, emotional abuse, physical abuse, emotional neglect, physical neglect, and social anxiety are associated with eating disorders. Moreover, this study found that overweight, obesity, physical neglect, emotional neglect and anxiety

Table 1
Demographics and clinical characteristics of participants with and without eating disorder.

Variable	Eating disorder group, (n = 144)	Control group, (n = 1466)	$\chi^2/Z/t$	df	P value	OR (95% CI)
Sex						
Males, n (%)	85(59.0)	762(52.0)	2.614	1	0.106	
Females, n (%)	59(41.0)	704(48.0)				
Nationality						
Han, n (%)	136(94.4)	1392(95.0)	0.070	1	0.791	
Others, n (%)	8(5.6)	74(5.0)				
Age(years), means $\pm$ sd	12.97 $\pm$ 1.119	13.13 $\pm$ 0.936	1.896	1	0.048	
Single child						
Yes, n (%)	58(40.3)	601(41.0)	0.028	1	0.867	
No, n (%)	86(59.7)	865(59.0)				
Physical disorder history, n (%)	32(22.2)	297(20.3)	0.311	1	0.577	
Mental disorder history, n (%)	3(2.1)	9(0.6)	2.098	1	0.147	
FHMD, n (%)	1(0.7)	10(0.7)	0	1	1	
BMI, means $\pm$ sd	21.25 $\pm$ 4.558	19.65 $\pm$ 3.696	4.240	1	<0.001	
BMI						
thin, n (%)	7(4.9)	145 (9.9)	32.313	3	<0.001	
normal weight, n (%)	83 (57.6)	1030 (70.3)				
overweight, n (%)	26 (18.1)	183 (12.5)				
obese, n (%)	28 (19.4)	108 (7.4)				
Non-suicidal self-injury, n (%)	43(29.9)	227(15.5)	19.417	1	<0.001	2.324(1.583–3.411)
Suicidal ideation, n (%)	50(34.7)	318(21.7)	12.626	1	<0.001	1.920(1.333–2.766)
Suicidal plans, n (%)	23(16.0)	154(10.5)	4.006	1	0.045	1.619(1.006–2.607)
Suicide attempts, n (%)	26(18.1)	99(6.8)	23.39	1	<0.001	3.042(1.899–4.873)
DASS, means $\pm$ sd	20.78 $\pm$ 15.756	13.17 $\pm$ 12.30	−5.822	1	<0.001	
Stress, means $\pm$ sd	7.26 $\pm$ 5.705	4.88 $\pm$ 4.468	−4.825	1	<0.001	
Stress, n (%)	64(44.4)	345(23.5)	30.256	1	<0.001	2.599(1.832–3.689)
Anxiety, means $\pm$ sd	7.00 $\pm$ 5.413	4.36 $\pm$ 4.279	−5.944	1	<0.001	
Anxiety, n (%)	101(70.1)	688(46.9)	28.261	1	<0.001	2.656(1.832–3.850)
Depression, means $\pm$ sd	6.52 $\pm$ 5.625	3.93 $\pm$ 4.515	−5.936	1	<0.001	
Depression, n (%)	81(56.3)	481(32.8)	31.705	1	<0.001	2.633(1.861–3.724)
CTQ, means $\pm$ sd	40.49 $\pm$ 13.266	32.07 $\pm$ 11.022	−8.095	1	<0.001	
Emotional abuse, means $\pm$ sd	8.88 $\pm$ 4.490	7.33 $\pm$ 3.377	−3.873	1	<0.001	
Emotional abuse, n (%)	30(20.8)	117(8.0)	26.105	1	<0.001	3.034(1.946–4.732)
Physical abuse, means $\pm$ sd	7.08 $\pm$ 3.314	6.02 $\pm$ 2.165	−3.904	1	<0.001	
Physical abuse, n (%)	27(18.8)	92(6.3)	29.808	1	<0.001	3.446(2.157–5.507)
Emotional neglect, means $\pm$ sd	14.63 $\pm$ 7.248	10.86 $\pm$ 6.025	−5.962	1	<0.001	
Emotional neglect, n (%)	75(52.1)	370(25.2)	47.244	1	<0.001	3.220(2.275–4.558)
Physical neglect , means $\pm$ sd	9.90 $\pm$ 3.753	7.87 $\pm$ 3.091	−6.306	1	<0.001	
Physical neglect, n (%)	80(55.6)	398(27.1)	50.687	1	<0.001	3.354(2.368–4.752)
SAS-A, means $\pm$ sd	34.74 $\pm$ 17.756	32.42 $\pm$ 13.799	−0.981	1	0.326	
FNE, means $\pm$ sd	16.67 $\pm$ 8.874	15.60 $\pm$ 7.207	−1.083	1	0.279	
SAD-N, means $\pm$ sd	10.82 $\pm$ 5.896	10.76 $\pm$ 4.676	−0.349	1	0.727	
SAD-G, means $\pm$ sd	7.25 $\pm$ 4.037	6.05 $\pm$ 3.166	−2.856	1	0.004	

