

Body dissatisfaction and social anxiety among adolescents: A moderated mediation model of feeling of inferiority, family cohesion and friendship quality

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Abstract

Previous research has documented that body dissatisfaction is positively related to social anxiety. However, little is known about the mediating and moderating mechanisms underlying this relation. Based on ecological systems theory, this study aimed to examine the chain mediation effect of friendship quality and family cohesion in the relationship between body dissatisfaction and social anxiety among adolescents and whether this mediating process was moderated by feeling of inferiority. A total of 972 students (mean age = 15.77 years, SD = 0.856) were enrolled in this study. All participants completed questionnaires regarding adolescent body dissatisfaction, feeling of inferiority, family cohesion, friendship quality and social anxiety. Our study found that body dissatisfaction was positively associated with social anxiety. Feeling of inferiority and family cohesion were found to play a chain-mediated role in the relation between body dissatisfaction and social anxiety. In addition, friendship quality plays a moderating role in the relationship between body dissatisfaction and feeling of inferiority. According to ecological systems theory, it suggested that family cohesion and friendship quality, as important elements in the microsystem of adolescents, interacted with each other, and interacted with the core parts of the ecosystem, such as body dissatisfaction and feeling of inferiority. These effects in turn have an impact on the individual's psychological characteristics-social anxiety. These findings show lights on how body dissatisfaction is associated with social anxiety in adolescents.

Introduction

Social anxiety disorder is one of the top five functionally impairing psychological disorders (Investigators et al., 2004), which is characterized by an early age of onset (Asher et al., 2017) and is the most prevalent in adolescence (Ollendick & Hirshfeld-Becker, 2002) with 15% prevalence rates (Heimberg et al., 2000). The data from the U.S. National Comorbidity Survey (NCS) shows that the lifetime prevalence of social anxiety disorders is 13.3% in the United States (Kessler et al., 1994). Social anxiety refers to anxious anticipation, depression, and strong fear of negative evaluation in social situations (Beidel & Turner, 2007), which can seriously damage the mental health of adolescents and may lead to insomnia (Buckner et al., 2008), mood disorders (Buckner et al., 2006), poor relationships (Heerey & Kring, 2007), academic difficulties and school dropout (Ruscio et al., 2008).

During adolescence, body and appearance undergo dramatic changes (Eisenberg et al., 2006), which will affect the formation of body image, and body dissatisfaction reaches its peak (Bucchianeri et al., 2013). According to the cognitive model of social anxiety disorder, distorted and negative self-image is a key factor in the maintenance of social anxiety (Hodson et al., 2008). Simultaneously, teenagers will face the pressure of social interaction with surrounding classmates, teachers, and parents. This makes them more prone to social anxiety (Rapee & Spence, 2004).

Previous studies have paid more attention to the influence of environmental or individual factors on adolescent social anxiety separately (Bynion et al., 2017; Detweiler et al., 2014), while little research has been done on the interaction between environment and individuals. According to ecological systems

theory, the microsystem in the system interacts and affects one's physical and psychological development (Bronfenbrenner & Morris, 2007). This study, therefore, aimed to examine the association of body dissatisfaction and social anxiety among adolescents, as well as the role of individual and environmental factors in this relationship.

Body dissatisfaction and social anxiety in adolescents

Body image, as a central to self-concept formation (Cash, 2004), can be divided into positive body image and negative body image. When individuals have negative evaluations of their bodies and high levels of dissatisfaction, he will experience negative body image, conceptualized as body dissatisfaction (Gattario & Frisen, 2019). It can damage one's mental health and social activities, especially for adolescents.

People with body dissatisfaction report more negative evaluations of their appearance (Barnier & Collison, 2019) and worry that others have negative evaluations of them, which leads them to experience more anxiety in social interactions (Pawijit et al., 2019). Studies also showed that patients with body dysmorphic disorder have higher levels of social avoidance and distress than healthy group (Pinto & Phillips, 2005). An experimental study found that compared with simply discussing the negative images, participants' anxiety about social situations was significantly improved after cognitive restructuring of the negative images through contextual updating of memory (Wild et al., 2008). It can be seen that body dissatisfaction is closely related to social anxiety. Therefore, this study proposes hypothesis 1: Body dissatisfaction is significantly positively correlated with social anxiety.

The mediating role of feeling of inferiority and family cohesion

Inferiority is a psychological structure emphasized in Erikson's psychosocial theory and Adler's personal psychology (Çelik & Ergün, 2016). It is a subjective feeling produced by comparing oneself with others (Strano & Dixon, 1990). Body dissatisfaction as the basis of individual self-concept (Shin & Nam, 2015) is closely related to mental health (Gattario & Frisen, 2019) and may lead to depression and low self-esteem (Paxton et al., 2006). For example, people with body dissatisfaction would control their body shape by dieting and other means to avoid the feeling of inferiority (Bellew et al., 2006).

