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The relationship between appearance anxiety and depression among Chinese college students: A serial multiple mediation model

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Background. Appearance anxiety is a popular topic in adolescence, and adolescents tend to be more sensitive to their appearance, and they may be at higher risk for depression. However, few studies have revealed the mechanisms linking appearance anxiety and depression in college students. The aim of this study was to explore the multiple mediating roles of interpersonal sensitivity and social support between appearance anxiety and depression among college students. **Methods.** A total of 724 college students completed questionnaires containing basic demographic characteristics, appearance anxiety scale, interpersonal sensitivity scale, perceived social support scale, and depression scale. Sequential multiple mediation analyses were performed using Hayes' PROCESS macro. **Results.** We found that appearance anxiety can not only directly affect depression, but also indirectly affects depression through three significant mediating pathways: (1) interpersonal sensitivity (B=0.107, 95% CI [0.083,0.132]), accounting for 50.23% of the total effect. (2) perceived social support (B=0.017, 95% CI [0.008,0.030]), accounting for 8.00% of the total effect. (3) interpersonal sensitivity and perceived social support (B=0.009, 95% CI [0.004,0.016]), which accounted for 4.23% of the total effect. The total mediating effect was 62.44%. **Limitations.** It is a cross-sectional research method and the causal relationship is unclear. **Conclusions.** This study found that lower interpersonal sensitivity and higher social support can effectively reduce depression caused by appearance anxiety among college students. The schools and related departments should take measures to reduce the interpersonal sensitivity of college students and establish reliable social support, thus reducing the occurrence of depression.

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Abstract

Background. Appearance anxiety is a popular topic in adolescence, and adolescents tend to be more sensitive to their appearance, and they may be at higher risk for depression. However, few studies have revealed the mechanisms linking appearance anxiety and depression in college students. The aim of this study was to explore the multiple mediating roles of interpersonal sensitivity and social support between appearance anxiety and depression among college students. **Methods.** A total of 724 college students completed questionnaires containing basic demographic characteristics, appearance anxiety scale, interpersonal sensitivity scale, perceived social support scale, and depression scale. Sequential multiple mediation analyses were performed using Hayes' PROCESS macro. **Results.** We found that appearance anxiety can not only directly affect depression, but also indirectly affects depression through three significant mediating pathways: (1) interpersonal sensitivity (B=0.107, 95% CI [0.083,0.132]), accounting for 50.23% of the total effect. (2) perceived social support (B=0.017, 95% CI [0.008,0.030]), accounting for 8.00% of the total effect. (3) interpersonal sensitivity and perceived social support (B=0.009, 95% CI [0.004,0.016]), which accounted for 4.23% of the total effect. The total mediating effect was 62.44%. **Limitations.** It is a cross-sectional research method and the causal relationship is unclear. **Conclusions.** This study found that lower interpersonal sensitivity and higher social support can effectively reduce depression caused by appearance anxiety among college students. The schools and related departments should take measures to reduce the interpersonal sensitivity of college students and establish reliable social support, thus reducing the occurrence of depression.

Keywords: appearance anxiety; depression; interpersonal sensitivity; social support; mediate

Introduction

Depression is an important public health problem that affects more than 300 million people worldwide, and the overall prevalence of depression among college students in China is 23.8%, and it is twice as common in adolescents as in children[1-3].It has been shown that college students have an increased risk of depression than others[4].The onset of depression can lead to a negative state of mind, poor sleep quality, and health-hazardous behaviors such as smoking, drinking, substance abuse, and poor eating and living habits[5, 6]. These behaviors may lead to hypertension, obesity, diabetes and other diseases in the future, which seriously reduce the quality of life and increase the economic burden[7]. What's more important is that the global suicide rate caused by depression is increasing every year, and depression is a major risk factor for adolescents' suicide[6]. According to existing studies, although there are many factors influence adolescents' depression, such as anxiety, appearance satisfaction, interpersonal sensitivity, and social support, the complex relationships among the influencing factors are still unclear and need to be further investigated[8-11].