Note: OR, odd ratio; FHMD, family history of mental disorder; BMI, Body Mass Index; SAS-A, social anxiety scale for adolescent; FNE, fear of negative evaluation; SAD-N, social avoidance and distress related to new situations; SAD-G, social avoidance and distress related to general social contexts.

level are independently correlated with eating disorders.

The prevalence of eating disorders varies across different regions. Our study found a prevalence of 8.9% among Hunan adolescents, which is lower than the prevalence reported in Taiwan (10.5%) (Wong et al., 2014), and higher than the prevalence reported in other cities. For example, a study in Wuhan found that the prevalence of eating disorders among female students was 1.05%, 2.98% and 3.58% for anorexia nervosa, bulimia nervosa, and binge-eating disorder (BED) respectively (Tong et al., 2014). Another study in Switzerland in 2016 found a lifetime prevalence rate of 3.5% for any eating disorder (Mohler-Kuo et al., 2016), while a meta-analysis including thirty-three studies found a pooled lifetime and a 12-month prevalence of eating disorders of 0.91% and 0.43% respectively (Qian et al., 2021). The discrepancy in the prevalence in different studies may be due to several aspects: Firstly, this may be due to different measurement methods utilized in different studies as well as different questionnaires and cut-off scores. Secondly, these studies were implemented in different social and cultural backgrounds, and cultural cognition related to eating disorders symptomatology might vary across racial and ethnic groups (Goel et al., 2020).

This study found that anxiety is independently associated with eating disorders, which is consistent with previous studies. Anxiety disorders are common among patients with eating disorders, and frequently pre-date the emergence of the eating disorders (Bulik, 2002; Hinrichsen

et al., 2007). Moreover, the most commonly observed comorbid anxiety problem in eating disorders is social anxiety (Schwalberg et al., 1992), which also in line with our finding of the association between social anxiety and eating disorders. A study conducted in Italy investigated the gender-dependent associations between anxiety and symptoms of eating disorders and found that anxiety plays an important role in eating disorders for both men and women (Ernst et al., 2021). In addition, One American study also pointed out that the dimension of anxiety sensitivity is positively associated with severity of eating disorders (Espel-Huynh et al., 2019). On the one hand, some studies pointed out that eating disorders symptoms such as guilt about eating, shape overvaluation, wanting an empty stomach etc., bridge eating disorders to anxiety symptoms (Godart et al., 2000; Smith et al., 2019). Specifically, studies about the sociocultural theory of eating disorders have pointed out that thin-ideal internalization may interact with social risk factors such as anxiety to influence eating disorders development (Christian et al., 2021). On the other hand, Studies about emotional regulation theory suggested that the association may be due to the similar maladaptive emotion regulation shared by eating disorders and anxiety (Burns et al., 2010; Sander et al., 2021). Theoretical models of eating disorders assume that maladaptive emotion regulation strategies increase the risk of eating disorders, and meanwhile, maladaptive emotion regulation plays an important role in the onset and maintenance of

Table 2

Binary logistic regression analysis for variables associated with eating disorders.