Adler (1996) proposed that humans are social beings at birth and the degree of health is bound to how social a person is. Excessive indulgence or neglect during the early years of development can make individuals experience feeling of inferiority and cause problems in social relationships (Adler, 1996). According to the theory of social hierarchy, emotions are affected by social rank (Gilbert, 2016). Individuals with lower social rank are more likely to develop feeling of inferiority and submissive behaviors, which are significantly linked to feeling shame, depression, and social anxiety (Gilbert, 2000). Accordingly, this study proposes hypothesis 2: Feeling of inferiority plays a mediating role in the relationship between body image distress and social anxiety.

Family cohesion refers to the perceived level of emotional bonding in the family, and it is expressed by feeling of belongings and acceptance (Liu, 2014). Most previous studies have focused on the influence of family cohesion on children's body dissatisfaction (Holsen et al., 2012; McCabe & Ricciardelli, 2003), but

few on the opposite influence. During adolescence, children pay more attention to appearance due to the increase of body dissatisfaction (Gattario & Frisen, 2019), which makes them always comes into conflict with parents (Fang, 1998) and may further affect family cohesion. The family functioning theory illustrates that the positive family environment plays an important role in the development of adolescent psychological and social functioning (Miller et al., 2000). In dysfunctional families, less communication and interaction among family members will cause a decrease in the sense of belonging and responsibility, which influence children's social adaptation (Kuhlthau et al., 2010). As a comprehensive indicator reflecting family members' affinity and positive family atmosphere, family cohesion is thought to protect against anxiety and depression (Cumsille & Epstein, 1994; Qu, 2021). Based on this, this study proposes hypothesis 3: Family cohesion plays a mediating role in body image distress and social anxiety.

Although both feeling of inferiority and family cohesion may be mediating variables between body dissatisfaction and social anxiety, there may be a connection between them. In family system, the relationship between members is interactive. Parents have been proved to have an important role in children's character formation. At the same time, children's character also affect the parents' attitude towards them (Li, 2001). In a cross-national study regarding family cohesion as a component of collectivism, individuals from China, include Mainland China, Taiwan and Hongkong, reported higher family cohesion than those from Western societies (House et al., 1999), it implied that the interpersonal interactions between them are more powerful (Meredith et al., 1994), children's psychology and behavior may have a greater impact on parent-child relationships. Based on this, hypothesis 4 is proposed: Feeling of inferiority and family cohesion may play a chain mediating role in the effect of body dissatisfaction on social anxiety.

The moderating effect of friendship quality

During adolescence, children gradually reduce their dependence on their parents and interact with friends more frequently (Brown & Larson, 2009), and the quality of friendships has an important impact on adolescents' psychology and behavior (Demir et al., 2007; Goswami, 2012). Friendship quality refers to the degree of companionship, intimacy, and security between friends (Gauze et al., 1996). High friendship quality can not only provide adolescents with external peer support, but also enhance their inner sense of self-worth (Troop-Gordon et al., 2015). According to the buffer theory of social support, social support perceived by individuals can enhance their ability to cope with stress and counteract the adverse effects of risk factors (Cohen & Wills, 1985). People with body dissatisfaction may develop feeling of inferiority, but if they have high-quality friendships, they can get additional social support, which will alleviate the feeling of inferiority caused by body image and vice versa. Based on this, this study proposes hypothesis 5: For adolescents, the influence of body image distress on inferiority complex will be moderated by the quality of their friendships.

In summary, this study constructed a moderated chain mediation model (see table1). The main purposes include: (1) examining the relationship between body dissatisfactions and social anxiety; (2) exploring the mediating effects of feeling of inferiority and family cohesion on body dissatisfaction and social

anxiety; (3) exploring the moderating effect of friendship quality on body dissatisfaction and social anxiety.

Materials And Method

Participants

A total of 972 high school students from Anhui, China were asked to complete the surveys. After excluding invalid and missing responses (such as missing and regular answers), the final sample include 924 participants ranging from 14 to 19 years old ($M = 15.77$, $SD = 0.855$). 42.3% of participants ($n = 411$) were females and 57.7% ($n = 561$) were males.

Adolescent body dissatisfaction

The Adolescent body dissatisfaction scale is compiled by Gao et al. (2005), and consists of 25 items that assess appearance, body, sex organs and gender dissatisfaction on a 3-point Likert scale with values ranging from 1 as conform to 5 as not conform. An example item is "I am always dissatisfied with my body shape." The lower the score, the higher the level of body dissatisfaction. Reliability analysis revealed a high degree of internal consistency as indicated by Cronbach's $\alpha = 0.844$.