Appearance anxiety (AA) refers to individuals who are overly concerned about their appearance, and then they may become unconfident and anxious about their appearance when they perceive social standards or poor evaluations of themselves by others[12]. Advances in a cognitive behavioural model of body dysmorphic disorder proposed: when individuals compare themselves to the least likely ideal appearance, it leads to negative emotions and these negative emotions can cause individuals to engage in self-protective behaviors such as avoidance[13, 14]. Some adolescents may be bullied, harassed, and ridiculed because of their appearance, which exacerbates adolescents' AA and gradually develops distorted perceptions and aversion to their own appearance[13, 15]. A cross-sectional study showed that people who had their eyes removed with higher levels of concern about their appearance than others were more likely to suffer from depression[16]; Anabolic-androgenic steroid users are at greater risk of depression if they have appearance problems[17]; Dissatisfaction with physical appearance can act as a mediator to influence the relationship between self-esteem and depression[11]. A study in Coimbatore showed that 77.6% of college women were dissatisfied with body image and depression was significantly associated with it[18]. At the same time, anxiety and depression are closely related, they are comorbidity, and anxiety is a risk factor for depression[19]. Studies have demonstrated that elevated levels of anxiety are associated with depression among college students in Latin America[10]. Based on existing studies, we can reasonably speculate that there is a link between AA and depression among college students.

Interpersonal sensitivity (IS) is one of the mental health problems faced by contemporary college students[20]. IS was first proposed by Boyce and Parker and is considered as a personality trait that usually manifests itself as an over-understanding of the behavior and emotions of others[21]. Discomfort and anxiety will happen on people with IS trait when they are interacting with people, which lead social anxiety and a strong sense of low-esteem, making individuals vulnerable to developing depression. They also often change their behavior to conform to the expectations and ideas of others[22, 23]. Some researchers have used structural equation modeling to show that IS moderates anxiety states in participants who were abused as children, and that also moderates AA in adolescents[24, 25]. Among Chinese college students, negative mood is correlated with IS, and it is one of the predictors of depression[8, 20]. Then, can IS be used as a mediating variable to moderate the relationship between AA and depression among college students? Further research is needed.

Social support (SS) refers to a social network of family, friends, teachers and classmates that provides emotional supports and practical help to individuals[26]. SS is a key factor in the mental health of college students and makes an important contribution to the mental health of adolescents[27, 28]. Peirce et al. constructed a model based on social support theory and found that SS was negatively associated with depression[29]; Study made by Jaycox et al. reported an effect of social interaction on depression in adolescents[30]. SS can significantly reduce the anxiety levels of community residents during the COVID-19 outbreak in Turkey in 2020[31]. Body image and SS in patients with Psoriasis were found to be major contributors to depression[32]. Meanwhile, SS was also a reliable predictor of IS and depression[33].

Based on the available studies, we can speculate that there is some relationship between AA, IS, SS and depression. To our knowledge, there are fewer studies on the mechanisms between AA and depression among Chinese college students, and there is a lack of studies demonstrating the mediating role of IS and SS in the relationship between AA and depression. Therefore, this study aimed to investigate the relationship between AA, IS, SS, and depression, as well as to explore the multiple mediating roles of IS and SS between AA and depression in college students. The purpose of this study is to gain a deeper understanding of the factors influencing depression and to provide a theoretical basis for the development of public health policies in relevant sectors. To prevent depression from the source and consciously reduce the risk of depression among college students, thus maintaining their physical and mental health at a high level. Based on the above, we propose the following three hypotheses:

H1: AA positively predicts depression among college students.

H2: AA indirectly predicts depression through high IS among college students.

H3: AA indirectly predicts depression through low SS among college students.

H4: AA indirectly predicts depression through high IS and low SS among college students.

Materials & Methods

2.1. Participants and Procedure

This study adopted a cross-sectional survey. From February 2 to February 5, 2023, a convenience sampling was used to recruit 737 college students for an online questionnaire survey at Chongqing Medical University. Respondents were briefed by professional investigators on the survey content and purpose prior to the survey to seek informed consent. The questionnaire included the Basic demographic variables, the Appearance Anxiety Scale-Brief Version (AASBV), the Perceived Social Support Scale (PSSS), the SCL-90 Interpersonal Sensitivity Subscale and the Patient Health Questionnaire(PHQ-9). The questionnaires were distributed and collected relying on the Questionnaire Star platform online. The inclusion criteria for this study were university students at Chongqing Medical University and after removing missing and invalid data, the remaining sample size was 724.