	B	S.E	Wald	df	P value	OR	95% CI	
							Lower	Upper
Age	−0.190	0.098	3.751	1	0.053	0.827	0.682	1.002
Sex								
Male	reference							
Female	−0.134	0.198	0.455	1	0.500	0.875	0.593	1.290
Nationality								
Han	reference							
Others	0.082	0.404	0.041	1	0.840	1.085	0.491	2.396
Single child								
Yes	reference							
No	−0.139	0.192	0.524	1	0.469	0.870	0.598	1.267
Physical disorder history								
No	reference							
Yes	−0.066	0.229	0.083	1	0.774	0.936	0.598	1.466
Mental disorder history								
No	reference							
Yes	0.583	0.724	0.648	1	0.421	1.791	0.433	7.402
FDMH								
No	reference							
Yes	−0.092	1.084	0.007	1	0.932	0.912	0.109	7.640
BMI			23.111	3	0.000			
Thin	reference							
normal weight	0.639	0.413	2.396	1	0.122	1.895	0.844	4.257
Overweight	1.146	0.459	6.228	1	0.013	3.146	1.279	7.739
Obesity	1.722	0.459	14.062	1	0.000	5.593	2.275	13.755
Emotional abuse								
No	reference							
Yes	0.247	0.299	0.685	1	0.408	1.281	0.713	2.301
Physical abuse								
No	reference							
Yes	0.352	0.304	1.343	1	0.247	1.423	0.784	2.582
Emotional neglect								
No	reference							
Yes	0.456	0.230	3.925	1	0.048	1.578	1.005	2.479
Physical neglect								
No	reference							
Yes	0.801	0.228	12.341	1	0.000	2.227	1.425	3.482
Stress								
No	reference							
Yes	0.243	0.252	0.930	1	0.335	1.275	0.778	2.088
Anxiety								
No	reference							
Yes	0.544	0.252	4.664	1	0.031	1.724	1.052	2.825
Depression								
No	reference							
Yes	0.191	0.252	0.571	1	0.450	1.210	0.738	1.984

Note: OR, odd ratio; CI, confidence interval; FHMD, family history of mental disorder; BMI, Body Mass Index.

Table 3

Correlation analysis of eating disorders, demographics and clinical characteristics.

	1	2	3	4	5	6	7	8	9	10	11	12
1. Eat												
2. Age	−0.094**											
3. BMI	−0.040	0.167**										
4. Stress	0.211**	−0.041	0.004									
5. Anxiety	0.231**	−0.065**	−0.010	0.821**								
6. Depression	0.173**	−0.019	0.017	0.802**	0.744**							
7. Emotional abuse	0.160**	−0.076**	−0.021	0.567**	0.541**	0.552**						
8. Physical abuse	0.143**	−0.071**	0.013	0.371**	0.348**	0.353**	0.558**					
9. Emotional neglect	0.024	0.028	0.040	0.215**	0.193**	0.284**	0.280**	0.207**				
10. Physical neglect	0.047	0.010	0.026	0.129**	0.121**	0.207**	0.209**	0.205**	0.696**			
11. FNE	0.181**	0.070**	−0.043	0.548**	0.575**	0.495**	0.448**	0.252**	0.152**	0.096**		
12. SAD-N	0.145**	0.064*	−0.046	0.440**	0.482**	0.401**	0.333**	0.171**	0.091**	0.032	0.786**	
13. SAD-G	0.120**	0.043	−0.002	0.494**	0.507**	0.497**	0.383**	0.224**	0.198**	0.184**	0.741**	0.725**

Note: BMI, Body Mass Index; FNE, fear of negative evaluation; SAD-N, social avoidance and distress related to new situations; SAD-G, social avoidance and distress related to general social contexts.

*: $p < 0.05$.**: $p < 0.01$.