Feeling of inferiority

The "Feeling of inferiority Scale for College, Middle and Primary School Students" compiled by Li et al. (2010) has 22 items, including four dimensions: life inferiority, social inferiority, academic inferiority, and character inferiority. One sample item is, "I feel inferior to him/her because I don't have the superior living conditions as him/her". Each item is answered ranging from "never" to "always" and each response is assigned a score from 1 to 5. The higher score denotes higher Feeling of inferiority. The scale achieved good inter-item reliability with the current sample (Cronbach's $\alpha = 0.931$).

Family cohesion

The Cohesion subscale of the Family Adaptability and Cohesion Scale (FACES) was used to measure family cohesion (Olson, 1983). The subscale contains ten questions that should be answered twice for father and mother separately. An example item is "My parents and I support each other in times of difficulty. The test questions are scored on a 5-point Likert scale ranging from 1= never to 5=always. Higher averaged scores represent higher levels of family cohesiveness. The Cronbach's alpha of the scale with our sample was 0.842.

Friendship quality

The friendship quality was measured by an 18-item scale, which was adapted from the Friendship Quality Questionnaire (FQQ) developed by Parker and Asher (1993). Participants were asked about the feeling with the best friend, such as "We always sit together whenever we get the chance", then responded to all questions on a 5-point scale that was score from 1= not conform at all through 5= totally conform. A

higher score indicates that the participants perceive a higher quality of friendship (Zhou, 2006). The Cronbach's alpha of the scale with our sample was 0.832.

Social anxiety

Social anxiety of the adolescents was assessed by the 19-item Chinese version Social Responsibility Scale, which was developed by Mattick and Clarke (1998) then revised by Ye (2007). The sample items include, "It's difficult for me to make eye contact with others". The scale was rated on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree) and higher score indicated higher social anxiety. The Cronbach's alpha of the scale with our sample was 0.891.

Data analyses

Statistical analyses were performed using SPSS 26.0 and the Process 3.5 macro program, including descriptive statistical analysis, correlation analysis, regression analysis, and test of moderating and mediation effect.

Results

Common method bias

Restricted by objective conditions, the data of all variables in this study were collected by the self-report of the participants, and the relationship between variables may be affected by common method bias. According to the suggestions of Zhou and Long (2004), corresponding controls were carried out in terms of procedures, such as protecting the anonymity of the participants and reducing the guess about the purpose of the measurement. To further improve the rigor of the study, Harman's factorial factor analysis was used to test the common method bias before analyzing the data. The results showed that there were 27 factors with eigenvalues greater than 1 when unrotated, explaining 65.20% of the variance, and the first main factor explains 12.64% of the variance, far less than the critical value of 40%. Therefore, there is no serious common method bias in this study.

Descriptive statistics and correlation analysis

Table 1 shows the descriptive statistics and correlation analysis results for each study variable. Body dissatisfaction and feeling of inferiority have a positive correlation with social anxiety and negative correlation with family cohesion. Friendship quality was significantly positively correlated with family cohesion, while friendship quality and family cohesion were significantly negatively correlated with social anxiety. There was a significant positive correlation between feeling of inferiority and body dissatisfaction, and a significant negative correlation with friendship quality. There was a small significant correlation between body dissatisfaction and friendship quality, indicating that the independent variable and the moderator variable were relatively independent, which was suitable for the subsequent moderation effect test (Wen, 2005).

The relationship between body dissatisfaction and social anxiety: a moderated mediation model test

The results of correlation analysis showed that the relationship between body dissatisfaction, family cohesion, friendship quality, feeling of inferiority, and social anxiety met the conditions for a moderated mediation model test. In the process of result analysis, this study used gender, age, and grade as control variables, and centralized all predictors (Hayes, 2013), and the variance inflation factors of all predictors were lower than 2. There was no multicollinearity problem.

Firstly, after controlling for gender and age, model 6 in the IBM SPSS macro program PROCESS compiled by Hayes was used to explore the chain mediating effect of feeling of inferiority and family cohesion in body dissatisfaction and social anxiety (see Table 2). The results showed that body dissatisfaction had a significant predictive effect on social anxiety ($\beta=0.30, t=9.06, p<0.001$). After introducing the feeling of inferiority and family cohesion, the predictive effect of body dissatisfaction on social anxiety was still significant ($\beta=0.15, t=4.73, p<0.001$), in which body dissatisfaction has a significant positive predictive effect on feeling of inferiority ($\beta=0.35, t=10.98, p<0.001$), and feeling of inferiority had a significant positive predictive effect on social anxiety ($\beta=0.33, t=10.7, p<0.001$); body dissatisfaction had a significant negative predictive effect on family cohesion ($\beta=-0.11, t=-3.01, p<0.01$), and family cohesion had a significant and negative predictive effect on social anxiety ($\beta=-0.16, t=-5.29, p<0.001$).