2.2. Measurement

2.2.1. Appearance anxiety

Appearance anxiety was measured by the Appearance Anxiety Scale-Brief Version (AASBV) written by Dion[12]. The Appearance Anxiety Scale-Brief Version consist of 14 items. We use a 5-point Likert scale ranging from 1 (never) to 5 (almost always), which reflects the respondents' combined attitudes toward appearance anxiety with a total score ranging from 14 to 70. The higher the overall score is, the higher the degree of appearance anxiety is[34].The Chinese version of the Appearance Anxiety Scale we chose is a short version which has good reliability and validity and the Cronbach’s alpha measured was 0.876.

2.2.2. Social support

We use the Perceived Social Support Scale（PSSS）to measure social support[35]. Response to an item was measured on a 7-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree). It has 12 items in total, and the total score reflects the total social support felt by the individual. The scale has three dimensions: family support, friends support, and others support. The overall score between 12-36 is a low support status; 37-60 is a medium support status; 61-84 is a high support status; the higher the overall score is, the higher the individual's social support people have[36]. In this study, the Cronbach's alpha for the scale was 0.930.

2.2.3. Interpersonal sensitivity

We used the Symptom Check List-90 (SCL-90) to assess respondents' interpersonal sensitivity[37]. The SCL-90 invented by Derogatis can be used to assess the intensity of self-reported symptoms, and the scale contains a number of subscales. We used one of them which is called the Interpersonal Sensitivity Subscale (9 items in total) to assess the intensity of interpersonal sensitivity among students at Chongqing Medical University. Responses to items are measured on a 5-point Likert scale (0=none 4=critical), with a total score ranging from 0-36. Subscale score greater than 2 indicates a psychological abnormality[38]. The Cronbach's alpha measurement for this subscale is 0.855, which is more than 0.8 with high reliability.

2.2.4. Depression

We use the Patient Health Questionnaire (PHQ-9) to measure depression[39]. PHQ-9 consists of nine items for depression self-assessment. The scale is efficient and convenient making it widely used in real life. It rated on a 4-point Likert scale with a score ranging from 0 to 3 and a total score range of 0-27 on the scale. The cut-offs have been proposed as 0–4, 5–9, 10–14, 15–19 and 20- 27 for no, mild, moderate, moderately severe and severe depression respectively[40].The Cronbach's alpha for this component in this study was 0.852.

2.3. Statistical Analysis

This study used the Statistical Package for the Social Sciences (SPSS) version 25.0 to analyze the data. Pearson's correlation was used to analyze the correlations between the appearance anxiety, social support, interpersonal sensitivity and depression. The Harman one-way test was used to judge whether there were significant common method deviations. For further understanding the relationship between the above variables, a serial multiple mediation model (model 6) was performed using PROCESS macro 3.5 software for SPSS provided by Hayes. Gender and age were used as covariates, appearance anxiety as the independent variable (X), interpersonal sensitivity and social support as mediating variables (M1, M2) and depression as the dependent variable(Y). After the model was built, the mediation effects were tested using a bootstrap (5000 bootstrap samples) based on 95% confidence intervals. If the 95% confidence interval for the mediating effect does not include zero, the mediating effect will be significant at the 0.05 level. The model of this study was tested to be significant at the 0.05 level.

Results

3.1. Common method biases

Factor analyses were conducted simultaneously for all items of AA, IS, SS, and depression using Harman's one-way test. There were 7 factors with eigenvalues greater than 1. The variance explained by the first factor was 26.80%, which was less than the critical criterion of 40%, and we concluded that there was no significant common method bias in this study.

3.2. Correlation analysis

The correlation matrix of key study variables is presented in Table 1. IS and AA were positively correlated ($r = 0.568$, $p < 0.01$); AA and IS were negatively correlated with SS (AA: $r = -0.323$, $p < 0.01$; IS: $r = -0.319$, $p < 0.01$); AA and IS were positively correlated with depression (AA: $r = 0.438$, $p < 0.01$; IS: $r = 0.534$, $p < 0.01$), and SS was negatively correlated with depression ($r = -0.344$, $p < 0.01$).