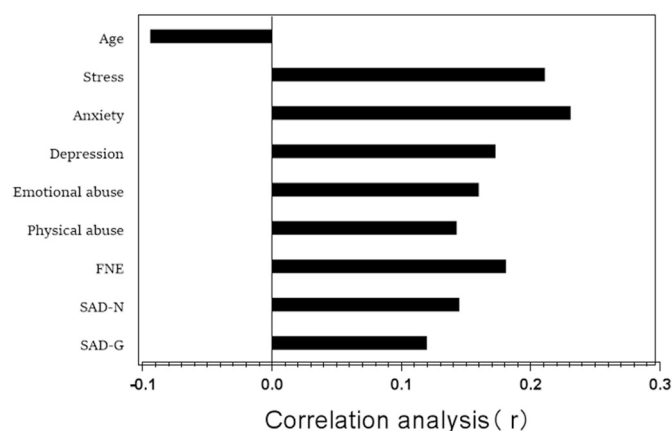


Fig. 1. Correlation analysis of eating disorders, demographics and clinical characteristics.

Note: FNE, fear of negative evaluation; SAD-N, social avoidance and distress related to new situations; SAD-G, social avoidance and distress related to general social contexts.

anxiety (Cisler et al., 2010; Everaert and Joormann, 2019). More interestingly, eating disorders and anxiety have some relevance of the microbe-gut-brain axis to psychopathology (Kleiman et al., 2015). Both anxiety and eating disorder psychopathology are associated with composition and diversity of the intestinal microbiota (Kleiman et al., 2015), suggesting that there might be microbiological evidence to support this link.

This study also found that eating disorders are linked with childhood maltreatment, particularly neglect, which is in line with some previous studies. In general, the prevalence of all types of childhood maltreatment appeared to be two to fourfold higher in EDs patients than in healthy controls (Rind et al., 1998; Romans et al., 2001; Rorty et al., 1994). As early as 2001, an American study showed that physical neglect is associated with dietary restraint (DUNCAN and R, 2000). In 2007, Kelly C. Allison found that binge eating disorder participants showed prominently more reports of emotional neglect, while physical neglect was more common in night eating syndrome patients (Allison et al., 2007). Similarly, a French study found that BED was predominantly associated with emotional neglect (Quilliot et al., 2019). Additionally, a controlled study in 2018 showed that emotional neglect is a specific factor involved in the development of eating disorders (Amianto et al., 2018). Moreover, a study in Israel found physical neglect to be linked with a higher prevalence of night eating syndrome and binge eating subgroups of eating disorders (Latzner et al., 2020). However, some studies have shown different results. A study in America suggested that childhood maltreatment is not generally associated with variability in eating pathology (Becker and Grilo, 2011). This might probably be because the sample size only included females. These association most likely involves multiple factors, including genetic, psychological, sociodemographic, environmental pressures, and cultural factors. Each of these factors provides a potential explanation for the association between childhood maltreatment and eating disorders. Genetic and non-shared environmental factors such as childhood maltreatment have been implicated in the etiology of certain eating disorders, where genetic risk has been expressed as parental psychopathology (Klump et al., 2002). From this perspective, parental psychopathology could increase the risk of childhood maltreatment, this may reflect the genetic risk that influences environmental risk (Natalie et al., 2011; Talmon and Widom, 2022). Other explanations could be those psychological problems associated with childhood maltreatment may disrupt a person's ability to engage in healthy eating and self-care, leading to eating disorders (Francis et al., 2015; Quilliot et al., 2019). Another possibility might be that maltreated children cope by engaging in risky behaviors, such as overeating, rather than more adaptive ways of coping in response to the

stresses of childhood maltreatment (Vincent et al., 1998). Moreover, other work has suggested that childhood maltreatment may lead to the development of maladapted personality traits, including perfectionism, negative urgency, external locus of control and interpersonal sensitivity which may be risk factors for eating disorders (Culbert et al., 2015; Micali et al., 2017; Molendijk et al., 2017; Moulton, 2013). However, to date, little is known about the underlying mechanisms and further research still needs to be conducted.