The results of the mediation test (see Table 3) showed that the upper and lower bounds of the Bootstrap 95% confidence interval of the direct and the chain mediating effect did not contain 0, indicating that body dissatisfaction could not only directly predict adolescents' social anxiety could also significantly predict it through the mediating effect of feeling of inferiority and family cohesion, which verifies the existence of the mediating effect of social anxiety, and the mediating effect accounted for 49% of the total effect.

Secondly, the model 83 in the SPSS macro program PROCESS compiled by Hayes (2017) was used to explore the moderating effect of friendship quality between body dissatisfaction and feeling of inferiority. The results are shown in Table 4.

In order to reveal the moderating role of friendship quality more clearly, friendship quality was divided into high and low groups according to one positive and negative standard deviations, and a simple slope test was performed to examine the relationship between body dissatisfaction, feeling of inferiority and friendship quality. The simple effect analysis diagram was shown in Figure 2.

The results showed that when the friendship quality was high, body dissatisfaction significantly predicted inferiority ($\beta_{\text{simple}}=0.44, t=6.85, p<0.05$), and when it was low, body dissatisfaction also significantly predicted inferiority ($\beta_{\text{simple}}=0.67, t=10.25, p<0.05$). It indicates that friendship quality had a moderating effect on the relationship between body dissatisfaction and feeling of inferiority.

Discussion

This study proposed a moderated mediation model and revealed that body dissatisfaction was positively associated with social anxiety. Feeling of inferiority and family cohesion were found to play a chain-mediated role in the relation between body dissatisfaction and social anxiety. In addition, friendship quality plays a moderating role in the relationship between body dissatisfaction and feeling of inferiority. According to ecological systems theory, it suggested that family cohesion and friendship quality, as important elements in the microsystem of adolescents, interacted with each other, and interacted with the core parts of the ecosystem, such as body dissatisfaction and feeling of inferiority. These effects in turn have an impact on the individual's psychological characteristics-social anxiety. These findings show lights on how body dissatisfaction is associated with social anxiety in adolescents.

The relationship of body dissatisfaction and social anxiety

The present study suggested that higher body dissatisfaction is associated with higher social anxiety among adolescents, confirming past finding with adult samples (Vassilopoulos, 2005), as well as with adolescents (Hodson et al., 2008). The findings supported the initial hypothesis and further supported the cognitive model of social phobia (Clark & Wells, 1995), that the self-image in the mind of social phobia is negative and partially distorted. Hulme et al. (2012) proposed that the self-memory system is responsible for the retrieval of self-related information in a specific context, and the self-image represents the working self in the self-memory system. A positive self-image can produce a positive working self (Hulme et al., 2012). Experiments have shown that participants who produce positive self-images always use emotion regulation strategies and experience less anxiety and discomfort (Lee et al., 2019). When faced with body-related stimuli, people with body dissatisfaction were significantly less likely to spontaneously use rational emotion regulation strategies, such as cognitive reappraisal (Schaefer et al., 2015). In social situations, unreasonable emotion regulation strategies can maintain or increase social anxiety (Spokas et al., 2009). Therefore, body dissatisfaction is significantly positively correlated with social anxiety.

The chain mediating effect of feeling of inferiority and family cohesion

Consistent with Hypothesis 2, this study shows that feeling of inferiority play a partial mediating role in the relationship between body dissatisfaction and social anxiety. Due to the dramatic changes in physiology, cognition, and emotions that occur during adolescence, adolescents pay more attention to their bodies. Existing studies have found that body dissatisfaction in both boys and girls increases dramatically during adolescence and plateaus in early adulthood (Bucchianeri et al., 2013; Gattario & Frisen, 2019). Adolescence is also a critical period for the formation of self-esteem (Harter & Leahy, 2001). When adolescents feel dissatisfied with their body image, they may experience negative emotion (e.g., disappointment, shame) (Conradt et al., 2007) and poor self-esteem (Davison & McCabe, 2006; French et al., 1996). While shame is often caused by not meeting a certain standard (Pila et al., 2015), low self-esteem is a sense of low value or low ability (Duchesne et al., 2017). And feelings of inferiority arise when individuals feels that he is inferior to someone in some way, or he does not meet the standard (Adler, 1996; Yao et al., 1996). Thus, body dissatisfaction was positively correlated with feeling of inferiority, and this finding was consistent with those from previous studies (BeLue et al., 2009; Gupta

& Gupta, 2013; Koo, 1995). People with high level of feeling of inferiority always perceive the environment as threatening (Adler, 1996), which may lead to low levels of social interest (Akdoğan, 2017; Brough, 1994) and social avoidance (Akdoğan & Çimşir, 2019). Therefore, people with feeling of inferiority are more likely to show social anxiety in social situations. Previous research found that compared with non-socially anxious people, people with social anxiety have more negative evaluation of themselves and their social performance (Dodge et al., 1988).