3.3. Multiple mediation analyses of the hypothesized model

A multiple mediation analysis was conducted to explore the mediation effects of IS and SS in a college student population. Control variables included gender and age. AA and depression were entered as independent and dependent variables respectively. The proposed mediators were IS and SS. Results of the analysis (Table 2) showed that AA was positively correlated with IS ($a1 = 0.570$, $p < 0.001$) and negatively correlated with SS ($a2 = -0.218$, $p < 0.001$). IS was negatively correlated with SS ($d21 = -0.120$, $p < 0.001$). In addition, IS was positively correlated with depression ($b1 = 0.388$, $p < 0.001$) and SS and depression were negatively correlated ($b2 = -0.163$, $p < 0.001$). AA was positively correlated with depression ($c' = 0.167$, $p < 0.001$).

The mediation path model is presented in Figure 1. The path coefficients show that all relationships in the model are significantly positive and negative. After including the two mediators, IS and SS, the direct effect of AA on depression remained significant. Thus, the association between AA and depression was partially achieved through these two mediators.

3.4. Bootstrap test of mediators

To test whether the mediating effect of IS and SS is significant, we performed bootstrap estimation procedure with 5000 bootstrap samples. The total effect, direct effect, and indirect effect are presented in Table 3. The path coefficients for the 95% CI of the paths do not include 0. As shown in Table 3, the significance of the direct effect of AA on depression (c'=0.081, 95% CI [0.045-0.116]) remained when the mediators (IS and SS) were included in the model. AA was found to indirectly affect psychological stress through three significant mediation pathways: (1) IS (B=0.107, 95% CI [0.083-0.132]), which accounted for 50.23% of the total effect, (2) SS (B=0.017, 95% CI [0.008-0.030]), which accounted for 8.00% of the total effect, and (3) IS and SS (B=0.009, 95% CI [0.004-0.016]), which accounted for 4.23% of the total effect. The total mediating effect was 62.44%.

Discussion

AA has long been a hot topic in adolescence. At the stage of physical and mental maturity, teenagers are delicate and sensitive, and they begin to care about their appearance, but external pressure on their appearance can lead to negative emotions. The data of this study was collected online from February 2 to February 5, 2023 and from students at Chongqing Medical University. This study is the first to explore the effects of IS and SS on adolescents' AA and depression in a sample of 724 at Chongqing Medical University in Chongqing, China, and to investigate the effects of SS and IS as mediating variables on AA and depression mechanism. The results of this study will contribute to the early detection and timely intervention of depression among college students, actively respond to the Plan of Health China 2030, and contribute to the healthy physical and mental growth of college students.

Our study found that AA positively and significantly predicted the onset of depression in a college student population, which is consistent with the findings of a study exploring the relationship between appearance and psychological distress in patients with rheumatic diseases[41]. In the 21st century when the Internet is developed, various social platforms and media are flourishing, and college students are surfing online while perceiving a large number of social standards for judging appearance and are exposed to an ideal appearance that does not correspond to reality and cannot achieve[42]. They gradually begin to pay excessive attention to their appearance and worry that they will be arbitrarily evaluated and deliberately kept away by others because of their appearance, this may even lead to thoughts of not being able to find a partner, to the point where anxiety gradually develops[43]. It is undeniable that appearance is the most intuitive "first face" in human interaction, we can use make-up to strengthen the confidence in our appearance, but it is more important to establish the correct concept of appearance and lessen the chance of AA. As mentioned in social comparison theory and self-discrepancy theory, when individuals compare themselves upward with other individuals or compare their ideal selves with their real-life selves, a discrepancy is created, which can lead to emotional vulnerability, anxiety and exacerbate depression[44, 45]. Previous studies have found that if they are more sensitive and attentive to their appearance than others, they may take a higher risk of depression[46]. Depression is the leading cause of illness and disability among adolescents[47]. When depression occurs during adolescence, they have a higher rate of recurrence of depression in the future and their quality of life will be seriously affected, which will increase the economic and health burden of society[48, 49]. In this regard, the relevant departments should strengthen the control of internet content, and schools can offer courses on appearance and dressing to help college students establish the correct perception of appearance, improve the "bluntness" of appearance, and reduce the anxiety generated by appearance.