We also found out that compared with the underweight group, the overweight and obese group is more likely to have eating disorders. With increasing concern about adolescent weight problems, numerous studies had showed that adolescent overweight and obesity is one of the risk factors for the development and maintenance of eating disorders' symptoms (Burrows and Cooper, 2002; Fairburn et al., 1999; Fairburn et al., 1998; Fan et al., 2010; Haines and Neumark-Sztainer, 2006). Furthermore, several studies have identified the association of increased risk for eating disorder symptoms with elevated weight, one possible explanation for this may be that overweight adolescents show greater concern about body image and a greater tendency to perform dietary restraint than their counterparts with normal weight (Neumark-Sztainer, 2003; Neumark-Sztainer et al., 2003; E Stice and Whitenton, 2002). More specifically, overweight and obese adolescents tend to display elevated risk for weight/shape concerns and dieting attempts which, in turn, are associated with disturbance in eating habits. Therefore, weight-related concerns and behaviors are not only independent indicators of eating disorder symptoms, but also serve as the mediator between BMI and eating disorder symptoms (Fan et al., 2010). Another explanation comes from the dietary restraint model, developed by Polivy and Herman (Polivy and Herman, 1985). As posited by the model, using cognitive control puts individuals at risk for disinhibited overeating, which involves loss of cognitive control overeating and is thought to occur as a result of the breakdown of prior restraint (Investigators, 2003; Shunk and Birch, 2004; Stice and Killen, 1998). Thus, this disinhibition may increase vulnerability to bingeing and overeating which leads to both overweight and eating disorders (Burrows and Cooper, 2002; Nichter et al., 1995). However, the causal mechanism of BMI and eating disorders still need to be explored.

Some limitations still need to be addressed. Firstly, our study was a cross-sectional design study. Therefore, we cannot draw any conclusions about causality, the causal links between these factors hinge on further research. Secondly, the study did not differentiate the specific subtypes of eating disorders. Therefore, the specific association between each factor and different subtypes is unknown. Thirdly, although the sample size of our study was large, all participants were from the same middle school in Hunan, and more data should be obtained from different regions in further studies to improve the representativeness. Fourthly, self-report scales were used to study eating disorders and the associated correlates of participants. Therefore, there may be an overestimation in prevalence compared with studies utilizing diagnostic interviews, diagnostic tools such as K-SADS or DSM criteria should be utilized in the future to be more accurate. Fifthly, the students may have problems in answering questions about family history of mental disorder, although they were provided guidance on how to fill the questionnaires and how to seek for help at school by the school teacher to make sure that they know how to seek for help, it's hard to make sure everyone would have done so. Finally, although we have rich experience in epidemiology studies, future pilot study would still improve the feasibility and reliability.

5. Conclusion

In conclusion, this study indicates that eating disorders are quite common among middle school students. Additionally, eating disorders are associated with younger age, non-suicidal self-injury, suicidal ideation, suicide attempts, stress, anxiety, depression, emotional abuse, physical abuse, emotional neglect, physical neglect, BMI and social

anxiety. This indicates the importance of addressing eating disorders as well as childhood maltreatment weight problems and emotional problems. The findings also highlight the importance of early assessment of childhood neglect in patients with eating disorders. Overall, this study provides valuable evidence to enhance our understanding of eating disorders in adolescents, and it also provides reference for school counselors and clinicians in the prevention and treatment of eating disorders.

Author contributions

Xuerong Luo and Yanmei Shen were responsible for the study design. Lintong Song and Sihong Li was involved in statistical analysis. Sihong Li, Lintong Song and Mireille Twayigira were involved in the manuscript preparation and drafting of the paper. Sihong Li and Lintong Song were involved in editing and revising the manuscript. Xuerong Luo, Yanmei Shen and Mireille Twayigira were responsible for the critical revision of the manuscript. All authors have contributed to and have approved the final manuscript.

Role of the funding source

This work was supported by the 2019 key R & D projects of Hunan Provincial Department of science and technology (No. 2019SK 2081). This source had no further role in this study design, in the data collection and analysis, in the writing of the report, and in the decision to submit the paper for publication.

Declaration of Conflicts of interest

None.

Acknowledgements

We would like to show our great gratitude to the school personnel who have offered invaluable support. We would like also to show our great gratitude to all of the students participated in this project.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jpsychires.2022.07.062>.

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