In addition, the study shows that adolescents' body dissatisfaction indirectly affects their social anxiety through family cohesion. The higher level of body dissatisfaction in adolescents, the lower the family cohesion, and the more obvious social anxiety. Hypothesis 3 is supported. Considerable research has demonstrated that individuals with high family cohesion show less body dissatisfaction (Anschutz et al., 2009; Golan & Crow, 2004). However, to our knowledge, little existing research has tested the influence of body dissatisfaction on family cohesion. Our finding elucidates the function of family cohesion in the relationship between body dissatisfaction and social anxiety. Most adolescents experience a sharp increase in body dissatisfaction during early adolescence (Grogan, 2021), while studies on Chinese families have found that appearance is one of the main sources of parent-child conflict, and it is difficult for both parties to reach a consensus (Fang, 1998). In the face of conflicts, parents and adolescents more often adopt passive, negative, confrontational or avoidant ways (Riesch et al., 2003), which cannot achieve effective communication (Montemayor, 1986) and are not conducive to problem solving, and then it will damage the parent-child relationship. Family cohesion, as a dimension of parent-child relationship will also be affected (Olson, 1983).

Studies have confirmed that a positive and harmonious parent-child relationship is conducive to the establishment of a secure attachment relationship, improves emotional security, and reduces the occurrence of behavioral problems (Beavers & Hampson, 2000), while negative parent-child attachment will damage children's interpersonal relationships and increase the incidence of behavioral problems, social anxiety and risk of depression (Bögels & Brechman-Toussaint, 2006). Therefore, family cohesion has a negative predictive effect on adolescent social anxiety (Johnson et al., 2001; Wentzel & Feldman, 1996).

This study also found that feeling of inferiority and family cohesion play a chain-mediated role in the relation of body dissatisfaction and social anxiety. The higher level of body dissatisfaction in adolescents, the stronger the feeling of inferiority, and the lower the family cohesion. Hypothesis 4 was verified. According to Erikson's psychological development theory, the main developmental task of adolescence is to explore self-identity (Erikson, 1993). Children's attitude towards their parents has changed from compliance and dependence to separation and attachment (Grotevant & Cooper, 2009), and they want to gain more independence and autonomy. Getting rid of parental control (Steinberg & Silverberg, 1986) leads to an increase in parent-child conflict (Galambos & Almeida, 1992). Studies have found that people with high feeling of inferiority are more likely to experience negative emotions such as depression, loneliness, hostility (Akdoğan & Ceyhan, 2014), and behaviors like insomnia and suicide (Lee, 2008). On the one hand, children's emotional and behavioral problems will bring great psychological

pressure to their parents (Blanchard et al., 2006). On the other hand, children with a strong sense of inferiority feel that they are not worthy of being loved (Adler, 1996) and tend to hide themselves and not communicate in the face of conflicts (Akdoğan, 2017). These are detrimental to the development of family cohesion, and further affect the level of social anxiety.

The moderating effect of friendship quality

This study found that friendship quality not only had a negative predictive effect on feeling of inferiority, but also moderated the mediating role of feeling of inferiority in the relationship between body dissatisfaction and social anxiety. At low levels of friendship quality, body dissatisfaction can significantly predict feeling of inferiority, while high levels of friendship quality can effectively buffer the negative effects of body dissatisfaction, hypothesis 5 is validated. First, according to social comparison theory, when individuals compare themselves with others, they may have feelings of inferiority, which will reduce their sense of self-worth and produce painful emotional experiences (Tiedens et al., 2004). But high-quality friendships can provide individuals with safety, support, and promote a sense of self-worth (Bukowski et al., 1994), all of which can help alleviate an individual's sense of inferiority. Second, high quality friendship means that individuals can get more social support from friends (Rubin et al., 2004), which can increase their psychological capital to cope with stressful events (Demir & Weitekamp, 2007), so friendship quality is often act as a protective factor on for negative psychology, thereby affecting the effect of risk factors on the individual's psychology. High friendship quality can not only provide adolescence with external social support, obtain spiritual comfort and a sense of belonging (Lacourse et al., 2003), but also improve individual pleasure, happiness and inner sense of self-worth (Demir & Weitekamp, 2007; Troop-Gordon et al., 2015), thereby alleviating the feeling of inferiority caused by body dissatisfaction. Individuals with low friendship quality are prone to conflict with others (Rubin et al., 2006) and lack the ability and skills to regulate negative emotions due to the lack of effective communication and experience sharing among peers (Buhs et al., 2006), which is not conducive to the relief of feeling of inferiority. In conclusion, body dissatisfaction increases the likelihood of social anxiety through feeling of inferiority, but high levels of friendship quality can reduce feeling of inferiority through improved self-worth.