Our study shows that IS mediates the relationship between AA and depression, with the mediating effect accounting for 50.23% of the total effect, so our hypothesis 2 holds. In other words, IS not only is a mental health problem for college students, but also has a great potential to affect depression in college students with appearance anxiety. College students with high IS are overly concerned about the feelings and behaviors of others, fear negative evaluation and

rejection from others, therefore they are psychologically fragile and sensitive. Such students are at high risk of losing themselves and becoming depressed in order to avoid rejection and criticism, and previous studies have confirmed that people with IS traits are more likely to develop depression[22]. In this regard, group counseling has been widely used in intervention studies of interpersonal communication and prevention of depression among college students with good results, and previous studies have also confirmed that group sand tray game therapy can effectively reduce IS of college students[50, 51]. Schools and other relevant departments can learn from the existing studies and actively carry out activities such as group counseling and group sand tray games to help individuals reduce IS and the occurrence of depression among college students.

Our study confirmed the validity of hypothesis 3. The mediating effect of SS between AA and depression accounted for 8% of the total effect, which can be interpreted as an effect of SS on depression caused by AA. SS is an important resilient resource for individuals in social life and a protective factor for college students' physical and mental health, which can enable college students to gain more confidence and energy. Maslow's hierarchy of needs theory suggests that active communication with family, friends, teachers and classmates can enhance inner sense of belonging and satisfaction and reduce negative emotions such as anxiety and depression[52]. The results of this study showed that SS was significantly and negatively correlated with AA and depression (AA $r=-0.323$, $p<0.01$; depression $r=-0.344$, $p<0.01$), indicating that higher SS can maintain a good emotional experience for individuals, enhance the coping and handle ability of college students when facing AA, and reduce the anxiety and depression caused by appearance[53]. AA may prompt college students to reduce social frequency, become sensitive and low self-esteem, and less sociable. Lower SS may increase their risk of depression[52]. Relevant departments should give high priority to the occurrence of depression among college students starting from their living and studying environment, guide them to reduce the evaluation of appearance of people around them, give them sufficient and reliable SS, build a good platform to communicate with them, and improve their coping ability and interpersonal skills.

From the regression model of this study, the total mediating effect was 62.44%, and the mediating effect of IS and SS between AA and depression accounted for 4.23% of the total effect. The correlation analysis showed a significant two-by-two correlation between AA, IS, SS and depression, indicating that our hypothesized mediators (SS and IS) play a significant role in the relationship between AA and depression, and these results are consistent with our hypothesis 4: AA can indirectly predict depression through high IS and low SS. Our findings enriched the mediating influences of AA leading to depression: college students with AA faced with higher SS or lower IS would reduce the occurrence of depression. Also, the results found that IS was significantly and negatively correlated with SS ($r=-0.319$, $p<0.01$), meaning that among college students with AA, those with lower IS received more SS and thus reduced the incidence of depression. College students are the backbone of social construction and development in the future, and although adolescence is often considered to be the best stage of health, this is by no means a reason to neglect the physical and mental health of college students. All departments

should take active measures to attach great importance to the physical and mental health of college students and draw a blueprint for a healthy and happy future together.

Conclusions

The study confirmed that the four hypotheses mentioned in the introduction hold true. Specifically, lower IS and higher SS can effectively reduce depression caused by AA among Chongqing medical students. It also reconfirmed that AA can directly or indirectly influence the occurrence of depression in college students. In our study, we also found a significant presence of IS and SS as mediators regulating the mechanism of action between AA and depression. It helps to clarify the potential mechanisms between AA and depression. The aim is to improve the physical and mental health of college students and appeal to the social to give high priority to young people. At the same time, college students should also actively communicate with people around them, improve their interpersonal skills and not over-interpret the feelings and behaviors of others to reduce their own psychological burden.