Strengths, limitations, and future directions

Based on the ecological systems theory, this study examined the mechanisms of body dissatisfaction on social anxiety from the perspectives of environmental and individual factors. Also, it suggested how social support and external environmental factors such as family cohesion and friendship quality affect the mechanism of social anxiety. The results verified and enriched the model of social anxiety of adolescence. In addition, this study also provides theoretical guidance and empirical evidence for how to alleviate adolescent social anxiety. First, it is necessary to pay full attention to the role of body dissatisfaction in adolescents' social anxiety. Educators need to guide adolescents to have a better attitude toward appearance and relieve adolescents' feeling of inferiority and social anxiety caused by body dissatisfaction. Secondly, parents need to pay attention to the emotional development with their

adolescent children, providing them with a good family environment, psychological support and skills to make friends, etc., so as to improve the children's ability to turn negative emotions into positive emotions, thereby reducing the possibility of children's social anxiety. It is of great significance to promote their mental health development.

However, some limitations of our study should be noted. First, this study used cross-section data to assess the link among variables during adolescence, which cannot reveal the causal relationship between variables, and can only infer the relationship between variables during adolescence, the environment and interpersonal communication styles of individuals after puberty will change. Future research needs to further identify and explore the relationship between the above variables and their dynamic changes. Second, variables in this study all were exclusively assessed by self-report measure, the measure of family cohesion is the child's perception rather than actual family cohesion, although the former may have a greater impact on adolescent development and adaptation than the latter, but to understand the role of family cohesion more fully, future research would benefit from using multi-informant reports of family cohesion (such as using both parent reports and adolescent self-reports). Finally, teacher and class cohesion, as an important social environment in the class environment, also play an important role in the psychological development of adolescents. Future research can comprehensively explore the influence of such factors on adolescents' social anxiety and other psychology.

Conclusion

Adolescent body dissatisfaction can positively predict social anxiety. Feeling of inferiority and family cohesion have a chain mediating effect between body dissatisfaction and social anxiety. Meanwhile, friendship quality has a moderating effect on the relationship between body dissatisfaction and feeling of inferiority.

Declarations

Acknowledgements

Informed Consent

Informed consent was obtained from all individual participants included in the study.

Ethics approval

This study was approved and consented by the Ethics Committee of The School of psychology of Liaoning Normal University.

Conflict of interest

The authors have no relevant financial or non-financial interests to disclose.

Availability of data and material

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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Authors' contributions

Hui Xu and Qianqian Dou conceived the study and designed the trial. Ruosong Chang and Qianqian Dou supervised the conduct of the trial, data collection, provided statistical advice on study design and analyzed the data. Qianqian Dou drafted the manuscript, and all authors contributed substantially to its revision. Hui Xu took responsibility for the paper as a whole.

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Tables

Table 1. Descriptive statistics and correlation analysis results of each variable (N=924)

Variables	M	SD	1	2	3	4	5	6	7
1 Sex			-						
2 Age	15.77	0.86	-0.12**	-					
3 Body dissatisfaction	44.90	8.45	0.27**	-0.11**	-				
4 Friendship quality	64.77	10.26	0.15**	0.02	0.09**	-			
5 Feeling of inferiority	33.57	12.90	0.07*	-0.06	0.35**	-0.10**	-		
6 Family cohesion	32.77	6.10	0.05	0.02	-0.14**	0.28**	-0.19**	-	
7 Social anxiety	52.62	13.60	0.13**	-0.07*	0.31**	-0.22**	0.42**	-0.24**	-

Note: 1. Gender is a dummy variable, male = 0, female = 1, and the mean represents the proportion of females.

2. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, the same below

Table 2. The mediating effect test of social anxiety

Regression equation		Fit metrics			Coefficient significance		
N=924							
outcome variable	predict variable	<i>R</i>	<i>R</i> ²	<i>F</i>	β	95% CI	<i>t</i>
SA	sex	0.32	0.10	34.45	0.09	[-0.04, 0.22]	1.43
	age				-0.04	[-0.11, 0.03]	-1.13
	BD				0.30	[0.23,0.03]	9.06***
FI	sex	0.35	0.12	42.87***	-0.05	[-0.18,0.07]	-0.85
	age				-0.03	[-0.10,0.05]	-0.7
	BD				0.35	[0.29,0.42]	10.98***
FC	sex	0.22	0.05	12.04***	0.18	[0.05,0.32]	2.71**
	age				0.01	[-0.07,0.08]	0.17
	IF				-0.16	[-0.23, -0.09]	-4.63***
	BD				-0.11	[-0.18, -0.04]	-3.01**
SA	sex	0.49	0.24	57.00***	0.14	[0.02,0.26]	2.33*
	age				-0.03	[-0.10,0.04]	-0.92
	IF				0.33	[0.27,0.39]	10.7***
	FC				-0.16	[-0.21, -0.10]	-5.29***
	BD				0.15	[0.09,0.22]	4.73***

Notes BD, body dissatisfaction; SA, social anxiety; IF, feeling of inferiority; FC, family cohesion.

Table 3 Decomposition table of total effect, direct effect and indirect effect

	Effect	Boot SE	Boot CI lower limit	Boot CI upper limit
Total effect	0.30	0.03	0.23	0.36
Direct effect	0.15	0.03	0.09	0.22
Indirect effect	0.14	0.02	0.10	0.19

Note: Boot SE, Boot CI lower limit and Boot CI upper limit refer to the standard error of indirect effects estimated by the bias-corrected percentile Bootstrap method, and the upper and lower limits of the 95% confidence interval, respectively, the same below.

Table 4 Moderated mediation test

Regression equation N=924		Fit metrics			Coefficient significance		
Outcome variable	Predictor variable	<i>R</i>	<i>R</i> ²	<i>F</i>	<i>β</i>	95% CI	<i>t</i>
FI	sex	0.38	0.15	31.27	-0.02	[-0.15,0.11]	-0.27
	age				-0.02	[-0.09,0.05]	-0.61
	BD				0.36	[0.30,0.43]	11.38
	FQ				-0.13	[-0.19, -0.07]	-4.15***
	BD*FQ				-0.08	[-0.14, -0.02]	-2.66**
FC	sex	0.22	0.05	12.04	0.18	[0.05,0.32]	2.71
	age				0.01	[-0.07,0.08]	0.17
	BD				-0.11	[-0.18, -0.04]	-3.01**
	FI				-0.15	[-0.23, -0.09]	-4.63**
SA	sex	0.49	0.24	56.99	0.14	[0.02,0.26]	2.34
	age				-0.03	[-0.10,0.04]	-0.92
	FI				0.33	[0.27,0.39]	10.71***
	BD				0.15	[0.09,0.22]	4.73***
	FC				-0.16	[-0.21, -0.10]	-5.29**

Notes BD, body dissatisfaction; SA, social anxiety; IF, feeling of inferiority; FC, family cohesion FQ, friendship quality.

Figures

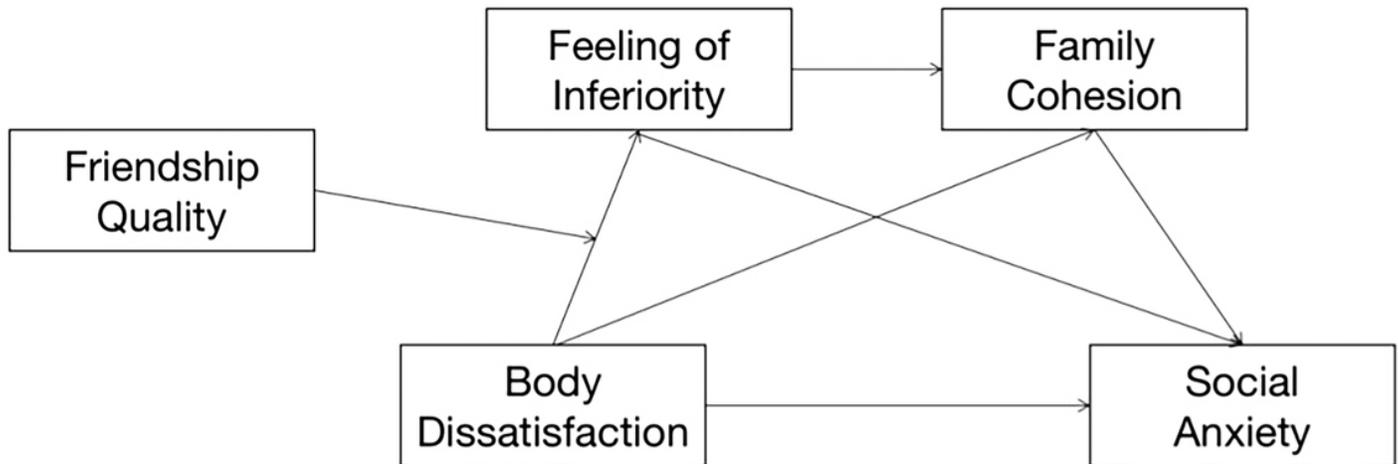


Figure 1

A model of the relationship between body image dissatisfaction, social anxiety, feeling of inferiority, family cohesion, and friendship quality body dissatisfaction was associated with social anxiety. Feeling of inferiority and family cohesion play a chain-mediated role in the relation between body dissatisfaction and social anxiety. Friendship quality plays a moderating role in the relationship between body dissatisfaction and feeling of inferiority.