Although all the hypotheses in the study are valid, the limitations in the study must also be acknowledged. Firstly, it is a cross-sectional research method and the causal relationship among AA, IS, SS and depression is unclear so the longitudinal studies could be conducted on the basis of this study to further explore the causal relationships between variables. Secondly, the study was conducted about three months after the strictly prevention and control of COVID-19 has been lifted in China, and because of the wearing of masks, people's anxiety about their appearance may change, which is unknown. It can be conducted another survey of AA several years later and compared it with this study to get conclusions. Thirdly, the population of this study were students of Chongqing Medical University and due to the special nature of their specialties, will have a more scientific perception of physiological appearance than other college students, and if the findings of this study are to be extended to other specialties or schools, the representative sample needs to be further expanded to reduce the error.

Acknowledgements

We thank each and every participant for their support of our study.

Ethics approval and consent to participate

The study involving human participants was reviewed and approved by the Ethics Committee of Chongqing Medical University. Participants provided written informed consent to participate in this study.

Consent for publication

Informed consent was obtained from all subjects involved in the study.

Availability of data and materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors declare no conflict of interest.

Funding

This research was funded by the Humanities and Social Sciences Research Project Fund of Chongqing Municipal Education Commission in 2022, grant number NO.22SKGH052.

Authors' contributions

Each author has met the authorship requirements. X.X., Y.Z., X.Z., X.W. and X.D. wrote the main manuscript text. Y.Z. organized the data and X.X. completed all data analysis. X.X. and L.Q. prepared the figures and tables. X.X., Y.Z. and M.Y. supervised the writing of the manuscript. X.X., Y.Z., X.Z., X.W., X.D., L.Q., B.M. and Y.H. investigated the data. All authors have read and agreed to the published version of the manuscript.

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Table 1(on next page)

Correlation analysis of appearance anxiety, interpersonal sensitivity, social support, and depression.

Table 1 Correlation analysis of appearance anxiety, interpersonal sensitivity, social support, and depression.

Variable	M±SD	①	②	③	④
□ Appearance anxiety	39.91±8.67	1			
□ Interpersonal sensitivity	12.61±5.82	0.568**	1		
□ Social support	60.32±11.66	-0.323**	-0.319**	1	
□ Depression	6.52±4.18	0.438**	0.534**	-0.344**	1

Note: *P<0.05, **P<0.01, ***P<0.001

Table 2(on next page)

Regression analysis of appearance anxiety, interpersonal sensitivity, social support, and depression.

Table 2 Regression analysis of appearance anxiety, interpersonal sensitivity, social support, and depression.

Regression model		Model fit index			Significance of regression coefficient	
Outcome Variables	Predictive Variables	R	R^2	F	β	t
Interpersonal sensitivity	Appearance anxiety	0.569	0.324	114.822	0.570	18.519***
Social support	Appearance anxiety	0.386	0.149	31.503	-0.218	-5.197***
	Interpersonal sensitivity				-0.120	-4.771***
Depression	Appearance anxiety	0.581	0.337	72.968	0.167	4.420***
	Interpersonal sensitivity				0.388	10.338***
	Social support				-0.163	-4.946***

Note: *P<0.05, **P<0.01 and ***P<0.001

Table 3(on next page)

Table 3 Significance test for mediating effects of appearance anxiety, interpersonal sensitivity, social support, and depression.

Table 3 Significance test for mediating effects of appearance anxiety, interpersonal sensitivity, social support, and depression.

	Effect	BootSE	BootLLCI	BootULCI	Percentage of total effect
Total effect	0.213	0.016	0.181	0.245	100%
Direct effect	0.081	0.018	0.045	0.116	38.03%
Total indirect effect	0.133	0.014	0.105	0.162	62.44%
Appearance anxiety →Interpersonal sensitivity →Depression	0.107	0.013	0.083	0.132	50.23%
Appearance anxiety →Social support →Depression	0.017	0.006	0.008	0.030	8.00%
Appearance anxiety →Interpersonal sensitivity →Social support →Depression	0.009	0.003	0.004	0.016	4.23%

Figure 1

Generalized linear model serial mediation

Figure 1 Generalized linear model serial mediation