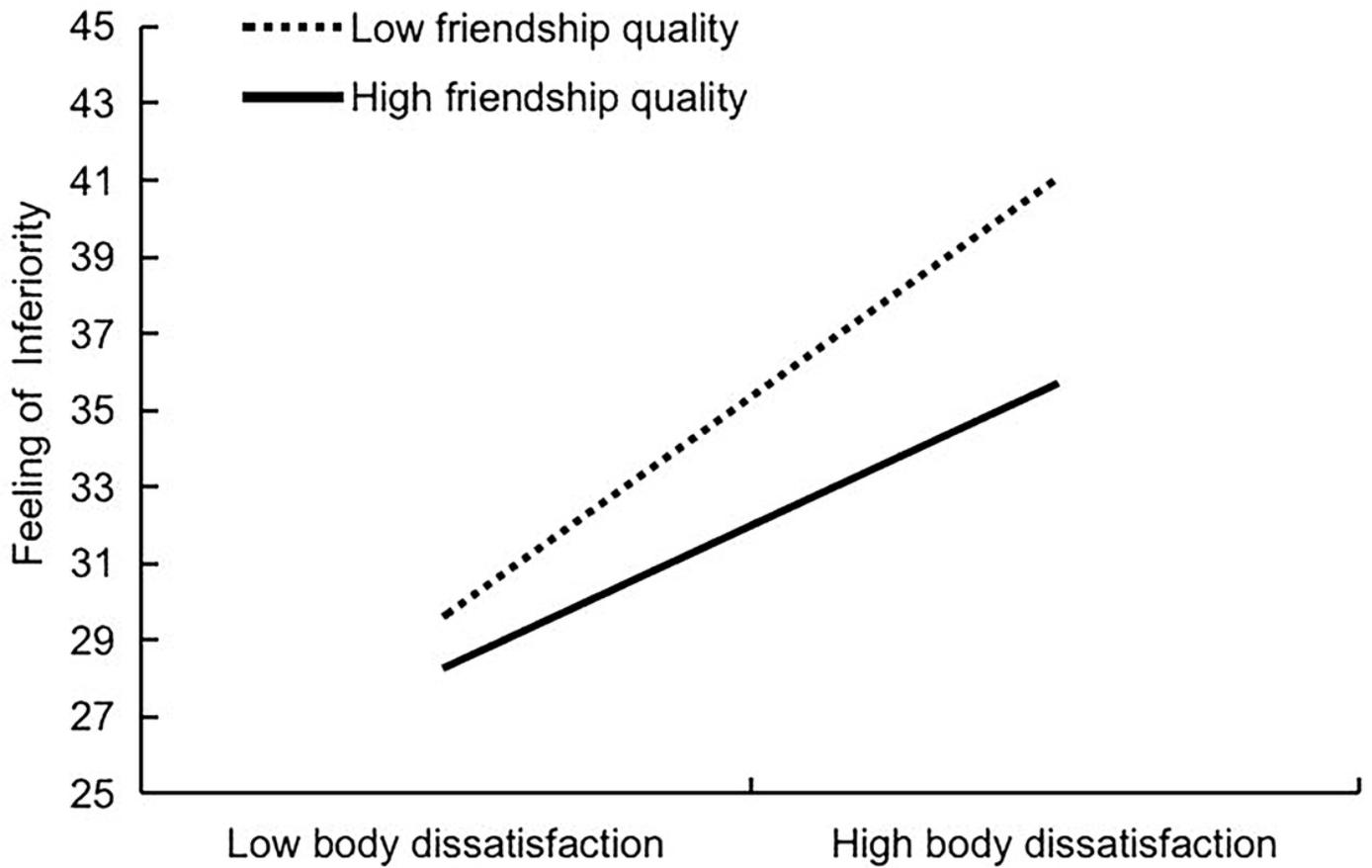


Figure 2

The moderating effect of friendship quality on the relationship between body dissatisfaction and feeling of inferiority. When the friendship quality was high, body dissatisfaction significantly predicted feeling of inferiority ($\beta_{simple}=0.44, t=6.85, p<0.05$), and when it was low, body dissatisfaction also significantly predicted feeling of inferiority ($\beta_{simple}= 0.67, t=10.25, p<0.05$).

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